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Banking Sector Soundness, Innovation, and Development:

Emerging Europe and South Asia

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Abstract

While most academic and practitioner researchers agree that a country's commercial banking sector's soundness is a very significant indicator of a country's financial market health, there is considerably less agreement and substantial confusion surrounding what constitutes a healthy bank in the aftermath of 2007+ financial crisis. Global banks' balance sheets, corporate governance, management compensation and bonuses, toxic assets, and risky behavior are all under scrutiny as academics and regulators alike are trying to quantify what are "healthy, safe and good practices" for these various elements of banking. The current need to quantify, measure, evaluate, and compare is driven by the desire to spot troubled banks, "bad and risky" behavior, and prevent real damage and contagion in the financial markets, investors, and tax payers as it did in the recent crisis. Moreover, future financial crisis has taken on a new urgency as vast amounts of capital flows (over $1 trillion) are being redirected to emerging markets. This study differs from existing methods in the literature as it entail designing, constructing, and validating a critical dimension of financial innovation in respect to the eight developing countries in the South Asia region as well as eight countries in emerging Europe at the country level for the period 2001 – 2008, with regional and systemic differentials taken into account. Preliminary findings reveal that higher stages of payment systems development have generated efficiency gains by reducing the settlement risk and improving financial intermediation; such efficiency gains are viewed as positive financial innovations and positively impact the banking soundness.

Keywords: *Financial Innovation; Banking Sector Soundness; Payment Systems Development; Developing Countries; Financial Crisis; Financial Soundness Measures; Financial Soundness Index*

1. INTRODUCTION

The impact and cost of the recent global financial crisis of 2007+ was staggering when compared to previous financial crises. We have yet to see the final outcome of this man-made disaster and will feel the ensuing consequences for at least another decade. One of the critical repercussions was loss of public and investor confidence in the soundness and stability of the financial systems of the world's most highly developed countries, such as, U.S., U.K., Germany, France, Switzerland, to mention a few. Of particular concern is the loss of confidence in the large, too big to fail, global commercial banks. This has, for better or worse, shaken the bedrock of major financial centers and has reintroduced the government as a major participant to the private financial sector.

While most academic and practitioner researchers agree that a country's commercial banking sector's soundness is a very significant indicator of a countries financial market health, there is considerably less agreement and substantial confusion surrounding what constitutes a healthy bank in the aftermath of 2007+ financial crisis. Global banks' balance sheets, corporate governance, management compensation and bonuses, toxic assets, and risky behavior are all under scrutiny as academics and regulators alike are trying to quantify what are "healthy, safe and good practices" for these various elements of banking. The current need to quantify, measure, evaluate, and compare is driven by the desire to spot troubled banks, "bad and risky" behavior, and prevent real damage and contagion in the financial markets, investors, and tax payers as it did in the recent crisis.

These types of bank soundness measurements have taken on a new urgency as vast amounts of capital flows are being redirected to emerging markets, such as, China, India, Brazil, Russia, and Thailand. The capital flows (over $1 trillion) to these emerging markets are due to the rapid economic growth rates that these countries are experiencing and are forecasted to have over the next 3-5 years compared to the sluggish growth in the developed countries. Needless to say that measurement of commercial bank soundness is even more complicated when it comes to developing country banks where regulations, supervision, corporate governance, and accounting practices are even more unclear than in developed economies. Moreover, the literature shows that the commercial banking sector plays a much larger role in the overall health, stability, and function of the financial sector in developing countries as

opposed to developed countries when compared to the non-bank financial sectors, such as, stocks, bonds, pension, and insurance markets. All this makes the measurement of commercial bank soundness in the emerging markets more imperative than ever before. It should be noted that several models of bank stress (i.e. soundness) tests have been developed and implemented by the multilateral community, specifically the International Monetary Fund (IMF) and the Bank of International Settlements (BIS) in 2009 and 2010. These stress tests were designed for developed country commercial banks and are inadequate for emerging markets banking institutions.

1.1 Current Knowledge of the Problem and Solutions

The financial sector is crucial to any economy, affecting its business climate, investment climate, and economic growth. Well functioning financial systems are not only critical for sustaining high economic growth paths—mobilizing savings from the public and allocating them to productive investments—but can play a pivotal role in making growth more inclusive, allowing more people to contribute to growth and share in the benefits—providing access to finance for all, which in turn is associated with more rapid growth, job creation, better income distribution, and poverty reduction In his seminal paper on financial sector development and growth, Levine (2005) reviews, appraises, and critiques theoretical and empirical research on the connections between the operation of the financial system and economic growth. In addition, he reviews the debates financial economists have on the comparative importance of bank-based and market-based financial systems over time (Goldsmith. 1969; Boot and Thakor,1997; Allen and Gale, 2000; Demirguc-Kunt and Levine, 2001—as stated in Levin,2005). The case for a bank-based system derives from a critique of the role of markets instruments providing financial functions. A strong and resilient banking system is the foundation for sustainable economic growth, as banks are at the centre of the credit intermediation process between savers and investors. While highlighting the growth enhancing role of banks, Levine argued that the case for bank-based systems is derived from the critiques of market-based systems. These are important facts to note since in most emerging countries financial systems are bank dominated.

