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Financial Development, Financial Structure, and Macroeconomic Volatility: Evidence from China

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Abstract: Using annual data from 1997–2014 of 30 provinces, municipalities, and autonomous regions, subdividing trended and cyclical volatility of macroeconomics and inflation, considering different indicators of financial development and financial structure, this paper investigated the impact of financial development and financial structure on macroeconomic volatility. The empirical results found that (1) the trended and cyclical volatility of the previous macroeconomic period had a significantly positive impact on that of the current period, and the impact of trended volatility was greater than that of cyclical volatility; (2) financial development had a significantly negative impact on macroeconomic cyclical volatility through inflation cyclical volatility, but inflation trended volatility would amplify macroeconomic volatility; financial markets have no significant effect on macroeconomic volatility; financial structure measured with the ratio of stock market turnover and the efficiency of the financial development had a significant positive impact on macroeconomic cyclical volatility; and (3) inflation trended volatility had a significantly negative impact on macroeconomic cyclical volatility and trended volatility, while inflation cyclical volatility had a significantly positive impact on macroeconomic cyclical volatility.

Keywords: financial development; financial structure; macroeconomic trended volatility; macroeconomic cyclical volatility

1. Introduction

Since the studies of Schumpeter [1], Goldsmith [2], and McKinnon [3] on the causality of financial development and economic growth, the relationship between financial development and economic growth has been a popular research topic among scholars. Theory suggests that the establishment and development of financial institutions and financial markets is essential for sustained economic growth. Financial development can reduce risk, improve corporate management, promote investment, lower transaction and information costs, and accelerate specialization [4]. These theoretical perspectives have been supported by a large number of empirical research papers (see [5,6] Literature Review). However, unlike the voluminous literature on the relationship between financial development and economic growth, until the last two decades, the relationship between financial development and economic volatility has gradually become the current focus instead of the subprime problem [7]. Moreover, based on various samples, indexes, and estimation methods, some inter-country empirical literature has investigated the role of financial development and growth volatility, but the conclusions are controversial. Denizer et al. [8] and Silva [9] provide supportive evidence for the stabilizing effect on economic volatility of the development of financial intermediaries, while Tiryaki [10] and Beck et al. [11] found no evident relationship between the development of financial intermediaries and

economic volatility. Easterly et al. [12] and Kunieda [13] even found a nonlinear relationship between the development of financial intermediaries and economic volatility.

Through careful analysis of the existing literature, this paper found that the main reason for controversial or even contradictory conclusions was that the inertia of economic volatility has not been considered in the existing literature. Moreover, the trend factor and the cyclical factor of volatility were not distinguished. Based on this, using annual data from 1997 to 2014 from 30 provinces, municipalities, and autonomous regions in China, subdividing macroeconomic cyclical volatility and trended volatility and inflation, considering different indicators of financial development and financial structures, this paper aimed to answer the following questions: First, will financially more-developed regions experience more or less economic volatility? Second, will financial development suppress external factors like inflation's impact on economic volatility? Third, will they affect trended and cyclical volatility in the same way? The empirical results showed the following: (1) The trended and cyclical volatility of the previous macroeconomic period had a significantly positive impact on that of the current period, and the impact of trended volatility was greater than that of cyclical volatility; (2) The scale and efficiency of financial development had a significantly negative impact on macroeconomic cyclical volatility. The scale and efficiency of financial development also suppressed macroeconomic volatility through cyclical volatility of inflation, while inflation trended volatility amplified macroeconomic volatility. Financial markets had no significant effect on macroeconomic volatility, but the total stock market capitalization suppressed macroeconomic cyclical volatility through cyclical volatility of inflation. Financial structures measured with the ratio of stock market turnover and the efficiency of the financial development had a significant, positive impact on macroeconomic cyclical volatility; (3) Inflation- trended volatility had a significantly negative impact on macroeconomic cyclical volatility and trended volatility, while cyclical volatility of inflation had a significantly positive impact on macroeconomic cyclical volatility.

The contributions of this paper are reflected as the following: First, many scholars have studied the relationship between financial development and macroeconomic volatility. However, without exception, they have not considered the inertia of economic volatility, resulting in the omission of variables and in defective measurement methods. By considering lagged terms of economic volatility, and using a dynamic panel estimation method for correction, this paper provides more reliable results. Second, many scholars have studied the impact of macroeconomic structure and distribution of cyclical volatility, such as financial development and external shocks, but the impact of these on trended volatility has not been studied. Aghion et al. [14] tried to build a model to solve the issue, but their empirical study ignored various factors causing volatility (except [15,16]), especially the difference between trended volatility and cyclical volatility. By subdividing trended volatility and cyclical volatility of economic development and inflation, and studying the difference among various volatility factors, this paper generates more detailed results. Third, previous literatures have found that financial development reduces macroeconomic volatility. However, when financial development is measured with different indicators, this kind of relationship between financial development and economic volatility has been proven to be not sound. This paper discusses the impact of the development of financial intermediaries, the financial market, and financial structure on macroeconomic volatility, so as to coordinate the resulting difference caused by various financial indicators.

The rest of this paper is organized as follows: Section 2 is a literature review. Section 3 describes the data, variables, and methodology used in this empirical strategy. Section 4 presents the empirical results. Finally, Section 5 is the conclusion.

2. Literature Review

The relationship between the real economy and the financial market is rooted in an enterprise's needs for external financing and borrowing capacity, depending on the market value of the enterprise's net assets. When an enterprise experiences a positive shock or a negative shock, the value of its net assets will increase or decrease, which will amplify the impact on the economy via the credit market,

resulting in fluctuations in the economy. This impact is called the financial accelerator effect. Bernanke and Gertler [17], Bernanke, Gertler, and Gilchrist [18] and Kiyotaki and Moore [19] believe that weak or unstable financial markets will experience an amplified economic volatility due to the financial accelerator effect, while developed financial systems will experience reduced economic volatility due to the financial accelerator effect.

In the financial accelerator model, there is some asymmetric information between debtors and creditors, and the loan interest rate is higher than the risk-free rate. This external financing premium is driven by two channels: the balance sheet channel and the information channel. The balance sheet channel reflects the dependence of external financing opportunities on the enterprise's balance sheet, and the information channel reflects the external financing premium as positively correlated with the severity of the company's problems. Later, some scholars analyzed the relationship between financial development and economic volatility with asymmetric information. Aghion et al. [20], Caballero and Krishnamurthy [21] believe that reducing the information friction of the credit market, reducing the enterprise's dependence on credit financing, and the development of financial intermediaries is conducive to curbing the financial accelerator effect, and would enhance counter-cyclical long-term investment so as to stabilize economic volatility. Bacchetta and Caminal [22] insist that, due to different marginal capital outputs between manufacturers, the economic impact reconfigures the manufacturers' funds, in such a way that it affects macroeconomic volatility. Due to asymmetric information, financial development will offset the shock's impact on macroeconomic volatility.

Other scholars analyzed the relationship between financial development and economic volatility from the perspective of risk management of investments. Acemoglu and Zilibotti [23] pointed out that inseparability of investments will limit the level of risk diversification of the economy. The desire to avoid high-risk investments will reduce the accumulation of capital, and because the risk cannot be effectively dispersed, the uncertainty of economic growth will increase. The development of financial intermediaries can effectively disperse investment risk, thereby moderating volatility in economic growth. Wang and Wen [24] believe that the development of financial intermediaries enhances risk management capabilities, so enterprises will be more sensitive to the irreversible fixed investment. In this way, when different enterprises face idiosyncratic or unforeseen shocks, business investment may experience great volatility, but the total investment in the economy will not.

