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Abstract

In this paper, we utilize stochastic frontier analysis to estimate the impact of the regulations and institutions on bank efficiency through analyzing 389 savings and commercial banks in 11 Asian countries during the period 2000-2012. We find that activity restriction, capital requirement, official supervisory and private monitoring have a positive impact on bank performance. Furthermore, a wholesome institutional environment with powerful government, low corruption and strict law can enhance bank inefficiency. Our results suggest that banking regulations can improve bank performance with high quality of the institutional environment.

Key words: Bank efficiency, regulations, institutions.

JEL Classification: G21, P34, P52.

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1. Introduction

Recently, there have seen a significant increase in the number of financial regulations in the world and the standards for supervisions are more strict than it used to be, since the international financial crisis in 2007 brought huge destruction to financial markets. Thus, a large majority of countries strengthens regulations and supervisions on the banks' activities meanwhile Basel Committee efforts to modify new regulations have gained space. There is an extended that Barth et al., (2004) Pasiouras et al., (2009) and Demirgüç-Kunt et al (2008) analyze the effect of a range of regulations and supervisions related to bank performance, and also investigate the bank's soundness. Similarly, Beck et al., (2006) examined the effect of regulations on the banking industry and particularly the impact of the crisis as well as risk. However, a consensus on how specific regulations influence bank performance under certain institutional environment has not been reached. Therefore, in this paper, we will fill a gap by examining the relationship between regulations, bank efficiency and institutions in Asia.

With the spread of liberal ideology of the Washington consensus, many countries in East Asia, has been reducing restrictions on capital account transactions and barriers to entry of foreign financial institutions into local markets so as to expand financial services since 1990s. Nevertheless, during the 1997-1998 period, a huge number of Asian countries faced financial disasters and their national economies were hit hard. For example, Japanese lending and FDI to other Asian countries fell dramatically at that time. Therefore, these Asian countries were motivated by their desire to construct effective and stable financial system as well as international regulations in order to prevent future crises. After this financial disaster, Asian countries decreased restrictions for foreign institutions' entry for the sake of improving economic recovery and development. Furthermore, major Asian countries opted for financial liberalization and monetary integration in East Asia. They made considerable progress in deregulation their domestic stock market and financial

sectors such as banks. The Association of Southeast Asian Nations is a good example for driving the economic boom and pursuing stable financial system. Similarly, China reduced restrictions for foreign banks' entry and enforced shareholding system in local banks step by step. Therefore, we select 11 Asian countries as our database which can represent almost whole Asian economic situation and bank performance.

As trade liberalization and economic globalization in Asia, the progress focused on regulation and supervision is enhanced in order to ensure sustainable economic development. Obviously, banks which are main financial intermediaries particularly in transition countries bear the restrictions of regulation primarily. Prior studies, such as Bonin et al (2005), Berger et al (2006), Yildirim and Philippatos (2007), Brissimis et al (2008) and Mamatzakis et al (2008), put forward views that rigorous supervisions may benefit bank performance, but all of them focus on European countries. While a relatively low number of researches analyze the relationship between bank performance, regulations and institutions. Thus, this paper will answer the question whether regulations and institutions can bring impact on bank performance by placing the spotlight on the sample of Asian countries.

The previous studies, like Bonin et al., (2005), Beck et al., (2006), Carbo et al., (2009), and Pasiouras et al., (2009), do provide some opinions for the relationship between regulations and bank performance but they have not reached a consensus and do not consider the impact of institutions. When analyzing data, we opt for stochastic frontier analysis (SFA) rather than data development analysis (DEA), in contrast to the study of Barth et al., (2002), which mainly use financial ratios for evaluating bank performance.

All in all, the purpose of this paper is to show how bank performance they are, through using the SFA model. Furthermore, it will further answer what the connection between regulations, bank performance and institutions is in Asian countries. Finally,

through applying the scientific research approach for estimating the relation, we can give some suggestions to improve the banking sector and to promote their performance in the future.

The rest of this paper is structured along the following lines. Section 2 provides a brief literature review for the related studies. Section 3 discusses the methods used to estimate bank efficiency and to examine the relation between regulations, bank performance and institutions. Section 4 presents the explanatory variables used to investigate the relationship. Section 5 analyses the empirical results, Section 6 eliminates endogenous problems and Section 7 concludes.

2. Brief literature review

2.1 Studies on Regulations

To begin with, we provide theoretical evidence to estimate whether the regulations related to Basel can improve bank performance by discussing early literatures. The studies closer to our paper are those of Beck et al., (2006) and Pasiouras et al., (2009). Their results indicate that appropriate financial regulation and supervision may enhance banking performance and ensure a stable financial system. The prudential regulations, according to their opinion, are deemed by policy marker to be an important tool to guarantee the soundness of the financial system and effectively promote banking performance. However, Barth et al., (2004) consider that the relationship between banking efficiency and supervisory power is not significant because high levels of non-performing loan leads to low level of governance. Moreover, they also indicate that there is no evidence that regulation can prevent banking crises even though regulation can improve supervision. Therefore, our study will further proof the positive effect of regulations on bank performance in order to make a consensus towards their connection.

This paper involves four regulatory variables activity restriction (ACTR), capital requirement (CAPR), power of the supervisory agency (SPR) and private monitoring

(PMON), whose impact on bank efficiency have not reached a consensus according to earlier studies. Therefore, our hypothesis is that whether the regulations of ACTR, CAPR, SPR and PMON can improve bank performance. It is obvious that Basel Ⅱ type regulation can affect aspects of a bank's performance, such as efficiency, soundness and risk-taking. Except the ACTR values, the specific regulations of concern in this paper relate to restrictions, including the three pillars of Basel Ⅱ, such as capital requirements (pillar 1), official supervisory power (pillar 2) and market discipline (pillar 3). Barth et al., (2004) and Demirgüç-Kunt et al (2008) find that banking performance and stability are influenced negatively by activity restrictions (ACTR) because banks would like to engage in a broad range of activities to generate more funds. Furthermore, banks may be allowed to consolidate on the exploitation of economies of scale and scope by giving fewer regulatory restrictions. However, Pasiouras et al., (2009) argue that if banks engage in diverse activities such as securities underwriting, real estate investment and insurance underwriting, it may create the conflicts of interest with their fundamental business. Additionally, less regulatory restrictions may lead to moral hazard problems so that managers are willing to exchange private information and conduct insider transactions. Therefore, our paper expects that activity restrictions can improve bank efficiency.