Several policy makers and academic researchers are focusing on developing measures to assess financial stability. Gadanecz and Jayaram (2009) have identified the set of Financial Soundness

Indicators developed by the IMF (IMF (2006)) as examples of such indicators, as are the monitoring variables used in Hawkins and Klau (2000), Nelson and Perli (2005) and Gray et al (2007) which focus on market pressures, external vulnerability and banking system vulnerability. In addition, many central banks attempt to assess the risks to the financial stability in their Financial Stability Reports (FSRs). The International Monetary Fund (IMF) is at the forefront of assessing risks to financial stability. The development of Financial Soundness Indicators (FSIs) responds to the need for better tools to assess the strengths and vulnerabilities of the financial system. The FSR analysis as well as FSIs developed by IMF have several key setbacks as far as the emerging countries are concerned. None of these studies include any of the emerging countries. While the indicators selected to represent financial system stability are fairly common, several dimensions that are important to most emerging countries such as remittances, savings, access to finance etc. are not taken into account.

The primary goal of this paper is to investigate the importance of the critical variable "payment systems development" as a proxy for financial innovation in measuring banking soundness in developing countries. The paper uses Emerging Europe and South Asia as a case study. The paper sheds more light on the methodology and research of financial soundness indexes that would serve as an early warning indicator for the overall health of the financial sector in developing countries.

We observed that while the academic literature is robust in assessing global banks in developed countries, it is very thin on soundness and risk analysis with regards to indices for bank soundness (stress tests) geared for emerging country banks. Moreover, the literature on bank risk and soundness, to date, has mostly focused primarily on bank performance and capital adequacy only. This study differs from existing methods in the literature as it focuses on "payment systems development" as the primary proxy for financial innovation in composite index of banking sector soundness specifically.

This differs from existing methods as it takes into account intricacies not only relevant to developing and emerging countries, but also the idiosyncrasies of individual countries and systemic differences.

Once the variable of financial innovation is constructed, the robustness of the new measure as a proxy for banking soundness is tested using regression analysis with economic growth (defined as the average rate of real per capita GDP growth as well as per capita GDP) as the dependent variable (King and Levine, 1993). The results of these regressions are compared against similar regressions conducted using Institutional Investors Credit Rating as the independent variable.

This study aspires to make a significant theoretical and practical contribution to the field of financial crisis management, especially in the field of developing and emerging markets. Moreover, identifying weak banking sectors early is imperative to avoid the trigger factor and cotangent for a full-fledged global financial crisis that leads to economic crisis as evidenced by the past financial crises. This paper is part of our ongoing research on a Developing Country Commercial Banking Soundness Index (DC-CBSI) that would serve as an early warning indicator for the overall health of the financial sector in various regional markets. Other regional groupings have been published under this format and methodology of index development in the banking sector.

2. THEORETICAL BACKGROUND AND LITERATURE REVIEW

Financial sector functions as the process of transforming the household deposits into firm loans (Zhang, 2010). Financial intermediation is a critical factor for growth and social inclusion. One of its core functions is to mobilize financial resources from surplus agents and channel them to those with deficits. It thus allows investor entrepreneurs to expand economic activity and employment opportunities. It also enables household consumers, micro-, and small entrepreneurs to expand their own welfare and earnings opportunities, and seek to smooth their lifetime outlays. In all cases, financial intermediation drives economic growth and contributes to social inclusion, provided it is conducted in a sound and efficient way. Efficiently processed information can support the efficient allocation of capital. It can help a financial intermediary to better define the capital it would need to achieve the returns sought, while maintaining its ability to face the financial consequences of unexpected events that may endanger its

stability. Banks engage in gathering and processing information on clients and markets, which allows them to manage different risks by unbundling them and reallocating the components.

Merton and Brodie (1995) argued that in response to market frictions financial systems influence the allocation of resources across space and time. As such, the efficiency of financial intermediation is enhanced by the development of the financial system that result in lower information, transaction, and monitoring costs and thus better allocation of resources. A modern financial system promotes investment by identifying and funding good business opportunities, mobilizes savings, monitors the performance of managers, enables the trading, hedging, and diversification of risk, and facilitates the exchange of goods and services. These functions result in a more efficient allocation of resources, in a more rapid accumulation of physical and human capital, and in faster technological progress, which in turn feed economic growth (Creane et al., 2004).

