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Does Basel Compliance Matter for Bank Performance?

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Does Basel Compliance Matter for Bank Performance?[1]

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Abstract

The global financial crisis underscored the importance of regulation and supervision to a well-functioning banking system that efficiently channels financial resources into investment. In this paper, we contribute to the ongoing policy debate by assessing whether compliance with international regulatory standards and protocols enchances bank operating efficiency. We focus specifically on the adoption of international capital standards and the Basel Core Principles for Effective Bank Supervision (BCP). The relationship between bank efficiency and regulatory compliance is investigated using the (Simar and Wilson 2007) double bootstrapping approach on an international sample of publicly listed banks. Our results indicate that overall BCP compliance, or indeed compliance with any of its individual chapters, has no association with bank efficiency.

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I. INTRODUCTION

In this paper, we assess whether compliance with international regulatory standards and protocols affects bank performance. We focus on the adoption of international capital standards and the Basel Core Principles for Effective Bank Supervision (BCP). These principles, issued in 1997 by the Basel Committee on Bank Supervision, have since become the global standards for bank regulation, widely adopted by regulators in developed and developing countries. The severity of the 2007–09 financial crisis has cast doubt on the effectiveness of these global standards; regulatory reforms are under way in several countries. The initial crisis-induced assessment of regulatory failure is now giving way to a more complex regulatory dialogue and detailed evaluation of the principles underlying international regulatory standards as well as the implications of their adoption, in terms of banks' safety and soundness. In addition, the burden of compliance with international regulatory standards is becoming increasingly onerous, and financial institutions worldwide are developing compliance frameworks to enable management to meet more stringent regulatory standards. As regulators refine and improve their approach and methodologies, banks must respond to more stringent compliance requirements. This has implications for risk management and resource allocation, and, ultimately, on bank performance.[5]

The goal of this paper is to advance the existing literature by examining the relationship between the observance of international regulatory standards and the performance the banking sector. To evaluate bank performance we follow a structural approach, which relies on a model of the banking firm and a concept of optimization (Hughes and Mester (2014). The traditional structural approach relies on the economics of cost minimization or profit maximization; bank technical or operating (in)efficiency is broadly defined as the distance between an actual production process and the "best practice" or the optimal standard.[6] From a theoretical perspective, scholars' predictions as to the effects of regulation and supervision on bank performance are conflicting. The greater part of policy literature on financial regulation has been

[5] By the end of 2014, Citigroup had nearly 30,000 employees working on regulatory and compliance issues (an increase of 33 percent since 2011). This trend is compounded by the fact that compliance staffing is increasing at a time when the bank has been shrinking assets and staff (The Tell, *Wall Street Journal*, July 2014). Similarly, JPMorgan Chase expanded its risk control staff by 30 percent since 2011. In Europe, Deutsche Bank is doubling its compliance spending and adding at least 500 additional resources (Bloomberg, 9 July 2014). In 2013, HSBC announced plans to add approximately 3,000 compliance staff. This would bring its total compliance staff to more than 5,000, almost 2 percent of its global workforce, which has shrunk by over 40,000 in the past two years. (the *Times*, 25 September 2013).

[6] Traditionally, structural approaches to the evaluation of bank performance have assumed that all banks are equally efficient at either minimizing costs or maximizing profits, subject to a random error (ε_i), which is assumed to be normally distributed. Alternatively, structural approaches rely on the estimation of a frontier to capture the best practice, and estimate inefficiency as the difference between the best practice performance and the actual performance. In this study we follow the latter. There are four main methodologies for estimating the frontier: stochastic frontier; the distribution-free approach; the thick frontier and data envelopment analysis (see Hughes and Mester, 2014 for a detailed discussion of the relative merits of the different methodologies).

inspired by the broader debate on the role of government in the economy. The two best-known opposing camps in this field are the public interest and the private interest defenders, who both, nonetheless, agree on the assumption of market failure. For the public interest camp, governments regulate banks to ensure better functioning and thus more efficient banks, ultimately for the benefit of the economy and the society (Feldstein 1972). For the private interest camp, regulation is a product of an interaction between supply; it is thus the outcome of private interests who use the coercive power of the state to extract rents at the expense of other groups (e.g., Stigler 1971).

According to the public interest view, which largely dominated thinking during the 20th century, regulators have sufficient information and enforcement powers to promote the public interest. In this setting, well-conceived regulation can exert a positive effect on firm behavior by fostering competition and encouraging effective governance in the sector. In contrast, according to the private interest view, efficiency may be distorted because firms are constrained to channel resources to special-interest groups. This implies that regulation may not play a role in improving bank efficiency. Kane (1977) suggested that these conflicting views help frame the complex motivations underlying regulatory policies. He argues that officials are subject to pressures to respond to both public and private interests, and that the outcome of such an oscillation depends on incentives. Swings in the approach to regulation reflect the interplay of industry and political forces and the occurrence of exogenous shocks (crises for example). These complex interactions may have conflicting effects on the efficiency of the banking system.

Given these unresolved conflicting theoretical views on regulation and, hence, on supervision, in the aftermath of the 2007–09 financial crisis, at a time when significant regulatory reforms are under way, it is important to shed more light on the effects of the existing approach to regulation in general and, ultimately, to propose policy avenues for improvements. Empirically, it seems that the private interest view is more consistent with the data (for example, Barth and others, 2008). This stream of research finds that regulatory approaches that support private sector monitoring of banks and strengthen incentives for market monitoring, improve bank performance and stability. Barth and others (2013) assess whether bank regulation, supervision and monitoring enhance or impede bank operating efficiency and find that tighter restrictions on bank activities are negatively associated with bank efficiency. On the other hand, greater capital regulation, greater official supervisory power and enhanced market-based monitoring are positively associated with bank efficiency.

However, there is no evidence that any common set of best practices is universally appropriate for promoting well-functioning banks. Regulatory structures that will succeed in some countries may not constitute best practice in other countries that have different institutional settings. As pointed out by Barth and others (2013), there is no broad cross-country evidence as to which of the many different regulations and supervisory practices employed around the world work best. As a consequence, the question of how regulation affects bank performance remains

unanswered. Regulators around the world are still grappling with the question of what constitutes good regulation and which regulatory reforms they should undertake.

In this paper, we contribute to the ongoing policy debate by assessing whether compliance with international regulatory standards and protocols on supervision enhances banks' operating efficiency. We focus on regulatory compliance, because it can affect bank performance through several channels: (i) lending decisions; (ii) asset allocation decisions; (iii) funding decisions. Regulatory compliance is costly. Ultimately, these costs are borne not by regulators or banks, but by bank customers, in terms of lower saving rates and higher lending rates. This, in turn, may lead to an inefficient allocation of resources in the economy. As Haldane (2013) indicates, if systemic stability can be achieved in other ways, these are deadweight costs to society. The evidence on the effects of regulatory compliance on bank stability is mixed and depends on the individual risk or the specific stability measures utilized. Podpiera (2004) finds some evidence that higher BCP compliance leads to lower non-performing loans (NPLs) and lower net interest margins (used as a proxy of bank efficiency) on an aggregate basis. Demirgüç-Kunt and Detragiache (2011), on the other hand, show that compliance with the overall BCP index, and with its constituent components, is not associated with bank risk, as measured by banks' Z-scores.

On the regulators' side, excessive reliance on systematic adherence to a checklist of regulations and supervisory practices might hamper regulators' monitoring efforts and prevent a deeper understanding of banks' risk-taking. More specifically, to shed some light on the aforementioned issues, we aim to answer the following questions: (i) Does compliance with international regulatory standards affect bank operating efficiency? (ii) By what mechanisms does regulatory compliance affect bank performance? (iii) To what extent do bank-specific and country-specific characteristics soften or amplify the impact of regulatory compliance on bank performance? (iv) Does the impact of regulatory compliance increase with level of development?

Building on the IMF and the World Bank Basel Core Principles for Effective Bank Supervision (BCP) assessments conducted from 1999 to 2010, we evaluate how compliance with BCP affects bank performance for a sample of 863 publicly listed banks drawn from a broad cross-section of countries.[7] We focus on publicly listed banks, on the assumption that these institutions are subject to more stringent regulatory controls and compliance requirements. This focus should also enhance cross-country comparability because these banks share internationally

[7] Only a handful of previous studies have used BCP data; these include: Sundararajan and others (2001); Podpiera (2004); Das and others (2005); Demirgüç-Kunt and others (2008) and Demirgüç-Kunt and Detragiache (2011). These studies have used BCP information to study bank soundness and performance; overall they do not find evidence to support the hypothesis that better compliance leads to a sounder banking system. A recent review of the FSAP program (IMF 2014) includes an extensive study on standard supervisory assessments and analyzes the link between standard assessments and financial performance measures. They conclude that while there is no perfect supervisory approach, the lack of certain key features in a supervisory approach is likely to lead to macro-financial consequences.

adopted accounting standards. Further, we categorize the sample countries by both economic development and geographic region. Following Demirgüç-Kunt and Detragiache (2011), to assess the level of bank compliance we use an aggregate BCP compliance score and a disaggregated approach, to differentiate among various dimensions of regulation and supervision. To measure bank performance we begin with the estimation of a common global frontier by means of Data Envelopment Analysis (DEA), a widely used nonparametric methodology. Unlike previous studies, the present study explicitly accounts for cross-country heterogeneity in bank efficiency analysis, by adopting a two-stage double bootstrapping procedure: the first stage produces (bias-corrected) efficiency estimates which are then used in the second-stage truncated regressions to infer how various (bank-specific and country-specific) factors influence the (bias-corrected) estimated efficiency (Simar and Wilson 2007). Earlier studies suggest that the impact of regulation and supervision increases with the level of development (Barth and others, 2004; Demirgüç-Kunt and others, 2008). To assess whether regulatory compliance affects banks differently in countries at different levels of development, we re-run the estimations focusing on a subsample of emerging markets.

Our results indicate that overall BCP compliance—or indeed compliance with any of the individual chapters—has no association with bank operating efficiency. This result holds after controlling for bank-specific characteristics, the macroeconomic environment, institutional quality, and the existing regulatory framework. It adds further evidence to the argument that compliance per se has little effect on bank efficiency. Conditional on being a good bank (that is, a bank complying international regulatory and supervisory standards) regulation has no impact on bank performance. Nevertheless, increasing regulatory constraints may prevent banks from efficient allocation of resources. When only banks in emerging and developing countries are considered, a relationship is revealed. The extent of ongoing supervision is negatively associated with input efficiency. On the other hand, the extent to which supervisors apply international global standards is positively associated with bank input efficiency. This difference indicates that in emerging markets, adherence to international standards of best practice may have a positive effect on bank performance. However, these results need to be treated with caution, because they may also reflect the inability of assessors to provide a consistent cross-country evaluation of effective banking regulation.