For the regulations of capital asset requirement, VanHoose (2007) argues that this standard of regulations may influence bank efficiency. First of all, restrictive capital requirements may affect the quality and quantity of lending because banks may have less deposit for making loans. Secondly, it will bring impact on the decision of banks in allocating their asset portfolios. Finally, it may affect the decision of banks for attacking their sources of funds and large requirements may also generate cost or opportunity cost to banks. Nevertheless, Pasiouras et al., (2009) indicate that restrictive capital requirement can lead to higher levels of bank capital, which can help banks to reduce risk on activities and cope with financial recession. Implementing activity restrictions for banks will influence banks to expand services

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and profitability by hindering sources of funds. As a result, our hypothesis is that high level capital requirement can enhance bank efficiency by reducing the probability of the financial crisis.

Some literatures such as Djankov et al (2002), shows that the supervisory agencies' power (SPR) may have the negative influence on bank performance. Firstly, powerful supervisors may use their right to make benefit for themselves, such as attracting campaign donations and extracting bribes. By the contrast, Barth et al., (2004) and Pasiouras et al., (2009) suggest that supervisory agencies may help banks avoid the market crisis by effectively regulating and disciplining. Generally, private monitoring (PMON) may also bring negative impact on bank performance, for example, private monitoring may relate to corruption and hinder bank's operations. However, Demirgüç-Kunt et al (2008) find that the private monitoring may assist efficient corporate finance and improve the lending of banks. Thus we anticipate that powerful agency and private monitoring have a positive impact on bank performance. In brief, a consensus on the relationship between regulation and banking performance has not been reached and still exists different opinions in above literatures.

2.2 Studies on institutions

Although above researches definitely discover the relationship between regulation and banking performance, the impact of quality of the institution is not considered. Our paper will consider the function of institutions such as governance effectiveness, control of corruption and rule of law, expecting that a sound quality of institutions may enhance bank performance. The recent studies of Barth et al., (2004), Beck et al., (2006) and Pasiouras et al., (2009) do estimate and compare bank performance to decide whether to lease restriction or implement regulation but they ignore the significant impact of quality of institutions. On the contrary, Delis (2012) discovers that quality of institutions is a critical character in shaping the relationship between financial reforms and bank performance, emphasizing that with advanced institutions,

financial liberalization policies can reduce the market power of banks in developed countries. It is not unreasonable that regulation which is one of financial policies as well, associates with institutions to play a role of the tide in financial market to raise and lower the banking ships. Similarly, early empirical studies such as Demirgüç-Kunt et al (2008) support that better institutional quality at the country level decreases the probability for a country to experience banking crises.

In our paper, institutional variables such as governance effectiveness, rule of law and control of corruption, are treated as complements with regulation and supervision, due to these variables can further embody the effect of regulation on bank performance. In a word, the advanced institutional characteristics are important prerequisites for regulations to have a strong impact on bank performance.

2.3 Studies on Bank Performance

Our study relates to some literatures which estimates the performance of banks. For example, the study of Brissimis et al (2008) examines bank performance by investigating efficiency, productivity growth and net interest margin, and mainly focuses on impact of banking sector reform among European countries. Similarly, Delis et al (2011) also analyses banking performance through estimating the total factor productivity growth, but the aim of Brissimis et al (2008) is to examine whether banking industry reform influences banking efficiency. Furthermore, other studies also contribute to the analysis of banking performance, but all of them choose EU member as an object, such as exploring the impact of ownership and privatization on bank efficiency (Bonin et al 2005 and Berger et al 2006), and efficiency convergence (Mamatzakis et al 2008). It is obvious that analysis of banking performance related to regulation is an original field for us to explore, in terms of increase of Asian economic status.

On the basis of Pasiouras (2008) result, he combines regulation and supervision

measures to estimate technical efficiency of banks. Similarly, Barth et al (2004) uses an approach of data development analysis to observe banks operation and concludes that strict supervision and capital reserve standards may be affected by banks' technical efficiency. However, Pasiouras et al (2009) indicates that cost efficiency is a wider concept than technical efficiency because it refers to both technical and allocative efficiency. Meanwhile, he also suggests that the method of stochastic frontier analysis (SFA) is better than the approach of data development analysis (DEA), due to it can allow us to distinguish between inefficiency and other stochastic shocks in the estimation of efficiency scores. In addition to this, our sample selects panel data rather than cross-section data, which is more suitable for the efficiency frontier method. When compared to these studies Pasiouras et al (2006) and Demirgüç-Kunt et al (2008) which mainly employ general methods and financial ratio as indicators of performance, we estimate bank efficiency by applying the efficient frontier method. The reason why the efficient frontier approach is superior is that it can simultaneously account for relevant inputs and outputs of a bank, as well as for differences in the input prices (Pasiouras et al 2009).

3. Data description

3.1 Examination of inefficiency

3.1.1 Inputs-Outputs

For estimating bank efficiency, we use data on the bank-level variables from BankScope and select the information from 11 Asian countries on closing to 389 commercial and saving banks. In terms of the time span of the database, we coverage data as comprehensive as possible for each country, country-specific variables are available for researching. We use the data from the 2000-2012 periods and all of them are reported in $US. Since applying intermediation approach, we will use two inputs and two output variables to examine bank efficiency. As above-mentioned, inputs include price of labor that is calculated by personnel expense, and price of financial capital that is measured by the total interest expense. Personnel expense can reflect the labor cost while interest expense to interest bearing funds can represent the

financial leverage. Equity is utilized as fixed netput, and we use GDP per capital as a control variable to distinguish each country's economy. Table 1 presents the mean values for estimating bank inefficiency and there have 2398 observations.

Table 1

Summary statistics of the variables used in estimating bank inefficiency

	Variable	Mean	St. dev.	Min.	Max.
Variables used to estimate bank inefficiency	Total cost (TC)	1.645	5.492	0.0005	72.89
	Price of labor (P1)	0.011	0.009	0.0002	0.147
	Price of financial capital (P2)	0.060	0.146	0.0001	4.740
	Net loan (Q1)	26.35	100.4	0.0005	1364.6
	Other earning assets (Q2)	23.06	126.7	0.001	2273.5
	Equity (N)	3.34	12.62	0.0033	179.4
	GDP per capital	11506.4	14245.42	1553.6	60800.9

Notes: The table reports summary statistics (mean, standard deviation, minimum and maximum) for the variables used in estimating bank inefficiency. Units of the variables are as follow: GDP per capital; Total cost, Net loan, other earning assets, equity is in $ millions expressed; price of financial capital and the price of labor are ratios.