2.1 Importance of Payment Systems Development as a Measure for Financial Innovation in the Banking Sector:

Financial innovation refers both to technological advances which facilitate access to information, trading and means of payment, and to the emergence of new financial instruments and services, new forms of organization and more developed and complete financial markets. To be successful, financial innovation must either reduce costs and risks or provide an improved service that meets the particular needs of financial system participants. From this point of view, it can be argued that development of payment and settlement systems has been one of the world's most important financial innovations over the years. It has both reduced transaction costs and eliminated settlement risks, and has also acted as a catalyst for a number of improvements in various areas that have helped to create a more efficient financial system in as a whole. By reducing transaction costs and increasing the efficiency of the intermediation process, development of payments systems would also lead to better allocation of resources. In the long term, this would positively impact economic growth. On another front advanced payment systems promote proliferation of new financial products that supports diversification of operational as well as market risks, thus making markets more complete. This has expanded the range of tradable risks through innovative instruments such as derivatives and securitization, thus making financial

markets deeper, more liquid, and more competitive. Hence, if financial innovation improves the efficiency of the financial system, then it also can be argued that it should also have a considerable effect on the functioning of the economy in general. For example, insofar as financial innovation improves the intermediation process, it is likely to have a positive impact on longer-term economic growth prospects.

From a theoretical perspective Krueger (1999) states that the subject of the New Monetary Economics is the financial system in a world of falling transaction costs and decreasing public regulation. He examines this concept further and states that Black (1970) and Fama (1980, 1983) by using the theory of finance similar to Modigliani and Miller (1958) develop their argument within a general equilibrium framework without transaction costs. This framework allows them to derive the neutrality of the financial sector. Furthermore, it leads to the conclusion that an unregulated system would be more efficient. In contrast to Fama and Black who are mainly concerned with efficiency, Greenfield and Yeager (1983) focus on the question of aggregate stability (long term stability and medium term, cyclical stability). They are concerned about the potential of the monetary sector to destabilize the economy. He further states that some authors have used the New Monetary Economics in order to analyze the consequences of the financial innovations in the payment system and have argued that technical development and innovations in the payment systems as decisive step on the way towards monetary separation and 'share banking and claim that such a world would be more efficient and more stable.

Merrouche and Nier (2009), argue that the efficiency of interbank payment systems may affect all of a) the banks' ability to offer transactions services to customers, and the interest rate banks need to pay on transactions deposits; and b) their ability to pool liquidity across banks. A greater efficiency of interbank payment systems is thus likely to affect credit creation. With rapid growth and integration of financial markets, cross border trade as well as financial activities has increased in parallel. This involves growth in the transfer activities that pass through payment systems. Such accelerated growth in payment systems involves a number of risk factors. Counterparty risk which is the credit and liquidity risks arising from the interbank exposures is the main risk. The failure of one bank participating in a payment system will cause the failure of others and thus leads to a systemic failure. Such disequilibrium in the payment system will have an adverse impact on the implementation of the monetary policy and as such will propagate a systemic crisis that will threaten financial system stability. In order to minimize this threat to

financial system stability, payment systems have to be protected from disruptions originating from outside the system, regardless of whether those disruptions are originated locally or even internationally.

Safe and efficient payment systems are critical to the effective functioning of the financial system. Payment systems are the means by which funds are transferred between banks. The most significant ones, referred to in this dissertation as systemically important payment systems, are a major channel for the transmission of shocks across domestic and international financial systems and markets—if the systems are not properly designed, managed, and regulated. Well-designed payment systems, by contrast, can contain the transmission of shocks and limit the adverse consequences of vulnerabilities in some participating banks or other systems. Robust payment systems are therefore, a key to maintaining and promoting financial stability. In the past few years a broad international consensus has developed on the need to strengthen payment systems by promoting internationally accepted standards and practices for their design and operation (CPSS 2001). The six indicators selected to measure the development of payment systems are standard ones used by the Committee on Payment and Settlement Systems of the Bank for International Settlements (CPSS various years).

Today, the market infrastructures are exposed to a wide range of credit, liquidity, operational and legal risks. Moreover, these infrastructures channel the flow of payments for goods, services, and financial assets. Their smooth operation is therefore a crucial prerequisite for the proper functioning of the financial system and the overall economy. In particular, given their extensive role and the large values and volumes of financial transactions they handle, any malfunctioning of these infrastructures can have negative repercussions for the implementation of monetary policy, the stability of the financial system and the currency (Trifonova, 2010).

