

Taxation and Financial Intermediation: Evidence from a Quasi-Natural Experiment

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Abstract

This study investigates the impact of taxes on the behaviour and performance of banks. Using a difference-in-differences approach that relies on the exogenous variation of tax imposed on gross profits of Japanese banks operating in Tokyo (known as the Tokyo bank tax), we find that affected banks increase both net interest margins, and net interest and fee margins. Further analysis suggests that depositors are most affected by adjustments to interest and fee rates at banks following the imposition of the tax. The imposition of the Tokyo bank tax also reduces the credit supply of affected banks relative to non-affected counterparts.

Keywords: bank taxation; net interest margin; Japanese banks; natural experiment

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1. Introduction

This study investigates the impact of taxation on the financial intermediation activities of banks. 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. Proposals have been advanced to increase bank taxes in order to replenish government coffers and contain excessive risk-taking by banks. However, opponents of such proposals contend that increasing taxes would have adverse consequences for customers if banks pass on any resultant cost increases.

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 or instead pass increased costs onto customers by restricting credit supply, reducing deposit rates or increasing loan rates. Furthermore, establishing a causal link from tax to bank behaviour is difficult, given that tax policy changes often form part of a broad package of reforms which are often anticipated in advance by market participants.

In this paper, we utilise a quasi-natural experiment to investigate how the unexpected imposition of a special tax (Tokyo bank tax) on the gross profits of a group of Japanese banks early in the 2000s influenced the lending, deposit taking, pricing and monitoring behaviour of affected banks.¹ We use this differential tax treatment to overcome identification concerns, and 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 growing literature on the taxation of banks via a research design that allows one to establish a causal link from taxes to bank behaviour. The results of our study have relevance beyond Japan, by contributing to and informing ongoing discussions amongst academics

¹ In the early 2000s, the banking sector in Japan was emerging gradually from a severe financial crisis. For extensive discussions of the financial crisis in Japan and its global repercussions see: Peek and Rosengren (2000); Hoshi and Kashyap (2000); Patrick and Ito (2005). For a more recent analysis and overview of Japan's banking sector see Uchida and Udell (2014).

and policy makers (discussed above) as to the best way to reform and design the taxation of banks following the global financial crisis.

To motivate our empirical tests we develop a model that describes the relation between a bank's monitoring activity, the intermediation process and the pricing of relevant products. The model incorporates the possibility of strategic default by borrowers; and the monitoring efforts of banks (to prevent default). Our model predicts an increase in the probability of default on loans, given that the introduction of a gross profit tax reduces the resources available to banks to perform effective monitoring. Faced with losses arising from loan 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 that banks accept fewer deposits and pay lower deposit rates; and under certain conditions reduce deposit rates by more than loan rates. The primary intuition for banks passing the impact of taxation to depositors instead of borrowers lies in the fact that, unlike the former, the latter have a tendency to default and resources must be spent to prevent them from doing so.

Our dataset comprises semi-annual financial accounts for a sample of 126 banks over the period 1998-2001 (which straddles the introduction of the 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 same difference in the behaviour of the unaffected group of banks.² We corroborate the difference-in-differences analysis with regression discontinuity and event study analyses.

² For one of the earliest applications of the difference-in-differences approach in banking, please see Jayaratne and Strahan (1996, 1998).

By way of preview, the main findings of the empirical analysis are as follows. In response to an unexpected tax on gross profit, banks increase both, 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 of the effects of the imposition of the tax 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 to the use of different estimation methods. Overall, the results of our empirical analysis suggest a causal link between the Tokyo bank tax and the financial intermediation activities of banks.

Our analysis contributes to several literatures. We contribute to a small literature that examines the pass-through effects of taxes to bank customers.³ 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 fully passed 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 Havrylchuk (2013) 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

³ Several studies have recently investigated the implications of taxation on the capital structure of banks. Schandlbauer (2016) finds that US banks increase leverage when exposed to increases in tax. 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. See also Heider and Ljungqvist (2015) and Doidge and Dyck (2015) for non-financial firms. 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. (2016) 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.

a large sample of European banks, Kogler (2016) finds that bank taxes only lead 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. Imai and Hull (2012) suggest that banks pass along taxes to customers that have the least access to alternative sources of funding. Other studies find no evidence of a change in banks' loan or deposit rates following the introduction of taxes (Capelle-Blancard and Havrylchuk 2014; Buch et al. 2016). Instead the tax burden is absorbed by banks. Our contribution to this strand of literature is manifold. First, we focus on the relatively simple gross-profit tax to investigate whether taxes affect bank behaviour.⁴ Second, we adopt a difference-in-differences methodology that is well suited for quantifying the impact of taxes on the financial intermediation activities of banks. Third, we derive our empirical hypotheses from a new model which incorporates information asymmetries. As such our model departs from the Monti-Klein approach, which is used extensively in this literature. This allows for a consideration of the monitoring function of banks (an integral part of the financial intermediation process). Fourth, in line with prior literature we find strong support for a pass-through effect of taxes to bank depositors, but divert from previous findings with respect to bank behaviour toward borrowers. As predicted by our model, and contrary to previous studies, we find that banks faced with an increase in taxes on gross profits reduce both deposit and loan rates.⁵ 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 a long established literature that examines the determinants of interest margins for financial institutions. Previous work finds that the size, capitalisation, credit risk and liquidity risk of banks along with the competition, regulation and supervision are important determinants of bank

⁴ Assessing the effect on banks 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. A tax on gross profit limits this possibility, and as a consequence allows for a better assessment of the effects of tax on the financial intermediation activities of banks.

⁵ This complements recent findings of Kitamura et al. (2015) using loan level data for Japan.

interest margins (Ho and Saunders 1981; Allen 1988; Valverde and Fernandez 2007). However, unlike the aforementioned studies, our theoretical approach incorporates 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. Furthermore, the decomposition of the net interest margin allows us to investigate thoroughly the effect of taxes on the pricing of deposits and loans.

Our analysis contributes to the recent literature which explores the effects of negative exogenous shocks on 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 (i.e. those with higher market share) extend fewer loans than less affected counterparts. Schandlbauer (2016) shows that banks reduce lending following an increase in taxes. This is particularly evident for less well-capitalised banks, which have more limited opportunities for increasing debt to benefit from tax-shields. Cornett et al. (2011) show that fewer new loans are originated when banks are exposed to liquidity risk, while Imai and Takarabe (2011) find that the sudden loss of deposits in combination with an imperfect substitutability of different funding types constrains bank financing and ultimately reduces the supply of credit. 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 rate-sensitive deposits.

