

The Effect of Financial Development on Economic Growth and Economic Volatility

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Abstract. After the Asian financial crisis in 1997, the academic circles turned their attention to the study of the relationship of financial development, economic growth and economic volatility. As an important development industry, the financial industry has a direct impact on global economic growth and economic stability. This paper analyzes the impact mechanism of financial development on economic growth and volatility from the perspectives of the credit market, capital market and financial derivatives market. Taking the macro data of 50 countries from 1997 to 2014 as samples, introducing GDP, government expenditure, trade openness, CPI and other control variables, using individual and time fixed effects, divide the sample into advanced countries and emerging countries, and verify the statistical relationship between financial development and economic growth and economic volatility from the two dimensions of financial development quantity and financial development quality. Besides, the impact of financial development on economic recession is explored. The results show that whether in advanced or emerging countries, the quantity of financial development has an inhibitory effect on economic growth, while the quality of financial development can promote economic growth. Financial development has less impact on economic volatility but has a greater impact on emerging countries than in advanced countries, which will help explain the economic phenomenon that the volatility of emerging countries is higher than that of advanced countries.

Keywords: financial development; economic growth; economic volatility; recession.

1. Introduction

Economic growth and economic stability are two things that all countries in the world attach great importance to, and both are closely related to financial development. After the subprime mortgage crisis, countries around the world have successively promulgated many policies related to financial development, with the hope that the financial industry can achieve healthy development forming the effect that the financial development leads economic growth and economic stability. Through nearly 15 years of development, the actual economic policy effect shows that this economic policy idea is established, and financial development promotes economic growth and maintains economic stability. For a long time in the past, scholars at home and abroad have conducted extensive research on the factors that affect economic growth and economic volatility, but they have ignored an important factor—financial development. This paper divides financial development into financial quantitative development and financial quality development and divides the sample into two groups: advanced countries and emerging countries, which effectively explains the phenomenon that financial development has a more obvious impact on emerging countries. In recent years, many scholars have studied economic fluctuations from the perspective of financial development, and their research methods are mainly empirical. According to the different models, it can be divided into 6 types, such as DSGE, GARCH, multivariate cross-sectional econometric model, TVAR model, ECM model, etc., almost including most of the empirical methods of economics. These studies provide historical references for later researchers, but there are also some deficiencies. This paper establishes a fixed-effect panel model, takes the economic data of 50 countries from 1997 to 2014 as samples and the control variables that affect the economy are introduced from the two dimensions, ‘the supply and the demand’, respectively, to verify the relationship between GDP growth rate and GDP volatility and the quantity and quality of financial development.

The structure of this paper can be divided into five parts: the first part is literature review; the second part is theoretical mechanism; the third part is descriptive statistics; the fourth part is empirical model; the fifth part is conclusion.

2. Literature Review

2.1 Economic growth

Goldsmith (1969) discusses the intrinsic link between finance and economic growth and draw the conclusion that the financial superstructure can speed up the pace of economic growth and enhance the ability of economic activities. King (1993) uses nearly 30 years of panel data from 80 countries and concludes that there is a positive internal relationship between finance and economic growth. Through empirical research on the internal relationship between financial development and economic growth, Harris (1997) have shown that when the total income level of residents is at different stages, the correlation between the two is even opposite.

2.2 Economic volatility

Quadrini (2006) observes that the economic fluctuations in the United States in the last 20 years are much smaller than those in the previous 30 years and point out that the source of slowing economic fluctuations is financial innovation. Motto & Rostagno (2009) fit with European and US data and point out that shocks from financial markets play an important role in explaining economic cycles. Wahid & Jalil (2010) use China's 1977-2006 data to analyze the relationship between financial development and economic fluctuations and it is concluded that financial development helps to smooth economic fluctuations.

3. Descriptive Statistics

In order to handle the problem of missing data, the paper use the mean value to replace the missing data. The paper collects panel data of 50 countries from 1997 to 2014 as samples. Descriptive statistics were performed by StataSE and the Table 3-1 shows the outcomes of the descriptive statistics for main variable of interest. The results show that the mean value of economic growth is 3.3518, and the standard deviation between years is greater than the standard deviation between individuals. The mean value of output volatility is 0.0311, and the difference of standard deviation between years and individuals is small. The mean value of the quantitative indicator of financial development, 'Private credit by deposit money banks to GDP', is 65.1092, and the standard deviation between individuals is greater than the standard deviation between years, which indicates that from the view of quantity, the level of financial development has a more significant variety across individuals than years. The mean value of the qualitative indicator of financial development, 'Bank return on equity' is 12.7977, and the standard deviation between years is greater than the standard deviation between individuals, which is contrast to the outcome from the view of quantitative indicating that from the view of quality, the level of financial development has a more significant variety across years than individuals. Besides, the mean value of GDP at market prices is 25.9599. The mean value of General government final consumption expenditure is 17.1314% of GDP. The mean value of Trade is 90.4036% of GDP. The mean value of CPI is 5.7330.

