A New Composite Financial Maturity Index and its application to China's Province-level Regions

Jianjun Zhang
School of Economics and Management, University of Xidian, China

Zuoxiang Zhao
Business School, University of Exeter, UK

Jon Tucker
Faculty of Business & Law, University of the West of England, UK

Acknowledgements
The first author acknowledges the support of the Xi'an City Social Science Foundation (No:14J190), the Projects of the National Social Science Foundation of China (No:15XJL087), and the China Scholarship Council (No:201308610046).

Address for correspondence:- jon.tucker@uwe.ac.uk

Abstract
This paper introduces a new regional "financial maturity index" (FMI) based on previous studies of financial development theory. We explore a unified measure of regional financial development by constructing a new composite financial maturity model. This paper presents a regional FMI measurement process to study 31 Chinese provincial level regions for the year 2012. Our empirical results correctly reflect the integrated financial development level of different areas, which can be summarised as gradually diminishing as we move from eastern to western areas within China. This trend is also consistent with the characteristics of China's regional economic and social development.

Keywords: Financial Maturity Index, Principal Component Analysis, Regional Financial Development, Inequality

Introduction
Over recent decades there have been significant advances in finance theory within the field of regional financial development. In his seminal study, Goldsmith (1969) proposed an analytical framework for financial development theory, as well as an evaluation system for financial development. In an empirical analysis of 35 countries, he finds a positive relationship between financial development and economic activity. Following his study, there was significant interest in the academic sphere in exploring the relation between financial development and economic growth in both cross-sectional and time series empirical studies (see for example, McKinnon, 1973; Shaw, 1973; King and Levine, 1993; De Gregorio and Guidotti, 1995; Levine, 1999; Beck et al., 2000; and Demirgu¨c¸-Kunt and Levine, 2004). How we might accurately reflect the level of financial development has become an important question in the field of study.

Caldero´n and Liu (2003) describe the level of regional financial development as capturing the quantity, quality, and efficiency of financial intermediary services, the growth in regional business turnover, profit and investment, and to measure it requires the combination of many factors describing financial activity. In recent years, researchers have developed many new and innovative ways to measure financial development. However, the earliest financial development indicator which we might identify in the literature is the Financial Interrelations Ratio (FIR) developed by Goldsmith (1969) which is a measure of the degree of financial intensity of an economic system[1]. In order to simplify the expression, he defines the total market value of financial assets in an entire economy as F, and defines total GDP as W. Then the FIR indicator can be employed for studying evolving financial structures. The research that followed Goldsmith evidences significant refinement in the definition and measurement of financial development indicators.

Measures of financial development are commonly based on the ratio of the money stock (usually M2) to the level of nominal GDP or GNP (Gelb, 1989; King and Levine, 1993). Such an approach is consistent with the outside money model proposed by McKinnon (1973), which indicates that the accumulation of real money balances would be essential to self-financed investment. However, Demetriades and Hussein (1996) argue that a more representative financial development measurement is the ratio of bank deposit liabilities to nominal GDP, excluding the currency in circulation from the broad money stock as an increasing ratio of broad money to nominal GDP reflecting the wide use of currency in circulation rather than the volume of bank money stocks. Furthermore, Rajan and Zingales (2003) suggest as

measures of financial development the use of financial market variables relative to the size of the economy. Such measures might include ratios such as deposits to GDP for the banking sector, the ratio of equity market capitalisation to GDP, the volume of equity issues to gross fixed-capital formation, and the number of financial institutions scaled by population count. These proxies are employed to broadly capture the financial maturity of nation-level regions.

Levine and Zervos (1998) find that stock market liquidity, size, volatility, and physical capital growth are significantly positively correlated with current and future (trend) economic growth. Beck et al. (1999) note that existing studies tend to rely on only a few banking and stock market measures to gauge financial development, and thus extend the range of measures to include a wide array of constructed indicators of the size, activity and efficiency of a range of financial institutions and markets. The database they employ is innovative as it is the first study of commercial banking related data which distinguishes between public and private ownership. Beck et al. measure size and activity indicators for non-banking intermediaries such as insurance institutions and pension funds, and also provide size indicators for primary equity and bond markets. Their database enables the systematic computation and analysis of financial market and structure indicators, thereby capturing the level of financial development both across countries and over time.

In 2008, the World Economic Forum introduced an annual financial development index that examines 55 financial systems across the world in its Financial Development Report (World Economic Forum, 2008). This index is constructed on the basis of the seven pillars of the level of financial development for an economy which comprise: the institutional environment, the business environment, financial stability, banking financial services, non-banking financial services, financial markets, and financial access. A standardised methodology is used to construct a unified measure of financial development, and each pillar within the total index is equally weighted. Countries may then be ranked on the index. Since 2008 the index has been revised annually and has become an important reference resource for financial development research.

However, according to the World Economic Forum's Financial Development Report (2012), there remains little agreement on how to best describe and define financial system development, and in particular how it might be gauged. Since an individual variable is able to capture an aspect of financial development only imperfectly, the results of empirical studies in the field can be significantly influenced by the particular variables selected. Moreover, previous studies focus in the main on regions at the nation level, whilst there is a paucity of intra-country studies where areas are subject to a similar policy and legal environment. Thus, the question of which financial development indicator or index best reflects the actual level of regional financial development remains contentious and an interesting avenue for investigation within the field of financial theory.

