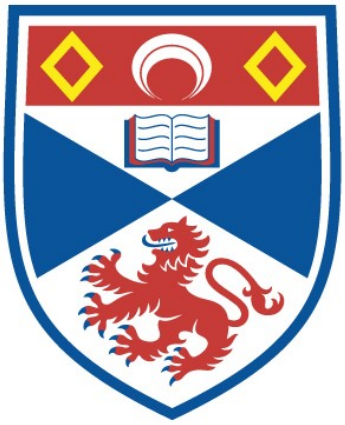
# BANK TAXATION: IMPLICATIONS FOR FINANCIAL INTERMEDIATION, LIQUIDITY CREATION, AND THE REAL ECONOMY

Anna Lucia Sobiech

A Thesis Submitted for the Degree of PhD
at the
University of St Andrews



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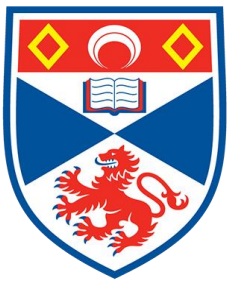

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# Abstract

This thesis investigates the implications of bank taxation for financial intermediation, bank liquidity creation, and the real economy. Our empirical analysis is underpinned by an identification strategy which relies on an exogenous variation in the taxation of banks. We exploit a unique quasi-natural experiment which occurred in the early 2000s when a group of Japanese commercial banks unexpectedly became liable to pay a gross-profit tax based on their respective presence in Tokyo prefecture.

In Chapter 3, we investigate the impact of the Tokyo bank tax on loan supply, pricing of loans and deposits, and the monitoring efforts of banks. Using a difference-in-differences approach, we find that affected banks increase net interest and fee margins. Depositors are most affected by adjustments to interest and fee rates. The imposition of the tax also reduces the credit supply of affected banks. Moreover, affected banks appear to reduce the effort devoted to the monitoring of borrowers.

In Chapter 4, we investigate the impact of the Tokyo bank tax on bank liquidity creation. Using a difference-in-differences approach, we find that affected banks reduce liquidity creation. This is driven primarily by the negative impact of the tax on the asset side of the balance sheet of affected banks. Specifically, the imposition of the tax leads affected banks to hold significantly less illiquid assets.

In Chapter 5, we investigate whether the Tokyo bank tax matters for the investments of corporates that borrow from banks affected by the tax. Using a sample of banks matched with corporates, we find that banks with a greater exposure to the tax reduce lending more. Following the reduction in credit supply, corporate borrowers reduce levels of investment. Other funding sources available to corporates do not alleviate fully the impact of the tax on the overall level of corporate funding and subsequent investment.

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# Contents

# List of Figures

# List of Tables

# Chapter 1 | General Introduction

The 2007-2009 global financial crisis and resultant financial instability necessitated large-scale taxpayer funded state interventions. The subsequent economic crisis as well as stimulus packages bore further on public finances leading to large budget deficits and the accumulation of public debt. Reforms to bank regulation and supervision have aimed to curb excessive risk-taking of financial intermediaries. At the centre of these reforms stands the request of the G-20 leaders that the financial sector should '*make a fair and substantial contribution*' (IMF 2010, p.6). Changes to bank regulation include: the phasing in of new capital and liquidity standards under Basel III; the separation of commercial and investment banking activity; and the launch of macro-prudential regulation to complement existing micro-prudential regulations.

Against this backdrop, many countries have introduced new taxes targeted specifically at financial intermediaries. Rather than adopt a coordinated approach to the introduction and design of bank taxes, thus avoiding opportunities for cross-border tax arbitrage (IMF 2010), most governments have taken a unilateral approach to bank taxation. This has resulted in the emergence of bank taxes ranging from taxes levied on specific forms of debt to special surcharges on the profits. Box 1 outlines the various bank taxation regimes. Common to all forms of bank taxes is their role in complementing regulatory initiatives that aim to boost the capacity of individual banks to absorb losses. By contributing to public finances, bank taxes allow governments to manage losses that fall on taxpayers and provide scope for crisis intervention.

Despite the introduction of bank taxes across the world, there is still a relatively limited understanding of how these affected banks and the customers they serve respond to taxation. Available evidence thus far suggests that the effect of taxation on bank behaviour is likely to depend on the type and size of the tax imposed, the prevailing market conditions under which banks operate and the interaction with existing bank regulation and supervision (Devereux 2014; Chronopoulos et al. 2017). In this thesis, we investigate the impact of bank taxation on financial intermediation (Chapter 3), bank liquidity creation (Chapter 4), and the real economy (Chapter 5). In order to do this, we ask four overarching questions: Are banks sensitive to taxation? Does taxation affect key functions (financial intermediation, liquidity provision, monitoring) performed by banks? What are the mechanisms through which taxation alters bank behaviour? Does taxing banks have consequences for local economic conditions?

Our empirical analysis focuses on examining a margin-based tax and is underpinned by an identification strategy which relies on an exogenous variation in the taxation of banks. We exploit a unique quasi-natural experiment which occurred in the early 2000s when Japanese banks unexpectedly became liable to pay a local tax in Tokyo. The so-called Tokyo bank tax was targeted at a small number of banks leaving others unaffected. This set up provides an opportunity to adopt a counterfactual research design to establish a causal link between taxation and bank behaviour, and how this impacts on bank customers and the wider economy.

**Box 1 | Bank Taxation Regimes**

Some argue that the taxation of banks should be aligned with non-financial firms (Gottlieb et al. 2012). Others favour a differential tax treatment for banks in order to reflect the special role of banks within the wider economy (Claessens et al. 2010). Bank taxes can be broadly divided into: risk-, transaction-, and margin-based tax schemes. These categories reflect differences in the tax bases upon which the tax is levied.

*Risk-based Tax Schemes*

Risk-based taxes or so-called bank levies fall typically on bank liabilities. Bank levies aim to reduce the risk-taking of individual banks that is likely to contribute to systemic risk. In addition, bank levies aim to raise revenue so as to assist governments in their efforts to recoup the costs incurred tackling of prior financial crises and to provide a source of funding that can be drawn upon in the event of future crises. Risk-based tax schemes have proved particularly popular among policy makers since the 2008 financial crisis. By 2012, 14 out of 28 European Union member states including France, Germany, Sweden and the UK had introduced a bank levy.

*Transaction-based Tax Schemes*

Transaction-based taxes are imposed on financial transactions. As such these taxes are not targeted exclusively at banks, but at any party that is involved in securities business. Transaction taxes aim to discourage high-risk, speculative activity which is likely to contribute to instability in the financial system. In some countries such as Switzerland or Belgium, transaction-based taxes have been in place for more than a century. In other countries such as France and Italy, transaction-based taxes were only introduced recently.

*Margin-based Tax Schemes*

Margin-based taxes or so-called financial activity taxes are levied on either bank profits, or employee remuneration, or the value added from financial intermediation activities. These types of taxes aim to alleviate imbalances in the tax treatment of financial institutions. These imbalances arise either from banks' exemption from value-added-tax (VAT) payments or from the exemption of interest payments from the corporate income tax base. To address existing tax distortions, Australia and New Zealand have introduced so-called goods and services tax (GST), which resembles a VAT tax. Belgium and Italy introduced a scheme known as allowance for corporate equity (ACE), which reduces the tax advantage of debt by granting equity holders an allowance equal to a risk-free return on equity. In 2017, Norway introduced a financial activity tax on bank remuneration.

The overarching finding of this thesis is that bank taxation impacts on bank behaviour with potentially adverse consequences for bank customers and the wider economy. We find that bank taxation has implications for the intermediation and liquidity creation function performed by banks. Our findings suggest a substantial pass-through of tax costs from bank owners to bank customers. In the presence of higher taxes, banks supply fewer loans, adjust the pricing of products and services for depositors, and reduce the provision of liquidity.

Moreover, we also uncover an important mechanism through which taxation can impact bank behaviour. In response to taxation, banks reduce their respective efforts in monitoring borrowers. The reduction in monitoring activity materialises in an adjustment of bank loan portfolios towards borrowers that are easier to monitor. Given the special role of banks in the economy, we find that taxation can also impact real economic outcomes. A reduction in credit supply in response to taxation is shown to impact adversely on the investment activity of corporate borrowers. Overall, the findings presented in this thesis suggest that banks respond to taxation by reducing their activity as financial intermediaries and liquidity creators, and that these tax-induced adjustments have consequences for the wider economy.

## 1.1 Literature Contribution and Policy Implications

This thesis contributes to distinct literatures on bank taxation, financial intermediation, liquidity creation, and finance and the real economy. The corresponding contributions are briefly outlined in the following paragraphs.

First, this thesis addresses an important short-coming in the literature on bank taxation. Unlike bank levies and financial activity taxes which have been

covered widely in the empirical and theoretical literature on bank taxation, there is considerably less evidence on margin-based (financial activity) taxes.[1] To some extent, this reflects the fact that despite their initial popularity in academic and policy arenas margin-based taxes have not been imposed as frequently as other types of bank taxes (IMF 2010). By analysing the Tokyo bank tax (which represents an example of a margin-based tax scheme) important evidence can be accumulated as to whether and how this type of tax impacts bank behaviour. By extension, our findings have relevance for policy makers tasked with the design of new bank taxes and contribute to policy discussions regarding the costs and benefits of bank taxation. We further contribute to the literature on bank taxation with a simple theoretical model which establishes the link between taxation and bank monitoring activity. In contrast to previous models of bank taxation (Albertazzi and Gambacorta 2010; Devereux et al. 2013; Kogler 2016) which emphasise the interaction of taxation, bank capitalisation and competition, the model presented (in Chapter 3) of this thesis considers the special role of banks as monitors of borrowers. A key insight from our model is that a tax on bank margins increases monitoring costs and reduces the profitability of lending activities. As a consequence, banks adjust their loan portfolios toward safer borrowers. These findings have relevance for policy makers charged with overseeing the effects of taxation on banks and bank-dependent borrowers.

Second, this thesis makes an important contribution to the well-established literature on financial intermediation.[2] While previous research provides numerous insights to financial intermediation in the context of institutions,

[1] Devereux (2014) and Chronopoulos et al. (2017) provide an overview of the various bank taxation regimes and recent developments in taxation

[2] Gorton and Winton (2003) provide an extensive discussion of the theoretical and empirical literature that explores the role of banks as financial intermediaries.

regulations and laws, there is a paucity of evidence on financial intermediation in the context of taxation. In this thesis, we show that taxation is an important determinant for the costs of financial intermediation. In response to higher taxation, banks increase net interest margins. From a welfare perspective, higher bank margins raise an important question of who ultimately bears the burden of bank taxation. In general, a widening of the net interest margin is indicative of banks passing through the burden of taxes to bank customers. Our analysis shows tax-induced adjustments to banks' pricing and product strategies affect borrowers and depositors alike. In addition to providing a better understanding of the factors that drive the pass-through of taxes from banks to customers, this thesis also produces valuable policy insights. For instance, if bank margins are determined by taxation and adversely impact the cost of intermediation services, then policy attention could arguably be better focused on alternative forms of bank regulation as a tool for improving bank stability.

Third, this thesis contributes to the strand of literature concerned with banks in their role as liquidity creators. In response to the 2008 global financial crisis (which vividly demonstrated the consequences of a liquidity freeze in interbank markets for the functioning of the banking sector and the economy overall), a new strand of literature emerged to better understand how banks create liquidity[3]. This thesis extends this literature by analysing bank liquidity creation in the context of taxation. A priori, it is not clear whether taxation impacts positively or negatively on bank liquidity creation. The effect is likely to depend on the accompanying incentive structure of taxes and the tax sensitivity of banks. In this

[3] See Berger et al. (2014) for an overview on bank liquidity creation. Important theoretical and empirical work on bank liquidity creation includes Diamond and Rajan (2001); Kashyap et al. (2002); Berger and Bouwman (2009); Fu et al. (2015); Andreou et al. (2016); Horvath et al. (2016); Jiang et al. (2016); Berger and Sedunov (2017).

thesis, we demonstrate that margin-based tax schemes, which incentivise banks to monitor less and increase leverage, induce a contraction in liquidity creation. The magnitude of the contraction is less pronounced among banks that are less sensitive to tax incentives. In response to taxation, better capitalised banks and banks with higher monitoring expenses reduce liquidity creation by less. As such, the results offer novel insights to the policy debate on the optimal design of bank taxation.

Fourth, this thesis contributes to the literature concerned with the impact of finance on the real economy.[4] Given that bank loans are the main source of external financing for corporates, changes in the banking system are likely to have a substantive impact on the real economy. Indeed, there is a growing body of research that demonstrates that changes in bank regulation affect real economic outcomes. However, to date there is a paucity of evidence regarding the real effects of bank taxation. This thesis fills this void by analysing how tax-induced changes in the banking system impact on the investment activity of borrowing corporates. Our findings suggest that policy interventions in the form of bank taxation have implications for funding conditions facing corporates and their resultant strategic investment decisions. Research on finance and the real economy is particularly prone to issues related to reverse causality where changes in the real economy drive finance rather than changes in finance. We overcome endogeneity concerns using a unique dataset with information on corporates' demand for credit. This enables us to control for demand-driven changes to finance

[4] Berger and Roman (2018) provide an extensive review of the literature that explores how shocks to bank lending activity impact the real economy. The literature focuses on a wide range of shocks including regulatory shocks (Aiyar et al. 2014; Jiménez et al. 2017), liquidity shocks (Khwaja and Mian 2008; Duchin et al. 2010; Cingano et al. 2013), bank capital injections (Giannetti and Simonov 2013; Berger and Roman 2017), and shocks to bank assets (Gan 2007; Bottero et al. 2015).

and isolate the impact of bank taxation on real economic outcomes. An important contribution of this thesis is that it does not only show an association between bank taxation and investment activity of borrowing corporates, but offers direct evidence explaining this association.

## 1.2 Thesis Outline

The remainder of this thesis divides into five chapters, comprising one background chapter, three empirical chapters, and a concluding chapter. Chapter 2 provides a general background to the Japanese banking system via a comprehensive analysis of evolution of bank size, balance sheet composition and performance. The chapter also includes a brief description of the various types of banks that populate the domestic banking industry. The chapter concludes with a short discussion of Japan's 1990s banking crisis and the early post-crisis years from 1999 to 2005.

Chapter 3 comprises an empirical investigation of bank taxation and financial intermediation. This chapter is the largest of the three empirical chapters and provides the foundation for the other empirical studies presented in this thesis. The chapter is concerned with two issues. First, we investigate whether taxation impacts on the functioning of banks as financial intermediaries. In this chapter we uncover the likely mechanism behind any adjustments to bank behaviour following changes in taxation. Second, we also investigate whether banks pass through tax costs onto bank customers. To inform our research hypotheses, we first present a simple theoretical model which incorporates elements of agency issues and contractual hazards into the context of bank taxation. The main predictions of the model are that taxation impacts on financial

intermediation activity by reducing the resources available to banks to perform monitoring. The model also predicts that depositors rather than borrowers bear the brunt of any tax. From our empirical analysis, it follows that taxation affects the effort banks devote to the monitoring of existing borrowers. Banks increase both net interest margins, and net interest and fee margins in response to higher taxation. Depositors are most affected by adjustments to interest and fee rates at banks. Taxation also impacts the overall credit supplied by banks.

Chapter 4 of this thesis is concerned with the implications of taxation for bank liquidity creation. Besides intermediating funds, a key function of banks is the creation of liquidity. Banks create liquidity by issuing relatively liquid liabilities to finance relatively illiquid assets. In this study, we take the analysis presented in Chapter 3 a step further to investigate the impact of taxation on the liquidity creation of banks. Using a now generally accepted indicator of liquidity creation developed by Berger and Bouwman (2009), we find that higher income taxation impacts negatively on bank liquidity creation. This reduction is driven primarily by the negative impact of tax on the asset side of the balance sheet. Further analyses suggest that bank monitoring is the key mechanism via which taxation affects adversely bank liquidity creation.

In Chapter 5, we turn the attention to the implications of bank taxation for the real economy. Official policy interventions in the banking industry are likely to have implications for funding conditions facing corporates and their resultant strategic investment decisions. In this chapter, we investigate whether bank taxation matters for the real economic outcomes of corporate borrowers. Using a large sample of banks matched with listed corporates, we find that banks with a

greater tax exposure reduce lending proportionately more than less exposed counterparts. The imposition of bank taxes reduces credit supply and leads corporates to reduce levels of investment. Moreover, corporate borrowers attempt to protect against the adverse impact of bank taxes by obtaining funding from other sources. Competitor banks (that are not exposed to the tax) assist corporates in the effort to substitute for the reduction in credit (by banks affected by bank taxes), but this does not alleviate the overall impact of bank taxes on corporate investment. Overall, these results suggest that by altering the environment in which corporates operate, taxation of the banking industry has a negative effect on the real economy.

# Chapter 2 | Background on the Japanese Banking Industry

## 2.1 Introduction

The Japanese financial system is one of the largest in the world. It is a prime example of a bank-based financial system (Levine 2002). The domestic banking industry comprises approximately 2000 depository institutions. Prior to the Second-Sino-Japanese War (1937-1945) well developed equity and bond markets provided the majority of finance to firms, while banks functioned primarily as underwriters for corporate equity and bond issuance (Allen 1996; Teranishi 2005). The issuance of bank loans was less common. After the Second-Sino-Japanese war, the financial system shifted towards a bank-based system patterned after US institutions. It was during this post-war period that Japanese banks exerted a dominant role in the financing of firms which persists today (Hoshi and Yasuda 2015).

In the late 1990s, the Japanese banking industry was impacted severely by the failure of its largest institutions. These failures spilled over to other banks, resulting in large aggregate losses for the entire banking industry. Large-scale government interventions stabilised the ailing banking system but resulted in high levels of government debt. Following the crisis, the Japanese banking industry was subject to wide-ranging regulatory and institutional reforms, which aimed to improve bank supervision and reduce excessive risk-taking. During global financial crisis of 2007-2009, the Japanese banking sector proved relatively resilient to shocks that emanated from Europe and the United States.

Against this background, this chapter outlines the key events that impacted the Japanese banking system since the late 1990s. Section 2.2 presents a brief analysis of the industry structure and performance of Japanese banks. Section 2.3 discusses the 1990s Japanese banking crisis. Section 2.4 examines the regulatory reforms and structural developments. Section 2.5 concludes the chapter.

## 2.2 Structure and Performance of Japanese Banking

The banking industry comprises commercial banks and cooperative banks.[5] Commercial banks are universal banks that are permitted to issue loans, collect deposits, and trade in financial markets. Under the Japanese Banking Law of 1981 city banks, first-tier and second-tier regional banks, and trust banks are classified as commercial banks. Shinkin, shinkumi and agricultural banks are classified as cooperative banks. The remainder of this section discuss the characteristics of commercial (Section 2.2.1) and cooperative banks (Section 2.2.2).

### 2.2.1 Commercial Banks

Under the Japanese Banking Law, city banks, regional banks, and trust banks are classified as commercial banks. City and regional banks are so-called ordinary, banks and are similar to commercial banks in other countries. Trust banks are a special type of commercial bank that is also permitted to offer trust services. City banks, first-tier regional banks, and trust banks are generally incorporated as stock incorporated firms and are publicly listed with free floating equity. Second-tier regional banks tend to be privately owned and unlisted.

[5] Alongside commercial and cooperative banks there also exist a number of other financial institutions that provide commercial banking services such as Japan Post Bank, foreign banks, as well as internet banks (Uchida and Udell 2014).

The classification of ordinary banks into city and regional banks is reminiscent of a time long before the 1990s. At first, the distinction between city and regional banks was based purely on geography. However, this distinction assumed a quasi-legal form during the post-war period with regional banks facing more restrictions on permissible activities relative to city banks.[6] Many restrictions on the permissible activities of regional banks were relaxed from the 1980s onwards. However, this did not eliminate the traditional segmentation between city and regional banks. The repercussions of their unequal regulatory treatment persist, and are evident in terms of differences in the size, customer base, business models and branch networks of city and regional banks.

In terms of size (measured by total assets), city banks are much larger than their regional counterparts. During Japan's high growth era in the 1980s, city banks grew much more quickly than regional banks, and regularly featured at the top of international league ranking tables of bank size. During this period city banks and regional banks also diverged in terms of their respective customer base and business models. Regional banks focus almost exclusively on small- and medium-sized firms. City banks have a customer base comprising both small domestic orientated firms and large corporates with nationwide and international scope. While the business model of city banks is based upon high volumes of transactions and a diversified portfolio of assets, the business model of regional banks is based on relationship lending (Uchida et al. 2008). Another notable difference between city and regional banks is the degree of expansion in their

[6] For example, the lending activities of regional banks were restricted to a narrowly confined geographical area. City banks, on the other hand, enjoyed relatively more freedom in their choice of borrowers and were permitted to lend nationwide. With regard to deposit taking, the policies were far more generous for regional banks than for city banks. In order to shield regional banks from competition, the Japanese government heavily curtailed a further extension of the already nationwide branch network of city banks (Teranishi 2005).

respective branch networks. City banks operate an extensive nationwide branch network, while the branch network of regional banks does not extend typically beyond the boundaries of the prefecture where the head office is located.

The classification of regional banks into first- and second-tier banks dates back to the early 1990s. Prior to 1992, Japan's banking industry also comprised a group of mutual banks so-called Sogo Ginko, which were regulated under a separate banking act (Mutual loans and Savings Bank Law 1951). In common with regional and cooperative banks, Sogo banks focused mainly on small firms, and operated within geographically confined areas. Sogo banks encountered difficulties during the 1980s. Industry deregulation and higher interest rates had translated into higher funding costs and severe competition from regional and cooperative banks (Brown 1999). In the early 1990s, the struggling Sogo banks were transformed into ordinary banks and classified as second-tier regional banks. Importantly, the two-tier classification of regional banks does not represent a legal distinction. Both types of regional banks operate under the same Banking Act and are supervised by the Financial Services Agency (FSA).[7]

In Japan, trust business is generally restricted to trust banks. Besides offering trust services, trust banks also engage in traditional banking activities. As of 2015, the Japanese banking sector had four regular trust banks, alongside 12 other trust banks including foreign-owned trust banks and trust bank subsidiaries. Trust services include money trusts, pension trusts, security investment trusts, as well as loan trusts. Trust banks manage trusts on behalf of institutional investors and individual customers. Besides ordinary deposits from banking business, money trusts and investment trusts represent the second largest source of funds

[7] Dekle and Hamada (2000) provide an excellent historical overview on mutual banks.

for trust banks. Trusts are transformed into long-term loans to the corporate sector and are used for investments in financial markets.[8]

### 2.2.2 Cooperative Banks

Cooperative banks in Japan comprise credit associations (so-called Shinyō Kinko or *shinkin* banks), credit cooperatives (so-called Shinyō Kumiai or *shinkumi* banks), as well as agricultural and fishery cooperatives and labour banks.[9] These banks are organised typically as not-for profit entities whose capital is subscribed by their respective members.[10]

Shinkin banks and shinkumi banks are supervised by the Financial Services Agency and operate under a special set of banking laws. A special feature of cooperative banks is that banking services are restricted to members. Cooperative banks are organised under a two-tier system under which a designated central bank provides clearing services and access to capital markets. Shinkin banks operate under the umbrella of the Shinkin Central Bank. Credit cooperative banks are organised under the Shinkumi Federation Bank. Like first- and second-tier regional banks, shinkin and shinkumi banks provide banking services to small and medium-sized firms. However, they tend to adhere to a stricter geographic demarcation than regional banks.

In terms of banking assets, shinkin banks represent the largest group of cooperative banks. Originally evolving from urban cooperatives, these banks have existed in their current form since 1951. Shinkin banks are small to medium-sized

[8] The Trust Companies Association of Japan (Trust Companies Association of Japan:www.shintakukyokai.or.jp) provides a detailed overview of trust banks.
[9] Uchida and Udell (2014) provide a comprehensive overview of the various bank types and business models of Japanese banks.
[10] Japan's cooperatives are designated as not-for-profit institutions. The law permits non-profit-institutions to generate and distribute surpluses (Kurimoto 2013).

financial institutions. They are organised in a two-tier system with a single central bank (Shinkin Central Bank) acting as the head organisation of the nationwide network of shinkin banks.[11] As of March 2015, there were 267 shinkin banks with approximately 7300 branches throughout Japan. These banks had an aggregate membership of 9.3 million members and deposits of ¥131 trillion (11% of the total deposit market in Japan).[12] The membership of shinkin banks consists of individuals (local residents) as well as small and medium-sized entreprises. Shinkin banks are governed by the Shinkin Banking Act, which sets out the rules and regulations for the conduct of business, management and supervision. Shinkin banks must limit the issuance of loans to their members.[13] However, they are free to accept deposits from non-members leading to a funding structure that is partially independent of membership.

By offering an extensive range of services and products to members and non-members, cooperative banks function like commercial banks. In common with commercial regional banks, cooperative banks are regionally oriented financial institutions with a focus on providing retail banking services to local customers. Branches are located typically in the prefecture or city where their headquarters are situated.[14] Cooperative banks focus on individuals as well as small and medium enterprises (defined as firms with 300 employees or less).[15] Anecdotal evidence from the Survey of Interfirm Relationships indicates that more than 40% of the

[11] The Shinkin Central Bank undertakes various financial activities on behalf of Shinkin banks. For instance, the bank undertakes international transactions and invests deposited funds of Shinkin banks into marketable securities.
[12] This compares to 105 regional banks with approximately 7500 branches and deposits of ¥248 trillion.
[13] For instance, according to Ch.5, Article 53 of the Shinkin Banking Act, Shinkin banks must restrict their lending to members. Pursuant the provision of a Cabinet Order, Shinkin banks may issue loans to local governments, financial institutions and persons other than members. A recent amendment of the Shinkin Banking Act adds universities and research institutes to the list of borrowers without membership.
[14] "On average, 81.1% of regional bank branches locate within the same prefecture of their head office; 95.8% of Shinkin bank branches operate in their home prefecture" Tsutsui and Kano (2003, p.158)
[15] Japan's economy consists of around 4.7 million small to medium-sized enterprises (Small and Medium Entreprise Agency of Japan).

responding small to medium-sized enterprises chose to bank with a *shinkin* bank; followed by city banks (25%) and regional banks (19%) (Uesugi 2015).

Due to the geographic concentration of their respective asset portfolios, regional and cooperative banks are heavily dependent on prevailing economic conditions of their respective home prefecture. Cooperative and regional banks also share the same supervisory regime. Both cooperative and regional banks are co-supervised by the FSA and the Ministry of Finance MOF (IMF, 2012a). Notably, there are no differences in the rules concerning the supervision of regional and cooperative banks. The common approach to supervision further substantiates the similarity of cooperative banks and their commercial counterparts.

Moreover, shinkin banks, shinkumi banks, and regional banks appear to face similar levels of competitive pressure and overall risk (Liu and Wilson 2013). However, shinkin banks generally have much higher credit risk as measured by the share of non-performing loans to total assets (IMF 2012b). In recent years, cooperative banks have been subject to deregulation that led to a substantive reduction in restrictions on permitted activities.

### 2.2.3 Number of Banks and Branches

Over the last two decades, the Japanese banking system has witnessed a considerable decline in the number of banks. As shown in Table 2.1, the most pronounced decline in the number of institutions took place among city banks, second-tier regional banks as well as cooperative banks. The reduction in the number of banks is mainly due to mergers and acquisitions, and to a lesser extent bank closures. Notably, the number of first-tier regional banks remained constant since the 1990s. This contrasts with a substantial decline in the number of second-

tier regional banks, which are acquired typically by first-tier regional banks. Merger and acquisition activity of shinkin and shinkumi banks began to accelerate towards the end of the 1990s leading to reduction of -40% in the number of shinkin banks and a reduction of -62% in the number of shinkumi banks since 1990 (Hosono et al. 2006).

**Table 2.1 | Number of Banks by Bank Type**

| | 1990 | 2000 | 2015 |
|---|---|---|---|
| City banks | 13 | 9 | 5 |
| Regional banks (Tier I) | 64 | 64 | 64 |
| Regional banks (Tier II) | 68 | 60 | 41 |
| Trust banks (domestic) | 16 | 8 | 4 |
| Shinkin banks | 451 | 372 | 267 |
| Shinkumi banks | 408 | 281 | 154 |

This table lists the number of banks by bank type in year 1990, 2000 and 2015. Source: Japan Bankers Association; Shinkin Central Bank; Shinkumi Federation Bank.

The decline in the number of banks is mirrored by a reduction in the number of branches. Table 2.2 shows a contraction in the number of branches by bank type between 2000 to 2015. Since 2000, all bank types experienced a decline in the number of branches, albeit of different magnitude. While the number of branches for city banks and first-tier regional banks reduced merely by 2% and 5% respectively, second-tier regional banks and trust banks experienced a reduction in the number of branches by 24% and 37% respectively. Compared to second-tier regional banks, shinkin and shinkumi banks exhibit a relatively moderate decline in the number of branches.

Comparing the reduction in the number of branches with the development in the number of banks from 2000 to 2015 shows that, for most bank types, the consolidation of banks outpaced the reduction in their branch networks. The number of city banks declined by 44%. This compares to a 2% decline in branches. Declines for other bank types second-tier regional banks (31% versus 24%), trust

banks (50% versus 37%), shinkin banks (28% versus 13%), shinkumi banks (45% versus 14%). Only first-tier regional banks exhibit a faster decline in branch numbers relative to the contraction in the number of banks. Here, a 5% contraction in the branch network stands against a constant number of banks since 2000. This may indicate the presence of cost advantages for first-tier regional banks that materialise with larger bank size. As for the other banks, the slower decline in branches may indicate that the distribution of financial services through a branch-based network continues to be an important element of the business model of Japanese banks.

**Table 2.2 | Number of Bank Branches by Bank Type**

| Year | City | Regional I | Regional II | Trusts | Shinkin | Shinkumi |
|---|---|---|---|---|---|---|
| 2000 | 2928 | 7904 | 4000 | 443 | 8480 | - |
| 2001 | 2853 | 7788 | 3873 | 399 | 8400 | - |
| 2002 | 2655 | 7600 | 3790 | 324 | 8263 | - |
| 2003 | 2608 | 7536 | 3567 | 299 | 8059 | 1985 |
| 2004 | 2575 | 7548 | 3354 | 292 | 7879 | 1955 |
| 2005 | 2470 | 7484 | 3312 | 294 | 7777 | 1922 |
| 2006 | 2463 | 7435 | 3274 | 292 | 7734 | 1901 |
| 2007 | 2473 | 7456 | 3252 | 295 | 7687 | 1858 |
| 2008 | 2484 | 7455 | 3253 | 293 | 7671 | 1826 |
| 2009 | 2479 | 7521 | 3149 | 273 | 7619 | 1785 |
| 2010 | 2489 | 7493 | 3138 | 277 | 7584 | 1765 |
| 2011 | 2510 | 7504 | 3129 | 282 | 7535 | 1755 |
| 2012 | 2525 | 7529 | 3062 | 283 | 7504 | 1737 |
| 2013 | 2532 | 7520 | 3054 | 287 | 7451 | 1723 |
| 2014 | 2868 | 7506 | 3058 | 275 | 7398 | 1718 |
| 2015 | 2870 | 7507 | 3056 | 278 | 7379 | 1709 |
| **% Change (2000-2015)** | **-2%** | **-5%** | **-24%** | **-37%** | **-13%** | **-14%*** |

This table lists the number of branches by bank type for the period 2000 to 2015. The table also records the percentage change in branches between 2000 and 2015. Source: Japan Bankers Association, Shinkin Central Bank, Shinkumi Federation Bank. *% Change 2003-2015.

### 2.2.4 Developments in Bank Size

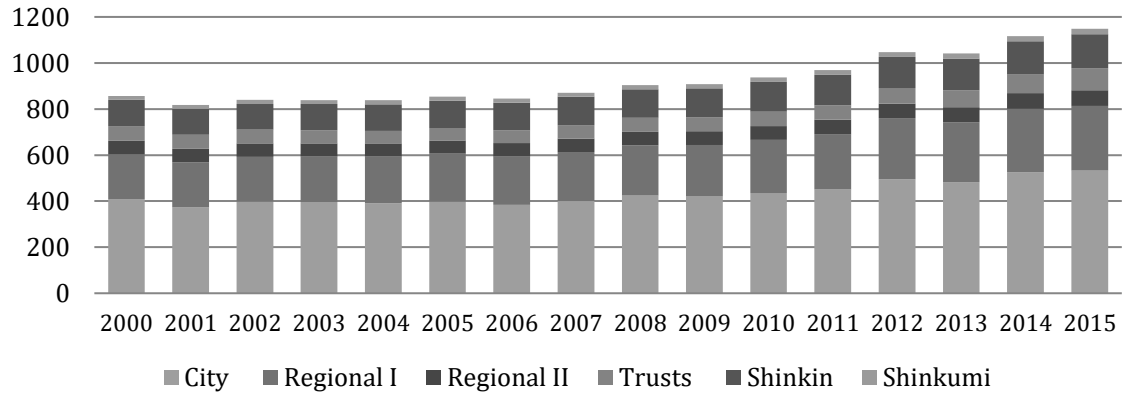
In the aftermath of the 1990s banking crisis, the banking sector suffered from excess capacity. It was predicted that the sector would considerably shrink in size (Patrick 1998). This prediction however proofed inconsistent with subsequent developments in the banking sector. Despite the notable decline in the number of banks, total aggregate assets of Japanese commercial banks remained relatively stable.[16] Figure 2.1 shows that aggregate assets of the Japanese banking sector grew moderately. From 2000 to 2015, aggregate total assets of commercial banks increased from ¥ 7.26 trillion to ¥ 9.77 trillion, a rate of 35%. The ratio of aggregate total assets of commercial banks to nominal GDP increased over the same period from 1.37 in 2000 to 1.83 in 2015.[17] Notably, the turmoil that emanated from the 2007-2009 global financial crisis had a benign impact on the Japanese banking system. Figure 2.1 shows that growth in aggregate banking assets stagnated in 2009 but picked up again in 2010. For a discussion of the global financial crisis and the Japanese banking system see Section 2.3.

The growth in aggregate assets of the Japanese banking sector which occurred alongside a significant reduction in the number of banks suggests a substantial increase in the size of banks. Figure 2.2 shows that the size of the average bank (dis-aggregated by bank type) increased since 2000. Trust banks, city banks, and first-tier regional banks exhibit the fastest growth in bank size. Second-tier regional banks, *shinkin* banks, *shinkumin* banks grew at a somewhat slower pace. The aggregate asset market shares of city banks, regional banks, and

[16] The stable development of Japanese banks' assets during the 2000s stands out against the enormous growth of banking sector assets in other countries. For example, Gischer et al. (2012) report a growth rate of 133% for aggregate asset holdings of the German banking sector between 2000 and 2010.
[17] Nominal GDP data series of Cabinet Office, Economic and Social Research Institute.

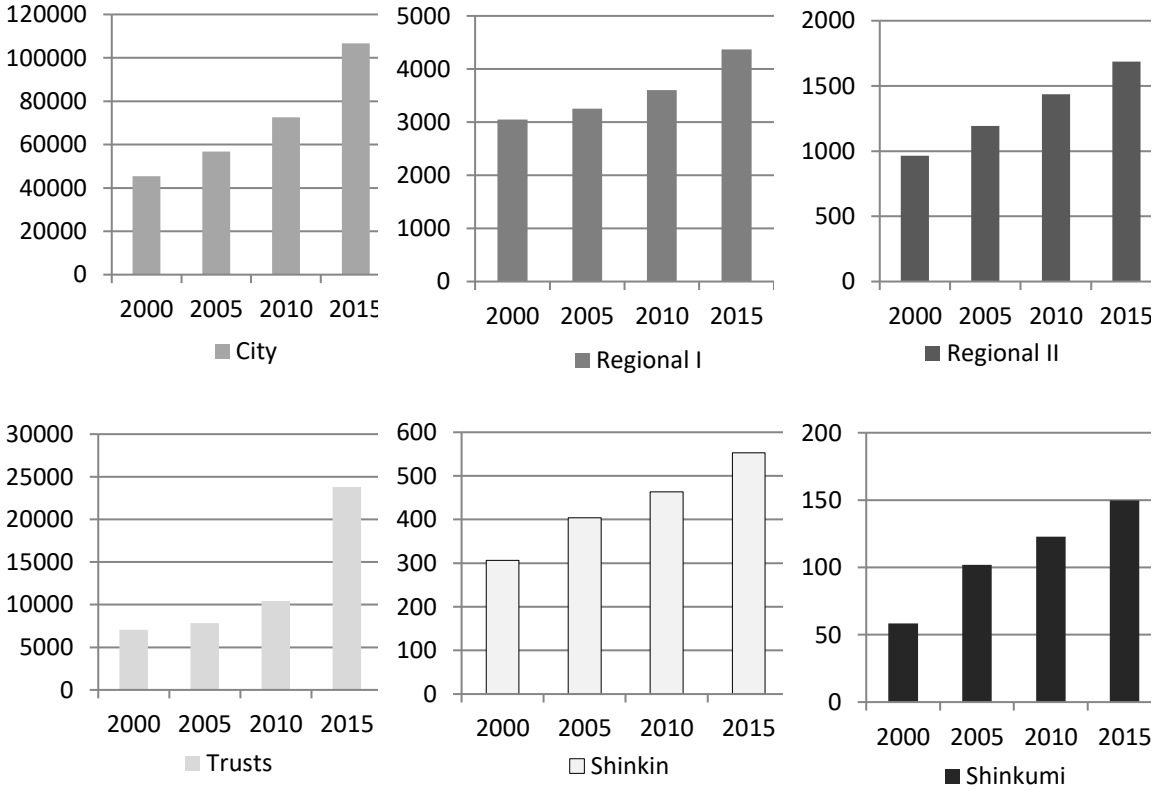
trust banks remained stable over the period from 2000 to 2015. A similar picture emerges for cooperative banks whose market share also remained unchanged.

**Figure 2.1 | Size of the Japanese Banking System 2000-2015**




This figure shows the evolution of aggregate total assets by bank type over the period from 2000 to 2015. Source: Japan Bankers Association, Bank of Japan, Shinkin Central Bank, Shinkumi Federation Bank. Unit: Trillion Japanese Yen.

**Figure 2.2 | Average Bank Size Selected Years 2000-2015**




This figure shows the development of the average bank size for different bank types over the period from 2000 to 2015. Source: Japan Bankers Association, Bank of Japan, Shinkin Central Bank, Shinkumi Federation Bank. Unit: Billion Japanese Yen. Author's own calculations.

### 2.2.5 Balance Sheet Composition

Table 2.3 shows the composition of bank balance sheets in 2005 and 2015. For all bank types, loans represent the most important component of bank assets in 2015. However, there are some notable differences across bank types. While loans account for 50% of total asset of city banks, and cooperative banks, the share is considerably higher for regional banks (around 70%). The stark difference between city banks and regional banks may reflect to some extent the more diversified business model of city banks.[18] As for cooperative banks, the difference to regional banks may reflect that cooperative banks in contrast to regional banks are mandated by law to limit the issuance of loans to members.

Bonds represent the second largest component of earning assets, accounting on average for 25% in 2015. Comparing balance sheet compositions of 2005 and 2015 shows a considerable increase in the share of bonds to total assets (of approximately four percentage points) for city, trust, and cooperative banks. To some extent, this increase reflects the expansion of Japanese banks into Japanese government bonds (JGBs). While JGBs made up 9% of total bank assets in 2000, by 2012 JGBs holdings doubled in size to over 18% (Bank of Japan 2014). Several factors explain why Japanese banks increasingly lend to the Japanese government. Hoshi and Ito (2012) argue that the expansion into JGBs was initially triggered by a continued lack of loan demand in the private sector. In search for alternatives to real estate and SME loans, banks shifted their focus to the public sector. The need to reduce risk and the favourable zero-weighting of JGBs in the calculation of

[18] Political factors have been shown to play an important role in determining lending of regional banks to local governments (Imai 2009).

regulatory capital may have also encouraged banks to increase their holdings of JGBs.