3. PURPOSE OF THE STUDY

The main purpose of this study is to investigate the robustness of using "payments systems development in the banking sector" as a proxy for financial innovation in measuring commercial banking soundness that would serve as an early warning indicator for the overall health of the financial sector. Specifically the study examines the following issues:

RQ1:"*Can payment systems development proxy for the financial innovation in the commercial banking sector especially in emerging Europe and South Asian countries?"*

RQ2: *How well is financial innovation dimension captured by the selected payment systems development indicators?*

RQ3: *How robust is the Banking Soundness index as measured by Financial Innovation when compared with other risk indices in the market?*

RQ3 deals with the robustness testing of the newly developed banking soundness index. Hence is outside the scope of this paper. However, in this paper, we measure the validity of using Financial Innovation as a proxy for Banking Soundness when compared to other risk indices in the market.

4. METHODOLOGY AND DATA

We conducted an analysis of change in the payment systems development in banking sectors of countries in the emerging Europe and South Asia region for the period 2001 – 2008. We collected annual aggregate data on the commercial banking sector of each country covered for eight years 2001–08. Using standardized data collection templates financial data for each country is collected directly from the regulatory authorities, their published reports and other reputable databases. The data comparability across the countries is ensured by providing a compilation guide setting out definitions of the indicators and underlying concepts. The study analyzes the empirical results of payment systems development by

referring to the money supply, retail and large value payment concentration ratios, during 2001- 2008 and examines the relationships and trends.

Table 4.1

Data Sample and Benchmark Countries

Region	Countries
Europe and Central Asia	EU candidate countries: Croatia; the former Yugoslav Republic of Macedonia; Turkey; Romania; Bulgaria Potential EU candidate countries: Albania; Montenegro; Serbia
South Asia	Afghanistan; Bangladesh; Bhutan; India; Maldives; Nepal; Pakistan; Sri Lanka
Benchmark countries	Australia; Canada; China; France; Germany; Hong Kong SAR, China; Italy; Japan; the Republic of Korea; Malaysia; New Zealand; Singapore; Thailand; the United Kingdom; the United States

Like most other developing countries, Emerging Europe and South Asian financial sectors are dominated by commercial banks and capital markets are mostly at nascent stages of development. Hence, a weak banking sector can be the trigger factor for full-fledged financial crisis that leads to economic crisis as evidenced by the past financial crises. Therefore, the stability and soundness of commercial banking sector is crucial for financial sector stability and economic development in these countries. Country-level financial sector indicators serve as an important tool for analytic and diagnostic work, strategy formulation, lending operations, and, ultimately, the evaluation of outcomes. It is hoped that the focus on financial innovation in this paper would provide insightful information about the operational efficiency in the banking sectors in these countries.

By using content analysis of the existing literature, intuitive reasoning, and theoretical basis, a set of underlying observable and measurable payment systems development variables are identified that would represent the financial innovation dimension. In most cases the variables have already been

established in the literature as measures for financial innovation through payment systems development.. To test such dimensional model against the data, factor analysis is used, as suggested by Pedhazur and Schmelkin (1991) and Field (2005). The underlying indicators are validated by using confirmatory factor analysis (CFA) to check whether the indicator variables load on the expected factor as predicted on the basis of a pre-established theory or hypothesis (Pedhazur and Schmelkin, 1991). Then, similar to Verkhohlyad (2008, p. 159), this paper uses principal component analysis (PCA) to capture the financial innovation dimension from the set of corresponding payment systems development variables. The strategy is to use the PCA as a data reduction method and take the first principal component (Pedhazur and Schmelkin, 1991). Once the financial innovation dimension is constructed, the validity of the new measure as a proxy for banking sector soundness is tested by using regression analysis with economic growth (defined as the average rate of real per capita GDP growth as well as per capita GDP) as the dependent variable (King and Levine, 1993). The results of the regression are compared with those of similar regressions that use the Institutional Investor's Credit Risk Rating as the banking soundness measure. Institutional Investor's Credit Risk Ratings are based on information provided by economists and sovereign-risk analysts at global banks and money management and securities firms on the credit worthiness of the country based on a sample for the study, updated every six months. And this rating is available for all countries; hence, it can be argued that this risk rating can be used as a reasonable measure of banking sector stability for a country.

