No Bigger, No Better:

Consolidation among Japan's Regional Banks

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Abstract

This study examines whether the form of bank consolidation changes the effects of consolidation events on bank profit and cost efficiency. Analyzing panel data on 122 regional banks in Japan over the 15 year period between 2000 and 2014, we find that the effects of consolidation through bank holding company (BHC) formation are quite different from the effects of consolidation through traditional merger and acquisition (M&A). Overall, consolidation statistically significantly increases profit efficiency of the banks in our sample. However, those efficiency gains all accrue to banks involved in M&A events; consolidation through bank holding company formation statistically significantly *reduces* bank profit efficiency. This finding holds even after controlling for economies of scale and economies of scope. The results call into question the current policy stance of the Financial Services Agency (FSA) promoting consolidation by regional banks in Japan.

Keywords: *bank, merger and acquisition, bank holding company, efficiency, stochastic frontier, Japan*

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1. Introduction

The third arrow of Abenomics, Japanese Prime Minister Shinzo Abe's set of policies designed to revitalize the Japanese economy, calls for radical changes in regional finance that will encourage more lending to regional companies. Japan's regional banks, which tend to have strong relationships with local companies and focus more on traditional "bread and butter" banking - taking deposits and making loans – are expected to play a significant role. But the other arrows of Abenomics, in particular the Bank of Japan's (BOJ) super loose monetary policy stance, may get in the way. In the month following the BOJs announcement of its negative interest rate policy (NIRP) on January 29th, the Nikkei stock market fell by about 10%, while bank shares lost nearly one quarter of their value. In the face falling loan balances and rising excess reserves at the banks, negative interest rates are intended to put pressure on banks to lend out their excess reserves rather than keep them sitting around. It also, indirectly, puts pressure on banks to charge their customers for deposits. So far, the banks have not gone that far, and even if they are willing to do so, over time depositors may find alternatives to bank deposits for storing their cash. If the deposit base shrinks, banks will be less, rather than more, likely to make loans. The regional banks, which are more dependent upon traditional lending, may see already thin profit margins disappear. Japan's regional banks face other challenges as well. Japan's aging population means their customer base is shrinking and growth prospects in Japan's rural areas are particularly bleak. Unlike the larger city banks, Japan's regional banks are not able to turn overseas to fill in the gaps. Rating agency Standard & Poor's expects profits at Japan's banks to fall overall in the coming year and among regional banks S&P is forecasting a 15% drop in profits.

The banks' regulator, the Financial Services Agency (FSA), thinks consolidation will help ("Japan appoints Mori," 2015). Since Nobuchika Mori took over as head of the FSA in 2015, there has been a special working group dedicated to discussing the structure and regulation of Bank Holding Companies (BHCs). Academic theory supports the logic behind the FSA's thinking that consolidation may increase bank profit and cost efficiency as banks are able to take advantage of economies of scale and scope.

Regional bank managers seem to agree as well. Nearly all regional bank consolidation announcements in Japan cite efficiency gains as one of the main objectives of consolidation (see reference list "Bank Official Announcements" in the appendix for details). The announcements argue that back office integration and re-allocation of excess employees, synergies from sharing soft information such as lending know-how and customer information, and lower-cost investment in new business models as a results of consolidation will contribute to higher cost efficiency.

However, empirical evidence on the effects of bank consolidation on efficiency is mixed (Berger & Mester, 1997). Some studies suggest that increased market power – which should yield efficiency gains through economies of scale – or expansion into non-interest income streams – which should yield efficiency gains through economies of scope – following bank consolidation on the contrary *reduce* bank efficiency. Montgomery & Takahashi (2015) report that, although higher market power is associated with higher profit efficiency on average, for banks that experience particularly large increases in market power as a result of merger, that relationship turns negative after merger. Taking up a related question, Akhigbe & Stevenson (2010) find that, contrary to the hypothesis of economies of scope, expansion into multi-noninterest income is associated with *decreased* profit efficiency following BHC formation. Perhaps it is not surprising then, that studies of the efficiency effects of bank mergers in Japan have yielded different results. A comprehensive study by Montgomery, Harimaya and Takahashi (2014) found no change in profit efficiency, but significantly lower cost efficiency following bank merger events in Japan. Earlier studies by Yamori and Harimaya (2009, 2010) found that mergers by small credit associations or mutual banks in Japan also result in lower technical and cost efficiency just after merger, but that efficiency was restored within a few years. And Yamori, Harimaya, & Kondo (2003) which, like our study, focuses on regional banks, find that while regional banks

affiliated with BHCs are not more cost-efficient than are independent banks, but they *are* more profit efficient.

Furthermore, bank holding company (BHC) formation – as the FSA seems to favor - is not the only option available to banks' wishing to consolidate. Banks may also choose tradidional merger and acquisition (M&A). In the case of M&A, two or more banks combine and become one bank. A recent example among regional banks in Japan was the merger of Juroku Bank and Gifu Bank in 2012, in which Gifu Bank was taken over by Juroku Bank and now, in name at least, only Juroku Bank remains. BHC formation, on the other hand, allows all consolidating banks to remain relatively independent under an umbrella holding company that owns the banks as subsidiaries. For example, in 2015, Higo Bank and Kagoshima Bank established the Kyushu Financial Group as a holding company, and these two banks joined as subsidiary banks. Exisiting studies of the effects of bank consolidation in Japan on efficiency, however, have focused solely on bank M&A events (Yamori & Harimaya, 2009; Yamori & Harimaya, 2010; Montgomery, Harimaya and Takahashi, 2014) or BHC formation (Yamori et al., 2003).

A significant contribution of this study is that it is the first to our knowledge to examine whether there are differential efficiency effects from consolidation through traditional merger and acquisition (M&A) as compared to bank holding company (BHC) formation. Like Yamori et al. (2003), we focus on consolidation of regional banks in Japan. However since their study was published, much richer data on regional bank consolidation has become available. Yamori et al. (2003) of necessity only analyzed a cross-section of nine bank and five BHC formations in fiscal year 2002[1]. Importantly, all of the banks affiliated with BHCs in that study later went on to merge via traditional M&A. According to FASF reports filed at the time of merger, the merging parties felt that the benefits of consolidation could be better realized through traditional M&A than in their existing BHC structure. Our richer data set on 122 banks over 15 years allows us to examine the veracity of that claim by distinguishing the efficiency effects of consolidation via M&A versus BHC formation. In addition, we pick up the unanswered question of whether economies of scope and economies of scale do indeed yield efficiency gains for regional banks in Japan.

