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The effect of Strategic Sale of Banks:

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Abstract

We examine the effect of strategic sale—the sale of banks to strategic foreign investors—on banks' performance. The Government of Indonesia implemented such a policy as a part of bank restructuring in the aftermath of the 1998 banking crisis. Using difference-in-difference models, we find that strategic sale leads to 12%-15% cost reduction. These results are robust to the use of other estimators such as difference-in-difference matching-estimators and stochastic-frontier analysis, to that of other performance measures such as return on assets and net interest margin, and also to that of different types of samples. These suggest that strategic sale could play an important role in restructuring troubled banks in developing countries.

Keywords: banking crisis, recapitalized banks, the sale of assets, difference-in-difference models, matching estimator

JEL classification: C21, C23, G21, G28

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1 Introduction

Banking crises may lead to painful recession and slow economic recovery. They also often call for the government to recapitalize distressed banks and restructure the industry, which may cost government budget dearly.[1]

Government typically implements a mix of regulatory forbearance, loan write-offs, asset workouts subsidy, debt forgiveness, bank recapitalization, and bank sale. This policy mix could determine how soon banking industry stabilizes and banks start lending.[2] Because banking constitutes a large part of financial industry, especially in developing countries, bank restructuring would in turn affect how fast economy is recovering.

In the aftermath of the 1998 banking crisis, the Government of Indonesia implemented banking reform in which strategic sale—the sale private banks that the government takes over and then recapitalizes to strategic foreign investors—was one of the key policies. This move, like many privatization drives, drew controversy and proved unpopular. Proponents argued that, in addition to helping the government to finance budget deficit, the sale would allow foreign investors to manage the banks, and improve their performance, a lot better than the government agencies did. Opponents rebutted that foreign investors might come in only for quick financial gain. Besides, some argued that the government sold the banks at fire-sale prices; improving banks' performance first before selling them would have given the government better price offers.

We delve into this debate by empirically evaluating the effect of this strategic sale on the banks' performance. The central questions are the followings: Does strategic

[1] Bordo, et.al. (2001) estimate that on average GDP falls by more than 10%. Honohan and Klingebiel (2003) estimate that, in 40 banking crises since 1980, bank resolution costs on average 13% of the countries' GDP. Radelet and Sachs (2002) estimate that recent banking crises in several East Asian countries cost even more, from 20% to 55% of the countries' GDP.

[2] See, for example, Colomiris, Klingebiel and Laeven (2004).

sale improve banks' costs efficiency? How large is the average effect of strategic sale on the banks' costs? How does this effect evolve over time? Does strategic sale improve other measures of banks' performance such as return on assets (ROA), net interest margin (NIM), and the amount of non-performing loans (NPL)?

The focus of this paper is overcoming problems in treatment evaluation. First, we never observe counterfactuals and therefore we need to estimate them. Second, typical analysis of the effect of privatization may suffer from selection bias. Investors may "cherry pick" the most promising banks, and the government may sell only the best banks to maximize revenue and these choices may not be orthogonal to unobservable factors that affect banks' performance.

Fortunately, the circumstances of the sale and, hence, the structure of our data, to some extent, reduces this potential source of bias: The government does not systematically choose which banks it sells to maximize revenue, and investors can buy recapitalized private banks only because no other banks are for sale. Moreover, to control for time-invariant unobserved banks' characteristics that may confound identification, we use panel data and difference-in-difference models. Further, to address some potential biases in difference-in-difference models, we use generalized difference-in-difference matching estimator.

To estimate the effect of strategic sale on banks' costs, in a regression of (the logarithm of) banks' costs on a translog function of banks' outputs and prices of inputs and banks' time-varying characteristics, we introduce a dummy for banks sold to strategic investors. The coefficient of this dummy would measure the average effect of strategic sale on the performance of banks sold to strategic investors (the average effect of treatment on the treated).

Our difference-in-difference estimates show that the strategic sale reduces banks' costs, and it does so quite significant economically. On average, banks sold to

strategic investors have about 12%-15% lower costs.

The estimates of the combined difference-in-difference and matching models support this finding. Using observations in the common support, we find that the effect of the strategic sale is about 4%, although it is statistically insignificant because the number of observations shrinks considerably. However, using observations in a less-strictly-defined common support, the strategic sale is associated with 11% lower costs. A generalized kernel difference-in-difference estimator also shows similar results: Using observations in the less-strictly-defined common support, the strategic sale is associated with about 20% lower costs.

We do some robustness checks. Using a more homogenous sample of banks, i.e. large private national banks only, we find that our results are quite robust. We estimate the effect of the strategic sale using the stochastic frontier analysis, and we get similar results. The evolution of the effect of strategic sale also reveals similar pattern of cost reduction. During the acquisition quarter, we find no effect of strategic sale. However, starting from the second quarter, the performance of banks sold to strategic foreign investors improves so that by the second year they enjoy cumulative 11%-20% lower costs. We also estimate the effect of strategic sale on other performance measures using the generalized kernel difference-in-difference models. We find that strategic sale is associated with higher banks' ROA and NIM, and with a lower NPL.

Our results suggest that strategic sale improves banks' performance and, hence, could play an important role in banking restructuring.[3] There are some reasons why strategic sale improves performance. First, foreign strategic investors often bring improved banking practices—e.g. sophisticated risk management practices, and technology from their parent banks—that can boost the performance of the

[3]See also Tschoegl (2003) for a similar argument.

acquired banks.[4] Moreover, new investors may also employ better human capital which will improve banks' performance.[5]

Second, bailed-out banks may suffer from the usual problems of public enterprises, such as political intervention, inefficient corporate governance, and the lack of competitive pressure.[6] When strategic foreign investors take controls of these banks, they improve banks' corporate governance and bring in a new management team whose interests are more aligned with them. Moreover, because the banks are not in the hands of the government anymore, the banks no longer suffer from any political intervention.[7]

We are not aware of empirical studies which examine the effect of strategic sale of recapitalized banks. However, some researchers have looked at the effect of the sale of state-owned banks to strategic investors. Clarke, Cull and Shirley (2005), in a recent survey of this literature, summarize that, if the government keeps no shares of stocks in the banks, strategic sale improves banks' performance.