As shown in Table 2.3, the share of stocks to total assets declined across all bank types between 2005 to 2015. On average, stocks accounted for 1.9% in 2015, compared to 3.1% in 2005. This contraction reflects the changing regulatory landscape. With the introduction of a legal limitation on shareholdings in 2001 and the stock purchasing program of Japan's central bank, banks began to decrease the proportion of stocks in their portfolios (Bank of Japan 2005). In particular, the practice of cross-shareholdings which had characterised the industry for most parts of the twentieth century became less common. In the early 2000s, banks reduced cross-held shares by around 70%. Like the expansion into JGBs, the off-loading of stocks had a positive impact on the risk-structure of bank portfolios. Lower levels of shareholdings generally made Japanese banks less exposed to market-risk.

Another notable change on the asset side of bank balance sheets is the disposal of non-performing loans (NPL). After a period of few NPL disposals, the year 2001 was characterised by a sudden jump in the write-downs of NPLs (Bank of Japan 2005). Several factors appear to have prompted the rise in the disposal of NPL including improvements of loan evaluation methods, improved economic conditions, changes in the ownership of banks as well as a more assertive bank supervisor (Harada et al. 2011)

Regarding foreign assets, there has been considerable change with the outbreak of the banking crisis in the late 1990s. The internationalisation trend of Japan's banking industry which had been ongoing for more than a decade came to

a drastic halt. Japanese banks substantially cut back their foreign asset holdings. 62 banks switched from an international to a domestic charter (Allen et al. 2011).

**Table 2.3 | Balance Sheet Composition by Bank Type**

Components of Assets and Liabilities as a % of Total Assets

| | City | Regional I | Regional II | Trusts | Shinkin | Shinkumi |
|---|---|---|---|---|---|---|
| **Year 2005** | | | | | | |
| *Assets* | | | | | | |
| Interbank | 1.9 | 1.1 | 1.1 | 1.0 | 0.1 | 0.0 |
| Bonds | 22.2 | 24.4 | 19.9 | 22.4 | 24.2 | 17.8 |
| Stocks | 4.6 | 3.7 | 2.6 | 7.4 | 0.5 | 0.2 |
| Loans | 50.1 | 63.9 | 68.6 | 54.0 | 53.4 | 54.0 |
| Others | 21.3 | 6.9 | 7.9 | 15.2 | 21.8 | 28.0 |
| *Liabilities* | | | | | | |
| Deposits | 64.1 | 86.0 | 90.0 | 56.5 | 92.3 | 91.8 |
| Interbank | 3.4 | 0.7 | 0.2 | 2.1 | 0.1 | 0.0 |
| Equity | 0.9 | 1.1 | 1.4 | 2.2 | 5.1 | 4.7 |
| Others | 31.7 | 12.2 | 8.4 | 39.3 | 2.6 | 3.4 |
| **Year 2015** | | | | | | |
| *Assets* | | | | | | |
| Interbank | 0.2 | 0.8 | 0.4 | 0.4 | 0.1 | 0.1 |
| Bonds | 23.5 | 28.2 | 24.1 | 28.5 | 28.9 | 21.7 |
| Stocks | 2.8 | 2.3 | 1.6 | 3.8 | 0.5 | 0.2 |
| Loans | 44.7 | 61.4 | 66.5 | 48.3 | 45.7 | 48.1 |
| Others | 28.8 | 7.3 | 7.4 | 19.0 | 24.7 | 29.8 |
| *Liabilities* | | | | | | |
| Deposits | 62.0 | 83.5 | 88.6 | 46.9 | 91.7 | 92.4 |
| Interbank | 0.6 | 1.9 | 0.1 | 4.0 | 0.1 | 0.0 |
| Equity | 0.9 | 0.9 | 1.3 | 1.1 | 5.6 | 5.9 |
| Others | 36.5 | 13.7 | 10.0 | 48.1 | 2.5 | 1.7 |

This table shows selected components of bank balance sheets by bank type. Components of assets and liabilities are listed as a % of total assets. Source: Japan Bankers Association, Bank of Japan, Shinkin Central Bank, Shinkumi Federation Bank.

The closure of many foreign branches also reflects the scale of the de-internationalisation of the industry; the number of non-domestic branches of Japanese banks decreased by more than half from 437 in 1995 to 130 in 2006. Imai and Takarabe (2011) note that developments abroad resembled those at home. Japanese city banks with nationwide operations also withdrew from activities in Japan's regional loan markets. Several factors explain the retrenchment of

Japanese banks. Peek and Rosengren (2000) and Caballero et al. (2008) suggest that Japanese banks may have reduced lending in non-core foreign and domestic markets in order to support their core (often financially stressed) domestic clients. By extending loans to insolvent domestic borrowers, Japanese banks avoided declaring loans as non-performing and were able to meet minimum capital requirements.[19] Allen et al. (2011) also argue that regulatory capital requirements best explain the de-internationalisation trend. Banks with international activities were required to hold 8% of risk-based assets in capital compared to 4% for domestic banks. Thus, banks finding it difficult to meet higher capital requirements had any incentive to retreat from international activities.

Regarding the funding structure of Japanese banks, there are some significant differences across bank type. Table 2.3 shows that for commercial banks, the share of book equity to total assets is on average 1% in 2015. In contrast, cooperative-type banks hold equity in the order of 5.7%. Following the legal act that limited banks' shareholdings, there have been some notable changes to the ownership structure of bank equity. Shares that were once cross-held by Japanese banks are now owned by foreign and domestic institutional investors (Bank of Japan 2005).

Funding through deposits represents the most important source of funds across all bank types. As shown in Table 2.3, for regional banks and cooperative banks, the share of deposits to total assets is on average 89%. City banks and trust banks rely to 62% and 47% on deposits for funding. For trust banks, money trusts (comparable to longer term deposits) are also an important source of funding (not

[19] The Japanese banks' practice of extending loans to insolvent borrowers has become generally known as "evergreening" (Peek and Rosengren 2005)

listed in Table 2.3). Notably, over the last two decades, there has been little change to the way Japanese banks are funded. The funding through repos continues to remain less common in Japan (Kashyap 2002, IMF 2012b). This stands in stark contrast to developments in the US and European banking systems which increasingly relied on money market funds. Overall, the average bank liability structure confirms some systematic funding differences across bank types. Regional and cooperative banks rely almost exclusively on retail funding from customer deposits. The funding structure of city banks and trust banks differs somewhat. Although most funds are obtained in the form of retail deposits, the use of money markets is considerably higher.

### 2.2.6 Development in Income and Expenses

The development of income and expenses is shown in Table 2.4. In the year 2005 and 2015, interest income is the most important source of revenues for Japanese commercial banks accounting on average for 58%. For shinkin banks interest income is significantly more important (83%). Comparing 2005 and 2015, a slight increase in the share of interest income to total income is visible for regional banks, trust banks and shinkin banks. The exception is the group of city banks whose revenue from interest income has decreased. City banks appear to have substituted interest income with fee-based income. Notably, this substitution effect is not observable for the other bank types. For regional banks, trust banks, and shinkin banks, income from interest and fees increased. Looking at 2015, there are some considerable differences in the importance of fees as a revenue source across bank types. While for trust banks and city banks fees accounted for 23% of revenues, for shinkin banks the corresponding figures was only 9% of total revenues. These stark differences across commercial and cooperative banks likely

reflect differences in business models. Overall, the development in interest income and fee income indicate that Japanese banks continue to perform their core function as financial intermediaries transforming deposits into loans.

**Table 2.4 | Income Statement by Bank Type**

Components of Income Statement as a % of Total Income and Expenses

| | City | Regional I | Regional II | Trusts | Shinkin | Shinkumi |
|---|---|---|---|---|---|---|
| **Year 2005** | | | | | | |
| *Income* | | | | | | |
| Interest | 58.2 | 67.2 | 70.3 | 37.0 | 83.0 | - |
| Fees | 19.5 | 15.4 | 13.1 | 23.0 | 9.0 | - |
| Other operating | 11.8 | 9.0 | 6.9 | 14.4 | 3.5 | - |
| *Expenses* | | | | | | |
| Interest | 28.5 | 9.1 | 4.9 | 19.2 | 4.8 | - |
| Fees | 4.5 | 5.7 | 6.9 | 3.9 | 6.0 | - |
| Administrative | 43.9 | 56.2 | 56.6 | 40.3 | 68.9 | - |
| Other operating | 7.7 | 9.7 | 8.7 | 16.8 | 2.8 | - |
| **Year 2015** | | | | | | |
| *Income* | | | | | | |
| Interest | 57.5 | 71.7 | 74.3 | 42.1 | 84.3 | - |
| Fees | 22.2 | 16.8 | 14.5 | 23.5 | 9.1 | - |
| Other operating | 9.9 | 5.2 | 4.2 | 7.2 | 6.6 | - |
| *Expenses* | | | | | | |
| Interest | 19.7 | 7.3 | 7.2 | 20.7 | 7.5 | - |
| Fees | 9.1 | 9.9 | 10.1 | 12.2 | 7.3 | - |
| Administrative | 58.9 | 73.8 | 74.8 | 52.2 | 84.3 | - |
| Other operating | 5.2 | 3.5 | 6.5 | 7.5 | 0.9 | - |

This table shows selected components of bank income statements by bank type. Components of income and expenses are listed as % of total. Source: Japan Bankers Association, Bank of Japan, Shinkin Central Bank for 2005, Nikkei Needs Financial Quest for 2015 shinkin bank financial data.

Regarding expenses, a heterogeneous picture emerges. As shown in Table 2.4, in 2015, fee-based expenses exceeded interest expenses for regional banks. In contrast, for city banks and trust banks, interest expenses dominate fee-based expenses. Comparing 2005 and 2015, fee expenses and administrative expenses have increased markedly across all bank types. The increase in administrative expenses (which include personnel expenses) may indicate that banks face increasing labour costs. Further inference is however not possible due to a lack of

detailed data on the composition of administrative expenses pertaining to labour costs.

### 2.2.7 Performance

Table 2.5 shows the mean of six bank indicators by bank type based on a sample of Japanese banks from 2005 to 2015. To compare bank performance, the following indicators are considered: net interest margin (measured as net interest income over total assets), return on assets (ROA, measured as net income over total assets), and return on equity (ROE, measured as net income over book equity). To gauge bank risks, non-performing loans (NPL, measured as non-performing loans to total assets) and loans to deposits ratio (LTD) are used. The final ratio of cost to income (COST, measured as administrative expenses over operating income) looks at the cost efficiency of banks. Figure 2.3 shows the development of the six indicators by bank type over time.

**Table 2.5 | Performance Indicators by Bank Type**

| | NIM | ROA | ROE | NPL | LTD | COST |
|---|---|---|---|---|---|---|
| City | 0.9 | 0.5 | 11.6 | 0.04 | 81.8 | 50.8 |
| Regional I | 1.4 | 0.3 | 5.9 | 0.2 | 73.2 | 58.7 |
| Regional II | 1.7 | 0.2 | 2.6 | 0.3 | 76.4 | 59.5 |
| Trusts | 0.7 | 0.7 | 10.0 | 0.1 | (101.4)* | 45.6 |
| Shinkin | 1.5 | 0.1 | 1.0 | 0.4 | 52.3 | 69.3 |
| Shinkumi | - | - | - | - | - | - |

This table shows the mean of six bank performance indicators by bank type. The statistics are based on a sample of Japanese banks for the period 2005-2015. Bank performance indicators are: 1) NIM: net interest margin [net interest income over total assets], 2) ROA: return on assets [net income over total assets], 3) ROE: return on equity [net income over book equity], 4) NPL: non-performing loans [non-performing loans to total assets], 5) LTD: loans to deposits ratio [loans divided by deposits] 6). COST: cost efficiency [administrative expenses over operating income]. Variables are winsorized at the top and bottom percentile. Unit: in percent. Source: Nikkei NEEDS Financial Quest. *The ratio in excess of 100% reflects that trust banks generally accept trusts besides deposits. Trusts are not reported in the financial statements underlying the calculation of the LTD ratio. Authors' own calculations.

ROA and ROE ratios indicate that Japan's largest banks persistently outperform smaller banks. City banks and trust banks count among the top performers throughout the period from 2005 to 2015 (ROA: 0.5% and 0.7%. ROE:

11.6% and 10%). In contrast, shinkin banks and second-tier regional banks exhibit the lowest returns (ROA: 0.2% and 0.1%. ROE: 2.6% and 1.0%). A different picture emerges when considering net interest margins. As shown in Table 2.5, smaller banks achieve higher margins than larger banks reflecting again differences in business model. While smaller banks focus on traditional high-margin banking activities, larger banks are evolving away from traditional business models towards less capital-intensive, and lower-margin business models.

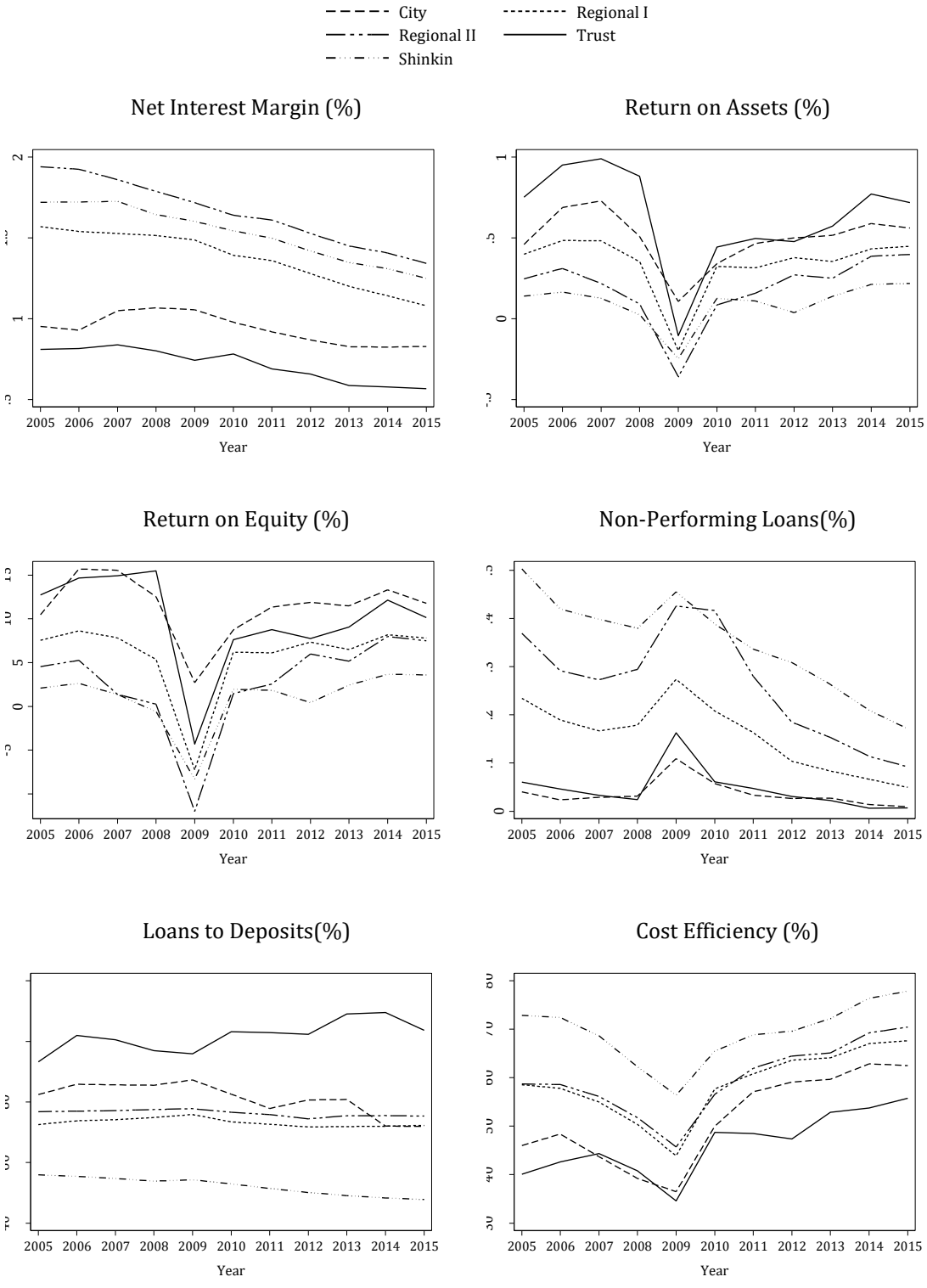
As shown in Figure 2.3, the global financial crisis impacted on the performance of Japanese banks; performance pressures are clearly visible across all bank types in the run-up to the crisis. In 2009, ROA and ROA ratios across all bank types increased again after two consecutive years of decline and stabilised after 2010. There is no visible impact of the crisis on net interest margins. As shown in Figure 2.3, net interest margins have weakened across all bank types since 2005. The secular downward trend in net interest margins results to some extent from the low interest rate environment in which Japanese banks have been operating since the mid-1990s (IMF 2012b).

Regarding NPL, Table 2.5 shows that smaller banks hold generally more credit risk than larger banks. Second-tier regional banks and shinkin banks have NPL ratios (NPL relative to total assets) of 0.3% and 0.4% respectively. This compares to a very low ratio for city banks (0.04%). Figure 3 shows the developments in NPL over time. Since 2005, bank credit risk has been on a negative trend across all bank types. Albeit for smaller banks, the decline is more pronounced then for larger banks. Following the outbreak of the financial crisis, NPL increased sharply in 2008 but have since declined.

Table 2.5 shows the loan-to-deposit ratio (LTD), a core indicator for liquidity mismatch risk. On average, banks exhibit relatively high LTD ratios. City banks have the highest LTD ratio (82%) followed by first- and second-tier regional banks (73% and 76% respectively). Shinkin banks have the lowest LTD ratio (52%), potentially reflecting the impact of regulations restricting the issuance of loans to members of the cooperative. The low LTD ratio of shinkin banks may indicate an abundance of deposits paired with a scarcity of viable lending opportunities. Developments in LTD ratios over the period from 2005 to 2015 are shown in Figure 2.3. Notably, there is no significant levelling off during the financial crisis of 2007 suggesting that Japanese banks continued to cover loans with stable retail savings.

The last column of Table 2.5 shows the cost efficiency of banks. COST ratios indicate that larger banks are relatively more cost efficient compared to smaller banks. Shinkin banks exhibit the lowest cost-to-income ratio (69.3%). The differences in cost efficiency across banks may to some extent reflect differences in the competitive conditions under which banks operate. For a brief discussion see Section 2.2.8. Developments in cost efficiency, as shown in Figure 2.3, further substantiate the trend discussed in Section 2.2.6. The increase in administrative costs since 2005 across bank types is mirrored by a decline in the cost efficiency of banks over the decade from 2005 to 2015. Although banks exhibited an improvement in cost efficiency for a short period prior to the global financial crisis, the trend reversed again in 2009. Since then, banks have become less cost efficient.

## Figure 2.3 | Performance Indicators by Bank Type 2005-2015




This figure shows the development of six mean bank performance indicators by bank type over the period from 2005 to 2015. Bank performance indicators are: 1) Net interest margin [net interest income over total assets], 2) Return on assets [net income over total assets], 3) Return on equity [net income over book equity], 4) Non-performing loans [non-performing loans to total assets], 5) Cost efficiency [administrative expenses over operating income], 6) Loans to deposits ratio [loans divided by deposits]. Variables are winsorized at top and bottom percentile. Unit: in percent. Source: Nikkei NEEDS Financial Quest.

### 2.2.8 Competition

The competitive landscape of the Japanese banking sector has been subject to considerable change over the last three decades. Leuvensteijn (2007) finds that the increased consolidation of the banking sector since the late 1990s was accompanied by an industry-wide improvement in competitive conditions. Commercial banks operated under low competitive pressures in the years prior to the Japanese banking crisis, but faced more competition following the outbreak of the crisis. Uchida and Tsutsui (2005) suggest the presence of some noticeable differences in the development of competitive conditions across bank types. Examining the competitive conditions for city banks and regional banks separately, city banks are found to operate under less fierce competition than in pre-crisis years. In contrast, regional banks facing relatively low competitive pressure in pre-crisis years are found to operate under more competitive conditions. Liu and Wilson (2013) suggest that competitive conditions may have intensified for smaller, locally operating banks including cooperative banks.

## 2.3 Crisis in Japanese Banking

In the 1990s, Japan experienced the failure of a large number of commercial banks and other financial institutions. Between 1995 and 2005, there were around 180 bank failures, commencing with a few isolated cases in the early 1990s, which eventually turned into a system-wide collapse towards the end of the decade. The crisis had severe repercussions for the economic development. For over a decade Japan's gross domestic production stagnated making the 1990s infamously known as the 'lost decade'. The severity of the shock and the far-reaching economic impact of the crisis motivated a large body of research across several disciplines to search

for the causes of the banking crisis. A variety of views emerged each offering a unique perspective on the origins of the banking crisis.

### 2.3.1 Causes of the Japanese Banking Crisis

Some argued that Japan's banking crisis was primarily the result of macroeconomic shocks, in particular the large fluctuations in land and asset prices in the early 1990s (Ueda 1998; Ito and Patrick 2005). This strand of literature traces the origins of the crisis back to the 1970s and 1980s when Japan had experienced an oil price shock and introduced a floating exchange rate. These shocks induced a shift away from capital-intensive industries with far-reaching consequences for Japanese banks. Their traditional client-base disintegrated and necessitated a re-orientation in lending activities. In search for alternative borrowers, banks expanded into real estate loan markets.[20] The increased loan supply paired with a loose monetary policy regime eventually led to acceleration in land prices and an overheating in economic activity. With the bursting of the housing bubble in the early 1990s, the vulnerabilities of the banking sector to movements in land prices began to emerge. At first, a number of isolated bank failures *(Jusen* banks) occurred but as land prices declined, bank failures accumulated.

Other authors argue that the collapse of the asset bubbles was merely a trigger, but that the actual problem emanated within the banks themselves. This strand of literature identifies weaknesses in the banking system as the core problem (Kanaya and Woo 2000; Hoshi and Kashyap 2004). The liberalisation of capital markets which started in the 1970s dramatically changed Japan's financial

[20] Nakagawa and Uchida (2007) find that the banks' expansion into real estate loan markets in the 1980s was characterised by irrational herd behaviour.

system. The gradual lifting of restrictions on bond issuance freed the corporate sector from its reliance on banks as a main source of funding. Capital markets gained in importance as an alternative to bank loans. Yet restrictions on the range of permissible bank activities were lifted only slowly. As a result, capital markets quickly began to take over some of Japanese banks' business. In order to make up for declining profits, banks shifted towards riskier investments (including small business loans).[21] The increased portfolio risk made the banking system less resilient to external shocks. When the real estate and asset price bubble eventually burst in the early 1990s, the banking system was unable to withstand the shock and experienced a system-wide collapse.

Other research points to weaknesses in Japanese institutions as a key cause of Japan's banking crisis (Brown 1999; Amyx 2004; Grossman 2010).[22] At the core of Japan's institutional problem stood the Ministry of Finance (MoF hereafter), an institution that acted as a bank supervisor and regulator since 1947.[23] To govern the activities of banks, the MoF typically engaged in administrative guidance; regulatory enforcement was less common. This manifested itself in low levels of litigation (Vanoverbeke et al. 2014). The absence of litigation, however, did not mean that the ministry played a marginal role. On the contrary, many MoF administrators had assumed powerful positions as external micromanagers instructing banks in their daily business affairs (Adams and Hoshi 1972; Amyx 2004). As MoF bureaucrats would often give preferential treatments to banks, maintaining a good relationship with the MoF became vital for banks' business

[21] Konishi and Yasuda (2004) also find that banks took on more risks when their franchise values declined.
[22] A direct implication of this is that a variety of crisis chronologies exists. For example, the literature discusses several different dates for the onset of the crisis; ranging from the early 1990s towards the latter-half of the 1990s (see Romer and Romer 2014 for a discussion).
[23] Japan's war period had caused a vacuum in the governance of banks which necessitated the establishment of the MoF as an external regulator and supervisor.

success (Hoshi and Ito 2004).[24] Under the protective governance of the MoF banks would remain shielded from overly competitive pressures. As a result, Japanese banks became increasingly uncompetitive and dependent (Dekle and Kletzer 2003). With the severe shock that emanated from the bursting of the real estate and asset bubbles in the early 1990s, the weaknesses in Japan's institutional design became apparent. The MoF could no longer protect banks from the disciplinary forces of the market. However, vested interests reduced the MoF's incentives to tackle the growing problem of bank failures. As the MoF failed to timely adopt reforms, isolated bank failures quickly developed into a system-wide collapse.

As the above analysis indicates, the views on the causes of the Japanese banking crisis range from macroeconomic shocks to weaknesses in banks and regulatory institutions. The disagreement about the origins of the crisis among policy makers in charge of resolving the crisis had direct implications for the official policy response to the crisis.

### 2.3.2 The Impact of the Global Financial Crisis

The 2007-2009 financial crisis had a relatively benign impact on the Japanese banking industry. In retrospect, the policy mix of the late 1990s is recognised as one of the key factors contributing to the resilience of banks during the global financial crisis. In particular, the improvements in financial supervision facilitating more timely and effective intervention contributed to stabilising the banking sector (Harada et al. 2011). Other factors that played a considerable role in shielding Japanese banks from the impact of the crisis are the loose monetary policy regime, the overall low exposure of Japanese banks to US subprime

[24] Amakudari, the hiring of MoF into boards of banks was a common strategy of banks (Amyx 2004).

mortgage markets, as well as the reliance of banks on deposits as a source of funding for securitized products (as opposed to short-term wholesale funding in repo markets which witnessed a substantial drying up of liquidity in the run-up to the global financial crisis).

The relatively benign impact of the financial crisis on the Japanese banking sector was not mirrored by developments in other sectors. The manufacturing sector whose revenues depend largely on exports significantly suffered from the collapse in international trade. Notably, the deterioration in corporate profits paired with funding difficulties in bond markets resulted in a return to bank finance (Hoshi and Yasuda 2015). The issuance of new bank loans to manufacturing firms increased steeply in 2008 indicating an increased dependence of the sector on banks as a source of funding.[25] The banking sectors' assistance in facilitating corporate financing during the global financial crisis may have alleviated a full-blown, domestic credit crunch from which many other advanced economies suffered.

To curtail the impact of the financial crisis on the economy, the Japanese government, like many other governments in advanced economies, took on an

[25] The role of banks as a provider of liquidity during firm financial distress is a widely discussed topic in the literature on Japanese banking. It links closely to the concept of *keiretsu* which can be loosely described as an affiliation of businesses around a so-called main bank (Hsu 1999). Two functions of the main bank have attracted the attention of the academic research: 1) the banks' function as a liquidity provider to *keiretsu* members in particular during periods of financial distress and 2) the banks' role in the governance of borrowing firms (for a review see Uchida and Udell 2014). Owing to its implicit focus on the relationship between banks and firms, the literature on the Japanese *keiretsu* system is closely related to the literature on relationship lending. Earlier strands of the *keiretsu* literature identify the *keiretsu* system as the main contributor to Japan's economic success in the 1970s and 1980s. However, in hindsight of the Japanese banking crisis of the 1990s, *keiretsu* systems have also been recognised as an impediment to economic growth. Weak firm performance and sluggish economic growth in Japan in the 1990s and 2000s have been attributed to some extent to excessive rent extraction of the Japanese banking system (e.g. Weinstein and Yafeh 1998). Although *keiretsu* has been the subject of intense research, it is not clearly defined. This is due to the main bank for which no universal definition exists. Evidence on *keiretsu* systems is also not without controversy; some authors have questioned the very idea of *keiretsu* as there is no direct proof its existence (Miwa and Ramseyer 2008).

expansionary fiscal policy. The increased government spending was financed by an increase in the issuance of government bonds; with the domestic banking sector acting as the main buyer of JGB. Between 2008 and 2010, major banks almost doubled their holdings of JGBs; from ¥70 trillion to ¥120 trillion. In the run-up to the sovereign debt crisis in Europe, Japan's substantial increase in public debt paired with the exposure of Japanese banks to domestic government debt temporarily sparked fears of spill-over effects. These did not materialise in part owing the fact that most JGB are held domestically reducing the impact of sudden flights out of JGB driven by international investors (Fukuda et al. 2012). However, an assessment of Japan's financial sector stability undertaken by the IMF identifies JGB market exposure as one of the central macro-financial risk factors (IMF 2012b). In particular, the group of second-tier regional banks is most vulnerable to sudden yield shocks likely affecting substantially the banks' ability to meet capital requirements.

## 2.4 Financial Sector Regulatory Reforms

The current structure of the Japanese banking system is largely influenced by various regulatory reforms that shaped the banking system from the late 1990s onwards. Following the banking crisis in the late-1990s, the banking industry became subject to substantial changes (for a review see Hoshi and Patrick 2000). The banking crisis revealed the weaknesses of the regulatory system and set the agenda for wide-ranging regulatory reform. The early post-crisis years were characterised by a large-scale re-design of the regulatory architecture including the establishment of new institutions.

The search for suitable policies to address the rise in bank failure in the late 1990s was characterised by a lack of consensus on the causes of the crisis. Different interpretations of the origins of Japan's banking crisis demanded different policy responses. The Japanese government made several attempts to stabilise the banking system and introduced a variety of measures and reforms. The result was a patchwork of policies of which some, in retrospect, turned out to be ineffective or even harmful (Calomiris and Mason 2003; Hoshi and Kashyap 2004; Allen et al. 2011).

Those stressing the important role of macroeconomic shocks in causing the banking crisis argued that the recovery of banks would largely depend on an improvement of Japan's economic conditions. It was generally understood that the causal link between economic growth and bank health would not be one-way. For the economy to improve, the undercapitalisation of banks would have to be addressed. However, as policymakers failed to recognise the actual dimension of banks' non-performing loans (NPL), the capital problem was perceived as a minor issue. As a result, a variety of policies were implemented that ignored the fragility of banks. For example, in order to alleviate a credit crunch, the government required that banks which had received public funds would have to increase lending to small and medium enterprises (SMEs). Hoshi and Kashyap (2010) provide evidence that this approach substantially worsened the situation. In the early 2000s, banks were confronted with a second wave of troubled loans when SMEs became financially stressed. Other policy examples include Japan's various piecemeal attempts to recapitalise banks. Allen et al. (2011) argue that many bail-out packages were too small to be effective because the dimension of Japanese banks' non-performing loans had been largely misunderstood. Caprio and

Klingebiel (1996) report that official estimates underestimated the amount of non-performing loans by a factor of two (10% [estimated] versus 20% [actual] of GDP). Giannetti and Simonov (2013) note that the modest approach to capital injections was not only ineffective but also harmful for the economic recovery. Instead of lending to clients with viable business opportunities, banks were found to have subsidised ailing borrowers. Another example is the Tokyo bank levy, a local tax on banks that was introduced against the warning of some bank supervisors and regulators pointing to the fragile state of the banking system. The results presented in Chapter 3, 4 and 5 provide evidence on the impact of the tax on bank behaviour, in particular on monitoring effort, liquidity creation, and the supply of credit to corporate borrowers. Banks are found to increase net interest margins, reduce monitoring of borrowers, supply less credit. and create less liquidity in response to the tax. These findings suggest that banks passed along most of their tax burden to their clients.

In retrospect, many of the policies that emanated from the macroeconomic-fluctuations view are regarded as ineffective (Hoshi and Kashyap 2010; Nelson and Tanaka 2014). Because policymakers had failed to understand the true dimension of banks' problems when designing policies, Japanese banks' problems remained largely unresolved under those policies. Nevertheless, the argument that Japan's banks would not return to stability unless economic conditions improved ultimately proofed to have a point. It was not until demand for Japanese exports had picked up that the situation of banks began to seriously improve (Bank of Japan 2005). A return to positive earnings and more solid capital positions allowed Japanese banks to finally resolve their problem of non-performing loans.

In the wake of the banking crisis, there were also some policies that emanated from the weaknesses-in-banks perspective. Acknowledging Japanese banks severe capital shortage, policymakers introduced a variety of policies that promoted a quick return to bank stability. These included changes to accounting and disclosure rules, restructuring programs, the lifting of a ban on bank holdings and a blanket deposit guarantee. Although the literature considers few of these policies as ineffective (Montgomery and Shimizutani 2009), most were heavily debated with regards to moral hazard and regulatory forbearance issues.

Due to the potentially high costs of being tough on banks *ex post*, it is not uncommon to see regulators practise forbearance in the aftermath of a crisis. Skinner (2008) provides evidence that Japanese regulators were soft on banks by adopting deferred tax accounting. In the same vein, Allen et al. (2011) discusses the Act of Revaluation of Land and the adoption of mark-to-market accounting. These accounting changes allowed Japanese banks to bolster their regulatory capital with deferred tax assets and unrealised capital gains on real estate. However, it was also a tool to window-dress public financial statements of banks (Hoshi and Kashyap 2010). Critics argued that the regulatory forbearance made insolvent banks look financially sound and thereby substantially increased uncertainty over the asset valuation of Japanese banks.

Another policy aimed at promoting bank stability was a change in disclosure requirements. The policy was motivated by the objective to reduce uncertainty over banks' asset valuations by increasing the level of transparency. Japan's crisis period had been characterised by a lack of information on the actual size of the banks' NPL problem. The problem arose as banks were not legally

required to disclose information on troubled loans. Although the existing degree of disclosure was perceived as sub-optimal, banking regulators only gradually shifted to a mandatory disclosure regime. It was feared that the increased transparency of banks would cause a system-wide run on banks. To smooth the transition, banks were provided with the option to disclose information on a voluntary basis. This created considerable heterogeneity in the disclosure levels across banks until 1999 when all banks became legally required to disclose NPL on new standardised definitions (Spiegel and Yamori 2006).

The blanket deposit guarantee scheme represents another policy that emanated from the weaknesses-in-banks narrative. The Japanese government fully backed depositors' funds from 1996 over period of six years. The main objective of the scheme was to prevent a bank run with system-wide implications. Among critics, the introduction of the blanket deposit insurance sparked a fierce debate on moral hazard issues and bank governing issues. Several studies find that depositors became more sensitive to bank financial conditions as soon as the Japanese government announced the return to a limited deposit insurance (Spiegel and Yamori 2007; Murata and Hori 2006; Hori et al. 2009). This suggests that the full-guarantee scheme suppressed market discipline and left the monitoring of banks mostly in the hands of Japan's regulators.

The restructuring of banks represents another policy that aimed to address the weaknesses in banks. Upon receipt of capital from public funds, Japanese banks were required to restructure their business including large cost cuts in personnel and other expenses (Onji et al. 2012). Restructuring programs were mainly motivated by the objective to increase the cost efficiency and profitability of

Japanese banks. Several studies indicate that Japan's largest banks needed to considerably shrink in size in order to operate more cost-efficiently (Altunbas et al. 2000). However, despite the substantial restructuring efforts in the aftermath of the crisis, Japan's largest banks struggled to recover earlier profitability levels (Bank of Japan 2001). Low revenues rather than excessive operational costs have been identified as the main cause of the weak post-crisis performance (Loukoianova 2008). The study suggested that the restructuring of large banks contributed to gains in efficiency but failed to address other issues that undermined performance. As Japan's larger banks continued to underperform, policymakers began to consider other options. There was a general recognition that a further consolidation of Japanese banks was necessary. In 1998, a long-held ban on bank holding structures was lifted and resulted in a substantial transformation of Japan's largest banks. By 2004, 16 large Japanese banks had amalgamated into six bank holdings, Japan's so-called mega banks. A direct result of this transformation was that banks had increased in size again. Montgomery et al. (2014) find that the rise in banks' size reversed most of the earlier gains in cost-efficiency; bank holdings were found to operate less cost-efficiently. However, their findings indicate that the increase in market power resulting from the consolidation somewhat improved the profitability of Japanese banks. Among policy circles, the emergence of mega banks and their increased market power raised too-big-to-fail concerns. Critics argued that the bank holding policy failed to address weaknesses in banks as it encourages excessive risk-taking of too-big-to-fail banks ultimately destabilising the entire banking system.

In retrospect, many of the policies that addressed the fragile state of banks have been criticised for promoting only short-run bank stability. Critics argued

that most policies were associated with an increase in moral hazard jeopardizing banks' long-run stability. Nevertheless, policies that prioritised bank stability often proofed to be more effective than other policies in addressing Japan's banking crisis, not least because the makers of those policies recognised the full dimension of the banks' NPL problem.

According to the institutional-weakness view, close ties between MoF officials and banks paired with lax enforcement practices had contributed to the built up of severe instabilities in Japan's banking system. Curtailing the authorities of the MoF was seen as an essential step towards a more stable banking sector. Following the collapse of Japan's banking sector, a variety of policies were introduced that promoted a change in Japan's institutions. The most notable program was the establishment of the Financial Service Agency (FSA) in 1998.

With the creation of the FSA, a new institution assumed the role of the MoF, Japan's previous bank regulator and supervisor. Like its predecessor, the FSA functions as an interpreter of financial regulation and has to ensure its compliance. In contrast to the MoF, the FSA was given more legal power in the governance of bank activities. This resulted in more rigorous examinations of banks' books and frequent onsite inspections of financial institutions. According to Hoshi and Kashyap (2010), the more assertive bank regulator and supervisor was the main determinant of Japanese banks' recovery in the early 2000s. Ota (2001) notes that the more rigorous approach to bank governance would have not been possible without the separation of fiscal policy making and bank regulation. Prior to the establishment of the FSA, the MoF had been jointly responsible for the regulation of banks as well as Japan's fiscal affairs. According to Ota, this joint authority had

caused severe conflicts of interest within the MoF. The MoF had little incentive to tackle the banks' NPL problem because large-scale loan losses in the banking sector would have had severe fiscal implications.[26] Ota concludes that with the establishment of the FSA these conflicts of interests were largely resolved.

Following Japan's banking crisis, there was a general recognition that leaving the governance of banks in the hands of the bank regulator was not a sustainable option. The introduction of the FSA was therefore accompanied by a comprehensive financial sector reform.[27] The dual approach was motivated by the objective to give markets a more meaningful role in the governance of banks (Hoshi and Ito 2004). A key obstacle to greater market discipline at that time was the common practice of cross-shareholding (Hanazaki and Horiuchi 2003). In 2001, the FSA therefore enacted a law that limited banks' shareholding causing a considerable unwinding of cross-held shares.

Despite the objective to curtail the power of the MoF, the ministry did not lose its role as a bank supervisor altogether. While the MoF is no longer in charge of large and foreign-capitalised banks, it maintained its role as a supervisor of small financial institutions. Because the FSA delegates some of its activities, the policing of small financial institutions is still in the hands of the Local Bureaus of the MoF. Anderson and Imoto (2008) conclude from this that the MoF continues to be a key determinant for the intensity with which regulation is actually enforced in Japan.

[26] Loan losses can be claimed as an allowable expense for tax purpose reducing not only the banks' tax liabilities but also the government's tax revenues.
[27] Due to its size, Japan's financial sector reform is often referred to as Japan's London-style Big Bang.

In retrospect, improving Japan's institutional framework and the governance of banks has been recognised as a key policy response to resolving Japan's banking problem (Hoshi and Kashyap 2004). Some argue that the FSA's more assertive regulation and supervision of Japanese banks was also an important determinant of the banks' improved resilience to shocks that recently emanated from the U.S. financial crisis in 2007 and the subsequent sovereign debt crisis in Europe (Harada et al. 2011).

Since the recent financial crisis, the deregulation of capital markets has continued alongside measures to enhance the stability of these markets (Hoshi and Yasuda 2015). To deregulate capital markets further, a number of measures have been brought under way that aim to increase the exposure of Japanese households in capital markets. These include the amendment of laws restricting investment into capital markets, tighter regulation pertaining to market misconduct and insider trading, as well as the introduction of higher fraud penalties. To stabilise capital markets, Japan's regulators have established a resolution mechanism and introduced stricter regulations for OTC derivative trades. In the years to come, the ongoing effort to deregulate capital markets is likely to put pressure on Japan's incumbent banks.

## 2.5 Summary

This chapter provides background information on the evolution of the Japanese banking industry since 1990s, relevant for putting findings on the Tokyo bank tax presented in Chapter 3, 4 and 5 into a broader economic and institutional context.

Section 2.2 delivers important insights into the structure and performance of Japanese banking since the early 2000s. By looking at key indicators across different bank types over time, a picture emerges that shows relatively homogenous trajectories across different bank types. Across all bank types, the number of banks and branches has declined; a secular trend that has started in the 1990s and is mirrored by developments in banking industries in other advanced economies. Net interest margins also declined while administrative expenses increased over time reflecting the impact of Japan's low interest rate environment and increases in the costs of labour.

