1997−2014 DEA−Malmquist

GMM

Total Factor Productivity TFP

20 70

TFP

TFP

TFP TFP

King et al. 1993

TFP Beck et al. 2000 Buera et al. 2011

TFP

TFP

Dasgupta 2004

2015

1997-2014

TFP TFP

1.

$Y_{it}=A_{it}\times F\ L_{it}\ K_{it}$ 1

$Y$ $A$ TFP $L$ $K$

$i$ $t$ TFP $A_{it}$

$A_{it}=\delta_{it}\times FD_{it}^{\alpha}\times X_{it}^{\beta}$ 2

$FD_{it}$ $X_{it}$ $\delta_{it}$ TFP $\alpha$ $\beta$

2

$A_{it}=\delta_{it}\times NF_{it}^{\alpha_1}\times INF_{it}^{\alpha_2}\ X_{it}^{\beta}$ 3

$NF_{it}$ $INF_{it}$ $\alpha_1$ $\alpha_2$ 3

$\ln A_{it}=\ln \delta_{it}+\alpha_1 \ln NF_{it}+\alpha_2 \ln INF_{it}+\beta \ln X_{it}$ 4

TFP TP TE

$\ln TFP_{it}=\alpha+\alpha_0 \ln TFP_{it-1}+\alpha_1 \ln NF_{it}+\alpha_2 \ln INF_{it}+\beta_1^{'} \ln X_{it}+H_{1i}+\varepsilon_{1it}$ 5

$\ln TP_{it}=\varphi+\varphi_0 \ln TP_{it-1}+\varphi_1 \ln NF_{it}+\varphi_2 \ln INF_{it}+\beta_2^{'} \ln X_{it}+H_{2i}+\varepsilon_{2it}$ 6

$\ln TE_{it}=\gamma+\gamma_0 \ln TE_{it-1}+\gamma_1 \ln NF_{it}+\gamma_2 \ln INF_{it}+\beta_3^{'} \ln X_{it}+H_{3i}+\varepsilon_{3it}$ 7

$H_i$ $\alpha$ $\varphi$ $\gamma$ $\beta^{'}$ $\varepsilon_{it}$

HUM EX

FDI DISA CUL URBAN

2.

1997-2014 30

30

1998-2015

GDP

3.

1 TFP

TFP

DEA-Malmquist DEA-Malmquist TFP

DEA-Malmquist

Fare et al.

1998

TFP

DEA-Malmquist

1997-2014

30

DEA-Malmquist

TFP

GDP

1997

DEAP 2.1 1997-2014

30 TFP TFP

TP

TE 1 3

1997-2014

TFP 6.6% TFP

6.4% 0.2%

TFP

2

2012

2010 GDP

2013

NF

INF GDP

1997 1

Andreas 2014

3

HUM

6

6 =0

=6 =9 =12 =16

EX

FDI

DISA

CUL

URBAN

TFP

TFP

Arellano et al. 1991 GMM

GMM GMM

Blundell et al. 1998 Blundell et al.

1998 GMM

GMM GMM

GMM

GMM

one-step two-step

GMM GMM

Roodman 2006

GMM Stata12.0

2

2 GMM

|  | 1 | 2 | 3 |
|---|---|---|---|
| lnTFP -1 | 0.0742*** 2.90 |  |  |
| lnTP -1 |  | 0.1254*** 3.27 |  |
| lnTE -1 |  |  | 0.0912*** 2.98 |
| lnNF | 0.0191** 2.25 | 0.0257*** 3.71 | -0.0002 -0.57 |
| lnINF | 0.0403*** 2.93 | 0.0037* 1.69 | 0.0366*** 3.01 |
| lnHUM | 0.1432** 2.04 | 0.7587** 2.28 | 0.0829* 1.76 |
| lnEX | 0.0458* 1.74 | 0.0076 1.18 | 0.0485** 2.22 |
| lnFDI | -0.0402 -1.56 | 0.0023 0.93 | -0.0149 -0.75 |
| lnDISA | -0.0034 -1.36 | -0.0015 -1.03 | -0.0009 -1.25 |
| lnCUL | 0.0299* 1.89 | 0.0161 0.93 | 0.0751** 2.32 |
| lnURBAN | 0.0379* 1.85 | 0.2015*** 3.86 | 0.0795* 1.81 |
|  | 0.6967 1.03 | -1.8316** -2.45 | -0.3821 -0.91 |
| Wald | 606.39[0.0000] | 646.37[0.0000] | 379.26[0.0000] |
| AR 1 | 0.0012 | 0.0070 | 0.0018 |
| AR 2 | 0.4136 | 0.2201 | 0.2425 |
| Sargan | 0.9890 | 0.9710 | 0.9910 |
|  | 540 | 540 | 540 |