The rest of this study is organized as follows. The following section provides institutional background on regional banks in Japan. Sections 3 and 4 describe the data and methodology used in the empirical analysis. Section 5 reports the results of that analysis and section 6 concludes.

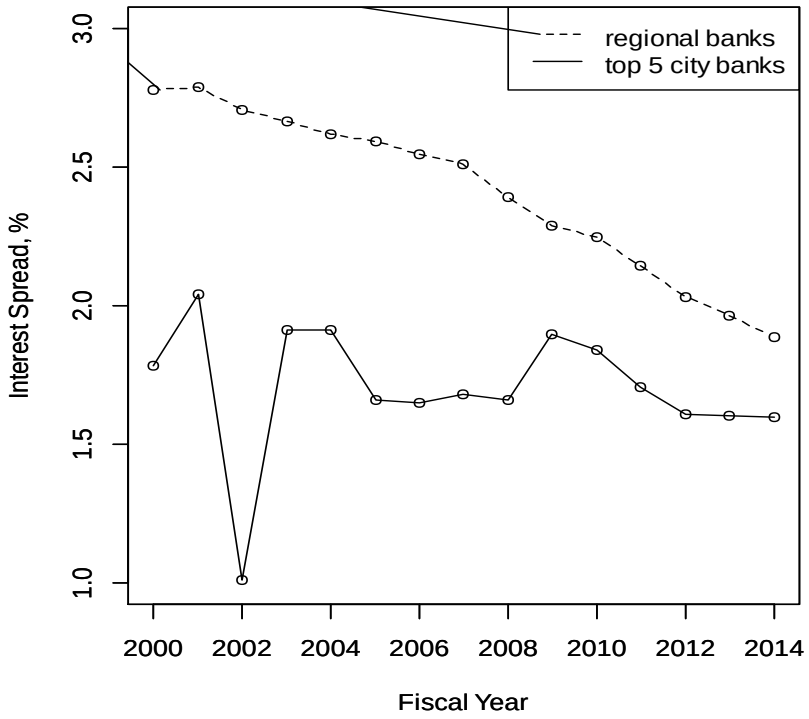
2. Regional Banks in Japan

Although not as well known as Japan's huge financial groups, Japan's 100-plus regional banks (see appendix 2 for a detailed list) together make up more than 40% of the total loans made in Japan, the same as the combined share of Japan's five biggest city banks: Bank of Tokyo-Mitsubishi-UFJ, Mizuho Bank, Sumitomo-Mitsui Banking Corporation, Resona Bank and Saitama Resona Bank.

With their knowledge of local regional companies, regional banks in Japan have been able to earn higher net interest margins – the difference between the interest banks pay on deposits and the interest they earn on loans – than their larger counterparts. But as shown in figure 1 below, net interest margins have been falling since 2000, and many question how long the banks' "pure-balance-sheet" model of taking deposits and making loans, without forays into more sophisticated financial products that might boost service fees, is sustainable.

[1] The fiscal year begins in April in Japan, so fiscal year 2002 is the period from April 2002 to March 2003.

Figure 1. Net Interest Margins of Japan's Banks: Regional Banks vs. the top five City Banks



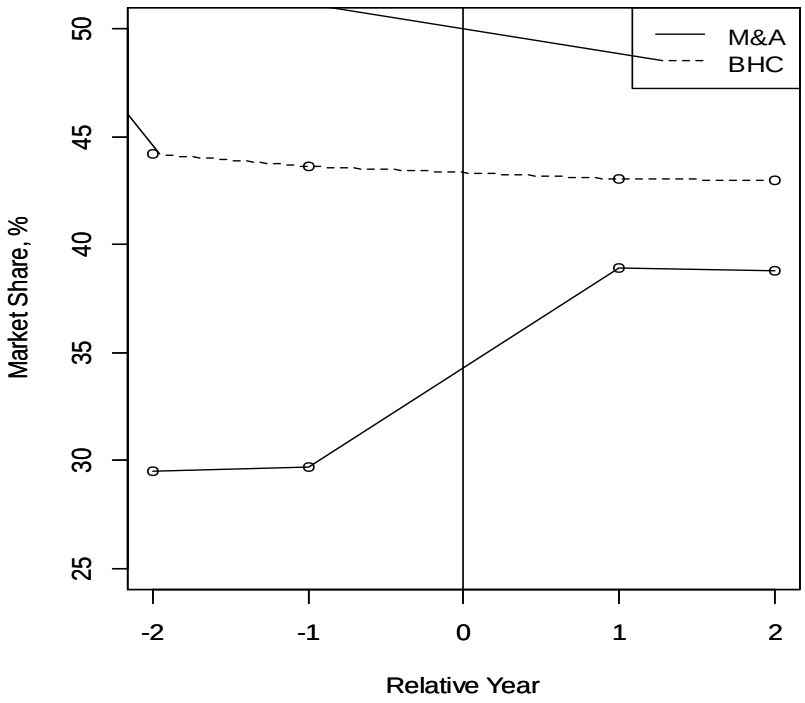
Note: Average net interest margin for each category of banks is calculated as interest income divided by total loans (as a proxy for the average interest rate on loans for each bank) minus interest expenses divided by total deposits (as a proxy for the average interest rate on deposits for each bank). Source: Japanese Bankers Association (JBA).

Perhaps motivated partly by falling interest margins, over the same period regional banks have consolidated significantly. The number of regional banks in Japan has decreased by about 15% over the period. Increasingly, the preferred mode of consolidation is BHC formation: in the last five years, nearly all regional bank consolidations have been BHC formations (see Appendix 1a and 1b). As of 2015, there were 10 regional BHCs in Japan, and 6 others are planned (see Appendix 1b). Since deregulation in the 1990s made them legal, the deposit share of BHC subsidiary banks has been steadily increasing, and in 2015 accounted for about 20 percent of total regional bank deposits.

Here, we first examine whether consolidation is indeed bringing increased market power – which would presumably lead to increased efficiency through economies of scale – or increased fee income – expansion in new, fee-based transactions that would presumably lead to increased efficiency through economies of scope.

Figure 2 plots the market share of regional banks that experience consolidation via traditional merger and acquisition (M&A) versus bank holding company (BHC) formation in the two years before and after the various consolidation events. Market share is measured as the share of each banks' deposits relative to total prefectural deposits. Figure 2 demonstrates that M&A does tend to increase market share for the banks involved, but the same is not true for bank holding company formation. In the two years following formation of a BHC, market share does not increase – and in fact may be falling modestly – on average for the consolidating banks.