4.1 Potential Index Validation

According to Diamantopoulos & Winklhofer (2001), Hauser & Goldberger (1971), Jarvis, Mackenzie, & Podsakoff (2003), and Jöreskog & Goldberger (1975), the estimation of the relationship between output indicators (the ones that represent effects of the construct) and the construct (as the input indicator) can serve as a means of validity testing. In addition, it is possible to assess the contribution and significance of the individual indicators by focusing on their particular relationship with the output indicator. Regression analysis will be used at this juncture. Regression analysis measures the degree of linear relationship between the predictor variable and the criterion variable (Wooldridge, 2006), and as such is deemed to be an appropriate tool here.

Therefore, in testing the validity the DC-CBSI Index, the study tests the relationship between a dependent variable, economic growth (defined as the average rate of real per capita GDP growth as well as per capita GDP), and the independent variable (the index as a proxy for financial sector soundness) using regression analysis. The robustness of the index is tested by using Institutional Investor's Credit Risk Rating as proxy for financial sector soundness against the same set of dependent variables. Furthermore, the study compares the descriptive statistics and results of the regressions as a test for robustness of the financial soundness indicator

The Developing Countries Commercial Banking Sector Soundness Index (DC-CBSI) Model: The model purposed to validate the DC-CBSI Index is as follows:

= *Dependent Variable:* *Economic Growth* (Levine, 2005) examines the connections between the operation of the financial system and economic growth;

= *Independent variable (regression 1):* Banking sector soundness (as proxied by financial innovation)

= *Independent variable (regression 2):* Banking sector soundness (as proxied by Institutional Investors Credit Rating)

5. HYPOTHESES:

The hypotheses developed based on the research questions are as below:

Hypothesis 1: Developments in the payment systems would generate efficiency gains by reducing the settlement risk and improving financial intermediation; thus positively impact the soundness of the banking sector.

- Hypothesis 1 a: A rise in the notes and coins in public circulation will negatively impact use of developed payment systems thus decrease the efficiency of financial intermediation.

- Hypothesis 1 b: A rise in narrow money supply (cash in circulation and transferable deposits held by nonbanks – M1) will negatively impact the use of developed payment systems thus decrease the efficiency of financial intermediation.
- Hypothesis 1 c: A rise in value of RTGS transactions indicate the use of advanced payment systems thus increase the efficiency of financial intermediation as well as reduce settlement risk.
- Hypothesis 1 d: A rise in value of retail transactions (such as checks and credit clearing) indicate the use of advanced payment systems thus increase the efficiency of financial intermediation.
- Hypothesis 1 e: High concentration of RTGS transactions value among the top five participants indicates less participation in advanced payment systems by intermediaries; thus will negatively impact efficiency of the financial intermediation.
- Hypothesis 1 f: High concentration of retail transactions value among the top five participants indicates less participation in advanced payment systems by intermediaries; thus will negatively impact efficiency of the financial intermediation.

6. RESULTS AND ANALYSIS

6.1 Confirmatory Factor Analysis

Financial innovation is represented by a set of observable and measurable indicators on payment systems development. The importance of each of these dimensions is already established in the financial literature and theory as explained. Confirmatory factor analysis (CFA) was used to assess the model fit. It was used to identify whether the micro indicators of payment systems development represent the latent dimension of financial innovation.

In the eight years of data that was analyzed, the CFA identified the model fit to be somewhat mediocre by registering average fit statistics under Bentler & Bonett's NFI (while all other model fit statistics were insignificant). The CFA, however, confirmed that the payment systems development indicator variables were somewhat predictive of the latent dimension of financial innovation as indicated by high t-values for most variables. The results confirm that most variables are representative of the

financial innovation dimension. Reasons for variations in data could be the non-availability of data which compelled the use of regional averages, or regional minimum values. Findings and analysis of CFA in respect of sample year 2001 is given below. Confirmatory factor analysis was carried out for all years. The results of all years showed similar characteristics and due to the repetitive nature, only detailed analysis in respect of year 2001 is presented below[1].

Table 6.1 . Confirmatory Factor Analysis - Results –2001:

A. Correlations

1. Payment Systems Development Indicators for Financial Innovation Dimension

	A6	B6	C6	D6	ENTER6	FORM6	G6
A6	1	0.6902	-0.0347	-0.2208	-0.2829	0.1279	0.2328
B6	**0.6902**	1	-0.449	-0.3942	0.1811	0.0175	-0.1873
C6	-0.0347	-0.449	1	0.6449	-0.5791	0.2869	0.6794
D6	-0.2208	**-0.3942**	**0.6449**	1	-0.1134	0.0917	0.2205
ENTER6	**-0.2829**	0.1811	**-0.5791**	-0.1134	1	-0.1034	-0.9235
FORM6	0.1279	0.0175	**0.2869**	0.0917	-0.1034	1	0.3012
G6	0.2328	-0.1873	**0.6794**	0.2205	**-0.9235**	**0.3012**	1

Fairly high correlations (in bold) among the variables under each latent dimension (under 1 and 3 matrices) is observed thus indicating that model structure is fairly sound.