Table 3-1 descriptive statistics

Variable		Mean	Std. dev.	Min	Max	Observations
Growth	overall	3.3518	3.7761	-14.8142	18.2866	N =900
	between		1.7165	0.4545	9.5183	n =50
	within		3.3717	-17.5557	19.0699	T =18
Volatility	overall	0.0311	0.0245	0.0029	0.2917	N =887

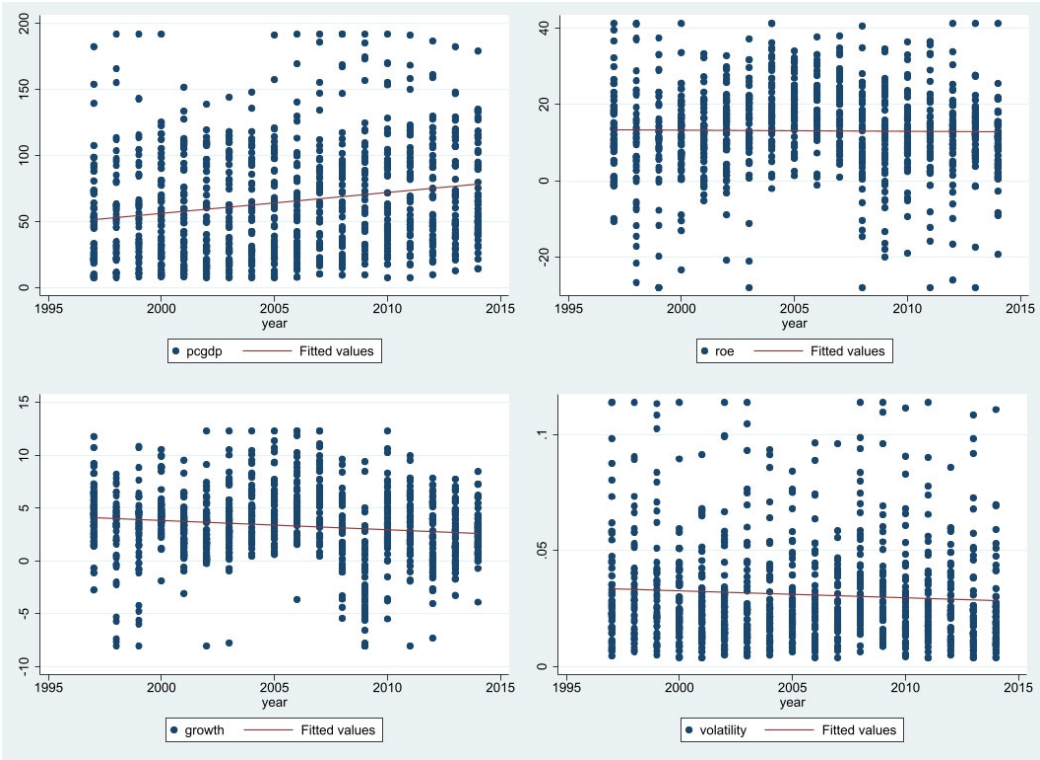
	between		0.0163	0.0055	0.6986	n =50
	within		0.0184	-0.0287	0.2530	T =17.74
pcgdp	overall	65.1029	42.3522	5.3888	262.4577	N =889
	between		37.4547	9.7732	144.7683	n =50
	within		20.3166	-49.5342	189.9754	T =17.78
roe	overall	12.7977	16.1678	-275.5843	71.7303	N =889
	between		6.2880	-0.1180	30.4626	n =50
	within		14.9229	-269.1811	67.4765	T =17.78
scale	overall	25.9599	2.0493	15.7586	30.4146	N =900
	between		2.0460	18.6911	30.2670	n =50
	within		0.3040	23.0274	28.8451	T =18
consumption	overall	17.1314	4.8464	4.8457	28.3898	N =900
	between		4.6998	5.1183	25.2886	n =50
	within		1.3479	11.1390	22.9327	T =18
trade	overall	91.4036	61.3041	18.7564	439.6567	N =900
	between		60.0055	26.1814	373.6411	n =50
	within		15.0208	31.6474	158.3619	T =18
cpi	overall	5.7330	35.1702	-4.4660	1037.473	N =900
	between		9.5252	0.0929	63.0477	n =50
	within		33.8811	-58.7287	980.1583	T =18

The data of the four important indicators of financial development, economic growth and economic volatility are made into scatter diagram, so that their trends from 1997 to 2014 can be seen more intuitively. The report calculates the aggregate trend for three groups, all the countries, advanced countries and emerging countries, respectively.

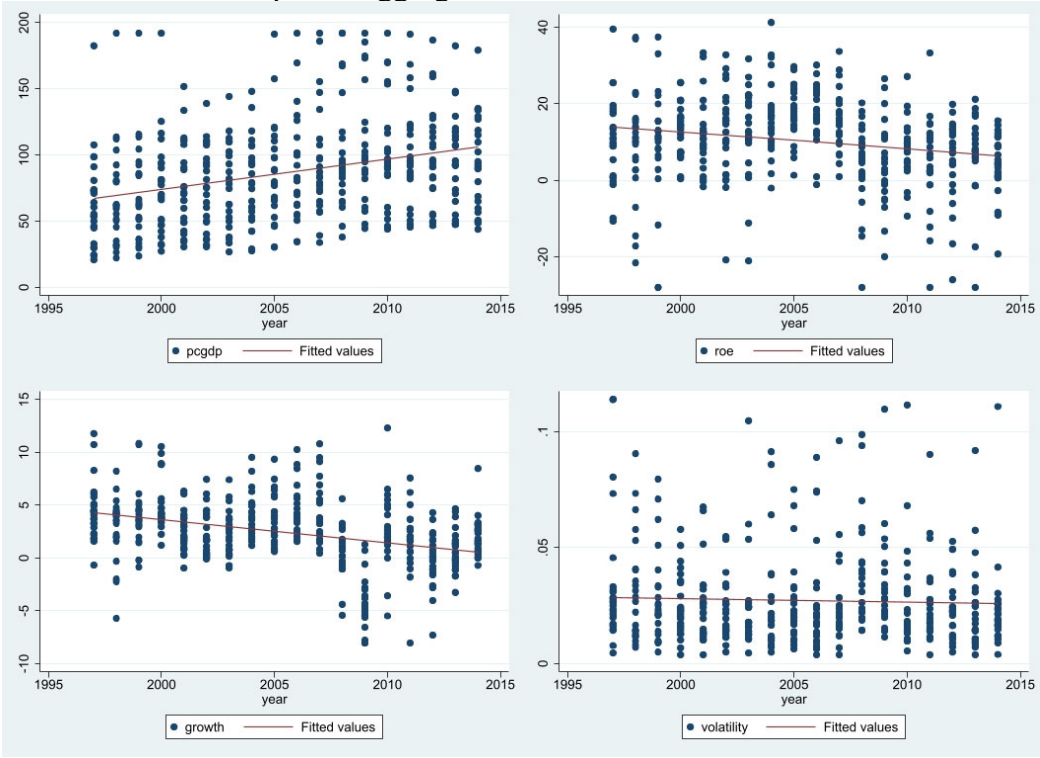
The Graph 3-1 shows the aggregate trend for all the countries from which we can discover that the Quantity of financial development has an upward trend, and the Quality of financial development is almost unchanged. However, both the economic growth and the economic volatility have down trends.