Finally, we connect to the literature which explores the optimal taxation of financial intermediation activities. To date, the findings and policy prescriptions emanating from this strand of literature have been inconclusive. For example, using a simple two-period consumption-savings model, a number of earlier studies conclude that interest spreads should be left untaxed because of the resultant distortionary effects on savings and investments decisions (Jack 2000; Boadway and Keen 2003). In contrast, a different model developed by Auerbach and Gordon (2002) shows that interest

spreads should be taxed. Taking into account the costs of financial transactions, the authors demonstrate that a uniform tax on intermediation services (and consumption) is equivalent to a tax on wages. Considering an environment in which demand for tax revenue vindicates the use of distortionary taxes, Lockwood (2014) argues that a tax on financial intermediation services may be optimal. To date, the widespread exemption of banks in most countries from margin-based taxation has proved an obstacle to empirical studies on this issue. The present study provides a rare opportunity to explore the effects of taxing financial intermediation services. Our results lend empirical support to the theoretical argument that a tax on net interest margins leads to distortionary effects caused by changes in bank behaviour.

In summary, this study provides new insights into 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 their respective pricing and lending strategies. As such the results have relevance for policymakers tasked with monitoring the effects of taxation on the financial system and real economy.

2. Background

To estimate the impact of taxes on bank behaviour, a source of exogenous variation in the tax treatment of banks is required. In the present study, 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, given that between 1996 and 1999, the revenues raised from corporate income taxes declined by more than 25 percent.

The Tokyo government selected banks for the tax treatment based on three conditions. First, banks had to have physical presence in Tokyo, in which case gross profits generated in this metropolitan area would be taxed by the Tokyo government. In other words, banks without headquarters or branches in Tokyo were exempt from the tax. Second, banks had to be domestic banks. Foreign banks (including those with operations in Tokyo) did not become subject to the bank

tax. Third, banks with average deposits exceeding ¥5 trillion over the five years prior to the introduction of the tax, were subject to the tax (DeWit 2000). Banks with deposits below this threshold were not affected by the tax.

The Tokyo Government had planned to levy the bank tax over a period of five fiscal years. However, as a result of legal challenges by banks, the bank 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. A timeline of key events surrounding the announcement, introduction and the repeal of the Tokyo bank tax is summarised in Table 1. For 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 tax intervention. After this declaration, the Tokyo government stopped collecting tax revenues related to the Tokyo bank tax.⁶

[Insert Table 1 about here]

The imposition of the Tokyo bank tax occurred during the period when the Japanese banking system was recovering from a major financial crisis. In 1998, Japan experienced the failure of some of its largest financial institutions. To resolve the banking crisis and to contain the negative impact on the economy, the government implemented a large-scale and far-reaching policy programme. This programme included: recapitalising failing banks; creating a new financial supervisor and establishing a support scheme for distressed non-financial firms. While none of these interventions were implemented over exactly the same period as the Tokyo bank tax, the injection of capital under the Prompt Recapitalisation Act as well as bank mergers could potentially act as confounding events, and

⁶ In fiscal year 2000, the Osaka government passed legislation for a bank tax comparable to the Tokyo bank tax. The legislation was scheduled to take effect from fiscal year 2001, but enforcement of the law was postponed in light of successful legal challenge to the Tokyo bank tax. The law was repealed in 2003 without having been put into operation.

affect any investigation of the Tokyo Bank Tax on bank behaviour. We investigate this further in Sections 7.2.1 and 7.2.2.

The Tokyo bank tax represents a direct form of a tax on financial intermediation services because it is based on gross profits. Gross profits comprise three components. The first is the net interest margin, defined as the difference between interest income and expenses. This margin is related to the bank's core function as a financial intermediary as it captures the price of intermediation of funds from savers (depositors) to entrepreneurs (borrowers). The net interest margin is by far the largest item component of gross profit, accounting on average for 80% of gross profits during the sample period. The two other components are the net fee and commission margin and the net trading margin.

3. Model and Hypotheses

3.1 A simple model of intermediation

We consider 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, which are used to finance loans to individual borrowers. While the bank pays a competitive rate to its depositors, it decides upon loan size, the loan rate and the degree of ex-post monitoring of borrowers.

The ex-post monitoring of borrowers is costly, but benefits the bank by reducing the probability that borrowers default on loans. The bank's monitoring effort reduces the risk of loan default and lowers the spread between deposit and loan interest rates.⁷ 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 will affect directly core financial intermediation activities including loan and deposit volumes, and the interest rates set for depositors and borrowers.

⁷ For a discussion of the importance of banks' monitoring function see for example (Besanko and Kanatas, 1993, Diamond 1984; Freixas and Rochet 2008).

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 degree of monitoring are affected by a sudden increase in tax rates. 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 would be $f(L) = A\sqrt{L}$, where A is a parameter.

Borrowers do not have any internal means of finance, so resort to bank financing. The bank charges interest rate R against a loan amount of L . The bank also chooses the probability, p , of monitoring each borrower that deters strategic default.

Since it is a one-period model 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 closely in order to deter strategic default.

A borrower may or may not behave honestly depending on the gains and costs associated with such behaviours. If the bank charges a loan rate R , on a loan size L , disbursed to a borrower, the pay-off of an honest borrower (who repays the total loan obligation) is:

$$f(L) - RL.$$

Whether a borrower behaves dishonestly and does not repay the loan depends on the bank's the frequency of monitoring effort, p . If the borrower intends to behave dishonestly, then a cost is incurred which takes a fraction α of output $f(L)$. If the borrower gets caught by the bank, RL is paid back and he also incurs legal and other pecuniary expenses amounting to c . 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:

$$p[(1 - \alpha)f(L) + c] \geq (1 - p)RL.$$

The expression above can be written in the equality form as:

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

Equation (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.⁸

Loan Contracts – Bank and Borrowers

The bank's profit after tax is given by:

$$(RL - r_d D + r_f S)(1 - \tau) - h(p)$$

Where τ 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 probability of monitoring 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 rapidly increase with the frequency of monitoring. The bank holds a safe asset, $S > 0$ and earns a risk free return, r_f .