The remainder of the paper is organized as follows: Section 2 presents methodology and data; Section 3 contains the results, and Section 4 concludes.

II. DATA AND METHODOLOGY

A. The Sample

The dataset used in this study comprises bank-level data and country-level data; it is compiled from a number of sources: (a) the IMF and World Bank Basel Core Financial Sector Assessment Program (FSAP) database, which includes detailed assessment of a country's

compliance with the Basel Core Principles for Effective Bank Supervision (BCP) during 1999–2010; (b) the Barth and others (2004, 2006, and 2008) surveys on bank regulation, supervision, and monitoring; (c) the World Bank Economic Indicators database (WDI); and (d) the Bankscope database provided by Bureau van Dijk and Fitch Ratings.

Bank-level information comprises balance sheet and income statement data for all publicly quoted commercial banks and bank holding companies. We focus on publicly quoted banks, on the assumption that these institutions are subject to more stringent regulatory controls and need to comply with international regulations, such as capital regulation. This focus should also enhance cross-country comparability, not least because publicly quoted banks follow international accounting standards to report end-of-year accounting variables (Laeven and Levine 2008). When constructing the dataset, we exclude banks with missing information on relevant accounting variables (total assets, loans, other earning assets, deposits, equity capital, interest and non-interest income, and interest and non-interest expenses). To prevent the possibility of outliers driving the results, we exclude the top and bottom 1 percent levels, in terms of bank size (total assets), for all years.[8] Finally, we apply data cloud methods to identify and remove outliers in terms of input/output mix[9] (see Section 2.B for more detail on input/output specification).

We then match the bank-level information with country-level information to investigate the link between regulatory compliance and bank performance, accounting for cross-country differences in macroeconomic and institutional factors. Our final cross-sectional sample includes 863 banks across 63 countries over the period 2001–10 (Table A.1).[10] Our sample is unbalanced and it includes countries with vastly different banking systems and economic conditions, with some countries only represented by a few listed banks, while others have a much higher sample share. Specifically, U.S. banks account for approximately 35 percent (304 banks) of the sample. To ensure that our findings are not overly influenced by U.S. banks, we examine results with and without them.

For the purpose of the analysis, we categorize the 63 countries in our sample both in terms of both economic development and geographic region, combining information from the International Monetary Fund (IMF) and the European Bank for Reconstruction and Development (EBRD). Countries are classified into four categories of economic development: (i) Major Advanced (countries in the G7 group); (ii) Advanced, (iii) Emerging and Developing; and (iv)

[8] This resulted in 10 observations being dropped from our sample.

[9] This method allows for the identification of "influential observations" in the application of Data Envelopment Analysis (see Wilson 1995).

[10] The original BCP assessment exercise examines 158 countries, principalities, and monetary unions; but because of data availability and the incomplete overlap among the four databases, the dataset's global span is reduced to 63 countries.

Transitional. In addition, countries are also classified into 10 geographical regions (Central and Eastern Europe (EEU); Latin America and the Caribbean (LAM); Middle East and North Africa (MEA); Newly Independent States of Former Soviet Union (FSU); North America (NAM); Other Pacific Asia (PAS); Pacific OECD (PAO); South Asia (SAS); Sub-Saharan Africa (AFR); Western Europe (WEU)).

Because the country-level regulatory data (data source (b)) are collected in three survey exercises (1999, 2002, and 2005/2006), following Barth and others (2013) we match the data for the regulatory variables as follows: the 1999 survey data are used for period 2000–01; the 2002 survey data are used for period 2002–04, and 2005/2006 survey data are used for period 2005–10. As each bank is in the sample is assessed at one point in time during the sample period, the data is cross-sectional.

B. Empirical Set-Up and Definition of Variables

Frontier methodologies for the analysis of firm performance have generated a large literature since the seminal work of Leibnestein (1966) introduced the concept of x-inefficiency as the gap between ideal efficiency and actual efficiency. Frontier approaches measure firm performance relative to 'best practice' in the industry. Such measures summarize performance in a single statistic that controls for differences among firms using a sophisticated multidimensional framework (Banker & Cummins, 2010). The evaluation of efficiency is based on the assumption that the production frontier of the fully efficient organization is known. In practice, data is used to estimate this idealized frontier. Over the last half century, estimations of this best practice frontier developed along two empirical paths, a parametric and a non-parametric one. In this study, we follow a non-parametric approach which uses linear programming methods to assign each observation to its own set of 'coefficients' from which inefficient behavior can be assessed. More specifically, we employ the most well known of these `data-oriented' methods, Data Envelopment Analysis (DEA), first introduced by (Charnes, Cooper, & Rhodes, 1978) and later extended by (Banker, Charnes, & Cooper, 1984). Our methodological approach represents an extension of the traditional DEA model.

Formally, DEA is a methodology directed to frontiers rather than central tendencies. It floats a piecewise linear surface to rest on top of the observations rather than fitting a regression plane through the `middle' of the data using statistical methods (Cooper, Seiford, & Zhu, 2011). DEA produces exact in-sample estimates of efficiency; that is a measure of the performance of an institution relative to the other institutions which are producing the same good or service. This method is non-stochastic; it assumes that all deviations from the frontier are the result of inefficiency. This represent a drawback of the approach, as statistical inference about estimates comparisons are precluded without further simulation techniques such as bootstrapping. To overcome this problem, we follow a double bootstrapping procedure, as proposed by Simar and Wilson (2007).

Another of the key issues that arises in the use of frontier methods for cross-country comparisons of bank efficiency is the existence of significant heterogeneity. Several studies have proposed alternative methodologies to overcome this problem. In this paper, we begin with the estimation of a common global frontier by means of Data Envelopment Analysis (DEA). In the next step, to account for cross-country heterogeneity we adopt a form of the two-stage approach with a double bootstrapping procedure (Simar and Wilson 2007). In this two-stage approach, the first stage measures efficiency by a DEA estimator and the second stage uses truncated regression to infer how various (bank-specific and country-specific) factors influence the (bias-corrected) estimated efficiency. The choice of this methodological approach is driven by the characteristics of our sample, which includes a large number of countries (and a relatively small number of banks per country) and therefore presents considerable challenges to accounting for differences in operating, regulatory, and macroeconomic conditions experienced by banks.[11] Our study is the first cross-country study to apply the double bootstrapping two-stage procedure in a consistent manner.[12]

In more detail, our approach can be broken up into three steps. In the first step, we use a nonparametric input-oriented DEA model to measure bank efficiency.[13] However, ignoring the complex and heterogeneous nature of the sample and simply benchmarking performance on the basis of a global common frontier would yield biased efficiency estimates. As a consequence, in the next stage, we apply the double bootstrapping procedure proposed by Simar and Wilson (2007) to explicitly account for the complex serial correlation in a two-stage DEA efficiency estimation. In the estimation of DEA technical efficiency scores, this procedure recognizes that certain bank-specific and environmental variables influence the estimate of the true unobserved efficiency score and is thus consistent with the second-stage truncated regression analysis (Glass and others, 2010)

In a second step, the results from a truncated regression of the initial DEA efficiency estimates on a set of environmental variables are used in a nonparametric bootstrap to generate

[11] An alternative methodology that is popular in cross-country studies is the meta-frontier approach (Battese and others, 2004), which allows for the estimation of technology gap ratios between individual country frontiers and the overall meta-frontier, which is derived as an envelopment of individual frontiers. For applications of the meta-frontier approach is banking, see, among others Bos and Schmeidel (2007) and Casu and others (2013). Because our study is limited to publicly listed companies, it does not include a sufficiently large number of observations per country to allow the estimation of individual country frontiers as well as a meta-frontier.

[12] Some previous studies (Brissimis and others, 2008; Delis and Papanikolaou 2009) have applied the bootstrapping procedure (more specifically, they have applied algorithm 1 from Simar and Wilson (2007) which improves inference but does not take into account the bias as detailed in equation (4)). Barth and others (2013) use the procedure as a robustness test without indication of the extent of its use.

[13]As a further robustness test, the original (raw) DEA estimates were used to create a subsample that excluded banks on the frontier (=1). This subsample was then used to re-estimate efficiency. The correlation between efficiency results of this reduced subsample was found to be statistically similar (a Pearson and Spearman rank correlation coefficient were significant at the 1 percent level) to the original estimates, a good indication that outliers haven't affected the results to a large extent (Casu and Molyneux 2003).

biased corrected efficiency estimates. This step adjusts for the influence on the DEA efficiency estimations of the correlation between observable bank/country level factors and the inputs/outputs in a bank production process. Finally, in a third step, the bias-corrected DEA efficiency estimates from step two are used as the dependent variable in a further truncated regression on the same set of environmental variables, and a parametric bootstrap is used to provide more efficient estimates of the statistical relationships between the environmental variables and bank efficiency.

C. Estimating Bank Efficiency

We proceed to evaluate bank operating efficiency as follows. Let us define a production set as

$$\mathbb{P} = \{(x, y): x\ can\ produce\ y\} \quad (1)$$

where $x \in \mathbb{R}_+^p$ denotes a vector of *p* inputs and $y \in \mathbb{R}_+^q$ denotes a vector of *q* outputs. The technology or production frontier is defined as

$$\mathbb{P}^T = \{(x, y) | (x, y) \in \mathbb{P}, (\theta x, y) \notin \mathbb{P}\ \forall\ 0 < \theta < 1\} \quad (2)$$

which is then used to measure the i^{th} banks' input technical efficiency, defined as

$$\delta_{input}(x_i, y_i) \equiv inf\{\theta > 0 |\ (\theta x_i, y_i) \in \mathbb{P}^T\} \quad (3)$$

the proportion by which input quantities can be reduced without reducing output quantities (Coelli and others, 2005).[14]

When a large cross-country sample is used to build a best-practice frontier, inefficiency for bank *i* in country *j* is measured in terms of distance from this global common frontier. This implies that any cross-country differences in the initial DEA efficiency scores are entirely attributed to bank-level managerial decisions regarding the scale and mix of inputs. If this assumption is not correct, it will result in biased efficiency estimates. In the next two steps, unlike most cross-country bank efficiency studies, we apply a double bootstrapping procedure (Simar and Wilson 2007) to account explicitly for the complex serial correlation in a two-stage DEA efficiency study. This procedure will adjust for the bias in the first stage DEA estimates of bank efficiency. We will then use these bias-corrected efficiency scores to improve statistical efficiency in the second-stage truncated regression estimates.