This paper differs from the literature in at least two respects. First, rather than relying on stochastic frontier analysis only, we use difference-in-difference and matching models to address the problems in treatment evaluation. Second, the structure of our data, to some extent, reduces potential sources of selection bias.

The paper proceeds as follows. Section 2 presents our empirical methodology. Section 3 describes our data, and Section 4 discusses our empirical results. Section 5 presents some robustness checks. Finally, Section 6 concludes.

[4] See Claessens and Lee (2002).

[5] See, for example, Buch (1997) for a discussion on the impact of foreign ownership on banks' performance in Central and Eastern Europe.

[6] See, for example, Shirley and Walsh (2000) for a survey of theoretical and empirical literature on the effect of privatization on firm performance.

[7] We may argue that these public enterprise problems plague bailed out banks at lesser degree because, unlike typical state-owned enterprises, government owns the banks for a short time only. This implies that the effect of strategic sale of state-owned banks may be larger than that of recapitalized banks we estimate here.

2 Strategic Sale of Indonesian Banks

Indonesia experienced a systemic banking crisis in 1997-1998. In the aftermath of the crisis, many of the 176 domestic banks were heavily undercapitalized. The capital adequacy ratios (CARs) of all 7 state banks were lower than -25%. Half of the regional-development banks and private national banks had its CAR lower than 4%, while one fifth of the private national banks had its CAR lower than -25%.[8]

[INSERT TABLE 1 HERE]

To resolve the crisis, the government established the Indonesian Bank Restructuring Agency (IBRA), a centralized agency that is given a mandate to handle the whole restructuring process. First IBRA categorized these banks into three categories, namely banks whose CARs were above 4%; banks whose CARs were between 4% and -25%; and banks whose CARs were less than -25% (see Table 1). Banks belonging to the first category were exempted from the restructuring program and could continue operating on the condition that their owners sufficiently increase their banks' capital. Failure to do so may lead to those banks being liquidated or taken over by IBRA.[9] Banks belonging to the second category were taken over and recapitalized by IBRA. Their assets and equities were transferred to IBRA, and in exchange for these assets and equities IBRA issued recapitalization bonds and paid interests on these bonds. Banks belonging to the third category were discontinued and their assets were liquidated. By the end of 1998, IBRA had closed down 48 pri-

[8]Private national banks are domestically owned banks, and can be categorized into *large private-national banks* and *small private-national banks*. Only the former are allowed to trade foreign currencies. Regional development banks are owned by their respective provincial government. They are similar to state banks, but are typically smaller in size. We exclude the regional development bank of Timor Timur from our sample since Timor Leste is now an independent state.

[9]IBRA's policies had not always been consistent, however. Some argue that IBRA's mishaps might actually aggravate Indonesia's banking problems. See, for example, Pangestu and Habir (2002) for the details.

vate national banks; recapitalized all 7 state banks and merged 4 of them into one; recapitalized 12 regional-development banks; and recapitalized 11 private national banks and merged 9 others into a single bank. As part of IBRA's exit strategy, some of those recapitalized banks were then sold to strategic foreign investors.

In short, to resolve the systemic banking crisis, the Government of Indonesian established an asset management institute, recapitalized banks, and sold the recapitalized banks to strategic foreign investors. The whole process of bank restructuring eventually made the government a dominant player in the banking industry. In addition to controlling all state banks, IBRA also controlled 6 previously privately owned banks. Pangestu and Habir (2002) estimated that by the end of 2000 the government owned about 85% of the third party liabilities of the Indonesian banking sector.

This banking overhaul, however, also severely strained the government budget. In the year 2000, the government had to service debt that was more than 100% of GDP and to finance a budget deficit that was more than 4% of GDP. Facing this large fiscal deficit, the government simply had to think about an exit strategy. They need to sell those recapitalized private-national banks in a timely manner so as not to strain the government budget even further.

The burden created by the fiscal deficit, and the scrutiny pressure imposed by the IMF, arguably dictated the government's decision to sell these banks to strategic foreign investors. Cherry picking by investors consequently was not ubiquitous. During the period of analysis, with an exception of one private bank, banks sold to strategic foreign investors were the recapitalized private banks only. The government did not sell its best banks to maximize revenue either. The recapitalized state-owned banks and regional-development banks were not for sale to foreign in-

vestors.[10]

3 Methodology

We evaluate the effect of strategic sale on banks' costs. The dependent variable in our analysis is the logarithm of banks' costs. The explanatory variables used in the analysis are; a strategic-sale dummy variable that equals one if the bank is sold to a strategic foreign investor and zero otherwise, a translog cost function as a control variable[11], and a vector of banks' time-varying characteristics.

3.1 Identification, Estimation Method, and Hypothesis

The coefficient of the dummy variable should capture the average effect of the strategic sale. However, identification of the average effect of the strategic sale may not be possible if the sale decision itself is not exogenous, for instance when investors "cherry pick" the most promising banks to buy. This choice may not be orthogonal to unobservable factors that affect banks' performance such as banks' reputation or banks' corporate culture. Likewise, to maximize revenue, the government may choose to sell the best banks only, and this decision may be correlated with unobservable factors that affect banks' costs. If this is the case, the correlation between

[10] The sale drew public controversies. Some members of the lower house of representative even opposed the government's decision to sell these banks. In fact, a number of times the government delayed banks' scheduled sales. However, in the end, IBRA went ahead with the sale of the recapitalized private banks to strategic foreign investors.

