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Globalization, regulation and profitability of banks: a comparative analysis of Europe, United States, India and China

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Abstract

The last financial crisis spurred regulators to emphasize enhanced stability indicators for financial institutions. Therefore, banks have to take into account this new element while defining their strategic decisions and their profitability. The aim of this paper is to provide evidence of the transformation of banking activities on a global scale comparing different regulatory and governance regimes.

Using a sample of 102 banks from 4 geographic regions (United States, Europe, China, India) we propose pooled and regional models to highlight the parameters that explain profitability and risk management of banks. Leveraging 2000-2016 monthly data, our empirical analysis underlines the regional differences in profitability, which influence global stability of banking institutions.

We find that increasing market capitalization often induces increased performance as expected; however a regional analysis of its impact reveals more nuanced geospatial variations and insights for risk management purposes. In particular, China constitutes an interesting case study as regards the impact of government on the performance of banking institutions, with this effect being cross validated by models contrasting private and public sector banks with different levels of government controls.

JEL classification: F65, G21, P5

Keywords: Regulation, Bank performance, Government intervention, Multiregional comparison, Risk management, Structural equation modeling

1. Introduction

Since several decades, banks have faced the dilemma of arbitraging between profit margin and stability. After the last crisis, performance and stability indicators are assumed to be the outcomes of strategic decisions for banks. The aim of this paper is therefore, to provide evidence of the transformation of banking structures on a global scale. Traditionally five main dimensions are used to describe business models of financial institutions: risk characteristics, systemic stability, bank performance, efficiency and corporate governance (Ayadi, R.et al., 2011). Beyond a discussion of all these aspects, this paper will focus on risk management and efficiency evaluation in order to identify the evolution of banking performance (Ramlall, I., & Ramlall, I., 2018). More

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specifically, we intend to identify the main factors that influence performance of banking institutions in the new regulatory environment.

A discussion taking into account the situation among banking activities in Asia, Europe and the United States will help to offer insights into the differences existing among banking institutions globally. In developed countries like the United States or Europe, banking systems enjoy free and relatively liberal activities. The situation is slightly different in China or India, where the intervention of the State could prevent or enhance profit and stability for banking institutions. Our international comparison leads us to discuss the influence of State intervention on the banking system structure, particularly for the Chinese case. We cross-validate this aspect by also developing models for public versus private banks.

In addition, we make a methodological contribution by explicitly addressing the potential correlations that could exist among a large number of ratios that could elaborate the links between stability and performance of banking institutions. Specifically, we employ available data for a sample of banks in different geographical areas to develop a pooled or transversal structural equation model. We analyse and contrast this with region-specific models for geo-specific insights. Unlike conventional regression equation modeling, our design has the advantage of allowing us to compare multiple model specifications to identify the best model for the pooled data and to underline the differences that could emerge from multiregional comparison using this pooled model as a referential benchmark.

After having presented the banking structures in Asia, Europe and United States and discussed the concept of performance and stability, the paper will present the dataset and the relevant ratios necessary to comprehend performance and stability for banking institutions. The structural equation models are explained in section 3. Section 4 discusses our baseline results. Section 5 concludes.

2. Hypothesis development

2.1. International banking structures: Key characteristics that influence performance

Europe offers several freedoms: freedom of establishment, freedom of capital circulation and freedom of provision of financial services. However, this is quite different in China or India. The aim of this section is to establish a topology of the banking systems selected in our sample in order to understand their strategic outcomes.

European banking systems are essentially constituted by universal banks (Paulet, 2005). These institutions can be understood as organisational structures, which maintain close relationships between firms and their financiers in order to guarantee a regular source of capital. While reserve requirements actually constrain banks, the European financial market is competitive and the universal bank model possesses a greater aptitude for the collection of information (with banks operating directly through representation on the Shareholders board), enabling them to better manage financial risks by a higher level of asset diversification. American banks enjoy the same competitive strength with a dominance of commercial and investment banks. The financial sector is largely dominated by the market, which explains the profit and risk encountered by banks.

The situation is more diversified in India. After a liberal period up to the mid 1960s, the banking industry experienced a wave of nationalization lasting up to the beginning of the eighties. But these public banks appear to be insufficiently competitive compared to foreign banks (Tzeremes, 2015). Therefore the Reserve Bank of India (RBI) initiated a banking reform towards deregulation in accordance with the traditional international standards (Koeva, 2003; Jayaraman and Srinivasan, 2014). Since 2000, Indian banks operate in a competitive environment (Prasad and Ghosh, 2005), and contribute to the economic development. The Indian Banking System consists of scheduled commercial banks (public sector banks, private sector banks), foreign banks, cooperative banks comprising of urban co-operative banks and rural co-operative credit institutions, and non-banking financial companies. Since the last global crisis, India adopted Basel III leading to higher and better quality capital. Banks have improved their risk management systems and have met the credit needs to satisfy the liquidity necessary for investment opportunities of companies. Nowadays, public sector banks remain dominant in the whole banking sector and represent about 75% of total advances in the Indian banking industry, whereas private sector banks are accountable for a share of 18.2% of the banking industry. Even if the ownership in the banking sector remained predominantly in the public sector despite a gradual decline in their share, India benefits from a liberal and friendly investment climate. Except for the particular structure of the financial institution, it seems that performance and stability of banking institutions are based fundamentally on the same criteria as their Western peers.

The Chinese banking system, in particular, deserves a closer review, as it is becoming a major actor in the global market. In 2005, Chinese banks intermediated about 72% of the capital in China, more than double the US percentage and 1.5 times higher than in other Asian countries (Farrel et al. 2006). Recently, their business model has been transformed due to the credit boom following the subprime mortgage crisis (Ho and al. 2013), the reduction in deposits and the development of 'shadow banking' (Valla 2013 ; Ma et al. 2013) . This situation remains one of the major preoccupations in the global world as China could induce difficulties for most developed and emerging economic areas.

The existing banking structure of China has gradually evolved from a Soviet-style mono-bank People's Bank of China (PBOC) system to a plural banking system since the inception of reforms in 1978. At that time, Chinese authorities established a two-tier banking system where top-tier banks (Agricultural Bank of China, Bank of China, China Construction Bank, Industrial and Commercial Bank of China) were under the control of the Central Bank and were originally responsible for serving distinct economic sectors and to grant loans for policy objectives (Fu et al. 2009) . In 1994 these banks were absolved of their policy lending objectives and were re-instated as commercial banks with the capacity to enter in direct competition with one another (Wong, 2000), despite remaining under government control.

The reforms between 1978 and 1994 have profoundly transformed the current Chinese banking structure. Nowadays, it includes various financial institutions in the form of commercial banks, policy banks, cooperative banks and non-bank financial institutions. By the end of 2014, China's banking system comprised 5 state-owned commercial banks (SOCBs), 12 joint stock commercial banks (JSCBs which focus mainly on specialized financial products and are partly owned by local government, state owned enterprises, and in few cases, by private corporations), 133 city commercial banks and 665 rural commercial banks. Further, there are 3 policy banks along with China Development Bank and 41 foreign banks. Nowadays, China's financial system remains a bank-dominated system. State intervention is still predominant: there exist persistent incentives to lend to state owned enterprises rather than private sector enterprises. However, the liberalization movement enhances a trend towards a convergence of Chinese banks versus the Western business model. This is precisely the focus of our empirical analysis. We intend to analyze if market development contributes to decreasing the importance of government intervention and improving banking performance.

Our previous discussion illustrates that banking systems could display wide diversity even with regard to their governance as in the case of China and India. As soon as the stock market developed, and financial liberalization occurred, the magnitude of this diversity began to shrink. Therefore, if determinant factors for performance were slightly different in the four geographical areas selected for our study, these differences could diminish over time. This will not be without influence on the stability of these financial institutions. This leads us to the following hypothesis:

H1 Stock market development and government intervention influence the geographic disparity and stability of the banking system.

2.2. Performance, liquidity and risk management for banking systems

Determinants of banking profitability are first categorized by internal variables. These factors, such as capital ratio, are commonly used to examine the correlation between bank profitability and risk management. A large body of literature states a high connection between bank's capital ratio and profitability. Brissimis, Delis, & Papanikolaou (2008) found that capital plays an important role in explaining a bank's profitability. Since the recent financial crisis, regulations have imposed higher capital requirements on banks, which can lower their charter value. By focusing on the increased risk levels, they must now manage, and by examining the increased speculative positions taken, banks are definitively adopting more cautious attitudes. Banks must simultaneously improve their risk management by evaluating their risk-weighted assets more adequately or by improving their equity ratios and profit margins. Collectively, the new regulated environment has enhanced bank management by improving the capitalization of institutions. However, Pasiouras, Tanna, & Zopounidis (2008) found that stricter capital requirements improve cost efficiency but reduce liquidity for banking institutions, which is not without influence on their profitability. In such a context, banks could issue short-term debt to fill this gap (Krishnamurthy and Vissing-Jorgenson (2012)). Hence the interconnection between financial institutions is a factor to take into consideration in the definition of the risk management of banks (Allen and Gale 2000; Rajan 2006, Brunnermeier 2008). Moreover, the magnitude of the liquidity channel based short term and long-term debt will have an impact on the overall strategies and activities of the bank. All these arguments lead us to the following hypothesis:

H2 The new regulated environment has impacted banking risk management and their liquidity differently across Western and Eastern institutions.

Usually, bank profitability is measured by the return on average assets (ROAA) or return on assets (ROA) (e.g., see Kosmidou (2008), Lei Wen (2009), Barros and Borges (2011), DePrince Jr, Ford, & Morris (2011)). Using structural equation modeling (SEM), this paper intends to deepen this analysis by studying the correlation between performance and stability in the new regulatory context to evaluate the influence of accounting ratios computed from banks' balance sheet and market indicators such as credit default swaps (CDS) spread and default probability on the credit and risk management of banking institutions. Our contribution will be to add a new and important element, the bank liquidity, into the classical analysis of the dual relationship between stability and profitability. SEM is particularly relevant to compare different models worldwide, based on a data inductive approach. We start by describing the variables on which our empirical analysis will be based.

CDS instruments are considered one of the most important innovations for financial institutions. Introduced in the mid-1990s, their usage increased substantially during the credit boom of the early 2000s to reach their highest level during the financial crisis. However, financial regulators, central banks and governments have taken into account their impact as regards the stability of the banking and financial system only after the shock.

Some researchers like Stulz (2009) consider that the implementation of CDS has improved financial institutions' efficiency by enhancing liquidity. But the last crisis has exhibited that its misuse could lead to the exact opposite result. Hence, CDS spreads have been used as a proxy for bank risk and default profitability: they reflect market perceptions about the banks' financial health (Longstaff et al., 2011). Furthermore, previous literature also recognizes the importance of regulatory capital and liquidity as bank level drivers that directly impact credit risk (Antao and Lacerda (2011), Chiaramonte and Casu (2013), Saidenberg and Strahan, (1999) and Akhavein et al. (1997)). Hence, CDS spreads can also be a good indicator of banks' credit risk and liquidity. Banks also use CDS to transfer risk (Thornton et al., 2018) to address risk management challenges (Cetina et al., 2015). Basel III provides an incentive for banks to buy CDS to reduce their regulatory capital, leading to excessive risk taking (Yorulmazer, 2013; Shan et al., 2014; Hasan and Wu, 2016). We intend to evaluate if the influence of CDS across different banking regions is identical.