⁸ In Equation (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:

$$D = L + X + S \quad (2)$$

Since the reserve requirement is mandatory and a constant fraction of the total deposits, $X = \beta D$, $0 < \beta < 1$. Incorporating X into (2) gives:

$$D(1 - \beta) = L + S \quad (3)$$

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 (2) and (3) respectively) can be expressed as:

$$\pi^b = [RL - r_d D + r_f \{D(1 - \beta) - L\}](1 - \tau) - h(p),$$

which can be rewritten as:

$$\pi^b = [RL - \{r_d - r_f(1 - \beta)\}D - r_f L](1 - \tau) - h(p) \quad (4)$$

The exercise above yields the bank's objective function, where the bank maximizes profit by choosing R , L , and p , subject to (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 its profit as given in (4). Incorporating (1) into (4), yields the following objective function in the 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:

$$\frac{p(1-\alpha)f'(L)}{(1-p)} = r_f \quad (5)$$

and

$$\frac{[(1-\alpha)f(L)+c](1-\tau)}{(1-p)^2} = h'(p) \quad (6)$$

The incentive constraint preventing strategic default is given by:

$$RL = p \frac{(1-\alpha)f(L)+c}{(1-p)} \quad (7)$$

Equations (5) and (6) determine jointly the optimal loan size (L^*) and monitoring effort (p^*) of the bank. The optimal values in Equation (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 (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 (6) and (7) can be combined to derive the following expression which pinpoints the relationship between the loan rate (R^*), monitoring effort (p^*) and the tax rate τ :

$$R^*L^*(1-\tau) = ph'(p)(1-p) \quad (8)$$

The left-hand side 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 (8) also captures the relationship between R^* and τ . 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:

The depositors of the bank are agents who smooth consumption over time (as in any standard model). We assume two periods, $t = 0, 1$. At period, $t = 0$, depositors have endowments of w_0 , and

w_1 in the second period, $t = 1$, 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 a 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 $D^* = \frac{1}{1+\theta} \left(w_0 - \frac{w_1}{r_d} \right)$.⁹ Thus for any deposit rate, r_d , offered by banks, individual depositors will 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:

$$\pi^{b*}(p, L) = \left[p^* \frac{(1-\alpha)f(L^*)+c}{(1-p^*)} - \{r_d - r_f(1-\beta)\} \frac{1}{1+\theta} \left(w_0 - \frac{w_1}{r_d} \right) - r_f L^* \right] (1-\tau) - h(p^*) = 0 \quad (9)$$

where $*$ denotes a variable set at the optimal level given by Equations (5) and (6). Equation (9) determines the optimal deposit rate $r_d = r_d(\tau)$. Deposits are determined by: $D^* = \frac{1}{1+\theta} \left(w_0 - \frac{w_1}{r_d(\tau)} \right)$.

3.2 Hypotheses

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

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

⁹ 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 $D^* = \frac{1}{1+\theta} \left(w_0 - \frac{w_1}{r_d} \right)$

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

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

The next set of hypotheses follows directly from the analysis of the bank's optimal contract design with borrowers. Specifically, 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 lending 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 τ on R^* , we write

Equation (8) in the following form:

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

First, we consider the case where taxes have no impact on the bank's monitoring activity, i.e. 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).¹⁰ This is the direct tax pass-through effect which is quite standard in the literature of taxes which assert that a part of the increased cost due to 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 activity, i.e. p^* is dependent of the tax rate. As shown in Hypothesis 6 (below), taxes can curb the resources that the bank devotes to monitoring borrowers, and as a consequence increases the risk of strategic

¹⁰ 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.

defaults 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 $\frac{G'(p^*)}{G(p)} \frac{dp^*}{d\tau} > \frac{dL^*}{d\tau} \frac{1}{L^*} + \frac{1}{1-\tau}$, 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 frequency of monitoring is lower.

In summary, the net effect on the loan rate depends on the relative strength of the incentive effect, which would prompt a reduction in the loan rate, over the direct tax pass-through effect which would prompt an increase in the loan rate.¹¹ This is formally stated in Hypothesis 5.

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 $\frac{G'(p^*)}{G(p)} \frac{dp^*}{d\tau} - \frac{dL^*}{d\tau} \frac{1}{L^*} + \frac{1}{1-\tau} > 0$ (Hypothesis 4). Using expressions from Hypothesis 3 (see Appendix) 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, ϵ_L and ϵ_{r_d} , are negative since $(1-p) < 1$ and $a < 1$. The change in the spread between the loan and deposit rate is

¹¹ 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, see for instance Stiglitz and Weiss (1981), Besanko and Kanatas (1993), Bester (1994) among others. However, our model differs from previous models as we show that taxes can have similar effects through the channels of strategic default and monitoring activity.

$\frac{dR^*}{d\tau} \frac{1}{R^*} - \frac{dr_d}{d\tau} \frac{1}{r_d} = \epsilon_L - \epsilon_{r_d} < 0$. 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 (i.e. $\frac{dp^*}{d\tau} < 0$). 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.

4. Empirical Strategy

In this section we describe our research design. This is followed by a description of our identification strategy. A discussion of the sample and the variables used in the empirical analysis is also provided.

4.1 Validity of Research Design

The validity of our research design rests on two major assumptions; shock exogeneity and strength. We discuss these in detail in this section and present evidence in support of these assumptions.

For our research design to be valid, an important requirement is shock exogeneity. Tax changes often violate exogeneity assumptions because governments discuss them far in advance of imposition, and as such do not enact them suddenly. If tax payers anticipate and change their 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 Tokyo bank 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 and do not identify any press coverage discussing the Tokyo bank tax before that date. At this first public announcement, the Tokyo Government issued a preliminary list with banks selected to pay the Tokyo bank tax. These banks would later all become subject to the bank tax and were obliged to make tax payments to the Tokyo Government at the end of fiscal year 2000.

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 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 potential interactions with other types of bank regulation, bank taxation is generally considered as a policy tool restricted to policymaking on the national level. We formally check for anticipation effects in our robustness checks (discussed later in the paper) 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 (bank tax coefficients related to our dependent variables are not statistically significant).

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 banks' tax costs, we would be concerned about a potentially weak effect from the adoption of the tax. We verify that the Tokyo bank tax represents a non-negligible cost by measuring 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 which represents around 30% of banks' overall tax expenses in that year.