The Graph 3-2 shows the aggregate trend for advanced countries from which we can discover that the Quantity of financial development remains an upward trend, the economic volatility has a slightly down trend, and the quality of financial development and economic growth has an obviously down trend.

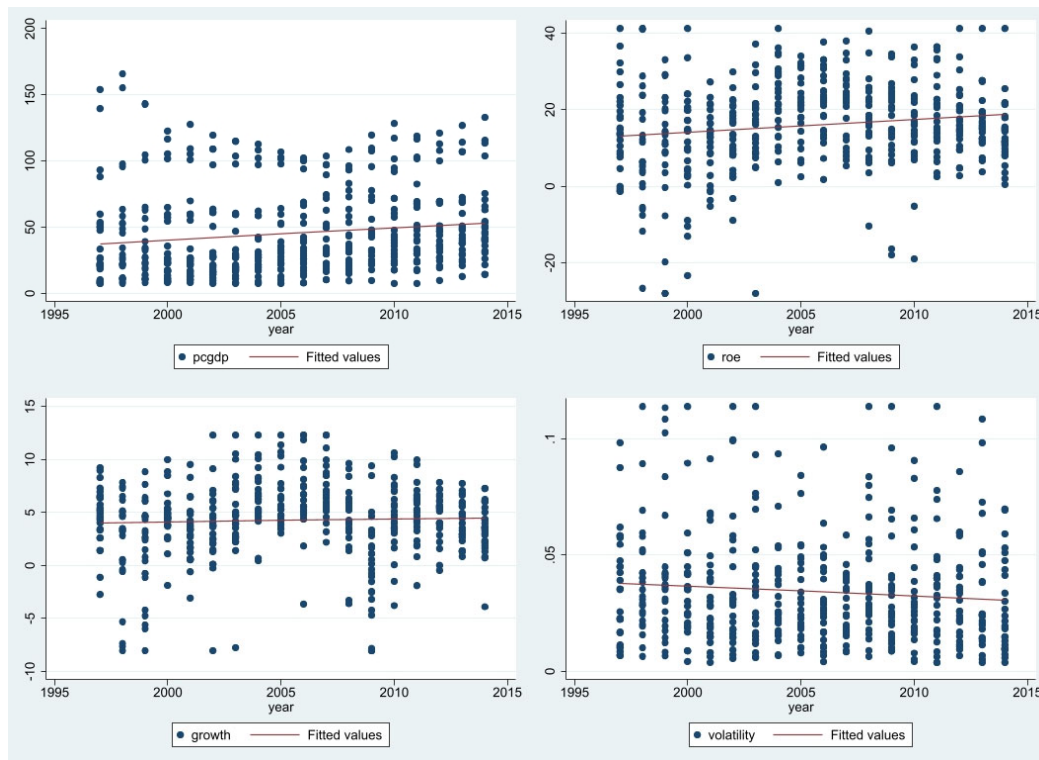
The Graph 3-3 shows the aggregate trend for emerging countries from which we can discover that both two financial developments have upward trends, the economic growth has a slight rise and the economic volatility has a down trend.



Graph 3-1 aggregate trend for all the countries



Graph 3-2 aggregate trend for advanced countries



Graph 3-3 aggregate trend for emerging countries

4. Empirical Model

4.1 Model design

Through the scatter diagram analysis in the previous section, it is concluded that financial development has different effects on economic growth and volatility, and the effects are different in advanced and emerging countries. This part will carry out a rigorous empirical analysis and use the measurement method to draw a stricter conclusion. There are two empirical models in this paper, which respectively verify the relationship between economic growth and economic volatility and financial development. Since each time period has a specific macroeconomic environment, it cannot be observed. Therefore, the paper adopts individual and time fixed effects. The regression models are settled as the following form:

$$GROWTH_{it} = \alpha + \beta FIN_{it} + X_{it} + \varepsilon_{it} \quad (1)$$

$$VOLATILITY_{it} = \alpha + \beta FIN_{it} + X_{it} + \varepsilon_{it} \quad (2)$$

Among them:

$GROWTH_{it}$ represents the annual GDP growth rate; $VOLATILITY_{it}$ represents the volatility of annual output; FIN_{it} indicates the degree of quantity and quality of financial development. As mentioned in the scatter diagram analysis section, the paper uses private credit by deposit money banks to GDP and bank return on equity as two measures of the degree of quantity and quality of financial development. X_{it} is a set of control variables including GDP at market prices, general government final consumption expenditure, trade and CPI. ε_{it} represents residual.

Table 4-1 The dependent and independent variables of the mode

	Variable meaning	Variable
Dependent variables	annual GDP growth rate	growth
	volatility of annual output	volatility
Independent variables	private credit by deposit money banks to GDP	pcgdp
	bank return on equity	roe
	GDP at market prices	scale

general government final consumption expenditure/GDP	consumption
Trade/GDP	trade
CPI Index	cpi

4.2 Interpretation of measurement results

(1) Model 1

The paper firstly explores the effect of financial development on the economic growth by using individual-fixed effects and time-fixed effects and divides the sample into all countries, advanced countries and emerging countries to explore respectively. The estimation results are shown from Table 4-2 to Table 4-7.