Liquidity leads us to specify the control variables necessary to understand their impact on performance and stability. The literature uses different control variables depending on the type of bank assets on which they focus. While Basel III intends to limit the extent to which banks can perform maturity transformation, short-term and long-term debt refer to different liquidity risk. Short-term debt refers to liquidity stress on the assets side of the banks' balance sheets. To control for differences in liquidity across banks' liabilities, papers considering deposits use deposit volumes, while papers evaluating bond spreads use bid-ask spreads (Santos, 2014). These considerations enable us to develop our second hypothesis further:

H2a Liquidity risk affects risk management and banking efficiency

Two remarks must be made with regard to this hypothesis. While this statement has largely been tested in the European context (see ECB, 2007), the inclusion in our sample of Chinese and Indian banks could give new insights as regards the influence of liberalization and State intervention to improve efficiency of financial institutions. The second remark concerns data collection. As we include Chinese and Indian banks in our sample, we choose to substitute the CDS and probability of default by a Z-score partly because of lack of data for these institutions and also because the Z-score is an accepted measure for bankruptcy risk in exploring capital structure determination (Wald, 1999; Graham, 2000; Allayannis et al., 2003; Molina, 2005). Z-score models are also extensively used as a tool in assessing firm financial health (De Nicoló et al., 2004).

Insolvency risk is captured by the Z-score (ZS), which indicates the probability of failure of a bank. For bank i, the sample-period average ZS is defined as,

$$ZS_i = \frac{ROA_i + EA_i}{\sigma_{ROA_i}} \quad \ldots.. \quad (1)$$

where ROA_i is the sample-period average value of the ith bank's return on assets, EA_i is the sample-period average value of bank i's equity-to-assets ratio, and σ_{ROA_i} is the standard deviation of the rate of return on assets over the sample period. ZS increases with profitability (ROA) and capitalization (EA), and decreases with the instability of profits (σ_{ROA}). Thus, ZS is an indicator of financial stability at the firm level that inversely proxies a bank's probability of failure. That is, a higher value of ZS indicates more bank stability and less overall bank risk. An advantage of the z-score is that it can be also used for institutions for which more sophisticated, market based data are not available. Indeed, the z-scores allow us to compare the risk of default in different groups of institutions, which may differ in their ownership or objectives, but face the risk of insolvency. For developed countries, the introduction of CDS spread will be taken into account to underline the predominance of financial activities in the overall transactions of banking institutions.

Our last argument will be to evaluate the overall trend towards convergence in default risk globally. Anginer and Demiguç-Kunt (2014) point out that this trend has been much stronger for North American and European banks. They stress that default probability has been higher for banks that are larger (with greater than 50 billion in assets) and in countries that are better integrated with more liberalized financial systems. What could be said about Chinese and Indian banks? According to Huang et al. (2005), the Chinese banking system faces numerous challenges. Economic growth in China has been slowing down since the global financial crisis and the stock market recently has faced severe blows. Furthermore, the rapid expansion of China's shadow-banking sector may pose a threat to banking stability (Li, 2014), which increases the probability of default. Banking institutions have seen their non-performing loans and assets increase. According to official reports, the ratio of non-performing loans is only about 1% for the vast majority of banks, suggesting that the banking system is stable. However, China's official figures are often of questionable reliability, as argued by Krugman (2011). Moreover, the Chinese banking system is dominated by a few big banks. As we suggest previously, large institutions have larger probability of default than smaller ones. Along the same line of argument, the presence of large sized banks encourages risky behavior in banks. Therefore, risk management and market power of banks could influence profitability and efficiency of the global system, which leads us to formulate the following hypothesis:

H2b Risk management and market share of banking institutions could endanger financial stability and reduce the efficiency of regulatory rules.

Our next step will be to present the institutions chosen in our sample and to define the parameters used to build our structural equation models.

3. Data and Research Methodology

The choice of the banks in our sample (Table 1) follows G-SIBs methodology proposed by the Financial stability Board (FSB). The FSB, in consultation with the Basel Committee on Banking Supervision (BCBS) and national authorities, has identified global systemically important banks (G-SIBs) since 2011. For Europe and United States, these lists give us the banks that are more systematically risky. On the same basis, we complete our dataset by Chinese and Indian banks, while being careful to include in our sample the diversity of the institutions present in China and India. We have therefore included private companies and state-owned corporations to analyse if this specific aspect could have an influence on the determination of performance and/or risk management in our structural equations. For China the state owned institutions include the five biggest domestic banks and the three biggest policy banks. Because of their size they are more exposed to risk. City banks, local and municipal banks (10 banks in total) have strong ties to their local government. After the subprime crisis, their models were subject to criticism, as many local governments undertook projects financed by special investment companies to maintain economic growth. They therefore have higher risk exposure. Rural and cooperative banks followed the same trend even though their size has no comparison with the preceding banks.. These banks have had an aggressive expansion of their total assets by around 22% in 2015 whereas their net profit declined by 4%. Therefore, their exposure to risk has increased and the inclusion in our sample is important to better understand the correlation between profitability and resilience to shocks on one hand, and the rapidity of government intervention on the other hand. Systematic risk of joint stock banks (11 institutions in our sample) are not very different from their Western peers as regards their exposure to risk. The Indian sample distinguishes private and public banks. The main factor that leads our comprehension of risk exposure is Non Performing Assets (NPAs). The magnitude of NPAs differs among private (represented by 13 institutions in table 1) and public banks (7 banks). Recently the NPAs of private banks are less than 1/3rd of those of public banks. One possible explanation could be the aggressive regulatory forbearance adopted by Indian authorities after the subprime crisis. The detailed list of banks is given in Table 1. To construct the dataset we use Bloomberg to extract both accounting ratios and market parameters. We collected monthly data for 102 banks. As regards the variables used for our SEM model, we retain ROA for profitability for all institutions for the following reasons. One could consider the total loans granted to an SME as a better indicator of efficiency for state banks. However this is not the case for private banks: banks diversify their traditional activities (collecting deposits and granting credit) via asset management insurance transactions that are more profitable for them (Apergis (2014)). For the evaluation of risk and stability aspects, we use CDS and default probability on the credit and risk management of banking institutions. CDS can be a good indicator of the banks' credit risk. Arakelyan et al. (2013) analysed market wide liquidity in CDS spreads and found that CDS spreads with low credit ratings tend to be more sensitive to aggregate liquidity shocks than those with good credit ratings. Although CDS spreads are currently widely considered relevant proxies for bank riskiness and default, they reflect only the market's perception. Therefore, there is a need to compare these measures with indexes relying on banks' fundamental characteristics, for which forward-looking probabilities of default constitute relevant indicators.

Credit risk management is one of the most important criteria to evaluate a bank's asset quality. Asari et al. (2011) suggested that non-performing loans are the most critical source of economic distortion. Hence, policy makers must consider this parameter to guarantee the stability of the financial system. Banks are also required to classify non-performing assets (NPA) further into the following three categories based on the period for which the asset has remained non-performing and on the effectiveness of the dues:

1. Sub-standard assets: a substandard asset is one that has been classified as an NPA for a period not exceeding 12 months.
2. Doubtful assets: a doubtful asset is one that has remained non-performing for a period exceeding 12 months.
3. Loss assets: a loss asset is one for which a loss has been identified by the bank, internal or external auditor or central bank inspectors, but for which the amount has not been written off entirely or partially.

The variables we selected are described in Table 2 and the descriptive statistics in Table 3. The average statistics help us to rank these banks comparatively to others over 2000-2016, which includes both the crisis period (the Great Financial Crisis GFC of 2008) and the implementation of new regulation rules. Since the four geographic regions chosen were not necessarily subjected to the same magnitude and nature of shocks (e.g. the IT bubble in the US, the sovereign debt crisis in the EU, and banking reforms in India and China) but were all impacted to different degrees by the GFC, we deliberately chose a wide-spanning timeframe encompassing the GFC and other crises. Thus, the coefficients computed by our models average out the effects of shocks and permit a comparison of the relatively time-insensitive effects of other key variables of primary interest such as the influence of government controls. As far as profitability is concerned we notice that magnitude of ROA is large (from – 7.12 to 5.94 in the pooled data) which is not surprising as our period includes the financial crisis. If we enter into details, we observe that the situation is different among the different regions. European variation is -1.59 to 1.9. Even if banks like Credit Agricole, Deutsche Bank, Unicredit or Intesa Sanpaolo suffer from huge losses, the universal banks are more resilient during the subprime crisis. United States and India are more closed from the figures of the pooled data with a magnitude of -5.86 to 5.94 for US and -7.12 to 2.74 for India. Big banks like Bank of America or Bank of India base the major part of their profit on their transactions on the financial markets. In the turbulence period, ROA reflects the fluctuations of the stock exchange, which justifies the heraldic figures of this parameter.

These observations are confirmed by the graph 1 based on Anova conducted for the different regions of our sample. Because of government intervention justified by their market shares (total assets are larger; $F=865.78$, $p<0.001$) and political objectives, Chinese banks exhibit higher ROA ($F=365.07$, $p<0.001$). These initial observations let us guess that the parameters on which profitability is based could be different. Therefore, we intend to evaluate the impact of market factors and accounting factors on the performance of banking institutions.

Table 1. List of banks and key characteristics (2000-2016)

Bank Name	COUNTRY	Statutes
AGRICULTURAL BANK OF CHINA	China	State Owned bank
BANK OF BEIJING CO LTD –A	China	Local Bank
Bank of China	China	State Owned bank
BANK OF COMMUNICATIONS	China	State Owned Bank
Bank of East Asia	China	Foreign bank
BANK OF GUIYANG	China	City bank
BANK OF HANGZHOU	China	City banks
BANK OF JIANGSU CO	China	Rural cooperative bank
BANK OF JINZHOU CO	China	Rural cooperative bank
BANK OF NANJING CO	China	Municipal government
BANK OF NINGBO	China	City bank
BANK OF SHANGHAI	China	City bank
CHINA BOHAI BANK	China	Joint Stock bank
CHINA CITIC BANK CORP	China	Joint Stock bank
CHINA CONSTRUCTION BANK	China	State Owned bank
CHINA DEVELOPMENT BANK CORP	China	Policy bank
CHINA EVERBRIGHT BANK CO-A	China	Joint stock bank
CHINA GUANGFA BANK CO LTD	China	Joint Stock bank
CHINA MERCHANTS BANK	China	Joint stock bank
CHINA MINSHENG BANKING-A	China	Joint stock bank
CHINA ZHESHANG BANK CO LTD	China	Joint stock
DALIAN CITY COMMERCIAL BANK	China	City bank
EXPORT-IMPORT BANK OF CHINA	China	Policy bank
FUJIAN HAIXIA BANK	China	City bank
HARBIN BANK	China	City bank
HUAXIA BANK	China	Joint Stock bank
IND & COMM BK OF CHINA	China	State Owned bank
INDUSTRIAL BANK CO	China	State Owned bank
JIANGSU CHANGSHU RURAL	China	Rural commercial bank
JIANGSU JIANGYIN RURAL	China	Rural commercial bank
JIANGSU WUJIANG RURAL	China	Rural commercial bank
JIANGSU ZHANGJIAGANG RURAL	China	Rural commercial bank
PING AN BANK	China	Joint Stock bank
POSTAL SAVINGS BANK OF CHINA	China	Policy bank
SHANGHAI PUDONG DEVEL BANK	China	Joint stock bank
WUXI RURAL COMMERCIAL BANK	China	Rural commercial bank
ZHEJIANG TAILONG COMMERCIAL	China	City bank