3.2 Determinant of inefficiency

3.2.1 Regulatory variables

Table 2

Summary statistics of the variables used in determining bank inefficiency

	Variable	Mean	Std. Dev.	Min	Max
Regulatory variables	ACTR	8.52	2.23	3	12
	CAPR	6.84	1.65	3	10
	SPR	11.07	2	7	16
	PMON	8.72	1.25	6	11

Notes: The table reports summary statistics (mean, standard deviation, minimum and maximum) for the variables used in determining bank inefficiency. Units on the variables are activity restrictions, capital requirement, power of the supervisory agencies and private monitoring.

To examine the impact of the regulatory variables on inefficiency while controlling for country-specific characteristics, RE_{tc} in Eq. (3) includes four regulatory variables such *ACTR, CAPR* and *SPR, PMON*. This information on regulations are obtained from database which is updated by Čihák et al (2012) in World Bank to provide regulatory responses to a broad of questions. While some missing data are estimated

in half value of each standard in terms of their national policy. $IE_{t,c}$ which is received from World Bank, is a variable to reflect the condition of institutional environment; Similarly, from World Development Indicators, we also obtain the variables of $M_{t,c}$ for controlling the macroeconomic environment while $B_{i,t,c}$ in equation (2) is a control variables acquired from BankScope for representing individual bank characteristics.

ACTR indicates the level of restrictions on the banks' activities. It can take values between 3 and 12 with higher values indicating higher restrictions. It includes three standards for evaluating the values such as securities, insurance and real estate activities, and it's four levels for evaluating is unrestricted (=1), permitted (=2), restricted (=3) or prohibited (=4). Thus the final assessment for ACTR is the summation of the values of securities, insurance and real estate activities.

CAPR is an indicator of capital requirements, accounting for both overall and initial capital stringency. For the overall capital stringency, it determines whether the capital requirement reflects certain risk elements and deducts certain market value losses from capital before minimum capital adequacy. In the second stringency, it indicates whether certain funds may be used to initially capitalize a bank and whether they are officially. CAPR can take values between 0 and 10 with higher values, suggesting a greater stringent capital requirement.

SPR is a measure of the power of the supervisory agencies and its values with greater values indicates more power of supervisions. It is examined on the basis of the answers and the aim of this measurement is to discover whether the supervisory authorities have the authority to take specific actions to prevent and correct problems. It also means to indicate whether supervisors can change the internal organizational structure of the bank and take some specific disciplinary action against bank management and directors, shareholders and bank auditors (Pasiouras et al 2009).

PMON is an index of market discipline that takes values between 0 and 12. It indicates whether there incentives for the private monitoring of firms, with higher values indicating more private monitoring. This standard includes whether subordinated debt allowable as part of capital, whether off-balance sheet items are disclosed to public and whether bank regulators are required to make public formal enforcement actions, which include cease and desist orders and written agreements between a bank regulatory body and a banking organization. Thus, higher values suggest higher disclosure requirements and more incentives to increase private monitoring.

3.2.2 Institutional variables

Table 3

Summary statistics of the variables used in determining bank inefficiency					
	Variables	Mean	Std. Dev.	Min	Max
Institutional variables	Governance effectiveness	0.25	0.74	-0.81	2.43
	Rule of law	-0.01	0.79	-0.98	1.81
	Control of corruption	-0.16	0.94	-1.13	2.42

Notes: The table reports summary statistics (mean, standard deviation, minimum and maximum) for the variables used in determining bank inefficiency. Units of the variables are institutional variables, such as political stability, governance effectiveness, rule of law and control of corruption.

Table 3 show the institional variables which is database coverd by Abiad et al (2010) who shows the new databse about institional environment. The variable in $IE_{t,c}$ in equation (3) corresponds to a number of indices which evaluate institutional quality in the countries examined. According to beck et al., (2006) and barth et al., (2009), we use three indexes obtained from World Bank to reflect institutional environment, such as governance effectiveness, rule of law and control of corruption. All of them take values between -2.5 and 2.5 with higher values reflecting greater institutional quality. For the *governance effectiveness*, it represents the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and

the credibility of the government's commitment to such policies. The variable *rule of law*, in turn, reflects perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence. It also means that it is an assessment of law quality, with higher values representing the greater quality of the judicial system but lower ratings indicating inferior enforcement. Finally, the variable *control of corruption* reflects perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption. Choosing this variable is relevant for our paper, due to corruption usually make markets less efficient and generates networking effects Delis (2012). At the same time, the research of bect et al., (2006) also support this idea that strict supervision of corruption can increase transparency of a bank, which can bring positive effect on bank performance. Therefore, analyzing data of *control of corruption* is aiming to ensure a well institutional condition and prevent moral hazard. Similarly, Lensink et al., (2008) indicate that the ono-high income countries about the impact pf foreign on efficiency depends on the quality of institutions, which means that the high quality of institutional envirornment positively affect efficiency of foreign banks.

3.2.3   Control variables

Table 4 shows the control variables. In the equation (3), we control for a number of macroeconomic and bank-specific variables which can bring impact on the bank performance. Thus, for representing the macroeconomic environment and monetary conditions, we use variables *GDP growth*, *inflation, domestic credit to private sector* and *unemployment rate* as control variables which are obtained from World Development and International Monetary Fund indicators. Since all data are described in $US, the variable *GDP growth*, *inflation* and *unemployment rate* can represent countries' characteristics respectively, while domestic credit to the private sector as a share of GDP represents the level of development of the financial sector.

Table 4

Summary statistics of the variables used in determining bank inefficiency

	Variables	Mean	Std. Dev.	Min	Max
Institutional variables	Inflation %	5.12	0.04	-3.06	20.3
	GDP %	6.03	0.03	-5.53	14.78
	Unemployment rate %	5.89	2.48	0.66	11.83
	Private sector credit (% of GDP)	77.67	52.06	16.9	219.28
Bank-specific variables	Bank Size	9.68	0.92	6.76	12.45
	Fee income	0.0065	0.003	0.0002	0.245
	Liquidity	0.22	0.16	0	0.96
	Non-performance loan	0.02	0.04	0	1.5
	Equity to asset	0.11	0.09	0	0.85

Notes: The table reports summary statistics (mean, standard deviation, minimum and maximum) for the variables used in determining bank inefficiency. There are Macroeconomic variables and individual bank characteristic variables. Bank size is the log of variables while ratio of liquidity, ratio of fee income and non-performance to total asset are simple ratios. GDP growth, Private sector credit and inflation are in % terms.