Section 2.3 and 2.4 highlight key developments in the banking industry and the regulatory landscape with a particular focus on the Japanese banking crisis of the 1990s. A short discussion of causes and effects of the Japanese banking crisis of the 1990s reveals the challenges faced by policy makers charged with the task of reforming the banking sector. The causes of the crisis were diverse and complex in nature and therefore required a major reform to both, bank regulation and the institutional framework. A brief analysis of these various policy measures against the backdrop of the more recent 2008 financial crisis shows that the resilience of the Japanese banking industry during the 2007-2009 global financial crisis is mainly due to the policy mix introduced after the banking crisis of the 1990s.

# Chapter 3 | Bank Taxation and Financial Intermediation

## 3.1 Introduction

This chapter investigates the impact of taxation on the financial intermediation activities of banks in Japan. Taxing banks has received widespread media coverage and attention in policy circles in many developed economies following the global financial crisis, where taxpayer funded bank bailouts led to large fiscal deficits. As part of a range of policy reforms, proposals to increase bank taxes have been suggested as a means to replenish government coffers and contain excessive risk-taking of banks. Opponents of such proposals contend that increasing taxes would have adverse consequences for customers if banks pass on any resultant cost increases by reduced lending, lower deposit rates or higher loan rates.

Anticipating and assessing the effects of taxation on the behaviour of banks is not straightforward. Depending on the type and size of the tax imposed, and the prevailing market conditions under which banks operate, banks may choose to absorb any increase in costs by reducing costly activities such as monitoring of borrowers, or instead pass increased costs onto customers by restricting credit supply, reducing deposit rates or increasing loan rates. Moreover, establishing a causal link from tax to bank behaviour is challenging, given that tax policy changes often form part of a broad package of regulatory and fiscal reforms, which are often anticipated in advance by market participants, and phased in gradually over an extended period of time.

In this chapter, we utilise a quasi-natural experiment to investigate how the unexpected imposition of a special tax on gross profits (known locally as the Tokyo bank tax) in 2000 influenced the lending, deposit taking, pricing and monitoring behaviour of Japanese banks.[28] The tax was levied on commercial banks with sizeable financial intermediation activities in Tokyo and had the objective of generating additional tax revenue for the Tokyo Government. The Tokyo Bank Tax was levied on gross profitability (composed of net interest, and net fee, commission and trading income).[29] As such the tax was tantamount to a tax on the financial intermediation activities of banks. Using this differential tax treatment to overcome identification concerns, we investigate whether there is a causal link from tax to the financial intermediation activities of banks. As such, we make a significant contribution to a small, but important literature on the taxation of banks. The results of our study have relevance beyond Japan, by contributing to and informing ongoing discussions amongst academics and policy makers as to the best way to reform and design the taxation of banks following the global financial crisis.

To inform our theoretical framework and research hypotheses we draw on prior theoretical contributions related to agency issues and contractual hazards in financial intermediation settings (Diamond 1984; Holmström and Tirole 1997). We develop a theoretical model (in Section 3.3) that describes the relationship between bank monitoring, the intermediation process and product pricing. A basic assumption underlying this model is that the outcome of a borrower's investment

[28] In the early 2000s, the banking sector in Japan was emerging gradually from a severe financial crisis. For extensive discussions of the financial crisis and its global repercussions see: Peek and Rosengren (2000); Hoshi and Kashyap (2000); Ito and Patrick (2005). For a more recent overview see Uchida and Udell (2014).
[29] In contrast to net profits, gross profits exclude expenses such as personnel costs, loan loss provisions, and write-offs.

project is not perfectly observed by the lender in the absence of monitoring. The model also incorporates the possibility of strategic default by borrowers. As a consequence, banks monitor borrowers closely in order to prevent them from defaulting on their loans. Given that the introduction of a gross profit tax reduces the resources available to banks to perform monitoring, our theoretical model predicts an increase in the probability of borrower default. Faced with loan losses arising from borrower defaults, banks reduce loan rates. This reduction in loan rates provides an incentive for borrowers not to default. Banks also reduce the size of their respective loan portfolios in order to compensate for the combined losses arising from the reduction in loan rates, reduced monitoring and increased taxation. On the liability side, our model predicts a reduction in the volume and rate of interest paid on deposits, and under certain conditions the reduction in deposit rates exceeds that of loan rates.[30] The intuition that depositors rather than borrowers bear the brunt of any tax is that the latter have a tendency to default. As a consequence, resources are required to enable monitoring activity and prevent borrower default.

Our dataset comprises semi-annual financial accounts for a sample of 126 banks over the period 1998-2001 (which straddles the introduction of the Tokyo bank tax in 2000). In order to assess the effects of the gross-profit tax on the financial intermediation activities of banks, we classify banks into those that are affected by the Tokyo bank tax and those that are not. Based on this classification, we use a difference-in-differences approach to compare the difference in behaviour of the affected banks between the pre-tax and post-tax period with the

[30] The conditions under which the reduction in deposit rates exceeds that of loan rates are described in detail in Section 3.3.2.

same difference in the behaviour of the unaffected group of banks. We corroborate the evidence presented from the difference-in-differences analysis with a regression discontinuity analysis and an event study.

By way of preview, the main findings of the empirical analysis suggest a causal link between the Tokyo bank tax and the financial intermediation activities of banks. In response to an unexpected tax on gross profit, banks increase net interest and net interest and fee margins. A decomposition of the net interest margin into deposit and loan pricing components indicates that both the interest rates paid to depositors and charged to borrowers decline following the introduction of the Tokyo bank tax. This implies a pronounced pass-through effect from banks to depositors. Further analysis reveals that when faced with additional taxes, affected banks reduce total lending. Furthermore, banks subject to the tax experience a decrease in rate-sensitive deposits on a larger scale than counterparts unaffected by the tax. These results are indicative of rate adjustments (in particular) for deposit products with relatively high interest rates, and confirm a partial pass-through effect of the tax from banks to depositors. These results are consistent regardless of the estimation method employed.

Our theoretical model also predicts that the channel through which a tax on gross profit leads to contraction in financial intermediation is via a reduction in the level of bank monitoring of borrowers. We investigate the validity of this prediction via a series of empirical tests employing a data set of banks and constituent borrowing firms. Underlying these aforementioned tests is the assumption that the cost of monitoring borrowing firms is lower when these firms are: geographically proximate to their lending bank; less informationally opaque

(with a credit rating assigned by a third-party agency); or invest more in pledgeable (tangible) assets. Thus, following an increase in taxation, affected banks seek to reduce monitoring costs by rebalancing their respective loan portfolios toward those borrowers that are geographically proximate, less informationally opaque or hold more pledgeable assets. Moreover, bank monitoring is of value to borrowing firms by providing valuable information to external stakeholders (investors, bondholders). This reduces the cost of external funding and enhances the overall market values of borrowing firms. Thus, following an increase in taxation, if affected banks reduce monitoring of borrowing firms, this is reflected in an increase in the cost of financing (bond issuance) and a decline in market values (returns to investors) of firms with existing borrowing relationships with banks affected by the Tokyo bank tax.

The results of the aforementioned series of tests are as follows. Banks subject to the provisions of the Tokyo bank tax reduce the costs of monitoring by reducing lending to firms located at distance (relative to counterparts that are geographically proximate); firms that are less informationally opaque; and firms that have less pledgeable assets. The costs of debt issuance increase for firms that borrow from affected banks, suggesting that the monitoring of these borrowers deteriorates after the introduction of the Tokyo bank tax. Finally, the market value of firms which borrow from affected banks reacts more negatively to the announcement of the tax relative to the market value of firms not borrowing from affected banks. We find no significant results after executing a placebo analyses in which assume falsely that the Tokyo bank tax was introduced one year prior to its actual introduction. Taken together these results provide corroborating evidence in support of the monitoring channel identified by our theoretical model.

Our analysis contributes to several literatures. We contribute to a small literature that examines the pass-through effects of taxes to bank customers.[31] The results emanating from this literature are rather mixed. Early evidence suggests that taxes feed through to higher levels of bank profitability (Demirgüç-Kunt and Huizinga 2001). Huizinga et al. (2014) extend this analysis by accounting for international double taxation and find that these taxes are almost passed fully through to bank customers. Other evidence, presented by Albertazzi and Gambacorta (2010) and Chiorazzo and Milani (2011) for large samples of European banks, and Capelle-Blancard and Havrylchyk (2017) for Hungary suggests that banks shift most of their respective tax burdens onto customers, with borrowers bearing most of the tax burden via increased loan rates or a reduction in credit access. For a large sample of European banks, Kogler (2016) finds that bank taxes lead only to small increases in net interest margins via increases in loan rates. Deposit rates paid to savers are unaffected. The level of competition and capitalization affect the pass-through of taxes. Other studies find no evidence of a change in loan or deposit rates following the introduction of bank taxes (Capelle-Blancard and Havrylchyk 2014; Buch et al. 2016). Instead the increased costs arising from the tax burden is absorbed by banks. Our contribution to this strand of literature is manifold. First, we derive our empirical hypotheses from a new theoretical model which incorporates a moral hazard problem for the borrower.

[31] Several studies investigate the implications of taxation on the capital structure of banks. Hemmelgarn and Teichmann (2014) and Keen and De Mooij (2016) provide cross country analyses of the impact of the asymmetric tax treatment of debt and equity on capital structure decisions of banks. Schepens (2016) finds that banks in Belgium increased equity capital following a policy change (known as allowance for corporate equity) that reduced the relative tax advantage of debt funding. Celerier et al. (2017) investigate the impact of a tax policy change in Italy. The authors find that banks increase equity capital when equity and debt are treated symmetrically by tax authorities. Moreover, such a symmetric tax treatment of debt and equity leads to a large expansion in bank lending.

This allows for a consideration of the monitoring function of banks and its interplay with taxes. As such our model departs from the Monti-Klein approach, which is used extensively in this literature (Klein 1971; Monti 1972). Second, we focus on a relatively simple gross-profit tax to investigate whether taxes affect bank behaviour. Assessing the effect on bank behaviour of a tax applied to net profit is difficult given that banks can use loan loss provisions and other forms of discretionary expense to reduce tax liability (Andries et al. 2017). A tax levied on gross profit limits this possibility, and enables a thorough assessment of the effects of tax on the financial intermediation activities of banks. Third, in line with prior literature we find strong support for a pass-through effect of taxes to bank depositors. However, we divert from previous findings with respect to bank behaviour towards borrowers. As predicted by our theoretical model (and contrary to previous evidence) we find that banks faced with an increase in taxes on gross profits reduce both deposit and loan rates. Therefore, banks that are left with fewer resources to monitor borrowers as a result of the tax, are forced to switch from a 'stick' (monitoring) to a 'carrot' (reduced loan rate) approach in order to discourage loan default.

We extend the literature that explores the determinants of bank monitoring effort. Previous research suggests that the extent to which banks engage in the processing of borrower-related information (loan monitoring) depends on: loan contract design (Cerqueiro et al. 2016); managerial contracting (Udell 1989); lending technology (Mester et al. 2007); organisational form (Stein 2002); and the structure of bank-firm relationships (Carletti 2004). Competition, capital requirements (Almazan 2002), and market power (Caminal and Matutes 2002) also impact monitoring. The novelty of our work lies in our analysis of how bank

monitoring effort changes in response to taxation. In a simple model, we show that taxes on gross profits reduce the incentive to exert sufficient effort to monitoring borrowers.

Our analysis contributes to a long-established literature that examines the determinants of interest margins for financial institutions. The results of prior research suggest that the size, capitalisation, credit and liquidity risk, competition, regulation and supervision are important determinants of bank interest margins (Ho and Saunders 1981; Allen 1988; Valverde and Fernandez 2007, Kitamura et al. 2015). Our approach augments these aforementioned studies by incorporating taxation as a key determinant of bank margins. The difference-in-differences approach used in the empirical analysis allows us to isolate the specific implications for interest margins of tax differences across banks, and decompose the net interest margin to investigate the effect of taxes on deposit and loan pricing.

Finally, our analysis contributes to the recent literature that explores the impact of negative exogenous shocks on bank credit supply. For example, Buch et al. (2016) find that banks subject to extra taxes do not on average reduce lending. However, banks most affected by the imposition of these taxes (those with higher market share) extend fewer loans than less affected counterparts. Schandlbauer (2017) shows that banks reduce lending following an increase in taxes. This is more evident for less well-capitalised banks, which have more limited opportunities for increasing debt in order to benefit from tax shields. Cornett et al. (2011) show that fewer new loans are originated when banks are exposed to liquidity risk. The results of the present study lend some support to prior literature

by finding that the Tokyo bank tax leads affected banks to contract credit supply. We also identify an overall reduction in the flow of intermediated funds. Banks affected by the Tokyo bank tax did not only extend fewer loans, but also held fewer interest rate-sensitive deposits.

In summary, this chapter provides new insights as to the effects of taxation on bank behaviour, and the extent to which banks pass on the increased burden of higher costs to customers via changes in pricing and lending strategies. As such the results have relevance for policymakers tasked with monitoring the effects of taxation on banks, the wider financial system and the real economy.

The remainder of the chapter is structured as follows. Section 3.2 provides a background to the current study. Section 3.3 introduces the theoretical model and the hypotheses. The sample and methodology are described in Section 3.4. Section 3.5 discusses the main results. In Section 3.6 we describe the sample and methodology related to testing the channel and discuss the results. Robustness tests are discussed in Section 3.7. Section 3.8 provides a summary.

## 3.2 Background

To estimate the impact of taxes on bank behaviour, we exploit a differential tax treatment of banks that occurred in Japan in 2000 when the Tokyo Government levied a special tax that affected one group of banks but left other banks unaffected. This decision was motivated by the urgent need to generate tax revenues for Tokyo, where the revenues raised from income taxes collected from banks declined by more than 25 percent between 1996 and 1999.

The Tokyo Government selected banks liable for the tax based on three criteria. First, banks with a physical presence in Tokyo would have gross profits

generated in this metropolitan area taxed by the Tokyo Government. Banks without headquarters or branches in Tokyo were exempt from the tax. Second, only domestic banks were liable for the tax. Foreign banks (including those with operations in Tokyo) were not liable for the tax. Third, banks with average deposits exceeding ¥5 trillion over the past five years were subject to the tax. Banks with deposits below this threshold were not liable for the tax (DeWit 2000).

A timeline of key events surrounding the announcement, introduction and the repeal of the Tokyo bank tax is summarised in Table 3.1. The Tokyo Government planned to levy the bank tax over a period of five fiscal years. However, following a successful legal challenge by banks, the tax was not levied over the full period. By the end of the second year, the Tokyo District Court declared the bank tax to be void followed by a final decision against the tax by the Tokyo High Court. For the purposes of the empirical analysis conducted in the present study, we consider the declaration of the District Court shortly before the end of fiscal year 2001 as the date which marks the official termination of the Tokyo bank tax. After this declaration, the Tokyo Government ceased collecting the Tokyo bank tax.

The imposition of the Tokyo bank tax occurred during the period when the Japanese banking system was recovering from a major banking crisis (see Chapter 2, Section 2.3), during which time some of the largest financial institutions failed. To resolve the banking crisis and to contain the negative impact on the real economy, the government implemented a large-scale and far-reaching programme of reforms. This programme included: recapitalising distressed banks; creating a new financial supervisor; and establishing a support scheme for distressed non-

financial firms. While none of these interventions were implemented over the same period as the Tokyo bank tax, the recapitalisation of distressed banks (under the terms of the Prompt Recapitalisation Act) as well as mergers between established banks could potentially act as confounding events, and affect the results of any investigation of the impact of the Tokyo Bank Tax on bank behaviour. We investigate this possibility in Section 3.7.2.

**Table 3.1 | Timeline of Events**

| Fiscal year | Date | Event |
|---|---|---|
| 1999 | February 7, 2000 | Ishihara announces plan to levy a special bank tax, selects banks for tax treatment |
| | March 23, 2000 | Tokyo Assembly of Public Finance approves bank tax |
| 2000 | April 1, 2000 | Tokyo bank tax adopted |
| | October 18, 2000 | Lawsuit filed against Tokyo Government |
| 2001 | July 7, 2001 | Tokyo Government collects tax revenue* |
| | March 26, 2002 | District Court declares bank tax to be void |
| | March 29, 2002 | Tokyo Government files appeal with the Tokyo High Court |
| 2002 | January 30, 2003 | Supreme Court rejects appeal by Tokyo Government and rules against the Tokyo bank tax |

Sources: Meji-Gakuin (2008), The Japan Times, Ministry of Finance (Japan). In common with the US, the Japanese taxation system generally delays the recognition of income for tax purposes until the income has been realised. Banks affected by the Tokyo bank tax filed tax returns at the end of fiscal year 2000 (fiscal year 2000 = 1st April 2000 - 30th March 2001). Tax payments were due by the end of the third month after filing.

The Tokyo bank tax levied on gross profit represents a direct form of a tax on financial intermediation. Gross profits comprise three components. First is the net interest margin, defined as the difference between interest income and expenses. This margin relates to a bank's core function as a financial intermediary, encapsulating the price of intermediation of funds from savers (depositors) to borrowers (entrepreneurs). The net interest margin represents the largest component of gross profit, accounting on average for 80% of gross profits during the sample period. The net fee and commission margin and the net trading margin represent the second and third components of gross profit.

## 3.3 Model and Hypotheses

### 3.3.1 A Simple Model of Intermediation

Banks in our framework design loan contracts and monitor borrower behaviour. Such actions aim to curb borrowers' moral hazard resulting in tendencies towards strategic default or outright repudiation on borrowed funds. Loan contract design and borrower monitoring have provided a unifying theme in models of financial intermediation (Diamond 1984; Rajan 1992; Besanko and Kanatas 1993; Holmström and Tirole 1997; Repullo and Suarez 1998).

We present a one-period model of financial intermediation with a single representative bank that performs tasks as an active lender and passive holder of deposits. The bank operates in a competitive market for deposits. Deposits are used to finance loans to individual borrowers. While the bank pays a competitive rate to depositors, it decides upon loan size, loan rate and the effort devoted to the ex-post monitoring of borrowers.

The ex-post monitoring of borrowers is costly, but reduces the probability of loan default. The bank's monitoring effort reduces the risk of loan default, and leads to a decline in the spread between deposit and loan interest rates. The model posits that if a tax is levied on the profit the bank earns from offering financial intermediation services to borrowers and depositors, then such a tax affects directly core financial intermediation activities including the volume of loans and deposits, and the interest rates for depositors and borrowers.

The bank engages with both borrowers and depositors via a set of loan and deposit contracts. In the remainder of this section, we present a model which addresses how key contractual variables, such as the size of loans and deposits,

loan and deposit rates, and monitoring effort are affected by a sudden increase in tax. For the purposes of exposition, we assume that depositors and borrowers are two distinct sets of agents. This allows us to analyse the features of loan and deposit contracts separately, before combining these to examine the overall impact of taxes on financial intermediation.

**Loan Contracts – Borrowers**

Each borrower has a project which produces a cash flow with a technology given by a concave production function,$f(L)$, where $L$ denotes the loan amount. We impose the following assumption on the technology: $f^{/}(L) > 0$ and$f^{//}(L) < 0$. An example of such a technology is $f(L) = A\sqrt{L}$, where $A$ is a parameter. Borrowers do not have any internal means of finance, and so rely on bank financing. The bank charges interest rate $R$ against a loan amount $L$. The bank also chooses the probability, $p$, of monitoring each borrower in order to deter strategic default. Given the one-period nature of the model capturing the relationship between the borrowers and the bank, there is no scope for reputation building by the borrower (which would emerge from repeated interactions). Hence, borrowers are more likely to default strategically after securing financing. Financial intermediation and lending in particular is special in this context, since banks can use information and expertise to monitor borrowers in order to deter strategic default.

A borrower may or may not behave honestly depending on the payoff (gains and costs) associated with such behaviours. If the bank charges a loan rate $R$, on a loan amount $L$, disbursed to a borrower, the pay-off to an honest borrower (who repays the total loan obligation) is $f(L) - RL$. Whether a borrower repays a loan depends on the bank's monitoring effort, $p$. If the borrower intends to behave

dishonestly, then a cost is incurred which takes a fraction $\alpha$ of output $f(L)$. If the borrower gets caught by the bank, $RL$ is paid back and legal and other pecuniary expenses amounting to $c$ are incurred. The borrower's expected pay-off from dishonest behaviour is $p[\alpha f(L) - RL - c] + (1-p)f(L)$. Hence the borrower's incentive compatibility condition is $f(L) - RL \geq p[\alpha f(L) - RL - c] + (1-p)f(L)$ which re-arranging reduces to $p[(1-\alpha)f(L) + c] \geq (1-p)RL$. This can be written in the equality form as:

$$RL = \frac{p[(1-\alpha)f(L)+c]}{(1-p)} \tag{3.1}$$

Equation (3.1) is the reduced form version of the borrower's incentive constraint precluding default, and states that the total obligation of the borrower must not exceed a multiple of the expected costs from default.[32]

**Loan Contracts – Bank and Borrowers**

The bank's profit after tax earned from financial intermediation activities is $\big(RL - r_d D + r_f S\big)(1-\tau) - h(p)$, where $\tau$ is the tax rate, $r_d$ is the rate paid on deposits, and $D$ is the amount of deposits. The cost of monitoring, $h(p)$, is an increasing and convex function of the bank's monitoring effort with $h^{/}(p) > 0$ *and* $h^{//}(p) > 0$. An example of such a monitoring cost function is: $h(p) = ap + \frac{1}{2}bp^2$, where $a > 0$ and $b > 0$ are constant, and where the cost of monitoring tends to increase rapidly with the effort devoted to monitoring. The bank holds a safe asset, $S > 0$ and earns a risk-free return, $r_f$.

[32] In Equation (3.1) the present value of the equilibrium loan can be written as: $L = \frac{p[(1-\alpha)f(L)+c]}{(1-p)R}$.

The bank's balance sheet comprising the sources of funds, $D$, equals the total uses of the fund, which are: the sum of loan disbursements, $L$; reserve requirements, $X$; and the safe asset, $S$. This can be expressed as:

$$D = L + X + S \tag{3.2}$$

Since the reserve requirement is mandatory and a constant fraction of the total deposits, $\mathrm{X} = \beta D$, $0 < \beta < 1$. Incorporating X into (3.2) gives:

$$D(1-\beta) = L + S \tag{3.3}$$

Assuming that the bank earns a return of $r_0 = 0$ on reserves, the profit (after using the identity of balance sheet and reserve requirements as given in (3.2) and (3.3) respectively) can be expressed as $\pi^b = \left[RL - r_d D + r_f\{D(1-\beta) - L\}\right](1-\tau) - h(p)$, which can be rewritten as:

$$\pi^b = \left[RL - \{r_d - r_f(1-\beta)\}D - r_f L\right](1-\tau) - h(p) \tag{3.4}$$

This yields the bank's objective function, where the bank maximizes profit by choosing $R$, $L$, and $p$, subject to (3.1). That is, the bank offers a combination of the loan rate $R$, and the loan size $L$, and commits to a monitoring policy $p$, to maximise profit as given in (3.4). Incorporating (3.1) into (3.4), yields the objective function in reduced form:

$$\pi^b(p, L) = \left[\frac{p[(1-\alpha)f(L)+c]}{(1-p)} - \{r_d - r_f(1-\beta)\}D - r_f L\right](1-\tau) - h(p),$$

where $\pi^b(p, L)$ is the bank's profit function with two choice variables, $p$ and $L$. The reduced form profit function above includes: (i) the incentive compatibility condition; (ii) the balance sheet identity; and (iii) the reserve requirement constraint.

The first-order conditions with respect to $L$ and $p$ for the optimum are:

$p(1-\alpha)f^{/}(L) = r_f(1-p)$, which can also be expressed as:

$$\frac{p(1-\alpha)f^{/}(L)}{(1-p)} = r_f \tag{3.5}$$

and

$$\frac{[(1-\alpha)f(L)+c](1-\tau)}{(1-p)^2} = h^{/}(p) \tag{3.6}$$

The incentive constraint preventing strategic default is given by:

$$RL = p\,\frac{(1-\alpha)f(L)+c}{(1-p)} \tag{3.7}$$

Equations (3.5) and (3.6) determine jointly the optimal loan amount ($L^*$) and monitoring effort ($p^*$) of the bank. The optimal values in Equation (3.7) can be substituted to solve for the optimal $R^*$ as a function of the tax rate, technology, costs of default, and other parameters. Equation (3.5) describes the trade-off for the optimal disbursement of the loan. The left-hand side represents the incremental productivity of the loan, while the right-hand side is the marginal cost of loan, which is the risk-free rate that the bank could have earned.

Equations (3.6) and (3.7) can be combined to derive the relationship between the loan rate ($R^*$), monitoring effort ($p^*$) and the tax rate $\tau$:

$$R^*L^*(1-\tau) = ph^{/}(p)(1-p) \tag{3.8}$$

The left-hand side of Equation (3.8) is the bank's marginal after-tax loan loss from a reduction in monitoring activity. The right-hand side captures the marginal savings from a reduction in monitoring activity. Equation (3.8) also captures the relationship between $R^*$ and $\tau$. We return to this relationship later when discussing Hypothesis 4.

The model so far completes the borrowing side of the bank loan where the optimal borrowing rate is $R^*(r_f, \tau)$, the optimal loan amount issued by the bank is $L^*(r_f, \tau)$ and the optimal probability of monitoring is $p^*(r_f, \tau)$. Next, we discuss the deposit contracts offered by the bank under competitive market conditions.

**Deposit Contracts – Bank and Depositors:**

Depositors of the bank are economic agents who smooth consumption over time (as in any standard model). We assume two periods, $t = 0, 1$. Depositors have endowments of $w_0$ at period 0 and $w_1$ at period 1 with $w_0 > w_1$. If depositors deposit $D$ with a bank and are promised a deposit rate equal to $r_d$, then the depositors' budget constraints are $w_0 = c_0 + D$ and $w_1 + Dr_d = c_1$, in each of the two periods, $t = 0, 1$, respectively, where $c_t$ denotes the consumption of the depositors at time *t*.

If the depositor's utility function is $u(c_0) + \theta u(c_1)$, then intertemporal maximization of utility would generate an optimal deposit function of $D^* = D^*(r_d)$. For example, if the depositor has a logarithmic utility function, then the optimal deposit function is given by $D^* = \frac{1}{1+\theta}\left(w_0 - \frac{w_1}{r_d}\right)$.[33] Thus for any deposit rate, $r_d$ offered by banks, individual depositors save $D^*$.

We assume that the competitive structure of the market, results in an equilibrium determination of the deposit rate where banks earn zero profit and depositors maximize utility. Proceeding with the logarithmic utility function of the depositors, a bank's competitive zero profit condition implies that the following condition holds for all banks:

[33] The first order condition for a logarithmic utility function is: $\frac{1}{w_0 - D} = \frac{\theta r_d}{w_1 + r_d D}$. By rearranging, we get the equation for $D^* = \frac{1}{1+\theta}\left(w_0 - \frac{w_1}{r_d}\right)$.

$$\pi^{b*}(p,L) = \left[p^* \frac{(1-\alpha)f(L^*)+c}{(1-p^*)} - \{r_d - r_f(1-\beta)\}\frac{1}{1+\theta}\left(w_0 - \frac{w_1}{r_d}\right) - r_f L^*\right](1-\tau) - h(p^*) = 0 \qquad (3.9)$$

where * denotes a variable set at the optimal level given by Equations (3.5) and (3.6). Equation (3.9) determines the optimal deposit rate $r_d = r_d(\tau)$. Deposits are determined by $D^* = \frac{1}{1+\theta}\left(w_0 - \frac{w_1}{r_d(\tau)}\right)$.

### 3.3.2 Hypotheses

Our hypotheses follow from the comparative statics results when all key endogenous variables are subject to changes arising from an exogenous increase of the tax rate. In this section, we list our testable hypotheses. A proof of each hypothesis (unless in the text below) are provided in Section A of the Appendix.

The first two hypotheses are related to the effect of a tax on the bank's deposit rate and volume.

***Hypothesis* 1:** In response to increased taxes on bank profit, the deposit rate declines unambiguously ($\frac{dr_d}{d\tau} < 0$).

***Hypothesis* 2**: The volume of deposits declines in response to increased taxes on bank profits ($\frac{dD^*}{d\tau} < 0$).

The next set of hypotheses follow directly from the analysis of the bank's optimal contract design with borrowers. Our third hypothesis considers the effect of a tax on the bank's volume of lending, while hypotheses 4 and 5 deal with the effect of a tax on the loan rate.

***Hypothesis* 3**: The bank reduces the volume of loans in response to taxes ($\frac{dL^*}{d\tau} < 0$).

***Hypothesis 4:*** The bank may reduce the loan rate.

Hypothesis 4 is concerned with the sign of $\frac{dR^*}{d\tau}$. In order to examine the impact of $\tau$ on $R^*$, we write Equation (3.8) in the following form:

$R^* = \frac{p^* h^{'}(p^*)(1-p^*)}{L^*(1-\tau)} = \frac{G(p)}{L^*(1-\tau)}$, where $G(p^*) \equiv p^* h'(p^*)(1-p^*)$.

First, we consider the case where taxes have no impact on bank monitoring effort. In other words, $p^*$ is independent of the tax rate and is constant. In this case, an increase in the tax rate leads to an increase in the loan rate (the denominator of $\frac{G(p)}{L^*(1-\tau)}$ diminishes as $\frac{dL^*}{d\tau} < 0$, and the term $(1-\tau)$ decreases). An increase of the loan rate allows the bank to recover some of its costs that arise from higher taxes, and from a decline in the volume of loans (see Hypothesis 3).[34] This is the direct tax pass-through effect where part of the increased cost arising from an increase in taxes is absorbed by clients (borrowers) who now pay a higher price (loan rate).

Second, we consider the case where taxes have an impact on the bank's monitoring effort. In this case $p^*$ is dependent on the tax rate. As shown in Hypothesis 6 (below), taxes can curb the effort that the bank devotes to monitoring borrowers, and as a consequence increases the risk of strategic default among borrowers. Formally, $\frac{dp^*}{d\tau} < 0$ and $G'(p^*) > 0$, which implies that the numerator also decreases as the tax rate increases. The combined impact of the tax rate on the numerator and denominator of $\frac{G(p)}{L^*(1-\tau)}$ however makes changes in the direction of the loan rate ambiguous. Taking a logarithmic differentiation of $R^* = \frac{G(p)}{L^*(1-\tau)}$, we obtain the following expression $\frac{dR^*}{d\tau}\frac{1}{R^*} = \frac{G'(p^*)}{G(p)}\frac{dp^*}{d\tau} - \frac{dL^*}{d\tau}\frac{1}{L^*} - \frac{1}{(1-\tau)}$. If $\frac{G'(p^*)}{G(p)}\frac{dp^*}{d\tau} >$

[34] An increase in the loan rate in response to higher tax rates is also in line with the prediction of a standard Monti-Klein model.

$\frac{dL^*}{d\tau}\frac{1}{L^*} + \frac{1}{(1-\tau)}$, the loan rate decreases. By decreasing the loan rate the bank prevents strategic defaults, which would have otherwise increased if the bank had opted for a higher loan rate while reducing monitoring effort. We call this the borrowers' incentive effect as it reduces their pay-off in default even when the bank's monitoring effort is lower.

In summary, the net effect on the loan rate of a tax on bank profit depends on the relative strength of the incentive effect. The prevalence of the incentive effect over the pass-through effect would prompt a reduction in loan rate. In contrast, where the pass-through effect dominates the incentive effect, there would be an increase in the loan rate.[35]

***Hypothesis 5:*** If the incentive effect dominates the tax pass-through effect, the loan and deposit rate both decrease. The relative magnitude of the downward adjustment of the two rates is ambiguous.

Formally, the change of the spread between the loan and deposit rate, $\frac{dR^*}{d\tau}\frac{1}{R^*} - \frac{dr_d}{d\tau}\frac{1}{r_d}$, is expected to decrease under the following conditions: $\frac{dr_d}{d\tau} < 0$ (Hypothesis 1) and $\frac{dR^*}{d\tau}\frac{1}{R^*} < 0$ if $\frac{G'(p^*)}{G(p)}\frac{\mathrm{d}p^*}{\mathrm{d}\tau} - \frac{dL^*}{d\tau}\frac{1}{L^*} + \frac{1}{(1-\tau)} > 0$ (Hypothesis 4). Using expressions from Hypothesis 3 (see Appendix I) gives: $\frac{dR^*}{d\tau}\frac{1}{R^*} - \frac{dr_d}{d\tau}\frac{1}{r_d} = \left[\left(\frac{G'(p^*)p(1-p)}{G(p)}a - 1\right)\epsilon_L - \epsilon_{r_d}\right] < 0$ where $\epsilon_L = \frac{dL^*}{d\tau}\frac{(1-\tau)}{L^*}$ (the tax elasticity of $L^*$) and $\epsilon_{r_d} = \frac{dr_d}{d\tau}\frac{(1-\tau)}{r_d}$ (the tax elasticity of $r_d$). If $\frac{G'(p^*)p}{G(p)} > 1$ (the incentive effect), the tax elasticities, $\epsilon_L$ and $\epsilon_{r_d}$, are negative since $(1-p) < 1$ and $a < 1$. The change in the

[35] The combined outcome of lower loan rates (Hypothesis 4) and lower loan volumes (Hypothesis 3) predicted by our model is similar to other models of financial intermediation (Stiglitz and Weiss 1981; Besanko and Kanatas 1993; Bester 1994). However, our model differs from previous models as we show that taxes can have similar effects through the channels of strategic borrower default and bank monitoring effort.

spread between the loan and deposit rate is $\frac{dR^*}{d\tau}\frac{1}{R^*} - \frac{dr_d}{d\tau}\frac{1}{r_d} = \epsilon_L - \epsilon_{r_d} < 0$. If the incentive effect is negligible, i.e. $\frac{G^{'}(p^*)p}{G(p)} \cong 0$ , the change in the spread between the loan and deposit rate is $\frac{dR^*}{d\tau}\frac{1}{R^*} - \frac{dr_d}{d\tau}\frac{1}{r_d} = \epsilon_L - \epsilon_{r_d} > 0$.

Our sixth and last hypothesis relates to the bank's monitoring efforts with respect to a change in the tax rate.

***Hypothesis* 6**: The optimal monitoring will decrease in response to taxes ( $\frac{\mathrm{d}p^*}{\mathrm{d}\tau} < 0$).

This hypothesis describes the tax wealth effect on the bank's monitoring effort. As marginal gains from recovering money from defaults are partly taxed away, the bank adjusts by reducing its monitoring costs at the margin.

### 3.4 Empirical Strategy

In this section we describe our research design, identification strategy, sample of banks and the outcome and control variables used in the empirical analysis.

#### 3.4.1 Research Design

For our research design to be valid, an important requirement is shock exogeneity. Tax changes often violate exogeneity assumptions because governments propose them far in advance of imposition and collection. If taxpayers anticipate and change behaviour prior to a change in taxation, potential outcomes are likely to be correlated with the policy intervention.

In this respect, the Tokyo bank tax is an exception for two reasons. First, the tax was planned in great secrecy giving banks no time to make strategic adjustments as a means of avoiding the Tokyo bank tax. No details were revealed

to the public prior to its first announcement on 8th February 2000 (DeWit, 2000). We verify this through a news wire search, where we find no press coverage discussing the Tokyo bank tax prior to this date. At the first public announcement, the Tokyo Government issued a preliminary list with banks selected to pay the Tokyo bank tax. These banks would later all be obliged to make tax payments to the Tokyo Government. Second, it is unlikely that banks could predict the type of tax change. For the tax proposal to become legally binding, it took approximately eight weeks. This period was marked by a high level of uncertainty as various decisions regarding the design of the bank tax were taken. Final terms and conditions of the bank tax were not revealed until one week prior to its formal adoption. In addition, the rule which legitimised the adoption of the Tokyo bank tax was based on an unusual interpretation of Japanese tax law. The Tokyo Government exploited a loophole in the tax system which entitled local governments to implement certain tax policies without the consent of the federal government (Ishi 2001). Although tax policies are not exclusively decided at federal level in Japan, the introduction of a special tax for banks on a local level was rather unusual. Due to the potential interaction with other types of bank regulation, bank taxation is generally considered as a policy tool used at national level. We check for anticipation effects in our robustness tests (discussed in Section 3.7.1) by introducing a placebo tax in the period just prior to the introduction of the Tokyo bank tax. If banks anticipated the tax change, we would expect to pick up a change in behaviour during this period. Our results are not indicative of any anticipatory effects (with the relationship between the Tokyo bank tax and our outcome variables proving to be insignificant).

Our research design also rests on the assumption that the adoption of the Tokyo bank tax triggered a change in bank behaviour. If the Tokyo bank tax did not represent a significant increase in the tax liabilities of affected banks, we would be concerned about a potentially weak effect from the introduction of the Tokyo Bank tax. We examine the tax payments made in relation to the Tokyo bank tax relative to other tax payments made during the fiscal year. In fiscal year 2000, the Tokyo Government collected bank taxes in the amount of ¥111 billion, representing around 30% of banks' overall tax expenses in that year.

### 3.4.2 Identification Strategy

Our assumption is that exogenous variation in taxation affects the ability of banks to act as financial intermediaries. We classify banks into affected banks (those that are liable to pay the Tokyo bank tax) and unaffected banks (those that are not). Based on this classification we use a difference-in-differences approach, which compares the difference in the outcome of the affected banks between the pre-tax period and the post-tax period with the same difference in the outcome of the unaffected banks. To investigate the effect of the Tokyo bank tax on bank behaviour, we estimate a regression of the form:

$$Y_{it} = \delta \underbrace{Bank_i^{Taxed} * Post_t}_{TAX_{i,t}} + \beta X_{i,t-1} + \alpha_i + \gamma_t + \epsilon_{it}, \tag{3.10}$$

where $i$ denotes bank and $t$ denotes time. $Y_{it}$ represents each of the dependent variables: net interest margin, net interest and fee margin, mark-up, and markdown, amount of loans granted, core and non-core deposits (see Section 3.4.3.2 for a discussion of variables). $Bank_i^{Taxed}$ is an indicator variable which captures whether a bank is liable for the Tokyo bank tax or not. The indicator

variable $Post_t$ equals one after the Tokyo bank tax is introduced and zero otherwise. Therefore, the dichotomous treatment indicator $TAX_{i,t}$ is zero for all banks in the pre-Tokyo bank tax period and one for those banks that are taxed when the Tokyo bank tax comes into effect. $X_{i,t-1}$ is a vector of bank level control variables that vary over time and across banks. These control variables include capital adequacy, asset quality, management efficiency, earnings, liquidity, diversification, size and market share. Each of these controls enters the model lagged by one period to avoid simultaneity. The model also includes time dummies, $\gamma_t$, to capture time effects common to all banks, as well as, bank specific fixed effects, $\alpha_i$, to control for unobserved bank level heterogeneity. $\epsilon_{it}$ is a stochastic error term.

Estimation of Equation (3.10) is executed using ordinary least squares (OLS), with standard errors that are robust to heteroscedasticity and clustered at the bank level to control for within-bank correlation (Arellano 1987). The coefficient of interest is $\delta$, which represents the impact of the Tokyo bank tax on bank behaviour.

A key identification assumption behind our estimation strategy is that, in the absence of treatment, the difference-in-differences estimator is zero; the so-called parallel trend assumption. This assumption requires that the trend in the outcome variable is similar for both treatment and control groups in the pre-tax (shock) period. To check whether the parallel trend assumption is satisfied we repeat the analysis in periods when there was no change in the taxes. We find that the coefficients on $TAX_{i,t}$ do not differ from zero (see Section 3.7.1).

### 3.4.3 Data

#### 3.4.3.1 Sample

The data used in our analysis is compiled from the Japan Bankers Association dataset, which provides detailed balance sheet and income statement for all 148 of its member-banks on an individual bank basis. Results reported here are all from the semi-annual frequency dataset. The period of analysis, spans March 1998 (fiscal year 1997) through September 2001 (fiscal year 2001). This period is determined primarily by the introduction of the Tokyo bank tax and the availability of semi-annual data. The Tokyo bank tax became effective on 1st April 2000. This divides our sample into a pre-intervention period of two and a half years, and an intervention period of one and a half years.