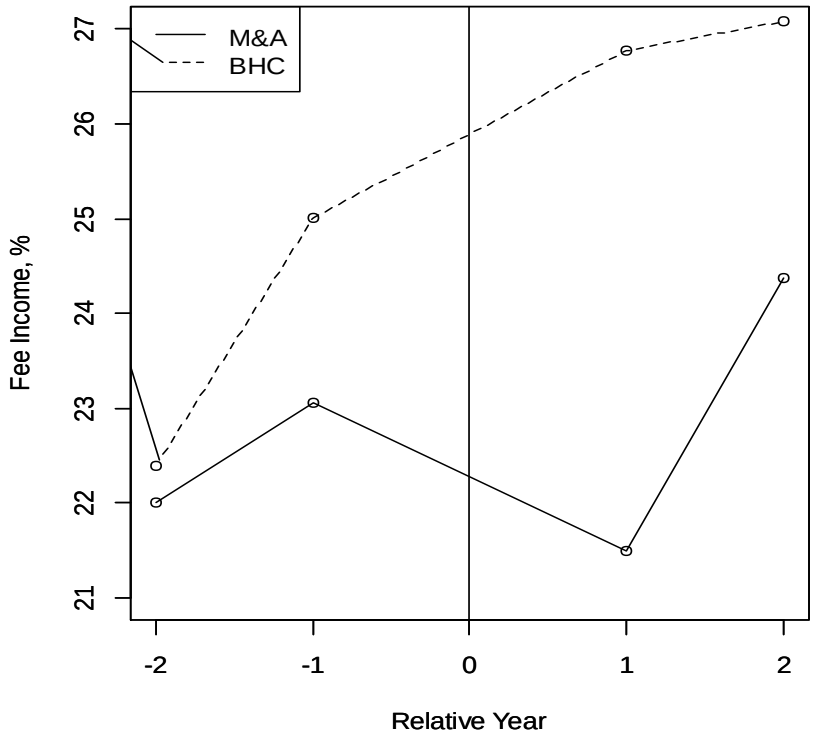
Figure 2. Share of Bank Deposits around Regional Bank Consolidation Events: M&A vs. BHC Formation



Note: Sample includes regional 1 and regional 2 banks that experienced a consolidation event, either via traditional M&A or BHC formation. Market share is defined as the deposits of each bank divided by the total bank deposits in the bank's home prefecture. Sources: Japanese Bankers Association (JBA, for bank deposits) and Bank of Japan (BOJ, for total prefectural deposits).

Figure 3 plots the the share of fee income for regional banks that experience consolidation via traditional merger and acquisition (M&A) versus bank holding company (BHC) formation during our sample period in the two years before and after the various consolidation events. The share of fee income is measured as the share of each banks' reported fees and commissions as a percent of total ordinary income. Figure 3 illustrates that bank holding company formation has a fairly significant impact on the share of fee income for the consolidating banks and the increase in fee income is higher for banks that consolidate via BHC formation than for banks that consolidate via traditional M&A.

Figure 3. Share of Fee Income around Regional Bank Consolidation Events: M&A vs. BHC Formation



Note: Sample is regional 1 and regional 2 banks that experienced a consolidation event, either via traditional M&A or BHC formation. Fee Income is measured as *fee and commissions* (*yakumu-torihikitou-shuueki*) divided by *ordinary income* (*keijo-rieki*). Source: Japanese Bankers Association (JBA).

These findings suggest that economies of scale and/or scope resulting from regional bank consolidation may depend critically on the form of that consolidation: through traditional M&A versus BHC formation. In the analysis to follow, we empirically analyze whether these consolidations are bringing the hoped-for efficiency gains and whether the form of consolidation - via M&A versus BHC formation – significantly influences changes in efficiency. The analysis to follow is informed by the patterns observed above on market share and share of fee income: we control for market share and share of fee income in our empirical analysis and also include it as an interaction term with BHC consolidation to see whether BHCs respond to changes in market share or fee income share differently from other banks.

3. Data

Table 1 reports the summary statistics of the data used in the analysis: 122 regional I and II banks' unconsolidated balance sheets and income statements for fiscal years 2000-2014, 15 years in all. Balance sheet and income statement data are obtained from the *Analysis of Financial Statements of All Banks* published by the Japanese Bankers' Association.

Table 1. Descriptive Statistics, 2000-2014

	Observations	Mean	Standard Deviation	Min	Max
Outcome					
Profit (π)	1,654	50,837	44,377.7	1,890	729,960
Cost (C)	1,654	6,436	25,143.6	-599,555	109,874
Outputs					
Total loans (y1)	1,654	1,765,389	1,521,744	124,236	9,778,038
Total securities (y2)	1,654	678,484	627,319.6	1	3,716,530
Fee income (y3)	1,654	7,545	7,386.2	166	57,021
Input prices					
Interest expenses (w1)	1,654	0.0021	0.0014	0.0002	0.0110
Non-interest expenses (w2)	1,654	16.410	2.898	1.502	28.637
Quasi-fixed input					
Total equity (z)	1,654	134,575	144,882.6	-701,674	945,496
Normalizer					
Total assets (q)	1,654	2,686,587	2,290,823	176,876	15,204,334
Asset Quality					
Credit risk (NPL/L) (%)	1,654	3.586	2.701	0.010	57.272

Notes: Units are million yen. The sample is 122 banks over 15 years with a total of 1,654 observations.

In table 1, the outcome variables are ordinary profits and ordinary costs. In defining inputs and outputs we employ the intermediation approach which defines total loans (y1), total securities (y2) and fee income (y3) as earning assets, while interest paid on deposits (w1) and non-interest expenses (w2) are inputs. Interest paid on deposits is not available for individual banks, so is calculated as the ratio of interest expeneses divided by total deposits for each bank. Non-interest expenses are the ratio of general and administrative expenses - which includes both personnel expenses and non-personnel expenses - divided by the total number of employees. Equity capital (z) is included as a standalone quasi-fixed input or netput. Total assets (q) are included as a normalizer. Asset quality or credit risk is represented by the ratio of non-performing loans to total loans (NPL/L). Non-performing loans are defined as any of the following: loans to borrowers in the process of legal bankruptcy, past due loans in arrears by 6 months or more, loans in arrears by 3-6 months or restructured loans.