Based on different samples, indicators, and estimation methods, some inter-country studies provide complex and even contradictory empirical evidence. From the macro level and the industry level, some empirical studies find that financial development will reduce macroeconomic volatility to some extent. On the macro level: Hausmann and Gavin [25], using data from 1970 to 1992 on developing countries in Latin America, measured macroeconomic volatility with the standard deviation of real GDP growth; Silva [9], using data from 1960 to 1997 on 40 countries, measured economic volatility with the standard deviation of cyclical factors after the BP filtering; Denizer et al. [8], using panel data from 1956 to 1998 on 70 countries, measured macroeconomic volatility with the standard deviation of real per capita income growth; Buch and Pierdzioch [26], using data on 76 countries, measured economic cyclical volatility with the standard deviation of the actual GDP growth rate; Tharavanij [27], using panel data from 1975 to 2004 on 44 countries, measured economic cyclical volatility with the standard deviation of growth rate of real per capita GDP and filtered real per capita GDP; Wang and Li [28] used provincial panel data on China from 1993 to 2005; Wahid [29], using data from 1977 to 2006 on China, measured economic volatility with a five year moving standard deviation; Zhu et al. [30], using panel data from 1978 to 2009 on 28 provinces, measured economic volatility with an average moving standard deviation of real per capita GDP; Yao et al. [31], using China's 2001–2012 time series data, measured economic volatility with the fluctuation factor as the year-on-year real growth rate of industrial added value with an HP filter; and Wang and Zhao [32], using macro data from 1961 to 2012 on 214 countries, measured macroeconomic volatility with the standard deviation of GDP growth. All the results show that financial development is conducive to reducing macroeconomic volatility. On the industry level: Larrain [16], using manufacturing industry data from 1963 to 1999

on 59 countries, measured industrial volatility with the standard deviation of detrend industrial output, and subdivided industrial volatility into systematic volatility and heterogeneous volatility (industrial volatility is irrelevant to the country's GDP). The results show that the inhibitory effect of bank credit on heterogeneous volatility is stronger, and this inhibitory effect is realized through counter-cyclical lending.

The above empirical literature examines the impact of financial development on economic volatility with a similar measuring method, using the standard deviation of the growth rate of real per capita GDP as economic volatility, but does not differentiate trended volatility and cyclical volatility. Darrat et al. [15], using annual data from 1973 to 2000 of the UAE, measured economic volatility with the average moving standard deviation of the two-year real GDP growth. The results show that financial development significantly suppresses long-term economic volatility, while having no significant effect on short-term volatility. Finally, Mallick [33] using data from 1980 to 2004 on 70 countries, subdivided the volatility of real per capita GDP growth into cyclical volatility and long-term volatility with the spectral method. The results show that financial development will only affect cyclical volatility, and external shocks will affect both cyclical volatility and long-term volatility of GDP growth.

Other literature argues that whether financial development stabilizes economic volatility depends on the nature of the impacts. Bacchetta and Caminal [22], considering the proportion of the enterprise with credit constraints caused by asymmetric information, and building a dynamic equilibrium macroeconomic model, found that whether financial constraints amplify or suppress volatility depends on the type of shocks, i.e., external shocks' effects on the enterprise, with credit constraints on external funding and internal funding. Hahn [34], using a study sample from 1970 to 2000 on 22 OECD countries, measured macroeconomic volatility with the standard deviation of real per capita GDP. The difference between the maximum and minimum of real per capita GDP, and the standard deviation of annual changes in real per capita GDP, shows that developed stock markets amplify monetary shocks but suppress physical shocks. Beck et al. [11], building a theoretical model on the assumption that financial intermediaries reduce company costs and the entrepreneur's cash flow, using panel data from 1960 to 1997 on 63 countries, measured economic volatility with the standard deviation of real per capita GDP. The results show that the economic impact did not necessarily increase volatility of economic growth, and the development of financial intermediaries offset the economic impact of the real economy, and amplified the monetary shocks. Luo and Du [35] used the periodic factor resulting from HP filtering in the real GDP time series as proxy variables to reflect output volatility. The results show that in China's process of economic operation, the development of financial intermediaries will amplify monetary shocks, but have no significant impact on the real shocks.

Some literature even believes that the relationship between the development of financial intermediaries and economic volatility is non-linear. For example, Easterly et al. [12], found that, while most bank credit is significantly correlated with lower growth volatility, the square term of the bank credit variable is significantly positive, indicating that non-linear financial development will reduce growth volatility. This means that a developed financial system provides opportunities for economic stability but also implies that an enterprise has high financial leverage, implying higher risks as well as lower stability. Thus, the relationship between the development of bank intermediaries and output growth volatility is U-shaped. In the Aghion et al. [36] model, the development of financial intermediaries stabilized economic volatility only after exceeding a certain threshold value. Kunieda [13], using period data from 1971 to 2000 on 90 countries, measured economic volatility with the variance of the growth rate of real per capita GDP, and found that financial development has a hump effect on growth volatility. This U-shaped relationship emerges in the following way: In the early stages of financial development, the growth rate shows less volatility. With the improvement and development of the financial sector, the economy shows more volatility. However, when the financial sector is mature, the growth rate shows less volatility. Zhao et al. [37] used the threshold vector auto regression (TVAR) model to conduct empirical research on the non-linear relationship

between the Chinese credit market and macroeconomic volatility on the macro level. The results found that from January 1990 to May 2006, economic volatility was significantly stronger when the credit market was in a state of "deflation" rather than when it was in a state of "inflation". Yao and Bao [38], using provincial data from 1994 to 2010 on China, measured the volatility of economic growth with a five-year moving average standard deviation of periodic factors in economic growth identified by the CF filtering method. They found that, although the development of China's financial intermediaries had a significant damping effect on monetary shocks, China had not yet reached the level where the development of financial intermediaries will stabilize economic volatility.

Ways and degrees of the impact of the development of financial intermediaries and the stock market on macroeconomic volatility have been compared in some literatures. Raddatz [39], using industrial data from 1980 to 1998 on 47 countries, measured economic volatility with the standard deviation of the increase of actual growth in the industry, the standard median deviation of the increase of actual growth in the industry, as well as the standard deviation of actual output growth. The results show that, through reducing the relative variance of each enterprise's output growth to reduce the variance of high-flow sectors, financial development can reduce economic volatility. The development of financial intermediaries plays a more prominent role than the stock market in reducing the fluctuations. Yeh et al. [40], using panel data from 1960 to 2009 on 40 countries, measured economic volatility with a five-year moving standard deviation of growth rate, a five-year average moving standard deviation of the absolute value of the growth rate's change, and generalized autoregressive conditional heteroscedasticity. There was a significant co-integrated relationship between the financial structure and economic growth and its volatility. In the long term, countries where the capital market develops better than the credit market enjoy faster economic growth, but suffer more economic volatility. Du and Pang [41], using China's real GDP data from 1992:1Q to 2003:4Q, measured cyclical volatility of economic growth with the conditional heteroscedasticity isolated from the conditional heteroscedasticity model. The correlation between financial development and economic cycles resulting from the development of China's financial intermediaries, interest rate trends, and the stock market was tested. The results show the development of financial intermediaries in China and that the financial market will amplify economic growth volatility. Dong [42], using China's 1992–2004 quarterly data, measured real GDP growth volatility with the absolute deviation of the actual growth rate and the long-term trend of HP filtering. The results show that the rapid development of China's financial market had an important impact on reducing growth volatility, and bank credit exhibited a greater ability to reduce output volatility than the stock market.

3. Data, Variables, and Methodology

3.1. Data

Using the annual data from 1997 to 2014 on 30 provinces, municipalities, and autonomous regions (The data of Tibet Autonomous Region is not included in this paper, because of the considerable lack of relevant data in Tibet.) in China, this paper studied the impact of financial development and the financial structure on macroeconomic volatility. The year 1997 was selected as the starting year for three reasons: First, after the 1997 Asian financial crisis, financial decision-making has gradually moved to the central government [35]. Second, in this paper it was necessary to use turnover rate, tradable value, and total value of the stock in each province, municipality, and autonomous region. China's stock market started at the end of 1990, and until 1997 a large number of listed companies emerged in each province, municipality, and autonomous region. Third, Chongqing became a municipality in 1997, so the mistake in the existing literature that Chongqing was a part of Sichuan Province can be avoided. Thus, the total observed values of annual data in this paper is 540.