z Wald P AR 1 AR 2 Sargan P * ** *** 10% 5% 1%

2 1 2 3 AR 2 P 0.1

GMM

Sargan P

1%

1 NF INF TFP

TFP

2 1%

10%

3

1%

TFP

TFP

Hoff et al.

1990

TFP

TFP

Kai

no 2005 2012

HUM TFP

TFP

EX TFP 10%

5% TFP

FDI TFP

2006

2005

1997

1997-2014 DEA-Malmquist
TFP GMM
TFP 1997-2014
TFP 6.6% TFP

TFP
TFP

1997-2006 2007-2014 TFP
2007-2014

TFP

TFP

1.

13. Arestis P., Georgios C.and D. Evangelia., 2006. Financial Development and Productive Efficiency in OECD Countries: An Exploratory Analysis. Manchester School, Vol.4: 417-440.

14. Aziz J.and C. Duenwald., 2002. Growth-Financial Intermediation Nexus in China. IMF Working Paper, No.194.

15. Beck T., Levine R. and Loayza N., 2000. Finance and the Sources of Growth. Journal of Financial Economics, Vol.58: 261-300.

16. Blundell R. and S. Bond., 1998. Initial Conditions and Moment Restrictions in Dynamic Panel Data Models. Journal of Econometrics, Vol.87: 115-143.

17. Buera F., Kaboski J.and Shin Y., 2011. Finance and Development: A Tale of Two Sectors. American Economic Review, Vol.101, No.5: 1964-2002.

18. Dasgupta B., 2004. Capital accumulation in the presence of informal credit contracts: Does the incentive mechanism work better than credit rationing under asymmetric information? University of Connecticut, Department of Economics Working Paper Series.

19. Fare R., Grosskopf S. and Russell R R., 1998. Index Numbers: Essays in Honor of Sten Malmquist [M]. Boston: Kluwer Academic Publishers.

20. Hoff K. and Stiglitz J., 1990. Imperfect Information and Rural Credit Markets: Puzzles and Policy Perspectives. World Bank Economic Review. Vol.5: 235-250.

21. Jeanneney S., Hua P. and Z Liang., 2006. Financial Development, Economic Efficiency, and Productivity Growth: Evidence from China. The Developing Economies, Vol.1: 27-52.

Based on China s provincial panel data from 1997 to 2014, this paper measures the agricultural total factor productivity of China and the developmental level of rural formal and informal finance by use the DEA-Malmquist index method and the Indirect Estimation Method. Then the paper analyzes the influences of the rural formal and informal financial development to the agricultural Total Factor Productivity growth and identifies its intermediate channel. The results show that from 1997 to 2014, the agricultural Total Factor Productivity is mainly driven by the agricultural technology progress; rural formal and informal financial development both has a significant role in promoting for the agricultural Total Factor Productivity growth, but the intermediate channel is different. Formal finance mainly through the channel of technical progress?to promote the agricultural Total Factor Productivity growth, and informal finance mainly through the technical efficiency channel. The auxo-action of rural formal and informal finance development to the agricultural Total Factor Productivity growth in the period 2007-2014 is significantly larger than during 1997-2006. This research conclusion to a certain extent supports the point of view that complementary relationship exists between rural formal and informal finance.

formal finance; informal finance; agricultural total factor productivity; system GMM