Our sample of commercial banks comprises both city and regional banks. Trust banks and long-term credit banks are excluded from our sample, since these types of banks have supervisory procedures and business models that are fundamentally different from commercial banks. The restriction of our sample to commercial banks ensures sufficient overlap in the distribution of the covariates across affected and unaffected banks, thus allowing the correct statistical inference to be drawn (Imbens and Rubin 2015).

Banks which either fail or went into public administration during the period of our analysis are excluded from the sample.[36] We also identify one incidence of a

[36] The following banks were excluded from the sample: Hokkaido Takushoku Bank (failed November 17, 1997), Tokuyo City Bank (failed Nov 27, 1997), Tokyo Sowa Bank (under public administration, June 12, 1999), Kokumin Bank (under public administration, April 11, 1999), Niigata Chuo Bank (under public administration, October 2, 1999), Ishikawa Bank (failed, March 2001), Chubu Bank (failed, March 8, 2001), Kyoto Kyoei Bank (failed, October 14, 1997), Kofuku Bank (under public administration, May 22, 1999), Kansai Sawayaka Bank (formerly Kofuku Bank), Namihaya Bank (under public administration, August 7, 1999), Midori Bank (failed, May 15,1998). (Source: Bank of Japan, Deposit Insurance Corporation Japan, Financial Services Agency Japan).

merger between an affected and an unaffected bank.[37] To ensure the separability of treatment and control groups, these banks are also excluded from our sample. Our final sample is an unbalanced panel of 998 bank-year observations of 126 Japanese commercial banks (9 city banks and 117 regional banks). Of the 126 commercial banks in our sample, 17 banks were subject to the Tokyo bank tax.

#### 3.4.3.2 Variables

To investigate the impact of the introduction of the Tokyo bank tax on bank behaviour, and in line with our hypotheses, we employ several dependent variables. The main variable of interest is the *net interest margin*, which is defined as interest income minus interest expenses over total assets. We use the *net interest margin* to capture a bank's ability to generate profits via financial intermediation. We also calculate the *net interest and fee margin*. This would account for a potential shift in the pricing of loans and deposits from a rate-based approach to a fee-based approach as a response to the Tokyo bank tax.

In principle, a pass-through of taxes could occur through an increase in the interest rate on loans or through a decrease in the interest rate on deposits. To investigate the effect of the tax on the pricing of loans and deposits, we calculate a *markdown* and *mark-up*. These are calculated using implicit interest rates on deposits and loans. Following prior literature, we define the implicit deposit (loan) rate as the ratio of interest expenses (income) to total deposits (loans) (Becker 1975). These implicit rates reflect the average interest rates over various types of deposits and loans respectively. We then calculate the *mark-up* (*markdown*) as the

[37] Hachijuni Bank (treated) acquires Niigata Chuo Bank (unaffected), September 29, 2000; (Financial Services Agency Japan).

spread between the implicit loan (deposit) rate and the money market interest rate (Albertazzi and Gambacorta, 2010).

To assess the effect of the Tokyo bank tax on the funds channelled from savers to borrowers, we use total loans, core and non-core deposits, denoted as *loanvol*, *coredep* and *noncoredep* respectively. We take the natural logarithm of these variables. Core deposits are those that have low interest-rate sensitivity. These include current, ordinary, savings and deposits at notice. Non-core deposits are those that have high interest-rate sensitivity, including time, instalment and negotiable certificates of deposits (Aonokazu, 2006). Core and non-core deposits are reported at an annual frequency.

Panel A of Table 3.2 provides detailed definitions of the outcome variables used in our analysis. Table 3.3 reports means and standard deviations of the same variables for affected and unaffected banks before and after the introduction of the Tokyo bank tax at the beginning of the new fiscal year in April 2000. Panel A of Table 3.3 shows that unaffected banks are slightly more profitable in intermediating funds (1.99%) than affected counterparts (1.33%). This pattern remains when fees are also considered. This is due to affected banks charging on average slightly lower rates on loans granted (2.27%) and paying higher rates to depositors (0.67%) relative to unaffected counterparts (2.54% and 0.27%). Treated banks are larger than unaffected counterparts (in terms of total loans).

## Table 3.2 | Variable Definitions and Sources

| Variable Name | Definition | Data Source |
|---|---|---|
| **Panel A \| Dependent Variables** | | |
| Net Interest Margin<br>*nim* | $\frac{(Interest\ Income\ -\ Interest\ Expenses)}{Total\ Assets}$ | Japan Bankers Association |
| Net Interest and Fee Margin<br>*nifm* | $nim + \frac{Fee\ Income - Fee\ Expense}{Total\ Assets}$ | Japan Bankers Association |
| Mark-up<br>*markup* | $\frac{Loan\ Interest\ Income}{Total\ Loans} - Money\ Market\ Rate$ | Japan Bankers Association and Bank of Japan |
| Mark-down<br>*markdown* | $\frac{Deposit\ Interest\ Expenses}{Total\ Deposits} - Money\ Market\ Rate$ | Japan Bankers Association and Bank of Japan |
| Loan Volume<br>*loanvol* | $log(Loans)$ | Japan Bankers Association |
| Core Deposit Volume<br>*coredep* | $log(Core\ Deposits)$<br>Core Deposits include: current deposits, ordinary deposits, savings deposits and deposits at notice | Japan Bankers Association and (Aonokazu 2006, p.3) |
| Non-core Deposit Volume<br>*noncoredep* | log($Noncore\ Deposits$)<br>Non-core deposits include: time deposits, instalment deposits and negotiable certificates of deposits | Japan Bankers Association and (Aonokazu 2006, p.3) |
| **Panel B \| Control Variables** | | |
| Capital Adequacy | $\frac{(Tier\ I\ Capital)}{Total\ Assets}$ | Japan Bankers Association |
| Asset Quality | $\frac{Nonperforming\ Loans}{Total\ Assets}$ | Japan Bankers Association |
| Management Efficiency | $\frac{Operating\ Expense}{Operating\ Income}$ | Japan Bankers Association |
| Earnings | $\frac{Net\ Income}{Total\ Assets}$ | Japan Bankers Association and Bank of Japan |
| Liquidity | $\frac{Cash}{Total\ Assets}$ | Japan Bankers Association |
| Diversification | $\frac{Operating\ Income - Interest\ Income}{Operating\ Income}$ | Japan Bankers Association |
| Size | $log(Total\ Assets)$ | Japan Bankers Association |
| Market Share | $\frac{Total\ Assets_i}{\sum_i^N Total\ Assets}$ | Japan Bankers Association |

The table presents definitions and data sources of the dependent and control variables used in the empirical analysis.

## Table 3.3 | Summary Statistics

| Variables | Affected banks | | Unaffected banks | |
|---|---|---|---|---|
| | *Before* | *After* | *Before* | *After* |
| **Panel A \| Dependent Variables** | | | | |
| Net Interest Margin (%) | 1.33 | 1.31 | 1.99 | 1.89 |
| | (0.28) | (0.26) | (0.23) | (0.24) |
| Net Interest and Fee Margin (%) | 1.48 | 1.48 | 2.09 | 1.99 |
| | (0.29) | (0.28) | (0.21) | (0.20) |
| Mark-up (%) | 2.27 | 2.15 | 2.54 | 2.49 |
| | (0.23) | (0.15) | (0.32) | (0.33) |
| Mark-down (%) | 0.67 | 0.46 | 0.27 | 0.17 |
| | (0.43) | (0.33) | (0.14) | (0.10) |
| Total Loans (¥ Trillion) | 11.81 | 11.46 | 0.97 | 0.97 |
| | (0.92) | (0.89) | (0.76) | (0.77) |
| Core Deposits (¥ Trillion) | 4.22 | 5.15 | 0.31 | 0.36 |
| | (0.90) | (0.88) | (0.92) | (0.95) |
| Non-core Deposits (¥ Trillion) | 8.32 | 8.16 | 0.87 | 0.88 |
| | (0.84) | (0.83) | (0.74) | (0.75) |
| **Panel B \| Control Variables** | | | | |
| Capital Adequacy (%) | 2.88 | 3.49 | 1.88 | 2.19 |
| | (1.03) | (1.04) | (0.82) | (1.03) |
| Asset Quality (%) | 2.93 | 4.08 | 2.71 | 4.86 |
| | (2.93) | (1.64) | (2.14) | (2.18) |
| Management Efficiency (%) | 0.97 | 1.09 | 1.03 | 1.05 |
| | (0.16) | (0.10) | (0.15) | (0.33) |
| Earnings (%) | -0.23 | 0.10 | -0.09 | -0.03 |
| | (0.64) | (0.22) | (0.62) | (0.43) |
| Liquidity (%) | 4.93 | 4.85 | 3.44 | 3.28 |
| | (2.69) | (2.06) | (2.08) | (1.78) |
| Diversification (%) | 27.12 | 31.23 | 17.12 | 17.05 |
| | (12.07) | (9.93) | (6.66) | (6.17) |
| Size (¥ Trillion) | 27.3 | 26.4 | 1.81 | 1.85 |
| | (22.8) | (22.2) | (1.28) | (1.32) |
| Market Share (%) | 3.38 | 3.52 | 0.23 | 0.24 |
| | (2.79) | (3.13) | (0.16) | (0.17) |
| Number of Observations | 85 | 50 | 542 | 321 |
| Number of Banks | 17 | 17 | 109 | 109 |

The table presents means and standard deviations (in parenthesis) of dependent and control variables used in the empirical analysis by treatment status before and after the introduction of the Tokyo bank tax.

Bank specific covariates include financial characteristics used typically by supervisors to monitor the performance and safety and soundness of banks. These include capital adequacy, asset quality, management efficiency, earnings and liquidity. We also include three additional covariates in order to capture any

effects related to bank size, diversification, and market share.[38] Panel B of Table 3.2 provides detailed definitions of the covariates used in our empirical analysis. The comparability of affected and unaffected banks is assessed based on these aforementioned observable covariates by examining their respective moments and empirical distributions. Panel B of Table 3.3 reports means and standard deviations of these variables for affected and unaffected banks before and after the introduction of the Tokyo bank tax. Overall, the summary statistics confirm that affected and unaffected banks are on average relatively similar across a number of dimensions. There are however, dimensions in which the two groups differ. We adjust statistically for such observed pre-intervention differences in the characteristics of affected and unaffected banks, by including all the aforementioned bank specific control variables in our estimable model.

### 3.5 Findings

Table 3.4 presents the results of estimating Equation (3.10). We find that the coefficients on TAX reported in Columns 1 and 2 are positive and statistically significant at the 1% level. This is consistent with our hypothesis that banks widen margins in response to the imposition of the Tokyo bank tax. The net interest margin (*nim*) and the net interest and fee margin (*nifm*) widen by 6.2 basis points and 8.2 basis points respectively, on average, after the introduction of the Tokyo bank tax. These coefficients also indicate that the impact of the tax on bank margins is economically significant since affected banks increase both their *nim* and *nifm* by about 20% of their respective within sample standard deviation. As such, these findings are consistent with banks passing some of the costs associated

[38] All regressions reported below include an income-based diversification measure. Nevertheless, our results do not change if an asset diversification measure is included as well. This implies that our findings are robust to differences in portfolio or business activities of banks included in our sample.

with the imposition of the tax onto customers via adjustments in interest and fee rates.

To disentangle the effect of the Tokyo bank tax on borrowers and depositors, we decompose the net interest margin into a *mark-up* and *markdown*. The results reported in Columns 3 and 4 of Table 3.4 indicate that both the *mark-up* and *markdown* decrease once the Tokyo bank tax is introduced. However, the *markdown* declines by two basis points more than the *mark-up*, which is in line with a widening of the net interest margin. Specifically, the *mark-up* declines on average by 8.3 basis points, whereas the *markdown* declines by 10.3 basis points. A declining *mark-up* is in line with our hypothesis that banks reduce their lending rate as a response to the tax. Overall, these results suggest a pronounced pass-through effect to depositors who shoulder a considerable portion of the increased tax burden arising from the introduction of the Tokyo bank tax. These results are also in line with prior evidence suggesting that taxes on banks are passed through to customers (Demirgüç-Kunt and Huizinga 2001).

Column 5 of Table 3.4 summarises the estimated relationship between the Tokyo bank tax and bank credit supply. The coefficient on TAX is negative and statistically significant at the 5% level. This finding indicates that banks when faced with the Tokyo bank tax reduce lending. The effect is also economically significant. Treated banks reduce total lending by 2.8% more than unaffected counterparts on average. The average affected bank contracts credit supply by ¥354bn. This decline in the credit extended by affected banks implies a sizeable reduction in funding for real economic activity. This supports our second hypothesis which contends that the imposition of the Tokyo bank tax affects the

entire economy via a contraction in credit supply. Our findings also accord with recent documented evidence of an adverse effect of taxes on credit supply (Buch et al. 2016; Schandlbauer 2017).

Finally, Columns 6 and 7 provide estimates of the tax effect on the volume of core deposits and non-core deposits. Banks affected by the Tokyo bank tax hold fewer non-core deposits (*noncoredepovol*) than banks in the control group. In the aftermath of the Tokyo bank tax, non-core deposits on average decline by 5.74 percent more for affected banks. Core deposits remain unchanged. These results are indicative of rate adjustments for deposit types with relatively high interest rates, and are consistent with the notion that banks affected by the tax accept fewer deposits. Our findings further substantiate a partial pass-through effect of the tax burden from banks to depositors.

### 3.6 Testing the Bank Monitoring Channel

Our theoretical model predicts that the channel through which a tax on gross profit leads to contraction in financial intermediation is via a reduction in the monitoring effort expended by affected banks. In this section, we present the results of several tests conducted at bank and borrower level, in order to provide corroborating evidence in support of the monitoring channel.

#### 3.6.1 Bank Monitoring and the Loan Portfolio

To investigate whether the Tokyo bank tax affects financial intermediation activity via an adverse impact on the monitoring effort of affected banks, we analyse changes in the structure of the loan portfolios of affected banks around the time of the introduction of the tax. First, we examine changes in the loan portfolios of banks in relation to the geographic proximity of their respective borrowers.

## Table 3.4 | Baseline Results

| | *nim* | *nifm* | *markup* | *markdown* | *loanvol* | *coredepovol* | *noncoredepovol* |
|---|---|---|---|---|---|---|---|
| TAX | 0.062*** | 0.082*** | -0.083*** | -0.103*** | -0.028** | 0.008 | -0.057*** |
| | (0.021) | (0.023) | (0.027) | (0.025) | (0.011) | (0.019) | (0.014) |
| Capital Adequacy | 0.044*** | 0.045*** | -0.019 | -0.046*** | 0.010*** | 0.025** | -0.00001 |
| | (0.008) | (0.010) | (0.012) | (0.012) | (0.003) | (0.010) | (0.004) |
| Asset Quality | 0.0001 | -0.003 | 0.007 | 0.005 | 0.0004 | -0.001 | 0.006*** |
| | (0.005) | (0.005) | (0.004) | (0.004) | (0.002) | (0.003) | (0.002) |
| Management Efficiency | -0.068 | -0.104 | -0.035 | 0.067 | 0.009 | -0.016 | 0.002 |
| | (0.054) | (0.063) | (0.045) | (0.042) | (0.017) | (0.050) | (0.024) |
| Earnings | 0.035*** | 0.036*** | 0.017* | -0.026* | -0.001 | 0.012 | 0.003 |
| | (0.010) | (0.011) | (0.010) | (0.013) | (0.003) | (0.010) | (0.005) |
| Liquidity | -0.006** | -0.008** | 0.001 | 0.010** | -0.002* | -0.002 | 0.001 |
| | (0.003) | (0.003) | (0.004) | (0.005) | (0.001) | (0.002) | (0.001) |
| Market Share | 0.287*** | 0.293*** | 0.314*** | 0.267 | 0.039 | -0.164* | 0.120*** |
| | (0.085) | (0.089) | (0.127) | (0.186) | (0.027) | (0.092) | (0.039) |
| Diversification | -0.001 | -0.001 | -0.0005 | 0.0006 | -0.0002 | 0.0002 | -0.0004* |
| | (0.001) | (0.001) | (0.0007) | (0.0006) | (0.0002) | (0.0002) | (0.0002) |
| Size | -0.435** | -0.424** | -0.254** | -0.030 | 0.863*** | 1.116*** | 0.903*** |
| | (0.183) | (0.172) | (0.122) | (0.060) | (0.042) | (0.136) | (0.058) |
| Bank Fixed Effects | YES | YES | YES | YES | YES | YES | YES |
| N | 998 | 998 | 998 | 998 | 998 | 500 | 500 |
| $R^2$ | 0.41 | 0.37 | 0.63 | 0.59 | 0.85 | 0.85 | 0.88 |

This table reports the results of ordinary least squares regressions using a sample of 126 Japanese banks spanning the period from March 1998 to September 2001. The dependent variables are defined in Table 3.2. The main explanatory variable is TAX, an indicator variable equal to one for banks affected by the Tokyo bank tax when it comes into effect and zero otherwise. To control for potential heterogeneity between affected and unaffected banks the lagged values of capital adequacy, asset quality, management efficiency, earnings, liquidity, market share, diversification and size (see Table 3.2 for definitions of these variables) are included in all regressions as further control variables. In addition, a set of time dummies and bank specific fixed effects are included across all regressions. Robust standard errors clustered at the bank level are reported in parentheses. ***, **, *, indicate significance at the 1%, 5%, and 10% level respectively.

Geographic proximity between banks and borrowers may reduce asymmetric information, which in turn lowers the cost of monitoring.[39] Prior evidence suggests that banks face higher costs in collecting soft information on distant borrowers relative to more geographically proximate counterparts (Sufi 2007; Agarwal and Hauswald 2010; Knyazeva and Knyazeva 2012; Cotugno et al. 2013). Moreover, banks may reject loan applications from firms that are located at distance, given that the reliability of soft information regarding the creditworthiness of the borrower decreases with distance (Hauswald and Marquez 2006). Therefore, we postulate that following the imposition of the Tokyo bank tax affected banks reduce the proportion of their overall lending toward borrowers that are geographically distant.

To test this hypothesis, we collect data on the loans outstanding to individual listed firms for each bank in our sample. The data are compiled from the Nikkei NEEDS Financial Quest database. The data are reported on an annual frequency. Each firm and bank included in this database has a unique geographic area code based on the location of their headquarters. Using these area codes we create two portfolios, which we term 'local' and 'distant'. The local portfolio (LP) contains all loans granted to firms located in the same area code as the bank is located. The distant portfolio (DP) contains loans granted to firms outside the area code where the bank is located. To test the monitoring channel, we estimate the following model:

$$Portfolio_{i,t} = \delta TAX_{i,t} + \beta X_{i,t-1} + \alpha_i + \gamma_t + \epsilon_{it} \quad (3.11)$$

[39] This is an assumption adopted in a number of theoretical papers, which investigate the impact of geographic proximity on: banks' decision to diversify (Almazan 2002), banks' ability to extract informational rents (Hauswald and Marquez 2006); and banks' competitive location (Lederer and Hurter, 1986).

where $Portfolio_{i,t}$ represents LP or DP as a proportion of total loans. The explanatory and control variables are as defined in Table 3.2. The model also includes time dummies, $\gamma_t$, to capture time effects common to all banks, as well as bank specific fixed effects, $\alpha_i$, to control for unobserved bank level heterogeneity. $\epsilon_{it}$ is a stochastic error term.

The results of estimating Equation (3.11) are reported in Panel A of Table 3.5. We find that both local and distant loan portfolios as shares of affected banks total loans decline after the introduction of the tax, reflecting an overall decline in the supply of credit granted by affected banks. However, the DP declines proportionately more than the LP. The difference in the decline of the DP relative to the LP is significant at the 10% level.

Overall these results suggest that banks affected by the imposition of the Tokyo bank tax reduce lending to firms located at distance relative to those which are geographically proximate. As such this lends support to the contention that the introduction of the Tokyo bank tax reduces the level of monitoring by affected banks. The robustness of these findings is verified by a placebo test whereby we show that local and distant portfolios do not change when we assume falsely that the Tokyo tax is introduced one year prior to its actual adoption. The results of this test are reported in Panel A of Table 3.10.

As a further test of whether banks respond to the tax by reducing lending to borrowing firms that entail higher monitoring costs, we follow Sufi (2007) and classify borrowing firms as transparent and opaque. We use these classifications to construct two portfolios. The transparent portfolio (TP) contains all loans granted to firms with a rating from the Rating and Investment Information, a Japanese

rating agency.[40] The opaque portfolio (OP) contains loans granted to unrated firms. We use the TP and OP to estimate Equation (3.11). The point estimates presented in Panel B of Table 3.5 suggest that affected banks reduce lending to unrated firms by more than to rated counterparts. This finding provides further support to the contention that the introduction of the Tokyo bank tax reduces the level of monitoring by affected banks.

Finally, we investigate whether banks respond to the Tokyo bank tax by altering lending to borrowers with higher levels of intangible assets. Intangible assets are difficult to value, and as such have lower collateral value, making them less useful as support for securing external financing (Almeida and Campello 2007). Moreover, given that the use of collateral mitigates borrower moral hazard and reduces the probability of default (Boot et al. 1991) or asset substitution (Stulz and Johnson 1985)[41], we might expect that banks affected by the tax reduce lending to those firms that invest more in intangible assets.

To investigate this proposition, we construct two loan portfolios based upon the extent to which borrowing firms invest in intangible assets as follows. The intangible portfolio (IP) contains loans granted to firms that belong to the top quantile of the distribution of intangible assets (normalised by total assets) in the pre-tax period.[42] The pledgeable portfolio (PP) comprises loans granted to firms in

[40] Unfortunately, due to a lack of data pertaining to rating information on Japanese listed companies our sample is restricted between 1999 and 2001, and thus prevents us from conducting a placebo test to verify the robustness of this analysis.

[41] Asset substitution describes the process of substituting less risky assets with riskier ones.

[42] Long and Malitz (1985) argue that informational asymmetry associated with a borrower's investment on research and development (R&D) projects is such that the potential of risk shifting is difficult for outsiders to detect. Building on this argument we create two portfolios based on the loans granted to firms in the bottom quantile and the top quantile of the distribution of their pre-tax period R&D expenses (normalised by total assets), respectively. Untabulated results lend support to the contention that the introduction of the Tokyo bank tax reduces the level of monitoring by affected banks.

the bottom quantile of the distribution of intangible assets (normalised by total assets) in the pre-tax period.

**Table 3.5 | Testing the Bank Monitoring Channel – Bank-based Analysis**

| Panel A \| Distance-based portfolios | | |
|---|---|---|
| | *Local Portfolio* | *Distant Portfolio* |
| TAX | -0.002** | -0.004* |
| | (0.001) | (0.002) |
| Control variables | YES | YES |
| Bank Fixed Effects | YES | YES |
| Observations | 457 | 457 |
| $R^2$ | 0.15 | 0.46 |
| Panel B \| Rated-based portfolios | | |
| | *Transparent Portfolio* | *Opaque Portfolio* |
| TAX | -0.003*** | -0.004*** |
| | (0.001) | (0.001) |
| Control variables | YES | YES |
| Bank Fixed Effects | YES | YES |
| Observations | 379 | 379 |
| $R^2$ | 0.39 | 0.47 |
| Panel C \| Collateral-based portfolios | | |
| | *Intangible Portfolio* | *Pledgeable Portfolio* |
| TAX | -0.002** | -0.0001 |
| | (0.001) | (0.001) |
| Control variables | YES | YES |
| Bank Fixed Effects | YES | YES |
| Observations | 474 | 474 |
| $R^2$ | 0.21 | 0.04 |

This table reports the results of the bank-based analysis on the bank monitoring channel. Panel A reports the results of ordinary least squares (OLS) regressions using a sample of 126 Japanese banks spanning the period from 1998 to 2001. The dependent variables are the shares of the local portfolio, LP (loans granted to firms located in the same area code as the bank is located) and distant portfolio, DP (loans granted to firms outside the area code where the bank is located) to the bank's total loan portfolio. Panel B reports the results of OLS regressions using a sample of 126 Japanese banks spanning the period from 1999 to 2001, due to data limitations on borrowing firms' ratings. The dependent variables are the shares of the transparent portfolio, TP (loans granted to firms rated by a third party) and opaque portfolio, OP (loans granted to unrated firms) to the bank's total loan portfolio. Panel C reports the results of OLS regressions using a sample of 126 Japanese banks spanning the period from 1998 to 2001. The dependent variables are the shares of the intangible portfolio, IP (loans granted to firms belonging to the top quantile of the distribution of pre-tax period intangible assets) and pledgeable portfolio, PP (loans granted to firms belonging to the bottom quantile of the distribution of pre-tax period intangible assets) to the bank's total loan portfolio. The main explanatory variable is TAX, an indicator variable equal to one for banks affected by the Tokyo bank tax when it comes into effect and zero otherwise. To control for potential heterogeneity between affected and unaffected banks the lagged values of capital adequacy, asset quality, management efficiency, earnings, liquidity, market share, diversification and size (see Table 3.2 for definitions of these variables) are included in all regressions as further control variables. In addition, a set of time dummies and bank specific fixed effects are included across all regressions. Robust standard errors clustered at the bank level are reported in parentheses. ***, **, *, indicate significance at the 1%, 5%, and 10% level respectively.

We use the IP and PP to estimate Equation (3.11). The point estimates presented in Panel C of Table 3.5 suggest that affected banks reduce lending to firms with higher intangible (fewer pledgeable) assets relative to total assets. The

robustness of these findings are verified by a placebo test where we falsely assume that the Tokyo tax is introduced one year prior to its actual adoption. The results of this test are reported in Panel B of Table 3.10. These findings further corroborate our hypothesis that the introduction of the Tokyo bank tax reduces the level of monitoring by affected banks.

### 3.6.2 Bank Monitoring and Borrowing Firms

#### 3.6.2.1 Evidence from the Bond Market

We also test for the existence of the monitoring channel predicted by our model by examining the value of bank monitoring to borrowing firms. To this end we first examine the effect of the announcement of the tax on the borrowing costs of firms. Here we focus on external public debt. Prior theoretical and empirical literature suggests that bank monitoring of corporate creditworthiness provides benefits to firm claimants (Holmström and Tirole 1997; Datta et al. 1999). These benefits arise due to banks' superior access to private information on borrowers (Fama 1985), as well as to their efficiency and flexibility in restructuring and renegotiating debt claims (Berlin and Loeys 1988; Gertner and Scharfstein 1991; Denis and Mihov 2003). In line with this literature, we postulate that if an increase in taxes reduces the monitoring effort expended by banks, we expect to observe higher at-issue yield spreads for public (straight) bond offerings from firms that borrow from banks that are liable to pay the Tokyo bank tax.

To test this hypothesis, we collect data on Japanese bond issues from Thomson Reuters SDC Platinum database and merge it with financial statements of bond issuing firms drawn from Datastream. Following standard practice in corporate bond pricing literature we restrict our sample to straight bonds with

fixed coupon rates (Gande et al. 1997; Datta et al. 1999). In doing so, we avoid complications of measuring yields for convertible and floating rate bond issues. We use our sample to estimate the following regression equation:

$$BPS_{f,j,t} = \alpha + \delta TAX_{f,t}^{Bond} + \beta X_{f,j,t} + \xi_f + \gamma_t + \varepsilon_{f,j,t} \quad (3.12)$$

where BPS is the premium of the at-issue yield spread of the debt security *j* over the yield of a Japanese government security of comparable maturity. $TAX_{f,t}^{Bond}$ is a dummy variable that equals zero for all bonds issued by a firm $f$ in the pre-Tokyo bank tax period $t$ and one for those bonds issued by firms that are customers of affected banks when the Tokyo bank tax comes into effect. More specifically, we consider the two largest banks the firm is banking with (in terms of loans granted to the firm) in classifying firms into treatment and control groups. This is done on the basis that the two largest banks a firm banks with typically have similar loan shares among bank lenders of the firms in our sample, and are therefore similarly incentivised to monitor the borrowing firms. $X_{f,j,t}$ represents a vector of bond and firm specific variables comprising: maturity (measured in years to bond maturity); amount (the natural logarithm of the size of the bond issue); size (the natural logarithm of the total assets of the issuing firm) and leverage (total debt scaled by total assets). We also control for Keiretsu affiliation[43], industry, prefecture and bank type effects. The model also includes time effects, $\gamma_t$, and firm specific fixed effects, $\xi_f$. $\varepsilon_{f,j,t}$ is a stochastic error term.

[43] Keiretsu are groups of Japanese firms and financial institutions that have financial inter-connections, leading to close cooperation (Hoshi et al. 1991; Berglof and Perotti 1994). The importance of Keiretsu in the Japanese economy, as well as the strength of the links between Keiretsu members is somewhat contested (Miwa and Ramseyer 2002; Ramseyer and Miwa 2002).

The estimation of Equation (3.12) is reported in Panel A of Table 3.6. All statistically significant control variables have the expected sign. The at-issue yield spread reduces with size (as larger firms are considered safer investments) and

**Table 3.6 | Testing the Bank Monitoring Channel – Borrower-based Analysis**

| Panel A \| Borrowers' cost of public debt | | | |
|---|---|---|---|
| | BPS | | |
| $TAX^{Bond}$ | 22.57** | | |
| | (9.41) | | |
| Maturity | -0.001 | | |
| | (0.002) | | |
| Amount | -2.182 | | |
| | (5.71) | | |
| Size | -67.42** | | |
| | (25.35) | | |
| Leverage | 151.43** | | |
| | (70.82) | | |
| Other control variables | YES | | |
| Observations | 660 | | |
| $R^2$ | 0.734 | | |
| Panel B \| Borrowers' market value | | | |
| | CAR[0,0] | CAR[0,3] | CAR[0,5] |
| $TAX^{Stock}$ | -0.203*** | -0.286** | -0.295** |
| | (0.062) | (0.111) | (0.111) |
| Size | -0.001 | 0.032 | 0.025 |
| | (0.016) | (0.020) | (0.020) |
| Risk | -0.126 | -0.065 | -0.107 |
| | (0.205) | (0.185) | (0.185) |
| Access to finance | 0.022 | -0.089 | -0.078 |
| | (0.049) | (0.136) | (0.135) |
| Other control variables | YES | YES | YES |
| Observations | 928 | 928 | 928 |
| $R^2$ | 0.101 | 0.181 | 0.176 |

This table reports the results of the borrower-based analysis on the bank monitoring channel. Panel A reports results on the effect of the Tokyo bank tax on the borrowers' cost of public debt using bonds issued during the period spanning fiscal year 1997 to fiscal year 2001. The dependent variable, BPS, is the at-issue yield spread in basis points of the debt security over that of a corresponding Japanese government security of comparable maturity. $TAX^{Bond}$ is an indicator variable equal to one if the two largest banks the firm is banking with (in terms of loans granted to the firm) are affected by the Tokyo bank tax when it comes into effect and zero otherwise. *Maturity* is the number of years of the security until maturity. *Amount* is the natural logarithm of the size of bond issue. *Size* is the natural logarithm of issuing firm's total assets. *Leverage* is the ratio of total debt to total assets of the issuing firm. Panel B reports coefficient estimates of OLS regressions of cumulative abnormal returns (CAR) for all listed Japanese firms included in the Japan Company Handbook (excluding banks) surrounding the announcement of the Tokyo bank tax. The event day 0 is February 7, 2000, when the Tokyo governor announced the plan to levy the Tokyo bank tax. The CAR is measured on the day of the announcement only, from day 0 to day 3, and from day 0 to day 5, as indicated. $TAX^{Stock}$ denotes the treatment group dummy which takes the value of one if the two largest banks the firm is banking with (in terms of loans granted to the firm) are affected and zero otherwise. *Market cap* is the natural logarithm of the firm's total market capitalization a month before the Tokyo bank tax announcement. *Risk* is the standard deviation of the firm's stock returns during the estimation period [-260,-20]. *Access to finance* is a dummy variable that equals one if the firm has issued at least one bond in the 3 years prior to the Tokyo tax bank announcement. Other control variables include industry, prefecture, bank-type and Keiretsu affiliation dummies. Robust standard errors clustered at the firm level are reported in parentheses.***, **, *, indicate significance at the 1%, 5%, and 10% level respectively.

increases with leverage (since more debt exacerbates risk shifting and asset substitution agency conflicts). More interesting (for our purposes) is that the at-issue yield spread increases by 22 basis points for bond issues offered by firms banking with affected banks after the introduction of the Tokyo bank tax. This increase in the at-issue-yield spread is economically and statistically significant (the latter at the 5% level) and is congruent with the contention of our theoretical model that the monitoring of borrowers by affected banks deteriorates after the introduction of the Tokyo bank tax. To validate this finding, in Panel C of Table 3.10 we report the results of a placebo test where we show no change in the at-issue yield spread in the 12 months prior to the introduction of the Tokyo bank tax.

#### 3.6.2.2 Evidence from the Stock Market

As an alternative approach to testing the monitoring channel, we investigate the effect of the announcement of the Tokyo bank tax on the stock prices of firms borrowing from affected banks. We postulate that if the increase in taxes reduces the monitoring effort expended by affected banks (as predicted by our theoretical model) we expect to observe negative abnormal returns for firms that borrow from banks subject to the Tokyo bank tax, upon the announcement of the tax. Our hypothesis aligns with extant literature, which views bank monitoring as a value enhancing function for the borrowing firm (Diamond 1991; Bhattacharya and Thakor 1993; Billett et al. 1995). This is due to bank monitoring raising the probability of firm success through enforcing either efficient project choice or level of entrepreneurial effort, which mitigates the moral hazard faced by outside shareholders and other investors (Seward 1990; Besanko and Kanatas 1993).

In testing our hypothesis, we obtain stock market data for all listed Japanese firms recorded in the Japan Company Handbook (excluding banks) from Datastream. Following Brown and Warner (1985), we calculate cumulative abnormal returns using the risk-adjusted market model as $CAR[0,n]_f = \sum_{t=0}^{n} AR_{f,t}$, where $CAR[0,n]_f$ is the cumulative abnormal return for firm *f* for event days 0 through $n$. $AR_{f,t}$ is calculated as $AR_{f,t} = R_{f,t} - \left(\hat{\alpha} + \hat{\beta} R_{M,t}\right)$, where $AR_{f,t}$ is the abnormal return for firm *f* on event day *t*, $R_{i,t}$ is the actual return on firm *f* for event day *t*, and $R_{M,t}$ is the daily return of the market portfolio approximated by the Tokyo Stock Price Index (Topix). $\hat{\alpha}$ and $\hat{\beta}$ are estimated from the equation $R_{f,t} = \alpha_f + \beta_f R_{M,t} + \varepsilon_{f,t}$ over the interval from 260 to 20 trading days before the event date. We subsequently regress these CARs on a treatment group dummy and control variables. Specifically, we estimate the following regression equation:

$$CAR[0,n]_f = \alpha + \beta TAX_f^{Stock} + X_f'\gamma + \varepsilon_f \tag{3.13}$$

$TAX_f^{Stock}$ is a dummy variable which takes the value of one if the firm's largest bank lenders are subject to the Tokyo bank tax and zero otherwise. As above, we consider the two largest banks the firm is banking with (in terms of loans granted to the firm) in classifying firms into treatment and control groups. $X_f$ denotes a vector of firm specific variables comprising: size (market capitalization); risk (volatility of stock returns); and access to alternative sources of finance (a dummy variable that takes the value of one if the firm has issued a bond within the past three years and zero otherwise).[44] We also control for Keiretsu affiliation, industry, and prefecture and bank type effects. Standard errors are clustered at the bank level.

[44] Data on Japanese bond issues are obtained from Thomson Reuters' SDC Platinum database.

Panel B of Table 3.6 provides estimates of Equation (3.13) for CARs of different length. In Column 1, where we consider the abnormal return on the day of the Tokyo tax announcement (CAR[0,0]) the coefficient on $TAX_f^{Stock}$ is -0.203, and is statistically significant at the 1% level. The difference in CARs between affected and unaffected firms increases slightly when we consider longer event windows. Specifically, when CAR[0,3] is considered (Column 2), the coefficient on $TAX_f^{Stock}$ is -0.286. This increases to -0.295 when CAR[0,5] is used in Column 3. These coefficients are also statistically significant at the 5% level. The negative signs on the coefficients indicate that the market value of firms which borrow from soon to be taxed banks reacts more negatively to the announcement of the tax than the market value of firms not borrowing from affected banks. These results are in line with the hypothesis that a reduction in bank monitoring activity can have a value destroying impact on the borrowing firm. This argument finds additional support from a placebo test conducted in the month prior to the introduction of the Tokyo Bank tax, the results of which are reported in Panel D of Table 3.10. Overall, Table 3.6 provides evidence in support of the monitoring channel identified by our model in Section 3.3 through which a tax levied on the gross profits of banks affects adversely financial intermediation activities.

### 3.7 Robustness Tests

This section presents the results of a set of robustness tests. These comprise: falsifications tests to test the common trend assumption, sensitivity checks on subsamples of banks and firms, tests on confounding events, and alternative methods (regression discontinuity and event study method).

### 3.7.1 Falsification Tests and Sensitivity Checks

A key identifying assumption behind the difference-in-differences approach is that outcome variables of affected and unaffected banks demonstrate similar trends in the absence of treatment (Abadie 2005). Although this assumption cannot be tested directly, placebo tests can to some extent mitigate concerns that the parallel trend assumption is violated. We conduct a placebo test by assuming falsely that the Tokyo bank tax was introduced one year prior to actual adoption. By introducing a placebo tax before the actual bank tax was adopted, we also test for potential anticipation effects. Panel A of Table 3.7 presents results of this test. None of the coefficients on Placebo-Tax are significant. This suggests that: the parallel trend assumption for the pre-period is not violated; anticipation effects are not present; and the effects on the outcome variables reported in Table 3.4 are associated with the introduction of the Tokyo bank tax.

To provide additional insights, we also examine whether certain groups of banks in our sample are driving our results. First, we consider the possibility that banks included in our control group and located further away from Tokyo may be exposed to different economic conditions than counterparts operating closer to Tokyo. In order to alleviate such concerns, we restrict our sample to banks which operate predominantly in the three major regions (Kanto, Chubu and Tohoku) that surround the Tokyo prefecture.[45] This restriction excludes banks located in Japan's other major industrial centres (such as the Kansai and Kyushu region) and reduces our sample size from 126 banks to 64 banks (comprising 17 affected and 47 unaffected). The results presented in Panel B of Table 3.7 are consistent with our

[45] Even after dropping the Tohoku region (which is more rural than either Kanto or Chubu), the results remain consistent.

main findings. Second, in Panel C of Table 3.7 we also consider the possibility that banks included in our control group and without any physical presence in Tokyo may behave differently to unaffected counterparts operating in Tokyo. We exclude banks without presence in Tokyo from our sample and re-estimate Equation (3.10). In all cases, the signs and the coefficients on the TAX variable are similar to those reported in Table 3.4. Third, in Panel D of Table 3.7, we address the possibility that our results are driven by banks included in our control group that are relatively smaller in size compared to the affected banks. To this end we restrict our sample to banks with total assets greater than the median bank in the sample. The results of this analysis are also consistent with our main findings.

Next, we deal with a common issue which often arises in empirical research using panel data in combination with difference-in-differences estimation. The problem arises due to serially correlated dependent variables, long time series, and little variation in the treatment variable (Bertrand et al., 2004). As a result, conventional OLS standard errors of difference-in-differences estimates could be biased downward. To alleviate concerns regarding serial correlation, we cluster the standard errors at the bank level throughout our analysis. To further check the robustness of our results, we collapse our sample period in two (Bertrand et al., 2004). We average the observations in dates prior to the Tokyo bank tax into a single pre-intervention period, and the observations in dates after the introduction of the tax into a single post-intervention period. The results are reported in Panel E of Table 3.7 and are consistent with the estimated tax effects reported in Table 3.4.