In this paper, we build upon advances made in the construction of the financial development index produced by the World Economic Forum, and introduce a new regional financial maturity index (FMI) to analyse regional financial development (maturity) conditions within China. We select China as a particularly interesting case for two reasons: (i) the study of financial development indices within China remains underdeveloped, and (ii) there is significant disparity across Chinese regions in terms of economic development (Keidel, 1995; Fan et al., 2007; Zhang, 2001), which may be at least in part driven by different levels

of regional financial development. In the paper, we conduct a crosswise comparison of the regions to analyse the reliability of the FMI, and to examine the main drivers of differences in regional financial development in China.

Method for constructing the FMI model

In the existing literature, many factors are identified as driving the level of financial development. In our paper, the FMI is constructed as a composite indicator which integrates many aspects of financial development. The common statistical methods employed to construct an index of multiple related observed variables include Factor Analysis (FA) and Principal Component Analysis (PCA)[2]. In this paper, we use PCA to construct our FMI to include a range of related financial indicators.

Jolliffe (2005) describes PCA as a statistical method which uses an orthogonal transformation to convert a set of possibly correlated observed variables into a set of linearly uncorrelated variables.[3] The method can be briefly explained as follows. Suppose FMI construction relates to financial variables. The total variable sample is denoted by $X=(X_1,X_2,...,X_p)^T$. In order to reduce large value dispersion of the initial variables which have different dimensions, the standardised data is computed by pre-processing our initial data using the Z-transform.

$$\frac{\lambda_j^*}{p}X_i^* = \frac{X_i-\mu_i}{\sqrt{\sigma_{ii}}}, \forall_i = 1,2,\ldots,p \quad (1)$$

Where $\mu_i=E(X_i)$ and $\sigma_{ii}=Var(X_i)$. The standardised variables are denoted by $X^* = (X_1^*, X_2^*, \ldots, X_p^*)^T$ The covariance matrix of the standardised variables is equal to the correlation matrix of the initial variables, which can be denoted by $\rho = (\rho_{ij})_{p\times p}$, where

$$\rho_{ij} = E(X_i^* X_j^*) = \frac{Cov(X_i,X_j)}{\sqrt{\sigma_{ii}\sigma_{ij}}}, \forall_i = 1,2,\ldots,p \quad (2)$$

We can use the correlation matrix of initial variables (ρ) to conduct a principal component analysis. The results are shown as

$$Y_i^* = (e_i^*)X^* = e_{i1}^* \frac{X_1-\mu_1}{\sqrt{\sigma_{11}}} + e_{i2}^* \frac{X_2-\mu_2}{\sqrt{\sigma_{22}}} + \ldots + e_{ip}^* \frac{X_p-\mu_p}{\sqrt{\sigma_{pp}}}, \forall_i = 1,2,\ldots,p \quad (3)$$

and

$$\sum_{i=1}^{p} Var(Y_i^*) = \sum_{i=1}^{p} \lambda_i^* = \sum_{i=1}^{p} Var(X_i^*) = p \quad (4)$$

where Y_i^* is the ith principal component of the standardised variable X*, and

$\lambda_1^* \geq \lambda_2^* \geq \ldots \geq \lambda_p^* \geq 0$ are the eigenvalues of the correlation matrix ρ, and $e_i^* = (e_{i1}^*, e_{i2}^*, \ldots, e_{ip}^*)^T$ are unit orthonormal eigenvectors with respect to the eigenvalue λ_j^*. Hence, we also can obtain the contribution rate of the ith principal component as $\frac{\lambda_i^*}{p}$, and the cumulative contribution rate of the total m principal component as $\frac{\sum_{i=1}^{m} \lambda_i^*}{p}$.

The first principal component always contains the most information with the maximum variance of any variable combination. If more than one principal component is chosen, then the information gathering is cumulative. Therefore, the covariance between each principal component is zero. Moreover, the decreasing variance as the number of principal components increases means that the contribution rate of each additional principal component is declining. By means of PCA, the information contained in each financial indicator may be reflected in different weights of a single composite unified financial development index. In this analysis, we construct a composite regional financial maturity index.

Data

In this paper, a total of 15 financial indicators for 31 Chinese province-level regions[4] are employed to construct the FMI model for the year 2012. By querying province-level data contained within China's Statistical Yearbook 2013 and the database of The People's Bank of China, we classify and sort our data in relation to the three pillars of a financial development evaluation system: financial scale, financial structure and financial efficiency, as summarised in Table 1. We discuss the variables contained under each of the three pillars below.

Table 1: The Definition of the Comprehensive Financial Indicators.

First Class Indicators	Second Class Indicators	Index Definition
Financial		
Scale	Number of Financial Professionals (X_2)	The total number of staff employed in financial institutions, including the central bank, commercial banks, government banks, non-bank credit institutions, and insurance companies.
	Deposit Balance of Financial Institutions (X_3)	The sum of deposits of the central bank, commercial banks, government banks and non-bank credit institutions, and insurance companies at the census date.
	Loan Balance of Financial Institutions (X_5)	The total loans outstanding of the central bank, commercial banks and government banks and non-bank credit institutions, and insurance companies.
	Annual GDP Growth Rate (X_{10})	The GDP annual growth rate, calculated at comparable prices.