[11] A translog cost function can be written as follows:

$$f(\mathbf{x}_{it};\beta) = \alpha + \sum_{i=1}^{n}\beta_i \ln w_i + \frac{1}{2}\sum_{i=1}^{n}\sum_{j=1}^{n}\beta_{ij} \ln w_i \ln w_j$$
$$+\sum_{i=1}^{m}\gamma_i \ln y_i + \frac{1}{2}\sum_{i=1}^{m}\sum_{j=1}^{m}\gamma_{ij} \ln y_i \ln y_j$$
$$+\sum_{i=1}^{n}\sum_{j=1}^{m}\delta_{ij} \ln w_i \ln y_j$$

where y_i is the value of output i and w_j is the price of input j.

the strategic sale and banks' performance would be confounded by the effect of, for example, banks' intangible assets. Fortunately, the circumstances of the sale, and hence the structure of our data, to some extent, eliminates these potential sources of bias. The government simply has to sell these banks within a reasonably short period of time.

In any case, the unobservable characteristics that may confound identification are most likely those that vary across banks but fixed over time. To control for this time-invariant unobserved heterogeneity, we use panel data and difference-in-difference estimation. More specifically, we can specify the difference-in difference model as a two-way fixed effect regression model as follows:[12]

$$c_{it} = \alpha S_{it} + f(\mathbf{x}_{it}; \beta) + \gamma \mathbf{z}_{it} + \delta_i + \lambda_t + \epsilon_{it}, \tag{1}$$

where c_{it} is the logarithm of bank i's costs in period t, S_{it} is a strategic-sale dummy variable equals one if bank i in period t is owned by a strategic foreign investor and zero otherwise, $f(\mathbf{x}_{it}; \beta)$ is a translog cost function where $\mathbf{x}_{it}$ is a vector of arguments of the cost function of bank i at time t, $\mathbf{z}_{it}$ is a vector of time-varying bank i's characteristics at time t, δ_i is bank i's fixed effect, and λ_t is the time effect at time t. The banks' fixed effect would capture time-invariant characteristics unique to bank i. The time effect would proxy all common factors that affect costs of all banks in period t that are uncontrolled for in Equation (1).

[12] We write a bank's costs as a function of a vector of observable variables $\mathbf{x}$ and unobservable variable u:

$$c_{1t} = g_1(\mathbf{x}) + u_{1t} \text{ and } c_{0t} = g_0(\mathbf{x}) + u_{0t}$$

where c_{1t} is the bank's costs at time t if the bank is sold to strategic investors, and c_{0t} is the bank's costs at time t if the bank is not sold. If the expected conditional costs only differ by a constant α, that is $g_1(\mathbf{x}) = \alpha + g_0(\mathbf{x})$ and $u_{1t} = u_{0t}$, then the general difference-in-difference estimator

$$\widehat{\varphi} = E(c_{1t} - c_{1t'}|x, D = 1) - E(c_{0t} - c_{0t'}|x, D = 0)$$

reduces to α in a two-way fixed effect model, where $t\prime$ is the pretreatment period, t is the post-treatment period, and D equals one if the bank is sold to strategic investors during the period of analysis and zero otherwise.

The error term ϵ_{it} is the time-varying error, which is assumed to be distributed independently of δ_i and λ_t. However, the error term ϵ_{it} may be correlated across banks and time. To address potential biases in the estimation of standard errors, we estimate the Huber/White heteroskedasticy robust standard-errors as well as the standard errors adjusted for intragroup correlation.

Our primary interest is therefore the sign and magnitude of α, the coefficient of the strategic sale dummy. We want to compare the costs of banks that are sold to strategic foreign investors to the counterfactual, i.e. the costs of those banks if they had not been sold to strategic foreign investors. Unfortunately, we never observe the counterfactual, and thus we must estimate the counterfactual using the changes in the cost structure of banks in the control group, i.e. a comparator group consisting of recapitalized banks that are not sold to strategic foreign investors and have similar observed-characteristics, before and after the intervention. We then could interpret α as the difference between the outcomes in the treated group consisting of the recapitalized banks sold to the strategic foreign investors before and after the intervention and the corresponding changes in the counterfactual, i.e. the difference-in-difference estimate of the average effect of the strategic sale on banks' costs.

We take as our null hypothesis that, controlling for the relevant explanatory-variables, banks' costs would remain the same whether or not these banks are sold to strategic foreign investors.

Hypothesis : *The strategic sale does not affect banks' costs.*

A negative and large absolute value of α would contradict our hypothesis, implying that those banks that are sold to strategic foreign investors do experience cost reduction. A positive and large α, on the other hand, would instead suggest

that costs of those banks have increased.

3.2 Heterogeneous Treatment Effects

In Equation (1) we assume that the impact of the strategic sale is homogenous across banks. If treatment effects are heterogeneous, the difference-in-difference estimates may suffer from two additional sources of bias (Heckman, Ichimura, and Todd 1997). Firstly, bias may arise if there are no banks in the control group that is comparable to banks in the treated group, and vice versa. Secondly, bias may also arise if the distribution of vector of the observable variables that affect banks' costs in the treated group is different from that in the control group.

We eliminate these two potential sources of bias using matching estimator technique. We pair all banks sold to strategic foreign investors in the treated group with corresponding banks in the control group. Comparing banks in the treated group with banks in the control group eliminates the first bias. Re-weighting the control group observations in the estimation eliminates the second bias.