Bank Name	COUNTRY	Bank Name	COUNTRY		Bank Name	COUNTRY
Banco Popolare	Europe	AXIS BANK LTD	India	Private sector	ALLY FINANCIAL	US
Barclays	Europe	BANDHAN BANK	India	Private sector	AMERICAN EXPRESS	US
BBVA	Europe	Bank of Baroda	India	Public sector	BANCO SANTANDER	US
BNP	Europe	Bank of India	India	Public sector	Bank of America	US
Commerzbank	Europe	Canara Bank	India	Public sector	BB&T CORP	US
Credit Agricole	Europe	CATHOLIC SYRIAN	India	Private sector	BMO HARRIS BANK NA/IL	US
Deutsche Bank	Europe	Federal Bank Ltd	India	Private sector	CAPITAL ONE FINANCIAL CORP	US
HSBC	Europe	Bank equitas small finance bank	India	Private sector	Chase Manhattan Corp	US
Intesa Sanpaolo	Europe	Yes bank	India	Private sector	CITIZENS FINANCIAL GROUP	US
Lloyds	Europe	HDFC Bank Ltd	India	Private sector	FIFTH THIRD BANCORP	US
Nordea	Europe	ICICI Bank Ltd	India	Private sector	HSBC HOLDINGS PLC-SPONS ADR	US
Santander	Europe	IDBI Bank Ltd	India	Public Sector	HUNTINGTON BANCSHARES INC	US
Seba	Europe	Union bank of India	India	Public sector	JPMORGAN CHASE & CO	US
SHBA	Europe	IDFC BANK LTD	India	Private sector	KEYCORP	US
Societe Generale	Europe	IndusInd Bank Ltd Jammu and Kashmir	India	Private sector Private sector	M & T BANK CORP	US
Sweda	Europe	Kotak Mahindra Bank	India	Private sector	PNC FINANCIAL SERVICES GROUP	US

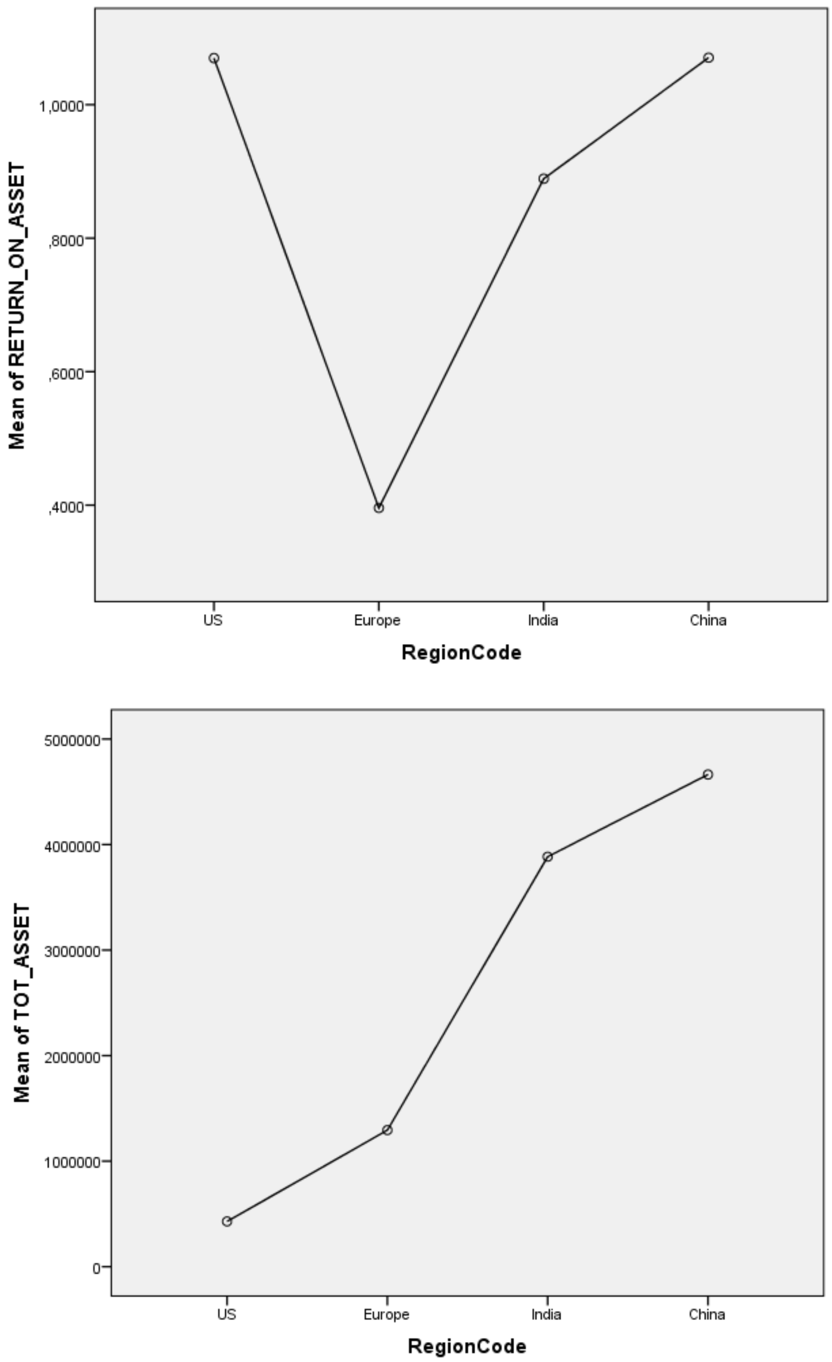
Bank Name	**COUNTRY**	**Bank Name**	**COUNTRY**		**Bank Name**	**COUNTRY**
UBS AG	Europe	Oriental bank of Commerce	India	Private Sector	REGAL BELOIT CORP	US
Unicredit	Europe	Punjab National Bank	India	Public sector	REGIONS FINANCIAL CORP	US
		State Bank of India	India	Public sector	SCHWAB (CHARLES) CORP	US
		RBL BANK LTD	India	Private sector	SunTrust Bank	US
					TORONTO-DOMINION BANK	US
					UNION BANKSHARES CORP	US
					US Bancorp	US
					USAA FEDERAL SAVINGS BANK	US

Table 2 List of variables

Ratio	Measure	Signification	Definition
Asset quality	Non-performing loans/ total loans and non-performing assets/total assets	Risk management	Non-performing assets are stressed assets, advances, where interest and/or instalment of principal remain overdue for a period of more than 90 days in respect to the term.
Performance	ROA, ROE, Market capitalization	Profitability	ROA tends to tell us how effectively an organization is taking earnings advantage of its base of assets. ROE is the amount of net income returned as a percentage of shareholders equity. Market capitalization is the market value of a company's
Default probability 1 year and 5 year	Combines information on capital structure (Total assets to total liabilities and Book equity to current liabilities), on liquidity (cash/current liabilities), on profitability (ROA et ROE), on market fluctuations, and on solvency probability to obtain the year default probability. The probability of default (PD) of an exposure is the greater of the one associated with the internal borrower grade to which that exposure is assigned, or 3 basis points (0.03%). The minimum requirements for the derivation of the PD estimates for each internal borrower grade are consistent with those for corporate exposures, except where highlighted below.	Market Risk	These indexes are giving the probability of default 5 years and 1 year forward. These measures are based on the propositions of Merton (1974), Bharath and Shumway (2008), and lastly Altman and Sabato (2005). See also Cai and Singenellore (2015) for the complete methodology.
Long term debt versus short term debt	Long-term debt consists of loans and financial obligations lasting over one year. It includes convertible, redeemable, retractable debentures, bonds, loans, mortgage debts, sinking funds, and long-term bank overdrafts. Short-term debt must be repaid or refinanced within a year.	Systemic banking risk	These ratios evaluate the resolvability of systemic banking firms, reduces the threat to financial stability.
CDS spread	A CDS is known in the financial world as a *credit default swap*. The spread is the difference between the actuarial rate of return of the bond and that of a risk-free loan of identical duration. The spread is naturally even lower as the solvency of the issuer is perceived as good.	Systemic banking risk	Because it has a simple structure and flexible conditions, banks and investors use it in order to hedge their exposure to credit risk. It can be considered as a sort of insurance for a credit default or some specified events mentioned in the contract
Z-score	Combines in one single indicator the banks' profitability, capital ratio and return volatility	Risk	Z-scores are often used to analyze credit, and will give an estimation of the probability of going bankrupt.

Source Bloomberg

Figure 1 ANOVA for ROA and Total assets by region



As mentioned in the previous sections, we intend to identify both the parameters that explain the performance of banking institutions and the stability of the whole system. During the first stage, we construct a pooled model to represent transversal features across all regions, which could be slightly different for the multi-regional comparison, consistent with our hypotheses H1 and H2. Before providing details of our models we describe our dataset.

Tables 3 (a)-(e) present the non-parametric (Spearman) correlation matrices as well as summary descriptives (minimum, maximum, mean, standard deviations) for the dataset as a whole (pooled) and for each geographical area (Europe, US, India, China).for all the independent variables described earlier, the mediator (current market capitalization) and the dependent (return on assets) variable. These detailed summary tables set the stage by highlighting all pairwise relationships that need to be taken into account and provide guidance for our subsequent more complex modeling. The presence of statistically significant correlations among the independent variables indicates the need for a modeling approach that can explicitly handle multicollinearity, hence our choice of structural equation modeling (SEM), which can simultaneously model all covariances as well as variances for all the variables involved (Kline, 1998).