Mathematically this bias can be described as follows:

[14] We report efficiency scores based on a variable returns to scale (VRS) assumptions.

$$\delta_i = \widehat{\delta_i} - BIAS\left(\widehat{\delta_i}\right) - \mu_i \qquad (4)$$

where δ_i is the true (unobservable) efficiency score for i^{th} bank, $\widehat{\delta_i}$ is the nonparametric DEA estimate of δ_i , $BIAS\left(\widehat{\delta_i}\right)$ is the bias of the nonparametric estimate which is strictly negative in finite samples, and μ_i is the error in the nonparametric estimate, which will disappear asymptotically.[15] As can be seen from (4) the true unobserved efficiency scores are generally downward biased, and nonparametric efficiency estimates that ignore this bias will provide a more favourable estimate of efficiency. In the context of our study, the bank would appear to be performing better, in terms of the efficient allocation of its resources, than is actually the case. Our estimation will implicitly account for this bias. Full details of the process used are described in Algorithm 2 in Simar and Wilson (2007).

D. Definition of Inputs and Outputs

The inputs and outputs used to estimate efficiency are defined based on an extension of the intermediation approach (Sealey and Lindley 1977), which does not penalize nontraditional banking activity and takes into account a bank's ability to manage risk. We estimate a model that has three inputs and three outputs.

The inputs are: (i) customer deposits and short-term funding; (ii) total costs (defined as the sum of interest expenses and noninterest expenses), and (iii) equity capital to adequately account for the impact of risk (Berger 2007). Hughes and Mester (2010) argue that the inappropriate treatment of equity capital can bias bank efficiency estimates because banks can use either capital or deposits to fund loans, and this choice has a direct effect on funding costs.[16] As equity capital has a minimum level due to capital adequacy regulation, it should be treated as a quasi-fixed input; a variable whose control is not at the complete discretion of the management.[17]

The three outputs are: (i) loans; (ii) other earning assets; and (iii) noninterest income as a proxy for off-balance-sheet activities.[18] We include the latter output to ensure that we do not penalize banks that have a substantial share of nontraditional activities (Barth and others, 2013)

[15] This is equation 16 in Simar and Wilson (2007).

[16] Hughes and Mester (2010) argue that most bank efficiency studies make use of financial statement data and define costs based on an accounting cash-flow concept rather than economic principles, the former using interest paid on debt (deposits) and not the cost of equity. This would mean that if a bank chooses to substitute some of its equity capital for debt its cash-flow costs will rise, making the less-capitalized bank appear more costly than the well-capitalized bank.

[17] In an input-oriented model we would thus treat equity as a negative output, (Bogeoft and Otto 2011).

[18] Although other studies have used the value of off-balance-sheet items, this variable has a significant number of missing values in our sample; thus, we rely on noninterest income as an appropriate proxy.

E. Measuring Bank Compliance

The principal variable of interest, BCP compliance, is derived from the IMF and World Bank Basel Core Financial Sector Assessment Program (FSAP) database.[19] Our study extends the work of Demirgüç-Kunt and Detragiache (2011) by using assessment data covering 1999–2010,[20] which includes a U.S. banking sector assessment. The Basel Core FSAP is an exhaustive global exercise, capturing the compliance features of banking industries in both developed and developing economies. The 25 BCP core principles are considered by regulators and by international organizations to be the best practice to date of compliance with banking regulation and supervision. These principles were issued in 1997 by the Basel Committee of Banking Supervision, and have been adopted by most countries in the world. Since 1999, the IMF and the World Bank have conducted regular assessments to gauge countries' compliance with these principles, mainly within their joint FSAP. The 25 BCP core principles are organized into seven chapters, as follows:

- Chapter 1 (BCPch1): Preconditions for effective banking supervision. Six subprinciples constitute the prerequisite to perform supervisory activities including objectives, responsibilities, adequate resources, independence, legal infrastructure, and the existence of arrangements of cooperation between supervisors for sharing information and protecting its confidentiality.

- Chapter 2 (BCPch2): Licensing and structure. Four principles set the powers of supervisors in terms of their authority to grant banks licenses and to review major acquisitions and investments.

- Chapter 3 (BCPch3): Prudential Regulations and Requirements. Ten principles are in place to ensure that supervisors set prudent and appropriate minimum capital adequacy requirements for all banks. These requirements reflect banks' risks, credit policies, loan provisioning, concentration, large exposures, risk mitigation policies, risk monitoring, audit, and code of conduct. These requirements impose a cost for banks, which have to put in place risk measurement, management, and governance systems to ensure compliance.

- Chapter 4 (BCPch4): Methods of Ongoing Supervision. Five principles impose regular supervisory visits to banks and contacts with bank management at group and subsidiary levels. In practice, compliance teams in banks must be kept ready to address supervisory matters when they arise.

- Chapter 5 (BCPch5): Information Requirements. One principle requires banks to maintain adequate records to enable supervisors to obtain a true and fair view on the financial conditions.

[19] For detailed information on the assessments of the Basel Core Principles, we refer the reader to their founding documents (Basel Committee on Banking Supervision 1997, 1999, 2006, 2011a, 2011b, 2012).

[20] The Demirgüç-Kunt and Detragiache (2011) study uses BCP compliance data covering the period 1999–2007.

This principle implies that banks must keep comprehensive internal data on exposures (on- and off-balance sheets, clients, risks) and share it with supervisors.

- Chapter 6 (BCPch6): Formal Powers of Supervisors. One principle aims to ensure that adequate corrective supervisory measures are in place for distressed banks.

- Chapter 7 (BCPch7): Cross-Border Banking. Three principles to encourage supervisors to practice global consolidated supervision over internationally active banks. These principles may not work in practice because of the lack of exchange of confidential information between supervisors, and the difficulty of home-host issues, particularly in case of distress.

Following Demirgüç-Kunt and Detragiache (2011), the level of bank compliance is assessed using an aggregate BCP compliance score and a disaggregated approach, to distinguishing among various dimensions of regulation and supervision. The variable "BCP compliance" specifies a measure of compliance for each country in our sample at one point in time. Bank-level and country-level information are matched with the year of assessment to produce a cross-sectional sample. More specifically, to assess the compliance rate with each of the 25 principles, a four-point scale is used: (i) noncompliant; (ii) materially noncompliant; (iii) largely compliant, and (iv) compliant. Numerical values are assigned to each of the grades (from 0 for noncompliant to 3 for compliant). An overall index of compliance is computed based on the sum of the seven regulatory dimensions (BCP score). Seven indexes of compliance are then calculated based on the individual dimensions of regulation. All indices are normalized to take values in the interval [0, 1]. This normalization also has the intuitively appealing property of a percentage interpretation on initial analysis.

F. Environmental Variables

Bank efficiency is normally expressed as a function of both internal and external contextual variables. Internal factors are usually related to bank management and are defined from a bank's financial statements and thus specific to its individual character. External factors describe the regulatory, macroeconomic, and financial development conditions that are likely to affect a bank's performance. The contextual variables used in this study are chosen to best fit the primary purpose of the analysis and include both bank-specific and country-specific variables.

The bank-specific variables include log of total assets (logta), loans to assets ratio (lta), book value equity to assets (eqta) and return on equity (roe). Bank size, lending behaviour, capitalization, and risk profile are considered key determinants of bank performance.

It has long been established in applied bank efficiency studies that bank size (logta) can significantly affect bank performance. Banks enjoy economies of scale as they grow larger. One of the reasons put forward in the literature is that larger banks can better diversify risk (particularly credit and liquidity risk), which should reduce the relative costs of risk management. This in turn should allow banks to conserve equity capital, reserves, and liquid

assets. Further, the spread of overhead costs (especially those associated with information technology) can also bring about larger efficiencies of scale in banking production (Hughes and Mester 2013). Although large banks can experience scale diseconomies and there might be costs associated with diversification, we expect an overall positive relationship between size and efficiency.

A bank's production process is underpinned by its ability to improve information asymmetries between borrowers and lenders. This implies that a measure of relative lending behaviour such as loans to assets (lta) can be an important determinant of bank performance. Furthermore, as banks make choices about their capital structure and the amount of risk to assume, capitalization decisions have a direct impact on performance. We model this potential impact by including equity to assets (eqta). We expect higher levels of capital to be related to a reduction in a bank overall risk, and posit a positive relationship between the equity to assets ratio and bank performance. Finally, we also control for performance differences resulting from a manager's ability to optimize the risk-return tradeoff, by including a bank's return on equity (roe). Although no consistent picture emerges in the literature as to the relationship between risk and bank efficiency, a bank risk-taking profile is an important determinant of performance.

Moving to the external country-specific characteristics, these are a vector of the macroeconomic conditions and financial conditions in the banking industry of each country in the sample. The business and economic cycle fluctuations are modelled using annual growth in GDP (gdpg) and annual rate of inflation (inf) measured as the percentage change in the consumer price index. Favorable economic conditions will stimulate an improvement in the supply and demand for banking services, and will consequently have a positive effect on bank efficiency (Lozano-Vivas and Pasiouras 2010). Furthermore, high inflation can affect bank performance in a number of ways: it might encourage banks to compete through excessive branch networks, thus affecting cost (Kasman and Yildirim 2006), or it might have a beneficial effect on bank margins (Demirgüç-Kunt and others 2004).

The level of financial intermediation is controlled by including the ratio of private sector banks' claims to GDP (PrCrGDP) as in Barth and others (2004). A higher ratio indicates increased loan activity, which is likely to improve bank efficiency. Higher efficiency resulting from high intermediation activity may be the effect of a bank's risk preferences; recall that our model takes this into consideration by including equity capital as both a quasi-fixed input and in ratio form (eqta) as an environmental variable.

Lastly, we control for bank sector concentration using the ratio of the assets held by the three largest banks as a proportion of all bank assets of the country (conc). Higher concentration

is thought to have a negative impact on bank efficiency because market power allows managers to relax their efforts to improve performance (Berger and Hannan 1998).[21]

The primary purpose of our study is to investigate whether BCP compliance plays a role in bank performance; therefore, it is vital to appropriately model the regulatory conditions within which each bank operates. We include six key features of banking regulation, which were first defined in Barth and others (2004, 2006). RESTR is a measure of the level of restriction placed on a bank's activity. Barth and others (2004) argue that allowing banks to be involved in a range of activities may encourage the rise of larger, more complex entities that are more difficult to regulate. Reduced competition and efficiency may result, because banks may systemically fail to manage their diverse set of financial activities beyond the traditional model, lowering profitability (Barth and others, 2003).