	Number of Banking Institutions (X_{11})	The number of total authority registered commercial banks, government banks, and their branches within a region.
	Number of Insurance Institutions (X_{12})	The total number of total business insurance companies and competent agencies registered within a region.
	Number of Securities Institutions (X_{13})	The total number of authority registered securities companies and their branches within a region.
Financial Structure	Financial Interrelations Ratio (X_1)	The ratio of a region's total financial asset values to the wealth of the whole economy.
	Annual Growth Rate of Local Fiscal Expenditure (X_8)	The annual growth rate of local fiscal expenditure.
	Insurance Depth (X_9)	The total insurance premium income of a country (region) divided by the total GDP of the country (region).
Financial Efficiency	Deposit Balance Growth Rate (X_4)	The annual growth rate of the total deposit balance of financial institutions.
	Loan-to-deposit Ratios (X_6)	Total loans divided by total deposit for all banking institutions in a region.
	Loan Balance Growth Rate (X_7)	The annual growth rate of the difference between loan amounts lent and recovered.
	Saving Rate (X_{14})	The increase in savings deposits of urban and rural residents as the percentage of unit worker monetary income.
	Transform Rate of Saving-to-investment Rate (X_{15})	An indicator of the extent to which the total savings of a region are transferred to investment in the real economy.

* The statistics in this table are all sourced from the "Chinese Statistical Yearbook 2012", China Statistics Press, 2012.

Financial Scale

In the existing literature, some scholars use M2/GDP to measure a country's financial scale (e.g. McKinnon, 1973; Han Z, 2007; Zhang and Wang, 2014) while others used (total indirect financing plus total direct financing)/GDP (e.g. Wang and Zhao, 2011; Deng and Zhang, 2012 ; Wang and Li, 2014; Tian et al., 2016). However, it is in practice quite difficult to collect data for M2. More importantly, these two methods only focus on currency market scale, while ignoring the individual stock market, bond market and insurance markets. Therefore, Fan et al. (2011) argue that financial scale can be measured by the absolute number of financial asset classes. From the perspective of liquidity, financial assets can also be divided into three types: money, bonds and stocks. Fan's method for measuring regional financial scale has been widely accepted and used by Chinese scholars (e.g. Sun, 2006; Zhang and Chen, 2011; Xiong and Wang, 2014). In this paper, we define financial scale as a broader measure of the size of financial markets, including the number of financial asset classes, the number of relevant financial institutions, and those financial indexes which provide a comprehensive representation of the overall scale of regional finance within a given period.

Financial Structure

Goldsmith (1969) clarifies the concept of financial structure to include financial tool utilisation, the integration of financial markets, and the management structure of financial institutions in an economy. Changes in financial structure can gauge changes in the level of financial development. Goldsmith also argues that a country's financial structure is not immutable, but changes over time. Based on this explanation of financial structure, the indicators selected in this paper reflect both the operational systems of financial institutions as well as the financial market structure of the country.

Financial Efficiency

Wang (2000) defines financial efficiency as the efficient level of money and capital circulation in a given market. Kong (2003) believes that modern financial development theory provides a solid theoretical framework for research on financial efficiency. Hence, financial efficiency should be described as the degree of coordination of a financial and economic system. Based on these advances in the literature, we choose five indicators to capture the degree of financial resource allocation and the operational efficiency of financial institutions as intermediaries engaging in economic activity.

Descriptive statistics for the financial indicator components are presented in Table 2. We can readily observe that there remain significant differences in financial development conditions across provinces in China. Taking the FIR (X_1), for example, Beijing has a score of 7.16 and Shanghai has a score of 5.18, occupying the first and second positions in terms of rank, respectively. Because of the high degree of economic financialisation in these regions, the two regions are clearly placed in the top echelon in terms of regional financial development. However, differences in the FIR across the other regions are not significant, and thus they can be placed in the second echelon. More specifically, 23 regions have a FIR between 2.0 and 3.8, and six regions have a ratio between 1.5 and 2.0. The lowest region is Inner Mongolia, with a ratio of only 1.578. This measure thus clearly confirms the superiority of Beijing and Shanghai as China's economic and financial centres when it comes to financial development. The difference between the first echelon and the remaining regions

is marked due to the priority application of social resources and preferential policies which the former enjoys. In contrast, the middle and western regions of China are still lagging behind in terms of financial development due to their outdated financial structures and inefficient services (Rahman and Luo, 2011). We can observe that the total GDP of the western regions reached 11391.46 billion CNY in 2012, an increase of 12.48% compared to 2011, which was faster than the eastern and middle regions with growth rates of only 3.18% and 1.54%, respectively.[5] The trend of consistently high economic growth demonstrates well their potential and their 'late-mover advantage' in financial development.

Table 2: Descriptive Statistics.

	N	Minimum	Maximum	Mean	Standard Deviation
X_1	31	1.58	7.16	2.8231	1.09482
X_2	31	7125	318182	108972.0645	70064.11362
X_3	31	2054.2	105099.6	29719.6968	25548.08337
X_4	31	0.13	24.8	7.7915	9.04796
X_5	31	664	67077.1	20626.7226	17071.2322
X_6	31	0.09	62.3	9.3016	13.34837
X_7	31	1.04	3.09	1.4649	0.36972
X_8	31	0.07	0.23	0.1648	0.03804
X_9	31	1.4	14.3	2.9516	2.22903
X_{10}	31	107.46	113.85	110.9981	1.75175
X_{11}	31	0	87	11.3548	20.02756
X_{12}	31	636	15762	6520.2581	3940.5339
X_{13}	31	5	141	54.4516	34.71199
X_{14}	31	0.86	4.74	1.6747	0.75163
X_{15}	31	0.32	0.96	0.7119	0.1294