The second control variables which are obtained from BankScope, are used for reflecting individual bank characteristics. We use the natural logarithm of total assets to represent *bank size* and the ratio of total equity to total assets to control *bank capitalization*. Delis (2012) points out that large and well-capitalized banks are probably able to have access to a cheaper source of funds, due to scale economies, informational asymmetries and moral hazard issues. Furthermore, large banks can play an effective role of institutions in enhancing effectiveness and may have a positive impact on cost efficiency. Therefore, this control variable can discover distinctly banks characteristics on the certain regulations. Additionally, the *fee income* which equals non-interest operating income divided by total assets, is considered as a control variable as well, because this difference may affect the pricing of loan products. Thus, the variable *fee income* is one of the main factors for assessing the impact of regulations, bank performance and institutions. In addition to, we use the ratio of *liquid assets to total assets* to represent bank liquidity for controlling the differences in bank assets. As can be seen that banks with high levels of liquid assets

in cash and government securities may receive lower interest income than banks with less liquid assets. We also choose the variable *non-performance loan to total asset* which is a proxy for default risk, to reflect individual banks' characteristics as well. Finally, the ratio of equity to total asset used to determine the financial health and long-term profitability of a bank. Therefore, it may have a negative effect on cost efficiency because it may generate additional expenses, such as labor costs and storage costs.

4. Methodology

4.1 Estimating Cost Inefficiency

In this study, we use the stochastic frontier analysis (SFA) methodology to examine bank cost inefficiency. According to Aigner et al (1977), the main advantage of employing SFA approach is that both error and inefficiency are incorporated in a composite error term. This method allows us to estimate a global frontier while accounting for cross- country differences. The general model for examining the cost frontier can be written as follows:

$$\ln C_{i,t} = f(P_{i,t} Q_{i,t} N_{i,t} Z_{i,t}) + v_{i,t} + u_{i,t} \qquad i = 1,2, \dots, N; t = 1,2, \dots, T \qquad (1)$$

Where $C_{i,t}$ the total cost for bank i at year t; $P_{i,t}$ is a vector of inputs; $Q_{i,t}$ denotes a vector of values of outputs, $N_{i,t}$ is a vector of fixed netputs while $Z_{i,t}$ is a vector of control variables. The term $V_{i,t}$ is symmetric error and represents that management of a bank cannot deal with this random fluctuation. $U_{i,t}$ captures the effects of inefficiency relative to the stochastic cost frontier and it is assumed to be independently distributed in one-side, meaning that this effect has potential to enhance the costs of banks over the best-practice level. It is obvious that examining bank cost function requires the data on input prices instead of input quantities and the information on the extra cost of allocative inefficiency. We use the translog specification which results in an empirical cost frontier model:

$$\ln C_{i,t} = \alpha_0 + \sum_i \alpha_i \ln P_{i,t} + \sum_i \beta_i \ln Q_{i,t} + \frac{1}{2} \sum_i \sum_j \alpha_{ij} \ln P_{i,t} \ln P_{j,t}$$

$$+ \frac{1}{2} \sum_i \sum_j \beta_{ij} \ln Q_{i,t} \ln Q_{j,t} + \sum_i \sum_j \delta_{i,t} \ln P_{i,t} Q_{j,t} + \sum_i \varphi_i \ln N_{i,t}$$

$$+ \frac{1}{2} \sum_i \sum_j \xi_{i,j} \ln P_{i,t} \ln N_{j,t} + \sum_i \sum_j \delta_{i,j} \ln Q_{i,t} \ln N_{j,t} + \sum_i \varepsilon_i \ln Z_{i,t}$$

$$+ v_{i,t} + u_{i,t} \tag{2}$$

In terms of the cost frontier model, not only the restrictions of standard liner homogeneity and symmetry are imposed in our paper, but also we consider the time and country effects. As above-mentioned, concerning the specification of the efficient frontier, we decide the bank's total cost (C), which is calculated as total expense (non-interest expenses plus interest expenses), as the dependent variable. Thus, following Sealey and Lindley (1997), we choose two outputs which include loans (net of provisions) and other earning assets (government securities, bonds, investment, CDs and T-bills). Furthermore, consistent with previous studies of bank efficiency, we select the following two inputs: price of labor (P_1), calculated as the ratio of personnel expense to total assets; price of financial capital (P_2), calculated as total interest expense to total interest bearing borrowed funds. As can be seen that equity is an alternative funding for a bank and it has potential to affect the bank's cost. Following Berger and Mester (1997) idea, we use equity of each bank in the model as a fixed netput (N) to control for differences in risk preferences[3]. In analyzing the efficiency frontier in a cross-country sample is crucial to apply variables which can capture country-level heterogeneity so that GDP per capital may be an indicator of the dynamism of each economy.

4.2 Determinants of inefficiency

This methodology of analysis uses the cost inefficiency scores to estimate the

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[3] If shareholders have more capital at stake with higher equity capital, they may behave in more risk averse manner than firms with lower level of equity. Additionally, the constant value (equity) can make all bank's profit to positive, because some banks may have negative profit.

impact of regulations and the quality of institutions in Asian 11 countries, using as control variables macroeconomic conditions and the bank characteristics. The general empirical model used to examine the relation between bank performance, regulations and institutions are the following:

$$Ineffi_{i,t} = b_0 + b_1 RE_{tc} + b_2 IE_{t,c} + b_3 M_{t,c} + b_4 B_{i,t,c}$$
$$+ \varepsilon_{i,t,c} \qquad\qquad (3)$$

In this equation, $Ineffi_{i,t}$ which is calculated by the cost frontier model (the equation 2) is the value of the inefficiency of bank i at time t in country c; RE_{tc} is the regulation variable, and measures the overall quality of supervision for financial markets in country c at time t; $IE_{t,c}$ is a set of variables representing the conditions of the institutional environment in country c at time t; $M_{t,c}$ is a set of variables reflecting the macroeconomic conditions in country c at time t; $B_{i,t,c}$ is a set of variables representing individual bank characteristics; and $\varepsilon_{i,t,c}$ is the error item. We run the regressions by pooling OLS using robust standard errors[4].