Following Rosenbaum and Rubin (1983), we match the treated and untreated banks using their propensity scores which are defined as the conditional probability of receiving treatment given observable pretreatment-characteristics $\mathbf{x}$, i.e. $P(\mathbf{x}) = \Pr(D = 1|\mathbf{x})$. Conditional on $P(\mathbf{x})$, we assume that the counterfactual outcome distribution of treated banks is the same as the observed outcome distribution of the control banks.

We estimate a logit model of the probability that a domestically owned bank is acquired by a strategic foreign investor during the period of analysis as a function of some pretreatment characteristics. We then use the logit model to predict the propensity scores, the probability that a bank will be sold to a strategic foreign investor.

We construct the common support of the distribution of $\mathbf{x}$ for the treated and control banks in two ways. Firstly, we drop observations whose propensity scores do not overlap across treated- and control groups. We call the resulting support as *Common Support 1.* Secondly, we exclude all observations whose propensity scores are higher than the maximum or less than the minimum propensity scores of the controls. We call the resulting support as *Common Support 2.* We then re-estimate the difference-in-difference model using each of these definitions of the common support.

We also estimate the average treatment effect on the treated using matching estimator. We use the generalized difference-in-difference matching estimator proposed by Heckman, Ichimura, and Todd (1997) which extends the conventional matching estimator to panel data. Hence, by controlling for the bank's fixed effect, we allow for the possibility that the selection into treatment may depend on the time-invariant unobservable variables.[13]

4 The Data

The data is taken from the quarterly financial statements of the Indonesian banking industry. Our sample period spans from the fourth quarter of 2000 to the second

[13]The Heckman's difference-in-difference matching estimators is defined as follows:

$$\widehat{\alpha} = \frac{1}{n_1} \sum_{i \epsilon I_1 \cap S_p} \left\{ (Y_{1ti} - Y_{1i'i}) - \sum_{i \epsilon I_0 \cap S_p} W_{ij} \left(Y_{0ti} - Y_{0i'i} \right) \right\}$$

where $(Y_{1ti} - Y_{1i'i})$ is a treated bank i's differences in outcome Y after and before intervention period while $\sum_{i \epsilon I_0 \cap S_p} W_{ij} \left(Y_{0ti} - Y_{0i'i} \right)$ is the weighted sum of the differences in outcome Y after and before the intervention period of banks in the control group I_0 among the common support S_p which are matched to bank i. These difference-in-differences are then averaged across all treated banks I_1 in the common support. The weights W_{ij} are

$$W_{ij} = \frac{G\left(\frac{P_j - P_i}{b_n}\right)}{\sum_{k \epsilon I_0} G\left(\frac{P_k - P_i}{b_n}\right)}$$

where $G(.)$ is a Gaussian Kernel function, P's are the propensity scores, and b_n is a bandwith parameter.

quarter of 2005. There are 132 banks in the sample. We focus only on domestically owned banks, and thus we exclude foreign-owned banks and joint-venture banks from our sample. These two types of banks were not subjected to the strategic sale, and they had already been owned by foreign investors. Domestically owned banks are composed of 35 large private national banks, 37 small private national banks, and 26 regional-development banks.[14] Some private national banks are publicly listed in the stock market. All banks sold to strategic foreign investors are large private national banks (see Table 2).

[INSERT TABLE 2 HERE]

Our dependent variable, c_{it}, is the logarithm of banks' costs. We define banks' costs as the sum of banks' operating and non-operating costs as reported in the income statements. The operating costs consist of interest expenses, general and administrative expenses, and personnel expenses. Table 3 shows the summary statistics of variables used in our analysis.

[INSERT TABLE 3 HERE]

The strategic sale dummy, S_{it}, equals one if bank i in period t is owned by a strategic foreign investor and zero otherwise. We obtain information on ownership and its evolution from the composition of shareholders reported in banks' quarterly financial statements. For some banks the information on ownership and on the sale of assets to foreign investors may not be consistently available throughout the whole period under study. Hence, for these banks we gather news about changes in their ownership structure and the sale of assets through several Indonesian newspapers. Another source of information that we use is the letters of intent of the Indonesian

[14] Later, to check for the robustness of our results, we also focus on only homogenous banks.

Government published at the IMF's website. These letters provide progress reports on the sale of some of these banks.

We use deposits, loans, and a measure of the unit price as the arguments of the cost function, $f(\mathbf{x}_{it}; \beta)$. Deposits and loans are, respectively, the sum of all type of deposits and loans reported in banks' balance sheets. Our measure of the unit price is the ratio between banks' operating costs to banks' assets. All arguments of the cost function are expressed in their logarithmic forms in our regressions. The cost function itself takes a translog form. Thus, in our regressions we express the cost function as the sum of the logarithms of deposits, loans, and the unit price, their square terms, and their interactive terms.[15]

We also include some time-varying bank characteristics, $\mathbf{z}_{it}$, that may affect banks' costs, such as banks' liquidity, non-performing loans and banks' capital adequacy ratio (CAR). They enter in our regressions as respectively, the lagged of banks' loan to deposit ratio, proportion of non-performing loans to productive assets, and banks' CAR.

5 Results

5.1 Basic Results

Table 4 presents our difference-in-difference estimates of the impact of strategic sale on the percentage change in banks' costs. Column (1) reports the estimation result obtained using a difference-in-difference model that only includes the strategic sale dummy and the time- and bank fixed effects. We find that the strategic sale is associated with 31% lower costs, and the impact is significant at 1% level.

[INSERT TABLE 4 HERE]

[15] See footnote (10) for the general form of a translog function.