## Table 3.7 | Robustness Checks

| Panel A: Fiscal Year 1999 | | | | | | | |
|---|---|---|---|---|---|---|---|
| | *nim* | *nifm* | *markup* | *markdownn* | *loanvol* | *coredep* | *noncoredep* |
| Placebo-TAX | 0.012 | -0.008 | 0.006 | -0.018 | -0.013 | -0.012 | -0.070 |
| | (0.020) | (0.022) | (0.024) | (0.018) | (0.009) | (0.054) | (0.047) |
| Control Var | YES | YES | YES | YES | YES | YES | YES |
| Fixed Effects | YES | YES | YES | YES | YES | YES | YES |
| Observations | 375 | 375 | 375 | 375 | 375 | 250 | 250 |
| Panel B: Economic Trends | | | | | | | |
| | *nim* | *nifm* | *markup* | *markdown* | *loanvol* | *coredep* | *noncoredep* |
| TAX | 0.055** | 0.062** | -0.071** | -0.091*** | -0.032*** | -0.006 | -0.043*** |
| | (0.026) | (0.028) | (0.031) | (0.027) | (0.012) | (0.019) | (0.014) |
| Control Var | YES | YES | YES | YES | YES | YES | YES |
| Fixed Effects | YES | YES | YES | YES | YES | YES | YES |
| Observations | 455 | 455 | 455 | 455 | 455 | 228 | 228 |
| Panel C: Tokyo Presence Sample | | | | | | | |
| | *nim* | *nifm* | *markup* | *markdown* | *loanvol* | *coredep* | *noncoredep* |
| TAX | 0.059*** | 0.077*** | -0.079*** | -0.097*** | -0.027** | 0.002 | -0.055*** |
| | (0.021) | (0.023) | (0.027) | (0.025) | (0.011) | (0.020) | (0.015) |
| Control Var | YES | YES | YES | YES | YES | YES | YES |
| Fixed Effects | YES | YES | YES | YES | YES | YES | YES |
| Observations | 894 | 894 | 894 | 894 | 894 | 447 | 447 |
| Panel D: Large Banks Sample | | | | | | | |
| | *nim* | *nifm* | *markup* | *markdown* | *loanvol* | *coredep* | *noncoredep* |
| TAX | 0.053** | 0.065** | -0.051* | -0.053* | -0.021* | -0.013 | -0.030** |
| | (0.022) | (0.024) | (0.030) | (0.030) | (0.012) | (0.017) | (0.016) |
| Control Var | YES | YES | YES | YES | YES | YES | YES |
| Fixed Effects | YES | YES | YES | YES | YES | YES | YES |
| Observations | 500 | 500 | 500 | 500 | 500 | 251 | 251 |
| Panel E: Two-Period Sample | | | | | | | |
| | *nim* | *nifm* | *markup* | *markdown* | *loanvol* | *coredep* | *noncoredep* |
| TAX | 0.056** | 0.078*** | -0.065** | -0.085*** | -0.017* | 0.042** | -0.030** |
| | (0.025) | (0.028) | (0.033) | (0.030) | (0.010) | (0.020) | (0.012) |
| Control Var | YES | YES | YES | YES | YES | YES | YES |
| Fixed Effects | YES | YES | YES | YES | YES | YES | YES |
| Observations | 250 | 250 | 250 | 250 | 250 | 250 | 250 |

This table summarises the results of a number of robustness tests on the effect of the Tokyo bank tax on bank behaviour as well as on the validity of the "parallel trend" assumption. Panel A presents the results of ordinary least squares regressions using a sample spanning the periods before the introduction of the Tokyo bank tax. The main explanatory variable is Placebo-TAX, an indicator variable equal to one for banks affected by the Tokyo bank tax when it comes into effect and zero otherwise, but this time we falsely assume that this happens one year prior to the actual introduction. In Panel B, we restrict our sample to banks with presence in Tokyo, in order to alleviate concerns that some unaffected banks do not compete with affected banks in Tokyo, and as a consequence may affect our results. In Panel C, we limit our sample to banks which operate predominantly in the three major regions (Kanto, Chubu and Tohoku) that directly surround the Tokyo prefecture, in order to alleviate concerns regarding differential economic climates across Japan driving our main findings. In Panel D, we limit our sample to banks which have total assets greater than that of the median bank, in order to alleviate concerns regarding relatively small sized banks driving our main findings. In Panel E, following Bertrand et al. (2004) we collapse our dataset into a two-period panel, by averaging the observations in dates prior to the Tokyo bank tax into a single pre-intervention period and likewise for the observations in dates after the tax which are averaged into a single post-intervention period, in order to account for problems arising from serially correlated outcomes. The main explanatory variable for Panels B, C, D, and E is TAX, an indicator variable equal to one for banks affected by the Tokyo bank tax when it comes into effect and zero otherwise. The dependent variables are defined in Table 3.2. The set of control variables include capital adequacy, asset quality, management efficiency, earnings, liquidity, size, diversification and market share (see Table 3.2 for definitions of these variables). In addition, a set of time dummies and bank specific fixed effects are included across all regressions. Robust standard errors clustered at the bank level are reported in parentheses. ***, **, *, indicate significance at the 1%, 5%, and 10% level respectively.

### 3.7.2 Confounding Events

The validity of our approach would be threatened if factors other than the Tokyo bank tax were driving our results. We isolate activities that could have the potential to confound our analysis.

#### 3.7.2.1 Mergers and Acquisitions

Our difference-in-differences approach in Section 3.5 identifies the effect of the Tokyo bank tax on the financial intermediation activities of banks. One potential confounder of this identification is the merger and acquisition (M&A) activity involving existing banks in our sample. Bank mergers may have similar effects on our outcome variables of interest as those attributed to the introduction of the Tokyo bank tax. However, such M&A activities are unlikely to affect all our outcome variables simultaneously in the same way as the Tokyo bank tax. For instance, in a perfectly competitive market a bank M&A is likely to result in a reduction in the loan supply, but at the same time push the loan rate upwards (Van Hoose 2010, p.88). In the deposits market, an M&A would bring about a reduction in deposits and a decrease in deposit rates. As a consequence, an M&A would result in a widening of the profit margin for the merging banks, much like the Tokyo bank tax. However, in contrast to the Tokyo bank tax, this would happen via a simultaneous increase in the loan rate and a decrease in the deposit rate. In order to check the robustness of our findings to bank M&A activity we include *Merger*, a dummy variable in the difference-in-differences regressions, which takes the value of one if a bank was involved in an M&A in that period and zero otherwise. The results which are reported in Panel A of Table 3.8 indicate that the tax effects on the different aspects of bank behaviour are similar to the estimates from our main difference-in-differences analysis.

In a second step, we attempt to account for the degree of difficulty and challenges bank management faces in consummating a merger. In line with the M&A literature we use the relative size, measured as the ratio of the target to acquirer assets, as a proxy for the complexity of an M&A deal (e.g. Healey and Palepu 1992; Brewer and Jagtiani 2013). We introduce an interaction term between the dummy for affected banks and the relative size of banks involved in an M&A activity, and a triple interaction term between the dummy for the affected banks, the dummy for the enactment of the Tokyo bank tax and the relative size variable. The results, shown in Panel B of Table 3.8, confirm our expectations that (complex or less so) mergers do not drive our main findings.

#### 3.7.2.2 Capital Injections

An alternative source of shock which could act as a confounder to the results of our analysis is the Prompt Recapitalisation Act (PRA) that was enacted by the Japanese government in March 1999. Under this act, some banks in our sample received public capital injections. Recent empirical findings suggest that capital injections result in boosting the credit supply of banks while at the same time increasing the loan rate as banks assume riskier projects (Allen et al. 2011; Black and Hazelwood 2013; Li 2013). Clearly, the effects of public capital injection on credit supply and lending rates are the opposite of what our model predicts for the Tokyo bank tax. Nevertheless, we re-run our difference-in-differences regressions including *PRA*, a dummy variable which takes the value of one if a bank received capital injection under the Prompt Recapitalisation Act in March 1999, and zero otherwise. Results are reported in Panel C of Table 3.8. In Panel D of Table 3.8 we re-estimate Equation (3.10) including additional interaction terms between the affected banks and a proxy for the intensity of bank recapitalization,

## Table 3.8 | Confounding Events

| Panel A: Mergers & Acquisitions | | | | | | | |
|---|---|---|---|---|---|---|---|
| | *nim* | *nifm* | *markup* | *markdown* | *loanvol* | *coredep* | *noncoredep* |
| TAX | 0.047*** | 0.068*** | -0.074*** | -0.080*** | -0.029** | 0.004 | -0.056*** |
| | (0.022) | (0.024) | (0.024) | (0.025) | (0.011) | (0.019) | (0.014) |
| Control Var | YES | YES | YES | YES | YES | YES | YES |
| Fixed Effects | YES | YES | YES | YES | YES | YES | YES |
| Observations | 998 | 998 | 998 | 998 | 998 | 500 | 500 |
| Panel B: Complexity of Mergers & Acquisitions | | | | | | | |
| | *nim* | *nifm* | *markup* | *markdown* | *loanvol* | *coredep* | *noncoredep* |
| TAX | 0.072*** | 0.087*** | -0.052* | -0.080*** | -0.022* | 0.023 | -0.040** |
| | (0.026) | (0.029) | (0.030) | (0.030) | (0.013) | (0.020) | (0.016) |
| TAX * Size | -0.014 | -0.082 | -0.142* | -0.054 | -0.032 | -0.066 | -0.075** |
| | (0.064) | (0.067) | (0.076) | (0.053) | (0.021) | (0.053) | (0.030) |
| Control Var | YES | YES | YES | YES | YES | YES | YES |
| Fixed Effects | YES | YES | YES | YES | YES | YES | YES |
| Observations | 998 | 998 | 998 | 998 | 998 | 500 | 500 |
| Panel C: The Prompt Recapitalisation Act | | | | | | | |
| | *nim* | *nifm* | *markup* | *markdown* | *loanvol* | *coredep* | *noncoredep* |
| TAX | 0.062** | 0.082*** | -0.083*** | -0.102*** | -0.028** | 0.007 | -0.058*** |
| | (0.021) | (0.023) | (0.027) | (0.024) | (0.011) | (0.020) | (0.014) |
| Control Var | YES | YES | YES | YES | YES | YES | YES |
| Fixed Effects | YES | YES | YES | YES | YES | YES | YES |
| Observations | 998 | 998 | 998 | 998 | 998 | 500 | 500 |
| Panel D: Intensity of the Prompt Recapitalisation Act | | | | | | | |
| | *nim* | *nifm* | *markup* | *markdown* | *loanvol* | *coredep* | *noncoredep* |
| TAX | 0.053** | 0.074*** | -0.043 | -0.064** | -0.021* | 0.027 | -0.041*** |
| | (0.022) | (0.025) | (0.028) | (0.026) | (0.012) | (0.020) | (0.014) |
| TAX * PRA | -1.061 | -0.420 | -0.637 | -0.364 | -0.921 | -0.562 | -0.257 |
| | (1.978) | (2.036) | (2.140) | (1.291) | (0.824) | (2.072) | (0.997) |
| Control Var | YES | YES | YES | YES | YES | YES | YES |
| Fixed Effects | YES | YES | YES | YES | YES | YES | YES |
| Observations | 998 | 998 | 998 | 998 | 998 | 500 | 500 |

This table reports the results of ordinary least squares regressions examining the effect of the Tokyo bank tax on Japanese banks' behaviour using a sample of 126 Japanese banks spanning the period from March 1998 to September 2001. The dependent variables are defined in Table 3.2. The main explanatory variable is TAX, an indicator variable equal to one for banks affected by the Tokyo bank tax when it comes into effect and zero otherwise. The set of control variables include capital adequacy, asset quality, management efficiency, earnings, liquidity, size, diversification and market share (see Table 2 for definitions of these variables). To rule out the role of mergers and acquisitions (M&A) between banks in our sample the regressions reported in Panel A also include the variable *Merger*, a dummy that equals one when a bank is involved in an M&A and zero otherwise. Panel B regressions include additional interaction terms between the dummy for affected banks and the complexity of M&As, proxied by the relative size of the involved entities, and a triple interaction term between TAX and the proxy for M&A complexity. Panel C regressions include the variable *PRA* to consider the effect of Prompt Recapitalisation Act. *PRA* is a dummy variable which takes the value of one if a bank received capital injection under the Prompt Recapitalisation Act in March 1999, and zero otherwise. Panel D focuses on the intensity of capital injections by including additional interaction terms between the dummy for affected banks and our proxy for the intensity of capital injections, measured by the ratio of a bank's capital injection to total assets, and a triple interaction term between the dummy for affected banks, the dummy for the introduction of the Tokyo bank tax, and the proxy for the intensity of capital injections. The set of control variables include capital adequacy, asset quality, management efficiency, earnings, liquidity, size, diversification and market share (see Table 3.2 for definitions of these variables). In addition, a set of time dummies and bank specific fixed effects are included across all regressions in all panels. Robust standard errors clustered at the bank level are reported in parentheses. ***, **, *, indicate significance at the 1%, 5%, and 10% level respectively.

measured by the ratio of capital injection received by a bank to its total assets, and a triple interaction term between the dummy for the affected banks, the dummy for the enactment of the Tokyo bank tax and the proxy for the intensity of the Prompt Recapitalisation Act. Our main findings remain robust to these tests.

### 3.7.3 Alternative Methods

#### 3.7.3.1 Regression Discontinuity Design

We take advantage of the transparent assignment mechanism of the Tokyo bank tax and apply a sharp regression discontinuity design. Banks were assigned to pay the Tokyo bank tax based on a simple and transparent rule. Banks which operated in Tokyo and held funds in excess of ¥5 trillion were assigned to pay the tax, while all other banks were exempt. This approach serves as an additional robustness check. In particular, we address concerns of a violation of only-through conditions by using a regression discontinuity design.[46] Because the assignment variable (funds) is unique to the Tokyo bank tax (no other contemporaneous policy assigns treatment based on the ¥5 trillion funds threshold), a design that takes into account this discontinuity enables us to retrieve the pure effects of the Tokyo bank tax on bank behaviour.

To uncover the average treatment effect, we examine the discontinuity in the conditional expectation of the net interest margin (and other outcome variables) given the amount of funds of bank *i*. Ideally, we would like to compare the outcomes only for those banks whose values are just below and just above the threshold of ¥5 trillion funds because these banks will have on average similar

[46] Using a difference-in-differences identification strategy, the only-through condition must hold in order to correctly identify the impact of the Tokyo bank tax on bank behaviour. The only-through condition means that the change in outcomes of affected banks is caused only through the imposition of the Tokyo bank tax and not by any other event. The only-through condition is violated if a confounding event which occurs at the time of the Tokyo bank tax causes the change in outcomes for affected banks.

characteristics. However, such an approach will severely limit our sample size and reduce the efficiency of our estimation method. We therefore follow Pettersson-Lidbom (2012) and estimate regressions of the form:

$$Y_{it} = \alpha_i + \beta_t + \gamma TAX_{it} + \theta f(x_{it}) + \sum_k \delta_k COV_{k,i,t-1} + \epsilon_{it} \quad (3.14)$$

where $f(X)$ is a smooth function of the forcing variable, $x_{it}$ (funds). To improve efficiency, we constrain the regression function to be of the same functional form on both sides of the cut-off. We restrict higher order polynomial to the order of two (Pettersson-Lidbom 2008).

The results from estimating Equation (3.14) are presented in Panel A of Table 3.9. The striking similarity of estimates lends strong support to the robustness of our original findings. For instance, using the net interest margin as our main outcome variable of interest reveals that the introduction of the Tokyo bank tax results in net interest margins widening by 4.8 basis points. This compares to the original estimate of 6.2 basis points for the difference-in-differences approach. The net interest and fee margin widens by 6.5 basis points (original: 8.2 basis points), the mark-up declines by -10.8 basis points (original: -8.3 basis points) and the mark-down by -13.2 basis points (original: -10.3 basis points). The volume of loans and non-core deposits declines by -3.1 and -6.4 basis points respectively (original: -2.8 and -5.7 basis points respectively). In line with our original findings, the Tokyo bank tax does not impact on the volume of core deposits.

#### 3.7.3.2 Event Study

The results of our theoretical model, backed up by our empirical findings, indicate that the introduction of the Tokyo tax influences interest rates on loans

and deposits, and the credit supply of affected banks. Such effects may in turn influence investors' expectations of the likely future profitability of the affected banks in our sample. To assess this proposition, we conduct an event study to evaluate whether the introduction of the Tokyo bank tax led to a reduction in the market value of affected banks. We obtain stock market data for 100 listed Japanese banks (16 treated, 84 unaffected) from Datastream. To this end, we estimate deviations in actual bank stock returns, as a result of the Tokyo bank tax announcement, from expected stock returns. Following Brown and Warner (1985)

**Table 3.9 | Alternative Identification Methods**

| Panel A: Regression Discontinuity | | | | | | | |
|---|---|---|---|---|---|---|---|
| | *nim* | *nifm* | *markup* | *markdown* | *loanvol* | *coredepovo* | *noncorede* |
| TAX | 0.048** | 0.065*** | -0.108*** | -0.132*** | -0.031*** | 0.009 | -0.064*** |
| | (0.020) | (0.022) | (0.027) | (0.023) | (0.011) | (0.021) | (0.014) |
| Control | YES | YES | YES | YES | YES | YES | YES |
| Polynomial (2) | YES | YES | YES | YES | YES | YES | YES |
| Fixed Effects | YES | YES | YES | YES | YES | YES | YES |
| Observations | 998 | 998 | 998 | 998 | 998 | 500 | 500 |
| Panel B: Event Study | | | | | | | |
| Event window | | *Treated Banks* | | | *Control Banks* | | |
| | CAAR | adj-Patell | adj-BMP | CAAR | adj-Patell | adj-BMP | |
| [-5, 5] | -11.18 | -2.35 ** | -3.29 *** | -2.16 | -0.021 | -0.75 | |
| [-5, -1] | -3.52 | -1.11 | -2.24 ** | -1.17 | -0.80 | -1.07 | |
| [0, 5] | -7.66 | -2.16 ** | -2.58 *** | -0.98 | -0.46 | -0.33 | |
| No of banks | 16 | | | 84 | | | |

This table reports the results from alternative identification methods. Panel A presents results from a sharp regression discontinuity design taking advantage of the sharp cut-off at ¥5 trillion in deposits for banks to be taxed by the Tokyo authorities. TAX is a treatment indicator taking the value one for affected banks and zero for unaffected banks. The set of control variables include capital adequacy, asset quality, management efficiency, earnings, liquidity, size, diversification and market share (see Table 3.2 for definitions of these variables). Panel B presents event study results. The event date considered in this analysis is February 7th, 2000, the day the Tokyo governor announced the plan to levy the Tokyo bank tax. CAAR denotes cumulative average abnormal returns. Both the adj-Patell statistic (Patell, 1976) and the adj-BMP statistic (Boehmer et al., 1991) are adjusted for cross-sectional correlation as recommended by Kolari and Pynnonen (2010). ***, **, *, indicate significance at the 1%, 5%, and 10%

among others, for each bank we estimate daily abnormal stock returns using the risk-adjusted market model $R_{i,t} = \alpha_i + \beta_i R_{M,t} + \varepsilon_{i,t}$, where $R_{i,t}$ is the daily return of bank $i$ and $R_{M,t}$ is the daily return of the market portfolio approximated by the Tokyo Stock Price Index (Topix). The risk-adjusted market model is estimated over

the interval from 260 to 20 trading days before the event date. We use the estimates $\hat{\alpha}_i, \hat{\beta}_i$ to construct abnormal returns in the event window as $AR_{i,t} = R_{i,t} - \left(\hat{\alpha}_i + \hat{\beta}_i R_{M,t}\right)$. We then aggregate daily abnormal returns by averaging them over all banks summing them over the trading days of different event windows to obtain cumulative average abnormal returns (CAAR). Formally, $CAAR = \sum_{t=t_0}^{T}\left(\frac{1}{N}\sum_{i=1}^{N} AR_{i,t}\right)$. Since the Tokyo bank tax applied to a considerable number of banks operating in Tokyo at the same time, this is likely to generate cross-sectional correlation in abnormal returns across affected banks. In order to address this issue, we test for statistical significance in the CAAR using both the adj-Patell and the adj-BMP test statistics proposed by Kolari and Pynnonen (2010), which are modified versions of the standardised tests developed, respectively, by Patell (1976) and (Boehmer et al. 1991).

Panel B of Table 3.9 reports CAAR over different event windows. Along with adj-Patell and adj-BMP statistics, separately for affected and unaffected banks. CAAR for affected banks on the event window [-5, 5] are negative and statistically significant, according to both statistics, indicating a decline of around 11% in the banks' stock prices arising from the introduction of the Tokyo bank tax. There is mixed evidence of a decline in the affected banks' market valuation in the window prior to the introduction of the Tokyo bank tax. This indicates that the tax was largely unanticipated by the investors. On the other hand, the impact of the tax before, after and around its announcement on the unaffected banks is indistinguishable from zero in a statistical sense. Overall, these findings indicate that market participants view the Tokyo bank tax as detrimental to the performance of the affected banks.

## Table 3.10 | Bank Monitoring Channel | Robustness checks

| Panel A: Distance-based portfolio \| Placebo test | | |
|---|---|---|
| | *Local Portfolio* | *Distant Portfolio* |
| Placebo-TAX | 0.001 | 0.002 |
| | (0.001) | (0.001) |
| Control variables | YES | YES |
| Bank Fixed Effects | YES | YES |
| Observations | 235 | 235 |
| $R^2$ | 0.14 | 0.16 |
| Panel B: Collateral-based portfolio \| Placebo test | | |
| | *Intangible Portfolio* | *Pledgeable Portfolio* |
| Placebo-TAX | -0.001 | -0.001 |
| | (0.001) | (0.001) |
| Control variables | YES | YES |
| Bank Fixed Effects | YES | YES |
| Observations | 243 | 243 |
| $R^2$ | 0.21 | 0.04 |
| Panel C: Borrowers' cost of public debt \| Placebo test | | |
| | *BPS* | |
| $PlaceboTAX^{Bond}$ | 36.72 | |
| | (25.47) | |
| Control variables | YES | |
| Observations | 566 | |
| $R^2$ | 0.739 | |
| Panel D: Borrowers' market value \| Placebo test | | |
| | CAR[0,0] | CAR[0,3] | CAR[0,5] |
| $PlaceboTAX^{Stock}$ | 0.078 | 0.069 | -0.059 |
| | (0.089) | (0.090) | (0.109) |
| Other control variables | YES | YES | YES |
| Observations | 928 | 928 | 928 |
| $R^2$ | 0.115 | 0.120 | 0.091 |

This table reports the results of robustness checks on the bank monitoring channel. Panels A and B report the results of ordinary least squares (OLS) regressions using a sample of 126 Japanese banks spanning the period before the introduction of the Tokyo bank tax. In Panel A the dependent variables are the shares of the local portfolio, LP (loans granted to firms located in the same area code as the bank is located) and distant portfolio, DP (loans granted to firms outside the area code where the bank is located) to the banks total loan portfolio. In Panel B the dependent variables are the shares of the intangible portfolio, IP (loans granted to firms belonging to the top quantile of the distribution of their pre-tax period intangible assets) and pledgeable portfolio, PP (loans granted to firms belonging to the bottom quantile of the distribution of their pre-tax period intangible assets) to the banks total loan portfolio. The main explanatory variable is Placebo-TAX, an indicator variable equal to one for banks affected by the Tokyo bank tax when it comes into effect and zero otherwise, but this time we falsely assume that this happens one year prior to the actual introduction. To control for potential heterogeneity between affected and unaffected banks the lagged values of capital adequacy, asset quality, management efficiency, earnings, liquidity, market share, diversification and size (see Table 3.2 for definitions of these variables) are included in the regressions as further control variables. In addition, a set of time dummies and bank specific fixed effects are included across both regressions. Panel C reports results on the effect of the Tokyo bank tax on the borrowers' cost of public debt using bonds issued during the period before the introduction of the Tokyo bank tax. The dependent variable, BPS, is the at-issue yield spread in basis points of the debt security over that of a corresponding Japanese government security of comparable maturity. The main explanatory variable is $PlaceboTAX^{Bond}$, an indicator variable equal to one if the two largest banks the firm is banking with (in terms of loans granted to the firm) are affected by the Tokyo bank tax when it comes into effect and zero otherwise, but this time we falsely assume that this happens one year prior to the actual introduction. Control variables include: a) *Maturity* is the number of years of the security until maturity; b) *Amount* is the natural logarithm of the size of bond issue; c) *Size* is the natural logarithm of issuing firm's total assets; d) *Leverage* is the ratio of total debt to total assets of the issuing firm. Other control variables include industry, prefecture, bank-type and Keiretsu affiliation dummies. Robust standard errors clustered at the firm level are reported in parentheses. Panel D reports coefficient estimates of OLS regressions of cumulative abnormal returns (CAR) for all listed Japanese firms included in the Japan Company Handbook (excluding banks) surrounding the announcement of the Tokyo bank tax, under the false assumption that the announcement of the tax occurred on January 7, 2000 instead of February 7, 2000. The event day 0 here is therefore January 7, 2000. The CAR is measured on the day of the announcement only, from day 0 to day 3, and from day 0 to day 5, as indicated. $PlaceboTAX^{Stock}$ denotes the treatment group dummy which takes the value of one if the two largest banks the firm is banking with (in terms of loans granted to the firm) are taxed and zero otherwise. Control variables are a) *Market cap* is the natural logarithm of the firm's total market capitalization a month before the Tokyo bank tax announcement; b) *Risk* is the standard deviation of the firm's stock returns during the estimation period [-260,-20]; c) *Access to finance* is a dummy variable that equals one if the firm has issued at least one bond in the 3 years prior to the Tokyo tax bank announcement. Other control variables include industry, prefecture, bank-type and Keiretsu affiliation dummies. Robust standard errors clustered at the firm level are reported in parentheses. ***, **, *, indicate significance at the 1%, 5%,

and 10% level respectively.

## 3.8 Summary

Following the global financial crisis, bank taxation has received widespread media coverage and attention in policy circles in many developed economies. The effect of taxation on the behaviour of banks is likely to depend on the type and size of the tax imposed, prevailing market conditions and the extent to which banks choose to pass through any resultant increases in costs to customers. In this chapter, we derive a theoretical model, which leads to several testable propositions related to how bank behaviour changes in response to a sudden imposition of a tax on gross profitability. Testing these aforementioned propositions empirically is challenging given identification concerns. This challenge is overcome in this chapter by utilising the case of the Tokyo bank tax, which was imposed on gross profits of large Japanese banks operating in Tokyo, while other banks operating in Japan remained unaffected.

Our theoretical model, derived hypotheses and research design rests on the assumption that the introduction of the Tokyo bank tax triggered a change in bank behaviour and affected the ability of banks to act as financial intermediaries with possible implications for loan supply, pricing of loans and deposits, and the monitoring of borrowers. The results derived from our estimable (difference-in-differences) model suggests that banks subject to the tax increased both, net interest and net interest and fee margins in response to an unexpected tax on gross profitability. An analysis of deposit and loan interest rate components of the net interest margin suggests that rates paid to depositors and charged to borrowers decline following the introduction of the Tokyo bank tax. Deposit rates decline by a greater degree than loan rates, implying that banks subject to the tax pass through

the effects of the tax to depositors. These banks also reduce total lending. On the liability side, the introduction of the Tokyo bank tax leads to a significant outflow of rate-sensitive deposits for banks subject to the tax compared to unaffected counterparts. These findings are robust to a battery of additional tests.

We conduct an extensive analysis to explore the extent to which banks subject to the Tokyo bank tax reduce monitoring of borrowers. Banks subject to the provisions of the Tokyo bank tax reduce lending to firms located at distance relative to counterparts that are geographically proximate; to firms which are more informationally opaque relative to less opaque counterparts; and to firms higher levels of intangible assets. The costs of debt issuance increase and market valuations decrease for firms that are customers of banks subject to the Tokyo bank tax.

Overall, the findings of this chapter suggest that taxes play an important role in affecting the behaviour of banks. The extent to which banks pass through any higher costs associated with tax increases to customers has implications for the cost and availability of credit to borrowers, and the interest rates paid to depositors. As such the results of this chapter have relevance to policymakers engaged in designing and monitoring the effectiveness of tax regimes in the banking industry. Our findings inform the ongoing policy debate about the appropriate scope of bank taxation as we show that the financial intermediation activity of banks is highly sensitive to taxation on gross profitability (at least within the laboratory of Japan). Because of banks may pass through increased tax costs, bank taxation can have sizeable effects for bank customers such as reduced credit supply for borrowers and lower deposit rates for depositors. Such

externalities of bank taxation suggest that the scope of bank taxation needs to be well balanced to prevent adverse impacts on the real economy. Additionally, our findings contain interesting information for bank supervisors who are concerned about the risk diversification of banks as we show that bank taxation impacts on the monitoring effort of banks and leads to adjustment of bank portfolios towards easier-to-monitor borrowers.

# Chapter 4 | Bank Taxation and Liquidity Creation

## 4.1 Introduction

Since the global financial crisis of 2007-2009, the taxation of banks has attracted the interest of academics and policy makers. Tax arrangements that incentivize financial institutions to assume excessive risks have been identified as one of the factors that contributed to the global financial crisis (de Mooij 2012). A general call has emerged for appropriately designed taxation schemes, which reduce the incentives for banks to take on excessive risks, and thus improve the safety and soundness of the financial system. [47]

Recent evidence suggests that taxation may prompt banks to alter the composition of liabilities and assets, with resultant changes in leverage (Keen and de Mooij 2016; Schepens 2016; Gambacorta et al. 2017) and portfolio risk (Horváth 2013; Milonas 2016). This in turn is likely to have implications for the liquidity that banks create. By taking on leverage, typically in the form of deposits to finance longer term loans, banks create liquidity (Diamond and Rajan 2001). Banks also create liquidity via off-balance sheet activity by extending credit lines (which can be drawn upon when required) to households and firms (Holmström and Tirole, 1998; Kashyap et al., 2002). The liquidity creation of banks is essential for the functioning of the real economy via the provision of funding for entrepreneurial activity and investment, which is necessary for stimulating employment and economic growth (Aghion et al., 2010; Berger and Sedunov, 2017).

[47] For a discussion of the various tax schemes see Chronopoulos et al. (2017).

In recent years an empirical literature has emerged which provides valuable insights to the measurement and underlying determinants of bank liquidity creation. Berger and Bouwman (2009) present a novel method to measure how much liquidity banks create for the economy. By explicitly focusing on the creation of liquidity rather than liquidity itself, Berger and Bouwman depart from standard measures of bank liquidity, which typically capture how liquid the bank is but not how much liquidity the bank provides.[48] The procedure involves the ranking and weighting of bank balance sheet and off-balance sheet items according to the degree of liquidity provided by the underlying banking activity.[49] Banking activities via which banks provide liquidity to the economy typically drain liquidity at the bank level. As such, the metric by Berger and Bouwman can also be understood as a direct measure of bank illiquidity. The findings of this literature suggest that large banks play an important role in liquidity creation, much of which is created off-balance sheet (Berger and Bouwman, 2009). Moreover, the level of competition, government regulation (in the form of capital and other forms of prudential regulation), and economic policy uncertainty exert an important influence on bank liquidity creation (Hovarth et al., 2014, 2016; Fungáčová et al., 2017; Berger et al. 2018).

To date, the role of taxes in determining bank liquidity creation remains unexplored. We address this gap in the literature by investigating how an exogenous variation in the tax treatment of banks affects bank liquidity creation. As in Chapter 3, our setting is the Japanese commercial banking industry over the

[48] Common measures of bank liquidity include the two Basel III measures (liquidity coverage ratio and net stable funding ratio) as well as market measures of liquidity such as trading volume and frequency.
[49] For instance, by issuing loans to borrowers, banks provide liquidity to households or the corporate sector. According to the Berger and Bouwman liquidity creation method, the issuance of loans is thus classified as a banking activity that creates liquidity.

period 1998 to 2001, when a special tax on the gross profitability of large banks operating in Tokyo was introduced. We use this setting to investigate whether the introduction of the aforementioned tax (in 2000) influenced the liquidity creation of affected banks.

A tax on gross profits can affect the leverage and profitability of banks, which in turn has implications for liquidity creation. Theory offers contrasting predictions regarding the likely impact of taxation on bank liquidity creation via changes in leverage and profitability. Taxation can impact bank liquidity creation by affecting bank leverage, given that tax rules (that allow the deduction of interest payments from income as an expense) encourage banks to borrow rather than raise equity. This bias toward debt funding affects the overall balance of debt and equity, and leads banks to opt for a fragile capital structure dominated by debt (Modigliani and Miller, 1963; Stiglitz, 1973; King 1974; Admati et al. 2013; Keen and de Mooij, 2016).[50] This fragile capital structure in turn may have positive or negative implications for bank liquidity creation. On the one hand, a fragile capital structure may increase liquidity creation. By issuing debt in the form of deposits, banks produce liquid claims that serve the liquidity needs of depositors (Gorton and Pennacchi 1990; DeAngelo and Stulz 2015). On the other hand, a fragile capital structure may impede bank liquidity creation. Reliance on less stable sources of funding other than equity reduces the ability of banks to absorb and mitigate the risks arising when transforming liquid liabilities into illiquid assets (Bhattacharya and Thakor 1993).

[50] The tax advantage of debt is potentially even more alluring for banks that compete with banks that are not taxed. To compete with unaffected competitors, banks may opt for high leverage to minimize tax payments.

Taxation impacts bank profitability, which in turn could lead to an increase or decrease in liquidity creation. By squeezing profits, taxation may induce a change in bank behaviour, which results in an increase in liquidity creation.[51] Specifically, if taxation leaves banks without some untaxed economic rent, banks may assume greater risks in the form of riskier portfolios.[52] By providing incentives to assume greater risk through extending riskier, more illiquid loans, taxation may be positively linked to bank liquidity creation. In contrast, if banks compensate for lower profits by cutting costs (via a reduction in the resources devoted to the monitoring of borrowers), then taxation may induce banks to adjust their respective optimal level of lending (an important component of liquidity creation) downwards to align with a lower level of monitoring activity (Caminal, 2003).[53] Ultimately, the extent to which the imposition of a tax on gross profits increases or decreases liquidity creation via changes in leverage and profitability of banks is an empirical question; one that we investigate in this chapter.

Following Berger and Bouwman (2009) we use a category-based measure of liquidity creation. We classify on- and off-balance sheet items as either liquid, semi-liquid or illiquid. Liquid items include cash and cash due from banks, current deposits, and interest rate derivatives. Illiquid items include commercial loans, corporate bonds and letters of credit. Positive, zero and negative weights are assigned to on- and off-balance sheet items depending on the extent to which

[51] If the costs associated with the tax cannot be fully arbitraged or passed onto customers (by lowering deposit rates or by increasing loan rates), the burden of the tax is borne by the banks via an immediate decline in profitability.

[52] The link between bank rents and risk-taking has been investigated extensively in the bank competition literature (Degryse et al, 2014). Theory predicts that an erosion of bank rents (from increased competition) results in a lower opportunity cost of bankruptcy. This in turn increases a bank's incentive to overinvest in risky assets (Keeley 1990; Chan et al., 1992).

[53] When extending credit, banks monitor borrowers in order to attenuate excessive risk-taking and prevent strategic default. Moreover, by monitoring borrowers intensively banks gain credibility as delegated monitors (Diamond, 1984). Given that the monitoring of borrowers is an integral part of the lending process and is important for deposit-funding, a reduction in monitoring is likely to adversely affect bank liquidity creation.

liquidity is created, remains unchanged or is destroyed respectively. A weight of 0.5 is assigned to all illiquid assets, liquid liabilities, and liquid off-balance sheet activities, while a weight of -0.5 is assigned to liquid assets, illiquid liabilities, and liquid off-balance sheet activities. All semi-liquid items are assigned a weight of zero. We also adopt a category-based measure of liquidity creation which excludes off-balance sheet activities.

We use a difference-in-differences estimation strategy to identify the impact of a change in tax policy on bank liquidity creation. Based on semi-annual financial statements for a sample of 107 Japanese commercial banks over the period 1998-2001 (which straddles the introduction of the tax in 2000) we find that an increase in taxation significantly reduces bank liquidity creation.[54] This holds for both of our liquidity creation measures (including and excluding off-balance sheet items). For banks subject to the Tokyo bank tax, liquidity creation declines by 3% for banks subject to the tax relative to unaffected counterparts. These estimates suggest that this reduction is also economically significant. Further analysis reveals that the observed decline in bank liquidity creation is driven primarily by the negative impact of the Tokyo tax on the asset side of the balance sheet (including a significant reduction in commercial loans). That is, banks affected by the Tokyo bank tax hold significantly less illiquid assets compared to counterparts not subject to the tax. We also exploit variation in bank characteristics to gain further insight concerning the mechanisms via which taxation affects liquidity creation. The results are consistent with two non-mutually exclusive mechanisms related to capitalisation and monitoring.

[54] The sample of 107 commercial banks differs in terms of number of banks from the sample of 126 commercial banks used in Chapter 3. The difference in the number of banks arises from a lack of available data pertaining to liquidity measures for 19 banks in the original sample used in Chapter 3.

Specifically, we find that when faced with a sudden increase in taxes, banks which are better capitalised and devote more resources to monitoring borrowers reduce liquidity creation less than less well capitalised counterparts.

A battery of additional tests are conducted in order to check the validity of our main findings. First, we examine explicitly the identifying (so-called parallel trends) assumption underlying the difference-in-differences approach. Second, we investigate the possibility that divergent economic conditions between regions (especially in those located farther away from Tokyo) are driving our results. Third, we restrict the analysis to large banks only in order to address the possibility that the impact of the Tokyo bank tax is heterogeneous with respect to observable bank characteristics (which may be unbalanced across affected and unaffected banks). Finally, we employ alternative specifications of our estimable model. The main findings of our empirical analysis are robust to all of these aforementioned additional tests.

The findings of this chapter both augment and complement prior literature. First, we extend the literature that examines the determinants of bank liquidity creation. Previous findings suggest that managerial ability, bank capitalisation along with competition and the existence of a deposit insurance scheme are important determinants of bank liquidity creation (Berger and Bouwman, 2009; Horvath et al., 2014; Fu et al., 2015; Andreou et al., 2016; Fungáčová et al., 2017; Jiang et al., 2018). In the same vein, this chapter investigates if taxation is a key determinant of liquidity creation. Our difference-in-differences approach is well suited to isolate the specific implications of tax differences across banks for liquidity creation.

Second, we augment prior research that investigates the link between taxation and the capital structure of banks. For example, Schandlbauer (2017) (focusing on staggered increases in corporate income taxation across different US states) finds that tax increases affect the capital structure choices of banks. Milonas (2016) extends this analysis to include both increases and decrease in corporate income tax. He finds a positive relation between tax changes and bank leverage. In the same vein, Schepens (2016) finds that banks in Belgium increase equity capital following a policy change that reduced the relative tax advantage of debt funding, while Celerier et al. (2017) find that banks in Italy increase equity capital when equity and debt are treated symmetrically by tax authorities.[55] Building on this literature, we present new evidence on the impact of a gross-profit tax on bank liquidity creation via its influence on bank funding decisions. In order to do so, we decompose liquidity creation into asset-side, liability-side, equity, and off-balance sheet components liquidity creation. We find that the introduction of the Tokyo bank tax leads to a reduction in the liquidity creation on the asset side, while impacting on semi-liquid liabilities as well as equity. Off-balance sheet liquidity creation remains unaffected.

Our findings have relevance for policy makers tasked with monitoring the safety and soundness of banks. Recent debates have centred on the extent to which revised capital and liquidity regulations are effective in limiting bank insolvency risk and reducing maturity mismatch (Bouwman 2014). Moreover, concerns have been expressed by the banking industry that enhanced solvency and liquidity standards will lead to increased costs and inhibit banks from pursuing profitable

[55] Hemmelgarn and Teichmann (2014) and Keen and De Mooij (2016) provide cross country analyses of the impact of the asymmetric tax treatment of debt and equity on capital structure decisions of banks.

opportunities (Tarullo, 2016). The evidence presented in this chapter suggests that taxes appear to alter bank behaviour and reduce the overall level of liquidity created by banks. Furthermore, the impact of taxation differs between the asset and liability sides of the bank balance sheet. This suggests that imposing additional taxes on banks may result in reduced lending for households and firms with potentially adverse consequences for the real economy.

The remainder of the chapter is structured as follows. Section 4.2 provides a background to the current study. The sample and methodology are described in Section 4.3. Section 4.4 discusses the main results. In Section 4.5 we report the results of a variety of robustness tests. Section 4.6 provides a summary of the main findings.

