Does Growth Cause Financial Deregulation in China? An Instrumental Variables Approach

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Abstract

Following Miguel et al. (2004), we use temperature and hours of sunshine variations as instrumental variables for economic growth in 27 Chinese provinces during 1981–98. Our 2SLS (Two-stage least squares) regression finds that growth has no significant effect on financial deregulation after controlling for predetermined home-bias political variable, population size, and time and province effects. Moreover, the home-bias political variable has a significant effect on financial deregulation, which shows that political and cultural factors are important driving forces in determining the path and logic of Chinese financial deregulation. The results hold up when we use GMM (Generalized method of moments) to deal with heteroskedasticity. The results are also robust in LIML (Limited information maximum likelihood) estimation that deals with weak instruments.

JEL Classification: O43, C23

Keywords: Financial Deregulation; Growth; Causality

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1 Introduction

The role of financial sector in the process of economic development has gained long-standing attention from academics and policy makers alike. This is understandable since financial sector is essential for the functioning of a capitalist society. Unfortunately, there is a debate on the finance-growth nexus (see Levine, 2005 for a review). Some authors such as Schumpeter (1912), McKinnon (1973), King and Levine (1993) and Levine and Zervos (1998) highlight the role of finance in promoting growth. In contrast, from the perspective of Robinson (1952) and Lucas (1988), "Finance does not cause growth; finance responds automatically to changing demands from the 'real sector.'" (Levine, 2005).

There is an enormously large body of existing literature that studies the effect of finance on growth (reviewed by Levine). However, there are few studies testing the conjecture of Robinson and Lucas. In this paper, we examine the effect of growth on finance. Considering the aforementioned debate, our investigation is also important for us to understand the relationship between finance and growth. However, estimating the effect of growth on finance is difficult because of endogeneity and omitted variable bias.

In this paper we use exogenous variations in temperature and hours of sunshine as instrumental variables for economic growth in order to estimate the impact of economic growth on financial deregulation, inspired by Miguel et al. (2004). Miguel et al. argue that weather shocks are plausible instruments for growth in gross domestic product (GDP) in economies that largely rely on agriculture (i.e., are not heavily industrialized). The instrumental variable (IV) method makes it credible to assert that the association between growth and financial deregulation is a causal relationship rather than simply a correlation.

The financial deregulation experience in the People's Republic of China (hereafter China) for the period 1978-1998 is suitable for this identification strategy. During this period, China is not heavily industrialized and the agricultural sector remains large. Figure 1 illustrates that agriculture played an important role in the Chinese economy from 1981 to 1998. For a backward province, Inner Mongolia, its agricultural real output consists of about 40% of real GDP. Even for Beijing, its agricultural real output is around 20% of real GDP. For Inner Mongolia, over 67% of labor was in agriculture in 1978, and its labor share in agriculture was still around 50% by 1998. Our data show that weather shocks are significantly related to economic growth across Chinese provinces (in the first-stage regression).

[Figure 1 Here]

A further strength of our empirical strategy is that it allows us to address the problem of measurement error in China's national income figures, which generates controversy in the literature. Some criticize that China's GDP figures are unreliable (Rawski, 2001; Young, 2003), while others show that they are reliable and the criticism is due to misunderstanding (Chow, 1993; Holtz, 2003). The measurement error on explanatory variables

would bias coefficient estimates on them toward zero. If the instrument variables are uncorrelated with the measurement error, the IV approach addresses the attenuation bias.

Another appealing feature of the Chinese financial deregulation experience is that the Chinese financial deregulation was conducted following the gradual approach. This yields substantive variations across time and across provinces in the degree of financial deregulation. Our analysis exploits these substantive variations.

Our main empirical findings are as follows. Using the reform period Chinese panel data on 27 provinces during the period 1981-98, we isolate the variation of growth explained by the variations in temperature and hours of sunshine variations and find that it has no significant causal effect on financial deregulation after controlling for the political variable, the size of population, and time and province effects. Moreover, the home-bias political variable has a significant effect on financial deregulation, which shows that political and cultural factors are important driving forces in determining the path and logic of Chinese financial deregulation (consistent with the argument of Shirk, 2003).

After we briefly introduce the Chinese financial deregulation, in section 2 we construct the variables. Section 3 presents the estimation results. Section 4 concludes.