3.2. Methodology

Based on the research approach of Beck et al. [11], and considering the endogeneity of financial development and financial structures, the one-period-lagged variables of financial development and financial structures are selected [8], thereby setting the following empirical model:

$$Volatility_{it} = \beta_1 Volatility_{i,t-1} + \beta_2 Fin_{i,t-1} + \beta_3 Shock_{i,t} + \beta_4 X_{i,t} + \alpha_i + \eta_t + \varepsilon_{it} \quad (1)$$

where: i and t, respectively, represent the provinces, municipalities, and autonomous regions as well as the corresponding time (the same as below); α_i and η_t, respectively, represent individual fixed effect and time fixed effect, so as to control the effect of factors which do not vary with individual and time on economic volatility; ε_{it} represents the error term.

Volatility represents the index of macroeconomic volatility. In the previous literature, there have been several ways to measure volatility, one of which is to divide a time span into several major stages, and to calculate the standard deviation of the corresponding variable at each stage, so as to obtain the corresponding indictors from the shorter panel of data. However, this method is suitable for panel data covering a very long time span. Due to the shorter time span of this study, this method was not suitable to measure economic volatility in China. Based on the method of Darrat et al. [15], the moving average standard deviation was used in this paper to measure macroeconomic volatility. Specific calculation steps are as follows: First, the natural logarithm of real per capita GDP was calculated, and the asymmetric CF filtering method was used to identify the trended factors and the cyclical factors in the macro-economy. After that, the moving standard deviation of the adjacent four-year real per capita GDP of trended factors and cyclical factors was used to measure trended volatility and cyclical volatility in the macro-economy [43]. Meanwhile, because the macroeconomic volatility was a continuous and dynamic process of adjustment, certain inertia characteristics and path dependencies should be taken into account; i.e., any previous economic volatility will have an impact on the current economic volatility. Meanwhile, a prominent advantage of the dynamic panel data model was that it is capable of resolving the problem of omitted variables through controlling the fixed effect, and solving the problem of reverse causality [44]. Therefore, the lagged dependent variable was included in the model $Volatility_{i,t-1}$.

Fin represents financial development and the financial structure. Financial development includes two aspects: the development of financial intermediaries and the development of the financial market, because the development of financial intermediaries includes the scale expansion of the financial system and also the efficiency improvement of the financial system. Based on the method used by Zhu et al. [30], the loan balance of financial institutions/GDP and private sector credit/GDP were used in this paper to reflect the scale expansion of the financial system and the efficiency improvement of the financial system. Based on the method used by Huang et al. [45], they estimated the ratio of private sector credit to GDP among China's provinces, municipalities, and autonomous regions. It was assumed in this estimation method that all credit rationing went to only two parts, namely, loans allocated to state-owned enterprises and loans allocated to the private enterprises. Assuming that the loans allocated to state-owned enterprises in the provinces, municipalities, and autonomous regions were positively correlated with their investment of fixed assets [46], the loan of private enterprises can be expressed as: total loan balance $\times$ (1 $-$ the investment of fixed assets of the state-owned economy/the total investment of fixed assets of the whole society). The development of financial markets can be measured from the two aspects of scale and liquidity. The capitalization of the stock market can be measured with the ratio of the stock market to economic scale; namely, the stock market capitalization of listed companies (average at the beginning and end of the stock market capitalization) in provinces, municipalities, and autonomous regions/GDP. Meanwhile, considering the tradable shares and non-tradable shares of listed companies in China, the market capitalization of listed companies should be measured with the market capitalization of tradable shares and total market capitalization; namely, the stock market tradable shares capitalization of listed companies (average at the beginning and end of the stock market tradable shares capitalization) in provinces,

municipalities, and autonomous regions/GDP and the total market capitalization of listed companies (average at the beginning and end of the total market capitalization) in provinces municipalities, and autonomous regions/GDP. The stock market liquidity should be measured with the economic liquidity provided by the stock market; namely, stock market trading value of listed companies (average at the beginning and end of stock market trading value) in provinces, municipalities, and autonomous regions/GDP.

To test the importance of financial structure for economic volatility, this paper follows the Levine [47] method. As for the indicators of bank credit and stock market development, two alternative indicators of financial structure were selected; namely, the relative activity and scale of the banking system and the stock market. The first indicator was used to measure stock market activity to banking system activity with the ratio of stock turnover/private sector credit; the second indicator was used to measure the stock market scale to the banking market scale with the ratio of stock market capitalization/private sector credit.

Shock represents external shocks. Based on the method used by Beck et al. [11], inflation volatility measured with the consumer price index was used as explanatory variables to represent external shocks. The measurement of inflation volatility should be conducted in the same way as the measurement of the volatility of real per capita GDP. The interaction term of the financial development and inflation volatility should be introduced to see whether financial development can effectively absorb external shocks and stabilize economic volatility.

X represents control variables. According to the relevant literature, other control variables used in the measurement model include: (1) trade openness, measured with the ratio of total import–export volume to GDP [12]; (2) human capital, measured with the ratio of the number of college students to the total population [33]; (3) government scale, measured with the ratio of local fiscal expenditure to GDP [38]; and (4) the level of economic growth, measured with the growth rate of real per capita GDP [10]. All basic data was calculated and systemized based on *China Statistical Yearbook* and *China Financial Yearbook* of various years. The names and definitions of related variables are presented in Table 1. Summary statistics of related variables are shown in Table 2.

Table 1. Variable, Name, and Definition.

Variable	Name	Definition
lnrpgdp	Natural logarithm of real capital GDP	Ln(real per capital GDP)
cpi	inflation	Consumer price index
tlnrpgdp	Trended term of lnrpgdp	See Section 3.1
clnrpgdp	Cyclical term of lnrpgdp	See Section 3.1
tcpi	Trended term of inflation	See Section 3.1
ccpi	Cyclical term of inflation	See Section 3.1
open	Trade openness	Total import–export volume/GDP
gov	Government scale	Local fiscal expenditure/GDP
human	Human capital	Number of college students/total population
ggdp	Economic growth	Growth rate of real per capita GDP
loan	Scale expansion of the financial system	Loan balance of financial institutions/GDP
nloan	Efficiency improvement of the financial system	Private sector credit/GDP
trade	Stock market capitalization	Stock market capitalization of listed companies (average at the beginning and end of the stock market capitalization) in provinces, municipalities and autonomous regions/GDP

Table 1. *Cont.*

Variable	Name	Definition
lcsm	Market capitalization of tradable shares	Stock market tradable shares capitalization of listed companies (average at the beginning and end of the stock market tradable shares capitalization) in provinces, municipalities, and autonomous regions/GDP
tcsm	Total market capitalization	Total market capitalization of listed companies (average at the beginning and end of the total market capitalization) in provinces municipalities, and autonomous regions/GDP
tradenloan	Relative activity	Stock turnover/private sector credit
lcsmnloan	Scale of the banking system and the stock market tradable shares	Stock market tradable shares capitalization/private sector credit
tcsmnloan	Scale of the banking system and the total stock market	Total market capitalization/private sector credit

Table 2. Summary Statistics.

Variable	Obs	Mean	Std. Dev.	Min.	Max.
lnrpgdp	450	9.7249	0.703	7.9347	11.2714
cpi	450	2.3975	2.1957	−3.300	10.100
tlnrgdp	450	0.0180	0.0088	0.0019	0.0612
clnrgdp	450	0.0003	0.0004	0.0000	0.0030
tcpi	450	0.3134	0.3774	0.0001	1.8049
ccpi	450	3.1643	2.5596	0.1264	14.6017
open	450	0.3243	0.4026	0.0357	1.7214
gov	450	0.1855	0.0846	0.0691	0.6121
human	450	0.0138	0.0072	0.0021	0.0356
ggdp	450	0.1162	0.0246	0.0490	0.2380
loan	450	1.0946	0.3577	0.5372	2.5847
nloan	450	0.6713	0.2488	0.3105	1.6827
trade	450	0.0032	0.0072	0.0002	0.1327
lcsm	450	0.2315	0.6162	0.0207	9.4521
tcsm	450	0.4649	1.1695	0.0576	16.8294
tradenloan	450	0.0044	0.0103	0.0003	0.2084
lcsmnloan	450	0.2999	0.7478	0.0345	14.8373
tcsmnloan	450	0.6118	1.3848	0.0922	26.4179

As a rudimentary check for multi-collinearity, Table 3 shows the correlations among lagged volatility and other independent variables used in the regression analysis. We find the highest correlation coefficient of 0.6732 appeared between tlnrpgdp1 and ggdp. As a rule of thumb, a correlation of 0.7 or higher in absolute value may indicate a multi-collinearity issue.