4.3 The Dynamic Panel Model

For the sake of further examining the impact of regulations and institutions on the inefficiency of Asian banks, we use a dynamic panel model to eliminate the potential endogenous problem by employing instrumental variables. Therefore, we choose the Arellano and Bover (1995) approach to and the equation is following:

$$Ineffi_{i,t} = b_0 + Ineffi_{i,t-1} + b_1 RE_{tc} + b_2 IE_{t,c} + b_3 M_{t,c} + b_4 B_{i,t,c} + \varepsilon_{i,t,c} \qquad (4)$$

In this equation, $Ineffi_{i,t}$ is value of the inefficiency of bank i at time t in country

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[4] For analyzing the panel data, the two main methods are *random effects* and *fixed effects* but neither of them are considered appropriate for our analysis. It is clear that the use of *fixed effects* is a valid approach because we just focus on time-invariant controls in our regressions and we do test the robustness of results in order to control for heteroskedasticity.

c; RE_{tc} is regulation variable; $IE_{t,c}$ is a set of variables of te institutional environment; $M_{t,c}$ is a vector of macroeconomic conditions in country c at time t; $B_{i,t,c}$ is a set of bank specific variables; and $\varepsilon_{i,t,c}$ is the error item.

5. Empirical results

5.1 Cost inefficiency estimates

Cost inefficiency estimations are presented in Table 5 and Table 6. They report the inefficiency scores on the cost frontier models by geographical region and year. Those scores display averages over the period 2000-2012 and through 11 countries. The Figure 1 in the appendix shows the result of the cost frontier model.

Table 5

Cost inefficiency estimates

	No of oberve.	Cost inefficiency	Min	Max
Country				
Australia	121	0.222	0.092	0.391
China	464	0.211	0.062	0.613
Hong Kong China	148	0.245	0.054	0.552
India	531	0.257	0.055	0.717
Indonesia	437	0.219	0.055	1.211
Japan	111	0.277	0.029	1.998
Sri Lanka	31	0.234	0.092	0.325
Malaysia	63	0.268	0.060	1.000
Philippines	214	0.216	0.064	0.943
Singapore	59	0.299	0.047	1.621
Thailand	222	0.231	0.052	1.021

Notes: The results are calculated from the total sample, showing the cost inefficiency of each country.

The full sample overall mean cost efficiency score equals 0.23. It is not unreasonable that these banks need to improve by 23% to assess the cost efficiency frontier. According to the studies of Yildirim and Philippatos (2007) and Pasiouras et al., (2009), banks in Singapore and Japan have the largest cost inefficiency levels, with scores of 0.299 and 0.277 respectively, while banks in China have the best performance with inefficiency scores at about 0.211. Furthermore, banks in Philippines also are the second best performers with the scores around 0.219, meaning that they need to promote by 21.9% to be efficient. It is evident that China has a

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majority of commercial and saving banks and locals likes to deposit their money according to their cultures and customs so that these banks can operate more efficient than that of other countries. In contrast, Japan and Singapore which are well-developed, prone to establish investment banks to stimulate their economic evolution and thus their saving and commercial banks may not receive enough attention.

Table 6

Cost inefficiency estimates

	No of oberve.	Cost inefficiency	Min	Max
Mean by year				
2000	50	0.200	0.060	0.407
2001	74	0.303	0.155	0.447
2002	80	0.306	0.135	0.409
2003	95	0.250	0.117	1.021
2004	130	0.213	0.099	0.469
2005	165	0.220	0.052	0.347
2006	196	0.251	0.103	0.467
2007	207	0.244	0.092	0.635
2008	223	0.239	0.070	0.411
2009	246	0.207	0.066	0.490
2010	273	0.198	0.061	0.278
2011	331	0.225	0.067	0.257
2012	328	0.230	0.073	0.291
Overall mean	2398	0.230	0.088	0.456

Notes: The results indicate the mean of the cost inefficiency of each year between 2000 and 2012.

In terms of time series in Table 6, there is a better bank performance in 2000 in Asian countries, but this trend shows increasing cost inefficiency levels at the mean after that. However, it peaks at higher scores with 0.306 in 2002, which can be explained by the challenges faced by Asian countries of more competitive environment as some foreign banks' entry. During 2003 to 2005, it shows a decreasing tendency before it rises to a higher level in 2006 which can be explained that the global financial crisis was gradually shaped so that Asian banks may cannot work effectively as usual. Whereas during the time of 2007-2010, it maintains a relatively decreasing tendency, meaning that envisaging the economic disaster, customers prefer to deposit money into commercial banks and saving rather than invest in financial

markets. Nevertheless, during the period 2011-2012, the scores increase constantly and reach at 0.23 which may be influenced by a new publication of regulations. All in all, during the period of 2000 and 2012, these ups and downs may be also caused by announcement of new regulations.

5.2 Determinants of inefficiency

5.21 The relationship between inefficiency and regulations

Table 7 shows the estimation of the influence of regulation on bank inefficiency and this model includes macroeconomic environment as well as bank specific variables. Furthermore, we analyze the impact of regulations on bank performance during the period 2000-2012 and investigate the four standards of the regulations.

In terms of the macroeconomic control variables, the variables of private sector credit(%) are significant at the 1% level of each model and have a negative impact on cost inefficiency, which means that this indicator can improve bank performance. However, almost all banks-specific variable coefficients are not really significant. As can be seen that for the first column, ACTR has a statistically negative impact on cost inefficiency, implying that higher restrictions of activities increase the cost efficiency of banks. This is consistent with the view that more regulations restrict banks to entry securities, insurance and real estate markets in order to protect banks from facing more risks. This negative impact also indicates that the lower cost may allow banks to utilize their funding sources more effectively and ensure the stable operation of Asian banks. On the other hand, because of higher restrictions on the bank's activities, banks may cut down their expenditures to acquire less expertise and specialization in financial markets, and thus they have improved cost efficiency.

Similarly, in the second column, CAPR has a significant negative impact on cost efficiency, showing that lower (higher) capital requirement result in higher (lower) cost inefficiency. As the study of Pasiouras et al., (2006) restrictive capital

requirements may lead to high level of bank capital so that there is low probability of financial distress. Furthermore, a higher capital requirement can restrict bank to engaging in higher risk activities and ensure a stable bank's performance. Therefore, banks with high capital requirement can envisage low risk and exhibit high efficiency.