[1] Note that since this paper is part of our ongoing research on a Developing Country Commercial Banking Soundness Index (DC-CBSI) the model fit is includes all the dimensions in the Soundness Index. Only Financial Innovation dimension is discussed in this paper.

B. The Fit Test

The CALIS Procedure
Covariance Structure Analysis: Maximum Likelihood Estimation

Fit Function	6.7524
Goodness of Fit Index (GFI)	0.5558
GFI Adjusted for Degrees of Freedom (AGFI)	**0.3685**
Root Mean Square Residual (RMR)	**0.1856**
Parsimonious GFI (Mulaik, 1989)	0.4561
Chi-Square	**202.5735**
Chi-Square DF	64
Pr > Chi-Square	**<.0001**
Independence Model Chi-Square	290.57
Independence Model Chi-Square DF	78
RMSEA Estimate	**0.2687**
RMSEA 90% Lower Confidence Limit	0.2275
RMSEA 90% Upper Confidence Limit	0.3107
ECVI Estimate	10.1274
ECVI 90% Lower Confidence Limit	8.5763
ECVI 90% Upper Confidence Limit	12.1711
Probability of Close Fit	**0.0000**
Bentler's Comparative Fit Index	**0.3481**
Normal Theory Reweighted LS Chi-Square	155.8145
Akaike's Information Criterion	74.5735
Bozdogan's (1987) CAIC	-81.2017
Schwarz's Bayesian Criterion	-17.2017
McDonald's (1989) Centrality	0.1070
Bentler & Bonett's (1980) Non-normed Index	0.2055
Bentler & Bonett's (1980) NFI	**0.3028**
James, Mulaik, & Brett (1982) Parsimonious NFI	0.2485
Z-Test of Wilson & Hilferty (1931)	8.0054
Bollen (1986) Normed Index Rho1	0.1503
Bollen (1988) Non-normed Index Delta2	0.3884
Hoelter's (1983) Critical N	14

For the chi-square test we specify the following hypothesis:

Ho (null): the model we have specified is correct (i.e. predicted covariance matrix E is equivalent to the observed covariance matrix S, E=S)

Ha: the underlying model is specified incorrectly.

Chi-square = 202.57, df=53, p-value <0.0001, so we reject the null hypothesis and find that the model does not reproduce the sample covariance. This means the model may not fit data well.

Since, chi-square test is considered to be quite sensitive, we also look at alternative measures of fit such as:

1) RMSR (root mean square residual) = 0.1856, which should be less than 0.05
2) Adjusted GFI (goodness of fit index) = 0.3685, which should be greater than 0.90
3) Bentler & Bonett's (1980) NFI = 0.3028, which should be more than 0.9 (which has fit ranges of 0= poor fit to 1=good fit.
4) RMSEA (Root Mean Square Error of Approximation) = 0.2687 which should be less than 0.05

These measures find no evidence that the model is a good fit with the exception of Bentler & Bonett's NFI, which is within the range but does not indicate a very good fit. However, in reality, it is rare to see these numbers comply and a model to be a good fit. It is so easy to reject the model just because there is a minor flaw in the model (Brown, 2006).

C. Covariance Structure Analysis: Maximum Likelihood Estimation

Manifest Variable Equations with Estimates

A6	=	0.0698*F6	+	1.0000 E31
Std Err		0.1875 LAM316		
t Value		0.3723		
B6	=	0.4795*F6	+	1.0000 E32
Std Err		0.1767 LAM326		
t Value		**2.7137**		
C6	=	-0.9654*F6	+	1.0000 E33
Std Err		0.1409 LAM336		
t Value		**-6.8504**		
D6	=	-0.6457*F6	+	1.0000 E34
Std Err		0.1673 LAM346		
t Value		**-3.8588**		
ENTER6	=	0.6056*F6	+	1.0000 E35
Std Err		0.1699 LAM356		
t Value		**3.5649**		
FORM6	=	-0.2743*F6	+	1.0000 E36
Std Err		0.1842 LAM366		
t Value		-1.4894		
G6	=	-0.7053*F6	+	1.0000 E37
Std Err		0.1632 LAM376		
t Value		**-4.3215**		
A7	=	0.8824*F7	+	1.0000 E38
Std Err		0.1770 LAM387		
t Value		**4.9850**		
B7	=	-0.0669*F7	+	1.0000 E39
Std Err		0.1980 LAM397		
t Value		-0.3379		
C7	=	0.5155*F7	+	1.0000 E40
Std Err		0.1854 LAM407		
t Value		**2.7805**		
D7	=	0.2105*F7	+	1.0000 E41
Std Err		0.1960 LAM417		
t Value		1.0741		
ENTER7	=	-0.0358*F7	+	1.0000 E42
Std Err		0.1981 LAM427		
t Value		-0.1807		
FORM7	=	-0.4094*F7	+	1.0000 E43
Std Err		0.1901 LAM437		
t Value		**-2.1539**		