Empirical results analysis

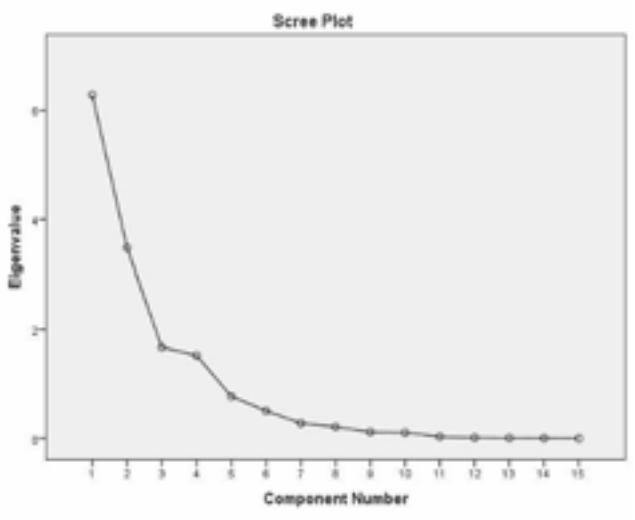
This paper employs PCA to analyse standardised data for the regional financial indicators. Table 3 show the total variance explained by each component and Figure 1 shows eigenvalues as we increase the number of components. The table shows that the eigenvalues of the first four principal components are greater than 1, and the cumulative variance contribution ratio of the total four components reaches 86.35%, thereby illustrating that the four principle components achieve good generalisation and explanation of the data.[6] Therefore, we select four principle components to construct our FMI.

Table 3: Total Variance Explained.

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	6.282	41.879	41.879	6.282	41.879	41.879
2	3.479	23.19	65.069	3.479	23.19	65.069
3	1.673	11.155	76.225	1.673	11.155	76.225
4	1.519	10.126	86.351	1.519	10.126	86.351
5	0.773	5.152	91.503			

Extraction Method: Principal Component Analysis

Figure 1: Eigenvalue Trend with Increasing Component Number.



The rotated component matrix is presented in Table 4. If we divide the values in each column of Table 4 by the corresponding square root of four initial eigenvalues in Table 3, the coefficients related to each variable in four component models are obtained and presented in the coefficient matrix of Table 5. Here, CF_1 to CF_4 are the columns of coefficients corresponding to the four principal components, respectively. Based on the variance contribution weight (w) of each principal component[7], the total coefficients (TF) for the four principal components can be calculated as

$$TF_1 = w_1 CF_{1i} + w_2 CF_{2i} + w_3 CF_{3i} + w_4 CF_{4i}, \forall_i = 1, 2, \ldots, 15 \quad (5)$$

Table 4: Rotated Component Matrix.

Number of Components				
	1	2	3	4
X_1	-0.07	0.944	0.184	0.129
X_2	0.956	-0.075	-0.198	0.036
X_3	0.832	0.487	-0.144	0.027
X_4	-0.143	0.02	0.937	-0.002
X_5	0.871	0.397	-0.105	-0.102
X_6	-0.251	0.05	0.827	0.367
X_7	-0.058	0.178	0.176	0.955
X_8	-0.522	-0.451	0.344	-0.136
X_9	0.579	0.038	0.424	-0.125
X_{10}	-0.537	-0.525	0.325	-0.161
X_{11}	0.41	0.786	-0.166	0.055
X_{12}	0.916	-0.291	-0.158	0.048
X_{13}	0.705	0.595	-0.185	-0.069
X_{14}	-0.063	0.897	0.18	0.323
X_{15}	-0.077	-0.16	0.009	-0.96

Table 5: Coefficient Matrix.

	CF1	CF2	CF3	CF4	TF
X_1	-0.02793	0.50611	0.142256	0.104667	0.153037
X_2	0.381425	-0.04021	-0.15308	0.029209	0.157839
X_3	0.331951	0.261097	-0.11133	0.021907	0.219308
X_4	-0.05705	0.010723	0.724422	-0.00162	0.068585
X_5	0.347512	0.212845	-0.08118	-0.08276	0.205515
X_6	-0.10014	0.026807	0.639378	0.297774	0.076133
X_7	-0.02314	0.095432	0.136071	0.774862	0.122852
X_8	-0.20827	-0.2418	0.265956	-0.11035	-0.14454
X_9	0.231009	0.020373	0.327807	-0.10142	0.147953

X_{10}	-0.21425	-0.28147	0.251267	-0.13063	-0.16237
X_{11}	0.163582	0.421401	-0.12834	0.044626	0.181174
X_{12}	0.365466	-0.15601	-0.12215	0.038946	0.124131
X_{13}	0.281281	0.318999	-0.14303	-0.05598	0.197057
X_{14}	-0.02514	0.480912	0.139163	0.262074	0.165684
X_{15}	-0.03072	-0.08578	0.006958	-0.77892	-0.12838

The financial maturity value (M) for each provincial region can then be calculated as

$$M = \sum_{i=1}^{15} TF_i \times X_i^* \quad (6)$$

For ease of comparison, we transfer the values into index form to develop our Financial Maturity Index (FMI). The transform process can be shown as:

$$FMI_i = \beta_0 + (1-\beta_0)\frac{M_i - M_{min}}{M_{max} - M_{min}}, \forall_i = 1, 2, \ldots, 31 \quad (7)$$

Where M_{min}=min{M_i}, M_{max}=max{M_i}, β0 represents the financial maturity index of region with the Mmin value. The value of β_0 ranges from 0 to 1, and existing empirical studies show that with regard to the maturity of regional finance, the ratio of the Chinese provinces with the highest score to those with the lowest score is close to 1:0.4 (Gao and Li, 2009; Zhang and Chen, 2012). Our assessment of the deposit balance of financial institutions, the distribution density of financial institutions, and the number of financial personnel indicates that in 2013, the ratio of Beijing, the best province in terms of regional financial development, to Ningxia, the worst scoring province is also 1:0.4. As the financial maturity index is a comparative concept and the value of financial maturity is just a relative score, the ranks for each region are not affected by the value of β_0. Therefore, the β_0 value is set as 0.4. In addition, the degree of financial maturity of a region with M_{max} is set to a using Equation 7, meaning that this region has the highest maturity level compared to others based on our calculations[8].