It is likely that banks may have tried to reduce their tax payments by making aggressive use of tax deductible items. In the early 2000s, it was common practice for Japanese banks to reduce tax liabilities by reporting large amounts of loan loss provisions. The reported amounts were often sufficient to shelter the entire corporate income tax bill. We suspect that this is unlikely in the current case, given that the Tokyo government imposed a tax on the gross (rather than net) profits of banks. This limited severely the scope of banks to use loan loss provisions and other forms of discretionary expense to reduce their tax liability to the Tokyo government.¹²

4.2 Identification Strategy

Our assumption is that exogenous variation in the taxation of banks affects their ability to act as financial intermediaries. We classify banks into treated banks (those that are affected by the Tokyo bank tax) and control 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 treated banks between the pre-tax period and the post-tax period with the same difference in the outcome of the non-treated banks, to estimate the effect of the tax on bank behaviour. We estimate regressions of the form:

$$Y_{it} = \delta \underbrace{Bank_i^{Taxed} * Post_t}_{TAX_{i,t}} + \beta X_{i,t-1} + \alpha_i + \gamma_t + \epsilon_{it} \quad (10)$$

where i denotes bank and t denotes time. Y_{it} represents each of the dependent variables (discussed in Section 4.3.2): the net interest margin, the net interest and fee margin, the mark-up, and the markdown, the amount of loans granted, the core deposits and the non-core deposits. $Bank_i^{Taxed}$ is an indicator showing whether a bank is taxed by the Tokyo government or not, and the binary variable $Post_t$ equals one after the Tokyo bank tax is introduced and zero otherwise. Therefore, the

¹² Banks gross profits include net income generated from interest, fee and commission as well as trading. In contrast to net profits, gross profits exclude expenses that banks incur by running their business, e.g. personnel costs, loan loss provisions and write-offs (Japan Bankers Association 2006).

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 (see Section 4.3.2 for a discussion). Each of these controls enters the model lagged by one period to avoid simultaneity. The introduction of the vector $X_{i,t-1}$ into our model effectively accounts for any observed pre-intervention differences in the characteristics of treated and non-treated banks. The model also includes time dummies, γ_t , to capture time effects common to all banks, as well as, bank specific fixed effects, α_i , to control for unobserved bank heterogeneity. ϵ_{it} is a stochastic error term.

Estimation of Equation (10) is achieved 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 here is δ , which represents the impact of the Tokyo bank tax on bank behaviour.

A key identification assumption behind this strategy is that, in the absence of treatment, the difference-in-differences estimator be zero, an assumption that is often referred to as the parallel trend assumption. In other words, this assumption requires that the trend in the outcome variable is similar for both treatment and control groups in the pre-shock period. As a check for the parallel trend assumption, we repeat the analysis in periods when there was no change in the tax rates. The coefficients on $TAX_{i,t}$ are not different from zero.

4.3 Data

4.3.1 Sample

The data used in our analysis is 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.¹³ 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. This screening process results in a deletion of 22 banks. The restriction of our sample to commercial banks ensures sufficient overlap in the distribution of the covariates across treated and untreated 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.¹⁴ We also identify one incidence of a merger between a treated and a non-treated bank.¹⁵ To ensure separability of treatment and control units, 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.

4.3.2 Variables

¹³ City banks are large in size with branches in major cities throughout Japan and beyond. These banks have a wide geographic scope, and a diversified portfolio of clients and products (including private banking and asset management). Regional banks are regulated under the terms of the Banking Act. These institutions operate within one of the 47 prefectures (administrative regions) in Japan. These banks are normally headquartered in the capital city of a prefecture, and carry out the vast majority of their business within a given prefecture, acting as an important source of finance for medium sized firms and local government. The majority of Regional banks are quoted publicly, and the largest offer a full range of banking and financial services.

¹⁴ 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).

¹⁵ Hachijuni Bank (treated) acquires Niigata Chuo Bank (non-treated), September 29, 2000; (Financial Services Agency Japan).

In order to investigate the impact of the introduction of the Tokyo bank tax on bank behaviour, and in line with our hypotheses, we employ a variety of 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. To 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 we also calculate banks' *net interest and fee margin*.

In principle, a pass-through of taxes could occur through an increase of the interest rate on loans or through a decrease in the interest rate on deposits. To investigate the effect of the tax on the bank's pricing of loans and deposits, we calculate the *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 spread between the implicit loan (deposit) rate and the money market interest rate (Albertazzi and Gambacorta (2010)).

In order to assess the effects 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*, *coredepo* and *noncoredepo* respectively. We take the natural logarithm of these variables. Core deposits are types of deposit that have low interest-rate sensitivity. These include current, ordinary, savings and deposits at notice. Non-core deposits are types of deposits that have high interest-rate sensitivity such as time, instalment and negotiable certificates of deposits (Aonokazu, 2006). Core and non-core deposits are reported at an annual frequency.

Panel A of Table 2 provides detailed definitions of the outcome variables used in our analysis. Table 3 reports means and standard deviations of the same variables for treated and non-treated 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 shows that non-treated banks are slightly more profitable in

intermediating funds (1.99%) than treated banks (1.33%). This pattern remains when fees are also considered. This is due to treated banks charging on average slightly lower rates on loans granted (2.27%) and paying higher rates to depositors (0.67%) relative to non-treated banks (2.54% and 0.27%). Compared to non-treated banks, treated banks are, on average, slightly larger in terms of total loans.

[Insert Table 2 about here]

[Insert Table 3 about here]

Bank-specific covariates include financial characteristics used typically by supervisors to compute CAMEL ratings, and comprise 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. Panel B of Table 2 provides detailed definitions of the covariates used in our empirical analysis. The comparability of treated and non-treated banks is assessed based on these observable covariates by examining their respective moments and empirical distributions. Panel B of Table 3 reports means and standard deviations of these variables for treated and non-treated banks before and after the introduction of the Tokyo bank tax. Overall, the summary statistics confirm that treated and non-treated 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 treated and non-treated banks, by including all the aforementioned bank-specific control variables in our estimable model.

5. Findings

Table 4 presents the results of estimating Equation (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 as a response to 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 taxed 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 with the imposition of the tax onto customers via adjustments in interest and fee rates.

[Insert Table 4 around here]

To disentangle the effect on borrowers and depositors, we decompose the net interest margin into the *mark-up* and *markdown*. Results reported in Columns 3 and 4 of Table 4 indicate that both the *mark-up* and the *markdown* decrease once the Tokyo bank tax is introduced. Nevertheless, 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* falls, 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. In doing so banks attempt to crowd out borrowers with bad projects with borrowers with good projects. Overall, these results suggest a pronounced pass-through effect to depositors who share a considerable portion of the tax burden. These results are also in line with prior evidence suggesting that taxes on banks are passed onto customers (Demirgüç-Kunt and Huizinga 2001). Moreover, Column 5 explores the relation between the Tokyo bank tax and the credit supplied by banks. 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 non-treated banks, on average, and the average affected bank contracts credit supply by ¥354bn. The cumulative decline in credit offered 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 2016).

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 (*noncoredepoval*) 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 treated 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.

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 drop in banks' monitoring effort. More specifically, the model predicts that taxes affect negatively banks' efforts to monitor borrowers.