Table 3. Correlation matrix.

Variable	tlnrpgdp1	clnrpgdp1	tcpi	ccpi	open	gov	human	ggdp	loan1	nloan1	trade1	lcsm1	tcsm1	tradenloan1	lcsmnloan1	tcsmnloan1
tlnrpgdp1	1.0000															
clnrpgdp1	0.0408	1.0000														
tcpi	−0.0797	−0.1213	1.0000													
ccpi	0.2985	0.3235	−0.3353	1.0000												
open	−0.1972	−0.1918	−0.1292	−0.1098	1.0000											
gov	0.1200	0.3362	−0.0985	0.2540	−0.3032	1.0000										
human	0.2034	−0.0804	−0.3271	0.0848	0.4706	−0.0840	1.0000									
ggdp	0.6732	0.0037	0.1020	0.1245	−0.0131	−0.0733	0.0836	1.0000								
loan1	−0.2573	0.0331	−0.0178	−0.0555	0.5576	0.2288	0.3586	−0.1625	1.0000							
nloan1	−0.1652	−0.1178	−0.1557	−0.0295	0.6816	0.0317	0.5671	−0.1657	0.8511	1.0000						
trade1	−0.0814	0.1000	−0.1378	0.1121	0.2285	0.1140	0.1639	−0.0616	0.2162	0.2105	1.0000					
lcsm1	−0.1777	0.0466	−0.1216	0.0652	0.3114	0.0723	0.1958	−0.1550	0.3870	0.3687	0.8633	1.0000				
tcsm1	−0.1768	0.0838	−0.0847	0.0412	0.3855	0.0389	0.2412	−0.1272	0.4354	0.3981	0.8651	0.8680	1.0000			
tradenloan1	−0.0311	0.1122	−0.1279	0.1210	0.0989	0.1187	0.0678	−0.0199	0.0581	0.0392	0.9726	0.7925	0.7542	1.0000		
lcsmnloan1	−0.1206	0.0834	−0.1062	0.0605	0.1621	0.0784	0.0725	−0.0905	0.1829	0.1452	0.9528	0.9203	0.8150	0.9517	1.0000	
tcsmnloan1	−0.1462	0.0935	−0.0719	0.0334	0.2192	0.0496	0.0807	−0.0851	0.2291	0.1637	0.9590	0.8602	0.9183	0.9299	0.9460	1.0000

Note: The table presents the correlation matrix among all the independent variables employed in this study. Refer to Table 1 for detailed variable descriptions.

In model (1), the lags of dependent variables function as explanatory variables makes the explanatory variable introversive. Hence, if we apply the random effect or fixed effect of panel data to estimate the model, we would get a biased and non-confirming estimated result. In order to solve the problem of introversion, Arellano and Bond [44] proposed the estimation method for difference GMM. By using lagged instruments of explanatory variables and predefined variables, as well as the difference of strict external variables as instrumental variables, we can achieve efficient estimation. Further research by Blundell and Bond [48], as well as Bond et al. [49], found that this kind of GMM estimation would be easily affected by weak instrumental variables and cause finite sample errors. To overcome this problem, Arellano and Bover [50] and Blundell and Bond [48] propose the system GMM estimator. The system GMM estimator combines the difference equation and level equation, and it uses additional difference variables as the tool of relevant variables of level equation. Generally speaking, system GMM estimators possess better finite sample property. In terms of choice of structural tools for weighted matrix, GMM estimation can be divided into one-step estimation and two-step estimation. Considering some flaws (Although one-step GMM is a consistent estimator, its validity depends on homoscedastic assumptions of the disturbing term. Specific forms of weighting matrix are not necessarily set in the two-step GMM method. Instead, the consistent estimator obtained from the first-step IV estimation is used for setting the weighting matrix in the second-step IV estimation. Thus, a valid estimation of heteroscedasticity and serial correlation is obtained [51]. Theoretically, the two-step GMM method is more reasonable. However, Bond et al. [49] believe that, with limited samples, the standard two-step GMM will show serious downward bias, thereby affecting the statistical inference.) in the two-step estimation method of the system GMM, we employed the method proposed by Windmeijer [52] to revise the estimators of standard errors. Generally speaking, we used the STATA process (xtabond2 command) developed by Roodman [53] to implement two-step GMM estimation.

4. Empirical Results and Discussion

4.1. The Impact of Financial Development on Macroeconomic Volatility

Table 4 shows the impact of financial development on macroeconomic volatility. In Table 4, columns (1)–(4) show the scale of the impact of financial development on macroeconomic volatility; columns (5)–(8) show the impact of efficiency of financial development on macroeconomic volatility. It can be seen in columns (1)–(8) in Table 4 that, no matter the scale or efficiency, the trended and cyclical volatility of the previous macroeconomy had a significantly positive impact on trended and cyclical volatility of the current macroeconomy, both of which passed the 1% significance test, but trended volatility showed a greater impact than cyclical volatility. This result suggests that the existing literature does not take into account that the lagged term of macroeconomic volatility affects the accuracy of the estimated value. Thus, we should avoid radical macroeconomic change, and make stable, healthy, and sustainable macroeconomic development, and this is consistent with the vision of the Chinese government. Similarly, the impact of inflation trended and cyclical volatility on macroeconomic volatility was not the same. Inflation trended volatility had a significantly negative impact on both macroeconomic cyclical volatility and trended volatility, while inflation cyclical volatility had a significantly positive impact on macroeconomic cyclical volatility, which suggests that inflation trended volatility will suppress macroeconomic volatility, and its cyclical volatility amplified macroeconomic volatility. Thus, only by taking into account trended or inflation cyclical volatility will it yield different results in the existing literature. At the same time, we also control ups and downs of inflation each year, especially, the inflation cyclical volatility. In the model in which inflation trended volatility was taken into account (columns (1) and (2)), the scale of financial development had no significant impact on macroeconomic trended volatility, but the signs were the opposite. In the model in which inflation cyclical volatility was taken into account (columns (3) and (4)), the scale of financial development had a negative impact on macroeconomic cyclical volatility, and passed the 1% significance test, which

agreed with the idea of Mallick [33] that increasing private credit will suppress macroeconomic cyclical volatility, but not affect the long-term macroeconomic volatility. However, the results were contrary to the Darrat et al. [15] results. In columns (1)–(4), the signs of the interaction term financial development scale and inflation trended volatility were positive, but not significant. The sign of the interaction term financial development scale and inflation cyclical volatility was negative, and passed the 5% significance test. These results show that the scale of financial development suppressed macroeconomic volatility through inflation cyclical volatility, but amplified macroeconomic volatility through inflation trended volatility. These results are opposed to Mallick's [33] conclusion; he found that external shocks affect not only cyclical volatility but also long-term volatility of GDP growth. The reason may be the difference of method of volatility measure and time horizons. Similarly, for the financial development level model, measured by financial development efficiency (columns (5)–(8)), financial development efficiency had a non-significantly positive impact on macroeconomic trended volatility and a non-significant impact on macroeconomic cyclical volatility in the model of inflation cyclical volatility. The reason may be that there are lower credit and loan amounts in the private sector economy; if the financial institutions, led by banks, are more inclined to lend to the state-owned sector, it will affect the enthusiasm of private sector development. Namely, the efficiency of financial development has not yet reached the level of affecting macroeconomic volatility. Apart from this, the remaining results were the same as the financial development scale. Therefore, taking scale and efficiency of financial development into account, the impact of financial development on macroeconomic volatility was basically consistent.