Table 7

The relationship between inefficiency and regulations

	Cost inefficiency	Cost inefficiency	Cost inefficiency	Cost inefficiency
Inflation %	-0.806	-0.124	0.072	-0.058
	(-0.77)	(-1.11)	(-0.70)	(-0.60)
GDP %	-0.20		-0.138	-0.111
	(-2.32)**		(-1.68)*	(-1.32)
Private sector credit (% of GDP)	-0.002	-0.002	-0.001	-0.002
	(-6.38)***	(-6.06)***	(-4.44)***	(-6.52)***
Unemployment rate %	-0.002	-0.005	0.002	-0.004
	(-0.90)	(-2.21)**	(-0.12)	(-1.93)*
Bank Size	0.003	0.010	-0.003	0.021
	(0.13)	(0.49)	(-0.18)	(1.20)
Fee income	0.006	0.004	0.003	0.002
	(0.29)	(0.21)	(0.16)	(0.08)
Liquidity	0.121	0.12	0.104	0.081
	(2.06)**	(1.94)*	(1.78)*	(1.39)
Non-performance loan	-0.056	-0.053	-0.066	-0.073
	(-0.44)	(-0.42)	(-0.53)	(-0.59)
Equity to asset	0.032	0.036	0.009	0.055
	(0.26)	(0.29)	(0.08)	(0.45)
ACTR	-0.006			
	(-3.24)***			
CAPR		-0.004		
		(-1.78)*		
SPR			-0.014	
			(-5.62)***	
PMON				-0.017
				(-5.77)***
R-sq	0.077	0.071	0.097	0.102
P-value	0.000	0.000	0.000	0.000

Notes: The table presents coefficients and t-statistics for the relationship between inefficiency and regulations. The dependent variable in columns is cost inefficiency scores. ***Statistical significance at the 1% level. **Statistical significance at the 5% level. *Statistical significance at the 10% level.

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For the third and fourth columns, there is significant negative impact on cost inefficiency caused by SPR and PMON. The effect of official supervisory action indicates that higher scores may give rise to greater cost efficiency, meaning that powerful supervision can improve the corporate governance of banks and their functioning (Beck et al., 2006). It is not unreasonable that supervisory authorities who have the ability to take specific actions to prevent and correct problems, can promote bank performance and efficiency. Similarly, the effect of PMON suggests that higher PMON can drive banks to work more effectively. This impact related to disclosure of accurate information to the public will allow private agents to mitigate asymmetric information (Beck et al., 2006 and Pasiouras et al., 2009). Obviously, as the information discovering to public, the moral hazard and corruption of bank officials will be reduced. Therefore, more private monitoring of banks may improve their functioning and increase cost efficiency.

According to the above results, it is evident that regulations have a significant impact on bank behaviors, which is lined with our hypothesis. Our results also support some early studies such as Barth et al., (2004), Demirgüç-Kunt et al (2008) and Pasiouras et al., 2009, that ACTR, CAPR, SPR and PMON have dramatically positive impact on bank efficiency, meaning that greater restrictions of these regulations can force banks to work at a higher level of efficiency. In conclusion, these significant results determine that bank performance is definitely improved by regulations.

5.22 The relationship between inefficiency and institutions

Table 8 shows the estimation of the influence of the institutional environment on bank inefficiency and this model includes macroeconomic environment as well as bank specific variables. Moreover, we analyze the impact of institutions on bank performance during the period 2000-2012 and investigate the three standards of institutional variables respectively.

Table 8

The relationship between inefficiency and institutions

	Cost inefficiency	Cost inefficiency	Cost inefficiency
ACTR	-0.004	-0.004	-0.004
	(-2.40)*	(-2.28)**	(-3.12)***
SPR	-0.009	-0.009	-0.01
	(-4.04)***	(-4.20)***	(-5.21)***
PMON	-0.124	-0.012	-0.113
	(-4.40)***	(-4.15)***	(-4.42)***
Private sector credit (% of GDP)	-0.013	-0.001	-0.001
	(-4.17)***	(-5.01)***	(-5.93)***
Bank Size	0.004	0.007	
	(0.19)	(0.37)	
Liquidity	0.086	0.083	0.077
	(1.43)	(1.40)	(3.33)***
Non-performance loan	-0.081	-0.083	
	(-0.65)	(-0.67)	
GDP %	-0.155	-0.114	-0.111
	(-1.85)*	(-1.54)	(-1.34)
Inflation %	0.067	-0.019	-0.173
	(-0.71)	(-0.18)	(-1.78)*
Unemployment rate %		-0.003	
		(-1.14)	
Governance effectiveness	0.052		
	(1.41)		
Control of corruption		0.023	
		(-0.89)	
Rule of law			-0.064
			(-2.37)**
R-sq	0.118	0.117	0.112
P-value	0.000	0.000	0.000

Notes: The table presents coefficients and t-statistics for the relationship between inefficiency and institutions. The dependent variable in columns is cost inefficiency scores. Since the institutional variables have correlation relationship, we run the fixed effect separately. ***Statistical significance at the 1% level. **Statistical significance at the 5% level. *Statistical significance at the 10% level.

According to Table 8, the macroeconomic variable such as private sector credit(%of GDP) are statistically significant at the 5% and unveil a negative impact on bank performance. In the third column, three regulation variables show an statistically significant as the 1% level, and exerts a negative effect on inefficiency in line with previous results in the Table 8, which further confirms that regulations can strongly affect bank performance. With the negative effect of regressor of private sector credit (% of GDP), the institutional variable of rule of law shows a significant and negative

effect on inefficiency. In the Lensink et al (2008) opinion, the quality of the rule of law can affect the cost efficiency through the effectiveness and predictability of the judiciary. Apparently, since the strict law may pave a normative way for financial firms to walk, banks may just follow the law which may reduce redundant and complicated procedure. Thus, combining regulatory effect, the rule of law may generate a positive impact on bank performance.

Consequently, through combining above significant result of rule of law and early studies of Demirgüç-Kunt et al (2008) and Delis, M., (2012), we support our hypothesis that the institutions have significant impact on bank performance. Furthermore, the institutional variable of rule of law displays dramatically negative impact on bank inefficiency so that rigorous law is able to enhance bank efficiency. The following section will further examine our results and eliminate the endogenous problems.

6. Endogeneity

So far, our results indicate the existence of close relations between bank performance, regulations and institutions. However, it does not mean that the results are perfect because there may exist potential endogeneity. Therefore, an important feature of this analysis is that we account for potential endogeneity of inefficiency. It is quite certain that implementing conspicuous regulations can restrict bank activity and influence their performance. However, reverse causality could arise, for example, when banking industry was a lower efficiency and even face financial crisis, which may render the policy maker to modify and draft items of regulation. For addressing the likely endogeneity of cost inefficiency, we employ an instrumental variable technique with a Generalized Method of Moments (GMM) estimator. A common problem in using empirical data is autocorrelation and heteroskedasticity, and we eliminate their impact using fixed effect with robust at Table 7 and 8. When facing heteroskedasticity and endogeneity problems, the GMM estimator introduced by Hansen (1982) may be more efficient than 2SLS.