We test this channel by examining the value of bank monitoring to borrowing firms. To this end we adopt two approaches. First, we investigate the effect of the announcement of the tax on the stock prices of firms borrowing from affected banks. Given that we do not directly observe banks' monitoring effort we instead look for indirect evidence that is consistent with the channel. We postulate that if the increase in taxes reduces banks' monitoring effort, 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 follows:

$$CAR[0, n]_i = \sum_{t=0}^n AR_{i,t} \quad (11)$$

where $CAR[0, n]_i$ is the cumulative abnormal return for firm i for event days 0 through n . $AR_{i,t}$ is calculated as

$$AR_{i,t} = R_{i,t} - (\hat{\alpha} + \hat{\beta}R_{M,t}) \quad (12)$$

where $AR_{i,t}$ is the abnormal return for firm i on event day t , $R_{i,t}$ is the actual return on firm i 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 following equation:

$$R_{i,t} = \alpha_i + \beta_i R_{M,t} + \varepsilon_{i,t} \quad (13)$$

over the interval from 260 to 20 trading days before the event date. We, subsequently regress these CARs on a treatment group dummy and a number of control variables. Specifically, we estimate the following regression equation:

$$AR_i = \alpha + \beta D_{treatment} + X_i' \gamma + \varepsilon_i. \quad (14)$$

Here $D_{treatment}$ 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. 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 on the basis that they have similar loan shares among bank lenders of the firms in our sample and are therefore similarly incentivised to monitor the borrowing firms. X_i denotes a vector of firm specific variables comprising: size (measured by market capitalization); risk (measured by volatility of stock returns); and access to alternative sources of finance (measured by a dummy that takes the value of one if the firm has issued a bond within the past three years and zero

otherwise).¹⁶ We also control for Keiretsu affiliations¹⁷, industry, and prefecture and bank type effects. The event day we focus on in our analysis is common to all firms in the sample. This makes it less likely for the individual firm returns to be independent. That is, firms borrowing from and being monitored by the same banks are more likely to move together once the bank tax is announced. We therefore estimate standard errors that are clustered at the bank level.

Panel A of Table 5 shows estimates of Equation (14) 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 $D_{treatment}$ is -0.203, and is statistically significant at the 1% level. The difference in CARs between treated and non-treated firms increases slightly when we consider longer event windows. Specifically, when CAR[0,3] is considered (Column 2), the coefficient on $D_{treatment}$ 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.

As an alternative approach to testing the monitoring channel of our theoretical model, we 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 there are benefits to the firm's claimants of bank monitoring of a firm's creditworthiness (Holmstrom and Tirole 1997; Datta et al. 1999). The literature attributes these benefits to banks' superior access to private information of borrowers (Fama 1985), as well as to their efficiency and flexibility in restructuring and renegotiating debt claims with their borrowers (Berlin and Loeys 1988; Gertner and Scharfstein 1991; Denis and

¹⁶ Data on Japanese bond issues are obtained from Thomson Reuters' SDC Platinum database.

¹⁷ Keiretsu are groups of Japanese firms and financial institutions that are financially inter-connected, 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 contested (Miwa and Ramseyer 2002; Ramseyer and Miwa 2002).

Mihov 2003). In line with this literature, we postulate that if an increase in taxes reduces banks' monitoring effort we expect to observe higher at-issue yield spreads for public straight bond offerings from firms that also borrow from banks that are subject to the Tokyo bank tax.

In order to test this hypothesis, we draw 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:

$$BPS_{i,t} = \alpha + \beta TAX_{i,t} + X'_{i,t}\gamma + \alpha_i + \gamma_t + \varepsilon_{i,t}, \quad (15)$$

where BPS is the premium of the at-issue yield spread of the debt security over the yield of a Japanese government security of comparable maturity. $TAX_{i,t}$ is a dummy variable that equals zero for all bonds issued by firms in the pre-Tokyo bank tax period and one for those bonds issued by firms that are banking with taxed banks when the Tokyo bank tax comes into effect. As above, we consider the two largest banks the firm is banking with (in terms of loans granted to the firm) in classifying bonds into treatment and control groups. $X_{i,t}$ represents a vector of bond and firm specific variables comprising: maturity (measured in years to maturity); amount (the natural logarithm of the size of the 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 affiliations, industry, prefecture and bank type effects. The model also includes time effects, γ_t , and firm specific fixed effects, α_i . ε_{it} is a stochastic error term.

The estimation of Equation 6 is reported in Panel B of Table 5. 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 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 taxed

banks after the introduction of the Tokyo bank tax. This increase in the spread is economically and statistically significant (the latter at the 5% level), and is congruent with the contention of our simple model that the degree of monitoring of the treated banks deteriorates after the introduction of the Tokyo bank tax. Overall, Table 5 provides evidence in support of the monitoring channel identified by our model in Section 3 through which a tax levied on banks' gross profits adversely affects financial intermediation.

[Insert Table 5 around here]

7. Robustness Checks

This section provides a detailed discussion of potentially confounding effects and also presents a number of robustness checks that support a causal interpretation of the findings obtained from our baseline model.

7.1 Falsification tests and sensitivity checks

A key identifying assumption behind the difference-in-differences approach is that outcome variables of treated and non-treated 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 two placebo tests by falsely assuming that the Tokyo bank tax was introduced one year prior to its actual adoption and one year after its abolishment. By introducing a placebo tax just before the actual bank tax was adopted, we also test for potential anticipation effects. Panel A of Table 6 presents results of the first placebo test. None of the coefficients on the Placebo-Tax are significant. This suggests that the parallel trend assumption for the pre-period is not violated and that anticipation effects are not present. Panel B presents results of the second placebo test and paints a similar picture for the period after the Tokyo bank tax was abandoned. That is, none of the coefficients on the Placebo-Tax are statistically

significant.¹⁸ Overall, both placebo tests suggest that the reported results in Table 4 are indeed associated with the adoption of the Tokyo bank tax.

[Insert Table 6 around here]

To provide additional insights, we also examine whether various subsamples are driving our results. First, we consider the possibility that banks included in our control group and located further away from the Tokyo metropolitan area may be exposed to different economic conditions than those banks operating in or around Tokyo. In order to alleviate concerns regarding differences in general economic conditions across Japan driving our results, we limit our sample to banks which operate predominantly in the three major regions (Kanto, Chubu and Tohoku) that 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 126 banks to 64 banks (17 treated and 47 non-treated). The results of this analysis are presented in Panel A of Table 7, and are consistent with our main findings.