In the above covariance structure analysis t-values of seven unconstrained factor loadings (B6, C6, D6, E6, G6, C7, and F7) appear to be significant. If the absolute value of the t-statistic is greater than or equal to 1.96, then the estimate are considered to be significant at 0.05 level. Therefore, it is observed that 5 out of 8 variables appear to be significant for **Financial Innovation** dimension. Again data issues and missing data appear to have some weight in these results.

D. Covariance Structure Analysis: Maximum Likelihood Estimation
Manifest Variable Equations with Standardized Estimates

```
A6      =   0.0698*F6      +  0.9976 E31
                  LAM316
B6      =   0.4795*F6      +  0.8775 E32
                  LAM326
C6      =  -0.9654*F6      +  0.2608 E33
                  LAM336
D6      =  -0.6457*F6      +  0.7636 E34
                  LAM346
ENTER6  =   0.6056*F6      +  0.7958 E35
                  LAM356
FORM6   =  -0.2743*F6      +  0.9616 E36
                  LAM366
G6      =  -0.7053*F6      +  0.7089 E37
                  LAM376
A7      =   0.8824*F7      +  0.4705 E38
                  LAM387
B7      =  -0.0669*F7      +  0.9978 E39
                  LAM397
C7      =   0.5155*F7      +  0.8569 E40
                  LAM407
D7      =   0.2105*F7      +  0.9776 E41
                  LAM417
ENTER7  =  -0.0358*F7      +  0.9994 E42
                  LAM427
FORM7   =  -0.4094*F7      +  0.9124 E43
                  LAM437
```

The best estimates of lamdas are given in the equations with standardized estimates. They represent the correlation between each observed variable and the corresponding factor. A good amount of variance in each observed variable is accounted for. R-squared for C6 is (-0.9654^2) = 0.93, R-squared for A7 is (0.8824^2) = 0.78 and so on. Higher values as factor loadings show that the indicators are reliable indicators of the latent constructs.

Accordingly, most variables under Financial Innovation are seen to be reliable indicators of the underlying construct. However, the results may be impacted due to data issues mentioned earlier.

6.2 Principal Component Analysis

Findings and analysis of PCA with respect to sample year 2001 is given in this section. In this study, a decision was taken to select the first principal component with respect to each of the latent dimensions as the representative measure of the dimension. (Note that although PCA results given in Table 6.2 are only for the Financial Innovation dimension, PCA analysis was done for all other dimensions in the index). In order to be able to compare PCA Scores in column A are standardized and the summative aggregation of standardized factor scores are given in column B.

Table 6.2: PCA Results of Financial Innovation–2001

	A	B
Country	Raw Scores	Standardized Scores
Afghanistan	-0.94821	0.321
Bangladesh	-1.03215	0.296
Bhutan	-1.1869	0.250
India	-1.19242	0.249
Maldives	-1.12423	0.269
Nepal	-1.29085	0.219
Pakistan	-1.16525	0.257
Sri Lanka	-1.02975	0.297
Albania	-0.64266	0.412
Croatia	0.545605	0.765
Macedonia	-0.80572	0.363
Montenegro	-0.64276	0.412
Serbia	0.646727	0.795
Turkey	0.939306	0.881
Bulgaria	-0.62128	0.418
Romania	-0.63894	0.413
Australia	1.338554	1.000
Canada	0.954524	0.886
France	1.012239	0.903
Germany	1.061289	0.918
Hong Kong, China	0.951413	0.885
Italy	0.612317	0.784
Japan	0.460543	0.739
Korea, Rep.	0.899089	0.870
New Zealand	0.96486	0.889
United Kingdom	1.326397	0.996
United States	0.992614	0.897
China	-2.02969	0.000
Malaysia	0.542254	0.764
Thailand	0.290147	0.844
Singapore	0.812957	0.689

6.3 Validity Test

As suggested in literature (Diamantopoulos & Winklhofer, 2001, Verkhohlyad, 2008), to test the validity of the soundness measure (financial Innovation) that is constructed, an estimation of the relationship between an output indicator (one that represent effects of the construct) and the construct (as the input indicator) is carried out using regression analysis. For this purpose, the long run economic growth is used as the dependent variable and is represented by both average real GDP per capita growth rate and GDP per capita. GDP per capita is a basic economic indicator and measures the level of total economic output relative the population of a country. It reflects changes in total wellbeing of the population. The relationship between a dependent variable (long-run economic growth) and the independent variable (the index as a proxy for financial sector stability) was tested using regression analysis. The validity of the index is tested by substituting credit risk ratings by Institutional Investor as proxy for financial sector stability against the same dependent variable. The descriptive statistics and results of the regressions are compared as a test for validity of the financial Innovations indicator as a good measure for banking soundness. The validity model allows testing the predictive power of the Financial Innovations as the independent variable.