1.2 The Chinese Gradual Financial Reform

Before 1978, China was a command economy. The financial system is underdeveloped with the government playing a dominant role (Lardy, 1998, ch. 3; Naughton, 1995, ch. 1). Interest rates were set administratively; monetary policy was conducted through direct allocation of credit and refinancing. Capital markets were nonexistent. The primary financial intermediaries were state banks that work under the command of the government.

In 1978, the Chinese government embarked on gradual financial deregulation aimed at establishing a market-based financial system. The Chinese gradual financial deregulation studied by previous works (see Lardy, 1998; Chow, 2004; Shirk, 2003; Brandt and Zhu, 2007) refers to the following. Across time, it involves a gradual implementation of piece-meal financial deregulation policies over a long period of time. Common themes of the piece-meal policies include the provision of more autonomy in credit allocation to state-owned banks, the removal of restrictions on their ownership structure, and the relaxation of geographical and legal restrictions on the entry of new financial intermediaries. Across provinces, it refers to a process that allows some provinces to implement some piece-meal financial deregulation policies first. Specifically, each year, the government may choose some financial deregulation policies and designate some cities and rarely some province(s) to carry out such policies. After one year or more, the government may spread them to the whole province, further to several provinces, and finally to the whole country. After decades of reform, state banks have been built into joint-stock commercial banks; various markets like money, bond and equity markets have been created. The role of market in

financial resource allocation has been enhanced. Nevertheless, the objectives of Chinese financial deregulation are far from being accomplished, and there are still many unresolved issues in the financial deregulation process (see Lardy, 1998; Naughton, 1998).

2 Data

We use the following formulation for empirical assessment:

$$FDereg_{it} = \beta_1 Growth_{it} + \beta_2 (POLITICS)_{i,t-1} + \beta_3 \ln(POP)_{it} + u_i + T_t + \varepsilon_{it} \qquad (1)$$

where $FDereg_{it}$ is the degree of financial deregulation for i^{th} province at period t – detailed in section 2.1. *Growth* is the average annual growth of real GDP per worker, constructed in section 2.2. The first control variable is the lagged political variable, denoted by $POLITICS_{i,t-1}$ – detailed in section 2.4. The reason to control for the political variable is two-fold. First, Levine (2005) reviews the finance-growth nexus literature and concludes that finance is usually influenced by political, legal and cultural factors. Second, Shirk (2003) argues that China's financial deregulation was conducted on a political ground. Following the study of Miguel et al. (2004), our second control variable is the logarithm of the size of population, denoted by POP. We conjecture that it is possible that when the government chooses the places to conduct financial deregulation, the local size of the economy such as the population may be one factor that the government considers. u_i and T_t stand for fixed province and time effects respectively.

We do not include more control variables for several reasons. First, it is hard to find variables with available data and with time and provincial variations that may determine the path and logic of financial deregulation in China. Second, growth may impact financial deregulation indirectly by affecting the other variables that may influence financial deregulation. Therefore, to get an estimated total effect of growth on financial deregulation, we do not go further to find more variables. This strategy is actually adopted in Franker and Romer (1999) who try to identify the effects of trade on growth.

Estimating the impact of economic growth on financial deregulation is difficult because of endogeneity and omitted variable bias (Solow, 2003, also discusses the effect of institutions on growth). We use the variations of temperature and hours of sunshine as instrumental variables for economic growth. This identification strategy concurs with Miguel et al. (2004) who use rainfall variations for growth.

2.1 Constructing Financial Deregulation Indicators

We locate China's financial deregulation policies from the book "The Big Economic Events since China's Reform and Opening-up (1978-1998)".[1] The international symposium or-

[1] There are other books documenting the gradual financial deregulation policies in China during the period 1978-1998, but the big events are similar across these books.

ganized by the Chinese Economists Society at the University of Southern California in 1997 divides China's financial deregulation policies as follows:

1. Domestic Financial Deregulation

   (a) Reforms of the banking sector:

      i. Reforming commercial banks and policy banks;

      ii. Regulations of banking institutions in China;

      iii. Entry of foreign banks in enhancing competition;

      iv. Possibilities of more domestic private banks.

   (b) Non-bank Financial Institutions and Regulations:

      i. Insurance market;

      ii. Non-bank deposit market, and non-bank deposit-taking institutions;

      iii. Regulations on gray and black credit market for small loans.