Table 6 then presents the FMI and reveals the ranking of financial development by region within China.

Table 6: Financial Maturity Results for Each Region.

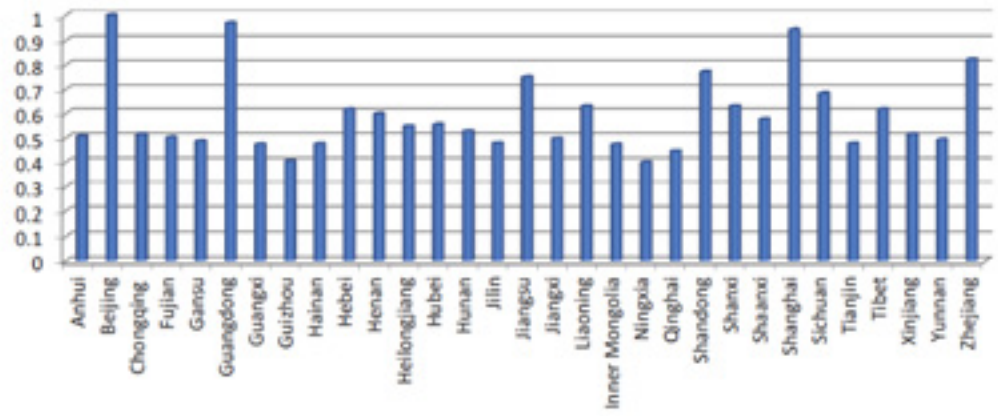
Region	M Value	FMI	Ranking
Anhui	-0.754585291	0.507636	19
Beijing	3.587501396	1000000	1
Chongqi	-0.700103191	0.513814	18

Fujian	-0.803878586	0.502047	20
Gansu	-0.939439853	0.486675	23
Guangdong	3.301241989	0.96754	2
Guangxi	-1.055855573	0.473474	27
Guizhou	-1.657824688	0.405215	30
Hainan	-1.043486439	0.474877	26
Hebei	0.210171722	0.617033	11
Henan	0.048599862	0.598712	12
Heilongjiang	-0.392388764	0.548707	15
Hubei	-0.339955493	0.554653	14
Hunan	-0.575926162	0.527895	16
Jilin	-1.00401073	0.479353	24
Jiangsu	1.384538502	0.750199	6
Jiangxi	-0.835533498	0.498457	21
Liaoning	0.334167509	0.631094	9
Inner Mongolia	-1.057974038	0.473234	28
Ningxia	-1.703815452	0.4	31
Qinghai	-1.289750573	0.446952	29
Shandong	1.573274581	0.7716	5
Shanxi	0.340170709	0.631774	8
Shaanxi	-0.144792166	0.576783	13
Shanghai	3.072586698	0.941612	3
Sichuan	0.806418455	0.684644	7
Tianjin	-1.019446394	0.477603	25
Tibet	0.218664924	0.617996	10
Xinjiang	-0.695383759	0.514349	17
Yunnan	-0.88517655	0.492828	22
Zhejiang	2.021989564	0.822481	4

In Figure 2 we present a histogram of FMI scores for each region. We can clearly observe that within China there are significant differences in financial maturity between eastern and mid-western areas. More specifically, in the six provincial regions of Beijing, Shanghai, Guangdong, Jiangsu, Shandong and Zhejiang, the financial maturity index values are all greater than 0.7, and significantly higher than for the other 25 regions. Most notably, Beijing has a value of 1.0 for FMI. The next most financially developed regions, Guangdong and Shanghai, have high FMI values approaching 1.0. Further, the provinces of Hebei, Li-

aoning, Shanxi, Sichuan and Tibet, exhibit FMI values between 0.6 and 0.7. In contrast, the FMI values of the remaining 20 provinces are similar, ranging between 0.4 and 0.6. These results show that regional economic growth is not independent of the support of efficient regional financial market, as best evidenced by the economic development of both Beijing and Shanghai. Approximately one third of Chinese provinces, such as Tianjin, Inner Mongolia, and Fujian, exhibit regional financial markets whose development has lagged far behind their regional economic development. Regional Chinese governments tend to prefer to focus their investment on industrial development projects, but they are reluctant to invest in the construction of regional financial markets. However, investing sufficient human and financial resources in the construction of regional financial market is clearly an effective way to ensure more rapid regional economic growth of a less developed province.

Figure 2: The Histogram of FMI Values of 31 Provincial Regions in China.



In 2013, the top ten Chinese provinces with regard to economic growth were: Tianjing ($16,419.44 for GDP per capital), Beijing ($15,216.31), Shanghai ($14,652.98), Jiangsu ($12,061.51), Zhejiang ($11,075.57), Inner Mongolia ($10,915.84), Liaoning ($9,961.65), Guangdong ($9,9474.66), Fujian ($9,374.26) and Shandong ($9,117.04). These ten provinces enjoyed a higher GDP per capital than the other Chinese provinces and are predominantly located in the southeastern coastal areas of China. More importantly, they are situated in the most important 'economic circles' in China such as the Bohai rim economic circle, the Yangtze River Delta, and Pearl River Delta economic circle. Thus, they have a firm foundation for economic development. As they are characterised by fast economic growth, their regional financial markets are also better constructed. In contrast, the bottom ten Chinese provinces include Shanxi ($5,635.39 for GDP per capital), Henan ($5,520.01), Sichuan ($5,250.31), Jiangxi ($5,140.40), Anhui ($5,133.87), Guangxi ($4,958.52), Tibet ($4,204.44), Yunnan ($4,062.13), Gansu ($3,983.10), and Guizhou ($3,710.78). These provinces are largely located in the hinterland of China, and are remote from the southeastern coastal areas. They suffer from relatively slow economic development and thus have poorly constructed financial markets. Thus, we expect that the provinces in the southeastern coastal areas of China witness faster economic growth and thus enjoy more developed regional financial markets than those provinces in the hinterland of China. According to the model proposed in this paper, the top ten provinces should also obtain higher regional financial maturity scores.