However, different banks may employ different types of technology, and the choice of technology may influence the way banks reduce their costs over the period of analysis. We therefore control for banks' technology by introducing a translog cost function into our estimation. We also allow for publicly listed banks to have different intercept from non-publicly listed banks by adding a dummy variable which equals one if banks are publicly listed and zero otherwise. Similar to our previous estimation, the strategic sale lowers banks' costs by about 15% (see Column 2). Albeit smaller than the previous estimate, it still remains relatively large. It is also statistically significant at 1% level.

We further control for some observed time-varying bank characteristics that may affect banks' costs such as banks' liquidity, non-performing loans and banks' CAR. We find that the strategic sale continues to be associated with lower costs, i.e. about 12% on average, and the impact is statistically significance at 5% level (see Column 3).[16]

As is mentioned earlier, if the impact of the strategic sale is not homogeneous across banks, but instead depends on the characteristics of banks, then our estimates may be bias. To eliminate the bias we employ a generalized difference-in-difference matching estimator technique.

5.2 Difference-in-Difference Matching Estimator

To proceed, we estimate the propensity scores using a logit model of the probability that a recapitalized bank that was under the control of IBRA before the last quarter of 2000 was sold to a strategic foreign investor by the first quarter of 2001, as a function of pretreatment characteristics. We take the pretreatment characteristics to be banks' characteristics in the last quarter of 2000. In case that the data on

[16]The three additional time-varying bank characteristics however are statistically insignificant.

banks' characteristics are not available for this period, we use the first quarter of 2001 instead. We try various alternatives of pretreatment characteristics, such as; the arguments of our translog cost function and some measures of banks' pretreatment performance that include liquidity, profitability, CAR and the value of non-performing loans. However, many of these variables turn out to be statistically insignificant. In the end, we settle with a simpler Cobb-Douglass cost function as a proxy of our pretreatment characteristics.

Columns (1-3) and (5-7) in Table 5 present the results of our difference-in-difference matching estimations using only observations in the common support, i.e. either Common Support 1 or Common Support 2.

[**INSERT TABLE 5 HERE**]

In Common Support 1, the sample consists of 10 banks only, and the number of observations falls drastically to around 178. For our basic specification that includes a proxy for banks' technology and a dummy variable for publicly listed banks (see Column 2), we find that the strategic sale is associated with 4% reduction in costs, unfortunately the impact is statistically not significant. We find an almost similar result when we control our analysis for observed time-varying bank characteristics (see Column 3). Similar to our basic results presented in Table 4, these additional control variables are also statistically insignificant.

In Common Support 2, the sample consists of most observations in our original sample. For our basic specification that includes a proxy for banks' technology and a dummy variable for publicly listed banks (see Column 6), we find that the strategic sale is associated with 16% of cost reduction. When we control our analysis for observed time-varying bank characteristics (see Column 7), the cost reduction effect of the strategic sale falls to 11%. They are statistically significant at respectively

1% and 10% level.[17]

We also relax the assumption of linear relationship between the strategic sale and banks' costs by estimating the average effect of the strategic sale using semi-nonparametric matching estimators. Columns (4) and (8) in table 5 show the average treatment effect on the treated of the strategic sale on banks' costs obtained from a generalized difference-in-difference kernel matching estimator. Using observations in Common Support 1, we find that the average treatment effect on the treated is positive, although it is statistically not significant (see Column 4). Using observations in Common Support 2, however, the strategic sale is associated with 21% reduction in costs, and it is statistically significant (see Column 8).

5.3 Some Further Issues

All in all our results show that the sale of recapitalized banks to strategic foreign investors does improve banks performance, i.e. reduces banks' costs. Some caveats, however, are in order. Firstly, even though most of our estimates are statistically significant when we use observations in Common Support 2 in our regressions, they are insignificant when we use observations in Common Support 1. This is probably due to the drastic fall in our sample-size when observations in Common Support 1 are used and at the same time we have a large number of bank- and time fixed-effects in the regressions.

Secondly, our difference-in-difference estimators rely on the assumption that the change in banks' costs in the control group is an unbiased estimate of the counterfactual. The reliability of our estimates naturally depends on whether this assumption is satisfied. In other words, consistent estimation of the average treatment effect on the treated, α, in Equation (1) requires that the change in banks' costs in the

[17] Among the three additional control variables, only banks' liquidity, that is loan to deposit ratio, that is statistically significant.

control group is an unbiased estimate of the counterfactual. Consequently, we need to satisfy two underlying assumptions of difference-in-difference models, namely that the time effect λ_t are common across the treated and control groups, and the composition of the treated and control groups remains stable after the intervention.

Since we use panel data and eliminate γ_i by differencing, we satisfy the second assumption. However, we cannot directly test whether the change in banks' costs in the control group is an unbiased estimate of the counterfactual. However, we can test whether the treated and control groups have the same time effect before the intervention. If they have a common time trend before the intervention, then it is likely that when they had not been sold to strategic foreign investors they would have the same time trend after the intervention.

To formally test the common time trend assumption we estimate the following modified version of Equation (1) using only observations in the pre-intervention period:

$$c_{it} = \sum_{t=1}^{T} \theta_t D_{it} + f(\mathbf{x}_{it}; \beta) + \gamma \mathbf{z}_{it} + \delta_i + \lambda_t + \epsilon_{it}, \tag{2}$$

where D_{it} is a dummy variable equals one if bank i is eventually sold to a foreign investor during the period of analysis and zero otherwise.