4. Empirical Methodology

4.1. Efficiency

To estimate profit efficiency, we estimate the following profit function:

$$\begin{aligned}\ln\left(\frac{\pi+\theta}{q}\right) = \alpha_0 &+ \sum_{j=1}^{3}\alpha_j \ln\left(\frac{y_j}{q}\right)_{i,t} + \sum_{h=1}^{2}\beta_j \ln(w_h)_{i,t} + \gamma_1 \ln(z)_{i,t} \\ &+ \frac{1}{2}\sum_{j=1}^{3}\sum_{k=1}^{3}\alpha_{jk} \ln\left(\frac{y_j}{q}\right)_{i,t} \ln\left(\frac{y_k}{q}\right)_{i,t} + \frac{1}{2}\sum_{h=1}^{2}\sum_{l=1}^{2}\beta_{hl} \ln(w_h)_{i,t}\ln(w_l)_{i,t} \\ &+ \frac{1}{2}\gamma_{11}\ln(z+\theta^*)_{i,t}\ln(z+\theta^*)_{i,t} + \sum_{j=1}^{3}\sum_{h=1}^{2}\delta_{jk} \ln\left(\frac{y_j}{q}\right)_{i,t} \ln(w_h)_{i,t} \\ &+ \sum_{j=1}^{3}\zeta_j \ln\left(\frac{y_j}{q}\right)_{i,t} \ln(z+\theta^*)_{i,t} + \sum_{h=1}^{2}\xi_h \ln(w_h)_{i,t}\ln(z+\theta^*)_{i,t} \\ &+ \tau_1 \ln\left(\frac{NPL}{L}\right)_{i,t} + \frac{1}{2}\tau_2\left[\ln\left(\frac{NPL}{L}\right)\right]^2_{i,t} + v_{i,t} - u_{i,t}\end{aligned} \tag{1}$$

In equation (1), subscripts *i* and *t* represent bank *i* and time *t*, respectively. π represents profit and θ represents the absolute value of the minimum profit (π) over all banks in the sample plus one – we add this constant because several observations report profit less than 0 but the log of a negative number is undefined. q represents total assets, which we use as a normalizer. z represents equity capital which is used as a netput.

y_j and y_k represent the *j*th and *k*th output (total loans, total securities or fee income), respectively. w_h and w_l represents the *h*th and *l*th input price (the price of deposits, price of non-interest inputs). Credit risk, defined as the ratio of non-performing loans to total loans, is included to control for asset quality.

$v_{i,t}$ represents the random error term of bank *i* in time *t*. $u_{i,t}$ represents the *in*efficiency of bank *i* at time *t*, which is assumed to follow a half-normal distribution.

Cost efficiency is estimated using a parallel cost function:

$$\begin{aligned}\ln\left(\frac{C}{q}\right) = \alpha_0 + \sum_{j=1}^{3}\alpha_j\, ln\left(\frac{y_j}{q}\right)_{i,t} + \sum_{h=1}^{2}\beta_j\, ln(w_h)_{i,t} + \gamma_1 \ln(z)_{i,t} \\ + \frac{1}{2}\sum_{j=1}^{3}\sum_{k=1}^{3}\alpha_{jk}\, ln\left(\frac{y_j}{q}\right)_{i,t} ln\left(\frac{y_k}{q}\right)_{i,t} + \frac{1}{2}\sum_{h=1}^{2}\sum_{l=1}^{2}\beta_{hl}\, ln(w_h)_{i,t} ln(w_l)_{i,t} \\ + \frac{1}{2}\gamma_{11} ln(z+\theta^*)_{i,t} ln(z+\theta^*)_{i,t} + \sum_{j=1}^{3}\sum_{h=1}^{2}\delta_{jk}\, ln\left(\frac{y_j}{q}\right)_{i,t} ln(w_h)_{i,t} \\ + \sum_{j=1}^{3}\zeta_j\, ln\left(\frac{y_j}{q}\right)_{i,t} ln(z+\theta^*)_{i,t} + \sum_{h=1}^{2}\xi_h\, ln(w_h)_{i,t} ln(z+\theta^*)_{i,t} \\ + \tau_1 ln\left(\frac{NPL}{L}\right)_{i,t} + \frac{1}{2}\tau_2\left[ln\left(\frac{NPL}{L}\right)\right]^2_{i,t} + v_{i,t} + u_{i,t}\end{aligned} \tag{2}$$

Variables are defined as above, with the exception that in the dependent variable profits are replaced with total ordinary costs, *C*. Note that the composite error term is now $v_{i,t} + u_{i,t}$.

After estimating equations (1) and (2), including parameters $\alpha, \beta, \gamma, \delta, \zeta, \xi, \tau$, the efficiency of each bank can be isolated employing Battese & Coelli (1992) point estimator.

$$efficiency_{i,t} = \mathrm{E}\left[exp\{-u_{i,t}\}|\varepsilon_{i,t}\right] = \left\{\frac{1-\Phi\left[\eta_{i,t}\sigma_i^* - (\mu_i^*/\sigma_i^*)\right]}{1-\Phi(-\mu_i^*/\sigma_i^*)}\right\} exp\left[-\eta_{i,t}\mu_i^* + \frac{1}{2}\eta_{i,t}\sigma_i^{*2}\right] \tag{3}$$

where $\sigma_i^* = \left(\mu\sigma_v^2 - \eta_i^{'}\,\varepsilon_i\sigma_u^2\right)/\left(\sigma_v^2 + \eta_i^{'}\,\eta_i\sigma_u^2\right)$, $\sigma_i^* = \sigma_v\sigma_u/\sqrt{\left(\sigma_v^2 + \eta_i^{'}\,\eta_i\sigma_u^2\right)}$ and $\Phi(*)$ represents the distribution function for the standard normal random variable. Time-variant term $\eta_{i,t}$ is expressed as $\eta_{i,t} = \exp[-\eta(t-T)]$, where t is time of the sample time period T; $\eta > 0$, $\eta = 0$ or $\eta < 0$ if $u_{i,t}$ decreases, remain constant or increases, respectively, which means that the frontier estimation is time *in*variant if $\eta = 0$ and is time variant otherwise.

4.2. Multivariate Regression Analysis

Next, we explore the issues raised above with more rigorous multivariate regression analysis. Specifically, we run a reduced form specification as in equation (4), regressing our efficiency estimates on various variables of interest.

$$\begin{aligned}efficiency_{i,t} = \alpha_1 + \beta_1\, PostConsolidate_{i,t} + \beta_2\, PostBHC_{i,t} + \beta_3 NeverConsolidate_{i,t} \\ + \beta_4 MarketShare_{i,t} + \beta_5\, FeeIncome_{i,t} + \beta_4\, T_t + \varepsilon_{i,t}\end{aligned} \tag{4}$$

In equation 4, "$PostConsolidate_{i,t}$" is a dummy variable that captures the overall average effect of consolidation on efficiency in the three years following consolidation. The main variable of interest is the "$PostBHC_{i,t}$" dummy, which equals one for banks that consolidated through bank holding company formation in the three years following consolidation. The coefficient estimate, β_2 addresses our central research question of whether the form of consolidation statistically significantly affects post-consolidation

efficiency. If β_2 is statistically significantly positive or negative, then consolidation through bank holding company formation yields significantly more or less efficient banks than does consolidation through traditional merger and acquisition.