COMP measures the level of regulation in place that would reduce competition (this includes entry requirements, limitations of foreign bank entry/ownership, and the fraction of new applications for banking licenses that are denied). As mentioned above, limited competition is likely to induce appropriating management behavior that may have a detrimental effect on bank efficiency. CAPRQ measures capital risk management restrictions. Pasiouras and others (2009) argue that capital requirements can affect bank efficiency and productivity in three ways. First, binding regulatory capital requirements reduce aggregate lending and affect loan quality, which in turn will affect efficiency. Second, stricter capital requirements influence a bank's asset portfolio mix, resulting in different portfolio returns; this will affect input-oriented bank efficiency, because these returns will require the management of different resources. Finally, as mentioned earlier, differing capital standards will influence a bank's decisions on the mix of deposits and equity, which entail different costs.

PRMON is a variable measuring the degree of private sector monitoring. This is a proxy for the third pillar of Basel II and can be related to the private monitoring hypothesis, which argues that supervisory power can incorporate business corruption and/or political motivation which, if increased, would affect bank lending integrity and compromise efficient credit allocation.[22] Many economists support a greater reliance on private sector monitoring to promote better-functioning banks, although the quality of private monitoring largely depends on the quality of information disclosure. Although we expect the effect to be country-specific, we expect a positive link between the degree of private market monitoring and bank efficiency.

[21] It has also been argued that higher concentration could be the result of efficiency in the production process (Lozano-Vivas and Pasiouras 2010).

[22] The antithesis is the *official supervision hypothesis*, which suggests that supervision can prevent systemic failures by direct oversight, regulation, and disciplinary action against banks.

DEPSEC is a measure of the amount of security in place for depositors, in terms of deposit insurance schemes. Research suggests that increased levels of deposit insurance will exacerbate moral hazard issues and reduce the incentives for private monitoring. In terms of the effect on bank efficiency, higher levels of security for depositors would reduce banks' incentives to efficiently allocate resources to the most productive opportunities, thereby resulting in a negative effect on efficiency.

CORPGOV is a measure of the level of effective corporate governance; it is derived from the External Governance Index. Better external governance is expected to enhance the private monitoring and disciplining of banks and thus boost banking efficiency.

Finally we control for differences in economic development of the countries in our sample. Countries are classified into four categories (Major Advanced, Advanced, Emerging and Developing, and Transitional) by development status. There may also be large regional differences, so countries are also defined into 10 regions (Central and Eastern Europe (EEU), Latin America and the Caribbean (LAM), Middle East and North Africa (MEA), Newly Independent States of the former Soviet Union (FSU), North America (NAM), Other Pacific Asia (PAS), Pacific OECD (PAO), South Asia (SAS), Sub-Saharan Africa (AFR), Western Europe (WEU)) and which are used to capture regional differences.

G. Methodology

The relationship between bank efficiency and regulatory compliance is evaluated using the following baseline specification:

$$EFF_{i,j} = \beta_0 + \beta_1 \text{BCPIndex}_j + \beta_2 \mathbf{B}_{i,j} + \beta_3 \mathbf{MF}_j + \beta_4 \mathbf{R}_j + \beta_5 \mathbf{I}_j + \epsilon_{i,j} \qquad (1)$$

where *i* indexes bank *i*, *j* indexes country j, $EFF_{i,j}$[23] is the efficiency score of bank *i* in country *j*, estimated by means of Data Envelopment Analysis and bias-corrected, as discussed in Section C. BCPIndex_j is the overall compliance index for country *j*, as discussed in Section E. The remaining environmental variables are included to capture observable cross-country and bank-characteristic differences. These have been discussed in Section F; Table A.3 presents the details of how variables were constructed.

More specifically, $\mathbf{R}_j$ is a vector of bank regulatory condition indicators (described in Barth, Caprio, and Levine (2006)) for country *j*; $\mathbf{MF}_j$ is a vector of macroeconomic and financial condition variables for country i; $\mathbf{B}_{i,j}$ is a vector of bank-specific characteristics for each bank *i* in

[23] Depending on the steps of our analysis this variable will differ. In the second step of our approach this would be the original DEA score estimated in the first step. In the third step of our approach this would be the bias-corrected efficiency estimate from the second step.

country j, and $\mathbf{I}_j$ is a vector of dummy variables controlling for regional or economic development differences. The error terms $\epsilon_{i,j}$ and $\omega_{i,j}$ are assumed to be random noise elements of the dependent variable $EFF_{i,j}$.

We estimate the model using a truncated regression in the double bootstrap procedure, as detailed in Section C.

In a second step, we decompose our main variable of interest, BCP, into the seven component chapters using the following disaggregated model:[24]

$$EFF_{i,j} = \beta_0 + \beta_1 \mathbf{BCPch}_j + \beta_2 \mathbf{B}_{i,j} + \beta_3 \mathbf{MF}_j + \beta_4 \mathbf{R}_j + \beta_5 \mathbf{I}_j + \omega_{i,j} \qquad (2)$$

where BCPch_j is an index of compliance, calculated based on the individual dimensions of regulation: BCPch_1 is Preconditions for Effective Banking Supervision; BCPch_2 is Licensing and Structure; BCPch_3 is Prudential Regulations and Requirements; BCPch_4 is Methods of OnGoing Supervision; BCPch_5 is Information Requirements; BCPch_6 is Formal Powers of Supervisors, and BCPch_7 is Cross-Border Banking. The remaining variables are defined as in equation (1).

H. Summary Statistics

Table 1 presents summary statistics of the full sample. Panel 1 describes the mean and standard deviation of each variable, while panel 2 provides an exposition of the median values categorized by economic development. Table 1b presents the correlation matrix of the BCP chapters. A few salient features emerge.

[Table 1: Descriptive Statistics]

Bank-level variables in panel 1 illustrate a host of differences between the 63 nations in our cross-country survey, indicative of variations in banking industry sophistication. The median values suggest that the sample is positively skewed, with a small number of large banks. Furthermore, there is a high degree of full-sample heterogeneity, with values varying widely about their means according to standard deviation figures.

From panel 1 the full-sample mean of the overall BCP compliance index (BCPscore) is 0.22, a much lower value than in the Demirgüç-Kunt and Detragiache (2011) study. This

[24] Given the high correlations between the BCP chapters, we used Principal Component Analysis (PCA) and the first principal component of each chapter was also used to assess whether bank input efficiency was harmed by sub chapter compliance. The empirical results were broadly similar to those reported in the main findings in Table 3a and 3b.

difference is likely owing to the inclusion of the U.S. banking sector, which dominates the sample and performed poorly in their 2010 BCP compliance assessment.

From panel 2 a number of interesting sample features emerge. First, overall compliance with the BCP appears to be higher in emerging and developing countries (45 percent), suggesting that these countries adhere more closely to BCP because their banking industries are nascent. A closer look at the regulatory control variables of emerging market and developing countries also suggests that these banking industries have many more restrictions placed on their activities (RESTR = 0.67), lack competition (COMP=0.67), and have no security in place for depositors (DEPSEC=0). All these characteristics would suggest a greater sensitivity to BCP compliance of banks in developing countries.

III. EMPIRICAL RESULTS

This section presents the results of our empirical analysis. First we present the bias-corrected efficiency estimates. We then present the results of the truncated regression analysis to infer how various (bank-specific and country-specific) factors influence the (bias-corrected) estimated efficiency.

A. Efficiency Estimations

We begin our empirical investigation with the estimation of (bias-corrected) efficiency scores. Table 2 presents summary statistics for the bias-corrected DEA estimates. These include the coefficient of variation (CV, the standard deviation scaled by the mean).[25] This is a scale-free measure of dispersion that represents a comparative measure of efficiency volatility, with lower values indicative of more stable bank performance.

The results are presented in three panels, one for each of the groupings mentioned above. In panels 1 and 2 estimates are disaggregated by level of economic development, while in panel 3 the disaggregation is by geographical region.

Firstly, the overall mean bias-corrected input technical efficiency is 0.419 (the equivalent mean for the Non-U.S. bank sample and the emerging market and developing countries bank sample are 0.584 and 0.803 respectively). This mean value implies that a typical bank could improve its input efficiency by 58 percent; or, if the average bank were producing on the frontier rather than at its current location, only 42 percent of inputs being used would be required to produce the output set.

[25] The coefficient of variation is also known as the relative standard error; the standard error of an estimate (in this instance the mean) divided by the estimate itself.

This global average is lower than in recent studies (Lozano-Vivas and Pasiouras 2010; Pasiouras 2008) that used DEA methods and similar samples. This difference is perhaps attributed to our explicit treatment of sample heterogeneity in the efficiency estimates.

As discussed above, nonparametric efficiency estimates using an unbalanced sample are inherently biased and will provide a more favorable picture of bank efficiency if this bias is ignored. A comparison of the overall mean raw efficiency[26] (0.537) and its bias-corrected counterpart (0.419) suggests that, on average, this estimated bias is 0.12. The comparative estimate of average bias in the non-U.S. and emerging market and developing country bank samples is 0.07 and 0.03 respectively.[27] The bias-corrected efficiency estimates thus reveal that the performance of banks is generally more inefficient than the raw, uncorrected DEA estimates suggest.

[Table 2: Bank efficiency estimates]

Second, there are some trends evident when moving from advanced to less advanced economies. In panel 1, mean efficiency scores exhibit little difference across major advanced and advanced country banks, while banks located in emerging market, developing, and transition countries are, on average, less efficient. Panel 2 results for the non-U.S. sample provide a much clearer picture of this trend. The most efficient banks are located in the major advanced countries (mean=0.642) while the least efficient banks are located in the emerging market and developing countries (mean=0.534).

Third, there appears to be an increase in the dispersion of bank efficiency estimates as we move from the most developed to the least developed countries. Panels 1 and 2 show some differences in the coefficient of variation across developmental levels, with major advanced country banks exhibiting the most stability in efficiency estimates (lower CV figure) while emerging market and developing country banks experience the most volatility in efficiency estimates (higher CV figure). This trend is most pronounced in the non-U.S. sample, where the coefficient of variation of the emerging and developing country banks (0.208) is nearly 30 percent higher than the corresponding figure for major advanced country banks (0.142).