We therefore observe that our FMI results are consistent with expectations for the regions in China in relation to regional economic and social development. The six regions with the highest FMI values are all located in eastern China, and are characterised by strong industrial competitiveness, an efficient market system, a high level of urbanisation, and a leading position in regional development including financial maturity (Demurger et al., 2002). Regions with FMI scores of between 0.6 to 0.7 are all positioned in the central area (excepting Sichuan and Tibet). These regions exhibit a relatively high level of economic and social development, and expect significant improvements in industrial competitiveness and financial development in the future. However, the remaining 20 regions with low FMI values ranging from 0.4 to 0.5 are largely located in western China and the interior. Because of relatively poor economic and social development and industrial competitiveness in these regions, financial market development tends also to be constrained (Yang, 2002).

In our study, there are two regions within China which have FMI values that are inconsistent with their level of regional economic development. The first one is Tianjin, which has a total GDP of 1.288 trillion RMB yuan in 2012, representing a growth rate of 13.8% on the previous year when calculated for comparable prices. In terms of absolute GDP, Tianjin ranked in the top five of Chinese cities in that year. Further, Tianjin's hi-tech industries generated 695.165 billion RMB yuan of gross industrial output value in 2012, an annual increase of 14.3%. This accounted for 29.9% of the output value of Industrial Enterprises above a designated size, also revealing that its capability for independent innovation ranks towards the top for the whole country.[9] However, our FMI measure for Tianjin is a mere 0.4776. One explanation is that Tianjin has a lower financial interrelations ratio, a smaller number of financial professionals, and fewer financial institutions compared with the financial development indicators of the other developed province level regions. Thus, Tianjin's regional financial development lags behind other developed regions and its regional financial market would appear to require further development.

The second region with an inconsistency between financial and economic development is Tibet, which is not only located in the southwest China, but is also on the Qinghai-Tibet Plateau area.[10] Tibet's special geographical and ecological environment impacts upon its level of economic development. Due to the limited availability of arable land, comparatively poor transport infrastructure, and a small population density, Tibet's regional economic development level is relatively low (Dreyer, 2003; Zhong et al., 2004). However, in this paper we compute the FMI score for Tibet at a surprisingly high 0.6179. One explanation for this inconsistency is that Tibet has enjoyed strong support from the Chinese central government for many years, and has benefited from significant fiscal aid and state subsidies (Fischer et al., 2009).[11] Moreover, the Tibetan population is relatively small and concentrated due to its special geography. Therefore, ideal conditions were created in Tibet for the advancement of its financial services industry, leading to a high financial interrelations ratio (3.877) and a high saving and transform rate of saving-to-investment, leading to a higher FMI score.

In summary, our study of regional financial maturity in China identifies significant differences in financial development across the regions. There are a number of potential explanations for this dispersion. Firstly, financial markets in the eastern developed regions were established at an early stage and thus they have in place a range of effective capital market operation mechanisms, and so the scale of financial capital is relatively large when compared to the middle and western areas of China. Secondly, due to the presence of a free and

vibrant economy, the degree of marketisation in east China is relatively high. The return on capital in financial markets is also higher, thereby attracting more financial institutions. Large multinational banks, as well as the stock exchanges, are concentrated in east China. The less advanced market mechanism in the western regions makes it more difficult to attract financial institutions and finance professionals, in turn leading to capital accumulation in the western regions which is markedly lower than that in the eastern regions.

According to Goldsmith's theory of financial development, financial structure encompasses the financial instruments, financial markets and financial institutions characterising a country's economic operations. Variations in financial structure represent changes in the level of financial development. The financial development of a country is achieved through the development of financial structure from the simple to the complex, from the elementary to the advanced. A comprehensive characterisation can be made of the level of financial development of financial services in a region by constructing an index reflecting its financial scale, structure and efficiency. It is widely accepted that the level of a country's financial development has a significant influence on its capacity for economic and social development. Generally speaking, the level of economic development is positively correlated with the level of financial development, and one promotes the other. By constructing an index reflecting regional financial scale, structure and efficiency we show that the level of financial development across the provinces of China presents a typical picture of "the East quick and the West slow", that is, a gradient decrease from the eastern regions of China as we move westwards, consistent with the pattern of economic development in China. With the exception of Tianjin and Tibet, the level of financial development in the provinces of China maps on to the level of economic development of those provinces, that is, the level of financial development in the provinces confirms the pattern of "East quick and West slow". Our results evidence a significant positive correlation between the levels of regional financial and economic development, and suggest strong interdependency between the two.