A dummy variable for banks that "$NeverConsolidate_{i,t}$" during the sample is included as a control variable in case efficiency is somehow different for banks that consolidate even before consolidation takes place. T_t is a time fixed effect which controls for macroeconomic factors such as interest rate risk, the business cycle, etc., that affect all banks in a given time period.

The parameter estimate β_4 captures the contribution of $MarketShare_{i,t}$, the ratio of bank deposits to total deposits of main busines prefecture. This parameter estimate captures the effect of market power or bank size. The parameter estimate β_5, which captures the contribution of $FeeIncome_{i,t}$, the ratio of fees and commissions to total (ordinary) income for each bank to profit or cost efficiency, is also of interest. This parameter estimate presumably captures the effects of bank diversification away from traditional "bread and butter" banking into more lucrative fee-generating activities.

5. Results: Consolidation, Market Power and Efficiency

Detailed results of profit and cost efficiency estimation are reported in appendix table 4, but the results aggregated by bank consolidation status are reported below in table 2.

Table 2. Mean efficiency by BHC & M&A status

	Profit efficiency	Cost efficiency	Number of banks	Total observations
Full Sample	0.910	0.893	122	1,654
Never consolidate	0.906	0.894	82	1,230
Before consolidate	0.923	0.811	39	125
After consolidate	0.913	0.888	24	78
After M&A	0.933	0.868	10	29
After BHC	0.904 **	0.884	20	64

Note: Sample period is 3 years before and after consolidation (excluding event year) for consolidated banks and all years for never consolidated banks. *, **, ***, indicate statistical significance relative to the "before consolidate" group at the 10, 5 and 1 percent level respectively.

Looking at table 2, we note that banks that consolidate tend to be more profit efficient to begin with. In the three years after consolidation, profit efficiency rises on average, while cost efficiency falls, for those banks that experience consolidation. The fall in cost efficiency is statistically significant at the 5% level. However, the modest rise in profit efficiency can be attributed entirely to the effects of consolidation via traditional merger and acquisition. Banks that consolidate through bank holding company formation, on the contrary, experience a statistically significant decline in both profit and cost efficiency in the three years following. In the next section, we examine this difference using more rigorous regression analysis.

Table 3. Regression Results – Effect of Consolidation on Profit and Cost Efficiency

	Profit efficiency		Cost efficiency	
	(1)	(2)	(3)	(4)
After Consolidate	-0.000 [0.007]	0.027** [0.011]	-0.008 [0.009]	0.000 [0.014]
After BHC		-0.038*** [0.012]		-0.012 [0.015]
Never Consolidate	-0.010** [0.004]	-0.011** [0.004]	0.002 [0.006]	0.002 [0.006]
Observations	1,389	1,389	1,389	1,389
Number of banks	122	122	122	122
Number of years	15	15	15	15
Adj. R-square	0.0052	0.0119	0.0017	0.0021

Note: Sample period is 3 years before and after M&A (excluding M&A year) for M&A banks and all years for never M&A ban Standard errors in brackets below each coefficient estimate. *, **, ***, indicate statistical significance at the 10, 5 and 1 percent level respectively. A "small" bank is defined as a bank with total assets of less than 1 trillion yen. Time fixed effects are included for every specification.

The results of multivariate regression analysis, reported in table 3 above, confirm some of the patterns observed above in table 2. Banks that consolidate do tend to be more profit efficient to begin with, as indicated by the statistically significantly negative coefficient estimate on the "Never Consolidate" control variable. For those banks that consolidate, there is no statistically significant change in cost efficiency: if anything, cost efficiency declines modestly. But profit efficiency rises. However, the rise in profit efficiency for consolidating banks can be attributed solely to banks that consolidate through traditional merger and acquisition. Banks that consolidate through bank holding company formation exhibit a statistically significant decline in profit efficiency in the three years following consolidation.

These results hold even after controlling for changes in economies of scope – as measured by market share in table 4 – and economies of scale – as measured by the share of fee income in table 5.

Table 4. Regression Results – Controlling for Economies of Scale

	Profit efficiency		Cost efficiency	
	(1)	(2)	(3)	(4)
After Consolidate	0.006**	0.026**	0.002	0.002
	[0.011]	[0.011]	[0.014]	[0.014]
After BHC	-0.038***	-0.038***	-0.011	-0.011
	[0.013]	[0.012]	[0.015]	[0.017]
Market Share	0.012***	0.013***	-0.021***	-0.022***
	[0.004]	[0.004]	[0.005]	[0.005]
Market Share x After BHC		0.031**		-0.019
		[0.013]		[0.017]
Never Consolidate	-0.013***	-0.014***	0.005	0.005
	[0.004]	[0.004]	[0.006]	[0.006]
Observations	1,389	1,389	1,389	1,389
Number of banks	122	122	122	122
Number of years	15	15	15	15
Adj. R-square	0.0178	0.0213	0.0133	0.0142

The results reported in table 4 indicate that, as we would expect based on the theory of economies of scale, more market power – as indicated by a larger market share – is indeed associated with higher profit efficiency. Coefficient estimates on market share are positive and highly statistically significant at the 1% level. This basic relationship holds for banks that form bank holding companies as well, as indicated by the positive and statistically significant coefficient estimate on the interaction term of market share with the BHC formation dummy. Even after controlling for market share, consolidation yields improved profit efficiency, as indicated by the positive and statistically significant coefficient estimate on the "After Consolidate" dummy. But those gains are all due to consolidation through M&A. The coefficient estimate on the "After BHC" dummy is still negative and highly statistically significant. In fact, it is so large that it suggests that bank holding company formation on average tends to *reduce* bank profit efficiency.