For all countries, the estimation results are shown in Table 4-2 and Table 4-3.

Table 4-2 mainly reports the empirical results of the effect of quantity of financial development on economic growth for the sample group of all countries. While using individual-fixed effects and time-fixed effects, the regressions all passed the F-test and the R² is 0.162. The coefficient of pcgdp is -0.017, indicating that when other variables are controlled the same, for every 1% increase in private credit by deposit money banks to GDP, the annual GDP growth rate will decrease by 0.017%. The t value is 3.76, significant within the 5% confidence interval, with economic significance and statistical significance. For other control variables, the coefficients of consumption, cpi and constant terms are significant under the 5% confidence interval, while the coefficients of scale and trade fail the t-test. To sum up, for all countries, the quantity of financial development dampens economic growth.

Table 4-2 the effect of quantity of financial development on the economic growth
(All countries)

	(1) Individual fixed effect	(2) Time fixed effect
pcgdp	-0.017*** (-3.76)	-0.017*** (-3.76)
scale	-0.060 (-0.77)	-0.060 (-0.77)
consumption	-0.189*** (-4.78)	-0.189*** (-4.78)
trade	0.004* (1.78)	0.004* (1.78)
cpi	-0.098*** (-2.94)	-0.098*** (-2.94)
_cons	9.334*** (4.64)	9.334*** (4.64)
N	900	900
r ²	0.162	0.162
r ² a	0.16	0.16

Table 4-3 mainly reports the empirical results of the effect of quality of financial development on economic growth for the sample group of all countries. While using individual-fixed effects and time-fixed effects, the regressions all passed the F-test and the R² is 0.209, illustrate that the quality of financial development can better match the economic growth than the quantity of financial development for all countries group. The coefficient of roe is 0.079, indicating that when other variables are controlled the same, for every 1% increase in bank return on equity, the annual GDP growth rate will increase by 0.079%. The t value is 5.52, significant within the 5% confidence interval, with economic significance and statistical significance. For other control variables, the coefficients

of consumption, cpi and constant terms are significant under the 5% confidence interval, while the coefficients of scale and trade fail the t-test. To sum up, for all countries, the quantity of financial development promotes economic growth which is contrast to the quality of financial development.

Table 4-3 the effect of quality of financial development on the economic growth
(All countries)

	(1) Individual fixed effect	(2) Time fixed effect
roe	0.079*** (5.52)	0.079*** (5.52)
scale	-0.135 (-1.53)	-0.135 (-1.53)
consumption	-0.208*** (-6.51)	-0.208*** (-6.51)
trade	0.001 (0.46)	0.001 (0.46)
cpi	-0.095*** (-3.43)	-0.095*** (-3.43)
_cons	9.725*** (4.40)	9.725*** (4.40)
N	900	900
r2	0.209	0.209
r2 a	0.20	0.20

For advanced countries, the estimation results are shown in Table 4-4 and Table 4-5.

Table 4-4 mainly reports the empirical results of the effect of quantity of financial development on economic growth for the sample group of advanced countries. While using individual-fixed effects and time-fixed effects, the regressions all passed the F-test and the R2 is 0.249, little higher than all countries group. The coefficient of pcgdp is -0.013, indicating that when other variables are controlled the same, for every 1% increase in private credit by deposit money banks to GDP, the annual GDP growth rate will decrease by 0.013%. The t value is -4.68, significant within the 5% confidence interval, with economic significance and statistical significance. For other control variables, the coefficients of scale, consumption, trade and constant terms are significant under the 5% confidence interval, while the coefficient of cpi fails the t-test. To sum up, for advanced countries, the quantity of financial development dampens economic growth while is as same to the result of all countries group.

Table 4-4 the effect of quantity of financial development on the economic growth
(Advanced countries)

	(1) Individual fixed effect	(2) Time fixed effect
pcgdp	-0.013*** (-4.68)	-0.013*** (-4.68)
scale	-0.293*** (-3.18)	-0.293*** (-3.18)
consumption	-0.148*** (-3.78)	-0.148*** (-3.78)
trade	0.006*** (3.48)	0.006*** (3.48)
cpi	-0.112* (-1.74)	-0.112* (-1.74)

_cons	13.922*** (4.96)	13.922*** (4.96)
N	432	432
r2	0.249	0.249
r2_a	0.24	0.24

Table 4-5 mainly reports the empirical results of the effect of quality of financial development on economic growth for the sample group of advanced countries. While using individual-fixed effects and time-fixed effects, the regressions all passed the F-test and the R2 is 0.262, having similar ability to explanation. The coefficient of roe is 0.054, indicating that when other variables are controlled the same, for every 1% increase in bank return on equity, the annual GDP growth rate will increase by 0.054%. The t value is 3.74, significant within the 5% confidence interval, with economic significance and statistical significance. For other control variables, the coefficients of scale, consumption, trade and constant terms are significant under the 5% confidence interval, while the coefficient of cpi fails the t-test. To sum up, for advanced countries, the quantity of financial development promotes economic growth.

Table 4-5 the effect of quality of financial development on the economic growth
(Advanced countries)

	(1) Individual fixed effect	(2) Time fixed effect
roe	0.054*** (3.74)	0.054*** (3.74)
scale	-0.308*** (-3.39)	-0.308*** (-3.39)
consumption	-0.196*** (-4.90)	-0.196*** (-4.90)
trade	0.005** (2.73)	0.005** (2.73)
cpi	-0.094* (-1.80)	-0.094* (-1.80)
_cons	13.639*** (4.97)	13.639*** (4.97)
N	432	432
r2	0.262	0.262
r2_a	0.25	0.25

For emerging countries, the estimation results are shown in Table 4-6 and Table 4-7.