2. Capital Market Development

   (a) On Equity and Bond market;

   (b) On Foreign Exchange Market.

We quantify all the financial deregulation policies into one single indicator, denoted as FD. Following the previous literature that studies banking sector and stock market separately (Levine and Zervos, 1998; Demirguc-Kunt and Levine, 2001), we further divide the financial deregulation policies into banking/non-bank policies (the policies belong to the domestic financial deregulation above), denoted as $BANK$, and stock market ones (the policies belong to the above capital market development), referred to as $STOCK$.

Since most financial deregulation policies are at the city level, we first construct the city level dummy variables. Then we aggregate them to the provincial level, using the ratios of the cities' population to their provincial population as weights:

$$Index = \sum_{j}(\sum_{i} \frac{Total\ Population\ of\ City\ i\ in\ Year\ t}{Total\ Population\ of\ the\ Province\ in\ Year\ t} \cdot I_{ci}^{t} + I_{p}^{t}) \qquad (2)$$

where I_{ci}^{t} is a dummy variable that equals one if city i receives a financial deregulation policy j in year t; I_{p}^{t} is an indicator variable that equals one if a financial deregulation policy j is conducted in the province. Adding together all policies (the $j^{'}s$) in and before year t for all the cities within a province yields its policy index for year t. The data on the cities' population are from the Statistical Yearbook on China's Cities.

For indicator Bank, if a deregulation policy is conducted through one of the big four state banks of China,[2] a weight of $\frac{1}{4}$ is imposed on the policy. A weight of $\frac{1}{5}$ is given to the policies as there are already big four state banks in operation. No adjustments are made for the other policies. An ideal weight should further consider the quality of the enforcement of the policies. However, finding a quality measure is a daunting task, hence we leave it to future research. The detailed data are presented in the Appendix. The summary statistics for our financial deregulation indexes are presented in Table 1.

[Table 1 Here]

2.2 Data on Real GDP Growth

The Statistical Yearbook of China (SYC) provides nominal GDP and GDP indexes for each province. Holtz (2003) shows that the Chinese GDP data are reliable, while others question their reliability (see Rawski, 2001). The problem with the implicit GDP deflator has been analyzed by Young (2003). Young decomposes the Chinese output into sectors and uses available price indices. He finds out that this would lower the aggregate GDP growth by 1.7%. In our cross province comparisons, this problem can be treated as measurement error on the independent variable, which can be dealt with IV regressions as long as the instruments are uncorrelated with the measurement error on GDP. With the nominal GDP and the GDP indexes and 1978 as our base year, the real GDP can be calculated as follows. We multiply the nominal GDP in 1978 by the GDP index in that year then divide the result by 100. The GDP deflator, which is not needed in our analysis, can then be backed out.

To calculate our independent variable, the growth rate of real GDP per worker, we need data on the labor force. However, there is a large statistical adjustment in 1990 on labor force. This has been analyzed in Young (1233-1234). For instance, the provincial statistical bureau of Jiangsu reported its labor force by using a new measurement detailed in Young. Resultantly, its labor force jumps from 35.19 million in 1989 to 42.25 million in 1990, while the SYC lists its labor force at 35.69 million in 1990. The provincial statistical bureau reports 6.56 million more workers. The provincial statistical bureau of Jiangsu should revise its labor force data before 1989 accordingly, but it did not. Around half of Chinese provinces made the changed in 1990. One can infer that it is not the case that the provincial statistical bureau has made up the numbers. Instead, it is just the change in statistical caliber as detailed in Young. Fortunately, SYC has maintained the original statistical caliber and provided the data on provincial labor force. Therefore, this relative more consistent series provided by SYC allow us to cover the periods before and after 1990 to avoid "spurious labor force growth" (Young, p. 1234).

[2]The big four state banks of China are: Bank of China (BOC), the Industrial and Commercial Bank of China (ICBC), China Construction Bank (CCB), and the Agricultural Bank of China (ABC).

Now with the labor force data and the real GDP data, we can calculate the growth rate of real GDP per worker (our main independent variable).