Table 5. Regression Results – Controlling for Economies of Scope

	Profit efficiency		Cost efficiency	
	(1)	(2)	(3)	(4)
After Consolidate	0.032**	0.032**	-0.005	-0.005
	[0.012]	[0.012]	[0.015]	[0.015]
After BHC	-0.041***	-0.041***	0.010	0.010
	[0.013]	[0.013]	[0.017]	[0.017]
Fee	-0.039***	-0.040***	0.008	0.007
	[0.014]	[0.014]	[0.017]	[0.017]
Fee x After BHC		0.024		0.017
		[0.029]		[0.036]
Market Share	0.010**	0.010**	-0.022***	-0.022***
	[0.004]	[0.004]	[0.005]	[0.005]
Never Consolidate	-0.015***	-0.015***	0.000	0.000
	[0.004]	[0.004]	[0.006]	[0.006]
Observations	1,389	1,389	1,389	1,389
Number of banks	122	122	122	122
Number of years	15	15	15	15
Adj. R-square	0.0263	0.0268	0.0123	0.0125

The results reported in table 5 illustrate that – contrary to the theory of economies of scope – banks that have expanded out of traditional lending into other revenue streams tend to be *less* profit efficiency. Coefficient estimates on the share of non-interest "Fee" income are positive and highly statistically significant at the 1% level. This result, combined with the evidence presented above in figure 3 that regional banks that form BHCs tend to increase their share of non-interest income, might help explain our results. However, even after controlling for the share of non-interest fee income, our basic result from above is robust. Consolidation yields improved profit efficiency overall, as indicated by the positive and statistically significant coefficient estimate on the "After Consolidate" dummy. But those gains are all due to consolidation through M&A. The coefficient estimate on the "After BHC" dummy is still negative and highly statistically significant. In fact, it continues to be so large that it suggests that bank holding company formation on average tends to *reduce* bank profit efficiency.

6. Conclusions

Japan's troubled regional banks are under pressure to consolidate. This study set out to examine whether the *form* of that consolidation – through through traditional merger and acquisition (M&A) or bank holding company (BHC) formation - matters. BHC formation has been promoted by policymakers as a way for banks to enjoy the efficiency-enhancing effects of consolidation – back office consolidation, better allocation of employees, information sharing and other synergies – while still remaining relatively independent. Since deregulation in the 1990s made them legal, the share of regional banks affiliated with a BHC has grown and BHCs now account for $1/5^{th}$ of the total number of regional banks in Japan. If the effects of consolidation via BHC formation differ from the effects of consolidation via traditional M&A, this trend has significant implications for Japan's economy.

The results presented above suggest that the effects of consolidation differ considerably with the form of consolidation. Although consolidation does, on average, yield higher profit efficiency for Japan's regional banks, those efficiency gains accrue exclusively to banks that consolidation through traditional M&A. Banks that consolidated through BHC formation, on the other hand, exhibit statistically significant profit efficiency *losses*. These results are robust to controls for economies of scale and scope.

The question on the mind of policymakers must be: “Why?”. Our analysis suggests some directions for future research. The sources of efficiency gains from consolidation, economies of scale and economies of scope, do not seem to be working as economic theory suggests they should. Economies of scale – measured by market power - are indeed associated with higher profit efficiency. But for Japan’s regional banks, while consolidation via M&A brings significant increases in market power, consolidation via BHC formation does not. Consolidation via BHC formation is associated with economies of scale: expansion into non-traditional revenue streams other than taking deposits and making loans. However, contrary to the theoretical predictions, expansion into non-interest income streams is associated with *lower*, not higher profit efficiency.

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Appendix Tables

Appendix 1a: Japanese regional bank merger events from 2000 to present

Fiscal year	M&A data	Post-merger bank	Acquirer bank	Target bank
2001	14 May, 2001		(Six banks)*	Niigata Chuo Bank
2002	3 March, 2003		(Three banks)**	Chubu Bank
2002	17 March, 2003	Sumitomo Mitsui Banking Corporation	Sumitomo Mitsui Banking Corporation	Wakashio Bank
2002	24 March, 2003		(Five financial institutions)***	Ishikawa Bank
2003	1 April, 2003	Shinwa Bank	Shinwa Bank	Kyushu Bank
2003	1 April, 2003	Kanto Tsukuba Bank	Kanto Bank	Tsukuba Bank
2003	1 February, 2004	Kansai Urban Banking Corporation	Bank of Kansai	Kansai Sawayaka Bank
2004	1 May, 2004	Momiji Bank	Hiroshima-Sogo Bank	Setouchi Bank
2004	1 October, 2004	Nishi-Nippon City Bank	Nishi-Nippon Bank	Fukuoka City Bank
2005	1 January, 2006	Resona Bank	Resona Bank	Nara Bank
2006	10 October, 2006	Kiyo Bank	Kiyo Bank	Wakayama Bank
2007	7 May, 2007	Kirayaka Bank	Shokusan Bank	Yamagata Shiawase Bank
2008	14 October, 2008	North Pacific Bank	North Pacific Bank	Sapporo Bank
2009	1 March, 2010	Kansai Urban Banking Corporation	Kansai Urban Banking Corporation	Biwako Bank
2009	1 March, 2010	Tsukuba Bank	Kanto Tsukuba Bank	Ibaraki bank
2010	1 May, 2010	Senshu Ikeda Bank	Bank of Ikeda	Senshu Bank
2012	18 September, 2012	Juroku Bank	Juroku Bank	Gifu Bank

Source: Japanese Bankers Association (JBA). Notes: *Business of Niigata Chuo Bank was transferred to six banks; Taiko Bank, Daishi Bank, Hachijuni Bank, Higashi-Nippon Bank, Towa Bank and Gunma Bank. **Business of Chubu Bank was transferred to three banks; Shimizu Bank, Shizuoka Chuo Bank and Tokyo Star Bank. *** Business of Ishikawa Bank was transferred to five financial institutions; Hokuriku Bank, Hokkoku Bank, First Bank of Toyama, Kanazawa Shinkin Bank and Noto Shinkin Bank.

Appendix 1b: Japanese regional bank holding company formation events from 2000 to present (including forthcoming events)