Table 4-6 mainly reports the empirical results of the effect of quantity of financial development on economic growth for the sample group of emerging countries. While using individual-fixed effects and time-fixed effects, the regressions all passed the F-test and the R2 is 0.087, obviously lower than the group of all countries and advanced countries. The coefficient of pcgdp is -0.003, indicating that when other variables are controlled the same, for every 1% increase in private credit by deposit money banks to GDP, the annual GDP growth rate will decrease by 0.003%. The t value is -0.29, insignificant within the 5% confidence interval, with only economic significance. For other control variables, the coefficients of scale, consumption and cpi are significant under the 5% confidence interval, while the coefficients of trade and constant terms fail the t-test. To sum up, for emerging countries, the quantity of financial development dampens economic growth but is not significant.

Table 4-6 the effect of quantity of financial development on the economic growth
(Emerging countries)

	(1) Individual fixed effect	(2) Time fixed effect
pcgdp	-0.003 (-0.29)	-0.003 (-0.29)
scale	0.300*** (3.02)	0.300*** (3.02)
consumption	-0.099** (-2.45)	-0.099** (-2.45)
trade	-0.004 (-1.09)	-0.004 (-1.09)
cpi	-0.115*** (-3.40)	-0.115*** (-3.40)
_cons	-0.856 (-0.34)	-0.856 (-0.34)
N	468	468
r2	0.087	0.087
r2_a	0.08	0.08

Table 4-7 mainly reports the empirical results of the effect of quality of financial development on economic growth for the sample group of emerging countries. While using individual-fixed effects and time-fixed effects, the regressions all passed the F-test and the R2 is 0.129, similar to the result of previous return and obviously lower than the group of all countries and advanced countries. The coefficient of roe is 0.060, indicating that when other variables are controlled the same, for every 1% increase in bank return on equity, the annual GDP growth rate will increase by 0.060%. The t value is 3.48, significant within the 5% confidence interval, with economic significance and statistical significance. For other control variables, the coefficients of consumption and cpi are significant under the 5% confidence interval, while the coefficient of scale, trade and constant terms fail the t-test. To sum up, for emerging countries, the quality of financial development promotes economic growth.

Table 4-7 the effect of quality of financial development on the economic growth
(Emerging countries)

	(1) Individual fixed effect	(2) Time fixed effect
roe	0.060*** (3.48)	0.060*** (3.48)
scale	0.247* (2.01)	0.247* (2.01)
consumption	-0.087** (-2.26)	-0.087** (-2.26)
trade	-0.004 (-0.96)	-0.004 (-0.96)
cpi	-0.119*** (-3.76)	-0.119*** (-3.76)
_cons	-0.718 (-0.23)	-0.718 (-0.23)
N	468	468
r2	0.129	0.129
r2_a	0.12	0.12

From the exploration of the effect of financial development on the economic growth, we can jump into the conclusion that the quantity of financial development dampens economic growth, and the quality of financial development promotes economic growth, no matter for all countries, advanced countries or emerging countries.

(2) Model 2

Then the paper explores the effect of financial development on economic volatility by using individual-fixed effects and time-fixed effects and also divides the sample into all countries, advanced countries and emerging countries to explore respectively. The estimation results are shown from Table 4-8 to Table 4-13.

For all countries, the estimation results are shown in Table 4-8 and Table 4-9.

Table 4-8 mainly reports the empirical results of the effect of quantity of financial development on economic volatility for the sample group of all countries. While using individual-fixed effects and time-fixed effects, the regressions all passed the F-test and the R² is 0.219. The coefficient of pcgdp is -0.0000462, indicating that when other variables are controlled the same, for every 1% increase in private credit by deposit money banks to GDP, the annual GDP growth rate will decrease by 0.0000462%. The t value is -2.25, significant within the 5% confidence interval, only with statistical significance. For all control variables including scale, consumption, trade, cpi and constant terms are significant under the 5% confidence interval. To sum up, for all countries, the quantity of financial development decreases economic volatility, although the effect is almost negligible.

Table 4-8 the effect of quantity of financial development on the economic volatility
(All countries)

	(1) Individual fixed effect	(2) Time fixed effect
pcgdp	-0.000** (-2.25)	-0.000** (-2.25)
scale	-0.003*** (-8.78)	-0.003*** (-8.78)
consumption	-0.001*** (-4.69)	-0.001*** (-4.69)
trade	0.000*** (6.28)	0.000*** (6.28)
cpi	0.000** (2.38)	0.000** (2.38)
_cons	0.109*** (12.78)	0.109*** (12.78)
N	900	900
r ²	0.219	0.219
r ² a	0.21	0.21

Table 4-9 mainly reports the empirical results of the effect of quality of financial development on economic volatility for the sample group of all countries. While using individual-fixed effects and time-fixed effects, the regressions all passed the F-test and the R² is 0.214. The coefficient of roe is -0.0000337, indicating that when other variables are controlled the same, for every 1% increase in bank return on equity, the annual GDP growth rate will decrease by -0.0000337%. The t value is -0.55, insignificant within the 5% confidence interval, with neither economic significance nor statistical significance. For all control variables including scale, consumption, trade, cpi and constant terms are significant under the 5% confidence interval. To sum up, for all countries, the quality of

financial development decreases economic volatility, but the effect is very small, which is same to the conclusion of the effect of quantity of financial development on the economic volatility.

Table 4-9 the effect of quality of financial development on the economic volatility
(All countries)

	(1) Individual fixed effect	(2) Time fixed effect
roe	-0.000 (-0.55)	-0.000 (-0.55)
scale	-0.003*** (-8.71)	-0.003*** (-8.71)
consumption	-0.001*** (-6.14)	-0.001*** (-6.14)
trade	0.000*** (5.02)	0.000*** (5.02)
cpi	0.001*** (3.04)	0.001*** (3.04)
_cons	0.118*** (12.55)	0.118*** (12.55)
N	900	900
r2	0.214	0.214
r2 a	0.21	0.21

For advanced countries, the estimation results are shown in Table 4-10 and Table 4-11.