[INSERT FIGURE 1 HERE]

The coefficients of interest are $\theta_t's$ which measure period t specific outcome differences between the treated- and control groups prior to the intervention. If we cannot reject the null hypothesis that $\theta_t's$ are jointly equal to zero, then the pre-treatment trends in the treated group are statistically similar to those in the control group.

Our results in Table 6 are however mixed: Even though we cannot reject the null hypothesis that $\theta_t's$ are jointly equal to zero, we also cannot reject the null hypothesis that they are jointly positive. Some individual estimates are positive

and statistically significant (see Columns 1 and 3). Individual estimates that are negative are statistically insignificant.

[**INSERT TABLE 6 HERE**]

Figure 1 shows the 95% confidence interval for the estimates of the pre-intervention time effect using the full sample. The horizontal axis shows all of the quarterly periods in our sample and the vertical axis shows the estimates of the time effect (see also Column 1 of Table 6). The estimates of the time effect are only statistically significant in the first four quarters and in the thirteenth quarter. In the other quarters, they are positive and are not statistically different from zero at 5% significance level.

These results therefore do not lend a strong support to our implicit assumption that the time effect λ_t is common across the treated and control groups during the pre-intervention period. It appears that, in some quarters, banks which were eventually sold to strategic investors had relatively higher costs. We nevertheless could still interpret our previous estimates as a lower bound of the effect of the strategic sale on banks' costs. We have shown that the strategic sale is associated with about 15% cost reduction. The actual effect of strategic sale on the reduction in banks' costs may be larger than 15%.

Finally, we can also analyze the evolution of the impact of strategic sale overtime by modifying Equation (1). We drop the strategic sale dummy and introduce quarterly dummies for the acquisition quarter and the periods thereafter. We thus have,

$$c_{it} = \sum_{m=0}^{n} \alpha_m S_m + f(\mathbf{x}_{it}; \beta) + \gamma \mathbf{z}_{it} + \delta_i + \lambda_t + \epsilon_{it}. \tag{3}$$

In which, S_m is a dummy variable equals one for banks that are owned by foreign investors and are in their m-th quarter(s) after the acquisition. The coefficient α_m captures the average effect of the strategic sale in period m after the acquisition. Each α_m would tell us what happen to banks' costs in each period: The coefficient α_0, for example, would capture the effect of the strategic sale in the acquisition quarter and α_1 would capture the effect in the subsequent quarter. Thus, all of these $\alpha'_m s$ would characterize the quarterly evolution of the effect of the strategic sale. The evolution tells us whether the cost reduction happens immediately after the banks are sold or instead few years later.

Table 7 presents our estimation results. First we include dummies for the quarters in which banks are sold and the three subsequent quarters thereafter. We find that the strategic sale can be associated with 1% cost reduction in the acquisition quarter, and respectively 5%, 8%, and 12% cost reduction in the three subsequent quarters (see Column 1).[18]

Further, when we include dummies for all quarters during the period of two years after the sale, we find that the strategic sale still contributes to the cost reduction. Over time, the effect of the strategic sale on the cost reduction evolves from 4% in the acquisition quarter to 12% by the end of the second year (see Column 2).[19]

[INSERT TABLE 7 HERE]

We find similar results when we control for banks' time-varying characteristics. Within a year after the event, the strategic sale leads to 7% cost reduction and within two years after the event it leads to 9% cost reduction.[20] When we use observations in Common Support 1, we find that within two years after the strategic

[18] The first quarter effect is not statistically significant while the others are statistically significant at 5 percent level.

[19] All dummies are now statistically significant at 5% level except for the dummy of the first quarter which continues to be statistically insignificant.

[20] For brevity, we do not provide the results.

sale there is 5% cost reduction (see Column 4), while when we use observations in Coomon Support 2 we find that the total impact is around 16% (see Column 6). The first estimate is statistically insignificant, however.

Overall, these results are in line with our previous results obtained using difference-in-difference models. During the quarter in which banks are sold to strategic investors, there is no change in banks' costs. Over time, however, banks' costs fall and by the end of the second year after the acquisition, the cost reduction could be as large as 12%-16%.

6 Robustness Checks

To see whether our results are robust to using other measures of banks' performance, we estimate the average treatment effect on the treated using among others; return on assets (ROA), net-interest margin (NIM), and the proportion of non-performing loans (NPL). We run the difference-in-difference kernel matching estimation. Table 8 presents our results.

Using observations in Common Support 1, the signs of our estimates are similar to what we expected. The strategic sale is associated with a higher ROA or NIM, and with a lower NPL (See Rows 1-3 of Table 3.7). However, these estimates are statistically insignificant.

[INSERT TABLE 8 HERE]

Using observations in Common Support 2, our estimates also have the expected signs, although, with the exception of the NPL, they continue to be statistically insignificant (see Rows 4-6 of Table 3.7). Thus, the strategic sale is associated with 1% increase in either ROA or NIM, and 3.5% decrease in the NPL.

Next, we consider a more homogenous sample by focusing on private banks

only. We re-estimate Equation (3.2) using both the basic difference-in-difference estimation and the difference-in-difference matching estimation.

[**INSERT TABLE 9 HERE**]

Table 9 presents the results. Overall, we find that our results are quite robust. The strategic sale is associated with 8%-12% cost reduction.

Finally, we estimate the effect of strategic sale on banks' cost efficiency using the standard frontier analysis. We first assume that the technology is time invariant, and then subsequently we relax this by assuming that the technology is time variant.[21] We present some of the results in Table 10.

[**INSERT TABLE 10 HERE**]

In all specifications, we find that the strategic sale is associated with 15%-35% lower costs. When we use observations in Common Support 1 only, the estimate of the effect of the strategic sale is statistically significant at 1% level.