Table 3 Bivariate correlations (Spearman) and univariate descriptive statistics for: (a) Pooled sample (Europe + US + India + China)

	Correlation coefficients										Descriptives			
	DEFAULT_ PROB_5YR	DEFAULT_ PROB_1YR	Z_SCORE	NON_ PERFORM_ ASSET	NON_ PERFORM_ LOANS	LT_ BORROW	ST_ BORROW	IMPLIED_ CDS_ SPREAD	CUR_ MKT_ CAP	RETURN_ ON_ ASSET	Min	Max	Mean	Std Dev
DEFAULT_PROB_5YR	1.00										0	0.38	0.02	0.01
DEFAULT_PROB_1YR	0.52***	1.00									0	0.24	0	0.01
Z_SCORE	-0.43***	-0.25***	1.00								-3.64	29.88	4.12	4.36
NON_PERFORM_ASSET	0	0.48***	0.03**	1.00							0	1234638.7	26734.47	75985.21
NON_PERFORM_LOANS	-0.01	0.48***	0.03**	1***	1.00						0	1234638.7	26300.38	75746.39
LT_BORROW	-0.06***	0.39***	0.05***	0.71***	0.71***	1.00					0	2633851.1	181876.36	312801.31
ST_BORROW	-0.07***	0.43***	0.28***	0.69***	0.7***	0.65***	1.00				0	2980121	216851.24	367518.67
IMPLIED_CDS_SPREAD	0.27***	0.54***	0.06***	0.51***	0.5***	0.25***	0.28***	1.00			5	1195	151.47	117.15
CUR_MKT_CAP	-0.37***	0.08***	0.5***	0.6***	0.6***	0.67***	0.68***	0.29***	1.00		67.17	3268984.41	185777.05	358297.12
RETURN_ON_ASSET	-0.39***	-0.57***	0.59***	-0.34***	-0.34***	-0.28***	-0.22***	-0.05***	0.16***	1.00	-7.12	5.94	0.86	0.88

*+p<0.10; *p<0.05; **p<0.01; ***p<0.001*

(b) Europe

	Correlation coefficients										Descriptives			
	DEFAULT_ PROB_5YR	DEFAULT_ PROB_1YR	Z_SCORE	NON_ PERFORM_ ASSET	NON_ PERFORM_ LOANS	LT_ BORROW	ST_ BORROW	IMPLIED_ CDS_ SPREAD	CUR_ MKT_ CAP	RETURN_ ON_ ASSET	Min	Max	Mean	Std Dev
DEFAULT_PROB_5YR	1.00										0.01	0.09	0.02	0.01
DEFAULT_PROB_1YR	0.86***	1.00									0	0.04	0	0
Z_SCORE	-0.44***	-0.53***	1.00								-2.58	9.82	2.36	2.24
NON_PERFORM_ASSET	0.56***	0.39***	-0.39***	1.00							213	87164.64	18274.43	17980
NON_PERFORM_LOANS	0.54***	0.39***	-0.41***	0.99***	1.00						213	87164.64	18272.67	17937.01
LT_BORROW	0.02	0.06**	0.13***	-0.02	-0.01	1.00					0	1352986	263561	276261.62
ST_BORROW	0.28***	0.36***	0.14***	0.3***	0.31***	0.37***	1.00				10887	1133987	196867.44	173517.87
IMPLIED_CDS_SPREAD	0.6***	0.55***	-0.42***	0.61***	0.61***	-0.03	0.09***	1.00			7	778	113.36	99.84
CUR_MKT_CAP	-0.64***	-0.61***	0.68***	-0.38***	-0.37***	0.41***	0.07***	-0.48***	1.00		2445.4	455619.59	79411.57	73203.85
RETURN_ON_ASSET	-0.64***	-0.68***	0.77***	-0.43***	-0.44***	0.01	-0.08***	-0.5***	0.52***	1.00	-1.59	1.9	0.4	0.42

*+p<0.10; *p<0.05; **p<0.01; ***p<0.001*

(c) US

	Correlation coefficients										Descriptives			
	DEFAULT_ PROB_5YR	DEFAULT_ PROB_1YR	Z_SCORE	NON_ PERFORM_ ASSET	NON_ PERFORM_ LOANS	LT_ BORROW	ST_ BORROW	IMPLIED_ CDS_ SPREAD	CUR_ MKT_ CAP	RETURN_ ON_ ASSET	Min	Max	Mean	Std Dev
DEFAULT_PROB_5YR	1.00										0.01	0.38	0.03	0.02
DEFAULT_PROB_1YR	0.87***	1.00									0	0.24	0	0.01
Z_SCORE	-0.4***	-0.29***	1.00								-3.64	20.4	2.75	2.22
NON_PERFORM_ASSET	0.09***	0.32***	-0.05**	1.00							0	46871	3950.1	8475.87
NON_PERFORM_LOANS	0.06***	0.29***	-0.05**	0.99***	1.00						0.43	46871	3687.55	8349.77
LT_BORROW	0.03	0.24***	0.11***	0.75***	0.73***	1.00					51.7	456288	49801.65	84135.27
ST_BORROW	-0.08***	0.16***	0.18***	0.61***	0.62***	0.7***	1.00				0	542207	54834.36	112036.7
IMPLIED_CDS_SPREAD	0.78***	0.8***	-0.37***	0.43***	0.4***	0.23***	-0.03	1.00			7	803	92.36	93.05
CUR_MKT_CAP	-0.12***	0.07***	0.29***	0.54***	0.53***	0.76***	0.76***	-0.02	1.00		67.17	308768.43	45173.39	52210.27
RETURN_ON_ASSET	-0.33***	-0.47***	0.49***	-0.48***	-0.5***	-0.11***	-0.15***	-0.52***	0.08***	1.00	-5.86	5.94	1.07	0.91

*+p<0.10; *p<0.05; **p<0.01; ***p<0.001*

(d) India

	Correlation coefficients										Descriptives			
	DEFAULT_ PROB_5YR	DEFAULT_ PROB_1YR	Z_SCORE	NON_ PERFORM_ ASSET	NON_ PERFORM_ LOANS	LT_ BORROW	ST_ BORROW	IMPLIED_ CDS_ SPREAD	CUR_ MKT_ CAP	RETURN_ ON_ ASSET	Min	Max	Mean	Std Dev
DEFAULT_PROB_5YR	1.00										0.01	0.14	0.02	0.01
DEFAULT_PROB_1YR	0.99***	1.00									0	0.06	0	0
Z_SCORE	-0.63***	-0.69***	1.00								-2.23	29.88	4.83	6.03
NON_PERFORM_ASSET	0.34***	0.34***	-0.39***	1.00							83.21	1234638.7	84895.1	164301.69
NON_PERFORM_LOANS	0.35***	0.35***	-0.39***	1***	1.00						83.21	1234638.7	84736.45	164284.44
LT_BORROW	-0.06*	-0.06*	-0.09***	0.58***	0.58***	1.00					7750	2633851.1	435528.82	555779.7
ST_BORROW	0.06*	0.07**	-0.01	0.59***	0.6***	0.55***	1.00				0	1153169.62	157152.1	220540.2
IMPLIED_CDS_SPREAD	0.52***	0.52***	-0.26***	0.18***	0.17***	0.08**	0.06*	1.00			38	1052	264.05	120.3
CUR_MKT_CAP	-0.53***	-0.57***	0.43***	0.27***	0.26***	0.64***	0.54***	-0.24***	1.00		11460.2	3268984.41	463554.71	596346.95
RETURN_ON_ASSET	-0.7***	-0.74***	0.8***	-0.55***	-0.55***	-0.15***	-0.18***	-0.35***	0.39***	1.00	-7.12	2.74	0.89	1.39

*+p<0.10; *p<0.05; **p<0.01; ***p<0.001*

(e) China

	Correlation coefficients										Descriptives			
	DEFAULT_ PROB_5YR	DEFAULT_ PROB_1YR	Z_SCORE	NON_ PERFORM_ ASSET	NON_ PERFORM_ LOANS	LT_ BORROW	ST_ BORROW	IMPLIED_ CDS_ SPREAD	CUR_ MKT_ CAP	RETURN_ ON_ ASSET	Min	Max	Mean	Std Dev
DEFAULT_PROB_5YR	1.00										0	0.05	0.02	0
DEFAULT_PROB_1YR	0.98***	1.00									0	0.02	0	0
Z_SCORE	-0.1***	-0.08***	1.00								0.26	24.82	8.5	4.75
NON_PERFORM_ASSET	-0.12***	-0.12***	0.45***	1.00							0	258053	31854.36	45083.75
NON_PERFORM_LOANS	-0.1***	-0.11***	0.45***	1***	1.00						0	229822	30274.35	43203.84
LT_BORROW	-0.05+	-0.02	0.47***	0.76***	0.77***	1.00					0	977980	103350.32	129643.72
ST_BORROW	0.02	0.06*	0.58***	0.85***	0.85***	0.84***	1.00				790.4	2980121	598504.15	619054.18
IMPLIED_CDS_SPREAD	0.5***	0.58***	0.15***	-0.1***	-0.09***	0.02	0.13***	1.00			5	1195	193.94	76.4
CUR_MKT_CAP	-0.29***	-0.29***	0.55***	0.89***	0.89***	0.77***	0.86***	-0.11***	1.00		10137.72	1926495.98	360055.21	438389.67
RETURN_ON_ASSET	-0.21***	-0.19***	0.49***	0.16***	0.16***	0.21***	0.29***	0.11***	0.33***	1.00	0.01	1.79	1.07	0.26

*+p<0.10; *p<0.05; **p<0.01; ***p<0.001*

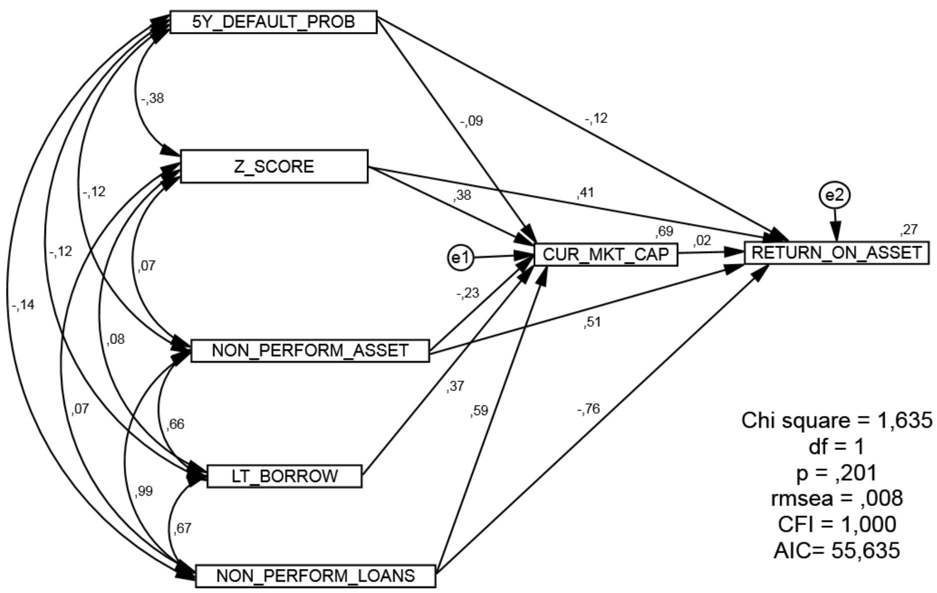
The bidirectional curved arrows in SEM allow for the input (exogenous) variables to be correlated and these are computed along with multiple hypothesized uni-directional pathways relating the independent, mediator, and dependent variables during the model fitting and compared to the sample correlations in order to evaluate the goodness of fit. Thus, this method is relevant to help the identification of the best model which fits the analysis of the correlation existing between performance and stability of banking structures (Tabachnick & Fidell, 2001, p. 111). SEM, which solves a system of several multiple regression equations simultaneously to reproduce the entire covariance matrix of the observed sample, is an excellent tool to predict both centrality (mean) and variance measures in a continuous dependent variable. In our case, we intend to evaluate the direct and indirect effects of factors that could influence both performance and stability of financial systems.

Secondly, multivariate methods (Fornell, 1984; Chin, 1998) allow analysis of all the variables in the model simultaneously instead of separately. In addition, measurement error is not aggregated in a single residual error term as in the case of conventional regression. Structural equation modeling (SEM) has been applied to our problem because it allows us to analyze the differences that could exist in diverse geographical areas inside a unique basic model.