The latter findings suggest that bank efficiency in emerging markets and developing countries is much more volatile. This increased volatility would suggest the necessity for tighter

[26] The summary statistics of these original (raw) DEA estimates are presented in Table A.2 of the appendix.

[27] To provide a complete picture of the bias, these averages should be assessed in conjunction with their standard deviations. The standard deviation of the bias estimates for the full, non-U.S., and emerging market and developing country bank samples are 0.14, 0.12, and 0.15 respectively. The latter suggests that while the average bias in the emerging and developing sample is smaller there is much more variability about this mean value. This increased variability is likely the result of much greater heterogeneity across banks in this subsample.

compliance with a set of effective banking supervision principles, and indicates the need for a more detailed analysis of these banks. Results from this analysis are summarized in panel 3: they suggest that a typical emerging market and developing country bank has a bias-corrected efficiency of 0.803[28] when benchmarked against best-practice peers of this subsample. This suggests that, on average, a bank producing on this emerging market and developing country bank frontier, instead of at its current location, would only need 80 percent of its inputs to produce the same amount of outputs. Overall there is little discernible difference across regions for banks located in emerging market and developing countries.[29]

B. Truncated Regression Results

The main aim of this study is to provide consistent estimation of the relationship between bank efficiency and BCP compliance, given the heterogeneous nature of the sample. Using the approach described in Section II (G), we adopt two model specifications to provide a commentary on whether overall BCP compliance or compliance with any of its component chapters influence bank efficiency. Following Simar and Wilson (2007), we use a truncated regression model to investigate how producer-specific and country-level variables influence bank efficiency, with parameters being estimated by maximum likelihood. The authors' Algorithm 2 is used to obtain the bootstrapped confidence intervals for these estimates. Specifically, the confidence intervals are constructed via the second part of the Simar and Wilson (2007) Algorithm 2 double bootstrapping procedure, using 30,000 replications. Tables 3a and 3b present the parameter estimates of the 12[30] regressions produced when the three groupings described above are used.

Effects of BCP compliance

None of the regression results provide robust statistical evidence to suggest that overall BCP compliance or compliance with any of the individual chapters has a positive influence on bias-corrected bank efficiency. This adds further support to the argument that BCP compliance has no impact on the operational performance of individual banks, and may also reflect the

[28] This is the average distance of a typical bank from a global frontier built using a sample of only the emerging market and developing country banks.

[29] When regional comparisons are considered, no obvious trends emerge. Banks located in PAS countries (This category includes 15 Indonesian banks, 10 Thai banks, and 19 Philippine banks) are, on average, more efficient than those in other regions, with a mean bias-corrected technical efficiency of 0.817. Furthermore, these banks experience more stability in their efficiency levels, with a lower coefficient of variation. At the other extreme, banks located in SAS countries (This category includes 38 Indian banks, 23 Bangladeshi banks, and 14 Sri Lankan banks) are, on average, the least efficient in all the regions, with a mean bias-corrected efficiency of 0.793.

[30] There are 12 regressions because each grouping is assessed using both models with two different sets of dummies: economic development dummies and regional dummies.

inability of assessors to provide a consistent cross-country evaluation of effective banking regulation (Demirgüç-Kunt and Detragiache 2011).

[Tables 3a & 3b: Truncated regressions]

Effects of bank characteristics

From Tables 3a and 3b, it is clear that bank-specific variables play an important role in explaining the variability of bias-corrected bank input efficiency. Typically, larger, more actively lending banks (that is, banks with higher loan-to-asset ratios) are more efficient; this finding persists across the two subsamples.

Effects of economic and financial conditions

Across the groupings analyzed, no consistent relationships between bias-corrected input bank efficiency and economic/financial conditions emerge. The full sample assessment suggests that banks in countries with higher relative economic growth (illustrated by GDP growth) are typically more efficient. Moreover, higher levels of financial intermediation (illustrated by the ratio of private sector banks' claims to GDP - PrCrGDP) are positively associated with bank efficiency. These finding are consistent with previous studies (Lozano-Vivas and Pasiouras 2010; Pasiouras 2008) and suggest that favorable macroeconomic conditions will positively affect the supply and demand of banking services, improving bank efficiency.

The results provide some evidence to suggest that concentration in the banking industry has a detrimental effect on bank efficiency, as indicated by the negative association between bank concentration (CONC) and bias-corrected bank input efficiency, from model 1 results using the regional dummies.

Regulatory effects

Similarly, there is little evidence of pattern when regulatory effects across the three groupings are considered. The full sample results provide some evidence to suggest that regulation which enhances private monitoring (PRMON) also increases bank efficiency, while regulation which stifles competition negatively affects bank efficiency. These findings add support to the private monitoring hypothesis; regulation that requires a bank to provide accurate and timely information to the public allows private agents to overcome information and transaction costs, enabling them to monitor banks more effectively. The latter finding is consistent with the recent finding that tighter restrictions on bank activities have a negative effect on bank efficiency (Barth and others 2013).

Furthermore, there is some evidence to suggest that corporate governance has a positive influence on bank efficiency, while increased depositor protection and restrictions on activity have a negative impact.

C. Regulatory Compliance in Emerging Markets

Because of the significant differences between emerging markets and advanced economies, in this part of the analysis we focus on a sample of emerging market and developing economies. Differences in the level of institutional development, law and order, contract enforcement, and corruption, for example, may affect both the level of compliance and the efficiency of banking institutions. We therefore examine whether the impact of regulatory compliance on bank efficiency is conditioned by the level of development. A higher level of compliance would provide a secure environment for stable industry growth, and thus improve banking efficiency; however, regulatory compliance with international standards is costly and could negatively affect bank resource allocation.

To this end, we re-estimate the (bias-corrected) efficiency scores on our subsample of banks from emerging market and developing economies, and then proceed with the two-stage analysis. The results are reported in Table 3b. Although the results on the aggregate BCP index do not support the hypothesis of an association between regulatory compliance and bank efficiency, when we explore the relationship between efficiency and compliance with the different chapters or group of principles, we find some evidence of a negative relation. In particular, for banks in emerging countries, compliance with Chapter 4 (Methods of Ongoing Supervision) has a negative and significant impact on the bias-corrected efficiency measures. Specifically, this chapter relates to the effectiveness of the existing supervisory framework and ability of supervisors to carry out their duties. Against a background of (potentially) increased supervisory scrutiny required to meet international standards, banks are likely to face more substantive compliance costs, such as investments in accounting systems, risk management systems, equipment, and training. This in turn can distort their business objectives, lowering investment and decreasing lending, and resulting in lower efficiency.

On the other hand, the extent to which supervisors apply international global standards is positively associated with bank input efficiency (Chapter 7). This latter result may indicate that in emerging markets, adherence to international standards of best practice has a positive effect on bank performance.

D. Sensitivity Analysis

For the purpose of robustness we re-estimate the models in Tables 4a and 4b using the Papke and Wooldridge (1996) fractional logit regression approach, as described in McDonald (2009). He argues that DEA efficiency is the outcome of a fractional logit process (taking values between zero and one) rather than a latent variable from a truncated process, as described by

Simar and Wilson (2007). Using the raw uncorrected DEA estimates, Table 3 reports the parameters that were estimated using quasi-maximum likelihood methods.

Overall, the results seem to corroborate the key findings reported in Table 2. Specifically, we continue to find no evidence of any beneficial relationship between bank efficiency and compliance with the BCPs.

[Tables 4a and 4b: Fractional logit regressions]

IV. CONCLUSIONS

This paper contributes to the ongoing debate over the impact of regulation and supervision on bank performance. Using World Bank Basel Core Principles for Effective Bank Supervision (BCP) assessments conducted from 1999 to 2010, we evaluate how compliance with BCP affects bank performance for a sample of 863 publicly listed banks drawn from a broad cross-section of countries.

Our results indicate that overall BCP compliance, or indeed compliance with any of its individual chapters, has no association with bank efficiency. This result holds after controlling for bank-specific characteristics, the macroeconomic environment, institutional quality, and the existing regulatory framework, and adds further support to the argument that although compliance has little effect on bank efficiency, increasing regulatory constraints may prevent banks from efficiently allocating resources. When only banks in emerging market and developing countries are considered, we find some evidence of a negative relation with specific chapters that relate to the effectiveness of the existing supervisory framework and the ability of supervisors to carry out their duties. However, these results need to be treated with caution, because they may also reflect the inability of assessors to provide a consistent cross-country evaluation of effective banking regulation.

One limitation of this type of analysis is that compliance with the Basel Core Principles for Effective Bank Supervision (BCP) is measured at a particular point in time and does not allow for taking into account the evolution of each country's banking system in compliance with international regulatory standards. However, a small number of countries in the sample have been surveyed twice. By focusing on these countries, it would be possible to assess the impact of the changes in compliance scores, both for those countries whose bank performance has moved closer to international standards and for those countries which have underperformed.

V. TABLES IN BODY OF TEXT

Table 1: Descriptive Statistics

Panel 1: Full sample summary statistics				**Panel 2: Median values by economic development**			
	Mean	Median	SD	Advanced	Emerging and Developing	Major Advanced	Transition
Bank level variables							
Inputs (Mil $)							
Deposits and short term funding	9,475	1,459	25,276	7,649	980	2,592	261
Total costs	606	105	1,808	409	105	125	28
Equity	964	158	2,882	558	100	255	41
Outputs (Mil $)							
Loans	7,325	1,013	21,655	5,692	597	1,992	196
Other Earning Assets	4,605	519	15,817	2,852	414	800	75
Non-Interest Income	185	21	953	95	18	26	10
Bank Characteristics							
Total Assets (Mil $)	13,123	1,807	38,800	9,862	1,199	3,229	331
Loan to Assets	0.58	0.61	0.16	0.61	0.52	0.65	0.57
Equity to Assets	0.1	0.09	0.08	0.06	0.09	0.09	0.12
Return on Equity	0.02	0.09	0.57	0.16	0.17	0.05	0.11
Country level variables							
*Regulatory variables**							
RESTR	0.58	0.61	0.12	0.44	0.67	0.61	0.44
COMP	0.55	0.5	0.21	0.33	0.67	0.5	0.83
CAPRQ	0.51	0.63	0.19	0.38	0.31	0.63	0.63
PRMON	0.67	0.8	0.15	0.7	0.6	0.8	0.5
DEPSEC	0.25	0.17	0.2	0.37	0	0.17	0.42
CORPGOV	0.63	0.69	0.16	0.69	0.58	0.69	0.46
*BCP variables**							
BCPscore	0.24	0.18	0.22	0.15	0.45	0.04	0.31
BCPch1	0.28	0.29	0.27	0.29	0.56	0	0.47
BCPch2	0.19	0.1	0.23	0.1	0.4	0	0.3
BCPch3	0.31	0.24	0.17	0.14	0.48	0.21	0.38
BCPch4	0.21	0.07	0.21	0.14	0.43	0.07	0.29
BCPch5	0.19	0	0.22	0	0.33	0	0.33
BCPch6	0.21	0	0.26	0.33	0.33	0	0.33
BCPch7	0.28	0.29	0.27	0.08	0.42	0.08	0.33
Other Controls							
Inflation	0.04	0.01	0.06	0.03	0.06	0.01	0.12
Private Credit per GDP	1.21	1.29	0.76	1.08	0.36	2.01	0.42
Concentration	0.54	0.42	0.23	0.89	0.56	0.42	0.73
GDP growth	0.06	0.04	0.09	0.05	0.06	0.04	0.17

The above variables describe the full sample of 863 banks. All bank-level monetary values are deflated to 2005 prices. *These variables have been normalized to take values in the interval [0, 1] because Simar and Wilson (2007) argue that this improves the optimization of maximum likelihood estimates of a truncated regression. This normalized variable also has the intuitively appealing property of a percentage interpretation.