Second, in Panel B of Table 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 treated 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 problem found in empirical studies 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

¹⁸ This exception might best be explained by the shift from a fully insured deposit schemes to a partially insured deposit scheme at the end of fiscal year 2004. The statistical significance and positive sign of the coefficient potentially indicate a drastic inflow of funds into larger banks. Savers may pulled out funds from smaller banks to take advantage of an implicit too-big-to-fail insurance scheme.

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 C of Table 7, and show little deviation from the estimated tax effects reported in Table 4.

[Insert Table 7 around here]

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 contemporaneous activities that could have the potential to confound our analysis.

7.2.1 Mergers and Acquisitions

Our difference-in-differences approach in Section 5 identifies the effect of the Tokyo bank tax on banks' ability to intermediate funds in the economy. One potential confounder of this identification is the merger and acquisition (M&A) activity involving banks in our sample. Bank mergers may have effects on our outcome variables similar to those attributed to the Tokyo bank tax. However, such M&A activities are unlikely to affect all our outcome variables simultaneously in the same way the Tokyo bank tax does. 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 (see 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 involved banks, much like the Tokyo bank tax. However, in contrast to the Tokyo bank tax though this would happen via the simultaneous increase in the loan rate and the 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 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 treated banks and the relative size of banks involved in an M&A activity, and a triple interaction term between the dummy for the treated banks, the dummy for the enactment of the Tokyo bank tax and the relative size variable. The results, shown in Panel B of Table 8, confirm our expectations that (complex or less so) mergers do not drive our main findings.

[Insert Table 8 about here]

7.2.2 Capital Injections

An alternative source of shock which could confound 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 since 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 8. In Panel D of Table 8 we re-estimate Equation (10) including additional interaction terms between the treated banks and a proxy for the intensity of a bank’s recapitalization, 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 treated 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.

7.3 Alternative Identification Strategy

7.3.1 Regression Discontinuity Design

In a final step, we take advantage of the transparent assignment mechanism of the Tokyo bank tax and apply a sharp regression discontinuity design. Banks were assigned to 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 excluded from it. 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. 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 will enable us to retrieve the pure effects of the Tokyo bank tax.

To uncover the average treatment effect, we look at 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 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:

$$Y_{it} = \alpha_i + \beta_t + \gamma TAX_{it} + \theta f(x_{it}) + \sum_k \delta_k COV_{k,i,t-1} + \epsilon_{it} \quad (16)$$

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) .

Results from estimating Equation (16) are presented in Panel A of Table 9. The striking similarity of estimates lends strong support to the robustness of our original findings. For instance, the estimate, using the net interest margin as our main economic outcome of interest, is 4.8 basis points. This compares to the original estimate of 6.2 basis points for the difference-in-differences approach. Although we observe a drop in the significance level for this specification, we do not detect a consistent decline in significance level for other specifications.

[Insert Table 9 about here]

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 treated 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 treated banks. We obtain stock market data for 100 listed Japanese banks (16 treated, 84 non-treated) 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) among others, for each bank we estimate daily abnormal stock returns using the risk-adjusted market model:

$$R_{i,t} = \alpha_i + \beta_i R_{M,t} + \varepsilon_{i,t} \tag{17}$$

where $R_{i,t}$ is the daily return of firm 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:

$$AR_{i,t} = R_{i,t} - (\hat{\alpha}_i + \hat{\beta}_i R_{M,t}) \quad (18)$$

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,

$$CAAR = \sum_{t=t_0}^T \left(\frac{1}{N} \sum_{i=1}^N AR_{i,t} \right) \quad (19)$$

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 treated 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).¹⁹

Panel B of Table 9 reports CAAR over different event windows, Along with adj-Patell and adj-BMP statistics, separately for treated and control banks. CAAR for treated banks on the event window [-5, 5] are negative and statistically significant, according to both statistics, indicating a drop of around 11% in the banks' stock price due to the Tokyo bank tax. There is mixed evidence of a decline in the treated 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 non-treated banks is indistinguishable from zero in a statistical sense. Overall, these findings indicate that the market participants' view of the Tokyo bank tax is detrimental for the performance of the affected banks and in line with our previous findings.

¹⁹ Kolari and Pynnonen (2010) show that both the adj-Patell and the adj-BMP statistics account for cross-sectional correlation in abnormal returns.

8. Conclusion

This study derives 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. Specifically, the model implies that following a tax increase, banks reduce monitoring to compensate for higher tax costs. This leads to a reduction in the volume of loans and rate of interest charged to borrowers. On the liability side banks take fewer deposits and pay lower deposit rates. Furthermore, deposit rates decline by more than loan rates.

Testing these aforementioned propositions empirically is challenging given identification concerns. This challenge is overcome in this study by utilising the case of the Tokyo bank tax, which imposed a special tax on the gross profits of banks. This affected one group of banks, but left other banks unaffected.

According to the results derived from our estimable model, banks subject to the tax increase both, net interest and net interest and fee margins in response to an unexpected tax on bank margins. An additional analysis decomposes the net interest margin into deposit and loan interest rate components in order to disentangle the extent to which borrowers and depositors are affected by widening margins at the banks subject to the tax. The results of this additional analysis suggest 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 their total lending. On the liability side, the 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.

Overall, the findings of this study suggest that taxes play an important role in explaining the behaviour and performance of banks. The extent to which banks pass on the higher costs associated with tax increases has implications for the cost and availability of credit to borrowers, and the interest rates paid to depositors. As such the results of this study have relevance to policymakers engaged in designing and monitoring the effectiveness of tax regimes in the banking industry.

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Tables

Table 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, 2001	District Court declares bank tax to be void

Source: Meiji-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.