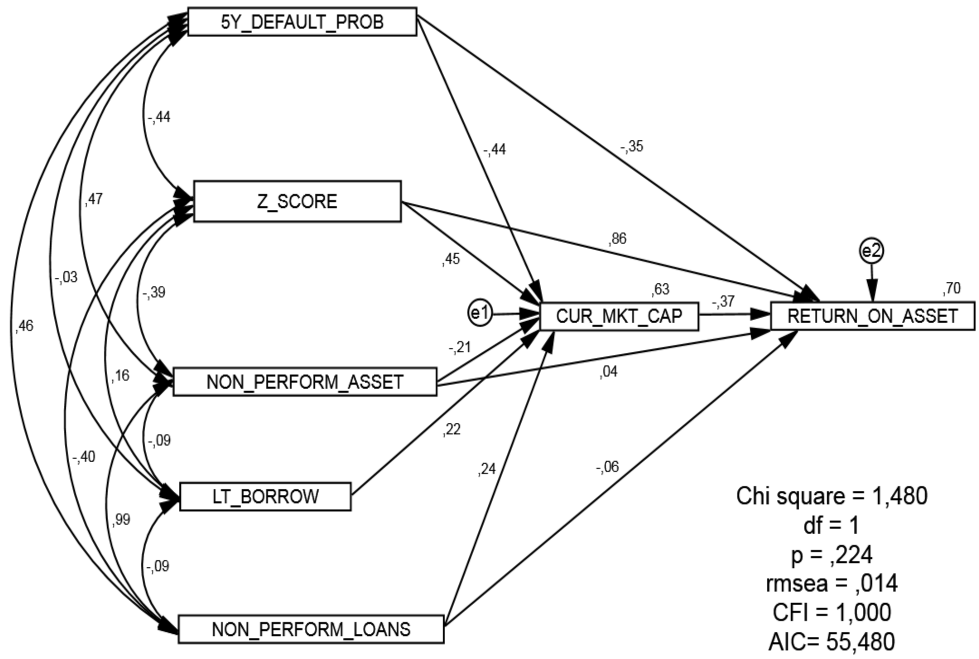
To reiterate, SEM is ideally suited for our analysis because of its ability to handle multicollinearity or endogeneity through explicit specification of covariances and non-recursive pathways, to handle measurement errors by specifically assigning error variables to all dependent variables, its flexibility and comprehensiveness, and its intuitively graphical manner of specifying complex models via causal and correlational pathways representing different equations. The ensemble of equations are then simultaneously solved to estimate coefficients and multiple parameters to evaluate model fit. We believe our use of SEM to address the high intercorrelations commonly encountered among ratios and variables in financial modeling empirically contributes to a deeper understanding of complex overlapping relationships between the independent, mediator and dependent variables (Kline, 1998) without being invalidated by variance inflation and other artefacts encountered by conventional statistical methods like ordinary least squares regression in the presence of multicollinearity.

We run the SEM approach first on our pooled data and on the different geographical areas of our sample. The representation of our different models is presented in Figure 1. After considering the pooled data, we analyze the model and use it as a baseline to extract regional differences by considering both Occidental (Europe and United States) and Oriental (China and India) countries. Next section will focus on the justification of the construction of our models and their respective interpretation.

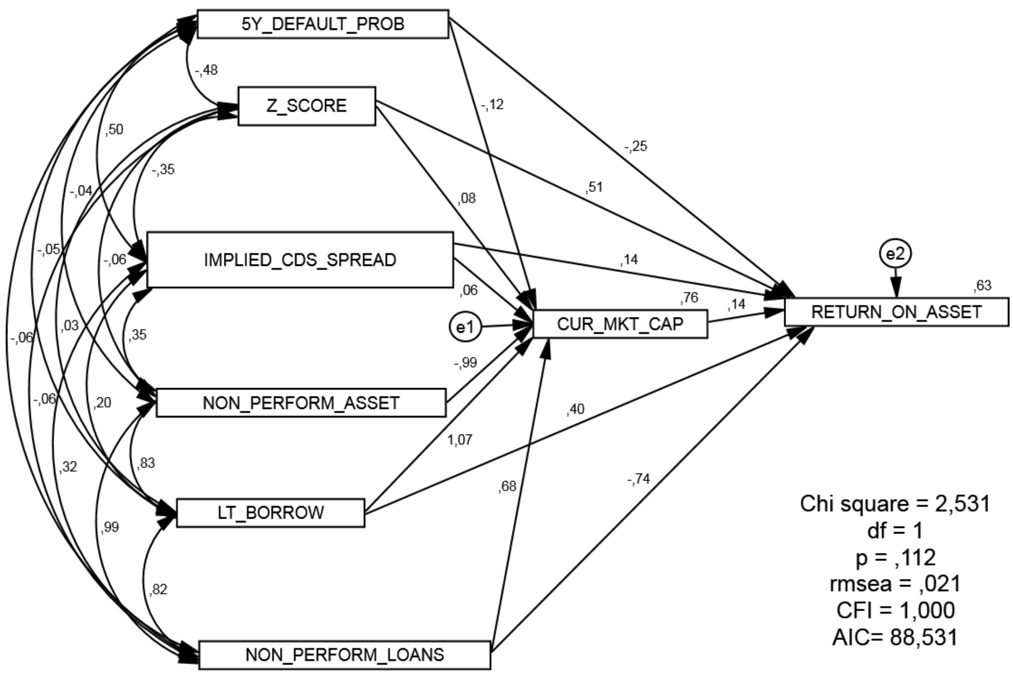
Figure 2 Representation of SEM Model for pooled data and specific geographical areas (Europe, United States, China and India)



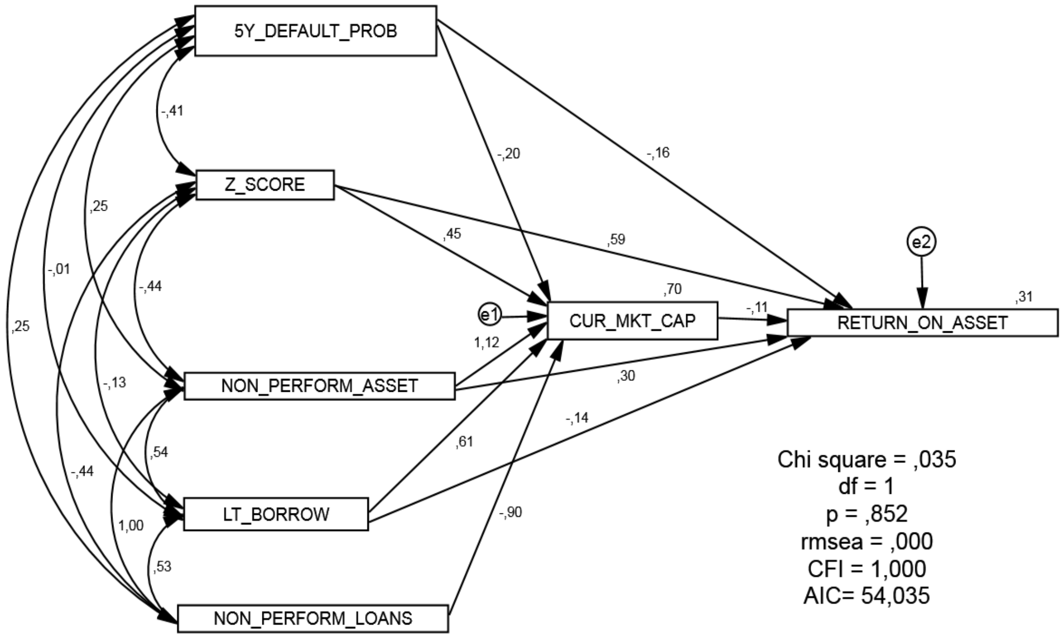
Europe Model



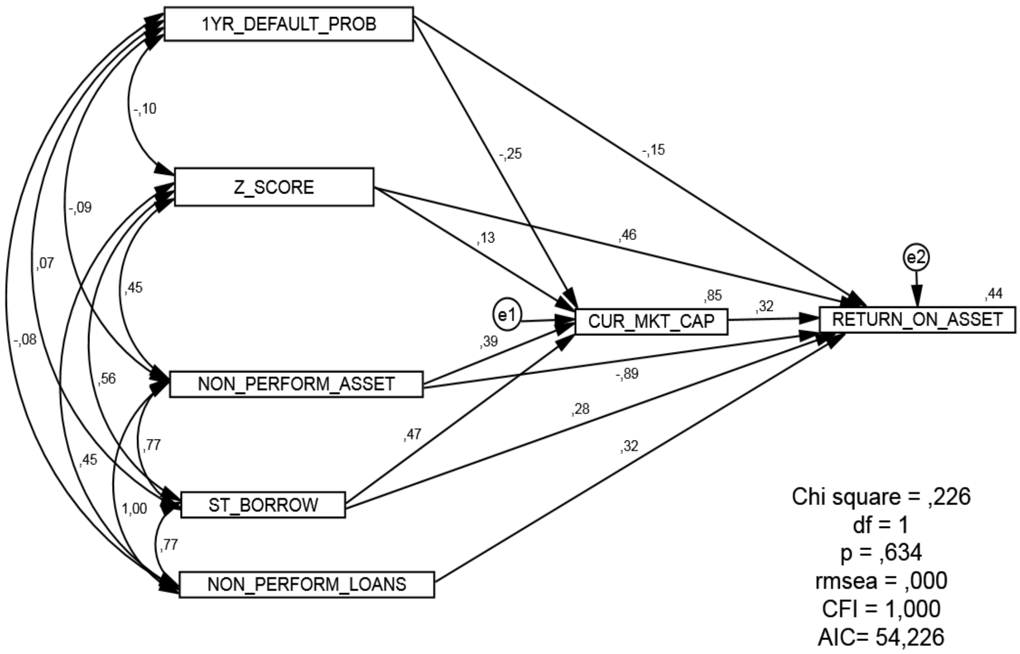
US Model



India Model



China Model



4. Analysis and interpretation of our results.

The overarching structure of our model isguided by the theoretical considerations discussed earlier. However, it is reasonable to anticipate and allow for some level of regional variations in the pathways connecting the various independent ratios to the mediator and dependent variables depending on local micro- and macro-environmental variables such as banking regulations and government interventions. We therefore evaluated several possible combinations of pathways region by region and used the Browne-Cudeck Criterion (BCC) to compare the fit of the various models to the data of that particular region (Browne & Cudeck, 1989, 1993).

$$\text{BCC} = \hat{C} + 2q\frac{\sum_{g=1}^{G} b^{(g)}\frac{p^{(g)}\left(p^{(g)}+3\right)}{N^{(g)}-p^{(g)}-2}}{\sum_{g=1}^{G} p^{(g)}\left(p^{(g)}+3\right)} \quad \ldots.. \quad (2)$$

Where: $\hat{C}$=Chi-squared discrepancy function, q=number of model parameters, G=number of groups, $p^{(g)}$=number of variables in group g, $N^{(g)}$=number of observations in group g, and $b^{(g)} = N^{(g)} - 1$.