Conclusion

The level of regional financial development reflects the effectiveness of financial services and the financial market function of a given region. A good measurement of financial development is essential when evaluating an area's progress and understanding its potential impact on economic growth. In practice, however, measuring the level of regional financial development is complex given the multi-dimensional factors which characterise it. Existing empirical studies tend to examine several quantitative financial indicators for a certain time period and/or a limited number of regions, focusing on measures such as the ratios of financial institutions' assets, liquid liabilities and deposits to nominal GDP. The diversity of financial market conditions and of financial services means that existing financial indicators are only able to capture certain aspects of financial development.

This paper draws upon advances in the financial development index constructed by the World Economic Forum, and classifies Chinese financial indicators in relation to three pillars: financial scale, financial structure and financial efficiency. The paper explains the construction of a composite regional financial maturity index by classifying regions according to 15 indicators across the three pillars. By means of a principal component analysis, a province-level regional financial maturity index is developed, and a ranking exercise is undertaken for the regions. This is an important contribution as the new FMI is able to capture differing regional financial development conditions well.

According to regional financial development theory, regional finance, as a core focus for promoting regional economic development, can improve societal productivity through optimised asset allocation in the real economy so as to promote regional economic growth. A significant positive interrelationship exists between regional economic growth and regional financial development. Thus it is expected that the provinces in the eastern part of China boast a higher level of regional financial development as well as a higher level of regional economic development, while the central and the western regions are characterised by a lower level of regional financial development due to a commensurately lower level of regional economic development. Our empirical analysis results are consistent with expectations due to the unbalanced nature of regional economic development. In addition, from a regional financial development perspective, our results provide a good explanation for the considerable regional economic differences between the eastern and the western part of China.

With regard to a market economy, the financial market is the most efficient way to conduct financing and to realise an optimal allocation of resources. Local governments focus on maintaining social stability, promoting economic development, and improving social welfare. They can raise funds for regional economic development by utilising the credit market, the capital market and foreign investment in order to achieve an optimal allocation of resources, to develop the regional economy, and to improve the standard of living. The implementation of financial policy should be guided by the markets and in accordance with regional economic development laws. Implementation should also be refined to promote an optimal industrial structure so as to provide effective financial support for economic growth. Therefore, local government should be fully aware of the very positive role of finance in facilitating regional economic development, in addition to maintaining a firm understanding of regional financial development law.

Notes

1. The Financial Interrelations Ratio can be calculated by the equation , where represents the total financial activity at a point of time, and represents total economic activity at that point.

2. FA is related to, but not identical to, PCA. FA belongs to the family of latent variable models which apply regression modelling techniques to test hypotheses and produce error terms, while PCA is a descriptive statistical technique.

3. Empirical research often involves the modelling of many related variables. However, including too many variables not only increases computing complexity, but also makes inference difficult. In many cases, related variables can provide overlapping information. As a result, researchers attempt to transform these variables into a smaller number of related new variables in order to capture most of the information contained therein.

4. Only finance data for 31 provincial regions are available for Mainland China. The regions exclude Hong Kong, Macau and Taiwan.

5. Data from the National Bureau of Statistics, China P.R. (NBS)

6. The general criterion for principal component selection is to ensure that 80% to 85% of the information is represented.

7. We calculate weight is $w_j = {}^{\lambda_j}/_{\sum \lambda_i}$ and $\sum w_j = 1, \forall_j = 1,2,3,4$. Here, λ_i denotes each initial eigenvalue.

8. Theoretically, this is just an ideal state. From a computation perspective, M value is the key to regional finance maturity estimation.

9 The data is sourced from the "2012 China's urban comprehensive competitiveness ranking" Chinese society for the study of urban competitiveness and the world city cooperation organization China city council, on 5th December 2012.

10. The Qinghai-Tibet Plateau is also known as the Tibetan Plateau or Himalayan Plateau. With an average elevation exceeding 4,500 metres, it is the highest and largest plateau in the world.

11. In April 15, 2015, the Information Office of the Chinese State Council issued a white paper, Tibet's Path of Development is Driven by an Irresistible Historical Tide, which reveals that the central government has continually increased financial transfer payments in Tibet for more than 60 years. From 1952 to 2013, central government financial aid to Tibet amounted to 544.6 billion yuan, accounting for 95% of Tibet's local public expenditure. In 2014 the central government subsidies for Tibet were 12.4 billion yuan, while in that year the proportion of local fiscal revenue in Tibet accounted for 13.5% of GDP. From 1994 to 2015, the central government has provided more than 6,000 technical personnel to work in Tibet, and has invested 33.39 billion yuan in Tibet for the construction of 8,855 projects. In the past three years, more than 2,000 professionals from mainland China chose to work in Tibet, more than 200 mainland enterprises have set up factories in Tibet, and more than 300 million yuan were donated to Tibet by all circles of society.

REFERENCES

Bartholomew, D.J., Steele, F., Galbraith, J. & Moustaki, I. (2008). Analysis of Multivariate Social Science Data. Florida : CRC press.

Beck, T. Demirgüc-kunt, A., & Levine, R. (1999). A new database on financial development and structure, Vol. 2146, World Bank Publications.

Beck, T., Demirgüc-Kunt, A., Levine, R. & Maksimov, V. (2000). Financial structure and economic development: Firm, industry, and country evidence, Vol. 2423, World Bank Publications.

Calderon, C., & Liu, L. (2003). The direction of causality between financial development and economic growth, Journal of Development Economics, 72, 321–334.

De Gregorio, J., & Guidotti, P.E. (1995). Financial development and economic growth. World Development, 23, 433–448.

Demetriades, P.O., & Hussein, K.A. (1996). Does financial development cause economic growth? time-series evidence from 16 countries, Journal of Development Economics, 51, 387– 411.