Table 1b: Correlation Matrix of BCP chapter variables

	BCPch1	BCPch2	BCPch3	BCPch4	BCPch5	BCPch6	BCPch7
BCPch1	1.00						
BCPch2	0.71	1.00					
BCPch3	0.65	0.76	1.00				
BCPch4	0.68	0.78	0.84	1.00			
BCPch5	0.70	0.75	0.71	0.73	1.00		
BCPch6	0.69	0.53	0.57	0.61	0.53	1.00	
BCPch7	0.64	0.59	0.70	0.68	0.58	0.54	1.00

Given the high correlations between the BCP chapters the first principal component of each chapter was also used to assess whether bank input efficiency was harmed by sub chapter compliance. The empirical results were broadly similar to those reported in the main findings in Table 3a and 3b.

Table 2: Bank efficiency estimates

Panel 1: Full Sample	**EFFbc**	**SD**	**CV**
All (n=863)	0.419	0.134	0.320
Advanced (n=73)	0.424	0.166	0.392
Emerging and Developing (n=238)	0.367	0.165	0.450
Major Advanced (n=421)	0.431	0.126	0.292
Transition (n=131)	0.424	0.11	0.259
Panel 2: Non US Sample			
All (n=559)	0.584	0.109	0.187
Advanced (n=73)	0.604	0.12	0.199
Emerging and Developing (n=238)	0.534	0.111	0.208
Major Advanced (n=117)	0.642	0.091	0.142
Transition (n=131)	0.578	0.097	0.168
Panel 2: Emerging and Developing Sample			
All (n=235)*	0.803	0.096	0.120
Latin America and the Caribbean (LAM) (n=52)	0.811	0.075	0.092
Middle East and North Africa (MEA) (n=50)	0.802	0.09	0.112
Other Pacific Asia (PAS) (n=41)	0.817	0.07	0.086
South Asia (SAS) (n=73)	0.793	0.126	0.159
Sub-Saharan Africa (AFR) (n=19)	0.796	0.077	0.097

EFFbc =Bias-corrected input technical efficiency under variable returns to scaled. This table presents efficiency scores averaged by developmental level and region. The results in all panels were obtained using model 1. The standard deviation (SD) and the coefficient of variation (CV) are reported for the EFFbc estimates. *The sample size is slightly smaller than that reported for the full sample because some banks were dropped in the initial outlier investigations.

Table 3a: Truncated regressions

	Full Sample Model				**No US model**			
Predictors	*Baseline*		*Disaggregated*		*Baseline*		*Disaggregated*	
Basel Core Principles								
BCPscore	-0.0421	-0.0081			-0.0397	-0.0334		
BCPch1			-0.0307	-0.0537			-0.106	-0.0632
BCPch2			0.064	0.0143			0.0301	0.0066
BCPch3			0.0567	0.0265			0.0504	0.1333
BCPch4			-0.0357	-0.0604			-0.1154	-0.1426
BCPch5			-0.0218	-0.0031			-0.0104	-0.0294
BCPch6			-0.0221	-0.0175			-0.0324	-0.0207
BCPch7			0.0332	0.008			0.0259	0.0002
Bank Specific								
logta	0.0093**	0.0113**	0.0105**	0.0111**	0.0145**	0.0135**	0.0129**	0.0128**
lta	0.215**	0.1765**	0.1885**	0.1881**	0.0252	0.0364	0.0006	0.0139
EqTa	-0.0876	-0.0916	-0.0578	-0.0804	-0.0075	-0.0195	-0.0206	-0.0338
roe	-0.0021	-0.0047	-0.0049	-0.0067	-0.0226	-0.0238	-0.0263	-0.0234
Country Specific								
infl	-0.0604	-0.4529**	-0.0033	-0.2049	-0.1732	-0.2984	-0.0911	-0.2745
gdpg	0.138**	0.0013	0.247	0.1295**	0.0355	0.0241	0.0174	0.0478
PrCrGDP	0.0327	0.1068**	0.0261	0.05**	0.0152	0.0325	0.0076	0.0136
conc	-0.0339	-0.12**	-0.0625	-0.0599	-0.0158	-0.0022	-0.043	-0.0422
caprq	0.0382	0.0003	0.0161	0.0014	0.022	0.0257	0.0085	0.0251
comp	-0.1723**	-0.0899**	-0.1424**	-0.1099**	-0.0315	-0.033	-0.0403	-0.0421
prmon	0.1481**	0.0432	0.1507**	0.0287	0.022	0.0519	0.0776	0.0161
depsec	-0.0638	-0.1591**	-0.0591	-0.0485	-0.0149	-0.0358	-0.0635	-0.0179
corpgov	0.0501**	0.0305	0.0289	0.0408	0.0568	0.1071	0.0481	0.0046
restr	-0.0442	-0.1295	-0.0116	-0.1709**	-0.0832	-0.0947	-0.1098	-0.1589
Developmental/Regional dummies								
ED	-0.0333		-0.0365		-0.0169		-0.0384	
MA	-0.0649**		-0.0762		0.027		0.011	
T	-0.0193		-0.0261		-0.0237		-0.023	
EEU		-0.011*		-0.012				
LAM		-0.0669**		-0.0569		0.055		0.081**
MEA		-0.0435		-0.0395		0.0276		0.0454
FSU		-0.021		-0.003		-0.0032		-0.0196
PAS		-0.1061**		-0.0602		0.0872**		0.0982**
PAO		-0.3277**		-0.17**		0.1064		0.0888
SAS		-0.0064		-0.0021		0.0014		0.0065
AFR		-0.0265		-0.0411		0.0349		0.0501
WEU		0.1011**		0.041		0.0747**		0.0738**
Year dummies included	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.6418**	0.4655**	0.5144**	0.4917**	0.3348**	0.2984**	0.3019**	0.2869**
Obs	863	863	863	863	559	559	559	559

Dependent variable is EFFbc,*i*,*j* = the bias-corrected input technical efficiency estimates.*** p<0.01 Significance from zero at the 1% level according to bootstrapped confidence intervals, ** p<0.05 Significance at the 5% level according to bootstrapped confidence intervals, * p<0.1 Significance from zero at the 10% level according to bootstrapped confidence intervals. 30,000 replications were used to calculate the bootstrapped confidence intervals for the above parameter estimates. For definition of dummy variables see body of text. In the full sample model the benchmark economic group is Advanced Economies and the benchmark region is North America; in the non-U.S. model the benchmark region is Central & Eastern Europe. The inclusion of year dummies is to capture the different assessments time periods.

Table 3b: Truncated regressions

Emerging and Developing Model				
Predictors	*Baseline*		*Disaggregated*	
Basel Core Principles				
BCPscore	-0.0347	-0.0852		
BCPch1			-0.2026	-0.0301
BCPch2			0.0143	0.1906**
BCPch3			0.1355	0.0641
BCPch4			-0.7468**	-0.0471
BCPch5			-0.1641	-0.1721
BCPch6			-0.1024	-0.013
BCPch7			0.6414**	0.1069
Bank Specific				
logta	0.0308**	0.0294**	0.032**	0.0351**
lta	0.1319**	0.1321**	0.1627**	0.1509**
EqTa	0.1788	0.191	0.1602	0.2854**
roe	-0.0011	-0.0065	-0.015	-0.016
Country Specific				
infl	-0.4184	-0.2507	-1.2901**	-0.1083
gdpg	0.0143	0.1831	0.8671	0.1755
PrCrGDP	0.0116	0.0918	0.0949	0.1021
conc	-0.0162	-0.0504	-0.0727	-0.0063
caprq	-0.0491	-0.0652	-0.2253	-0.0754
comp	-0.0207	-0.0029	-0.2923	-0.0246
prmon	0.0082	0.3298	0.7974	0.0375
depsec	-0.061	-0.0667	-0.3125**	-0.1554
corpgov	0.0544	0.161	0.1955	0.0099
restr	-0.0135	-0.1372	-0.6102	-0.2471
Regional dummies				
MEA		-0.0238		-0.0065
PAS		-0.0333		-0.0062
SAS		-0.0774		-0.0828
AFR		-0.0327		-0.0155
Year Dummies included	Yes	Yes	Yes	Yes
Constant term	0.2815	0.4504	1.2641**	0.1664
Observations	235	235	235	235

Dependent variable is EFFbc,*i*,*j* = the bias-corrected input technical efficiency estimates.*** p<0.01 Significance from zero at the 1% level according to bootstrapped confidence intervals, ** p<0.05 Significance at the 5% level according to bootstrapped confidence intervals, * p<0.1 Significance from zero at the 10% level according to bootstrapped confidence intervals. 30,000 replications were used to calculate the bootstrapped confidence intervals for the above parameter estimates. In the dummy variables categorisation the benchmark region is Latin America and the Caribbean.