BCC is a measure developed specifically to assess SEM models based on analysis of moment structures and therefore superior to more generally applicable measures.

The best-fit models (lowest BCC) are shown in Figure 1 for the global (pooled) region as well as for each separate region. The corresponding path coefficients (standardized and non-standardized), standard errors, p-values, as well as model fit parameters (Chi-square, degrees of freedom df, overall model p, root mean square error of approximation RMSEA, cumulative fit index CFI, and Akaike information criterion AIC) are summarized for each regional model in Tables 4a and 4b.

Table 4a Multi-regional structural equation models : 1. Pooled, 2. Europe, 3. US

	Model 1: Pooled (Europe, US, India, China)				**Model 2 : Europe**				**Model 3 : US**			
Variables	**Std. Coeff.**	**Non-std. Coeff.**	**SE**	**p-value**	**Std. Coeff.**	**Non-std. Coeff.**	**SE**	**p-value**	**Std. Coeff.**	**Non-std. Coeff.**	**SE**	**p-value**
Dependent variable: *RETURN_ON_ASSET* ***Mediator variable:*** *CUR_MKT_CAP*												
5Y_DEFAULT_PROB → CUR_MKT_CAP	-0.086	-9.926	0.746	<0.001***	-0.441	-48.58	1.624	<0.001***	-0.124	-9.553	0.886	<0.001***
1Y_DEFAULT_PROB → CUR_MKT_CAP												
Z_SCORE → CUR_MKT_CAP	0.376	1.398	0.024	<0.001***	0.446	1.127	0.036	<0.001***	0.079	0.405	0.052	<0.001***
NON_PERFORM_ASSET → CUR_MKT_CAP	-0.225	-0.158	0.040	<0.001***	-0.214	-0.162	0.067	0.015*	-0.992	-0.720	0.043	<0.001***
NON_PERFORM_LOANS → CUR_MKT_CAP	0.590	0.402	0.039	<0.001***	0.242	0.184	0.067	0.006**	0.682	0.483	0.040	<0.001***
LT_BORROW → CUR_MKT_CAP	0.375	0.283	0.006	<0.001***	0.224	0.119	0.007	<0.001***	1.071	0.908	0.013	<0.001***
ST_BORROW → CUR_MKT_CAP												
IMPLIED_CDS_SPREAD → CUR_MKT_CAP									0.057	0.085	0.019	<0.001***
CUR_MKT_CAP → RETURN_ON_ASSET	0.021	0.002	0.001	0.140	-0.367	-0.022	0.001	<0.001***	0.137	0.011	0.002	<0.001***
5Y_DEFAULT_PROB → RETURN_ON_ASSET	-0.123	-1.465	0.119	<0.001***	-0.350	-2.310	0.100	<0.001***	-0.249	-1.506	0.087	<0.001***
1Y_DEFAULT_PROB → RETURN_ON_ASSET												
Z_SCORE → RETURN_ON_ASSET	0.410	0.158	0.004	<0.001***	0.864	0.131	0.002	<0.001***	0.514	0.207	0.005	<0.001***
NON_PERFORM_ASSET → RETURN_ON_ASSET	0.510	0.037	0.006	<0.001***	0.045	0.002	0.004	0.577				
NON_PERFORM_LOANS → RETURN_ON_ASSET	-0.760	-0.054	0.006	<0.001***	-0.060	-0.003	0.004	0.456	-0.742	-0.041	0.001	<0.001***
LT_BORROW → RETURN_ON_ASSET									0.403	0.027	0.002	<0.001***
ST_BORROW → RETURN_ON_ASSET												
IMPLIED_CDS_SPREAD → RETURN_ON_ASSET									0.139	0.016	0.002	<0.001***
Chi square	1.635				1.480				2.531			
Df	1				1				1			
p *(for SEM ; >0.05 indicates good fit)*	0.201				0.224				0.112			
RMSEA	0.008				0.014				0.021			
CFI	1.000				1.000				1.000			
AIC	55.635				55.48				88.531			

*+p<0.10; *p<0.05; **p<0.01, ***p<0.001*

Table 4b Multi-regional structural equation models : 4. India, 5. China

	Model 4: India				**Model 5 : China**			
Variables	**Std. Coeff.**	**Non-std. Coeff.**	**SE**	**p-value**	**Std. Coeff.**	**Non-std. Coeff.**	**SE**	**p-value**
Dependent variable: *RETURN_ON_ASSET* ***Mediator variable:*** *CUR_MKT_CAP*								
5Y_DEFAULT_PROB → CUR_MKT_CAP	-0.196	-27.29	2.175	<0.001***				
1Y_DEFAULT_PROB → CUR_MKT_CAP					-0.251	392.76	14.818	<0.001***
Z_SCORE → CUR_MKT_CAP	0.446	1.074	0.040	<0.001***	0.133	0.440	0.037	<0.001***
NON_PERFORM_ASSET → CUR_MKT_CAP	1.121	0.860	0.205	<0.001***	0.386	0.280	0.011	<0.001***
NON_PERFORM_LOANS → CUR_MKT_CAP	-0.903	-0.696	0.206	<0.001***				
LT_BORROW → CUR_MKT_CAP	0.610	0.539	0.015	<0.001***				
ST_BORROW → CUR_MKT_CAP					0.468	0.385	0.013	<0.001***
IMPLIED_CDS_SPREAD → CUR_MKT_CAP								
CUR_MKT_CAP → RETURN_ON_ASSET	-0.107	-0.031	0.011	0.006**	0.317	0.007	0.001	<0.001***
5Y_DEFAULT_PROB → RETURN_ON_ASSET	-0.162	-6.507	1.003	<0.001***				
1Y_DEFAULT_PROB → RETURN_ON_ASSET					-0.146	-5.224	0.781	<0.001***
Z_SCORE → RETURN_ON_ASSET	0.587	0.407	0.021	<0.001***	0.460	0.035	0.002	<0.001***
NON_PERFORM_ASSET → RETURN_ON_ASSET	0.304	0.067	0.007	<0.001***	-0.888	-0.015	0.003	<0.001***
NON_PERFORM_LOANS → RETURN_ON_ASSET					0.323	0.005	0.003	0.104
LT_BORROW → RETURN_ON_ASSET	-0.140	-0.036	0.009	<0.001***				
ST_BORROW → RETURN_ON_ASSET					0.282	0.005	0.001	<0.001***
IMPLIED_CDS_SPREAD → RETURN_ON_ASSET								
Chi square	0.035				0.226			
Df	1				1			
p *(for SEM ; >0.05 indicates good fit)*	0.852				0.634			
RMSEA	0.000				0.000			
CFI	1.000				1.000			
AIC	54.035				54.226			

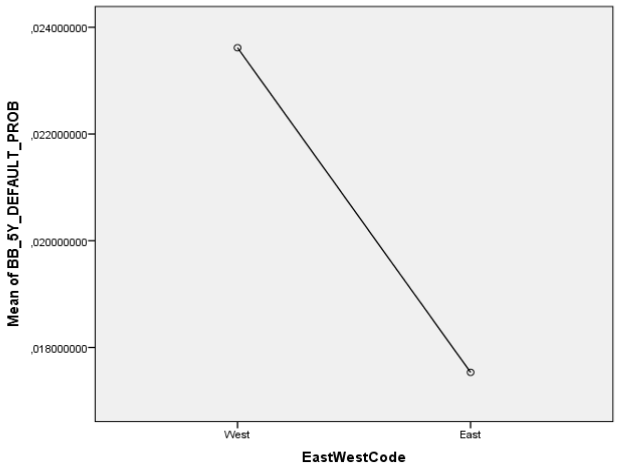
*+p<0.10; *p<0.05; **p<0.01, ***p<0.001*

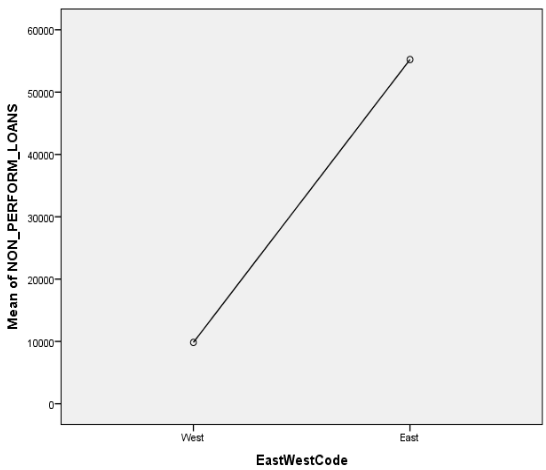
For robustness, since our dataset was extensive in terms of the wide range and measurement scales of the variables included and multi-regional in terms of geographic scope, all continuous ratio variables were subjected to natural logarithmic transforms, and both standardized (scale-invariant) and non-standardized estimates were computed and presented in the tables 4a and 4b. Only the standardized estimates are shown in Figure 1 for ease of interpretability and the corresponding non-standardized estimates are reported in Tables 4a-b.

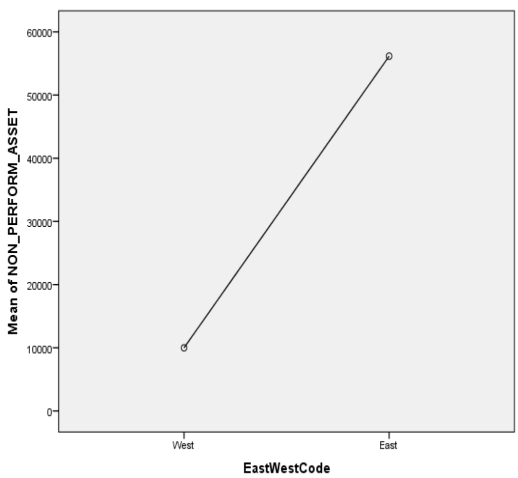
All our models presented show excellent fit as determined by low chi-square values with $p>0.05$, $CFI>0.95$, and $RMSEA>0.05$ indicating that the covariance matrix reproduced by the SEM models is very close to that of the observed sample covariance.

Globally, the structure of the general model conforms to the theoretical issues developed in our first section. The signs of our estimated coefficients respect our expectations. Our hypothesis H1 is confirmed: the new financial environment has a significant impact on banking strategies. However, despite the new regulatory rules we notice significantly high influence of instability factors (5-year default probability, non-performing assets, non-performing loans) on performance (ROA), all of which show significant differences between the Eastern and Western region as highlighted by graph 2 (Anova for: 5-yr default: $F=361.98, p<0.001$; NPA: $F=845.28, p<0.001$; NPL: $F=820.17, p<0.001$). This is consistent with the results of Lazarides, (2016) for Europe and Egan et al. (2017) for the United States. For these researchers, the required level of capitalization imposed by the regulation is far from being sufficient to cover the risk assumed by bankers to increase their profit margins. This confirms our hypothesis H2b. Let us discuss this point as regards the different regions considered in our analysis. For India and China, Chu (2016) and Middi (2016) stress that the exposure to off balance sheet activities has led banking institutions to be exposed to high risk. Capitalization could become not relevant enough to cover their risk management. Z-score and capitalization influence banking performance. The higher the level of risk for banks, the higher will be the capitalization, which in turn, is expected to reduce the overall performance.