Table 6.3: Validity Test Results of Financial Innovation–2001

Pre-crisis 2001								
	GDP Growth Rate				GDP Per Capita			
	R squared	Global F test	T test	p>F P>|t|	R squared	Global F test	T test	p>F P>|t|
Financial Innovation	**0.024**	0.34	0.58	0.568	**0.53**	15.45	3.93	0.0015
Institutional Investor Credit rating: All Countries	0.033	0.99	-0.99	(0.3283)	0.788	107.64	10.38	(<0.0001)
Institutional Investor Credit rating: Benchmark Countries	0.072	1.02	-1.01	(0.3311)	0.701	30.47	5.52	(<0.0001)
Institutional Investor Credit rating : Developing Countries	**0.0001**	0.00	-0.04	(0.9717)	**0.209**	3.71	1.93	(0.0748)

Table 6.3 shows the descriptive statistics of R squared Global F-test and t-test and their probabilities in respect of the two proxies of financial soundness used as independent variables, for the sample year 2001 when the dependent variable is the average real per capita GDP growth rate and GDP per capita. The two proxies are Financial Innovations measure constructed in this study; and Institutional investor Credit risk Rating (IICR).

In respect of average real per capita GDP growth rate, the low R-square values, lower global F-tests and the t-tests along with the high probability values show that the tests are statistically insignificant for the most part. The exceptions were, IICR for the benchmark countries. This is the main reason for running the validity tests with GDP per capita level as the dependent variable. However notwithstanding the lower explanatory Financial Innovations show better results than IICR for developing countries. Since the results are statistically insignificant (low R-squares, low f-statistics, higher t-value and higher probabilities), no further analysis is done on Growth rate as the dependent variable.

In the validity tests done using GDP per capita level as the dependent variable, the analysis of the results validates the Financial Innovations even with data issues. Here, the developing countries versus benchmark countries show interesting results. For developing countries, Financial Innovations outperforms IICR. Although the explanatory power of Financial Innovations of the total variability in economic growth of the developing countries is only around 53 percent, this is significantly higher than 21 percent of IICR for 2001. On the other hand, in respect of benchmark countries and all countries, IICR is at 70 percent and 78 percent respectively. Similar results could be seen in the explained variability measure in all years, where Financial Innovations showed higher explanatory power when compared with IICR for developing countries. These results validate the Financial Innovations as a better measure of the financial soundness in developing countries. Therefore the validity tests can be seen as proof for Financial Innovations being a better proxy for financial soundness and risk in developing countries.

Hence these test results also provide further evidence on the robustness of the Financial Innovations as an individual component on the Banking Soundness index that is developed.

7. Limitations

There are several data issues such as availability, issues with different accounting standards, regulatory standards etc, which, to a certain extent, will be addressed by providing a common compilation guide of definitions and concepts as well as a common data template. Use of dummy variables in the model also will hopefully minimize the impact further. The variables will have endogeneity and multicollinearity issues. Also general limitations relevant to factor analysis as well as OLS regression need to be addressed.

8. Contributions

From a academic point-of-view, the finding of this study and the theoretical underpinnings of the Index contribute to the literature on (a) global financial crisis management, (b) banking sector development in emerging economies, (c) banking sector soundness, (d) bank stress test measures, and (e) index development in the field of finance and banking. From a policy point-of-view, the findings of this study would contribute towards the multinational community (IMF, BIS, World Bank) knowledge base in developing more appropriate regulatory rules for the emerging countries' financial sectors and banking institutions. Country-level bank soundness indicators such as financial innovations as well as the Index itself serve as important tools for analytic and diagnostic work, strategy formulation, lending operations, and, ultimately, the evaluation of outcomes. A comprehensive set of core indicators for a large number of countries can help to benchmark countries' vulnerability to financial crisis, identify their strengths and weaknesses, and provide a rationale for particular policy and government interventions. For example, if a country measures well below its benchmark in any of the financial sub-sectors (banking, capital markets, insurance) or thematic areas (financial infrastructure), the case can be made that reforms in that area merit more attention to prevent future problems.

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