We use regulatory variables such as ACTR, CAPR, SPR and PMON, and cost inefficiency as instruments in the analysis for dealing with endogenous problem. Activity restrictions, capital requirement, power of supervisions and private monitoring are key determinants for the scope of operations of banks and are likely to affect the level of inefficiency. These indexes provide information as to whether banks can engage in securities, insurance, and real estate activities, and indicate whether certain funds may be used to initially capitalize a bank, and whether supervisors can change the internal organizational structure of the bank, and whether off-balance sheet items are disclosed to public. Additionally, banking inefficiency represents an indicator for determining whether the bank's operation can reach an efficient level. We test for the relevance of these instruments or the endogeneity of cost inefficiency using the Arellano-Bond test which estimates whether exist autocorrelation, and Hansen test which replaces Sargan test to reveal whether the instruments are not valid.

The results in Table 9 show that the regulation variables CAPR is significant at the 10% level and the variable (SPR) is statistically significant at the level of 1% and PMON is significant at the 5% level. In the first column, the variable ACTR is statistically significant at the level of 1%, while that in the third column is significant at the 10% level. The ACTR, CAPR, SPR and PMON exhibit a negative effect on inefficiency. These results remain robust in line with previous research on the Table 9, meaning that the regulations have a strong effect on bank performance. Additionally, the dynamic analysis does mainly confirm the static fixed effects results in relation to the impact of regulations on bank inefficiency. Therefore, through utilizing the dynamic panel model, we deal with the endogenous problem and support our hypothesis that regulations have a positive effect on bank performance, meaning that restrictive supervision can enhance bank efficiency. Therefore, the significant impact of regulations on bank efficiency support our idea that activity restriction (ACTR), capital requirement (CAPR), power of the supervisory agency (SPR) and private monitoring (PMON) can improve bank performance.

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Table 9

The relationship between cost inefficiency and regulations

Dependent variable :	Cost Inefficiency	Cost Inefficiency	Cost Inefficiency	Cost Inefficiency
lag inefficiency	0.595	0.606	0.606	0.561
	(8.40)***	(8.10)***	(8.10)***	(7.66)***
ACTR	-0.005		-0.002	
	(-3.73)***		(-1.66)*	
CAPR		-0.003	-0.003	0.003
		(-1.89)*	(-1.90)*	(-1.10)
SPR	-0.007	-0.005	-0.005	
	(-3.56)***	(-2.58)***	(-2.68)***	
PMON				-0.007
				(-2.34)**
Liquidity	0.084	0.071	0.071	
	(1.65)*	(1.75)*	(1.85)*	
PSC (% of GDP)	-0.0005	-0.0004	-0.0004	-0.00003
	(-3.13)***	(-2.89)***	(-2.32)***	(-0.16)
Inflation %	-0.169	-0.141	-0.141	-0.015
	(-2.08)***	(-1.98)**	(-1.99)**	(-0.16)
Bank Size	0.011	0.016	0.016	-0.006
	(1.22)	(2.18)**	(2.30)**	(-0.45)
Non-performance loan	-0.009	0.067	0.067	-0.256
	(-0.03)	(1.03)	(1.03)	(-0.76)
Equity to asset	-0.288	-0.046	-0.046	-0.51
	(-2.06)**	(-0.90)	(-0.90)	(-2.96)***
Unemployment rate		-0.003	-0.003	-0.001
		(-1.66)*	(-1.76)*	(-0.61)
GDP %	-0.099			
	(-1.18)			
Hansen (p-value)	0.513	0.878	0.978	0.617

Notes: The relationships between bank performance and regulations. This table shows bank-level GMM regressions with robust standard errors. The dependent variable is the cost inefficiency, which is used to reflect bank's performance; a lower value illustrates greater bank performance. The explanatory variables are regulatory and bank-specific banks. The Arellano-Bond test for autocorrelation has a null hypothesis of no autocorrelation. The Hansen's J statistic tests the validity of the instruments used, and rejection implies that the instruments are not valid. The variable of PSC is private sector credit (% of GDP). ***Statistical significance at the 1% level. **Statistical significance at the 5% level. *Statistical significance at the 10% level

Apparently, according to the Table 10, the results in the first column suggest that the indicator of governance effectiveness has a dramatically negative effect on cost inefficiency at the level of 5%, and thus authority effectiveness can enhance bank efficiency. Since this element reflects the quality of public services and the civil service, the quality of policy implementation, and the credibility of the government's

commitment, strong government performance can generate higher efficient service and high quality of infrastructure which may force banks to polish their operation in order to satisfy people demand and reach national standard. Additionally, taking an example of China, their policy maker has enough power to drive the whole country to develop at top speed within 30 years, meanwhile their commercial and saving banks, which are almost controlled by government, can utilize tons of deposit to stimulate evolution of financial market because of governmental force and effectiveness. Therefore, there definitely has an influence from government in fostering bank efficiency.

In the second column, three regulatory variables have a significant negative impact on bank inefficiency, meanwhile the institutional variable of control of corruption has a dramatic negative impact on inefficiency at the level of 5%. It is evident that bribery usually generates less efficient market and give rise to networking effects, which may lead to some non-transparent transactions. Therefore, the high value of control of corruption can restrain the moral hazard and excessive patronage in order to normalize the right of managers. Furthermore, this practice may reduce the private deal and suspicious connection between politics and business. Therefore, bank efficiency can be enhanced by control of corruption. Additionally, there is a significantly negative effect between bank inefficiency and rule of law in the third column, meaning that restrictive law can improve bank performance. It is certain that the rigorous law can safeguard the regulations surrounding in an efficient way and a high quality of the judicial system can support help government to ensure a stable banking industry.