Table 4-10 mainly reports the empirical results of the effect of quantity of financial development on economic volatility for the sample group of advanced countries. While using individual-fixed effects and time-fixed effects, the regressions all passed the F-test and the R2 is 0.333, higher than the regression results above. The coefficient of pcgdp is 0.0000436, indicating that when other variables are controlled the same, for every 1% increase in private credit by deposit money banks to GDP, the annual GDP growth rate will increase by 0.0000436%. The t value is 1.21, insignificant within the 5% confidence interval, with neither economic significance nor statistical significance. For other control variables, the coefficients of scale, trade and constant terms are significant under the 5% confidence interval, while the coefficients of consumption and cpi fail the t-test. To sum up, for advanced countries, the quantity of financial development increases economic volatility.

Table 4-10 the effect of quantity of financial development on the economic volatility
(Advanced countries)

	(1) Individual fixed effect	(2) Time fixed effect
pcgdp	0.000 (1.21)	0.000 (1.21)
scale	-0.001** (-2.53)	-0.001** (-2.53)
consumption	0.000 (0.59)	0.000 (0.59)
trade	0.000*** (9.48)	0.000*** (9.48)
cpi	0.000 (0.05)	0.000 (0.05)
_cons	0.028** (2.27)	0.028** (2.27)

N	432	432
r ²	0.333	0.333
r ² _a	0.32	0.32

Table 4-11 mainly reports the empirical results of the effect of quality of financial development on economic volatility for the sample group of advanced countries. While using individual-fixed effects and time-fixed effects, the regressions all passed the F-test and the R² is 0.335, possess a high level of explanation ability. The coefficient roe is -0.0001816, indicating that when other variables are controlled the same, for every 1% increase in bank return on equity, the annual GDP growth rate will decrease by 0.0001816%. The t value is -2.16, significant within the 5% confidence interval, with only statistical significance. For other control variables, the coefficients of scale, trade and constant terms are significant under the 5% confidence interval, while the coefficients of consumption and cpi fail the t-test. To sum up, for advanced countries, the quality of financial development decreases economic volatility which is different to the result of quantity.

Table 4-11 the effect of quality of financial development on the economic volatility
(Advanced countries)

	(1) Individual fixed effect	(2) Time fixed effect
roe	-0.000** (-2.16)	-0.000** (-2.16)
scale	-0.001** (-2.36)	-0.001** (-2.36)
consumption	0.000 (1.13)	0.000 (1.13)
trade	0.000*** (9.57)	0.000*** (9.57)
cpi	-0.000 (-0.12)	-0.000 (-0.12)
_cons	0.028** (2.28)	0.028** (2.28)
N	432	432
r ²	0.335	0.335
r ² _a	0.33	0.33

For emerging countries, the estimation results are shown in Table 4-12 and Table 4-13.

Table 4-12 mainly reports the empirical results of the effect of quantity of financial development on economic volatility for the sample group of emerging countries. While using individual-fixed effects and time-fixed effects, the regressions all passed the F-test and the R² is 0.244. The coefficient of pcgdp is -0.0001313, indicating that when other variables are controlled the same, for every 1% increase in private credit by deposit money banks to GDP, the annual GDP growth rate will decrease by 0.0001313%. The t value is -3.89, significant within the 5% confidence interval, only with statistical significance. For all control variables including scale, consumption, trade, cpi and constant terms are significant under the 5% confidence interval. To sum up, for emerging countries, the quantity of financial development decreases economic volatility, the effect does not have economic significance.

Table 4-12 the effect of quantity of financial development on the economic volatility
(Emerging countries)

	(1) Individual fixed effect	(2) Time fixed effect
pcgdp	-0.000*** (-3.89)	-0.000*** (-3.89)
scale	-0.005*** (-8.57)	-0.005*** (-8.57)
consumption	-0.001*** (-7.63)	-0.001*** (-7.63)
trade	0.000** (2.38)	0.000** (2.38)
cpi	0.001** (2.36)	0.001** (2.36)
_cons	0.181*** (11.88)	0.181*** (11.88)
N	468	468
r2	0.244	0.244
r2_a	0.24	0.24

Table 4-13 mainly reports the empirical results of the effect of quality of financial development on economic volatility for the sample group of emerging countries. While using individual-fixed effects and time-fixed effects, the regressions all passed the F-test and the R2 is 0.230. The coefficient of roe is 0.0001033, indicating that when other variables are controlled the same, for every 1% increase in bank return on equity, the annual GDP growth rate will increase by 0.0001033%. The t value is 0.89, insignificant within the 5% confidence interval, with neither economic significance nor statistical significance. For other control variables, the coefficients of scale, consumption, cpi and constant terms are significant under the 5% confidence interval, while the coefficient of trade fails the t-test. To sum up, for emerging countries, the quality of financial development increases economic volatility slightly.

Table 4-13 the effect of quality of financial development on the economic volatility
(Emerging countries)

	(1) Individual fixed effect	(2) Time fixed effect
roe	0.000 (0.89)	0.000 (0.89)
scale	-0.006*** (-11.63)	-0.006*** (-11.63)
consumption	-0.001*** (-7.05)	-0.001*** (-7.05)
trade	-0.000 (-1.09)	-0.000 (-1.09)
cpi	0.001*** (3.02)	0.001*** (3.02)
_cons	0.207*** (15.27)	0.207*** (15.27)
N	468	468
r2	0.230	0.230
r2_a	0.22	0.22

From the exploration of the effect of financial development on economic volatility, we can jump into the conclusion that the effects of both the quantity and quality of financial development on economic volatility is quite small which even have no economic significance. Furthermore, the statistical significance is also uncertain, nearly half of the coefficients of pcgdp or roe are insignificant. The quantity of financial development will increase the economic volatility of advanced country but decrease the one of emerging country and the quality of financial development can decrease the economic volatility of advanced country and increase the one of emerging country. For all the countries, the development of finance can decrease the finance volatility, no matter quantitatively or qualitatively.