Table 4a: Fractional logit regressions

	Full Sample Model				**No US model**			
Predictors	*Baseline*		*Disaggregated*		*Baseline*		*Disaggregated*	
Basel Core Principles								
BCPscore	-0.1761	-0.0311			-0.1608	-0.1262		
BCPch1			-0.094	-0.2558			-0.4367*	-0.255
BCPch2			0.257	0.0495			0.1246	0.0206
BCPch3			0.2205	0.0946			0.2185	0.5351
BCPch4			-0.1593	-0.2546			-0.485*	-0.5858*
BCPch5			-0.1037	-0.0163			-0.04	-0.1226
BCPch6			-0.0911	-0.075			-0.1378	-0.0901
BCPch7			0.117	0.048			0.1088	0.017
Bank Specific								
logta	0.0376***	0.0458***	0.0425***	0.0445***	0.0599***	0.056***	0.0528***	0.0528***
lta	0.8652***	0.7111***	0.76***	0.7599***	0.0983	0.1411	0.0032	0.0495
EqTa	-0.3667	-0.411	-0.2499	-0.3685	-0.0314	-0.0796	-0.087	-0.1384
roe	-0.0079	-0.0171	-0.0188	-0.0254	-0.0928	-0.0938	-0.1064	-0.0918
Country Specific								
infl	-0.2097	-0.8707**	-0.1109	-0.775	-0.6654	-1.2129*	-0.3584	-1.1381
gdpg	0.5482	0.0107	0.9443**	0.4956	0.1414	0.0953	0.0797	0.1907
PrCrGDP	0.1402	0.4537***	0.1046	0.2165	0.0553	0.1182	0.0381	0.0454
conc	-0.1443	-0.4951***	-0.2613	-0.2515	-0.0556	-0.0089	-0.176	-0.1827
caprq	0.1467	0.0011	0.0634	0.003	0.0946	0.1046	0.0373	0.0989
comp	-0.6893***	-0.35	-0.5677**	-0.4276*	-0.1501	-0.1509	-0.178	-0.1936
prmon	0.6239*	0.1757	0.6391*	0.1	0.0881	0.2126	0.3187	0.063
depsec	-0.2732	-0.6676***	-0.2505	-0.198	-0.0537	-0.1561	0.2593	-0.0768
corpgov	0.1996	0.1288	0.0886	0.1855	0.2441	0.452*	0.2003	0.0051
restr	-0.1462	-0.5012	-0.0289	-0.6914	-0.3502	-0.3967	-0.4664*	-0.6696*
Developmental/Regional dummies								
ED	-0.1309		-0.1559		-0.0725		-0.1621	
MA	-0.272		-0.3249		-0.1091		0.0435	
T	-0.0791		-0.1124		-0.0912		-0.0908	
EEU		-0.054		-0.044				
LAM		-0.2705*		-0.2318		0.2208**		0.3345**
MEA		-0.1796		-0.1749		0.1001		0.181
FSU		-0.0923		-0.015		-0.0152		-0.0741
PAS	PAS		-0.4438***		-0.2632		0.3628***	0.416***
PAO		-0.3695***		-0.7429**		0.4079*		0.3455
SAS		-0.0155		-0.01		0.0059		0.0372
AFR		-0.0984		-0.1772		0.1417		0.2062
WEU		0.4348**		0.1818		0.2869**		0.2924**
Year dummies	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Constant	0.5553	-0.1583	0.0183	0.0457	0.6631	-0.8267*	0.8019	0.8643*
Obs	863	863	863	863	559	599	559	559

EFF*i,j* = the original uncorrected raw DEA efficiency estimates.*** p<0.01(1% significance), ** p<0.05(5% significance), * p<0.1(10% significance). In the full sample model the benchmark economic group is Advanced Economies and the benchmark region is North America; in the non-U.S. model the benchmark region is Central & Eastern Europe.

Table 4b: Truncated regressions

Emerging and Developing Model				
Predictors	*Baseline*		*Disaggregated*	
Basel Core Principles				
BCPscore	-0.2648	-0.5947		
BCPch1			-0.313*	-0.1361
BCPch2			0.1546	0.1247**
BCPch3			0.5671	0.5683
BCPch4			-0.4336***	-0.0149
BCPch5			-0.6399	-0.9718
BCPch6			-0.5507	-0.2959
BCPch7			0.5554***	0.5177
Bank Specific				
logta	0.1545***	0.1491***	0.1534***	0.1818***
lta	0.6931**	0.711**	0.8478**	0.8238***
EqTa	1.0277	1.1263	0.8814	0.6909**
roe	-0.0203	-0.0476	-0.1205	-0.1125
Country Specific				
infl	-0.27*	-0.2667	1.1257***	-0.5981
gdpg	0.0034	0.0611	0.3102***	0.8413
PrCrGDP	0.0617	0.5442	0.076	0.5642
conc	-0.1676	-0.2662	-0.0282	-0.1945
caprq	-0.2012	-0.3987	-1.1174	-0.5588
comp	-0.1591	-0.0093	-1.4498**	-0.05
prmon	0.2253	0.0046	0.1605**	0.0293
depsec	-0.2976	-0.4088	-0.0464***	-0.7912
corpgov	0.243	0.0156	0.6992	0.0979
restr	-0.0759	-0.81	0.2457**	-0.5493
Regional dummies				
MEA		-0.1637		-0.0118
PAS		-0.234		-0.1382
SAS		-0.4048		-0.5257
AFR		-0.1734		-0.1093
Year Dummies included	Yes	Yes	Yes	Yes
Constant term	-0.2386	-0.1698	-0.5465***	-0.3416
Observations	-0.1632	-0.5712	-0.2545	-0.4914

Dependent variable is EFFi,j =the original uncorrected raw DEA efficiency estimates.*** p<0.01(1% significance), ** p<0.05(5% significance), * p<0.1(10% significance). In the dummy variables categorisation the benchmark region is Latin America and the Carribean.

VI. APPENDIX

A.1. Full Sample

Country	Number of banks	Year BCP assessment	Country	Number of banks	Year BCP assessment
Armenia	1	2005	Korea Rep. Of	10	2001
Australia	1	2005	Kuwait	6	2003
Austria	2	2003	Latvia	2	2001
Bahrain	1	2005	Lebanon	3	2001
Bangladesh	23	2009	Lithuania	4	2001
Bolivia	4	2003	Luxembourg	2	2001
Bosnia-Herzegovina	13	2005	Malawi	2	2007
Chile	7	2003	Malta	4	2002
Croatia	23	2003	Mauritius	3	2005
Cyprus	2	2005	Mexico	5	2006
Czech Republic	1	2000	Moldova Rep. Of	8	2007
Denmark	11	2005	Morocco	5	2007
Ecuador	6	2003	Oman	3	2003
Egypt	21	2002	Panama	5	2001
Estonia	1	2000	Peru	6	2005
Finland	2	2001	Philippines	17	2001
Germany	11	2003	Poland	11	2000
Ghana	4	2000	Portugal	4	2005
Greece	10	2005	Romania	3	2008
Guyana	2	2005	Russian Federation	56	2007
Honduras	13	2002	Singapore	1	2002
Hong Kong	1	2002	Slovakia	5	2002
Hungary	2	2000	Slovenia	1	2000
India	38	2000	Spain	6	2005
Indonesia	15	2000	Sri Lanka	14	2004
Israel	8	2000	Sweden	2	2001
Italy	19	2003	Switzerland	6	2001
Jamaica	2	2005	Syrian Arab Rep.	5	2008
Japan	87	2002	Thailand	10	1999
Jordan	6	2003	Trinidad & Tobago	2	2005
Kenya	10	2007	Ukraine	1	2002
Korea Rep. of	10	2001	U.S.A	304	2010

Table A.2: Summary statistics for original DEA estimates

Panel 1: Full Sample	**Raw DEA Efficiency Scores**
All (n=863)	0.537
Advanced (n=73)	0.638
Emerging and Developing (n=238)	0.417
Major Advanced (n=421)	0.609
Transition (n=131)	0.439
Panel 2: Non US Sample	
All (n=559)	0.655
Advanced (n=73)	0.78
Emerging and Developing (n=238)	0.58
Major Advanced (n=117)	0.869
Transition (n=131)	0.552
Panel 2: Emerging and Developing Sample	
All (n=235)*	0.828
Latin America and the Caribbean (LAM) (n=52)	0.831
Middle East and North Africa (MEA) (n=50)	0.828
Other Pacific Asia (PAS) (n=41)	0.787
South Asia (SAS) (n=73)	0.848
Sub-Saharan Africa (AFR) (n=19)	0.84

These are the Original (raw) input technical efficiency estimated under a variable returns to scale assumption.

Table A.3: Variable definitions

Variables	Definition	Original Source
Financial Intermediation Model		
Bank outputs		
Loans	Total loans (mil USD)	Bankscope
Other earning assets	Total other earning assets (mil USD)	Bankscope
Non-interest income	Total noninterest income and other fee-based income (mil USD). This measure accounts for nontraditional banking activities in the financial intermediation process.	Bankscope
Bank inputs		
Customer deposits and short term funding	Total customer deposits and short-term funding (mil USD)	Bankscope
Total costs	Total of interest and noninterest expenses (mil USD)	Bankscope
Equity Capital	Total Equity (mil USD). This measure is used to adequately capture the impact of risk in the financial intermediation process.	Bankscope
Other Variables		
Dependent variables in regression models		
EFFraw,i,j	Original (raw) DEA input technical efficiency estimates. These scores are calculated in the first step of our analysis before the application of the Simar and Wilson (2007) double bootstrapping procedure.	Authors' calculation
EFFbc,i,j	Bias-corrected DEA input technical efficiency estimates. These scores result from the application of the first bootstrap of the Simar and Wilson (2007) double bootstrapping procedure on the raw DEA estimates.	Authors' calculation
Macroeconomic and financial conditions variables		
Infl	An annual rate of inflation measured as the percentage change in the consumer price index.	World Bank Indicators (WDI)
Gdpg	A measure of the economic conditions under which a bank operates. It is defined as the real annual growth in GDP.	World Bank Indicators (WDI)
PrCrGDP	A ratio of private sector credit to gross domestic product that measures the level of financial development.	World Bank Indicators (WDI)
Conc	A measure of market concentration, which is calculated as the ratio of the assets of three largest banks to the assets of all publicly traded banks.	Thorsten Beck, Aslı Demirgüç-Kunt and Ross Levine, (2000), "A New Database on Financial Development and Structure," World Bank Economic Review 14, 597-605. (Dataset updated April 2013)
Regulatory conditions variables		
Caprq	Measures whether capital requirements reflect certain risk elements and deducts certain market value losses from capital adequacy. It is an index that is the normalised sum of the answers to the following questions (yes=1, no=0). (1) Is the minimum required capital asset ratio risk-weighted in line with Basle guidelines? (2) Does the ratio vary as a function of individual credit risk? (3) Does the ratio vary with market risk? (4) Before minimum capital adequacy is determined, which of the following are deducted from the book value of capital: (a) market value of loan losses not realised in accounting books? (b) Unrealised losses in securities portfolios? (c) Unrealised foreign exchange losses? It takes values	(Barth, Caprio, and Levine 2006)