Demirgu¨c¸-Kunt, A., & Levine, R. (2004). Financial structure and economic growth: A cross-country comparison of banks, markets, and development, Boston: MIT press.

Demurger, S., Sachs, J.D., Woo, W.T., & Bao, S., Chang, G., & Mellinger, A. (2002). Geography, economic policy, and regional development in China, Asian Economic Papers, 1, 146–197.

Deng, Q., & Zhang, S. (2012). The dynamic analysis on scale, structure, efficiency of regional financial development and economic growth. Statistics & Information Forum, 1, 43-48. (In Chinese).

Dreyer, J.T. (2003). Economic development in Tibet under the People's Republic of China, Journal of Contemporary China, 12, 411–430.

Fabrigar, L.R., Wegener, D.T., MacCallum, R.C., & Strahan, E.J. (1999). Evaluating the use of exploratory factor analysis in psychological research, Psychological Methods, 4, 272-299.

Fan, S., Kanbur, R., & Zhang, X. (2011). China's regional disparities: Experience and policy, Review of Development Finance, 1, 47-56.

Fischer, A.M. (2009). The political economy of boomerang aid in China's Tibet, China Perspectives, 3, 38-55.

Gao, X., & Li, Y. (2009). The Measurement and Research on China's Rural Financial Maturity, Journal of Nanjing Normal University (Social Science Edition), 1, 64-75 (In Chinese).

Gelb. A. H. (1989). Financial policies, growth, and efficiency, World Bank Research Working Paper No. 202, World Bank, Washington D. C.

Goldsmith, R.W. (1969). Financial structure and development, Vol.1 New Haven: Yale University Press.

Han, Z. (2007). Empirical analysis of China's rural financial development level - Based on the contrast between the rural and the whole country. Rural Economy, 1, 17-21. (In Chinese).

Johnson, R.A., Wichern, D.W., &. Education, P. (1992). Applied Multivariate Statistical Analysis, Vol. 4, Prentice hall Englewood Cliffs, NJ.

Jolliffe, I. (2005). Principal Component Analysis, New York, NY, Wiley Online Library.

Keidel, A. (1995). China: Regional Disparities. World Bank, China and Mongolia Department, Washington, D.C.

King, R.G., & Levine, R. (1993). Finance, entrepreneurship and growth, Journal of monetary Economics, 32, 513–542.

Kong, X. (2003). The theoretical problem of finance coordination, Economics Perspectives, 10, 36-38. (In Chinese) .

Levine, R. (1999). Law, finance, and economic growth, Journal of Financial Intermediation, 8, 8-35.

Levine, R., & Zervos, S. (1998). Stock markets, banks, and economic growth, American Economic Review, 88, 537-558.

McKinnon, R.I. (1973). Money and capital in economic development, Washington, DC: Brookings Institution Press.

Rahman, M.W., & Luo, J. (2011). The development perspective of finance and microfinance sector in China: How far is microfinance regulations?, International Journal of Economics and Finance, 3, 160-170.

Rajan, R.G., & Zingales, L. (2003). The great reversals: the politics of financial development in the twentieth century, Journal of Financial Economics, 69, 5–50.

Shaw, E.S. (1973). Financial deepening in economic development, Oxford: Oxford University Press.

Sun, W. (2006). A Research on Dimensions, Structure and Efficiency of Financial Development Chinese science and Technology Papers Online,1,1-5.(http://www.paper.edu.cn).

Tian, Li, Zhao & Tan. (2016). A Research on Dynamic Demonstration Evaluation of Provincial Financial Scale in China, Journal of Shijiazhuang University, 4, 21-27.

Wang, Z. (2000). An empirical investigation of the channels of monetary transmission, Research on Financial and Economic Issues, 5, 19-22 (In Chinese).

Wang, W., & Li, F. (2014). Bank-Type Financial Intermediaries, Financial Scale and Macroeco-

nomic Volatility, Modern Economic Science, 5, 29-39. (In Chinese).

Wang, X,, Fang, J., & Zhao, Z. (2011). Financial scale, financial structure and economic growth: Empirical research on provincial panel data, Technoeconomics & Management Research, 9, 59-64. (In Chinese).

Wang, X., & Zhao, Z. (2011). Financial Scale, Financial Structure and Economic Growth in China:Empirical Study Based on Provincial Panel Data, Journal of Finance and Economics.11, 50-60. (In Chinese).

World Economic Forum (2008). The Financial Development Report 2008, Geneva, Switzerland, New York, USA . http://www.weforum.org/.

World Economic Forum (2012). World Economic Forum's Financial Development Report, http://www.weforum.org/reports/financial-development-report-2012.

Xiong, X., & Wang, Y. (2014). A Study of Coordinated Development among Financial Scale, Structure and Efficiency in Guizhou Province, Journal of Regional Financial Research. 11, 20-26. (In Chinese).

Yang, D.T. (2002). What has caused regional inequality in China? China Economic Review, 13, 331–334.

Zhang, W. (2001). Rethinking regional disparity in China. Economics of Planning, 34, 113-118.

Zhang, J., & Chen, C. (2012). Regional Finance Maturity in China: Measurement and Contrast, Research and Development, 3, 85-88. (In Chinese).

Zhang, L, & Wang, J. (2014). Empirical analysis of relationship between rural financial scale, structure, efficiency of and economic growth in China. Journal of Northwest A & F University (Social Science Edition), 2, 53-59. (In Chinese).

Zhong, X., Li, X., & Peng, C. (2004). Analysis on the status of farmers, agriculture and country-side, and development strategies and measures in Tibet autonomous region, Journal of Mountain Science, 1, 175–182.