The impact of other control variables on macroeconomic volatility was as follows: (1) In the model of inflation cyclical volatility, apart from openness having a non-significant positive impact on macroeconomic volatility, the other signs in the model were negative, indicating that openness can reduce macroeconomic volatility; (2) Government expenditure had a negative impact on macroeconomic trended volatility, but a positive impact on macroeconomic cyclical volatility; (3) Human capital suppressed macroeconomic volatility, but the significance was different. The impact of human capital on macroeconomic trended volatility was significantly negative, but its impact on cyclical volatility was not significant; (4) Economic growth had a positive impact on macroeconomic trended volatility, and passed the 1% significance test, but its impact on macroeconomic cyclical volatility was not significant.

Table 4. The impact of financial development on macroeconomic volatility.

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	tlnrpgdp	**tlnrpgdp**	**clnrpgdp**	**clnrpgdp**	**tlnrpgdp**	**tlnrpgdp**	**clnrpgdp**	**clnrpgdp**
L.tlnrpgdp	0.899 *** (13.88)	0.884 *** (17.68)			0.922 *** (15.58)	0.874 *** (18.20)		
L.clnrpgdp			0.472 *** (5.17)	0.445 *** (9.02)			0.404 *** (3.61)	0.403 *** (7.14)
loan1	−0.0005 (−0.43)	0.0005 (0.46)	−0.0005 *** (−3.60)	−0.0003 *** (−2.62)				
loan1tcpi1	0.0010 (1.55)		0.0001 (0.91)					
loan1ccpi1		−0.0002 ** (−2.38)		−0.00002 ** (−2.27)				
nloan1					0.0004 (0.17)	0.0007 (0.42)	−0.0005 ** (−2.38)	−0.0002 (−1.41)
nloan1tcpi1					0.0013 (1.17)		0.0001 (0.79)	
nloan1ccpi1						−0.0002 *** (−2.68)		−0.00004 *** (−3.28)
open	−0.0025 (−0.89)	−0.0039 (−1.19)	−0.0002 (−1.21)	0.0002 (1.05)	−0.0045 * (−1.71)	−0.0036 (−1.19)	−0.0001 (−0.87)	0.0001 (0.44)
gov	−0.0059 (−0.75)	−0.0056 (−0.63)	0.0005 (0.51)	0.0022 * (1.91)	−0.0084 (−1.14)	−0.0079 (−1.10)	0.0009 (1.03)	0.0010 (1.49)
human	−0.615 *** (−6.07)	−0.602 *** (−7.04)	−0.0109 (−1.17)	−0.0253 *** (−2.78)	−0.608 *** (−5.41)	−0.538 *** (−5.41)	−0.0075 (−0.89)	−0.0129 (−1.58)
ggdp	0.0700 *** (3.69)	0.0692 *** (3.81)	0.0007 (0.53)	0.0002 (0.14)	0.0675 *** (3.42)	0.0703 *** (4.03)	0.0009 (0.80)	−0.0006 (−0.57)
tcpi	−0.0016 ** (−2.56)		−0.0002 * (−1.90)		−0.0014 ** (−2.25)		−0.0002 * (−1.79)	
ccpi		0.0003 *** (2.64)		0.0001 *** (6.29)		0.0002 *** (2.81)		0.0001 *** (6.66)
N	360	360	360	360	360	360	360	360
Number of groups	30	30	30	30	30	30	30	30
Number of instruments	340	340	340	340	340	340	340	340
Wald chi2	1622.38 (0.000)	2185.75 (0.000)	334.76 (0.000)	344.38 (0.000)	1796.19 (0.000)	2140.18 (0.000)	240.28 (0.000)	311.75 (0.000)
Arellano-Bond test for AR(1)	1.54 (0.123)	1.16 (0.248)	−2.29 (0.022)	−2.34 (0.019)	1.58 (0.114)	1.31 (0.191)	−2.10 (0.035)	−2.18 (0.030)
Arellano-Bond test for AR(2)	−1.48 (0.138)	−0.32 (0.746)	−2.28 (0.022)	−1.89 (0.059)	−1.25 (0.211)	−0.56 (0.572)	−2.28 (0.022)	−2.15 (0.032)
Hansen test of overidentifying restrictions	27.53 (1.000)	25.69 (1.000)	25.01 (1.000)	23.92 (1.000)	27.42 (1.000)	24.76 (1.000)	25.56 (1.000)	22.17 (1.000)

Note: The model (1) in the text is estimated by GMM-Sys for the period 1997–2014. *z*-statistics in bracket are calculated using heteroscedasticity-robust standard errors; () is *p* value *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

4.2. The Impact of Financial Market Development on Macroeconomic Volatility

Table 5 shows the impact that the development of the financial market has on macroeconomic volatility. The results in Table 5 show that results vary when development of the financial market is measured with various indicators. When development of the financial market was measured with turnover rate in the stock market, development of the financial market had a positive impact on macroeconomic cyclical volatility and trended volatility, but was not significant. When development of the financial market was measured with the value of tradable shares, development of the financial market had a negative impact on macroeconomic cyclical volatility and trended volatility. Apart from the model of financial market development and inflation trended volatility, the coefficient of the remaining variables in the model were not significant. When development of the financial market was measured with turnover rate in the stock market, development of the financial market had a non-significantly negative impact on macroeconomic trended volatility. However, it had a positive impact on macroeconomic cyclical volatility, and the coefficient of that variable passed the 5% significance test in the cyclical fluctuation model of development of the financial market and inflation. The sign of the interaction term development of the financial market and inflation trended volatility being positive was only significant in the cyclical volatility model of stock market capitalization and inflation. The sign of the interaction term development of the financial market and inflation cyclical volatility being negative was significant in the cyclical volatility models of both the value of tradable shares in the stock market and inflation as well as in the cyclical volatility model of the stock market capitalization and inflation. Therefore, the Chinese government should not only pay attention to the development of scale of the stock market, but also to the infrastructure construction of the stock market. Moreover, government should be built with a long-term investment value of the stock market, rather than with a speculative effect of the stock market. Signs and significance of related control variables were similar to those shown in Table 4.

Table 5. The impact of financial market development on macroeconomic volatility.

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	tlnrpgdp	**tlnrpgdp**	**clnrpgdp**	**clnrpgdp**	**tlnrpgdp**	**tlnrpgdp**	**clnrpgdp**	**clnrpgdp**	**tlnrpgdp**	**tlnrpgdp**	**clnrpgdp**	**clnrpgdp**
L.tlnrpgdp	0.918 ***	0.859 ***			0.893 ***	0.864 ***			0.881 ***	0.867 ***		
	(20.76)	(20.99)			(18.66)	(20.85)			(20.34)	(21.01)		
L.clnrpgdp			0.402 ***	0.410 ***			0.412 ***	0.400 ***			0.412 ***	0.375 ***
			(4.78)	(6.76)			(4.88)	(7.14)			(5.50)	(6.55)
trade1	0.0376	0.0112	0.0194	0.0113								
	(0.44)	(0.13)	(1.56)	(1.13)								
trade1tcpi1	0.126		0.0064									
	(0.65)		(0.23)									
trade1ccpi1		−0.0164		−0.0028								
		(−1.25)		(−0.90)								
lcsm1					−0.0002	−0.0002	−0.0001 **	−0.0002				
					(−0.48)	(−0.22)	(−2.37)	(−0.81)				
lcsm1tcpi1					0.0020		0.0005					
					(1.38)		(1.09)					
lcsm1ccpi1						−0.00006		−0.00002 *				
						(−0.68)		(−1.76)				
tcsm1									−0.0003	−0.0003	0.00001	0.0001 **
									(−0.78)	(−0.97)	(0.21)	(2.35)
tcsm1tcpi1									0.0008		0.0002 *	
									(0.77)		(1.77)	
tcsm1ccpi1										−0.00006		−0.00002
										** (−2.05)		*** (−3.62)
open	−0.0042 *	−0.0029	−0.0002 *	0.0001	−0.0036	−0.0029	−0.0002	0.0004	−0.0032	−0.0026	−0.0002	0.0002
	(−1.94)	(−0.84)	(−1.65)	(0.32)	(−1.60)	(−1.10)	(−1.45)	(1.06)	(−1.35)	(−1.01)	(−1.35)	(0.72)
gov	−0.0083	−0.0078	0.0002	0.0004	−0.0089	−0.0085	0.0008	0.0011	−0.0054	−0.0074	0.0002	0.0005
	(−1.03)	(−1.15)	(0.28)	(0.34)	(−0.89)	(−1.08)	(1.06)	(0.86)	(−0.80)	(−1.00)	(0.25)	(0.91)
human	−0.580 ***	−0.551 ***	−0.0126	−0.0158 *	−0.565 ***	−0.555 ***	−0.0143 **	−0.0229 **	−0.583 ***	−0.582 ***	−0.00963	−0.0183
	(−9.76)	(−7.20)	(−1.61)	(−1.69)	(−6.24)	(−5.40)	(−2.05)	(−2.11)	(−10.96)	(−6.09)	(−1.50)	*** (−2.84)