## 4.2 Background

In the 1980s, Japan witnessed the formation and then bursting of a stock market and real estate bubble. This was followed by a severe banking crisis, which had a long-lasting impact on the banking system and real economy throughout the 1990s and 2000s. Many Japanese banks with extensive equity holdings and loans collateralized by real estate, experienced dramatic declines in the value of their assets and capital. The effects of the crisis on bank profits were severe, with write-downs and losses amounting to ¥46.5 trillion during the second half of the 1990s (Bank of Japan, 2000). The bankruptcy of some of Japan's largest financial institutions in 1997 brought the banking system close to the brink of collapse. To rescue ailing banks, the Japanese Government intervened with large-scale capital injections using public funds amounting to ¥9.8 trillion equivalent to 1.9% GDP.

Despite a second round of capital injections, banks did not recover and continued to report losses. These losses led to a large decline in tax revenues of local (prefectural) governments.[56] The government in Tokyo was particularly impacted given that this prefecture depended largely on tax revenue from the financial sector. In the fiscal year 1999, Tokyo's estimated revenue shortfall amounted to ¥700 billion.

To address the decline in tax revenue, the Tokyo Government introduced a new bank tax. This tax targeted commercial banks with deposits exceeding ¥5 trillion (DeWit, 2000). After its initial announcement in February 7, 2000, the tax became effective on April 1, 2000 and was to be levied over a five-year period. Banks affected by the Tokyo bank tax regarded the new bank tax as an undue financial burden, and so filed a lawsuit against the Tokyo Government shortly after the introduction of the tax. Two years later the Tokyo District Court declared the tax to be void claiming it treated the banking sector unfairly. Table 3.1 in Chapter 3 provides a chronology of key events surrounding the introduction, operation and eventual repeal of the Tokyo Bank Tax.

The Tokyo bank tax was levied at a rate of three percent on gross profits (before personnel expense, operating expense and loan write-off deductions). Gross profits were at relatively high levels arising from an expansion of bank interest margins following the introduction of a zero-interest rate policy in early 1999. Due to aggressive loan loss provisioning and write-offs, banks generally reported negative net profits. Thus, a tax on net profit would have yielded little or no extra tax revenues for the Tokyo government. However, taxing gross rather

[56] Japan is among the countries with the highest statutory corporate income tax rates (de Mooij and Saito, 2014). Depending on firm size, level of income, and region, corporate income tax rates vary and typically range from 30 to 40 percent. Since the 1990s, corporate income tax rates have gradually declined.

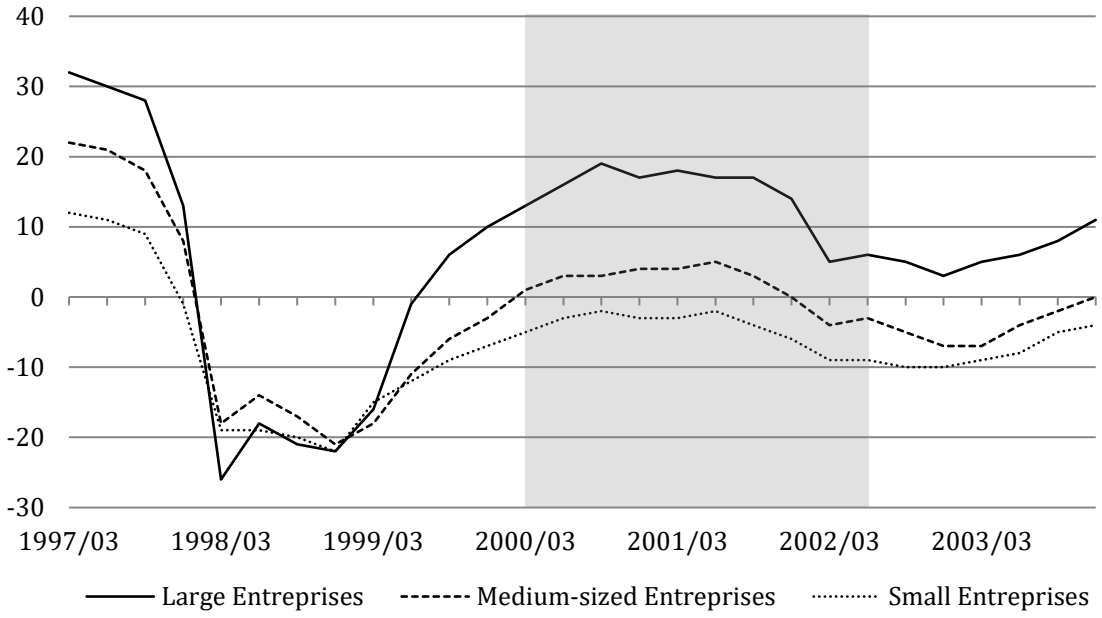
than net profits removed the possibility that banks could inflate expenses to minimise profits and tax liabilities, and thus ensured a stable stream of tax revenue for the Tokyo government.

The Tokyo bank tax affected 17 commercial banks in Japan.[57] Bank lending attitudes deteriorated during the implementation period of the tax, according to a survey of Japanese enterprises (see Figure 4.1). Among the bank types affected by the tax were city and regional banks, which together account for approximately 85% of the total assets of the banking industry in Japan. City and regional banks each provide financing to firms but may differ in the size of the firms they lend to. While regional banks typically focus on small to medium-sized domestic companies, city banks also serve large corporations domestically and overseas.[58]

Given their size and prominent role in the administering of payments, city and regional banks represent important constituents of Japan's payment system. These banks perform the twin role of distributing currency and of producing and servicing demand deposits. Regional and city banks also engage actively in the trading of financial derivatives with a focus on interest rate swaps. They also pursue traditional off-balance sheet activities including the provision of standby letters of credit and other commitments.

[57] As in Chapter 3, the group of 17 commercial banks excludes affected trust banks and long-term credit banks. See Section 4.3.2 for further explanation.
[58] At the onset of the Japan's crisis beginning in the early 1990s, city banks began to drastically retreat from their international activities evidenced by a decline in overseas lending (Peek and Rosengren 2000).

**Figure 4.1 | Tankan Survey: Lending Attitude of Financial Institutions**




Source: Bank of Japan. Tankan Survey: Lending Attitude of Financial Institutions. Fiscal Year 1997-2003, quarterly. Survey item 612: Judgement of financial institutions' attitude towards lending as perceived by the responding enterprise (manufacturing and non-manufacturing industries [excluding financial institutions]). Diffusion index calculated by subtracting the percentage share of responding enterprises which judge business conditions to be "unfavourable" from the percentage share of responding enterprises which judge business condition to be "favourable". The grey-shaded area denotes the period during which the Tokyo bank tax was operational.

Despite the deregulation of the banking industry, city and regional banks maintained the characteristics of traditional financial intermediaries throughout the 1990s. In terms of balance sheet composition, loans make up the majority of assets of city and regional banks (Table 4.1). These assets are funded mainly by deposits, albeit for city banks to a lesser extent relative to regional banks. The equity capital ratio of both city and regional banks was approximately 4%. During the 2000s, security holdings became relatively more important, particularly for city banks. To fund assets, regional banks increased their reliance on deposits, while city banks began to reduce dependence on deposit funding. Overall, there was a proliferation of liquid demand deposits relative to other forms of deposits. City banks also held considerably more equity capital during the 2000s.

**Table 4.1 Balance Sheet of Japanese Commercial Banks**

Components of Assets and Liabilities as a % of Total Assets

| | 1990s | | 2000s | |
|---|---|---|---|---|
| (in percent) | City | Regional | City | Regional |
| Cash | 7.52 | 4.88 | 4.34 | 3.03 |
| Earning Assets | 86.45 | 93.79 | 89.95 | 96.27 |
| Loans & Bills discounted | 70.85 | 71.84 | 55.87 | 68.26 |
| Security holdings | 16.30 | 19.14 | 26.13 | 25.47 |
| Other earning assets | 12.86 | 9.02 | 17.99 | 6.27 |
| Total liabilities | 95.48 | 95.89 | 92.55 | 95.43 |
| Total deposits | 71.48 | 88.96 | 71.74 | 94.11 |
| Demand deposits | 18.66 | 20.65 | 47.21 | 41.95 |
| Other liabilities | 28.52 | 11.04 | 28.26 | 5.89 |
| Equity capital | 4.52 | 4.11 | 7.45 | 4.57 |
| Total assets | 100.00 | 100.00 | 100.00 | 100.00 |

This table reports balance sheet components of assets and liabilities as a percentage of total assets of city and regional banks for 1990s (1990–1999) and 2000s (2000–2009). Source: Bank of Japan Statistics.

Casual observation of aggregate balance sheets over the fiscal years 1997 and 2005 suggests that regional banks contributed considerably to the provision of liquidity. Panels A and B of Table 4.2 show that regional banks were represented among the top liquidity creators. Notably, city banks that are typically larger than regional banks did not create the most liquidity. Overall, liquidity creation was higher in fiscal year 2005 than in the crisis year 1997.

**Table 4.2 | Top 10 Liquidity Creators**

| | Panel A: Fiscal Year 1997 | | | Panel B: Fiscal Year 2005 | | |
|---|---|---|---|---|---|---|
| Rank | Name | Type | LC | Name | Type | LC |
| 1 | Chiba Bank | regional | 0.12 | Ashikaga Bank | regional | 0.28 |
| 2 | Bank of Okinawa | regional | 0.12 | Toho Bank | regional | 0.24 |
| 3 | Kagoshima Bank | regional | 0.12 | Bank of Yokohama | regional | 0.24 |
| 4 | Miyazaki Bank | regional | 0.12 | Minato Bank | regional | 0.23 |
| 5 | Toho Bank | regional | 0.10 | Miyazaki Bank | regional | 0.23 |
| 6 | Chikuho Bank | regional | 0.10 | Kagoshima Bank | regional | 0.22 |
| 7 | Bank of Yokohama | regional | 0.10 | Chiba Bank | regional | 0.21 |
| 8 | Bank of Fukuoka | regional | 0.09 | Bank of Okinawa | regional | 0.20 |
| 9 | Oita Bank | regional | 0.09 | Eighteenth Bank | regional | 0.20 |
| 10 | Tohoku Bank | regional | 0.09 | Musashino Bank | regional | 0.20 |

This table reports the top ten banks in terms of liquidity creation for the fiscal years 1997 and 2005. LC denotes the liquidity created per gross total assets using the Berger and Bouwman (2009)'s cat-fat measure (see Panel B of Table 4.3 for a definition). Author's own calculation.

## 4.3 Methodology

We employ a difference-in-differences approach to exploit the exogenous variation in the taxation of banks. This enables us to identify the causal effect of an increase in taxation on bank liquidity creation.

We classify banks into affected banks (those that are affected by the Tokyo bank tax) and unaffected banks (those that are unaffected by the tax). This allows us to compare the difference in the liquidity creation of the affected banks between the pre-tax period and the post-tax period with the same difference in the liquidity creation of the unaffected banks, and thus retrieve the average treatment effect of the tax on banks' liquidity creation.

Our estimable model is as follows:

$$\frac{LC_{it}}{GTA_{it}} = \delta \underbrace{Bank_i^{Taxed} * Post_t}_{TAX_{i,t}} + \beta X_{i,t-1} + \alpha_i + \gamma_t + \epsilon_{it} \quad (4.1)$$

In Equation (4.1), $i$ and $t$ denote bank and time, respectively. $LC_{it}$ represents bank liquidity creation (discussed in detail below) and $GTA_{it}$ denotes gross total assets. $TAX_{i,t}$ is an indicator variable that equals zero for all banks in the pre-Tokyo bank tax period and one for those banks that are taxed when the Tokyo bank tax comes into effect. The coefficient $\delta$ captures the impact of the Tokyo bank tax on bank behaviour.

$X_{i,t-1}$ represents a vector of bank level control variables that vary over time and across banks. These control variables account for factors that could influence the level of bank liquidity creation as well as any observed pre-intervention differences in the characteristics of affected and unaffected banks. The control variables include the bank size (measured as the log of total assets) and bank

diversification (measured as the ratio of non-interest income to total operating income). Market share is measured as the proportion of an individual bank's assets to total aggregate assets. The vector $X_{i,t-1}$ includes variables that are used typically by supervisors to monitor capital adequacy, asset quality, managerial efficiency and earnings. Capital adequacy is defined as the ratio of tier 1 capital (common stock, retained earnings, and legal reserves) to total assets. Asset quality is measured by the ratio of non-performing loans to total assets. Managerial efficiency is proxied by the ratio of operating expense over operating income. Earnings are defined as net income divided by total assets. Each control variable enters the model lagged by one period to avoid simultaneity. Bank fixed effects, $\alpha_i$, and time fixed effects, $\gamma_t$, capture the unobserved characteristics of banks and economy wide disturbances. $\epsilon_{it}$ is the error term. Standard errors are clustered at the bank level to account for within-bank correlation (Bertrand et al. 2004).

### 4.3.1 Liquidity creation measures

Following Berger and Bouwman (2009) we employ both a narrow and a broad measure of liquidity creation. The narrow measure (defined as 'nonfat' in Berger and Bouwman's terminology) focuses on banks' on-balance sheet activities only, while the broad measure (defined as 'fat' in the Berger and Bouwman's terminology) takes into consideration both on- and off-balance sheet (OBS) activities. We compute these two measures of bank liquidity creation based on the categorisation (cat) of balance sheet and off-balance sheet items as follows. [59]

[59] We are unable to compute measures of liquidity creation based on the maturity profiles of on- and off-balance sheet activities due to data limitations.

## Table 4.3 | Construction of Liquidity Creation Measures

| Panel A: Item classification and weighting | | |
|---|---|---|
| *Assets* | | |
| Illiquid assets (weight = ½) | Semi-liquid assets (weight = 0) | Liquid assets (weight =-½) |
| Commercial loans | Consumer loans | Trading account securities |
| Premises and movable property | Residential real estate loans | Money held in trust |
| Other assets | | Investment securities |
| Customers' liabilities for acceptance and guarantees | | Call loans |
| | | Bills purchased |
| | | Monetary claims purchased |
| | | Cash and due from banks |
| | | Foreign exchange |
| *Liabilities plus equity* | | |
| Liquid liabilities (weight = ½) | Semi-liquid liabilities (weight = 0) | Illiquid liabilities & equity (weight = -½) |
| Current deposits | Deposits at notice | Debentures |
| Ordinary deposits | Time deposits | Corporate bonds |
| Savings deposits | Negotiable certificates of deposit | Convertible bonds |
| Call money | Bills sold | Acceptance and guarantees |
| Trading liabilities | Commercial paper | Other liabilities |
| | Borrowed money | Common stock |
| | Foreign exchange | New stock subscriptions |
| *Off-balance sheet activities (OBS)* | | |
| Illiquid OBS (weight = ½) | Semi-liquid OBS (weight = 0) | Liquid OBS (weight = -½) |
| Guarantees | | Interest rate derivatives |
| Standby letters of credit | | Foreign exchange derivatives |
| Letters of credit | | Equity derivatives |
| | | Fixed income derivatives |
| | | Commodity derivatives |
| | | Credit derivatives |
| Panel B: Liquidity creation measures | | |
| Cat-fat | $1/2 *$ (illiquid assets + liquid liabilities + illiquid OBS) $-1/2 *$ (liquid assets + illiquid liabilities + equity + liquid OBS) | |
| Cat-nonfat | $1/2 *$ (illiquid assets + liquid liabilities) $-1/2 *$ (liquid assets + illiquid liabilities + equity) | |

This table illustrates the classification and the weighting of the balance sheet items in line with the liquidity creation measure by Berger and Bouwman (2009) adapted for the Japanese banking industry. Panel A lists the items of bank balance sheets and off-balance sheets under liquid, semi-liquid and illiquid. Bank activities that add to liquidity creation are classified as illiquid, those that have a neutral effect are classified as semi-liquid, and those that subtract from liquidity creation are classified as liquid. The weigths ½, 0, and -½ are multiplied times the yen amount of the corresponding bank activities. Panel B illustrates the calculation of cat-fat and cat-nonfat. The weighted yen amounts are added to arrive at the total yen value of liquidity creation of each bank in our sample.

First, we classify balance sheet items as liquid, semi-liquid, or illiquid. Second, these classified items are assigned weights in line with liquidity creation theory as follows: 0.5 for illiquid assets, liquid liabilities, and illiquid OBS items; 0 for semi-liquid liabilities and semi-liquid OBS items; and -0.5 for liquid assets, illiquid liabilities, and liquid OBS items. Third, the classified and weighted on- and off-balance sheet items are combined to obtain the broad (cat-fat) and the narrow (cat-nonfat) liquidity creation measures (Berger and Bouwman, 2009, 2016). Table 4.3 illustrates the classification and the weighting of the balance sheet items in line with the construction of the two liquidity measures. Finally, following Berger and Bouwman (2009, 2016), our analysis is based on the cat-fat and the cat-nonfat liquidity creation measures normalised by total assets to make them comparable across banks.

### 4.3.2 Data

Our analysis focuses on commercial banks operating in Japan over the period from March 1998 (fiscal year 1997) through September 2001 (fiscal year 2001). The sample period straddles the introduction of the Tokyo tax in April 2000. In order to ensure that there is sufficient overlap in the distribution of the covariates across the affected and unaffected banks, we restrict our analysis to commercial (city and regional) banks. This allows us to obtain correct statistical inference from our difference-in-differences analysis (Imbens and Rubin 2015).

Our sample comprises city and regional banks. Trust banks and long-term credit banks are excluded from the sample, since these types of banks have business models that differ from those pursued by commercial banks. Banks which either failed or went bankrupt during the sample period are also excluded from

our sample.[60] One merger between an affected and an unaffected bank occurred during our sample period.[61] These banks are also excluded from the empirical analysis in order to ensure the separability of affected and unaffected banks.

The primary source of data is the Japanese Bankers Association. This provides detailed semi-annual balance sheet and income statement information for each member bank. We supplement this information with hand collected data on off-balance items drawn from electronic copies of bank financial statements (yuho) obtained from Bloomberg. Our final sample is an unbalanced panel of 745 bank-year observations of 107 Japanese commercial banks (8 City banks and 99 Regional banks). Of the 107 commercial banks in our sample, 16 banks were affected by the Tokyo bank tax.

Panel A of Table 4.4 reports the mean and standard deviation of the bank liquidity creation measures for the affected and unaffected banks before and after the introduction of the Tokyo bank tax. According to the broad (cat-fat) measure of liquidity creation, unaffected banks create slightly more liquidity than taxed counterparts. Specifically, in the pre-tax period both groups create approximately ¥0.30 of liquidity per ¥1 of total assets employed. The difference between the two groups is also statistically indistinguishable from zero (t-stat = 0.07). In the post Tokyo tax period, however, control group banks create ¥0.46 of liquidity per ¥1 of total assets employed compared to affected banks which create ¥0.42 of liquidity

[60] The following banks were excluded from the sample: Hokkaido Takushoku Bank (failed November 17, 1997), Tokuyo City Bank (failed Nov 27, 1997), Tokyo Sowa Bank (under public administration, June 12, 1999), Kokumin Bank (under public administration, April 11, 1999), Niigata Chuo Bank (under public administration, October 2, 1999), Ishikawa Bank (failed, March 2001), Chubu Bank (failed, March 8, 2001), Kyoto Kyoei Bank (failed, October 14, 1997), Kofuku Bank (under public administration, May 22, 1999), Kansai Sawayaka Bank (formerly Kofuku Bank), Namihaya Bank (under public administration, August 7, 1999), Midori Bank (failed, May 15,1998). (Source: Bank of Japan, Deposit Insurance Corporation Japan, Financial Services Agency Japan).

[61] Hachijuni Bank (affected) acquires Niigata Chuo Bank (unaffected), September 29, 2000 (Financial Services Agency Japan).

per ¥1 of total assets employed. This difference is statistically significant at the 5% level (t-stat = 2.47).

**Table 4.4 | Summary Statistics**

| Variables | Affected banks | | Unaffected banks | |
|---|---|---|---|---|
| | *Before* | *After* | *Before* | *After* |
| Panel A: Dependent Variables | | | | |
| Cat-fat | 0.30 | 0.42 | 0.30 | 0.46 |
| | (0.18) | (0.12) | (0.19) | (0.10) |
| Cat-nonfat | 0.28 | 0.40 | 0.29 | 0.45 |
| | (0.18) | (0.12) | (0.19) | (0.10) |
| Panel B: Control Variables | | | | |
| Capital Adequacy (%) | 2.81 | 3.33 | 1.91 | 2.18 |
| | (0.93) | (0.85) | (0.69) | (0.98) |
| Asset Quality (%) | 2.86 | 3.97 | 2.62 | 4.79 |
| | (2.03) | (1.61) | (2.10) | (2.15) |
| Management Efficiency (%) | 0.97 | 1.09 | 1.03 | 1.05 |
| | (0.16) | (0.10) | (0.15) | (0.16) |
| Earnings (%) | -0.23 | 0.10 | -0.08 | -0.03 |
| | (0.65) | (0.22) | (0.63) | (0.44) |
| Diversification (%) | 25.94 | 30.06 | 17.50 | 17.58 |
| | (11.41) | (8.77) | (6.72) | (6.30) |
| Size (log) | 30.50 | 30.52 | 28.15 | 28.18 |
| | (1.02) | (1.02) | (0.66) | (0.68) |
| Market Share (%) | 3.48 | 3.49 | 0.26 | 0.27 |
| | (2.89) | (2.92) | (0.16) | (0.17) |
| Number of Observations | 80 | 47 | 450 | 267 |
| Number of Banks | 16 | 16 | 91 | 91 |

The table presents means and standard deviations (in parenthesis) of both dependent and control variables used in our analysis before and after the introduction of the Tokyo bank tax and by treatment status. The set of control variables include capital adequacy, asset quality, management efficiency, earnings, size, diversification and market share. See Table 3.2 for a definition.

Panel B of Table 4.4 reports the mean and standard deviation for each of the control variables used in our analysis for both affected and unaffected banks before and after the introduction of the Tokyo bank tax. Overall, the summary statistics confirm that affected and unaffected banks are on average relatively similar across a number of covariates including capital adequacy, asset quality, management efficiency, and earnings. Affected and unaffected banks differ to some extent in terms of size, market share, and diversification. Affected banks are larger, hold more market share and are more diversified than their unaffected counterparts.

## 4.4 Findings

Table 4.5 presents our main results. In Column 1 we report estimates using the broad liquidity creation measure (cat-fat to total assets) as the dependent variable, while controlling for time and bank fixed effects only. The treatment effect is -0.035 and is statistically significant at the 5% level. This result indicates that banks affected by the Tokyo tax experience a 3.5 percentage point reduction in their liquidity creation relative to unaffected banks. The economic significance of the impact of the tax on bank liquidity creation is considerable. To illustrate this point, consider the average affected bank in our sample, which has total assets of ¥28.3 trillion ($249 billion). The 3.5 percentage point reduction in the cat-fat to total assets ratio implies a loss of ¥990 billion ($8.71 billion) in liquidity creation.[62] The effect of taxation on liquidity creation is robust when we control for bank level time varying characteristics albeit the coefficient in this case (shown in Column 2) is marginally smaller.

In Columns 3 and 4, the dependent variable is the narrow liquidity creation measure (cat-nonfat to total assets). The results using this measure are similar in both size and significance to the results for our broad liquidity creation measure. This suggests that the reduction in liquidity creation by affected banks is not due to changes in their OBS activities, but rather arises from changes in the composition of on-balance sheet assets and liabilities.

Next, we explore the relationship between the gross profit tax and the components of liquidity creation. Table 4.6 presents the results of model (4.1) re-estimated using the individual components of the broad (cat-fat) liquidity creation

[62] When considering the median treated bank in our sample with total assets of ¥10.9 trillion ($95.82 billion) the effect of the tax is equally notable, as it implies a reduction of ¥381 billion ($3.35 billion) on its liquidity creation.

measure. Here we use the liquid, semi-liquid, and illiquid items of the asset-side, liability-side, and OBS section of the balance sheet (deflated by total assets) as outcome variables. We find that the tax is associated negatively with bank liquidity

**Table 4.5 | The Effect of Tax on Liquidity Creation**

| | cat-fat | cat-fat | cat-nonfat | cat-nonfat |
|---|---|---|---|---|
| TAX | -0.035** | -0.028** | -0.034** | -0.028*** |
| | (0.017) | (0.014) | (0.016) | (0.013) |
| Capital Adequacy | | 0.001 | | -0.0006 |
| | | (0.004) | | (0.004) |
| Asset Quality | | 0.004** | | 0.004** |
| | | (0.002) | | (0.002) |
| Management Efficiency | | 0.0002 | | 0.002 |
| | | (0.022) | | (0.002) |
| Earnings | | 0.002 | | 0.001 |
| | | (0.005) | | (0.005) |
| Market Share | | 0.009 | | 0.020 |
| | | (0.042) | | (0.040) |
| Diversification | | -0.001* | | -0.0004 |
| | | (0.0003) | | (0.0003) |
| Size | | -0.088* | | -0.089* |
| | | (0.052) | | (0.050) |
| Constant | 0.060*** | 2.579* | 0.059*** | 2.589* |
| | (0.006) | (1.472) | (0.006) | (1.437) |
| Bank Fixed Effects | Y | Y | Y | Y |
| Observations | 844 | 844 | 844 | 844 |
| $R^2$ | 0.890 | 0.893 | 0.885 | 0.888 |

This table reports the results of ordinary least squares regressions using a sample of 107 Japanese banks spanning the period from March 1998 to September 2001. The dependent variables are cat-fat and cat-nonfat. The main explanatory variable is TAX, an indicator variable equal to one for banks affected by the Tokyo bank tax when it comes into effect and zero otherwise. To control for potential heterogeneity between affected and unaffected banks the lagged values of capital adequacy, asset quality, management efficiency, earnings, market share, diversification and size are included in some specifications as further control variables. In addition, a set of time dummies and bank specific fixed effects are included across all regressions. Robust standard errors clustered at the bank level are reported in parentheses. ***, **, *, indicate significance at the 1%, 5%, and 10% level respectively.

creation on the asset-side of the balance sheet only. Banks liable to pay the Tokyo bank tax have significantly less illiquid assets. This could be due to affected banks contracting their loan portfolios as a response to the tax (see Buch et al., 2016; Schandlbauer 2017; Banerji et al., 2018). There is little evidence of an effect of the tax on either semi-liquid or liquid assets. The detrimental effect of the tax on asset-side liquidity creation is offset partially by the lower equity to total assets held by

affected banks relative to their unaffected counterparts; a difference that is significant at the 1% level (Table 4.6 Panel C).

**Table 4.6 | Components of Liquidity Creation**

| Panel A: Assets | | | |
|---|---|---|---|
| | *Illiquid (1/2)* | *Semi-Liquid (0)* | *Liquid (-1/2)* |
| TAX | -0.057** | -0.024 | 0.005 |
| | (0.023) | (0.014) | (0.004) |
| Control variables | YES | YES | YES |
| Bank Fixed Effects | YES | YES | YES |
| Observations | 844 | 844 | 844 |
| Panel B: Liabilities | | | |
| | *Illiquid (1/2)* | *Semi-Liquid (0)* | *Liquid (-1/2)* |
| TAX | 0.004 | -0.025*** | 0.007 |
| | (0.003) | (0.009) | (0.006) |
| Control variables | YES | YES | YES |
| Bank Fixed Effects | YES | YES | YES |
| Observations | 844 | 844 | 844 |
| Panel C: Equity | | | |
| | *Illiquid (1/2)* | *Semi-Liquid (0)* | *Liquid (-1/2)* |
| TAX | -0.004*** | | |
| | (0.001) | | |
| Control variables | YES | | |
| Bank Fixed Effects | YES | | |
| Observations | 844 | | |
| Panel D: Off-Balance Sheet Activities | | | |
| | *Illiquid (1/2)* | *Semi-Liquid (0)* | *Liquid (-1/2)* |
| TAX | 0.00024 | | -0.00005 |
| | (0.00408) | | (0.00067) |
| Control variables | YES | | YES |
| Bank Fixed Effects | YES | | YES |
| Observations | 844 | | 844 |

This table reports the results of ordinary least squares regressions using a sample of 107 Japanese banks spanning the period from March 1998 to September 2001. The dependent variables are liquidity creation components normalised by the total assets. Liquidity is calculated based on the cat-fat measure. The set of control variables include capital adequacy, asset quality, management efficiency, earnings, size, diversification and market share. In addition, a set of time dummies and bank specific fixed effects are included across all regressions. Robust standard errors clustered at the bank level are reported in parentheses. ***, **, *, indicate significance at the 1%, 5%, and 10% level respectively.

We find that the tax affects semi-liquid liabilities. However, this category of liabilities carries a zero weight in the construction of both the broad and narrow measures of liquidity creation, and so does not impact on the overall liquidity created by banks (see Table 4.6 Panel B). In terms of magnitude, the imposition of

the Tokyo bank tax induces a reduction in asset-side liquidity of 5.7 percentage points, in liability- and equity-side liquidity of 2.5 and 0.4 percentage points respectively. The effect of tax on the asset-side of bank liquidity creation is larger than any of the other components of the balance sheet. Overall, the findings in Table 4.6 indicate that the reduction in bank liquidity creation is driven mainly by the negative impact of the Tokyo bank tax on the asset side of the balance sheet. [63]

## 4.5 Testing the Mechanisms

The results of our initial empirical analysis suggest that the introduction of the Tokyo tax had a significant impact on bank liquidity creation. Moreover, our findings suggest that the tax affects certain components of the balance sheet, namely the illiquid assets and capital held by banks. In this section, we explore the possible mechanisms relating to bank leverage and profitability through which taxation may affect bank liquidity creation.

First, the imposition of a tax on gross profitability could affect bank liquidity creation by inducing changes in the extent to which banks assume portfolio risk (Caminal, 2003; Horváth 2013; Milonas 2016; Gambacorta et al. 2017). Since an increase in tax costs leaves banks with a lower amount of after-tax earnings, banks may choose to re-organise portfolios by reallocating from safer toward riskier assets.[64] For example, banks may reduce investments in government securities and shift to riskier commercial or consumer credit. The reallocation of portfolios toward riskier assets leads to an increase in asset-side liquidity creation. Thus, if

[63] Our findings will understate the actual impact of the tax on liquidity creation if a mechanical relationship exists between taxes and liquidity creation. That is, tax settlements paid to the tax collecting authority may reduce cash holdings of banks. According to liquidity creation measure by Berger and Bouwman (2009), a reduction in cash increases the liquidity created by the bank. Findings presented in Table 4.6 however do not point to a strong offsetting impact from this relationship. The coefficient on TAX for liquid assets (which include cash holdings) as the outcome variable is close to zero and not statistically significant.

[64] Caminal (2003) theoretically shows that banks increase risk-taking if taxes reduce their ability to seek economic rent.

taxation affects liquidity creation through the risk-taking mechanism, we would expect that banks which take more risk increase liquidity creation following the imposition of the tax.

In order to assess the risk-taking mechanism, we augment Equation (4.1) with an interaction term between TAX and Asset Quality (for a definition see Section 4.3), our proxy for bank risk-taking. This common proxy indicator of risk-taking is motivated by the fact that non-performing loans involve a mechanical classification of loans as non-performing when payment is overdue. As such this proxy is less prone to manipulation by bank managers than loan loss provisions (Shrieves and Dahl 2003). The results of this analysis presented in Table 4.7 Panel A provide little evidence in support of this mechanism. The interaction term enters the regression with a negative coefficient and is statistically insignificant at conventional levels.

Second, the imposition of a tax on gross profitability could affect bank liquidity creation by inducing changes in the extent to which banks fulfil their respective monitoring function as part of their overall financial intermediation activities (Dia and van Hoose 2016; Banerji et al., 2018). If taxation affects liquidity creation through this mechanism, then the negative impact of taxation on liquidity creation should be weaker among banks that devote more resources to the monitoring of borrowers.

We test this monitoring mechanism by introducing an interaction term between *High Monitoring* and TAX into Equation (4.1). To construct *High Monitoring*, we follow Coleman et al. (2006) and calculate a salary expenses ratio defined as personnel expenses to total non-interest expenses. Given that the salary

expense ratio is driven in large part by the size of the bank, we divide banks into five groups based on total assets. For each bank half-year observation, we compute the difference between the salary expenses ratio and the median for a given group of banks. We then set *High Monitoring* equal to one if the salary expenses ratio adjusted for bank size is positive and zero otherwise. The results are presented in Table 4.7 Panel B and are consistent with the monitoring mechanism being at play in the case of the Tokyo tax. The estimated coefficients on the interaction between taxation and monitoring enter positively and significantly. Our findings imply that banks that devote more resources to the monitoring of borrowers reduce liquidity creation by less following the imposition of the Tokyo bank tax.

Third, taxation could affect liquidity creation via the leverage of banks. As interest payments are deducted prior to arriving at gross profit, banks might opt for a more fragile capital structure to take advantage of this tax shield. If so, a fragile capital structure dominated by debt and deposits may reduce the ability of banks to absorb risk and hence create liquidity. This implies that the negative impact of tax on liquidity creation would be weaker among better capitalised banks. A competing view in relation to bank capital is that fragility induces banks to monitor their borrowers more intensely and hence extend more loans and create more liquidity. We use *Capital Adequacy* to proxy for the capital structure of the bank. We include this proxy along with its interaction with the *TAX* variable in Equation (4.1) to assess whether bank capitalisation mechanism is relevant in explaining the link between taxation and bank liquidity creation. The results reported in Table 4.7 Panel C are consistent with the view that bank capital absorbs risk. The interaction term of the *Tax* and *Capital Adequacy* enters positively and significantly in both regressions. This implies that the Tokyo tax

exerts a less pronounced negative effect on liquidity creation for better capitalised banks.

**Table 4.7 | Testing the Mechanisms (Risk-Taking, Monitoring, Capitalisation)**

| | Panel A: Risk-Taking | | Panel B: Monitoring | | Panel C: Capitalisation | |
|---|---|---|---|---|---|---|
| | *cat-fat* | *cat-fat* | *cat-nonfat* | *cat-nonfat* | *cat-nonfat* | *cat-nonfat* |
| TAX | -0.027* | -0.027** | -0.052** | -0.054*** | -0.032** | -0.033** |
| | (0.014) | (0.013) | (0.021) | (0.019) | (0.014) | (0.013) |
| TAX · Asset Quality | -0.003 | -0.003 | | | | |
| | (0.009) | (0.009) | | | | |
| TAX · Monitoring | | | 0.041* | 0.044* | | |
| | | | (0.024) | (0.023) | | |
| TAX · Capital Adequacy | | | | | 0.008* | 0.009** |
| | | | | | (0.005) | (0.005) |
| Asset Quality | 0.004** | 0.004** | | | | |
| | (0.002) | (0.002) | | | | |
| Monitoring | | | 0.006 | 0.006 | | |
| | | | (0.005) | (0.005) | | |
| Capital Adequacy | | | | | -0.001 | -0.001 |
| | | | | | (0.004) | (0.004) |
| Constant | 2.581* | 2.591* | 2.700* | 2.717* | 2.545* | 2.550* |
| | (1.467) | (1.432) | (1.486) | (1.455) | (1.447) | (1.410) |
| Control variables | YES | YES | YES | YES | YES | YES |
| Bank Fixed Effects | YES | YES | YES | YES | YES | YES |
| Observations | 844 | 844 | 844 | 844 | 844 | 844 |
| $R^2$ | 0.893 | 0.888 | 0.885 | 0.888 | 0.893 | 0.888 |

This table reports the results of ordinary least squares regressions examining the effect of Tokyo tax on liquidity creation. We consider the three different mechanisms through which tax can impact on liquidity creation. Panel A focuses on bank risk-taking by introducing an interaction term between TAX, an indicator variable equal to one for banks affected by the Tokyo bank tax when it comes into effect and zero otherwise, and our proxy for bank risk-taking (Asset Quality, defined as non-performing loans to total assets). We consider monitoring as an alternative non-mutually exclusive mechanism in Panel B. Panel C focuses on bank capital as an alternative mechanism through which tax affects liquidity creation. Lagged values of management efficiency, earnings, market share, diversification and size are included as further control variables. In addition, a set of time dummies and bank specific fixed effects are included across all regressions. Robust standard errors clustered at the bank level are reported in parentheses. ***, **, *, indicate significance at the 1%, 5%, and 10% level respectively.

## 4.6 Robustness checks

In Table 4.8, we check the robustness of our estimates of the effect of the Tokyo bank tax on bank liquidity creation to common problems inherent in differences-in-differences approach. First, we focus on whether the outcome variables of affected and unaffected banks demonstrate similar trends in the

absence of treatment. This is a key assumption behind our identification strategy (and is often referred to as the parallel trend assumption). Although this assumption cannot be tested directly, placebo tests can be useful in mitigating concerns that the parallel trend assumption is violated. As a check for the parallel trend assumption, we conduct a placebo test by assuming falsely that the Tokyo bank tax was introduced one year prior to its actual adoption. By introducing a placebo tax just before the actual bank tax was introduced, we also test for potential anticipation effects. Panel A of Table 4.8 presents results of this placebo test. None of the coefficients on the Placebo-Tax are significant. This suggests that the parallel trend assumption for the period prior to the introduction of the tax is not violated and that anticipation effects are not present.

Next, we focus on the possibility that the OLS standard errors of our difference-in-differences estimates of treatment effects are biased downward as a result of serially correlated dependent variables (Bertrand et al., 2004). In order to alleviate concerns regarding serial correlation, we cluster the standard errors at the bank level throughout our analysis. To further check the robustness of our results, we collapse our data into a two-period panel. All observations prior to the introduction of the Tokyo bank tax are averaged into a single pre-intervention period, while all observations after the tax are averaged into a single post-intervention period. The results shown in Panel A of Table 4.8 suggest that there is little deviation from the estimated tax effects reported in Table 4.5. This confirms that the baseline results are robust to using estimators that adjust standard errors for serial correlation.

**Table 4.8 | Falsification Tests**

| Panel A: Fiscal Year 1999 | | |
|---|---|---|
| | *cat-fat* | *cat-nonfat* |
| Placebo-TAX | -0.010 | -0.010 |
| | (0.020) | (0.020) |
| Control variables | YES | YES |
| Bank Fixed Effects | YES | YES |
| Observations | 318 | 318 |
| Panel B: Two-Period Sample | | |
| | *cat-fat* | *cat-nonfat* |
| TAX | -0.027** | -0.026** |
| | (0.013) | (0.012) |
| Control variables | YES | YES |
| Bank Fixed Effects | YES | YES |
| Observations | 211 | 211 |

This table reports the results from falsification tests. Panel A presents the results of ordinary least squares regressions using a sample spanning the period before the introduction of the Tokyo bank tax. The main explanatory variable is Placebo-TAX, an indicator variable equal to one for banks affected by the Tokyo bank tax when it comes into effect and zero otherwise, but this time we assume falsely that this happens one year prior to actual introduction. In order to account for problems arising from serially correlated outcomes, In Panel B we collapse our dataset into a two-period panel, by averaging the observations in dates prior to the Tokyo bank tax into a single pre-intervention period and likewise for the observations in dates after the introduction of the tax, which are averaged into a single post-intervention period (Bertrand et al., 2004). The dependent variables are cat-fat and cat-nonfat. The set of control variables include capital adequacy, asset quality, management efficiency, earnings, size, diversification and market share. In addition, a set of time dummies and bank specific fixed effects are included across all regressions. Robust standard errors clustered at the bank level are reported in parentheses. ***, **, *, indicate significance at the 1%, 5%, and 10% level respectively.

To provide additional insight, we also examine whether various subsamples are driving our results. First, we consider the possibility that liquidity creation by banks located at distance from Tokyo may be affected by different economic conditions to those experienced by banks located in or close to Tokyo. To alleviate concerns regarding the impact of different economic conditions across Japan impacting on the liquidity created of banks located in different geographic areas, we re-estimate our regressions imposing geographic restrictions on our sample. The restricted sample contains banks operating predominantly in the three major regions (Kanto, Chubu and Tohoku) that directly surround the Tokyo prefecture. This restriction effectively excludes banks located in Japan's other major industrial centres (such as the Kansai and Kyushu regions), and reduces our sample size from

107 banks to 48 banks (16 affected and 32 unaffected). The results of this analysis are presented in Panel A of Table 4.9, and are consistent with our main findings, indicating that the average effect of tax on bank liquidity creation is negative and statistically significant, even when a geographically constrained sample is considered.

We also consider the possibility that some of the unaffected banks that have no physical presence in Tokyo, and which do not compete directly with the affected banks might be driving our results. To address this concern, we exclude from our sample those banks that have no physical branch presence in the Tokyo area. This exclusion restriction results in a sample of 97 banks (comprising 16 affected and 81 unaffected). The results shown in Panel B of Table 4.9 are consistent with those reported in Table 4.5.