7 Concluding Remarks

We have shown that, after overcoming problems in treatment evaluation, strategic sale of banks in developing countries like Indonesia improves banks' performance.

Economically, the cost reduction is quite large, both right after the banks are sold and over time since then. Our basic results show that, on average, strategic sale is associated with 12-15% lower costs. These results are robust to other estimators such as combined matching and difference-in-difference, generalized difference-in-difference kernel matching, and stochastic frontier analysis. They are robust too to different types of samples. We also find that strategic sale is associated with the improvement in the other measures of banks' performance such as ROA and NIM.

[21] We use the Batesse and Coelli (1995)'s stochastic frontier models.

We therefore argue that the sale of recapitalized banks to strategic foreign investors plays an important role in banking restructuring in developing countries.

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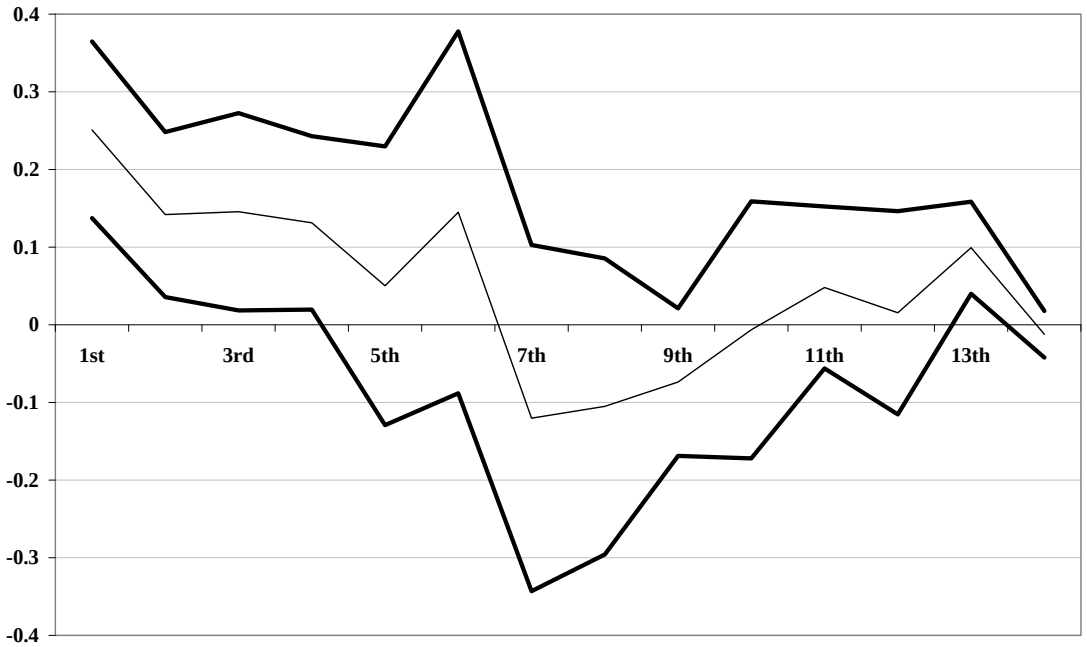

Figure 1: The 95 Percent Confidence Interval of Preintervention Time Effects

Bank types	No. of banks	CAR			Restructuring methods			
		>4%	(-25%, 4%)	<-25%	Closed	Recapitalized…		Merged
						by gov't	by owners[1]	
State	7			7		7		4
Regional development	27	13	10	4		12		
Private national	142	72	40	30	48	4	7	9

Note: This table is adapted from Box 4 of Pangestu and Habir (2002). [1]Owners of these banks injected new capital; the government supplemented them.

Table 1: Indonesia's Bank Restructuring

Ownership	Number of banks
State owned	5
Large private national	35
Always domestically owned	*29*
Sold to strategic investors	*6*
Small private national	37
Regional development	26
Joint venture	18
Foreign owned	11
TOTAL	132

Table 2: Ownership of Banks, 2000-2005

	Observations	Mean	Standard Deviation
ln(Cost)	2,408	11.21	1.78
S	2,618	0.02	0.14
ln(Loan)	2,501	13.28	1.88
ln(Asset)	2,509	14.11	1.78
ln(Deposit)	2,488	13.76	1.86
ln(Price)	2,408	-3.96	0.78

Table 3: Summary Statistics

Dependent variable: ln(cost)			
	Full Sample		
	(1)	(2)	(3)
Strategic sale	-0.31	-0.15	-0.12
	(0.06)	(0.05)	(0.06)
Public bank dummy	No	Yes	Yes
Translog cost function	No	Yes	Yes
Time-varying characteristics	No	No	Yes
Observations	1,885	1,870	1,682
R^2	0.07	0.98	0.98

Note: All regressions include time and bank fixed effects. Robust standard errors are in parentheses.

Table 4: Basic Results

Dependent variable: ln(cost)								
	Using obs. in Common Support 1				**Using obs. in Common Support 2**			
	Difference-in-difference			**Kernel**	**Difference-in-difference**			**Kernel**
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Strategic sale	-0.02	-0.04	-0.03	0.13	-0.30	-0.16	-0.11	-0.21
	(0.08)	(0.04)	(0.05)	(0.13)	(0.07)	(0.06)	(0.06)	(0.12)
Public bank dummy	No	Yes	Yes	-	No	Yes	Yes	-
Translog cost function	No	Yes	Yes	-	No	Yes	Yes	-
Time-varying characteristics	No	No	Yes	-	No	No	Yes	-
Observations	178	178	161	58	1,764	1,764	1,603	1,670
R^2	0.28	0.94	0.95	-	0.08	0.98	0.98	-

Note: All regressions include time and bank fixed effects. Robust standard errors are in parentheses. Standard errors for the kernel matching estimates are bootsrapped standard errors with 100 replications.