Figure 3 ANOVA for 5 year default, non performing loans, non performing assets for Eastern and Western regions



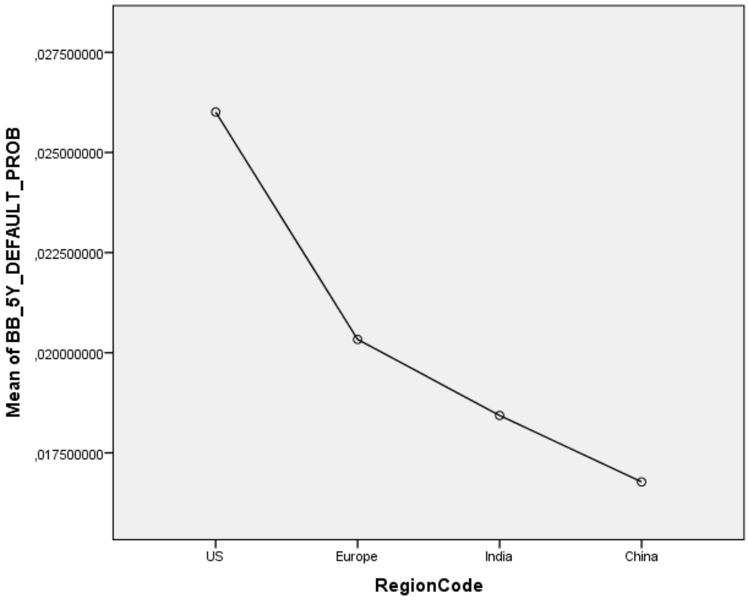


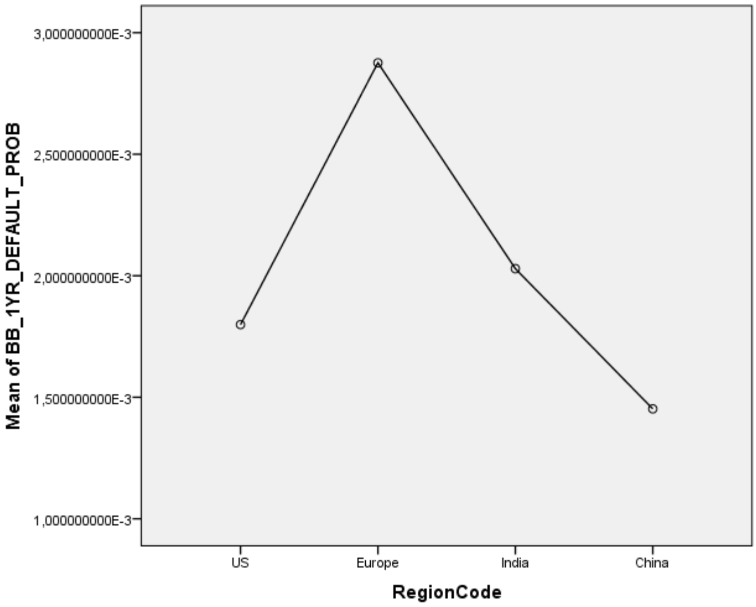


A more detailed comparison of the situation in Europe and the United States yields interesting insights into the relationships between key variables. For the United States, the 5-year default probability has a lower negative effect on capitalization than in Europe (-0.124 vs -0.441, $p<0.001$ as stated by table 4b) and long term borrowing is directly correlated to performance, while for Europe, performance is not affected by non- performing loans. In the European case, this situation can be explained by the following argument: capitalization provides a more stable environment in which banks can develop their business, but reduces these banks' profit margin. In other words, regulation could lead to an unintended consequence: banks could react and find a way to improve their profitability by undertaking more risky transactions in financial markets. In particular, this additional level of profit could be achieved by off-balance transactions. American banks use long term debts (0.224 vs 1.071 , $p<0.001$ as stated by table 4b) to increase their liquidity, improve their efficiency and control their systemic risk. Hence, despite the regulatory rules, the fluctuations existing on financial markets continue to affect performance due to the additional risk bankers are tempted to take to increase their profit margin. Second, instability factors are represented by non-performing loans, assets and 5-year default probability. In other words, market values have large influence both on performance and stability (magnitude and sign similar in US and Europe, $p<0.001$ as stated by table 4b) . This is reinforced by the significance of the implied CDS spread for American banking institutions. This could be explained by the different banking structures existing in Europe and in the United States and the predominance of financial market activities in the global stability of banks. If universal banks dominate European institutions, investment and commercial banks are largely present in American markets. First, the recent crisis has shown that universal banks were more resilient than commercial and investment banks. The market share of European investment banks has declined since 2010/2011 while it has increased in the United States from 35% in 2011 to 45% in 2015 (Goodhart, 2016). This could justify the differences in magnitudes of instability for the banking and financial institutions. Secondly, the relative magnitude of asset management activities to retail activities is an important element to understand the capability of resilience of banking structures.

As for Indian and Chinese banks, the situation is slightly different. Indian banking institutions behave more like European banks, whereas the Chinese system has to take government intervention into account to explain the correlation between profitability and stability. Hence, 1-year default probability and short term borrowing have a direct influence on capitalization and profitability in China while 5-year default probability and long term borrowing are the relevant ratios that directly impact performance for Indian banks. This is consistent with the results of Rajan and Dhal (2003) for India as confirmed by graph 3 (Anova $F=199.79$, $p<0.001$ for 5-yr default; $F=20.82$, $p<0.001$). This reflects the different policies in China and India. To maintain political control over state banks to pursue non-economic objectives, the Chinese government refinances or bails out inefficient and loss-making state banks rather than privatizing them like in India (Haas, R., & Lelyveld, I. (2014)). As mentioned by Acharya and Subramanian (2016), Indian public sector banks were in precarious conditions. But the Indian Government counts more on a significant reduction in the banks' balance sheets rather than a direct intervention to recapitalize the public sector banks. Globally, solutions are designed more for the long term to restore efficiency of the banking system. This difference in time horizons is consistent with interventionist policies of the Chinese government to restore stability of the financial system (Huang and Alii, 2016). The same arguments could be as regards the correlation between non-performing assets and return on assets. (Table 4b). The direct intervention of Chinese government as soon as the banks face difficulties sometimes prevents correct evaluation of the impact on bailouts as for Western countries. This is not the case in India where the coefficients have magnitude and sign comparable to the ones obtained for the European case. The preceding discussion offers support for hypothesis H2a with some nuances for Asian regions.

Figure 4 ANOVA for 5 year defaut and 1 year default by regions





Since the last decade, Asian banks have increased their off-balance sheet activities, which may both expand trading and banking assets and facilitate securitization. While it can contribute to higher performance for banks, it also could increase instability of banking systems. However, the findings appear to be positive for Indian banks. Provisioning has grown enormously in recent years, giving the impression that bank executives are worried about the quality of their loan books. Provisioning began to increase massively in India in 2015, following governmental attempts to deal with legacy issues in the banking industry. The Reserve Bank of India has forced Indian banks to recognize more of their non-performing loans and to recapitalize in order to restore stability.

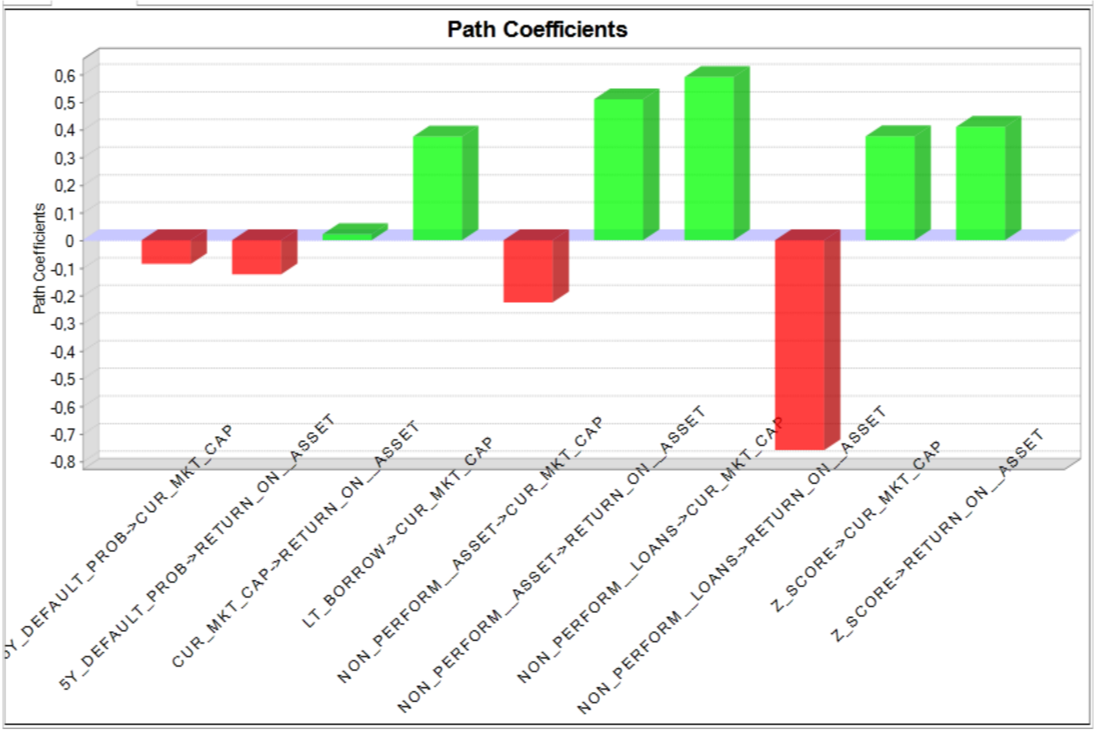
Contrary to Western economies, China's shadow banking is playing an active role in broadening investment channels to the private sector with less complex financial instruments. The credit market constitutes the main instrument for derivative products. Because of strong regulations for banks and very low official rates of interest, banks search for alternatives to increase their performance. The authors believe that Chinese shadow banking is associated with lower risk in comparison to other countries, because its constituent institutions do not use aggressive strategies such as hedge funds, investment funds and other such entities (Łasak, 2016). Combined with the intervention of the State in the real economy and on the financial market, this could explain the differences noted in our model as compared to Indian banks.

In order to confirm the validity and robustness of our results, we considered methods other than SEM that are capable of handling multicollinearity. Partial least squares (PLS) is an approach that combines principal component analysis (PCA) and regression for simultaneous multiple-mediation models such as those used in this study. Table 5 below presents a comparison of the standardized path coefficients computed by the PLS model with those computed by the SEM model for the pooled model that includes the entire dataset for the four geographic regions (Europe, US, India, and China) while Figure 2 shows the PLS standardized path coefficients in graphical form. The results for the SEM and PLS show near-perfect match in sign and magnitude both for the path coefficients as well as the model fit parameters (shown in bold) to the third decimal point.