4.3 Interpretation of mixed regression estimation results

In order to obtain the robust standard errors by different methods, the paper conduct the mixed regression estimation, abandoning using fixed-individual effect and fixed-time effect, to see whether the regression results are significant or not. The regression divides the data into advanced countries group and emerging countries group. The outcomes of the regression are shown in Table 4-14.

Table 4-14 mainly reports the empirical results of mixed regression estimation and the regressions all passed the F-test.

To analyze the effect of financial development on economic growth. The coefficient of pcgdp is -0.019, indicating that when other variables are controlled the same, for every 1% increase in private credit by deposit money banks to GDP, the annual GDP growth rate will decrease by 0.019%. The t value is -4.94, significant within the 5% confidence interval, with economic significance and statistical significance. The coefficient of roe is 0.099, indicating that when other variables are controlled the same, for every 1% increase in bank return on equity, the annual GDP growth rate will increase by 0.099%. The t value is 9.34, significant within the 5% confidence interval, with economic significance and statistical significance. According to mixed regression estimation, the quantity of financial development dampens economic growth while the quality of financial development promotes economic growth.

To analyze the effect of financial development on economic volatility. The coefficient of pcgdp is -0.0000423, indicating that when other variables are controlled the same, for every 1% increase in private credit by deposit money banks to GDP, the annual GDP growth rate will decrease by 0.0000423%. The t value is -2.08, significant within the 5% confidence interval, with only statistical significance. The coefficient of roe is -0.0000728, indicating that when other variables are controlled the same, for every 1% increase in bank return on equity, the annual GDP growth rate will decrease by 0.0000728%. The t value is -1.22, significant within the 5% confidence interval, with neither economic significance nor statistical significance. According to mixed regression estimation, both the quantity and quality of financial development decrease economic volatility to a very small extent.

Table 4-14 mixed regression estimation results

	(1) economic growth	(2) economic growth	(3) economic volatility	(4) economic volatility
pcgdp	-0.019*** (-4.94)		-0.000** (-2.08)	
roe		0.099*** (9.34)		-0.000 (-1.22)
scale	-0.056 (-0.77)	-0.146** (-2.31)	-0.003*** (-6.81)	-0.003*** (-7.76)
consumption	-0.208*** (-8.42)	-0.221*** (-9.81)	-0.001*** (-3.70)	-0.001*** (-4.75)
trade	0.004*	0.001	0.000***	0.000***

	(1.95)	(0.58)	(5.28)	(4.70)
cpi	-0.097***	-0.089***	0.001***	0.001***
	(-3.09)	(-2.76)	(3.18)	(3.65)
_cons	9.665***	9.927***	0.110***	0.119***
	(4.79)	(5.44)	(8.98)	(9.87)
N	900	900	900	900
r2	0.153	0.224	0.219	0.216
r2_a	0.15	0.22	0.21	0.21

4.4 Interpretation of nonlinear regression estimation results

For better fitting, the paper constructs the nonlinear relationship of financial development and economic growth and economic volatility by adding the square of financial development indicators to identify a nonlinear effect. Therefore, the paper adopts two nonlinear regression models. The regression models are settled as the following form:

$$\text{GROWTH}_i = \alpha + \beta_1 \text{FIN}_i + \beta_2 \text{FIN}_i^2 + X_i + \varepsilon_i \quad (3)$$

$$\text{VOLATILITY}_i = \alpha + \beta_1 \text{FIN}_i + \beta_2 \text{FIN}_i^2 + X_i + \varepsilon_i \quad (4)$$

Table 4-15 mainly reports the empirical results of nonlinear regression estimation and the regressions all passed the F-test. However, the result is unsatisfied and the R2 is far below the one of mixed regression estimation which means nonlinear regression estimation fits less well.

To analyze the effect of financial development on economic growth. The coefficient of pcgdp is -0.116. The t value is -7.48, significant within the 5% confidence interval, with economic significance and statistical significance. The coefficient of pcgdp2 is 0.0003065. The t value is 3.77, significant within the 5% confidence interval, with only statistical significance. The coefficient of roe is 0.096. The t value is 4.86, significant within the 5% confidence interval, with economic significance and statistical significance. The coefficient of pcgdp2 is -0.0001629. The t value is -0.30, insignificant within the 5% confidence interval, with neither economic significance nor statistical significance.

To analyze the effect of financial development on economic volatility. The coefficient of pcgdp is -0.0003312. The t value is -2.07, significant within the 5% confidence interval, with only statistical significance. The coefficient of pcgdp2 is 0.000. The t value is 1.64, insignificant within the 5% confidence interval, with neither economic significance nor statistical significance. The coefficient of roe is -0.000061. The t value is -0.62, insignificant within the 5% confidence interval, with neither economic significance nor statistical significance. The coefficient of pcgdp2 is 0.000. The t value is 0.54, insignificant within the 5% confidence interval, with neither economic significance nor statistical significance.

Since the goodness of fit is too low, we think the linear regression model is a better choice.