The negative effect of the Tokyo bank tax on bank liquidity creation could be driven by differences in the size of banks included in the affected and control groups. To address this concern, we limit our sample to banks with total assets greater than that of the median bank. The results of this analysis shown in Panel C of Table 4.9, suggest that restricting our sample to relatively large banks does not change materially the results reported in Table 4.5.

Finally, the inclusion of Capital Adequacy as a control variable in some specifications used for our main analysis could raise endogeneity concerns, given that both our broad and narrow measures of liquidity creation capture the share of equity in liquidity creation by construction. Although our results remain robust to excluding Capital Adequacy as a control variable, (see columns 1 and 3 of Table 4.5) following Berger and Bouwman (2009) and Fu et al. (2016), we reconstruct

**Table 4.9 | Robustness Checks**

| Panel A: Economic Trends | | |
|---|---|---|
| | *cat-fat* | *cat-nonfat* |
| TAX | -0.032** | -0.031** |
| | (0.016) | (0.015) |
| Control variables | YES | YES |
| Bank Fixed Effects | YES | YES |
| Observations | 474 | 474 |
| Panel B: Tokyo Presence | | |
| | *cat-fat* | *cat-nonfat* |
| TAX | -0.029** | -0.029** |
| | (0.014) | (0.013) |
| Control variables | YES | YES |
| Bank Fixed Effects | YES | YES |
| Observations | 772 | 772 |
| Panel C: Large Banks Sample | | |
| | *cat-fat* | *cat-nonfat* |
| TAX | -0.029** | -0.028** |
| | (0.013) | (0.012) |
| Controls variables | YES | YES |
| Bank Fixed Effects | YES | YES |
| Observations | 463 | 463 |
| Panel D: Alternative Liquidity Creation Measures | | |
| | *cat-fat* | *cat-nonfat* |
| TAX | -0.029** | -0.029** |
| | (0.013) | (0.013) |
| Controls variables | YES | YES |
| Bank Fixed Effects | YES | YES |
| Observations | 844 | 844 |

This table reports the results of further robustness checks on the effect of the Tokyo bank tax on bank liquidity creation. In Panel A, we limit our sample to banks which operate predominantly in the three major regions (Kanto, Chubu and Tohoku) that directly surround the Tokyo prefecture, in order to alleviate concerns regarding differential economic climates across Japan driving our main findings. In Panel B, we restrict the sample to those banks that have physical presence (i.e. branches) in Tokyo, in order to alleviate concerns that our results might be driven by unaffected banks that do not compete directly with affected banks. In Panel C, we limit our sample to banks which have total assets greater than that of the median bank, in order to alleviate concerns regarding relatively small sized banks driving our main findings. In Panel D, the dependent variables have been reconstructed to exclude equity's effect on liquidity measures. The main explanatory variable is TAX, an indicator variable equal to one for banks affected by the Tokyo bank tax when it comes into effect and zero otherwise. The set of control variables include capital adequacy, asset quality, management efficiency, earnings, size, diversification and market share. In addition, a set of time dummies and bank specific fixed effects are included across all regressions. Robust standard errors clustered at the bank level are reported in parentheses. ***, **, *, indicate significance at the 1%, 5%, and 10% level respectively.

both dependent variables excluding equity to further alleviate any concerns associated with this variable. The results, reported in Table 4.9 Panel D, suggest that our main findings are robust to the exclusion of equity from the liquidity

creation measures. The coefficient on *TAX* is still negative and significant in both cases.

## 4.7 Summary

Liquidity creation is one of the core functions of banks. Prior literature suggests that the extent to which banks can perform this core function is likely to be affected by managerial decision making, capitalisation, competition from other financial intermediaries, and capital, liquidity and deposit insurance regulations. The level of taxes is also likely to be a key determinant of bank liquidity creation. Taxes increase bank costs, which if not arbitraged or passed onto customers will impact on profitability, leading banks to change the asset and liability composition of balance sheets. To date, there is no evidence regarding the effects of taxation on bank liquidity creation.

In this chapter we fill this gap via a research design and setting which allows us to isolate the implications of taxation for bank liquidity creation. Using a sample of Japanese commercial banks, we provide new evidence on the relationship between taxation and bank liquidity creation. As our identification strategy we use the sudden introduction of the Tokyo bank tax (which affected some banks but left others unaffected). This differential tax treatment of banks allows us to identify the impact of taxation on bank liquidity creation.

Using a difference-in-differences approach we estimate the impact of taxes on bank liquidity creation. Our regression results indicate that gross profit taxes have a negative effect on bank liquidity creation. Specifically, banks affected by the Tokyo bank tax create significantly less liquidity than banks that were not affected by the tax. Our findings suggest that the downward adjustment in liquidity

creation is primarily driven by illiquid bank assets. We detect only a marginal effect of tax on the liability-side liquidity creation and no effect on off-balance sheet liquidity creation. Furthermore, we provide evidence on the underlying mechanisms that drive the observed reduction in bank liquidity creation. We test for the presence of three non-mutually exclusive mechanisms related to bank risk-taking, monitoring and capitalisation. Our findings suggest that banks which are better capitalised and devote more resources to the monitoring of borrowers reduce liquidity creation by less when faced with a sudden increase in taxes. We do not find evidence for the risk-taking mechanism.

# Chapter 5 | The Real Effects of Bank Taxation

## 5.1 Introduction

The global financial crisis and subsequent slow economic recovery have underlined interconnections between banks and the real economy. In this chapter we investigate the impact of a sudden introduction of a bank tax on the banking sector and real economy in Japan. We assess how banks adjust their balance sheets in response to the higher costs resulting from the tax, and how these adjustments affect the investment decisions of corporate borrowers. To the best of our knowledge, our study is the first to investigate the effects of bank taxation on real economic outcomes.

In many countries, there has been a proliferation of new and enhanced bank regulations. These have included tax schemes that are targeted specifically at the banking industry. The net effects of bank taxation depend crucially on the extent to which banks internalise or pass through (to customers) the increased costs arising from the taxes. For example, if banks pass through increased costs by reducing the availability of credit or increasing interest rates on borrowed funds, then this is likely to have implications for the ability of borrowing corporates to access external finance and execute real investments. As a consequence, understanding how banks respond to changes in taxes, and whether this has implications for corporate level investment is of substantive interest to policymakers charged with overseeing developments in the banking industry and real economy.

Assessing the implications of bank taxation for corporate borrowers and the real economy faces a significant challenge given that changes in economic conditions that prompt governments to change the taxation arrangements for banks may also affect corporate investment behaviour. To assess the effects of bank taxation on real economic decisions of corporates, we therefore require a change in the taxation of banks that is independent from a change in the demand for credit. In this study, we overcome this identification problem in two ways. First, we utilise an exogenous variation in bank taxation induced by an unexpected imposition of a local bank tax (in Tokyo, Japan) which affected one group of banks, but left others unaffected. Second, we rely on an estimation strategy (pioneered by Khwaja and Mian, 2008), which permits us to disentangle supply-side from demand-side factors. Specifically, we utilise loan level data on the individual corporate customers of banks. In our sample (discussed in more detail below) we observe the borrowing activity of approximately 2400 corporates that borrow from an average of seven banks. We exploit the presence of these multiple bank-corporate relationships, and control for credit demand of corporates by including corporate fixed effects. The use of corporate fixed effects allows us to absorb the individual demand conditions for credit that may influence bank lending behaviour and isolate supply- from demand-side effects. As a consequence, estimated differences in credit supply can be thus attributed correctly to differences in bank exposures to tax.

As an empirical setting we exploit the so-called Tokyo bank tax as a quasi-natural experiment. At the beginning of the fiscal year 2000, large Japanese banks with operations in Tokyo and deposits exceeding ¥5 trillion unexpectedly became liable to pay a tax to the Tokyo government. The Tokyo bank tax which was

introduced as part of a populist political agenda led by the Tokyo Governor Ishihara aimed to curtail the excessive profitability of banks and arrest a three-year long decline (1997-1999) in tax revenues raised from banks for local government coffers. Under the terms of the Tokyo bank tax, the tax base shifted from net to gross profit, resulting in a considerable widening of the tax base, and increasing the tax liability of affected banks. The Tokyo bank tax was not part of a broader or widely anticipated set of fiscal reforms but was instead specifically targeted at large banks. These banks represented an important source of funding for corporates with operations outside the Tokyo prefecture. There was considerable variation in the individual tax liabilities of banks subject to the Tokyo bank tax, since the amount payable to the local (Tokyo) government was related directly to the number of employees based in Tokyo.

Our empirical analysis comprises two stages. In the first stage, we investigate the impact of the bank tax on the availability of credit, and the likely implications for the investment activity of borrowing corporates. In the second stage, we investigate if corporates compensate for a decline in credit by utilising alternative sources of funding (such as internal cash reserves, equity and bond issuance and loans from banks not liable for the Tokyo bank tax). We complement this via an investigation of whether competitor banks (exempt from the Tokyo bank tax) which compete in local loan markets with banks liable to pay the tax adjust their credit supply in response to the tax.

To execute the first stage of our analysis, we use a loan level dataset to investigate if banks that are more affected by the Tokyo bank tax supply less credit to large corporate borrowers. A priori, we expect that banks with a higher

exposure to the Tokyo area (and thus a high Tokyo bank tax liability) tighten credit supply relatively more than less exposed counterparts.[65] We investigate changes in credit supply by examining both the likelihood that a new loan is granted, and the amount of new credit extended. By means of a corporate fixed effects estimation strategy, we show that banks more exposed to the Tokyo bank tax reduce lending to corporates. More precisely, the within-corporate comparison reveals that a 10-percentage point increase in bank tax exposure, reduces lending by 7.95 percentage points.

To finalise the first stage of our empirical analysis, we investigate the implications of changes in the lending patterns of banks for corporate level investments. When financing frictions are present, a negative shock to the supply of external finance will impede corporate investment (Holmström and Tirole 1997). The effects of such a shock should be more severe for corporates that depend on external finance to fund investment opportunities, and for corporates that face higher costs in acquiring external finance. Using corporate level data, we quantify the extent to which corporate level investment is affected by a reduction in credit supplied by banks liable to pay the Tokyo bank tax. We find that a 10-percentage-point increase in corporate exposure to the bank tax results in a reduction in corporate level investment of 0.7 percentage points. This suggests that the imposition of the Tokyo bank tax had a relatively modest impact on corporate investment.

The second stage of our empirical analysis focuses on the impact of the Tokyo bank tax on corporate financing and related developments in local loan

[65] Using bank level data, Banerji et al. (2018) find that the imposition of the Tokyo bank tax results in additional costs to banks which hampers their ability to function as financial intermediaries (evidenced by a resultant decline in credit supply).

markets. Given that our sample comprises large publicly listed corporates, the relatively small effect of the Tokyo bank tax on corporate investment may in part be attributable to the availability of alternative sources of funding to large corporates. Corporates may compensate for any reduction in credit from banks affected by the tax through the use of internal cash reserves, issuing equity or bonds, or borrowing from other banks. Using our corporate level dataset (which we complement with data on corporate equity and bond issuance), we investigate the extent to which corporates compensate for any decline in credit by raising funds from alternative sources. We find that corporates do not compensate fully for the decline in credit by using alternative funding sources, and thus experience an overall modest decline in overall funding.

To finalise the second stage of our empirical analysis, we investigate if banks that compete in local loan markets with banks liable to pay the tax increase credit to corporates affected by the decline in credit. Exploiting the spatial segmentation in local loan markets, we investigate the extent to which regional banks that were exempt from the Tokyo bank tax respond by increasing lending to affected corporates. Our findings suggest that regional banks that compete in local loan markets with banks liable for the bank tax, expand short-term credit supply. However, this is insufficient to mitigate the decline in credit to corporates and the subsequent decline in corporate investment.

We undertake a number of additional tests to verify the validity of our main findings. In order to check the plausibility of our common trends assumption, we perform placebo tests in the pre- and post-shock (tax) periods. We also undertake a further test to disentangle credit supply- from demand-side effects by using an

alternative method. Specifically, we use a simple ordinary least squares estimation and compare the estimates with our original findings. The common trend analysis reveals no systematic differences across corporates in the pre- or post-shock period, lending strong support to our common trend assumption. Moreover, the alternative method approach also produces estimates in line with our main findings and supports the assertion that demand-side factors are not driving the results.

The present study is related to prior literature that examines the effects of corporate taxation on non-financial corporates. Results emanating from this literature suggest that taxation can influence: mergers and acquisitions (Auerbach and Reishus 1988); the repatriation of profits (Blouin and Krull 2009; Graham et al. 2011); location decisions (Voget 2010; Barrios et al. 2012); and corporate risk-taking (Ljungqvist et al. 2017). We contribute to this literature via an examination of the effects of taxes that are targeted at banks on non-financial corporates. To the best of our knowledge, the findings presented in our study are the first to document the propagation of bank taxation to the real economy. Specifically, we show that an increase in bank taxation is associated with a reduction in bank lending leading to a decline in corporate level investment activity.

We also contribute to a growing literature that investigates changes in bank lending to corporates following a regulatory change.[66] A number of studies investigate the impact of bank capital injections for the real economy. For example,

[66] Berger and Roman (2018) provide an extensive review of the literature that explores how bank shocks impact the real economy. The burgeoning real effects literature focuses on a wide range of shocks affecting bank lending activity, including regulatory shocks (Aiyar et al. 2014; Jiménez et al. 2017), liquidity shocks (Khwaja and Mian 2008; Duchin et al. 2010; Cingano et al. 2013), bank capital injections (Giannetti and Simonov 2013; Berger and Roman 2017), and shocks to bank assets (Gan 2007; Bottero et al. 2015). The literature examines implications of shocks for the geographical (Giannetti and Laeven 2012; De Haas and Van Horen 2012; Liberti and Sturgess 2016) and sector specialisation of bank portfolios (De Jonghe et al. 2016).

in a cross-country study, Laeven and Valencia (2013) provide evidence that the recapitalization of banks has a significantly positive effect on the growth of corporates. Giannetti and Simonov (2013) show that the re-capitalisation of Japanese banks in the late 1990s led to an increase in bank lending, followed by an increase in investments by borrowing corporates. Berger and Roman (2017) provide evidence that the purchase of toxic bank assets by the US Treasury (under the terms of the Troubled Asset Relief Programme) improved employment conditions and reduced the rate of corporate bankruptcies. Gropp et al. (2018) investigate the effects of higher capital requirements (by exploiting the 2011 capital exercise by the European Banking Authority) on bank lending to corporate and retail borrowers. The results of the empirical analysis suggest the presence of a strong link between bank capital and lending. This is particularly evident for corporates that have a high dependence on external finance. Focusing on the international transmission of changes in UK banks capital requirements, Aiyar et al. (2014) find a substantial impact on the supply of cross-border capital. UK banks are found to reduce cross-border credit in particular to other banks. Smolyansky (2016) investigates the propagation of changes in corporate income tax rates for a sample of US banks. The author finds that banks reallocate credit to small-and medium-sized corporates in states that have not undertaken tax changes. Further, the credit reallocation of affected banks impacts on local employment. Finally, Jiménez et al. (2017) investigate the impact of macro-prudential policy measures (introduced in Spain in 2000) on real economic outcomes. The authors provide evidence that dynamic loan-loss provisioning smoothes credit cycles, which in turn impacts positively on corporate performance.

We augment these aforementioned studies in two ways. First, by using a unique shock that emanates from a sudden imposition of a local tax targeted exclusively at banks, we adopt a research design that allows us to identify the impact of fiscal policy changes affecting banks on real economic outcomes. In contrast to Smolyansky (2016) who focuses on the link between ordinary income taxation (affecting all corporates including banks), bank lending and the real economy, we focus on a tax that is targeted exclusively at banks. This allows us to alleviate concerns that a change in income tax impacts both the behaviour of banks and corporates simultaneously. Second, by using a sample of large listed corporates from various industries (to investigate the lending decisions of banks following a tax shock) we can rule out the possibility that our empirical results are driven by small bank-dependent borrowers, or by industries where levels of investment are particularly sensitive to a contraction in bank credit (Rajan and Zingales 1998). Overall, the findings of this study suggest that bank taxation impacts corporate level investment via a decline in the availability of credit.

The rest of the chapter is structured as follows. Section 5.2 provides a background to the present study. In Section 5.3, we present the first stage of the empirical analysis focusing on the impact of bank taxation on credit supply, and how this affects the investment activity of borrowing corporates. Section 5.4 discusses the second stage of our analysis focusing on the compensation behaviour of corporates and related developments in local loan markets. Section 5.5 presents the results of various robustness tests. Section 5.6 provides a summary.

## 5.2 The Tokyo Bank Tax

Japanese banks reported large losses for several consecutive years following the banking crisis of 1997. This led to a large decline in the tax revenues of the Tokyo prefecture.[67] To address the decline in tax revenues, the Tokyo Government introduced a new tax targeted at banks operating in Tokyo.

Banks were selected by the Tokyo government based on the amount of deposits held (at the end of fiscal year 1999). 26 banks with deposits exceeding ¥5 trillion and operations in Tokyo (branches or headquarters) were deemed liable to pay the Tokyo bank tax.[68] The tax was levied on gross profitability (before personnel expense, operating expense and loan write-off deductions) weighted by the scale of respective presence in the Tokyo prefecture. According to the Handbook of Japanese Taxes, the tax amount payable to the Tokyo government is calculated based on the ratio of employees in Tokyo relative to the total number of domestic employees (Japanese Ministry of Finance, 2006). This ratio varied across banks liable to pay the Tokyo bank tax ranging from 0.01 to 0.72. Figure 5.1 summarizes the variation of this ratio across the 26 banks that were affected by the Tokyo bank tax.

At the time when the tax was introduced, the gross profitability of banks was relatively high. However, aggressive loan loss provisioning and loan write-off policies led banks to report low net profits (Ota 2001). Thus, higher tax rates on net profit were unlikely to yield extra tax revenues. Under the terms of the Tokyo bank tax, taxing gross rather than net profits removed the possibility that banks

[67] The Tokyo prefecture was highly dependent on the tax revenues generated by the financial sector. In fiscal year 1999, Tokyo's estimated revenue shortfall amounted to ¥700 billion.
[68] The types of banks affected by the Tokyo bank tax include commercial banks (city and regional banks) as well as trust and long-term credit banks.

could minimise their respective tax exposure by inflating expenses, and thus ensured a stable stream of tax revenue for the Tokyo government.

Table 3.1 in Chapter 3 provides a chronology of key events related to the Tokyo bank tax. Key events relevant to this analysis include the date when the tax became effective (1st April 2000), as well as the decision of the Tokyo District Court to call off the Tokyo bank tax two years later (26th March 2002) on the grounds that it violated the right to equal treatment.[69]

**Figure 5.1 | Individual Bank Exposure to the Tokyo Bank Tax**

Figure embargoed at author's request.

(See Declaration for details)

[69] The right to equal treatment (Article 14 of the Japanese Constitution) ensures that firms are treated equally. Thus, a tax that affects some firms, but excludes others is deemed unlawful.

## 5.3 Stage 1: Impact of Bank Taxation on Bank Lending and Corporate Investment

In the first stage of our empirical investigation, we exploit the imposition of the Tokyo bank tax to identify the impact of taxation on bank lending and corporate investment. Section 5.3.1 outlines our empirical strategy. In Section 5.3.2, we present the data. Section 5.3.3 discusses the findings.

### 5.3.1 Empirical Strategy

*Impact of Bank Taxation on Bank Lending*

To identify the impact of local bank taxation on the supply of credit to corporate borrowers, we follow Khwaja and Mian (2008) and compare changes in credit for each corporate across the 26 banks affected by the Tokyo bank tax.[70] Specifically, we test whether banks with a relatively greater exposure to the Tokyo bank tax reduce lending to the *same* corporate by more than banks less exposed to the tax. Here, we use a loan level dataset and exploit the fact that Japanese corporates typically hold credit relationships with multiple banks. By focusing on a sample of corporates that borrow from multiple banks, corporate specific credit demand shocks can be absorbed through introducing corporate fixed effects to the following model:

$$\Delta Credit_{ij} = a_i + \beta BEX_j + \delta X_j + \epsilon_{ij} \quad (5.1)$$

where $\Delta Credit_{ij}$ is the change in credit granted to corporate $i$ by bank $j$ after the imposition of the Tokyo bank tax. $BEX_j$ is the bank's exposure to the Tokyo bank tax, measured as the number of employees based in Tokyo relative to total number of employees in fiscal year 1998. The vector of bank specific control variables, $X_j$,

[70] Khwaja and Mian (2008) provide the theoretical and empirical foundations underlying empirical studies on the bank lending channel and its impact on the real economy. By exploiting the presence of multiple corporate relationships in a loan level dataset, their proposed estimation strategy allows for the control of demand-side effects.

include: capital-to-assets, return on equity, liquidity-to-assets, bank size and loan loss provisions-to-total-loans.

To capture both changes in credit granted and the likelihood that a new loan is granted we employ different credit growth measures. *Credit growth* is defined as the change in the total outstanding credit granted to each corporate in the sample between fiscal year 1999 and fiscal year 2001 over total credit outstanding in fiscal year 1999 (pre-shock period). We also decompose total credit into short-term and long-term components. We also add two additional indicator variables, *Entry* and *Exit*. *Entry* takes the value of one if the corporate receives credit from a new bank in the second year of the Tokyo bank tax but had no outstanding credit from that bank in the year before the imposition of the tax, and zero if otherwise. *Exit* takes the value of one if an existing bank-corporate relationship is terminated in the second year of the Tokyo bank tax, and zero otherwise. $a_i$ is the corporate fixed effect that absorbs a credit demand shock specific to an individual corporate.

*Impact of Bank Taxation on Corporate Investment*

We extend our empirical analysis and exploit the imposition of the Tokyo bank tax to investigate how corporate investment responds to bank taxation. Specifically, we examine if corporates that are affected by the tax (via their existing relationship with a bank subject to the provisions of the Tokyo bank tax), change their investment activity following the imposition of the Tokyo bank tax.

In order to identify the impact of bank taxation on corporate level investment, we follow Cingano et al. (2016) and compare the changes in the investment rate across corporates. We classify corporates as affected by the Tokyo

bank tax based upon their relative exposure to banks that are liable to pay the tax. Corporate exposure is calculated for the fiscal year prior to the introduction of the Tokyo bank tax as follows:

$$CEX_i = \sum_j w_{ij,1999} * BEX_{j,1999} \quad (5.2)$$

where corporate exposure $CEX_i$ depends upon $BEX_j$, which is defined as bank exposure to the Tokyo bank tax (measured as the number of employees based in Tokyo relative to total number of employees). $w_{ij}$ is the share of credit the corporate borrows from each bank relative to total debt (as reported in the balance sheet).[71] Using $CEX_i$ as a measure of corporate level exposure to the Tokyo bank tax via its borrowing relationships, we estimate the following:

$$INV_i = a + \beta CEX_i + \gamma X_i + \epsilon_i \quad (5.3)$$

where $INV_i$ is the sum of investment flows after the shock, normalised by the start-of-period assets. Conditional on corporate exposure being exogenous to corporate investment decisions, estimates of $\beta$ are used to infer the aggregate influence of the tax shock on the capital accumulation of corporates.

The vector of control variables $X_i$ includes industry fixed effects to control for unobserved industry level heterogeneity in corporate investment behaviour. To capture corporate level determinants of credit demand, $X_i$ also includes a set of corporate specific credit demand parameters obtained from estimating corporate fixed effects $a_i$ in Equation (5.1), and a set of proxies for corporate growth opportunities (Tobin's Q defined as market-value-to-book-value of equity, size) and frictions to capital accumulation (leverage, liquidity) prior to the imposition of

[71] The following example illustrates the calculation of CEX. A corporate borrows a total of ¥100m from three banks. ¥30m from bank A, ¥20m from bank B, and ¥50m from bank C so the weights $w_{ij}$ are 0.3, 0.2, and 0.5 respectively. Assuming that the tax exposure (BEX) of bank A is 0.2, bank B is 0, and bank C is 0.6, CEX is then: 0.3*0.2 + 0.5*0.6 = 0.36.

the Tokyo bank tax. At corporate level we include Tobin's Q, the liquidity (cash-to-total assets), leverage (debt-to-equity), corporate size (and its quadratic), the number of banks that are lending to corporate *i*, and the corporate's credit demand derived from the estimates of Equation (5.1), along with industry and prefecture fixed effects. The various definitions of corporate specific control variables are presented in Table 5.1. The financial ratios (liquidity and leverage) are included to capture a corporates ability to service debt obligations. Tobin's Q is included to control for corporate profitability and growth opportunities. The quadratic of corporate size is included alongside corporate size to control for potential non-linear effects. The number of bank relationships and the estimated corporate fixed effects from Equation (5.1) are included to control for a corporate's use of multiple banking relationships and demand for credit.

### 5.3.2 Data

We obtain loan level data from the Nikkei NEEDS Financial Quest database for the period fiscal year 1999 to 2002. This period comprises one pre-treatment year, two treatment years, and one post-treatment year. The loan level dataset comprises detailed annual information on the credit granted to Japanese listed corporates by each of their banks. Corporates report total bank debt, which can be decomposed into short-term (< one year maturity) and long-term (> one year maturity) components.[72] We match this loan level dataset with two further datasets. This first dataset contains bank level balance sheet, income statement items and other attributes (location of bank headquarters). The second dataset contains corporate level balance sheet, income statement, and other attributes (associated industry and location of corporate headquarters). Finally, we hand-

[72] The credit reported is actually drawn credit in year *t*; undrawn credit is not reported.

collect data on the number of Tokyo-based employees from the notes of annual reports of banks liable for the Tokyo bank tax.

To obtain the baseline sample, we select all listed non-financial corporates and banks for which information on total assets are available for the year prior to the introduction of the Tokyo bank tax. Following Khwaja and Mian (2008), we restrict the analysis to corporates that borrowed from at least two banks and drop all corporates with a single bank relationship.[73] This yields a baseline sample of 2368 non-financial publicly listed corporates active in fiscal year 2000, which receive loans from 140 different banks. We observe that corporates on average borrow from 7 banks. 26 out of 140 banks in the baseline sample are liable to pay the Tokyo bank tax.

For our analysis of the impact of the Tokyo bank tax on corporate investment outcomes, we first use the baseline sample to calculate $CEX_i$ as in Equation (5.2). We then amend the baseline sample by collapsing multiple bank relationships to corporate *i* into a single "average" bank relationship to corporate *i*. To construct this "average" bank, we sum all loans issued to corporate *i* by each of its banks in a given year and take the average of those banks' characteristics.[74] This yields a cross-sectional time series dataset with the corporate as the cross-sectional unit borrowing from a single, synthetically created bank. The sample consists of the original 2368 corporates from the baseline sample. In a final step,

[73] Multiple banking is very common in Japan. A mere 4.7% of corporates in our sample borrow from a single bank in FY1999. For datasets with a large number of corporates with single bank relationships, Degryse et al. (2018) suggest including these corporates in the identification of supply shocks.

[74] The following example illustrates the steps used to calculate the "average" bank. A corporate borrows ¥30m from bank A, ¥20m from bank B, and ¥50m from bank C in year 200X. To determine the loan amount issued by the "average" bank, we simply take the sum of all loans issued to the corporate: ¥30m + ¥20m + ¥50m = ¥100m. To determine the characteristics of this "average" bank, we take the following steps. Assume that the Return-on-Equity (ROE) for bank A is 0.02, for bank B, 0.04, and for bank C, 0.06. The ROE of the "average" bank is then the average ROE of bank A, B, and C: (0.02 + 0.04 + 0.06)/3 = 0.04.

we add to this dataset the estimates of the corporate fixed effects from the first part of our analysis. Table 5.1 provides detailed definitions of both our outcome and control variables. Table 5.2 reports summary statistics. In Appendix II we provide an overview of the samples used in Stage 1 of our empirical analysis.

**Table 5.1 | Variable Definitions**

| | |
|---|---|
| **Shock** | |
| Pre-shock period | FY 1999 |
| Shock period | FY 2000 and FY 2001 |
| Post-shock period | FY 2002 |
| | |
| ***Loan level analysis*** | **Definition** |
| Credit growth | Change in credit granted within a bank-corporate pair between FY1999 and FY2001 relative to credit measured in pre-shock period |
| Short-term credit growth | Change in short-term credit (maturity < 1 year) granted within a bank-corporate pair between FY1999 and FY2001 relative to credit measured in pre-shock period |
| Long-term credit growth | Change in long-term credit (maturity > 1 year) granted within a bank-corporate pair between FY1999 and FY2001 relative to credit measured in pre-shock period |
| Entry | Dummy variable equals one if corporate has credit granted from bank during shock period but not in pre-shock period; zero otherwise. |
| Exit | Dummy variable equals one if bank-corporate relationships are terminated; zero otherwise. |
| BEX (Bank exposure) | Ratio of the number of employees based in Tokyo relative to total number of employees (pre-shock period) |
| TAX | Dummy variable equals one if a bank (exempt from the Tokyo bank tax) is headquartered in the same prefecture in which a bank liable to pay the Tokyo bank tax is headquartered; zero otherwise |
| Capital to total assets | Bank equity capital over total assets (pre-shock period) |
| Return on equity | Bank income before income taxes over equity capital (pre-shock period) |
| Provisions to total loans | Bank provision for loan losses over total loans and bills discounted (pre-shock period) |
| Liquidity | Bank cash and due from banks over total assets (pre-shock period) |
| Size | Bank total assets (pre-shock period) |
| | |
| ***Corporate level analysis*** | |
| Capital investment rate | Cumulative net investment, obtained as the sum of investment expenditure in FY2001, normalised by the value of total assets as of FY1999. |
| Funds | Sum of change in credit granted plus new equity issued plus new bonds plus change in cash (between FY1999 and FY2001) over sum of credit plus equity plus bonds plus cash (all measured in pre-shock period |

**Table 5.1 (continued)**

| | |
|---|---|
| CEX (Corporate exposure) | Average exposure of corporates to the Tokyo bank tax measured as weighted average of *Bank Exposure* of all banks that are lending to the corporate. Weights are bank share of total credit to corporate. |
| Credit demand | Corporate credit demand is the fixed effects from estimation of Equation (5.1) |
| Liquidity | Corporate cash to total assets (pre-shock period) |
| Tobin's Q | Corporate market value to book value (pre-shock period) |
| Bank-relationships | Number of lenders a corporate borrows from measured in pre-shock period |
| Leverage | Corporate debt to equity (pre-shock period) |
| Size | Corporate total assets (logarithm) (pre-shock period) |

## Table 5.2 | Summary Statistics

| | Mean | St. dev. | Min | Max | Obs |
|---|---|---|---|---|---|
| ***Loan level Dataset*** | | | | | |
| BEX (Bank Exposure) | 0.35 | 0.27 | 0 | 0.71 | 15830 |
| TAX | 0.22 | 0.41 | 0 | 1 | 4129 |
| Credit growth | 0.1 | 0.86 | -0.86 | 7.14 | 15830 |
| Short-term credit growth | 0.09 | 0.71 | -0.83 | 5.78 | 12332 |
| Long-term credit growth | 0.12 | 1.16 | -0.92 | 9.59 | 8736 |
| Exit | 0.05 | 0.22 | 0 | 1 | 17284 |
| Entry | 0.05 | 0.22 | 0 | 1 | 13826 |
| Bank Control Variables | | | | | |
| Size | 16.6 | 1.28 | 13.5 | 18.18 | 15830 |
| Capital | 0.05 | 0.01 | 0 | 0.08 | 15830 |
| Liquidity | 0.04 | 0.02 | 0.01 | 0.08 | 15830 |
| Loan loss provisioning | 0.03 | 0.05 | 0 | 0.41 | 15830 |
| Return on equity | 0.02 | 0.1 | -0.71 | 0.09 | 15251 |
| ***Corporate level Dataset*** | | | | | |
| CEX (Corporate Exposure) | 0.24 | 0.18 | 0 | 0.68 | 2368 |
| Investment rate | 0.18 | 0.21 | -0.08 | 1.91 | 2368 |
| Credit demand | -0.07 | 0.7 | -0.86 | 4.42 | 2368 |
| Liquidity | 0.12 | 0.09 | 0 | 0.74 | 2368 |
| Tobin's Q | 3.94 | 6.07 | 0 | 53.96 | 2368 |
| Bank-relationships | 18.65 | 13.6 | 2 | 141 | 2359 |
| Leverage | 4.85 | 11.21 | 0.14 | 81.67 | 2368 |
| Size | 10.56 | 1.46 | 6.19 | 14.83 | 2368 |

This table presents summary statistics of dependent and independent variables for the sample of 140 banks used for the loan level analysis and corporate level analysis. Detailed definitions of the variables are provided in Table 5.1. All accounting data are winsorized at the 98% level to reduce the impact of outliers.

### 5.3.3 Findings

Table 5.3 reports the results of estimating Equation (5.1). We find that the coefficient on Bank Exposure ($BEX_j$) reported in Column 1 is negative and statistically significant at the 10% level. The point estimate of 0.795 in Column 1

implies that a 10-percentage-point increase in tax exposure reduces credit growth by about 7.95 percentage points during the second year the tax was in place. With the average bank supplying approximately ¥274bn of credit to the corporates in the sample, this finding translates to a reduction in credit supply of approximately ¥21.81bn in fiscal year 2001.[75] Thus the effect of the tax on credit supply is both statistically and economically significant. Columns 2 and 3 report the coefficient on $BEX_j$ for short-term and long-term credit growth. The coefficient in Column 3 is negative and statistically significant at the 5% level. A 10-percentage-point increase in tax exposure reduces long-term credit growth by 9.14 percentage points. The coefficient in Column 2 is not statistically significant. These findings provide evidence that the Tokyo bank tax impacts on the supply of long-term, but not short-term credit. Columns 4 and 5 summarise the effect of bank exposure to the tax on corporate's exiting or entering bank relationships. The coefficients on $BEX_j$ are not statistically significant. In other words, we do not find evidence of corporates exiting or entering a relationship with banks that are exposed to the Tokyo bank tax.

Column 1 in Panel B of Table 5.3 reports the results of estimating Equation (5.3), controlling for a number of factors that could influence corporate level investments. The coefficient on $CEX_i$ in Column 1 is negative and statistically significant at the 5% level. This suggests that the imposition of the Tokyo bank tax has an adverse effect on corporate level investment during the two-year enforcement period of the Tokyo bank tax. The effect is also economically significant but relatively modest; a ten-percentage point increase in $CEX_i$ results in a reduction in the investment rate of 0.7 percentage points.

[75] Expressed in US dollars, this amounts to $2.5bn and $200m respectively

**Table 5.3 | The Effect of Tax on Credit Growth and Corporate Investment**

| **Panel A** | *Credit growth* | *Short-term* | *Long-term* | *Exit* | *Entry* |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| *Bank Exposure* | -0.795** | -0.583 | -0.914*** | 0.0903 | -0.180 |
| | (0.432) | (0.352) | (0.336) | (0.269) | (0.156) |
| Corporate FE | Y | Y | Y | Y | Y |
| Bank Controls | Y | Y | Y | Y | Y |
| Observations | 9608 | 7134 | 5596 | 17284 | 12906 |
| **Panel B** | *Investment* | | | | |
| | (1) | | | | |
| *Corporate Exposure* | -0.0706** | | | | |
| | (0.0289) | | | | |
| Corporate Controls | Y | | | | |
| Industry Fixed Effects | Y | | | | |
| Prefecture Fixed Effects | Y | | | | |
| Observations | 2296 | | | | |

This table presents the estimates from the first stage of the empirical analysis, which focuses on the impact of the Tokyo bank tax on credit supply and corporate investment activity. The sample consists of loan level data of 2368 corporate borrowers and 26 banks that were affected by the Tokyo bank tax. Panel A presents estimates of Equation (5.1). The dependent variable is the growth in credit (Column 1), short-term credit (Column 2) and long-term credit (Column 3) issued by bank *j* liable to the Tokyo bank tax to corporate *i* between FY 1999 and FY 2001. The dependent variable in Column 4 is an indicator variable that is one if bank-corporate relationships are terminated between FY 1999 and FY 2001; zero otherwise. The dependent variable in Column 5 is a dummy variable that is one for new bank-corporate relationships and zero otherwise between FY 1999 and FY 2001. Bank Exposure is measured as the number of employees based in Tokyo relative to total number of employees as of FY 1999. Bank specific control variables are capital, return on equity, provisions to loans, liquidity, bank size as of FY 1999. Heteroskedasticity robust standard errors clustered at the bank level and firm level are reported in parentheses. The dependent variable in Column 1 of Panel B is corporate cumulative net investment in FY 2001 divided by the value of total assets as of FY 1999 (pre-shock). Corporate Exposure is the average exposure of corporate i to the Tokyo bank tax measured as the weighted average of Bank Exposure of all banks that are lending to the corporate. Weights are bank share of total credit to corporate i. Control variables are corporate credit demand, corporate size (+ quadratic), corporate liquidity, corporate leverage, corporate Tobin's Q as of FY 1999. Corporate industry and prefecture fixed effects are included. All accounting data are winsorized at the 98% level to reduce the impact of outliers. Heteroskedasticity robust standard errors clustered at the main bank level are reported in parentheses. ***, **, *, indicate significance at the 1%, 5%, and 10% level respectively.

## 5.4 Stage 2: Impact of Bank Taxation on Corporate Hedging and Local Loan Markets

In the second stage of our analysis, we exploit the imposition of the Tokyo bank tax in order to investigate if corporates compensate for the adverse impact on funding (arising from the imposition of the Tokyo bank tax) by obtaining finance from alternative sources. These sources include: internal cash reserves; equity and bonds; and, borrowing from other banks (unaffected by the Tokyo bank tax). We complement our analysis with an investigation of the impact of bank

taxation on local loan markets. Exploiting the spatial segmentation of Japanese local loan markets, we investigate the extent to which regional banks that were exempt from the Tokyo bank tax respond by increasing lending to corporates affected by a decline in credit following the imposition of the tax. Our empirical strategy is outlined in Section 5.4.1. In Section 5.4.2, we present the data. Section 5.4.3 discusses the findings.

### 5.4.1 Empirical Strategy

*Impact of Taxation on Corporate Hedging*

Our empirical results suggest that a sudden increase in bank taxation leads to a decline in lending to existing corporates. The degree to which the decline in lending affects corporate level investment depends crucially on the extent to which other banks fill any void in credit supply by increasing lending to the corporates affected by the decline in lending. We therefore investigate if corporates compensate for the reduction in credit by borrowing more from banks that are not liable to the Tokyo bank tax. In order to do so, we follow Khwaja and Mian (2008) and examine the lending activity of all banks in our sample. We assume that the 140 banks not liable to the Tokyo bank tax have experienced no other changes in their respective tax burdens.[76] In addition, we augment our analysis by investigating if corporates compensate for the reduction in loans by issuing new equity or bonds, or draw upon internal cash reserves.[77] To test the extent of substitution, we estimate the following cross-sectional regression:

$$\Delta Funds_i = a + \beta CEX_i + \gamma X_i + \epsilon_i \quad (5.4)$$

[76] This assumption is reasonable as Tokyo remained the only prefecture to impose the bank tax. Osaka prefecture considered the imposition of a tax similar to the Tokyo bank tax but this was never enacted.
[77] Jimenez et al. (2010) suggest including all available funding sources to gain a complete picture of the credit supply shocks.

where $\Delta Funds_i$ represents the change in credit of corporate *i* from banks liable to pay the Tokyo bank tax and from those banks not liable. We add to the change in credit any new equity and bonds issued by the corporate, as well as changes in cash reserves. For our statistical inference, we calculate $\Delta Funds_i$ as follows: $\Delta Funds_i = \frac{\Delta Credit + \Delta\text{Equity} + \Delta\text{Bonds} + \Delta\text{Cash}}{Credit_{1999} + Equity_{1999} + Bond_{1999} + Cash_{1999}}$. $CEX_i$ in Equation (5.4) is the loan-size weighted average of a corporate's exposure to the Tokyo bank tax, calculated for the fiscal year prior to the introduction of the tax. The vector of loan-size weighted averages of bank control variables, $X_i$, include the: capital-to-assets ratio, return on equity, liquidity-to-assets ratio, size (measured by total assets) and the ratio of loan loss provisions-to-total loans. We control for corporate level loan demand using the estimated corporate fixed effects from Equation (5.1). $\beta$ in Equation (5.4) captures the extent to which corporates compensate for the decline in loans (from banks affected by the Tokyo bank tax) through a combination of: loans from other banks (unaffected by the Tokyo bank tax); funds raised in financial markets; and internal cash reserves. A $\beta$-coefficient equal to zero implies that corporates fully compensate for any decline in loans using alternative sources of finance.