Table 5 Comparison of standardized path coefficients computed by the PLS model and SEM Model

	Pooled Model (Europe, US, India, China)	
Variables	**SEM**	**PLS**
5Y_DEFAULT_PROB → CUR_MKT_CAP	-0.086	-0.086
1Y_DEFAULT_PROB → CUR_MKT_CAP		
Z_SCORE → CUR_MKT_CAP	0.376	0.375
NON_PERFORM_ASSET → CUR_MKT_CAP	-0.225	-0.225
NON_PERFORM_LOANS → CUR_MKT_CAP	0.590	0.590
LT_BORROW → CUR_MKT_CAP	0.375	0.375
CUR_MKT_CAP → RETURN_ON_ASSET	0.021	0.021
5Y_DEFAULT_PROB → RETURN_ON_ASSET	-0.123	-0.123
Z_SCORE → RETURN_ON_ASSET	0.410	0.410
NON_PERFORM_ASSET → RETURN_ON_ASSET	0.510	0.510
NON_PERFORM_LOANS → RETURN_ON_ASSET	-0.760	-0.760
Chi square	**1.635**	**1.635**
SRMR	**0.0014**	**0.001**
NFI	**1.000**	**1.000**
Adj R-square for CUR_MKT_CAP	**0.690**	**0.688**
Adj. R-square for RETURN_ON_ASSET	**0.270**	**0.266**

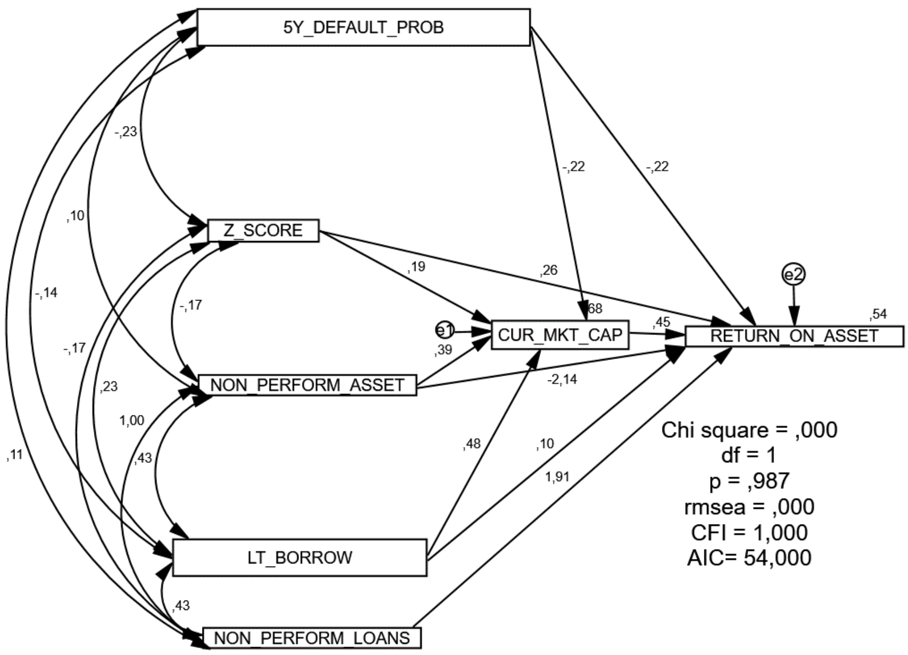
Figure 5 PLS standardized path coefficients



To extend further our cross-validation, we also rerun models using a different proxy for the government intervention since government controls vary by not only geographic region but are also calibrated to the type of banking institution (private vs public) in each geographic region. For this analysis, we group all banks in the public domain irrespective of geographic region (state-owned or controlled banks in China and national or state-controlled banks in India) together in Model 6 and all private banks together independent of region in Model 7. We exclude the US and European regions on account of relatively minimal government intervention compared to that imposed in China and India. Figure 3 and Table 6 report the detailed results (unstandardized and standardized path coefficients, standard errors, p-values, and model fit parameters) for the public (Model 6) and private (Model 7) banking models. In developing the models (Figure 3) we observe that the pathway structure of the model with best fit for the public banks (Model 6) closely resembles that for China (Model 5). On a similar vein, the best fit model for private banks (Model 7) has a pathway structure similar to that for India (Model 4). This confirms and supports our earlier findings with respect to government controls since the level of government intervention is in general higher in China than in India, even when considering the combined cohort of public and private banks.

Figure 6 SEM Models for private and public banks (India and China combined)

Public banks



Private Banks

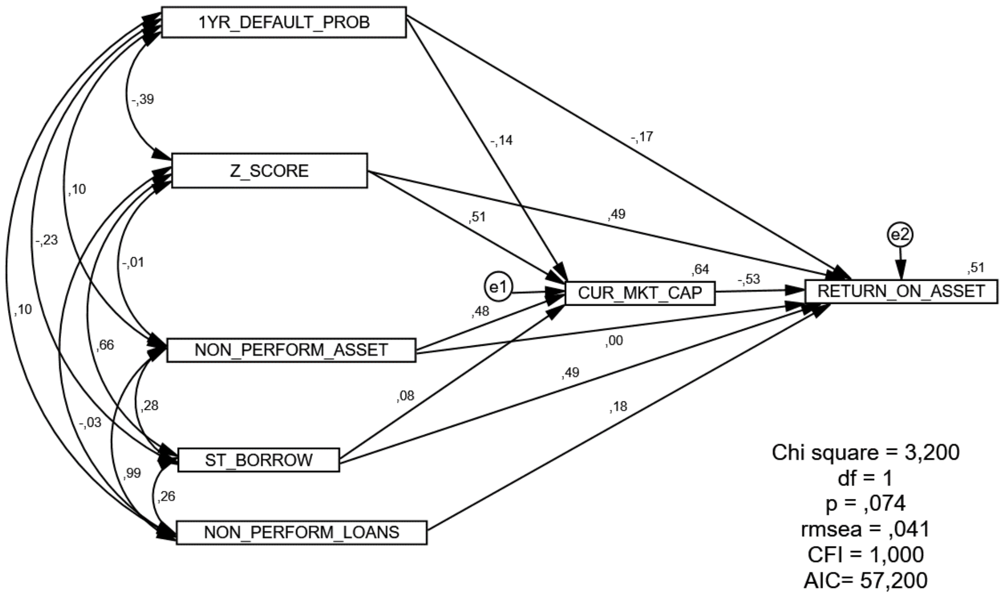


Table 6 SEM Models for private versus public banks (India and China combined)

	Model 6: Public				**Model 7 : Private**			
Variables	**Std. Coeff.**	**Non-std. Coeff.**	**SE**	**p-value**	**Std. Coeff.**	**Non-std. Coeff.**	**SE**	**p-value**
Dependent variable: *RETURN_ON_ASSET* ***Mediator variable:*** *CUR_MKT_CAP*								
5Y_DEFAULT_PROB → CUR_MKT_CAP					-0.224	-69.25	4.126	<0.001***
1Y_DEFAULT_PROB → CUR_MKT_CAP	-0.145	-48.05	6.008	<0.001***				
Z_SCORE → CUR_MKT_CAP	0.51	0.786	0.037	<0.001***	0.188	0.610	0.046	<0.001***
NON_PERFORM_ASSET → CUR_MKT_CAP	0.477	0.445	0.017	<0.001***	0.395	0.362	0.014	<0.001***
LT_BORROW → CUR_MKT_CAP					0.479	0.291	0.009	<0.001***
ST_BORROW → CUR_MKT_CAP	0.084	0.041	0.012	<0.001***				
IMPLIED_CDS_SPREAD → CUR_MKT_CAP								
CUR_MKT_CAP → RETURN_ON_ASSET	-0.534	-0.169	0.01	<0.001***	0.450	0.015	0.001	<0.001***
5Y_DEFAULT_PROB → RETURN_ON_ASSET					-0.221	-2.207	0.172	<0.001***
1Y_DEFAULT_PROB → RETURN_ON_ASSET	-0.173	-18.21	2.257	<0.001***				
Z_SCORE → RETURN_ON_ASSET	0.491	0.24	0.016	<0.001***	0.264	0.028	0.002	<0.001***
NON_PERFORM_ASSET → RETURN_ON_ASSET	0.005	0.001	0.045	0.974	-2.143	-0.063	0.007	<0.001***
NON_PERFORM_LOANS → RETURN_ON_ASSET	0.177	0.051	0.043	0.241	1.906	0.056	0.007	<0.001***
LT_BORROW → RETURN_ON_ASSET					0.103	0.002	0.000	<0.001***
ST_BORROW → RETURN_ON_ASSET	0.494	0.076	0.004	<0.001***				
Chi square	3.2				0.000			
Df	1				1			
p *(for SEM ; >0.05 indicates good fit)*	0.074				0.987			
RMSEA	0.041				0.000			
CFI	1.000				1.000			
AIC	57.2				54.0			

To summarize, the highlights of key findings from the multiregional models are the following:

In the pooled model, the mediation pathway (current market capitalization as a mediator for return on assets) is non-significant. This is because this path coefficient has different signs for different regions: negative for Europe (-0.367, $p<0.001$) and India (-0.107, $p=0.006$), but positive for the US (0.137, $p<0.001$) and China (0.317, $p<0.001$), leading to a cancelling out effect when extracting a global relationship by combining all regions together. The interpretation is that increasing market capitalization is associated with increasing ROA bank performance in the US and China, but with decreasing returns in Europe and India. When pooled, the effects are mixed and no generalization statement can be made about this mediation relationship on a global scale (i.e. there is no region-insensitive relationship with respect to whether increased capitalization results in increased performance). This supports our hypothesis H2. The additional observations below offer more detailed insights about these regional differences.

Neither non-performing loans nor non-performing assets have a direct significant effect on ROA in Europe. Non-performing loans have a strong significant direct negative effect on ROA (-0.742, $p<0.001$) in the US, but not in India or China. Non-performing assets, on the other hand, have a significant direct effect on ROA only in India (0.304, $p<0.001$) and China (-0.888, $p<0.001$). The difference of sign could probably be explained by the stronger state intervention in China than in India.

Implied credit default swap is essential to take into account and therefore plays an important role in explaining banking ROA performance in the US, but does not figure in the other regional models. It has a significant positive direct effect (0.139, $p<0.001$) on ROA and a positive indirect effect of 0.008, $p<0.001$.

The regional banking model for China includes short-term independent variables (1-year default probability and short-term borrowing) in order to explain ROA performance while all other regions include relatively longer-term independent variables (5-year default probability and long-term borrowing).

5. Conclusion

Our SEM analysis provides novel insights into how market capitalization affects profitability and risk management of global banks. The multiregional discussion informs the debate about the importance of bank bailouts and government intervention to restore stability, while revealing potential unintended consequences of regulation.

When banks are troubled, regulatory interventions and capital support reduce bank risk taking. The underlying financial architecture for banking institutions still explains the relationship between profitability and risk management as underlined in our multiregional analysis. Complementarily, government interventions serve to reduce the volume of NPLs and NPAs. Their efforts have paid off. Indian banks showed better assets quality than China's banks. Indian banks are now better integrated into global markets and have to reinvent their internal governance to improve their place on these broader financial markets. China however remains a specific case study as regards the government role to guarantee stability and performance for the financial system.

As a whole our results underscore the fact that, despite their regional differences, banking institutions globally still have room to improve their performance in a more regulated and intensely competitive world without endangering their stability through excessive risk-taking.

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