Table 2 Variable definitions and sources

Variable name	Definition	Data Source
Panel A: Dependent variables		
Net Interest Margin <i>nim</i>	$\frac{(\text{Interest Income} - \text{Interest Expenses})}{\text{Total Assets}}$	Japan Bankers Association
Net Interest and Fee Margin <i>nifm</i>	$nim + \frac{\text{Fee Income} - \text{Fee Expense}}{\text{Total Assets}}$	Japan Bankers Association
Mark-up <i>mark-up</i>	$\frac{\text{Loan Interest Income}}{\text{Total Loans}} - \text{Money Market Rate}$	Japan Bankers Association and Bank of Japan
Markdown <i>markdown</i>	$\frac{\text{Deposit Interest Expenses}}{\text{Total Deposits}} - \text{Money Market Rate}$	Japan Bankers Association and Bank of Japan
Loan Volume <i>loanvol</i>	$\log(\text{Loans})$	Japan Bankers Association
Core Deposit Volume <i>coredeповol</i>	$\log(\text{Core Deposits})$ 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 <i>noncoredeповol</i>	$\log(\text{Noncore Deposits})$ 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	$\frac{(\text{Tier I Capital})}{\text{Total Assets}}$	Japan Bankers Association
Asset Quality	$\frac{\text{Nonperforming Loans}}{\text{Total Assets}}$	Japan Bankers Association
Management Efficiency	$\frac{\text{Operating Expense}}{\text{Operating Income}}$	Japan Bankers Association
Earnings	$\frac{\text{Net Income}}{\text{Total Assets}}$	Japan Bankers Association and Bank of Japan
Liquidity	$\frac{\text{Cash}}{\text{Total Assets}}$	Japan Bankers Association
Diversification	$\frac{\text{Operating Income} - \text{Interest Income}}{\text{Operating Income}}$	Japan Bankers Association
Size	$\log(\text{Total Assets})$	Japan Bankers Association
Market Share	$\frac{\text{Total Assets}_i}{\sum_i^N \text{Total Assets}}$	Japan Bankers Association

Table 3 Summary Statistics

Variables	Taxed banks		Non-taxed banks	
	<i>Before</i>	<i>After</i>	<i>Before</i>	<i>After</i>
Panel A: Dependent Variables				
Net Interest Margin (%)	1.33 (0.28)	1.31 (0.26)	1.99 (0.23)	1.89 (0.24)
Net Interest and Fee Margin (%)	1.48 (0.29)	1.48 (0.28)	2.09 (0.21)	1.99 (0.20)
Mark-up (%)	2.27 (0.23)	2.15 (0.15)	2.54 (0.32)	2.49 (0.33)
Mark-down (%)	0.67 (0.43)	0.46 (0.33)	0.27 (0.14)	0.17 (0.10)
Total Loans (log)	30.10 (0.92)	30.07 (0.89)	27.60 (0.76)	27.60 (0.77)
Core Deposits (log)	29.07 (0.90)	29.27 (0.88)	26.45 (0.92)	26.61 (0.95)
Non-core Deposits (log)	29.75 (0.84)	29.73 (0.83)	27.49 (0.74)	27.50 (0.75)
Panel B: Control Variables				
Capital Adequacy (%)	2.88 (1.03)	3.49 (1.04)	1.88 (0.82)	2.19 (1.03)
Asset Quality (%)	2.93 (2.93)	4.08 (1.64)	2.71 (2.14)	4.86 (2.18)
Management Efficiency (%)	0.97 (0.16)	1.09 (0.10)	1.03 (0.15)	1.05 (0.33)
Earnings (%)	-0.23 (0.64)	0.10 (0.22)	-0.09 (0.62)	-0.03 (0.43)
Liquidity (%)	4.93 (2.69)	4.85 (2.06)	3.44 (2.08)	3.28 (1.78)
Diversification (%)	27.12 (12.07)	31.23 (9.93)	17.12 (6.66)	17.05 (6.17)
Size (log)	30.49 (0.99)	30.51 (0.98)	27.95 (0.79)	27.97 (0.81)
Market Share (%)	3.38 (2.79)	3.52 (3.13)	0.23 (0.16)	0.24 (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 both dependent and control variables used in our analysis before and after the introduction of the Tokyo bank tax and by treatment status.

Table 4 Difference-in-Differences: Main Findings

	nim	nifm	mark-up	markdown	loanvol	coredepovl	noncoredepov
TAX	0.062*** (0.021)	0.082*** (0.023)	-0.083*** (0.027)	-0.103*** (0.025)	-0.028** (0.011)	0.008 (0.019)	-0.057*** (0.014)
Capital Adequacy	0.044*** (0.008)	0.045*** (0.010)	-0.019 (0.012)	-0.046*** (0.012)	0.010*** (0.003)	0.025** (0.010)	-0.00001 (0.004)
Asset Quality	0.0001 (0.005)	-0.003 (0.005)	0.007 (0.004)	0.005 (0.004)	0.0004 (0.002)	-0.001 (0.003)	0.006*** (0.002)
Management Efficiency	-0.068 (0.054)	-0.104 (0.063)	-0.035 (0.045)	0.067 (0.042)	0.009 (0.017)	-0.016 (0.050)	0.002 (0.024)
Earnings	0.035*** (0.010)	0.036*** (0.011)	0.017* (0.010)	-0.026* (0.013)	-0.001 (0.003)	0.012 (0.010)	0.003 (0.005)
Liquidity	-0.006** (0.003)	-0.008** (0.003)	0.001 (0.004)	0.010** (0.005)	-0.002* (0.001)	-0.002 (0.002)	0.001 (0.001)
Market Share	0.287*** (0.085)	0.293*** (0.089)	0.314*** (0.127)	0.267 (0.186)	0.039 (0.027)	-0.164* (0.092)	0.120*** (0.039)
Diversification	-0.001 (0.001)	-0.001 (0.001)	-0.0005 (0.0007)	0.0006 (0.0006)	-0.0002 (0.0002)	0.0002 (0.0002)	-0.0004* (0.0002)
Size	-0.435** (0.183)	-0.424** (0.172)	-0.254** (0.122)	-0.030 (0.060)	0.863*** (0.042)	1.116*** (0.136)	0.903*** (0.058)
Constant	14.079*** (5.138)	13.914*** (4.828)	9.429*** (3.415)	0.941 (1.700)	3.504*** (1.186)	-4.745 (3.848)	2.180 (1.636)
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 square regressions using a sample of 126 Japanese banks spanning the period from March 1998 to September 2001. The dependent variables are defined in Table 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 treated and control banks the lagged values of capital adequacy, asset quality, management efficiency, earnings, liquidity, market share, diversification and size (please see Table 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.

Table 5 Testing the Bank Monitoring Channel

Panel A: Bank monitoring effect on borrowers' market value			
	CAR[0,0]	CAR[0,3]	CAR[0,5]
$D_{\text{treatment}}$	-0.203*** (0.062)	-0.286** (0.111)	-0.295** (0.111)
Size	-0.001 (0.016)	0.032 (0.020)	0.025 (0.020)
Risk	-0.126 (0.205)	-0.065 (0.185)	-0.107 (0.185)
Access to finance	0.022 (0.049)	-0.089 (0.136)	-0.078 (0.135)
No of Observations	928	928	928
R ²	0.101	0.181	0.176
Panel B: Bank monitoring effect on borrowers' cost of public debt			
TAX	22.57** (9.41)		
Maturity	-0.001 (0.002)		
Amount	-2.182 (5.71)		
Size	-67.42** (25.35)		
Leverage	151.43** (70.82)		
No of Observations	660		
R ²	0.734		

Panel A 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. $D_{\text{treatment}}$ 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. *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. Panel B 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 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* is an indicator variable equal to one for firms banking with banks 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. Industry, prefecture, bank-type and Keiretsu affiliation dummies are included in all regressions but not reported here. Robust standard errors clustered at the bank level are reported in parentheses.***, **, *, indicate significance at the 1%, 5%, and 10% level respectively.