	between 0 and 1, with values closer to 1 indicating greater capital stringency.	
compj	Measures the restriction on entry or the lack of competition using the following questions: (1) Limitation on foreign bank entry/ownership (0-3) lower value indicative of greater stringency; (2) Entry into banking requirements (0-8) higher value indicates greater stringency; (3) Percentage of entry applications denied. An overall index is calculated by normalizing each question to take values between 0 and 1 and taking an overall average. Values closer to 1 indicate greater restrictions on competitiveness.	(Barth, Caprio, and Levine 2006)
prmonj	Measures the degree to which banks are required to publicly disclose accurate information and whether incentives are in place to encourage private monitoring. It is an index that is the normalized sum of the answers to the following questions. In questions 1–6: yes=1 and no=0 while the opposite occurs in the case of questions 7 and 8 (i.e. yes = 0, no = 1). (1) Is subordinated debt allowable (or required) as part of capital? (2) Are financial institutions required to produce consolidated accounts covering all bank and any nonbank financial subsidiaries? (3) Are off-balance sheet items disclosed to the public? (4) Must banks disclose their risk management procedures to public? (5) Are directors legally liable for erroneous/misleading information? (6) Do regulations require credit ratings for commercial banks? (7) Does accrued, though unpaid interest/principal enter the income statement while the loan is nonperforming? (8) Is there an explicit deposit insurance protection system? It takes values between 0 and 1, values closer to 1 indicate higher levels of private monitoring.	(Barth, Caprio, and Levine 2006)
depsecj	This index is calculated as the average of three normalized variables. Each variable is normalized to take values between zero and one. The variables are: a) Deposit insurer power: based on the assignment of 1 (yes) or 0 (no) values to three questions assessing whether the deposit insurance authority has the authority: (1) to make the decision to intervene in a bank, (2) to take legal action against bank directors or officials, or (3) has ever taken any legal action against bank directors or officers. The sum of the assigned values ranges from 0 to 3, with higher values indicating more power. (b) Deposit insurance funds to total bank assets: the size of the deposit insurance fund relative to total bank assets. In the case of the U.S. savings and loan debacle during the 1980s, the insurance agency itself reported insolvency. This severely limited its ability to effectively resolve failed savings and loan institutions in a timely manner (Barth, 1991). (c) Moral hazard index: based on Demirgüç-Kunt and Detragiache (2002), who used principal components to capture the presence and design features of explicit deposit insurance systems, with the latter including: no coinsurance, foreign currency deposits covered, interbank deposits covered, type of funding, source of funding, management, membership, and the level of explicit coverage. Higher values imply greater moral hazard. Values closer to 1 indicate higher levels of depositor security.	(Barth, Caprio, and Levine 2006)
corpgovj	A measure of corporate governance and quantifies the effectiveness of external audits of banks. It is the normalized sum of the answers to the following questions (Yes=1, No=0): 1.Is an external audit a compulsory obligation for banks? 2.Are specific requirements for the extent or nature of the audit spelled out? 3. Are auditors licensed or certified? 4. Do supervisors get a copy of the auditor's report? 5. Does the supervisory agency have the right to meet with external auditors to discuss their report without the approval of the bank? 6. Are auditors required by law to communicate directly to the supervisory agency any presumed involvement of bank directors or senior managers in illicit activities, fraud, or insider abuse? 7. Can supervisors take legal action against external auditors for negligence? It takes values between 0 and 1. Values closer to 1 indicate better strength of external audit.	(Barth, Caprio, and Levine 2006)

restrj	This measures the extent to which a bank can participate in: (1) securities activities; (2) insurance activities; (3) real estate activities; (4) bank ownership of nonfinancial firms ; (5) Nonfinancial firms owning banks; and (6) Nonbank financial firms owning banks. These activities can be; unrestricted=1: full range of activities can be conducted directly in the bank; permitted=2: full range of activities can be conducted but some must be done within subsidiaries; restricted=3: less than full range of activities can be conducted in the bank or subsidiaries; and prohibited=4: the activities cannot be conducted in the bank or subsidiaries. Summing all values and normalizing the result to be between 0 and 1 creates an overall index. Values closer to 1 indicate greater restrictiveness.	(Barth, Caprio, and Levine 2006)
BCP compliance variables	*Twenty-five individual compliance rates based on each of the BCPs are used in the constructions of the below variables. Each rate is based on a four-point scale: noncompliant=0; materially noncompliant=1; largely compliant=3; and compliant=4. These 25 are categorized into seven chapters which represent different regulatory dimensions of supervision. The first seven variables below represent each of these chapters.*	
BCPCh1 (Chapter 1)	Measures the extent to which the preconditions for effective banking supervision have been met. This index is a normalized sum of the rates of compliance with sub-principles of principle 1: 1(1): There should be clear responsibilities and objectives set by legislation for each supervisory agency; 1(2): Each supervisory agency should possess adequate resources to meet the objective set, provided on terms that do not undermine the autonomy, integrity and independence of supervisory agency; 1(3): A suitable framework of banking laws, setting bank minimum standard, including provisions related to authorization of banking establishments and their supervision; 1(4): The legal framework should provide power to address compliance with laws as well as safety and soundness concerns; 1(5): The legal framework should provide protection of supervisors for actions taken in good faith in the course of performing supervisory duties; and 1(6): There should be arrangements of interagency cooperation, including with foreign supervisors, for sharing information and protecting the confidentiality of such information. This index takes values between 0 and 1, with values closer to 1 indicative of better adherence to these preconditions.	IMF/World Bank Basel Core Financial Sector Assessment Program (FSAP) database.
BCPCh2 (Chapter 2)	A measure of the power of supervisors to grant banks licences and review major financial transactions. This index is a normalized sum of the compliance rates of principles 2-5; 2: Definition of permissible activities; 3: Right to set licensing criteria and reject applications for establishments that do not meet the standard sets; 4: Authority to review and reject proposals for significant ownership changes; and 5: Authority to establish criteria for reviewing major acquisitions or investments. This index takes values between 0 and 1, with values closer to 1 indicative of greater power of supervisors to licence and influence structure.	IMF/World Bank Basel Core Financial Sector Assessment Program (FSAP) database.
BCPCh3 (Chapter 3)	Measures the prudence and appropriateness of the minimum capital adequacy requirements that supervisors set. This index is the normalized sum of the rates of compliance with principles 6–15: 6: Prudent and appropriate risk-adjusted capital adequacy ratios must be set; 7: Supervisors should evaluate banks' credit policies; 8: Banks should adhere to adequate loan evaluation and loan-loss provisioning policies; 9: Supervisors should set limits to restrict large exposures, and concentration in bank portfolios should be identifiable; 10: Supervisors must have in place requirements to mitigate the risks associated with related lending; 11: Policies must be in place to identify, monitor, and control country risks, and to maintain reserves against such risks; 12: Systems must be in place to accurately measure, monitor, and adequately control markets risks, and supervisors should have powers to impose limits or capital charge on such exposures; 13: Banks must have in place a comprehensive risk management process to identify, measure, monitor, and control all other material risks and, if needed, hold capital against such risks; 14:	IMF/World Bank Basel Core Financial Sector Assessment Program (FSAP) database.

	Banks should have internal control and audit systems in place; and 15: Adequate policies, practices, and procedures should be in place to promote high ethical and professional standards and prevent the bank being used by criminal elements. This index takes values between 0 and 1, with values closer to 1 indicating a greater compliance cost for banks of adherence to the minimum capital requirements.	
BCPCh4 (Chapter 4)	This measures the extent of the ongoing supervision. This index is calculated as the normalized sum of the rates of compliance rates with principles 16–20: 16: An effective supervisory system should consist of on-site and off-site supervision; 17: Supervisors should have regular contact with bank management; 18: Supervisors must have a means of collecting, reviewing, and analysing prudential reports and statistics returns from banks on a solo and consolidated basis; 19: Supervisors must have a means of independent validation of supervisory information, either through on-site examinations or use of external auditors; and 20: Supervisors must have the ability to supervise banking groups on a consolidated basis. This index takes values between 0 and 1, with values closer to 1 indicative of higher levels of on-going supervision.	IMF/World Bank Basel Core Financial Sector Assessment Program (FSAP) database.
BCPCh5 (Chapter 5)	A measure of the required extent of a bank's internal financial records. This variable is the normalized compliance rate for principle 21: Each bank must maintain adequate records that enable the supervisor to obtain a true and fair view of the financial condition of the bank, and must publish on a regular basis financial statements that fairly reflect its condition. This variable takes values between 0 and 1, with values closer to 1 indicative of the increased information requirements placed on banks by supervisors.	IMF/World Bank Basel Core Financial Sector Assessment Program (FSAP) database.
BCPCh6 (Chapter 6)	A measure of the formal powers of supervisors, calculated as the normalized compliance rate of principle 22: Adequate supervisory measures must be in place to bring about corrective action when banks fail to meet prudential requirements when there are regulatory violations, or when depositors are threatened in any other way. This should include the ability to revoke the banking license or recommend its revocation. This variable takes values between 0 and 1, with values closer to 1 indicative of greater supervisory powers.	IMF/World Bank Basel Core Financial Sector Assessment Program (FSAP) database.
BCPCh7 (Chapter 7)	Measures the extent to which supervisors apply global consolidated supervision over internationally active banks. This index is calculated as the normalized sum of the compliance rates of principles 23-25: 23: Supervisors must practice global consolidated supervision over internationally active banks, adequately monitor, and apply prudential norms to all aspects of the business conducted by these banks; 24: Consolidated supervision should include establishing contact and information exchange with the various supervisors involved, primarily host country supervisory authorities; 25: Supervisors must require the local operations of foreign banks to be conducted at the same standards as required of domestic institutions, and must have powers to share information needed by the home country supervisors of those banks. This index takes values between 0 and 1, with values closer to 1 indicative of increased practice of global consolidated supervision.	IMF/World Bank Basel Core Financial Sector Assessment Program (FSAP) database.
BCPScore	Finally, following (Demirgüç-Kunt and Detragiache 2011), an overall index is created by taking the mean value of all seven chapter indices above. This index takes values between 0 and 1, with values closer to 1 indicative of increased overall compliance with the BCPs.	IMF/World Bank Basel Core Financial Sector Assessment Program (FSAP) database.

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