Fiscal year	Establishment date	Dissolution date	Bank holding company	Affiliated banks
2001	2 April, 2001	1 October, 2012	Sapporo Hokuyo Holdings	North Pacific Bank, Sapporo Bank
2001	28 September, 2001	1 April, 2007	Momiji Holdings	Hiroshima-Sogo Bank, Setouchi Bank
2002	1 April, 2002	20 June, 2008	Kyushu Shinwa Holdings	Shinwa Bank, Kyushu Bank
2002	1 March, 2003	26 December, 2005	Ashigin Financial Group	Ashikaga Bank
2003	1 September, 2003	1 September, 2004	Hokugin Financial Group	Hokuriku Bank
2004	1 September, 2004	(continue to present)	Hokuhoku Financial Group	Hokkaido Bank, Hokuriku Bank
2005	3 October, 2005	25 September, 2008	Kirayaka Holdings	Shokusan Bank, Yamagata Shiawase Bank
2005	1 February, 2006	1 October, 2013	Kiyo Holdings	Kiyo Bank, Wakayama Bank
2006	1 October, 2006	(continue to present)	Yamaguchi Financial Group	Yamaguchi Bank, Momiji Bank
2007	2 April, 2007	(continue to present)	Fukuoka Financial Group	Fukuoka Bank, Kumamoto Family Bank
2007	1 Oct, 2007	(continue to present)	Fukuoka Financial Group	Shinwa Bank (joined in Fukuoka FG)
2008	1 July, 2008	(continue to present)	Ashikaga Holdings	Ashikaga Bank
2009	1 October, 2009	(continue to present)	Fidea Holdings	Hokuto Bank, Shonai Bank
2009	1 October, 2009	(continue to present)	Senshu Ikeda Holdings	Bank of Ikeda, Senshu Bank
2010	1 April, 2010	(continue to present)	Tomony Holdings	Tokushima Bank, Kagawa Bank
2012	1 October, 2012	(continue to present)	Jimoto Holdings	Kirayaka Bank, Sendai Bank
2014	1 October, 2014	(continue to present)	Tokyo TY Financial Group	Tokyo Tomin Bank, Yachiyo Bank
2015	1 October, 2015	(continue to present)	Kyushu Financial Group	Higo Bank, Kagoshima Bank
	(forthcoming)		Concordia Financial Group	Yokohama Bank, Higashi-Nippon Bank
	(forthcoming)			Joyo Bank, Ashikaga Bank
	(forthcoming)			Tomony Holdings, Taisho Bank

Appendix 1b: (*continued*)

Fiscal year	Establishment date	Dissolution date	Bank holding company	Affiliated banks
	(forthcoming)			Nishi-Nippon City Bank
	(forthcoming)			Tokyo TY Financial Group, ShinGinko Tokyo
	(forthcoming)			Fukuoka Finacial Group, Eighteenth Bank

Source: Japanese Bankers Association (JBA).

Appendix 2: All names of regional banks for this study

Code	Regional bank I	Code	Regional bank II
0116	Hokkaido Bank	0501	North Pacific Bank
0117	Aomori Bank	0508	Kirayaka Bank
0118	Michinoku Bank	0509	Kita-Nippon Bank
0119	Akita Bank	0502	Sapporo Bank
0120	Hokuto Bank	0507	Yamagata Shiawase Bank
0121	Shonai Bank	0512	Sendai Bank
0122	Yamagata Bank	0513	Fukushima Bank
0123	Bank of Iwate	0514	Daito Bank
0124	Tohoku Bank	0516	Towa Bank
0125	77 Bank	0517	Tochigi Bank
0126	Toho Bank	0519	Ibaraki Bank
0128	Gunma Bank	0520	Tsukuba Bank
0129	Ashikaga Bank	0522	Keiyo Bank
0130	Joyo Bank	0524	Wakashio Bank
0131	Tsukuba Bank	0525	Higashi-Nippon Bank
0133	Musashino Bank	0526	Tokyo Star Bank
0134	Chiba Bank	0530	Kanagawa Bank
0135	Chiba Kogyo Bank	0531	Niigata Chuo Bank
0137	Tokyo Tomin Bank	0532	Taiko Bank
0138	Bank of Yokohama	0533	Nagano Bank
0140	Daishi Bank	0534	First Bank of Toyama
0141	Hokuetsu Bank	0535	Ishikawa Bank
0142	Yamanashi Chuo Bank	0537	Fukuho Bank
0143	Hachijuni Bank	0538	Shizuoka Chuo Bank
0144	Hokuriku Bank	0539	Chubu Bank
0145	Bank of Toyama	0541	Gifu Bank
0146	Hokkoku Bank	0542	Aichi Bank
0147	Fukui Bank	0543	Bank of Nagoya
0149	Shizuoka Bank	0544	Chukyo Bank
0150	Suruga Bank	0546	Daisan Bank
0151	Shimizu Bank	0547	Biwako Bank
0152	Ogaki Kyoritsu Bank	0552	Kansai Sawayaka Bank
0153	Juroku Bank	0554	Kansai Urban Banking Corporation
0154	Mie Bank	0555	Taisho Bank
0155	Hyakugo Bank	0557	Nara Bank
0157	Shiga Bank	0558	Wakayama Bank

Appendix 2: All names of regional banks for this study (*Continued*)

Code	Regional bank	Code	Regional bank II
0158	Bank of Kyoto	0562	Minato Bank
0159	Kinki Osaka Bank	0565	Shimane Bank
0160	Senshu Bank	0566	Tomato Bank
0161	Senshu Ikeda Bank	0568	Setouchi Bank
0162	Nanto Bank	0569	Momiji Bank
0163	Kiyo Bank	0570	Saikyo Bank
0164	Tajima Bank	0572	Tokushima Bank
0166	Tottori Bank	0573	Kagawa Bank
0167	San-in Godo Bank	0576	Ehime Bank
0168	Chugoku Bank	0578	Bank of Kochi
0169	Hioshima Bank	0581	Fukuoka City Bank
0170	Yamaguchi Bank	0582	Fukuoka Chuo Bank
0172	Awa Bank	0583	Saga Kyoei Bank
0173	Hyakujyushi Bank	0585	Bank of Nagasaki
0174	Iyo Bank	0586	Kyushu Bank
0175	Shikoku Bank	0587	Kumamoto Bank
0177	Bank of Fukuoka	0590	Howa Bank
0178	Chikuho Bank	0591	Miyazaki Taiyo Bank
0179	Bank of Saga	0594	Minami-Nippon Bank
0180	Eighteenth Bank	0596	Okinawa Kaiho Bank
0181	Shinwa Bank	0597	Yachiyo Bank
0182	Higo Bank		
0183	Oita Bank		
0184	Miyazaki Bank		
0185	Kagoshima Bank		
0187	Bank of The Ryukyus		
0188	Bank of Okinawa		
0190	Nishi-Nippon City Bank		
0191	Kitakyushu Bank		

Notes: In total, 122 regional banks are on the list. Banks in a low of "regional bank I" are member of *Regional Banks Association of Japan*; banks in a row of "regional bank II" are member of *The Second Association of Regional Banks*. Banks changed their names mostly due to mergers, but names on the list are the latest one.