Table 6 Falsification Tests

Panel A: Fiscal Year 1999							
	nim	nifm	mark-up	markdown	loanvol	coredepovol	noncoredepovol
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 variables	YES	YES	YES	YES	YES	YES	YES
Observations	375	375	375	375	375	250	250
Panel B: Fiscal Year 2003							
	nim	nifm	mark-up	markdown	loanvol	coredepovol	noncoredepovol
Placebo-TAX	0.077	0.047	0.092	-0.015	-0.031	-0.003	-0.031
	(0.051)	(0.061)	(0.094)	(0.015)	(0.020)	(0.022)	(0.029)
Control variables	YES	YES	YES	YES	YES	YES	YES
Observations	476	476	476	476	476	239	239

This table presents the results of ordinary least squares regressions using a sample spanning the periods before the introduction (Panel A) and after the abolishment (Panel B) of the Tokyo bank tax. The dependent variables are defined in Table 2. 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 (Panel A) and one year after its abolishment (Panel B). The set of control variables include capital adequacy, asset quality, management efficiency, earnings, liquidity, size, diversification and market share (please see Table 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.

Table 7 Robustness Checks

Panel A: Economic Trends							
	nim	nifm	mark-up	markdown	loanvol	coredepoval	noncoredepoval
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 variables	YES	YES	YES	YES	YES	YES	YES
Observations	455	455	455	455	455	228	228
Panel B: Large Banks Sample							
	nim	nifm	mark-up	markdown	loanvol	coredepoval	noncoredepoval
TAX	0.056**	0.067***	-0.052*	-0.053*	-0.020*	-0.013	-0.030**
	(0.022)	(0.024)	(0.030)	(0.029)	(0.012)	(0.017)	(0.015)
Control	YES	YES	YES	YES	YES	YES	YES
Observations	504	504	504	504	504	253	253
Panel C: Two-Period Sample							
	nim	nifm	mark-up	markdown	loanvol	coredepoval	noncoredepoval
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 variables	YES	YES	YES	YES	YES	YES	YES
Observations	250	250	250	250	250	250	250

This table provides further robustness checks on the effect of the Tokyo bank tax on bank behaviour. 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 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 C, 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 dependent variables are defined in Table 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 (please see Table 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.

Table 8 Confounding Events

Panel A: Mergers & Acquisitions							
	nim	nifm	mark-up	markdown	loanvol	coredepolvol	noncoredepolvol
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 variables	YES	YES	YES	YES	YES	YES	YES
Observations	998	998	998	998	998	500	500
Panel B: Complexity of Mergers & Acquisitions							
	nim	nifm	mark-up	markdown	loanvol	coredepolvol	noncoredepolvol
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 * Relative 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 variables	YES	YES	YES	YES	YES	YES	YES
Observations	998	998	998	998	998	500	500
Panel C: Prompt Recapitalisation Act							
	nim	nifm	mark-up	markdown	loanvol	coredepolvol	noncoredepolvol
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 variables	YES	YES	YES	YES	YES	YES	YES
Observations	998	998	998	998	998	500	500
Panel D: Intensity of Prompt Recapitalisation Act							
	nim	nifm	mark-up	markdown	loanvol	coredepolvol	noncoredepolvol
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 intensity	-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 variables	YES	YES	YES	YES	YES	YES	YES
Observations	998	998	998	998	998	500	500

This table reports the results of ordinary least square 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 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 (please 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 treated 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 treated banks and our proxy for the intensity of capital injections, measured by the ratio of a bank's capital injection to its total assets, and a triple interaction term between the dummy for treated 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 (please see Table 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.

Table 9 Alternative Identification Strategy

Panel A: Regression Discontinuity							
	nim	nifm	mark-up	markdown	loanvol	coredepoval	noncoredepoval
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 variables	YES	YES	YES	YES	YES	YES	YES
Polynomial (2)	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			

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 taxed banks and zero for non-taxed banks. The set of control variables include capital adequacy, asset quality, management efficiency, earnings, liquidity, size, diversification and market share (please see Table 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% level respectively.

Appendix

Hypothesis 1:

To derive hypotheses (1) and (2), we rely on the following two equations:

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

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

The first equation is the competitive bank's break-even condition reported in equation (9) in the text and the second one 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:

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

and implicitly differentiating the zero profit condition with respect to τ , 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:

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

Hypothesis 3 and 6:

In order to derive the hypotheses 3 and 6, we use the first-order conditions given by (5) and (6)

$$r_f = \frac{p(1-\alpha)f'(L)}{(1-p)} \tag{5}$$

$$h'(p) = \frac{[(1-\alpha)f(L)+c](1-\tau)}{(1-p)^2} \tag{6}$$

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 $L = p \frac{(1-\alpha)f(L)+c}{(1-p)}$:

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

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

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

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

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

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

It must be noted that $\Delta \equiv \pi_{pp}^b(p, L) - \pi_{pL}^b \pi_{Lp}^b > 0$ 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:

$$\pi_{LL}^b(p, L) < 0, \pi_{pp}^b(p, L) < 0 \text{ and } \pi_{LL}^b(p, L) \pi_{pp}^b(p, L) - \pi_{pL}^b \pi_{Lp}^b > 0,$$

where subscripts refer to the partial derivatives with respect to the relevant variables.²⁰ In our model,

these conditions are:

$$\pi_{LL}^b(p, L) = p \frac{(1-\alpha)f''(L)}{1-p} = r_f a < 0 \text{ where } a = -\frac{f''(L)}{f'(L)}$$

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

$$\pi_{Lp}^b = \frac{r_f}{p(1-p)} = -\pi_{pL}^b = \frac{r_f}{p(1-p)} \text{ and}$$

$$\Delta \equiv \pi_{pp}^b(p, L) - \pi_{pL}^b \pi_{Lp}^b = (1-p)r_f a G(p) - \left(\frac{r_f}{p(1-p)}\right)^2 > 0$$

²⁰ For example: $\pi_{LL}^b(p, L) = \frac{\partial \pi_L^b(p, L)}{\partial L}$.