Table 10

Determinants of cost inefficiency

Dependent variable :	Cost Inefficiency	Cost Inefficiency	Cost Inefficiency
lag inefficiency	0.622	0.611	0.612
	(-9.32)***	(8.60)***	(9.55)***
ACTR	-0.001	-0.002	-0.001
	(-1.65)*	(-2.51)**	(-1.58)
CAPR	-0.001		-0.0003
	(-1.38)		(-0.46)
SPR	-0.002	-0.001	-0.003
	(-2.49)**	(-1.87)*	(-3.68)***
PMON	-0.002	-0.003	-0.002
	(-1.36)	(-2.48)**	(-1.68)*
Liquidity	0.010	0.029	0.007
	(0.67)	(1.76)*	0.48
PSC (% of GDP)	-0.0001	-0.0002	-0.0001
	(-2.27)**	(-2.71)**	(-2.27)**
Inflation %	-0.055	-0.052	-0.060
	(-1.59)	(-1.61)	(-1.65)*
GDP %	-0.005	-0.019	-0.004
	(-0.13)	(-0.53)	(-0.12)
Bank Size	0.007	0.008	0.001
	(2.42)**	(2.12)*	(0.11)
Non-performance loan	0.057	-0.012	0.035
	(0.49)	(-0.09)	(0.30)
Equity to asset	-0.069	-0.084	-0.097
	(-1.35)	(-1.61)	(-2.13)**
Governance effectiveness	-0.019		
	(-2.35)**		
Control of corruption		-0.017	
		(-2.48)**	
Rule of law			-0.018
			(-1.70)*
Hansen (p-value)	0.100	0.969	0.100

Notes: The relationships between bank performance, regulations and institutions. This table shows bank-level GMM regressions with robust standard errors. The dependent variable is the cost inefficiency, which is used to reflect bank's performance; a lower value illustrates greater bank performance. The explanatory variables are regulatory, institutional and bank-specific banks. The Arellano-Bond test for autocorrelation has a null hypothesis of no autocorrelation. The Hansen's J statistic tests the validity of the instruments used, and rejection implies that the instruments are not valid. The variable of PSC is private sector credit (% of GDP). ***Statistical significance at the 1% level. **Statistical significance at the 5% level. *Statistical significance at the 10% level.

As a result, institutional variables have significant coefficients at the 5% and 10% level respectively, which supports our hypothesis that institutions have a positive impact on bank performance and improve bank efficiency. The powerful governance, lower corruption and restrictive law can ensure a wholesome circumstance to implement effective regulations so that regulations can further improve bank performance in a soundness environment. Running the regression with robust specifies that the resulting standard errors are consistent with panel-specific autocorrelation and heteroskedasticity. Furthermore, according to the Hansen test, the instruments are valid and the results have vanished the endogenous and exogenous problem.

7. Conclusion

This is the first study showing the interaction between inefficiency, regulations and institutions in the banking industry of 11 Asian countries. This paper provides theoretical and empirical analysis consisting 2398 observations from 409 commercial and saving banks, covering the period of 2000-2012. Through discussing the conflicts of the impact of regulations in early literature, we focused on the relationship between bank performance and regulations related to three pillars of Basel II (capital requirement, power of supervisors and private monitoring) and restrictions on bank activities.

For estimating of inefficiency, we established parametric methods (stochastic frontier analysis) to set up inefficiency examination and these scores are used in both static and dynamic panel data models to discover the impact of regulations and institutions on bank performance. There are four indexes constituting regulations such as activity restrictions (ACTR), capital requirement (CAPR), power of supervisors (SPR) and private monitoring (PMON), meanwhile the variables of governance effectiveness, rule of law and control of corruption composite institutional environment index. There also combine bank-specific and macroeconomic controlling variables.

Our results illustrate that more restrictions on bank activities, higher power of supervisory agency and more transparent private monitoring can enhance bank efficiency. First of all, strict restriction of bank engaging, diverse activities can reduce the conflicts of interest with their fundamental business and risk from various activities. Similarly, the high level of capital requirement can enhance bank efficiency by reducing the probability of financial crisis and risk. Furthermore, powerful supervisors can supervise the bank's situation more accurately and enforce bank to report their information timely, which may help banks to avoid the market crisis by effectively regulating and disciplining. Additionally, the greater private monitoring can help supervisors to conduct surveillance to bank effectively and allow them to intervene if necessary. For the institutional variables, governance effectiveness, rule of law and control of corruption have positive impact on bank performance due to they are the basis to guarantee a stable environment in the banking industry.

Overall, this paper utilizes Asian evidence to support that regulations and institutional environment can enhance bank operating performance. Through discussing with earlier studies and giving empirical investigation, we support the consensus that specific regulations can influence bank performance under certain institutional environment. Our study also highlights the characteristic of bank regulations and institutional environment that helps improve bank efficiency, which may be valuable for both academic and policy makers to explore what determine bank efficiency.

Therefore, policy makers should enhance the level of restriction on bank's activities, which meaning that government should prevent banks from participating in securities, insurance and esate activities. Furthermore, the quantity of capital requirement of banks should be increased by authority, which can reduce the probability of defualt risk. The great power of supervisory agencies and private monitoring, moreover, are able to improve banks efficiency because strict supervision and higer disclosure requirement may improve the management of banks. Finally, policy makers should

not only focus on standard of regulations, but also need to refine the institional environment. According to the results, government should improve the quality of vivil service and credibility of authority, meanwhile, rigid law which is corner stone for higher quality of institions may provide foundation for setting effective regulation. In a similar way, reducing corruption can reflect the power of government and improve transparency, which is a base of great government effectiveness by improving the credibility of authority.

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Appendix:

Figure 1

Cost frontier model	
Dependent variables:	Log total cost
log P1	0.864
	(11.18)***
log P2	-0.15
	(-2.75)***
log Q1	0.760
	(14.88)***
log Q2	0.434
	(6.74)***
log N	-0.179
	(-2.20)**
log Z	-0.08
	(-9.75)***
HalflogP1	0.183
	(13.90)***
HalflogP2	-0.288
	(-4.22)***
logP1logP2	(-0.004)
	(-0.42)
HalflogQ1	0.214
	(29.79)***
HalflogQ2	0.219
	(16.06)***
logQ1logQ2	-0.217
	(-25.58)***
HalflogP1logQ1	-0.022
	(-1.33)
HalflogP1logQ2	0.019
	(0.84)
HalflogP2logQ1	0.12
	(8.64)***
HalflogP2logQ2	0.024
	(1.47)
HalflogP1logN	0.076
	(2.84)***
HalflogP2logN	-0.112
	(-5.70)***
HalflogQ1logN	-0.009
	(-0.05)
HalflogQ2logN	0.015
	(-0.74)

Notes: This figure shows the cost frontier model which is used to predict inefficiency. Q1 is loans (net of provisions) and Q2 is other earning assets (government securities, bonds, investment, CDs and T-bills). P1 is price of labor and P2 is price of financial capital. We use equity of each bank in the model as a fixed netput (N) to control for differences in risk preferences and Z is control variables. ***Statistical significance at the 1% level. **Statistical significance at the 5% level.