Table 5. *Cont.*

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	tlnrpgdp	**tlnrpgdp**	**clnrpgdp**	**clnrpgdp**	**tlnrpgdp**	**tlnrpgdp**	**clnrpgdp**	**clnrpgdp**	**tlnrpgdp**	**tlnrpgdp**	**clnrpgdp**	**clnrpgdp**
ggdp	0.0706 *** (4.05)	0.0745 *** (4.23)	0.0019 ** (2.41)	−0.0006 (−0.40)	0.0727 *** (3.95)	0.0741 *** (4.22)	0.0016 ** (1.99)	−0.0015 (−1.28)	0.0764 *** (4.34)	0.0722 *** (3.79)	0.0016 ** (2.00)	−0.0010 (−1.14)
tcpi	−0.0008 ** (−2.11)		−0.0002 *** (−2.82)		−0.0009 * (−1.89)		−0.0002 *** (−3.04)		−0.0009 ** (−2.09)		−0.0002 *** (−3.14)	
ccpi		0.0002 ** (2.10)		0.0001 *** (5.08)		0.0002 ** (2.04)		0.0001 *** (5.62)		0.0002 ** (2.33)		0.0001 *** (6.18)
N	360	360	360	360	360	360	360	360	360	360	360	360
Number of groups	30	30	30	30	30	30	30	30	30	30	30	30
Number of instruments	340	340	340	340	340	340	340	340	340	340	340	340
Wald chi2	2487.71 (0.000)	1945.13 (0.000)	441.65 (0.000)	397.02 (0.000)	2077.34 (0.000)	2181.12 (0.000)	282.97 (0.000)	380.31 (0.000)	2711.67 (0.000)	3155.85 (0.000)	282.77 (0.000)	737.42 (0.000)
Arellano-Bond test for AR(1)	1.51 (0.130)	1.24 (0.214)	−2.29 (0.022)	−2.24 (0.025)	1.31 (0.189)	1.32 (0.186)	−2.21 (0.027)	−2.24 (0.025)	1.03 (0.303)	1.31 (0.190)	−2.32 (0.020)	−2.20 (0.028)
Arellano-Bond test for AR(2)	−1.28 (0.199)	−0.91 (0.363)	−2.34 (0.019)	−2.07 (0.039)	−1.32 (0.188)	−1.26 (0.207)	−2.32 (0.021)	−2.07 (0.039)	−1.54 (0.123)	−1.22 (0.222)	−2.25 (0.025)	−2.27 (0.023)
Hansen test of overidentifying restrictions	26.26 (1.000)	27.49 (1.000)	27.12 (1.000)	27.83 (1.000)	26.52 (1.000)	28.46 (1.000)	25.53 (1.000)	25.71 (1.000)	28.26 (1.000)	28.77 (1.000)	24.22 (1.000)	21.34 (1.000)

Note: The model (1) in the text is estimated by GMM-Sys for the period 1997–2014. *z*-statistics in bracket are calculated using heteroscedasticity-robust standard errors; () is *p* value *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

4.3. The Impact of Financial Structure on Macroeconomic Volatility

Table 6 shows the impact of the financial structure on macroeconomic volatility, showing that results varied when the financial structure was measured with various indicators. When the financial structure was measured by the ratio of turnover rate in the stock market to financial development efficiency, the financial structure had a positive impact on macroeconomic cyclical volatility and trended volatility. This in turn had a significantly positive impact on macroeconomic cyclical volatility. When the financial structure was measured by the ratio of the value of tradable shares to financial development efficiency, the financial structure had a negative impact on macroeconomic cyclical volatility and trended volatility, but was not significant. When the financial structure was measured by the ratio of stock market capitalization to financial development efficiency, the financial structure had a non-significantly negative impact on macroeconomic trended volatility, but a positive impact on cyclical volatility. The coefficient of the variable passed the 10% significance test in the trended volatility model of inflation. Thus, compared with the bank credit market, the stock market development has a weak influence on the macroeconomic volatility in China. The reason may be that banks, in the provision of funds, are still in the core position; the stock market still provides mainly financing for the state-owned sector [54]. Therefore, the government should pay attention to the financing and development of all sectors, including the private sector involved in the stock market, so as to improve the influence of the stock market development on the macroeconomy. Signs and significance of related control variables were similar to those shown in Table 4.

4.4. Robustness Test

In order to test the reliability of the results, several sensitivity tests were conducted. First, the calculation method on the main variables was converted to test the reliability of the results; namely, the macroeconomy was measured with the real GDP instead of the real per capita GDP. The macroeconomic cyclical volatility and trended volatility were measured by the moving standard deviation of the five-year real per capita GDP adjacent trended factors and cyclical factors instead of the moving standard deviation of the four-year real per capita GDP. The volatility of inflation was measured by the rate of change in the retail price index instead of the rate of change in the consumer price index. Secondly, square terms of financial development, the financial market development, and the financial structure were added to the model in order to examine the non-linear relationship between the financial index and economic volatility. Finally, to further address the causality between the financial index and economic volatility, the result of the inverse regression was also shown in this paper. To be specific, the lagged term of trended volatility and cyclical volatility of the moving standard deviation of real per capita GDP was used as an independent variable, and a related financial index was used as a dependent variable for regression. It was found that the above changes created no impact on the signs or the significance of the main results (we have not listed these results here for lack of space).

Table 6. The impact of financial structure on macroeconomic volatility.