Table 5: Difference-in-difference and Kernel Matching

Dependent variable: ln(cost)			
	Full Sample	**Common Support 1**	**Common Support 1**
	(1)	(2)	(3)
Quarter 1	0.25	-0.13	0.25
	(0.06)	(0.10)	(0.06)
Quarter 2	0.14	-0.20	0.15
	(0.05)	(0.08)	(0.06)
Quarter 3	0.15	-0.15	0.16
	(0.06)	(0.14)	(0.07)
Quarter 4	0.13	-0.10	0.15
	(0.06)	(0.10)	(0.05)
Quarter 5	0.05	-0.12	0.05
	(0.09)	(0.09)	(0.10)
Quarter 6	0.15	-0.08	0.15
	(0.12)	(0.04)	(0.11)
Quarter 7	-0.12	-0.17	-0.11
	(0.11)	(0.07)	(0.12)
Quarter 8	-0.11	-0.23	-0.09
	(0.10)	(0.12)	(0.10)
Quarter 9	-0.07	-0.21	-0.06
	(0.05)	(0.06)	(0.06)
Quarter 10	-0.01	-0.12	-0.02
	(0.08)	(0.11)	(0.09)
Quarter 11	0.05	-0.03	0.06
	(0.05)	(0.09)	(0.05)
Quarter 12	0.02	-0.03	0.04
	(0.07)	(0.10)	(0.06)
Quarter 13	0.10	0.13	0.12
	(0.03)	(0.05)	(0.04)
Quarter 14	-0.01	0.00	-0.02
	(0.02)	0.00	(0.02)
Quarter 15	0.00	0.04	0.00
	(0.00)	(0.02)	(0.00)
Observations	1,825	133	1,732
F-statistics	30.32	9.89	54.89
	[0.00]	[0.00]	[0.00]
R^2	0.94	0.98	0.95

Note: All regressions include public bank dummy, translog cost function as well as time and bank fixed effects. Robust standard errors are in parentheses.

Table 6: Common Time-trend Assumption

Dependent variable: ln(cost)						
	Full Sample		Using obs. in Common Support 1		Using obs. in Common Support 2	
	(1)	(2)	(3)	(4)	(5)	(6)
Acquisition quarter	-0.01	-0.04	0.05	0.03	-0.02	-0.05
	(0.04)	(0.04)	(0.05)	(0.06)	(0.05)	(0.05)
One quarter later	-0.05	-0.08	0.00	-0.01	-0.07	-0.10
	(0.02)	(0.03)	(0.03)	(0.04)	(0.03)	(0.04)
Two quarters later	-0.08	-0.11	-0.04	-0.06	-0.11	-0.14
	(0.05)	(0.06)	(0.05)	(0.06)	(0.06)	(0.07)
Three quarters later	-0.12	-0.15	-0.08	-0.09	-0.15	-0.19
	(0.04)	(0.06)	(0.05)	(0.06)	(0.05)	(0.06)
Four quarters later		-0.12		-0.03		-0.17
		(0.06)		(0.06)		(0.05)
Five quarters later		-0.11		-0.06		-0.17
		(0.05)		(0.07)		(0.04)
Six quarters later		-0.14		-0.03		-0.20
		(0.05)		(0.05)		(0.04)
Seven quarters later		-0.12		-0.05		-0.16
		(0.05)		(0.05)		(0.06)
Observations	1,870	1,870	178	178	1,764	1,764
R^2	0.94	0.94	0.98	0.98	0.95	0.95

Note: All regressions include public bank dummy, translog cost function as well as time and bank fixed effects. Robust standard errors are in parentheses.

Table 7: The Effect of Strategic Sale Overtime

	Outcome		Average Treatment on the Treated	
Using obs. in Common Support 1	ROA	(1)	0.19	(2.78)
	NIM	(2)	0.24	(1.16)
	NPL	(3)	-3.81	(5.79)
Using obs. in Common Support 2	ROA	(4)	0.98	(1.12)
	NIM	(5)	0.95	(0.95)
	NPL	(6)	-8.60	(3.36)

Note: Standard errors for estimates using observations in Common Support 2 are bootsrapped standard errors with 100 replications.

Table 8: Matching with Other Performance Measures

Dependent variable: ln(cost)						
	Full Sample		**Using obs. in Common Support 1**		**Using obs. in Common Support 2**	
	(1)	(2)	(3)	(4)	(5)	(6)
Strategic sale	-0.12	-0.11	-0.08	-0.08	-0.09	-0.09
	(0.05)	(0.06)	(0.05)	(0.05)	(0.05)	(0.06)
Time-varying characteristics	No	Yes	No	Yes	No	Yes
Observations	1,345	1,254	124	124	647	596
R^2	0.95	0.96	0.97	0.97	0.95	0.96

Note: All regressions include public bank dummy, translog cost function as well as time and bank fixed effects. Robust standard errors are in parentheses.

Table 9: More Homogenous Samples

Dependent variable: ln(cost)						
	Full Sample		**Using obs. in Common Support 1**		**Using obs. in Common Support 2**	
	(1)	(2)	(3)	(4)	(5)	(6)
Strategic sale	-0.29	-0.22	-0.36	-0.15	-0.35	-0.28
	(0.06)	(0.05)	(0.05)	(0.04)	(0.06)	0.28
Time invariant inefficiency	Yes	-	Yes	-	Yes	-
Time variant inefficiency	-	Yes	-	Yes	-	Yes
Observations	1,870	1,870	178	178	1,764	1,764

Table 10: Stochastic Frontier Analysis