Appendix 3: Definition of variable for stochastic frontier analysis

Symbol	Definition	
Dependent Variables		
π	Profit	*Ordinary profit*
C	Cost	*Ordinary cost*
Output quantities variables		
y_1	Loans	*Loans and bills discounted*
y_2	Securities	*Securities*
y_3	Fees and commissions	*Fees and commissions*
Input prices variables		
w_1	Interest price	*Interest expenses* divided by *Deposit* (%)
w_2	Non-interest price	*General and administrative expenses* divided by *Number of employee* (%)
Netput quantities variables		
Z	Capital equity	*Total net assets*
Normalizer		
q	Total asset	*Total assets*
Risk variables		
NPL/L	Credit risk	*Non-performing loans*[1] divided by *loans and bills discounted* (%)

[1] *Non-performing loans* is defined as sum of *loans to borrowers in legal bankruptcy*, *past due loans in arrears by 6 months or more*, *loans in arrears by 3 months or more and less than 6 months* and *restructured loans*.

Appendix 4: Efficiency estimation results

	(4a)			(4b)		
Sample	Unbalanced panel data for 122 regional banks (2000-2014)					
Specification	Maximum likelihood (time-variant stochastic frontier estimation)					
Dependent variable	$ln\left(\frac{C}{q}\right)$			$ln\left(\frac{\pi+\theta}{q}\right)$		
	estimates		standard error	estimates		standard error
Intercept	-18.607	***	[4.920]	2.755		[6.546]
$\ln(y_1/q)$	-3.047		[3.080]	-5.017		[3.987]
$\ln(y_2/q)$	-2.454	***	[0.594]	-2.067	**	[0.803]
$\ln(y_3/q)$	-3.185	***	[0.994]	1.595		[1.313]
$\ln(w_1)$	0.532	*	[0.306]	-0.136		[0.388]
$\ln(w_2)$	3.223	*	[1.674]	-0.767		[2.257]
$\ln(z+\theta^*)$	-0.306		[0.344]	1.038	**	[0.453]
$0.5\cdot[\ln(y_1/q)]^2$	2.674	**	[1.101]	-11.696	***	[1.290]
$\ln(y_1/q)\cdot\ln(y_2/q)$	0.261	***	[0.100]	-0.867	***	[0.125]
$\ln(y_1/q)\cdot\ln(y_3/q)$	-0.743	**	[0.321]	1.075	***	[0.410]
$0.5\cdot[\ln(y_2/q)]^2$	-0.085	***	[0.011]	0.163	***	[0.014]
$\ln(y_2/q)\cdot\ln(y_3/q)$	-0.338	***	[0.059]	0.222	***	[0.078]
$0.5\cdot[\ln(y_3/q)]^2$	-0.331	***	[0.118]	-0.002		[0.150]
$0.5\cdot[\ln(w_1)]^2$	0.095	***	[0.017]	-0.026		[0.022]
$\ln(w_1)\cdot\ln(w_2)$	0.114	*	[0.062]	-0.166	**	[0.079]
$0.5\cdot[\ln(w_2)]^2$	-0.384		[0.295]	0.357		[0.397]
$0.5\cdot[\ln(z+\theta^*)]^2$	0.044	***	[0.009]	0.014		[0.011]
$\ln(y_1/q)\cdot\ln(w_1)$	-0.063		[0.100]	-0.415	***	[0.124]
$\ln(y_1/q)\cdot\ln(w_2)$	-0.452		[0.626]	1.912	**	[0.816]
$\ln(y_2/q)\cdot\ln(w_1)$	-0.030		[0.022]	-0.149	***	[0.028]
$\ln(y_2/q)\cdot\ln(w_2)$	-0.043		[0.116]	1.062	***	[0.157]
$\ln(y_3/q)\cdot\ln(w_1)$	0.018		[0.029]	-0.001		[0.037]
$\ln(y_3/q)\cdot\ln(w_2)$	0.237		[0.162]	-0.303		[0.229]
$\ln(y_1/q)\cdot\ln(z+\theta^*)$	-1.154	***	[0.138]	3.358	***	[0.190]
$\ln(y_2/q)\cdot\ln(z+\theta^*)$	-0.241	***	[0.035]	0.902	***	[0.046]
$\ln(y_3/q)\cdot\ln(z+\theta^*)$	0.065	*	[0.035]	-0.092	*	[0.047]
$\ln(w_1)\cdot\ln(z+\theta^*)$	-0.005		[0.014]	-0.017		[0.018]
$\ln(w_2)\cdot\ln(z+\theta^*)$	0.015		[0.064]	0.792	***	[0.087]
$\ln(\mathrm{NPL/L})$	0.131	***	[0.017]	0.072	***	[0.021]
$0.5\cdot[\ln(\mathrm{NPL/L})]^2$	0.137	***	[0.013]	-0.089	***	[0.016]
Observations	1654			1654		
Number of banks	122			122		
Log likelihood	577.401			177.553		

Appendix 5: Result of regression analysis (pooling OLS estimation)

	(5a)		(5b)		(5c)		(5d)	
Sample	Unbalanced panel data for 122 regional banks (2000-2014) 3 years before and after events for consolidated banks all years for never consolidated banks							
Specification	Regression (pooling OLS estimation)							
	M&A				BHC			
	Cost efficiency		Profit efficiency		Cost efficiency		Profit efficiency	
dum.M&A	**-0.03848**	***	**0.02498**	***				
	[0.0100]		[0.0083]					
dum.BHC					**0.00005**		**0.00049**	
					[0.0079]		[0.0065]	
Total assets	-0.00380	***	0.00370	***	-0.00428	**	0.00680	***
	[0.0017]		[0.0014]		[0.0017]		[0.0014]	
Market share	-0.00004		0.00020	***	-0.00015	**	0.00024	***
	[0.0000]		[0.0000]		[0.0000]		[0.0000]	
Interest	0.13764	***	-0.09683	***	0.15167	***	-0.07625	***
	[0.0244]		[0.0203]		[0.0245]		[0.0202]	
Securities	0.31892	***	0.03071		0.22970	***	0.04539	
	[0.0479]		[0.0397]		[0.0497]		[0.0409]	
Fee	-0.04155		-0.14166	***	-0.01430		-0.13827	***
	[0.0264]		[0.0219]		[0.0267]		[0.0220]	
Intercept	0.82086	***	0.90429	***	0.82333		0.88903	
	[0.0342]		[0.0284]		[0.0339]		[0.0280]	
Observations	1527		1527		1527		1527	
Adj R-square	0.07617		0.04788		0.07008		0.04031	
Sample banks	122		122		122		122	
Sample years	15		15		15		15	

Notes: Standard errors are in brackets below each coefficient estimate.

* Statistical significance at 10 percent level.

** Statistical significance at 5 percent level.

*** Statistical significance at 1 percent level.

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