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	tlnrpgdp	**tlnrpgdp**	**clnrpgdp**	**clnrpgdp**	**tlnrpgdp**	**tlnrpgdp**	**clnrpgdp**	**clnrpgdp**	**tlnrpgdp**	**tlnrpgdp**	**clnrpgdp**	**clnrpgdp**
L.tlnrpgdp	0.901 *** (17.71)	0.875 *** (22.67)			0.885 *** (17.57)	0.870 *** (21.87)			0.895 *** (22.92)	0.871 *** (19.41)		
L.clnrpgdp			0.386 *** (5.78)	0.364 *** (6.41)			0.444 *** (6.16)	0.388 *** (6.24)			0.426 *** (5.65)	0.370*** (7.23)
tradenloan1	0.0843 (1.26)	0.0283 (0.49)	0.0269 *** (3.23)	0.0124 ** (1.98)								
lcsmnloan1					–0.0002 (–0.40)	–0.0012 (–1.42)	–0.0001 (–0.45)	–0.0001 (–0.72)				
tcsmnloan1									–0.00001 (–0.07)	–0.0002 (–0.90)	0.0001 * (1.83)	0.00007 (1.45)
open	–0.0039 * (–1.77)	–0.0033 (−1.31)	–0.0002 (–1.34)	–0.00005 (–0.25)	–0.0035 (–1.59)	–0.0032 (–1.02)	–0.0002 (–1.32)	0.0001 (0.31)	–0.0036 (–1.53)	–0.0027 (–1.12)	–0.0002 (–1.56)	0.0001 (0.47)
gov	–0.0103 (–1.48)	–0.0115 (–1.56)	–0.00002 (-0.03)	–0.000003 (–0.00)	–0.0072 (–1.15)	–0.0057 (–0.75)	0.0002 (0.20)	0.0006 (0.76)	–0.0064 (-0.96)	–0.0079 (–0.97)	0.0001 (0.17)	0.0005 (1.07)
human	–0.576 *** (–9.78)	–0.557 *** (–7.60)	–0.0128 * (–1.76)	–0.0140 * (–1.80)	–0.567 *** (–9.48)	–0.597 *** (–7.47)	–0.00938 (–1.10)	0.0198 ** (–2.03)	–0.595 *** (–9.63)	–0.583 *** (–6.38)	–0.00705 (–1.19)	–0.0137 * (–1.88)
ggdp	0.0708 *** (3.58)	0.0696 *** (4.26)	0.0015 * (1.84)	0.0001 (0.13)	0.0749 *** (4.25)	0.0701 *** (3.72)	0.0017 ** (2.48)	–0.0008 (–0.60)	0.0756 *** (4.56)	0.0712 *** (4.07)	0.0019 ** (2.34)	0.0004 (0.36)
tcpi	–0.0006 (–1.53)		–0.0001 ** (–2.10)		–0.0008 * (–1.84)		–0.0002 *** (–2.89)		–0.0008 ** (–2.33)		–0.0001 ** (–2.53)	
ccpi		0.0002* (1.69)		0.00005 *** (3.38)		0.0002 ** (2.11)		0.00006 *** (4.08)		0.0002 ** (1.98)		0.00005 *** (3.86)
N	360	360	360	360	360	360	360	360	360	360	360	360
Number of groups	30	30	30	30	30	30	30	30	30	30	30	30
Number of instruments	330	330	330	330	330	330	330	330	330	330	330	330
Wald chi2	1469.45 (0.000)	2368.14 (0.000)	362.01 (0.000)	445.11 (0.000)	1815.12 (0.000)	1977.96 (0.000)	256.86 (0.000)	207.14 (0.000)	3608.52 (0.000)	1752.10 (0.000)	254.39 (0.000)	387.77 (0.000)
Arellano-Bond test for AR(1)	1.54 (0.125)	1.65 (0.098)	–2.30 (0.021)	–2.18 (0.029)	1.24 (0.216)	1.41 (0.158)	–2.30 (0.022)	–2.21 (0.027)	1.24 (0.215)	1.42 (0.156)	–2.40 (0.016)	–2.23 (0.026)
Arellano-Bond test for AR(2)	–1.21 (0.228)	–1.07 (0.284)	–2.39 (0.017)	–2.19 (0.029)	–1.42 (0.155)	–1.03 (0.303)	–2.18 (0.029)	–1.99 (0.047)	–1.53 (0.126)	–1.28 (0.199)	–2.15 (0.032)	–2.05 (0.040)
Hansen test of overidentifying restrictions	28.04 (1.000)	26.79 (1.000)	26.77 (1.000)	25.44 (1.000)	28.20 (1.000)	28.60 (1.000)	28.51 (1.000)	27.45 (1.000)	28.13 (1.000)	28.43 (1.000)	27.34 (1.000)	27.33 (1.000)

Note: The model (1) in the text is estimated by GMM-Sys for the period 1997–2014. *z*-statistics in bracket are calculated using heteroscedasticity-robust standard errors; () is *p* value *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

5. Conclusions

Using annual data from 1997 to 2014 on 30 provinces, municipalities, and autonomous regions in China, subdividing cyclical volatility and trended volatility of the macroeconomy and inflation, and considering various measurement methods for indicators of financial development and the financial structure, this paper systematically studied the impact of financial development and the financial structure on macroeconomic volatility. Considering endogenous issues of financial development and the financial structure, controlling the opening policy, government expenditure, and human capital and growth rate of GDP in different regions in China, the results found that: (1) Trended and cyclical volatility of the previous period's macroeconomy had a significantly positive impact on those of the current period, and the impact of trended volatility was greater than that of cyclical volatility; (2) Inflation trended volatility had a significantly negative impact on macroeconomic cyclical volatility and trended volatility, and inflation cyclical volatility had a significantly positive impact on macroeconomic cyclical volatility; (3) The scale and efficiency of financial development had no significant impact on macroeconomic trended volatility, but had a significantly negative impact on macroeconomic cyclical volatility; (4) The scale and efficiency of financial development suppressed macroeconomic cyclical volatility through inflation trended volatility, but amplified macroeconomic volatility through inflation trended volatility; (5) The turnover rate in the stock market had a non-significantly positive impact on macroeconomic cyclical volatility and trended volatility. The value of tradable shares had a non-significantly negative impact on macroeconomic cyclical volatility and trended volatility. The stock market capitalization had a non-significantly negative impact on macroeconomic trended volatility, but a positive impact on macroeconomic cyclical volatility. Financial market development amplified macroeconomic trended volatility but suppressed inflation cyclical volatility; (6) The financial structure measured by the ratio of turnover rate in the stock market to efficiency of financial development had a positive impact on macroeconomic cyclical volatility and trended volatility, and this impact had a significantly positive impact on macroeconomic cyclical volatility. The financial structure measured by the ratio of the value of tradable shares to the efficiency of financial development had a non-significantly negative impact on macroeconomic cyclical volatility and trended volatility. The financial structure measured by the ratio of stock market capitalization to the efficiency of financial development had a non-significantly negative impact on macroeconomic trended volatility, but had a positive impact on macroeconomic cyclical volatility.

The practical significance of this paper is obvious. First, we should avoid ups and downs in the macroeconomy, the macroeconomy of the previous period will affect trended volatility and cyclical volatility in macroeconomy; second, we should reasonably increase credit, especially private sector credit, because the growth of the credit scale will restrain trended volatility and cyclical volatility in the macroeconomy; third, turnover rate and capitalization of the stock market may amplify cyclical volatility in the macroeconomy. Consequently, in China, the more developed the stock market is in relation to the bank credit sector, the greater cyclical volatility is. Therefore, instead of scale development, relevant government departments should focus on long-term investment and development depth in the stock market.

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References

1. Schumpeter, J. *The Theory of Economic Development*; Harper & Brothers: Manhattan, NY, USA, 1912.
2. Goldsmith, R.W. *Financial Structure and Development*; Yale University Press: New Haven, CT, USA, 1969.