Table 4-15 nonlinear regression estimation model

	(1) economic growth	(2) economic growth	(3) economic volatility	(4) economic volatility
pcgdp	-0.116*** (-7.48)		-0.000** (-2.07)	
pcgdp2	0.000*** (3.77)		0.000 (1.64)	
roe		0.096*** (4.86)		-0.000 (-0.62)
roe2		-0.000 (-0.30)		0.000 (0.54)
scale	0.911 (0.93)	-0.556 (-1.35)	0.001 (0.23)	-0.002 (-0.37)
consumption	-0.749***	-0.724***	0.001	0.000

	(-6.35)	(-4.87)	(1.26)	(0.70)
trade	0.012	-0.005	0.000	0.000
	(1.28)	(-0.53)	(1.15)	(0.19)
cpi	-0.118***	-0.106**	0.001***	0.001***
	(-3.14)	(-2.55)	(4.38)	(4.77)
_cons	-2.367	29.892***	-0.002	0.070
	(-0.09)	(2.83)	(-0.01)	(0.52)
N	900	900	900	900
r2	0.245	0.221	0.052	0.025
r2 a	0.24	0.22	0.05	0.02

4.5 Endogenous test and solution

The endogeneity problem refers to one or more explanatory variables in the model have correlation to the error term. So that it is necessary to make endogenous test. The paper use Granger causality test to judge whether there is the endogeneity of financial development and economic growth, the results are shown in Table 4-16.

From table 4-16, the z-bar tilde for growth to pcgdp is 18.9476 and the p-value is 0 so we rejected the hypothesis and achieve the conclusion that economic growth does Granger-cause private credit by deposit money banks to GDP for at least one panel. The z-bar tilde for pcgdp to growth is 6.3599 and the p-value is 0 so we rejected the hypothesis and achieve the conclusion that Granger-cause private credit by deposit money banks to GDP does economic growth for at least one panel. As a result, economic growth and private credit by deposit money banks to GDP are Granger causality and private credit by deposit money banks to GDP is an endogenous variable.

Table 4-16 Granger causality test results

	(1) growth to pcgdp	(2) pcgdp to growth
W-bar	6.2075	2.8587
Z-bar	26.0736	9.2933
	(p-value=0)	(p-value=0)
Z-bar tilde	18.9476	6.3599
	(p-value=0)	(p-value=0)

In order to solve the endogeneity problem, we choose the secured creditors 1st in liquidation as the instrument variable and make 2sls regression. After testing, secured creditors 1st in liquidation is a strong instrumental variable. Then the paper makes the 2sls regression and the outcome of the regression is showed in Table 4-17.

Table 4-17 mainly reports the 2SLS regression results of the effect of quantity of financial development on the economic growth. While using the instrumental variable, secured creditors 1st in liquidation, the regression passes the F-test and the R2 is 0.198. The coefficient of pcgdp is 0.016, indicating that when other variables are controlled the same, for every 1% increase in private credit by deposit money banks to GDP, the annual GDP growth rate will increase by 0.016%. The t value is 1.13, insignificant within the 5% confidence interval, with only economic significance. For all the other control variables, the coefficients of scale, consumption, cpi and constant terms are significant under the 5% confidence interval, while the coefficient of trade fails the t-test. To sum up, the quantity of financial development promotes economic growth after solving the problem of endogeneity.

Table 4-17 2SLS regression results

	(1) pcgdp	(2) growth
secu_1st	25.643*** (7.45)	
scale	3.931*** (3.28)	-0.487*** (-3.29)
consumption	3.239*** (11.61)	-0.339*** (-5.78)
trade	0.201*** (8.59)	-0.004 (-0.89)
cpi	-1.477*** (-6.09)	-0.099*** (-3.23)
pcgdp		0.016 (1.13)
_cons	-116.276*** (-3.50)	21.251*** (5.17)
N	540	540
r2	0.493	0.198
r2 a	0.49	0.19

4.6 The effect of financial development on economic recession

Furthermore, the paper use panel logistic model to explore how financial development affects economic recession and the outcomes are shown in Table 4-18.

The results show that the t-value of pcgdp is 2.53 and its coefficient is positive indicating that an increase in quantity of financial development increases the probability of falling into recession under 95% confidence level. The t-value of roe is -3.28, and the correlation coefficient is negative, which means an increase in quality of financial development significantly reduces the probability of falling into recession under 95% significance level.

Table 4-18 panel logistic model result

	(1) modelcoef	(2) modelodds	(3) mode2coef	(4) mode2odds
pcgdp	0.00711** (2.53)	0.00711** (2.53)		
scale	-0.0800 (-1.41)	-0.0800 (-1.41)	-0.0456 (-0.83)	-0.0456 (-0.83)
consumption	0.00739 (0.30)	0.00739 (0.30)	0.0194 (0.84)	0.0194 (0.84)
trade	-0.000794 (-0.40)	-0.000794 (-0.40)	0.000550 (0.29)	0.000550 (0.29)
cpi	0.0333* (1.88)	0.0333* (1.88)	0.0278 (1.57)	0.0278 (1.57)
roe			-0.0271*** (-3.28)	-0.0271*** (-3.28)
_cons	-0.624 (-0.39)	-0.624 (-0.39)	-1.018 (-0.65)	-1.018 (-0.65)
N	900	900	900	900
R2				
adj. R2				

5. Conclusion

The financial development plays an important role in economic growth and economic volatility. The quantity of financial development dampens economic growth, and the quality of financial development promotes economic growth, no matter for all countries, advanced countries or emerging countries. However, after solving the endogeneity problem, the quantity of financial development promotes economic growth. The effects of both the quantity and quality of financial development on economic volatility is quite small and uncertain which is related to the region. The quantity of financial development will increase the economic volatility of advanced country but decrease the one of emerging country and the quality of financial development can decrease the economic volatility of advanced country and increase the one of emerging country. For all the countries, the development of finance can decrease the finance volatility, no matter quantitatively or qualitatively. After exploring the effect of financial development on economic recession, the paper finds that an increase in quantity of financial development increases the probability of falling into recession but an increase in quality of financial development significantly reduces the probability of falling into recession. As a result, the government should pay more attention to build a high-quality financial development model.

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