*Impact of Taxation on Local Loan Markets*

A priori, one would expect that corporates reliance on other banks as alternative providers of funds should be reflected in an increase of credit supplied by those banks. To verify whether banks not liable to pay the Tokyo bank tax increase their volume of credit, we also investigate whether there are any spill-

over effects arising from the introduction of the Tokyo bank tax.[78] Specifically, we examine whether the imposition of the Tokyo bank tax results in a change in the competitive conditions of regional loan markets where affected and unaffected banks compete with one another. Imposing a tax on some banks, while exempting others may worsen the relative competitive position of affected banks.

Our identification strategy exploits the fact that loan markets of smaller banks in Japan are characterised by spatial segmentation. Until the early 2000s, the lending activity of smaller banks was confined largely within the prefecture where bank headquarters were located (Kano and Tsutsui 2003; Ishikawa and Tsutsui 2013).[79] Therefore, we hypothesise that unaffected regional banks (competitor banks), which compete with at least one affected bank in the same loan market, increase lending in response to the tax.[80] We do not expect the same spill-over effect for unaffected, regional banks that operate in loan markets without the presence of banks liable to pay the Tokyo bank tax. We estimate a regression of the form:

$$\Delta Credit_{ij} = a + \beta TAX_j + \delta X_j + \epsilon_{ij} \quad (5.5)$$

where $\Delta Credit_{ij}$, is the change in short-term and long-term credit granted to corporate *i* by bank *j* after the imposition of the Tokyo bank tax. $TAX_j$ is a dummy variable which takes the value of one if a bank (exempt from the Tokyo bank tax) is headquartered in the same prefecture as a bank liable to pay the Tokyo bank tax is headquartered and zero otherwise. The vector of bank specific control variables,

[78] Our approach is similar to the study by Haskamp (2018) which investigates the spill-over effects of the German bank levy focusing on changes in the loan interest rates charged by local banks.
[79] An amendment of the Bank Law in 2002 lifted restrictions applied to the opening of new branches.
[80] Several banks affected by the Tokyo bank tax are headquartered in other prefectures than the Tokyo prefecture.

$X_j$, include: capital-to-assets, return on equity, liquidity-to-assets, bank size and loan loss provisions-to-total loans. A detailed definition of the variables is provided in Table 1. $\beta$ in Equation (5.5) captures the extent to which competitors of banks that are liable to pay the Tokyo bank tax increase credit supply to corporates, and therefore facilitate the substitution efforts of corporates.

If competitor banks increase the supply of credit to corporates, then an important question is whether these banks expand their overall volume of credit or alternatively adjust the composition of their loan portfolios. To provide a clearer picture of the spill-over effects emanating from the Tokyo bank tax, we also investigate developments in the loan volume of competitor banks. We use a difference-in-differences estimation strategy, and estimate a regression of the following form:

$$\Delta loanvol_{jt} = \delta \underbrace{Bank_i^{Taxed} * Post_t}_{\widehat{TAX}_{j,t}} + \beta X_{j,t-1} + \alpha_i + \gamma_t + \epsilon_{jt} \quad (5.6)$$

where *j* denotes bank and *t* denotes time. $loanvol_{jt}$ represents the loan volume measured by the logarithm of loans. We also use the ratio of loans to total assets as an alternative measure. $Bank_j^{Taxed}$ is an indicator variable which captures whether a regional bank competes in a loan market with a bank affected by the Tokyo bank tax or not. The indicator variable $Post_t$ equals one after the Tokyo bank tax is introduced and zero otherwise. $X_{j,t-1}$ is a vector of bank level control variables that vary over time and across banks. Bank control variables include: bank capital, return on equity, loan loss provisions to total loans, liquidity and bank size. A detailed definition of the variables is provided in Table 5.1. To avoid simultaneity, each of these controls enters the model lagged by one period. The model also

includes time dummies, $\gamma_t$, to capture time effects common to all banks, as well as, bank specific fixed effects, $\alpha_i$, to control for unobserved bank level heterogeneity. $\epsilon_{it}$ is a stochastic error term.

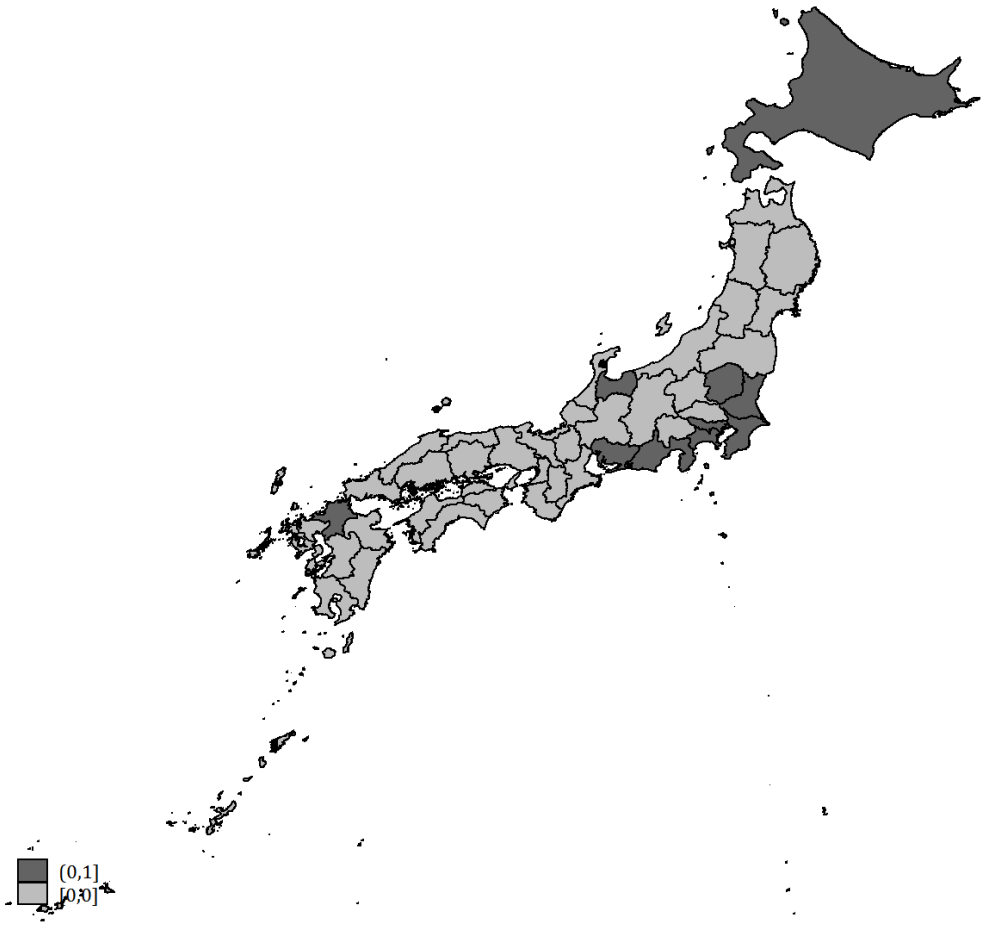
### 5.4.2 Data

To investigate if corporates (that experience a decline in credit from the banks affected by the Tokyo bank tax) compensate for the decline in bank credit by using other sources of funding, we rely on the baseline sample which comprises borrowing activity of 2368 corporates from a total of 140 banks. We obtain detailed data on equity and bond issuance for those corporates from Thomson Reuter. In a final step, we amend the baseline sample following the steps described in Section 5.3.2 to obtain a panel dataset with the corporate as the cross-sectional unit.

To investigate if smaller regional banks increase credit supply to corporates, we again use the baseline sample comprising loan level data of 2368 corporates. We amend the sample by excluding all banks that are liable to the Tokyo bank tax, and those that are not classified as regional banks. This yields a sample of 112 regional banks which were exempt from the Tokyo bank tax. 26 banks of these 112 banks are competing in local loan markets (as proxied by the presence of bank headquarters) with at least one bank liable to pay the Tokyo bank tax (as proxied by the presence of bank headquarters). The remaining 86 banks operate in loan markets without the immediate presence of a bank liable to the bank tax. Figure 5.2 shows a map depicting the headquarter locations of banks subject to the Tokyo bank tax. We obtain the area code of bank headquarters from Nikkei NEEDS Financial Quest.

Finally, for our analysis of developments in loan volumes of smaller regional banks, we obtain semi-annual data on bank balance sheets of the 112 regional banks from Nikkei NEEDS Financial Quest for the period from fiscal year 1999 to 2001. An extended discussion of the sample construction for Stage 2 of the analysis is provided in Appendix II.

**Figure 5.2 | Headquarter Location of Banks Liable to the Tokyo Bank Tax**




This figure shows a map of 47 prefectures in Japan. Dark-grey shaded areas indicate presence of headquarters of both, banks liable to pay the Tokyo bank tax and competitor banks that are exempt from paying the Tokyo bank tax. Light-grey shaded areas indicate presence of banks that operate in loan markets without the immediate presence (headquarter location) of banks liable to pay the Tokyo bank tax.

### 5.4.3 Findings

Column 1 of Panel A in Table 5.4 reports the estimates of Equation (5.4) for the change in credit augmented by the change in newly issued equity, bonds and cash in fiscal year 2001. The coefficient is statistically significant at the 1% level

and is negative and close to zero. This implies that corporates protect against the adverse impact of the Tokyo bank tax by: borrowing more from banks exempt from the Tokyo bank tax; increased equity and bond issuance; and drawing upon internal cash reserves.

Columns 1 and 2 of Panel B in Table 5.4 report the estimates of Equation (5.5) for the change in short-term and long-term credit. The coefficient in Column 1 is positive and statistically significant at the 1% level. This implies that competitor banks (exempt from the Tokyo bank tax) which compete in local loan markets with banks liable to pay the Tokyo bank tax, on average increase their supply of short-term credit to corporates.

Columns 1 and 2 of Panel C in Table 5.4 report the estimates of Equation (5.6) for the change in the loan volume of competitor banks. The coefficients are positive and statistically significant at the 10% and 5% level. This implies that regional banks which compete in loan markets with affected banks increase their loan portfolio relative to their regional counterparts, which are located in prefectures without an affected bank headquarter location. When comparing the coefficients reported in Panel B with those reported in Panel C, we observe that the magnitude of the expansion of the loan portfolio relative to the increase in short-term credit is lower by a factor of 8. This suggests that competitor banks may adjust both, the volume of the loan portfolio as well as its composition in response to the Tokyo bank tax.

Overall, the results of our empirical analysis provide some evidence of substitution behaviour on the part of corporates. To some extent, corporates compensate for any decline in credit by borrowing more from alternative sources

## Table 5.4 | The Effect of Tax on Corporate Hedging and Local Loan Markets

| **Panel A \| Corporate Hedging** | *Funds* (1) | |
|---|---|---|
| *Corporate Exposure* | -0.0482*** (0.0170) | |
| Corporate Credit Demand | Y | |
| Bank Controls | Y | |
| Corporate Industry FE | Y | |
| Corporate Prefecture FE | Y | |
| Observations | 2348 | |
| **Panel B \| Credit Supply (Competitor Banks)** | *Short-term credit* (1) | *Long-term credit* (2) |
| *TAX* | 0.108*** (0.037) | -0.0291 (0.127) |
| Bank Controls | Y | Y |
| Corporate Industry FE | Y | Y |
| Corporate Prefecture FE | Y | Y |
| Observations | 2403 | 1277 |
| **Panel C \| Loan Growth (Competitor Banks)** | *Loan to asset ratio* (1) | *Loan volume* (2) |
| *TAX* | 0.0140* (0.00786) | 0.0167** (0.00730) |
| Bank Controls | Y | Y |
| Observations | 273 | 273 |

This table presents the estimates of Equation (5.4), (5.5) and (5.6) from Stage 2 of our analysis focusing on the impact of the Tokyo bank tax on corporate financing and spill-over effects in local loan markets. The dependent variable in Column 1 of Panel A is the growth in credit issued by banks, both liable to and exempt from the Tokyo bank tax, plus issuance of new equity, bonds and change in cash reserves of a corporate between FY 1999 and FY 2001. Corporate Exposure is the average exposure of corporate i to the Tokyo bank tax measured as the weighted average of Bank Exposure of all banks that are lending to the corporate. Weights are bank share of total credit to corporate i. Bank specific control variables are loan-size weighted averages of bank capital, return on equity, provisions to loans, liquidity, bank size as of FY 1999. Heteroskedasticity robust standard errors clustered at the main bank level are reported in parentheses. The dependent variable in Column 1 (2) of Panel B is the growth in short-term (long-term) credit issued by banks exempt from the Tokyo bank tax. TAX is a dummy variable which equals one if a bank (exempt from the Tokyo bank tax) is headquartered in the same prefecture in which a bank liable to pay the Tokyo bank tax is headquartered; and zero otherwise. Heteroskedasticity robust standard errors clustered at the bank level are reported in parentheses. The dependent variable in Column 1 of Panel C is the change in the loans-to-total-assets ratio; the dependent variable in Column 2, is the change in total loans (logarithm). TAX is a dummy variable which equals one if a bank (exempt from the Tokyo bank tax) is headquartered in the same prefecture in which a bank liable to pay the Tokyo bank tax is headquartered; zero otherwise. All accounting data are winsorized at the 98% level to reduce the impact of outliers. Heteroskedasticity robust standard errors clustered at the bank level are reported in parentheses. ***, **, *, indicate significance at the 1%, 5%, and 10% level respectively

of funding including capital markets and other banks exempt from the Tokyo bank tax. We observe that competitor banks assist corporates in their substitution efforts. However, the credit supplied is insufficient to allow corporates to fully compensate for the reduction in credit supplied by bank affected by the Tokyo bank tax.

## 5.5 Robustness of Main Findings

This section presents the results of a set of robustness tests. These comprise: placebo tests to test the common trend assumption and tests to disentangle credit supply- from demand-side effects using an alternative estimation method.

### 5.5.1 Common Trend Analysis

In this section, we present the results of several tests conducted at bank and borrower level, in order to provide corroborating evidence in support of our main findings from Stage 1 and 2 of our empirical analysis. To test pre- and post-shock trends we assume falsely that the Tokyo bank tax was imposed in FY 1999 and FY 2001 and introduce a placebo tax for these fiscal years.

First, we execute a test to ensure that *Corporate Exposure* is not correlated with credit growth across corporates before and after the Tokyo bank tax. Credit growth is measured on a year-by-year basis normalised by the stock of credit outstanding in fiscal year 1999. Columns 1 and 4 in Panel A of Table 5.5 report the coefficients for the period pre- and the post-imposition of the Tokyo bank tax period. The coefficients for these years are not statistically significant. This suggests that there are no systematic differences in the growth of credit to corporates with differential exposure to banks liable to pay the Tokyo bank tax.

Second, we repeat the common trend analysis for corporate investment. The yearly investment rate is measured as the cumulative net investment divided by the value of total assets as of fiscal year 1999. The results are reported in Table 5.5 Panel B. The coefficients in Column 1 are not statistically significant suggesting that there are no systematic differences in investment behaviour of corporates

## Table 5.5 | Common Trend Analysis

| **Panel A \| Credit Growth** | **FY 1999 (pre-shock)** | **FY 2000** | **FY 2001** | **FY 2002 (post-shock)** |
|---|---|---|---|---|
| *Corporate Exposure* | -0.382<br>(0.230) | -0.244**<br>(0.0953) | -0.324*<br>(0.190) | -0.658<br>(0.394) |
| Bank Controls | Y | Y | Y | Y |
| Industry FE | Y | Y | Y | Y |
| Prefecture FE | Y | Y | Y | Y |
| Observations | 2035 | 2035 | 2035 | 2035 |
| **Panel B \| Investment** | **FY 1999 (pre-shock)** | **FY 2000** | **FY 2001** | **FY 2002 (post-shock)** |
| *Corporate Exposure* | -0.0290<br>(0.0186) | -0.0543**<br>(0.0272) | -0.0706**<br>(0.0289) | -0.0682*<br>(0.0402) |
| Corporate Controls | Y | Y | Y | Y |
| Industry FE | Y | Y | Y | Y |
| Prefecture FE | Y | Y | Y | Y |
| Observations | 2354 | 2357 | 2296 | 1939 |
| **Panel C \| Credit Growth (Competitor Banks)** | **FY 1999 (pre-shock)** | **FY 2000** | **FY 2001** | **FY 2002 (post-shock)** |
| *TAX* | 0.00007<br>(0.0226) | -0.0574**<br>(0.0365) | -0.015**<br>(0.0517) | 0.0523<br>(0.0339) |
| Bank Controls | Y | Y | Y | Y |
| Industry FE | Y | Y | Y | Y |
| Prefecture FE | Y | Y | Y | Y |
| Observations | 3738 | 3558 | 3041 | 2277 |

This table presents the results from the trend analysis of pre- and post-shock trends. To test pre- and post-shock trends we falsely assume that the Tokyo bank tax was imposed in FY 1999 and FY 2002 and introduce a placebo tax for these fiscal years. The dependent variable in Columns 1-4 in Panel A is the difference between the stock of credit at the beginning and end of the indicated year normalised by the stock of credit in FY 1999. This sample is restricted to corporates exposed to banks liable to the Tokyo bank tax. Bank specific control variables are loan-size weighted averages of bank capital, return on equity, provisions to loans, liquidity, bank size as of FY1999. Corporate industry and prefecture fixed effects are included. Heteroskedasticity robust standard errors clustered at the main bank level are reported in parentheses. The dependent variable in Columns 1-4 in Panel B is the cumulative net investment in indicated year divided by the value of total assets as of FY 1999. Corporate Exposure is the average exposure of corporate i to the Tokyo bank tax measured as the weighted average of Bank Exposure of all banks that are lending to the corporate. Weights are bank share of total credit to corporate i. Corporate specific control variables are size, credit demand, Tobin's Q, leverage, cash, bank-relationships as of FY1998. Heteroskedasticity robust standard errors clustered at the main bank level are reported in parentheses. The dependent variable in Columns 1-4 in Panel C is the short-term credit growth. This sample is restricted to bank that were exempt from the Tokyo bank tax. *TAX* is a dummy variable which equals one if a bank (exempt from the Tokyo bank tax) is headquartered in the same prefecture in which a bank liable to pay the Tokyo bank tax is headquartered; zero otherwise. All accounting data are winsorized at the 98% level to reduce the impact of outliers. Heteroskedasticity robust standard errors clustered at the bank level are reported in parentheses. ***, **, *, indicate significance at the 1%, 5%, and 10% level respectively.

with differential exposure to banks liable to pay the Tokyo bank tax. The coefficient in Column 4 is statistically significant, suggesting a sustained impact of the Tokyo bank tax on corporate investment beyond the two-year period during which the tax was operational.

Finally, we perform the common trend analysis of short-term credit growth using the sample of 112 banks that were exempt from the Tokyo bank tax. The results are reported in Table 5.5 Panel C. The coefficients in Columns 1 and 4 are not statistically significant. This confirms that the credit supply of banks in local loan markets follows a common trend in the pre-tax and post-tax period.

### 5.5.2 Loan Supply versus Demand Effects

One possible identification limitation of testing whether the Tokyo bank tax affects bank lending is that, in principle, economic conditions unrelated to the Tokyo bank tax could impact bank credit supply. For example, suppose an adverse change in economic conditions renders investments less profitable for corporates. The subsequent decline in corporate loans leads to a reduction in bank lending (which is not related to the imposition of the tax).

To mitigate concerns that economic effects unrelated to the Tokyo bank tax are biasing our results, we use a simple strategy proposed by Jiménez et al. (2010). Following Jiménez et al. (2010), we first estimate Equation (5.1) using an ordinary least squares (OLS) instead of a corporate fixed effects estimation procedure. In contrast to the corporate fixed effects estimation, the OLS estimation procedure does not absorb corporate specific credit demand. Thus, if banks affected by the Tokyo bank tax are more likely to reduce lending to corporates that simultaneously receive a negative shock to credit demand, then the estimated $\beta$-coefficient from the OLS estimation would be biased and different from the estimated $\beta$-coefficient using corporate fixed effects.[81] In a second step, we therefore compare the estimated $\beta$-coefficients from the two estimation

[81] For a more detailed discussion of the methodology see Jimenez et al. (2010) on page 7-9

procedures. As long as the estimated $\beta$-coefficients are similar, we can interpret credit demand shocks during our sample period to be largely uncorrelated with the credit supply shock driven by the Tokyo bank tax. In other words, demand shocks are unlikely to drive our results.

Column 1 in Panel B of Table 6 reports the coefficients for the model with corporate characteristics for fiscal year 2001. Importantly, the coefficient is very similar to the coefficient in the fixed effects model, and so supports our interpretation that loan supply effects are driving the results.

**Table 5.6 | Robustness Checks**

| **Baseline** | (1) | (2) | (3) |
|---|---|---|---|
| *Bank Exposure* | -0.795* | -0.583 | -0.914** |
| | (0.432) | (0.352) | (0.336) |
| **OLS** | (1) | (2) | (3) |
| *Bank Exposure* | -0.826* | -0.590* | -0.842** |
| | (0.430) | (0.332) | (0.354) |
| Bank Controls | Y | Y | Y |
| Industry Fixed Effects | Y | Y | Y |
| Prefecture Fixed Effects | Y | Y | Y |
| Observations | 9608 | 7134 | 5596 |

This table presents the estimates of the robustness test introduced in Section 5.5.2. The table presents the OLS estimates of Equation (5.1). The dependent variable in Columns 1, 2 and 3 is growth in credit, short-term credit and long-term credit issued by bank *j* to corporate *i* between FY 1999 and FY 2001. Bank Exposure is measured as the number of employees based in Tokyo relative to total number of employees as of FY 1999. Bank specific control variables are capital, return on equity, provisions to loans, liquidity, bank size relationship as of FY 1999. Corporate industry and prefecture fixed effects are included. All accounting data are winsorized at the 98% level to reduce the impact of outliers. Heteroskedasticity robust standard errors clustered at the bank level are reported in parentheses. ***, **, *, indicate significance at the 1%, 5%, and 10% level respectively.

## 5.6 Summary

Bank taxes are likely to affect bank behaviour, which in turn is likely to affect funding conditions facing corporates and resultant investment decisions that over time can impact the real economy. Exploiting the Tokyo bank tax shock and a unique loan level dataset, we investigate the economic impact of bank taxation on bank lending activity and corporate level investment. By means of a corporate fixed effects estimation strategy (which accounts for any changes in corporate

specific loan demand), we show that an increase in bank exposure to the Tokyo bank tax leads to a reduction in the supply of credit. In other words, banks affected by the Tokyo bank tax pass on the increased costs arising from the imposition of the tax to their respective borrowing corporates.

Using corporate level data, we find that the reduction in bank lending impacts on corporate level investment. The effect however is relatively modest, reflecting the ability of corporates to compensate for the decline in credit via the increased use of internal cash reserves and funds from other banks and capital markets (via increased equity and bond issuance). While rival banks that are unaffected by the Tokyo bank tax assist corporates in their substitution effort, the additional credit provided is not sufficient to alleviate entirely the adverse impact of the tax on corporate investment.

The negative impact of bank taxes on corporate investment has important implications for the efficacy of tax policy given that reduced corporate investment is likely to have consequences for production, labour and ultimately economic growth. In light of the increasing reforms to bank taxation worldwide, our study makes an important contribution to the debate on the relative merits of taxing banks and sheds further light on the importance of banks for the real economy.

# Chapter 6 | Conclusion

Large-scale taxpayer funded interventions to mitigate the effects of the global financial crisis, and the resultant rise in public debt prompted major reforms to the regulation and supervision of banks. New capital and liquidity regulations have been accompanied by the introduction of taxes targeted specifically at banks. Such taxes aim to discourage excessive bank risk-taking, curtail excessive rent extraction, and allow governments to recoup the costs of tax payer funded interventions and build resolution funds to tackle future episodes of instability in the banking industry.

This thesis investigates the implications of a tax on the gross profitability of banks for financial intermediation, bank liquidity creation and the real economy. As financial intermediaries, banks serve as a middleman between savers and borrowers, meet deposit and credit demands, monitor borrowers on behalf of savers, and create liquidity. Understanding whether and how taxation impacts on bank behaviour is important given the critical role that banks play within the financial system and wider economy. In this thesis, we investigate: how sensitive banks are to changes in taxation; whether taxes impact on key functions performed by banks; the underlying mechanism through which taxation affects bank behaviour; and how changes in bank behaviour impact on the funding environment facing corporates and by extension the likely impact on real economic outcomes.

Identifying a suitable exogenous shock to bank taxation is a significant challenge given that changes to bank taxation are announced typically well in advance of imposition and often occur alongside other policy reforms. We address this challenge using a quasi-natural experimental research design to investigate how the unexpected imposition of a special tax on the gross profitability of banks in Tokyo influenced the lending, deposit taking, pricing, monitoring and liquidity creation of Japanese commercial banks. Using this differential tax treatment to overcome identification concerns, we investigate whether there is a causal link from tax to bank behaviour and real economic outcomes. Our findings are as follows. In Chapter 3, we show that banks are sensitive to changes in taxation. This is evidenced by observed changes in the quantity and pricing of financial services, and the effort devoted to monitoring borrowers in response to a tax on the gross profitability of banks. Specifically, banks increase net interest and net interest and fee margins. A decomposition of the margin reveals that both the interest rates paid to depositors and charged to borrowers decline. This implies a pronounced pass-through effect from banks to depositors. Further analysis shows that banks subject to the tax experience a decrease in interest rate-sensitive deposits and reduce total lending. Furthermore, banks reduce monitoring costs via the rebalancing of respective loan portfolios toward borrowers that are geographically proximate, more transparent or hold more assets that can be readily used as collateral.

Chapter 4 sheds further light on the tax sensitivity of banks by presenting evidence that banks create less liquidity following a tax on gross profitability. The observed reduction in liquidity created is driven by a decline in the amount of illiquid bank assets. We identify only a marginal effect of tax on liquidity created on

the liability-side of the balance sheet, and no effect of tax on liquidity created off-balance sheet. Better capitalised banks and banks that devote more resources to the monitoring of borrowers decrease liquidity creation by less than counterparts in response to the tax.

The results of the empirical investigation conducted in Chapter 5 suggest that a tax on gross profitability which impacts on bank lending also has implications for the investment activity of corporates. Consistent with the view that bank loans cannot be easily substituted with other financing sources, the investment activity of corporates borrowing from affected banks declines. This effect however is relatively mild, reflecting the ability of large publicly listed corporates to compensate for the decline in credit supply via funding from capital markets. In order to assist corporates in mitigating the effects of a decline in bank funding, banks not affected by the tax increase lending. However, the additional credit provided by banks unaffected by the tax is not sufficient to alleviate completely the decline in corporate investment resulting from the decline in funding provided by banks affected by the tax.

Overall, the findings presented in this thesis make a valuable contribution to the understanding of how banks, in their key role as financial intermediaries respond to taxes. Using an innovative quasi-natural experimental research design, we establish a causal link between bank taxation and bank behaviour. We also provide a comprehensive analysis of the underlying mechanism and impact of the Tokyo bank tax as a representative of a margin-based tax. Our study on a margin-based tax scheme fills an important void in the literature on bank taxation which has to date focused almost exclusively on risk-based and transaction-based taxes.

We also present the first empirical evidence of a link between bank taxation and bank monitoring effort.

The results presented in this thesis generate important implications for policy makers engaged in monitoring the effectiveness of tax regimes in the banking industry. Bank taxes are increasingly seen as a viable instrument to augment enhanced capital and liquidity regulations. Unlike regulatory measures which typically restrict or mandate certain activities, bank taxes work via incentives and therefore require less micro-managing of banks. More than a decade since the onset of the global financial crisis, bank taxes have become a permanent feature of many banking industries alongside other forms of bank regulation. Tax schemes which aim to reduce excessive risk-taking of banks proved particularly popular. More recently, we have also witnessed the emergence of margin-based tax schemes that aim at curbing the excessive profits of banks. This thesis sheds some light on banks' behavioural responses to this type of taxes and the likely distortions that come with it. It provides guidance for policy makers on whether tax policy weakens or strengthens banks and also discusses likely interactions with other regulatory measures such as capital and liquidity requirements.

Our findings presented in Chapter 3 and 5 underscore the importance of a careful design of bank taxation. The pass-through of the tax burden from banks to bank customers has implications for the cost and availability of credit to borrowers, and their resultant investment activity, as well as the interest rates paid to depositors. The substantial pass-through highlights another important issue. A tax that is not borne by the owners of the bank is likely to be inconsistent

with the request of the G-20 for a fair and substantial contribution of the banking sector. Policy makers would be well advised to find ways that limit the pass-through of tax cost onto bank customers. Furthermore, the findings presented in Chapter 4 confirm a link between bank taxation and liquidity creation. In light of recently introduced bank liquidity regulations (including the Basel Liquidity Coverage Ratio), our results underscore the importance of considering the interaction of bank taxation and liquidity regulation when introducing new tax schemes for banks.

Based on the empirical analyses presented in this thesis, several shortcomings of this thesis can be identified. The first shortcoming is related to the use of the Tokyo bank tax as a quasi-natural experiment. Overall, the Tokyo bank tax qualifies as a suitable quasi-natural experimental design given the size, suddenness and unexpected nature of its imposition. Moreover, banks were assigned on observable characteristics, and the tax (shock) occurred in isolation from other policy reforms and government interventions to the banking industry. There are however two drawbacks of the Tokyo bank tax. The first is related to the fact that the tax was effective for a period of approximately two years. Such a short period of enforcement precludes an analysis of the long-term effects of the tax on bank behaviour. For instance, a longer period of enforcement would have provided an opportunity to investigate whether taxes affect location decisions, and whether banks affected by the tax relocated from the high-tax rate Tokyo prefecture to another prefecture. Another drawback is related to the legal actions that were taken against the Tokyo government shortly after the Tokyo bank tax became effective. It is plausible to assume that banks may have corrected their behaviour in anticipation of an early withdrawal of the bank tax. Such anticipatory

adjustments could undermine the statistical significance of some of our estimation coefficients. Unfortunately, we have no credible way of assessing whether any such adjustments did take place.

There are also a number of limitations related to the data used in our analyses. The lack of panel data at a higher frequency than semi-annual or annual poses limitations to uncovering the effect of the Tokyo bank tax. Data at a monthly or quarterly frequency would have provided opportunities for a more nuanced analysis and allowed us to capture more precisely any changes in bank behaviour in response to taxation. For instance, we could identify if changes in bank behaviour are different in the specific months in which tax payments are made to the Tokyo government. Furthermore, the use of bank level data poses limitations to uncovering changes in bank lending in response to taxation. While we are able to capture heterogeneity, the use of bank level data fails to mitigate concerns that demand-side effects are driving our results. We address this limitation in Chapter 5 by using individual loan level data (which allows us to isolate potential demand-side effects). However, this loan level dataset is limited to a sample of large, publicly listed corporates which report their outstanding loans with individual banks. As a consequence, we are unable to investigate any changes in bank lending to households or small and medium-sized enterprises (SMEs). As is the case in the vast majority of advanced industrialised economies, SMEs play a pivotal role in the Japanese economy, and thus a study which investigates the impact of bank taxation on funding conditions facing SMEs would fill a significant void in the current academic and policy evidence base.

Overall, recent years have seen significant advances in our understanding of the design and impact of bank taxation schemes. A number of studies have generated evidence that provides important insights for policy makers tasked with designing and implementing risk- and transaction-based bank taxation schemes. However, there remains a paucity of studies that examine the effects of margin-based tax schemes on bank behaviour. While this thesis addresses this void to some extent, it would be fruitful for future research to examine how margin-based taxes impact bank behaviour in geographies beyond Japan. The recent imposition of margin-based taxes in the UK in 2016 and Norway in 2017 are likely to provide promising avenues for further research. It may also be valuable to look at franchise tax schemes as applied in some US state. As for research directions, we would suggest to extent the research avenues taken in this thesis. For instance, it would be of interest to the academic community and policy makers to gain further insights into the impact of bank taxes in an international context. Given the unilateral approach to the design and imposition of bank taxes, there are likely ample opportunities for tax arbitrage. Research would be of value that investigates the extent to which cross-border pass-through effects exist and whether taxes directed at banks impact on domestic or non-domestic economies differently.

# Appendices

## Appendix I

This appendix provides the proofs of our theoretical model presented in Section 3.3.1 of Chapter 3.

### Hypothesis 1

To derive Hypothesis 1 and 2, we rely on the following two equations:

$$\left[\frac{(1-\alpha)f(L^*)+p^*c}{(1-p^*)} - \{r_d - r_f(1-\beta)\}\frac{1}{1+\theta}\left(w_0 - \frac{w_1}{r_d}\right) - r_f L^*\right](1-\tau) - h(p^*) = 0,$$

and $D^* = \frac{1}{1+\theta}\left(w_0 - \frac{w_1}{r_d}\right)$.

The first equation is the competitive bank's break-even condition reported in Equation (3.9) in Section 3.3.1, while the second is the depositor's optimal level of deposits. The first equation implicitly defines the deposit rate as a function of taxes and can be rewritten as:

$$\left[\frac{(1-\alpha)f(L^*)+p^*c}{(1-p^*)} - r_f L^*\right] - \frac{h(p^*)}{(1-\tau)} = \{r_d - r_f(1-\beta)\}\frac{1}{1+\theta}\left(w_0 - \frac{w_1}{r_d}\right).$$

By using the envelope theorem and implicitly differentiating the zero-profit condition with respect to $\tau$, we get:

$$\frac{dr_d}{d\tau} = -\frac{\frac{h(p)}{(1-\tau)^2}}{\frac{1}{1+\theta}\left[\left(w_0 - \frac{w_1}{r_d}\right) + \{r_d - r_f(1-\beta)\}\frac{w_1}{(r_d)^2}\right]} < 0.$$

**Hypothesis 2**

The proof follows by implicitly differentiating $D^* = \frac{1}{1+\theta}\left(w_0 - \frac{w_1}{r_d}\right)$, which gives rise to the following expression:

$\frac{dD^*}{d\tau} = \left(\frac{1}{(1+\theta)r_d}\right)^2 w_1 \frac{dr_d}{d\tau} < 0$, with $\frac{dr_d}{d\tau} < 0$ as shown in Hypothesis 1.

**Hypothesis 3 and 6**

To derive Hypothesis 3 and 6, we use the first-order conditions given by (A-1) and (A-2)

$$r_f = \frac{p(1-\alpha)f^{/}(L)}{(1-p)} \quad \text{(A-1)}$$

$$h^{/}(p) = \frac{[(1-\alpha)f(L)+c](1-\tau)}{(1-p)^2} \quad \text{(A-2)}$$

Differentiating these two equations with respect to the tax, we get a system of simultaneous non-linear equations:

$$\frac{p}{1-p}(1-\alpha)f^{//}(L)\frac{dL}{d\tau} + \frac{(1-\alpha)f^{/}(L)}{(1-p)^2}\frac{dp}{d\tau} = 0$$

$$\frac{(1-\alpha)f^{/}(L)}{(1-p)^2}\frac{dL}{d\tau} + \left[\frac{[(1-\alpha)f(L)+c]2}{(1-p)^3} - \frac{h^{//}(p)}{1-\tau}\right]\frac{dp}{d\tau} = \frac{[(1-\alpha)f(L)+c]}{(1-p)^2(1-\tau)}$$

We simplify both equations by using the first order condition, $p(1-\alpha)f^{/}(L) = r_f(1-p)$ and the incentive constraint $L = p\,\frac{(1-\alpha)f(L)+c}{(1-p)}$:

$$(1-p)r_f a\frac{dL}{d\tau} + \frac{r_f}{p}\frac{dp}{d\tau} = 0 \quad \text{(A-3)}$$

$$\frac{r_f}{p}\frac{dL}{d\tau} + \left[\frac{[(1-\alpha)f(L)+c]2}{(1-p)^2} - \frac{h^{//}(p)(1-p)}{1-\tau}\right]\frac{dp}{d\tau} = \frac{RL}{p(1-p)(1-\tau)}, \quad \text{(A-4)}$$

where $a = \frac{f^{//}(L)}{f^{/}(L)} < 0$

By using Cramer's rule and the implicit function theorem, we get:

$\frac{dL}{d\tau} = -\frac{RL}{p^2(1-p)(1-\tau)\Delta} r_f < 0$ (Hypothesis 3)

$\frac{dp}{d\tau} = -\frac{RL}{p(1-\tau)\Delta} a r_f < 0$ (Hypothesis 6).

It must be noted that $\Delta \equiv \pi^b_{pp}(p,L) - \pi^b_{pL}\pi^b_{Lp} > 0$ due to concavity of the objective function implied by the second order condition of the optimization.

A sufficient condition for concavity of the objective condition is as follows:

$\pi^b_{LL}(p,L) < 0, \pi^b_{pp}(p,L) < 0$ and $\pi^b_{LL}(p,L)\ \pi^b_{pp}(p,L) - \pi^b_{pL}\pi^b_{Lp} > 0$,

where subscripts refer to the partial derivatives with respect to the relevant variables.[82]

In our model, these conditions are:

$\pi^b_{LL}(p,L) = p\frac{(1-\alpha)f^{//}(L)}{1-p} = r_f a < 0$ where $a = -\frac{f^{//}(L)}{f^{/}(L)}$

$\pi^b_{pp}(p,L) = \frac{[(1-\alpha)f(L)+c]2}{(1-p)^3} - \frac{h^{//}(p)(1-p)}{(1-\tau)} \equiv G(p) < 0$

$\pi^b_{Lp} = \frac{r_f}{p(1-p)} = -\pi^b_{pL} = \frac{r_f}{p(1-p)}$ and

$\Delta \equiv \pi^b_{pp}(p,L) - \pi^b_{pL}\pi^b_{Lp} = (1-p)r_f a G(p) - (\frac{r_f}{p(1-p)})^2 > 0.$

[82] For example: $\pi^b_{LL}(p,L) = \frac{\partial \pi^b_L(p,L)}{\partial L}$.

## Appendix II

This appendix provides the overview of samples used in Stage 1 and 2 in Chapter 5.

### Table (A1) | Samples used in Stage 1 and 2 in Chapter 5

| | **Stage 1** | | **Stage 2** | | |
|---|---|---|---|---|---|
| **Outcome variable** | Credit supply | Corporate investment | Corporate funds | Credit supply (competitor banks) | Loan Volume (competitor banks) |
| **Level/Cross.Unit** | Loan (issued by bank j to corporate i) | Corporate | Corporate | Loan (issued by bank j to corporate i) | Bank |
| **No. corporates/banks** | 2368 corporates<br>26 banks (liable to the Tokyo bank tax) | 2368 corporates | 2368 corporates<br>140 banks<br>(of which 26 liable to the Tokyo bank tax, 114 exempt from the Tokyo bank tax) | 2368 corporates<br>112 banks (exempt from Tokyo bank tax, bank type: regional)<br>(of which 26 banks compete in local loan markets where the headquarter of at least one bank liable to the Tokyo bank tax is located) | 112 banks (exempt from Tokyo bank tax, bank type: regional)<br>(of which 26 banks compete in local loan markets where the headquarter of at least one bank liable to the Tokyo bank tax is located) |
| **Composition** | Unbalanced | Unbalanced | Unbalanced | Unbalanced | Unbalanced |
| **Merged with** | Bank balance sheet, income statement, attributes<br>Corporate balance sheet, income statement, attributes | n.a. | Corporate equity and bond issuance | Bank area code | Bank area code |
| **Selection criteria/ Amendments** | Drop if corporate asset/ bank asset not present in FY 1999<br>Number of bank relationships: >1 | Aggregate data on loans to each corporate<br>Create single “average” bank (see Section 3.2 for details) | Expand baseline sample by including banks exempt from Tokyo bank tax<br>Aggregate data on loans to each corporate<br>Create single “average” bank (see Section 3.2 for details) | Exclude banks liable to the Tokyo bank tax | Exclude banks liable to the Tokyo bank tax |

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