3. McKinnon, R.I. *Money and Capital in Economic Development*; Brookings Institution: Washington, DC USA, 1973.
4. Levine, R. Financial Development and Economic Growth: Views and Agenda. *J. Econ. Lit.* **1997**, *35*, 688–726.
5. Levine, R. Finance and Growth: Theory and Evidence. In *Handbook of Economic Growth*; Aghion, P., Durlauf, S.N., Eds.; Elsevier: Amsterdam, The Netherlands, 2005; pp. 865–934.
6. Ang, J.B. A Survey of Recent Developments in the Literature of Finance and Growth. *J. Econ. Surv.* **2008**, *22*, 536–576. [CrossRef]
7. Aizenman, J.; Pinto, B. (Eds.) *Managing Economic Volatility and Crises: A Practitioner's Guide*; Cambridge University Press: Cambridge, UK, 2005.
8. Denizer, C.; Iyigun, M.; Owen, A. Finance and Macroeconomic Volatility. *Contrib. Macroecon.* **2002**. [CrossRef]
9. Silva, G.F. The Impact of Financial System Development on Business Cycles Volatility: Cross-Country Evidence. *J. Macroecon.* **2002**, *24*, 233–253. [CrossRef]
10. Tiryaki, G.F. Financial Development and Economic Fluctuations. *METU Stud. Dev.* **2003**, *30*, 89–106.
11. Beck, T.; Lundberg, M.; Majnoni, G. Financial Intermediary Development and Growth Volatility: Do Intermediaries Dampen or Magnify Shocks? *J. Int. Money Financ.* **2006**, *25*, 1146–1167. [CrossRef]
12. Easterly, W.; Islam, R.; Stiglitz, J. Shaken and Stirred: Explaining Growth Volatility. In *Annual World Bank Conference on Development Economics*; Pleskovic, B., Stern, N., Eds.; The World Bank: Washington, DC, USA, 2000; pp. 191–211.
13. Kunieda, T. Financial Development and Volatility of Growth Rates: New Evidence. Available online: https://mpra.ub.uni-muenchen.de/11341/1/MPRA_paper_11341.pdf (accessed on 28 September 2015).
14. Aghion, P.; Angeletos, G.; Banerjee, M.A.; Manova, K. Volatility and Growth: Credit Constraints and the Composition of Investment. *J. Monet. Econ.* **2010**, *57*, 246–265. [CrossRef]
15. Darrat, A.F.; Salah, A.S.; Hassan, A.Y. Assessing the Role of Financial Deepening in Business Cycles: The Experience of the United Arab Emirates. *Appl. Financ. Econ.* **2005**, *15*, 1–16. [CrossRef]
16. Larrain, B. Do Banks Affect the Level and Composition of Industrial Volatility? *J. Financ.* **2006**, *61*, 1897–1925. [CrossRef]
17. Bernanke, B.; Gertler, M. Agency Costs, Net Worth, and Business Fluctuations. *Am. Econ. Rev.* **1989**, *79*, 14–31.
18. Bernanke, B.; Gertler, M.; Gilchrist, S. The Financial Accelerator and the Flight to Quality. *Rev. Econ. Stat.* **1996**, *78*, 1–15. [CrossRef]
19. Kiyotaki, N.; Moore, J. Credit Cycles. *J. Polit. Econ.* **1997**, *105*, 211–248. [CrossRef]
20. Aghion, P.; Banerjee, A.; Piketty, T. Dualism and Macroeconomic Volatility. *Q. J. Econ.* **1999**, *114*, 1359–1397. [CrossRef]
21. Caballero, R.J.; Krishnamurthy, A. International and Domestic Collateral Constraints in a Model of Emerging Market Crises. *J. Monet. Econ.* **2001**, *48*, 513–548. [CrossRef]
22. Bacchetta, P.; Caminal, R. Do Capital Market Imperfections Exacerbate Output Fluctuations? *Eur. Econ. Rev.* **2000**, *44*, 449–468. [CrossRef]
23. Acemoglu, D.; Zilibotti, F. Was Prometheus Unbound by Chance? Risk, Diversification and Growth. *J. Polit. Econ.* **1997**, *105*, 709–751. [CrossRef]
24. Wang, P.F.; Wen, Y. Financial Development and Economic Volatility: A Unified Explanation. Available online: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1396720 (accessed on 28 September 2015).
25. Hausmann, R.; Gavin, M. Securing Stability and Growth in a Shock—Prone Region: The Policy Challenge for Latin America'. Available online: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1815944 (accessed on 30 September 2015).
26. Buch, C.M.; Pierdzioch, C. The Integration of Imperfect Financial Markets: Implications for Business Cycle Volatility. *J. Policy Model.* **2005**, *27*, 789–804. [CrossRef]
27. Tharavanij, P. Capital Market and Business Cycle Volatility. Monash University Economics Discussion Paper. Available online: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1015182 (accessed on 28 September 2015).
28. Wang, X.; Li, L. Financial Development, Economic Volatility and Economic Growth in China. *Shanghai Econ. Rev.* **2009**, *2*, 34–43. (In Chinese)
29. Wahid, J. Financial Development and GDP Volatility in China. *Econ. Not.* **2010**, *39*, 27–41. [CrossRef]
30. Zhu, T.; Qi, X.; Li, L. Financial Development, Exogenous Shock and Economic Volatility. *J. Bus. Econ.* **2011**, *1*, 52–59. (In Chinese)

31. Yao, Y.; Peng, L.; Zeng, X. Financial Development Dampening Macroeconomic Fluctuation in China: Empirical Analysis Based on EGARCH Model. *Jianghan Acad.* **2013**, *6*, 5–10. (In Chinese)
32. Wang, Y.; Zhao, Q. Financial Development and Macroeconomic Volatility. *Stud. Int. Financ.* **2015**, *2*, 3–13. (In Chinese)
33. Mallick, D. Financial Development, Shocks, and Growth Volatility. *Macroecon. Dyn.* **2014**, *18*, 651–688. [CrossRef]
34. Hahn, F.R. *Financial Development and Macroeconomic Volatility: Evidence from OECD Countries*; WIFO Working Papers No. 198; Austrian Institute of Economic Research: Vienna, Australia, 2003.
35. Luo, Z.; Du, Y. Banking Development and Macroeconomic Volatility in China: Theory and Empirics. *Mod. Econ. Sci.* **2009**, *1*, 65–71. (In Chinese)
36. Aghion, P.; Bacchetta, P.; Banerjee, A. Financial Development and the Instability of Open Economies. *J. Monet. Econ.* **2004**, *51*, 1077–1106. [CrossRef]
37. Zhao, Z.; Yu, Z.; Liu, M. The Nonlinearity between Credit Market and Macroeconomic Volatility in China: An Empirical Research from the Perspective of Financial Accelerator. *Econ. Res. J.* **2007**, *6*, 27–38. (In Chinese)
38. Yao, Y.; Bao, X. Does the Development of Financial Intermediation smooth Economic volatility? Evidence From China. *J. Financ. Econ.* **2013**, *1*, 61–70. (In Chinese)
39. Raddatz, C. Liquidity Needs and Vulnerability to Financial Under-Development. *J. Financ. Econ.* **2006**, *80*, 677–722. [CrossRef]
40. Yeh, C.C.; Huang, H.C.; Lin, P.C. Financial Structure on Growth and Volatility. *Econ. Model.* **2013**, *35*, 391–400. [CrossRef]
41. Du, T.; Pang, D. The Relativity of the Shock of Finance and the Business Cycle: From Three Aspect. *J. Cent. Univ. Financ. Econ.* **2006**, *10*, 38–43. (In Chinese)
42. Dong, L. An Empirical Study on Financial Development and Volatility of Chinese Economic Growth Rates. *Econ. Manag.* **2006**, *11*, 84–87. (In Chinese)
43. Christiano, L.J.; Fitzgerald, T.J. The Band Pass Filter. *Int. Econ. Rev.* **2003**, *44*, 435–465. [CrossRef]
44. Arellano, M.; Bond, S. Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations. *Rev. Econ. Stud.* **1991**, *58*, 277–297. [CrossRef]
45. Huang, L.; Xu, L.; Ran, M. The Financial Development, FDI and Technical Progress: An Threshold Model Analysis Based on the Inter-Province Panel Data in China. *J. Ind. Eng. Manag.* **2009**, *3*, 16–22. (In Chinese)
46. Zhang, J.; Wan, G.H.; Jin, Y. The Financial Deepening-Productivity Nexus in China: 1987–2001. *J. Chin. Econ. Bus. Stud.* **2007**, *5*, 37–49.
47. Levine, R. Bank-Based or Market-Based Financial Systems: Which Is Better? *J. Financ. Intermed.* **2002**, *11*, 398–428. [CrossRef]
48. Blundell, R.; Bond, S. Initial conditions and moment restrictions in dynamic panel data models. *J. Econ.* **1998**, *87*, 115–143. [CrossRef]
49. Bond, S.; Bowsher, C.; Windmeijer, F. Criterion-based inference for GMM in autoregressive panel data models. *Econ. Lett.* **2001**, *73*, 379–388. [CrossRef]
50. Arellano, M.; Bover, O. Another look at the instrumental variables estimation of error components models. *J. Econ.* **1995**, *68*, 29–51. [CrossRef]
51. Hayashi, F. *Econometrics*, 1st ed.; Princeton University Press: Princeton, NJ, USA, 2000.
52. Windmeijer, F.A. Finite Sample Correction for the Variance of Linear Efficient Two-step GMM Estimators. *J. Econ.* **2005**, *126*, 25–51. [CrossRef]
53. Roodman, D. How to do xtabond2: An Introduction to Difference and System GMM in Stata. *Stata J.* **2009**, *9*, 86–136. [CrossRef]
54. Allen, F.; Qian, J.; Qian, M.J. Law, finance, and economic growth in China. *J. Financ. Econ.* **2005**, *77*, 57–116. [CrossRef]