Since the book on financial deregulation only covers the period 1978-1998, our data sample ends at 1998. Before 1998, among the 31 provincial governments in China, four are municipalities and four are autonomous regions. We delegate the usage 'province' to all. Before 1997, Chongqing was a city of Sichuan province, hence both of them are excluded from the sample. Hainan was part of Guangdong before it became an independent province. Since there is a complete set of data for Guangdong, it is kept in the data sample while Hainan is dropped. Tibet is excluded because there are many missing data. In summary, the data sample comprises panel data of 27 provinces and 18 years (1981-1998). We will follow the common practice in the empirical growth literature to take six-year average of our data. The six-year averaging of the data matches, to some extent, with the political cycle in China. The National People's Congress (NPC) and the Chinese People's Political Consultative Conference (CPPCC) are held in the same year every five years starting from 1978, setting up all the important economic policies in China. Therefore, our sample produces a balanced panel with 81 observations.

2.3 Weather Data

The Weather Yearbook of China (WYC) provides monthly data on temperature and hours of sunshine for the capital city of the Chinese provinces from 1985 to 1998. The data before 1985 are not available since the WYC started from 1985. Since we employ the Chinese panel data from 1981 to 1998 and take six-year averages to avoid the business cycle phenomena, we have three sub-periods: 1981-86, 1987-92, and 1993-98. In China most provincial capital city is located in the middle of the province, so we treat the data for capital city as the average for the whole province. Since sub-periods 1987-92 and 1993-98 have complete data, we calculate the weather indicators as follows. We calculate "temperature yearly difference"[3] for each year and then average over six years to get average "temperature yearly difference", denoted by Tempdiff. We calculate the variance for each year based on the 12 month data and then take six-year averages to get the variations for temperature and sunshine, denoted by Tempvar and Sunvar respectively.

Since sub-period 1981-86 only has data for 1985-1986, we get the weather indicators from the Natural Resources Database of China Academy of Sciences (denoted by CAS-NRD). CAS-NRD provides weather data for around 600 weather observatories across China. Each weather observatory has monthly data points on temperature and hours of sunshine for the period 1951-80. Given the 24 data points each weather observatory has, we calculate its temperature yearly difference, variance of monthly temperatures, and variance of monthly hours of sunshine. Since each province has around 20 weather obser-

[3] "Temperature yearly difference" is the difference between the highest and lowest monthly average temperatures, which measures the annual range of temperature.

vatories in 20 cities/counties, we take averages of the data over the weather observatories to get the provincial data on Tempdiff, Tempvar, and Sunvar.

2.4 Other Control variables

Levine (2005) reviews that many studies suggest that finance is influenced by legal, political and cultural factors. As far as China is concerned, political, cultural and institutional factors determine the path and logic of financial deregulation. Shirk (2003, p.129), for instance, argues that the path of financial reform in China since 1979 reflects a political logic: "The actual pattern of economic reform did not reflect economic theories so much as it did 'the conflict of various kinds of interests, that is the conflict, coordination, and balancing of interests between various trades and industries, between urban and rural areas, between localities, and between localities and the central authorities'." Therefore, politics is one important factor in driving the path and logic of financial deregulation. Moreover, culture plays an important role in determining the path of financial deregulation. The Chinese culture is that policy makers tend to give preferential policies to their hometown. We term this as the home-bias of politicians. We combine the political and cultural factors to build our home-bias political variable (detailed below).

Following the literature on politician turnovers and economics growth in China, we find the book entitled "Annals of the Officials of the People's Republic of China". It lists China's government officials and their tenure in office for all the national government departments from its founding in 1949 to year 2003. We argue that the bargaining and coordination of these government officials of the highest rank, i.e. the ministers of all the national government departments, plays an important role in determining what provinces receive the preferential treatment in the process of financial deregulation. We choose the ministers, rather than the vice-ministers, of all the national government departments to represent the distribution of political powers. This is because in the Chinese institutional framework in which the minister has absolute power over the vice-ministers in making the final decisions. Therefore, we find over 200 ministers for over 100 national government departments (some of them were closed after 1978 and some were set up after 1978) during the reform period 1978-1998.

During our sample period 1981-1998, the majority of the national government department ministers are generals or officers of the People's Liberation Army or important members of the Chinese Communist Party. They earn their power in war and in the founding of China. After the founding of China in 1949 when their age was mainly in the range of 20-40, they continued to work as the national government department ministers until retirement. Therefore, their selection into office was mainly based on their role in war, which is exogenous to the process of financial deregulation.

We use culture to assign the national government department ministers to the provinces. As argued, the ministers are influenced by the Chinese culture in choosing the designated

cities or provinces to conduct financial deregulation: they tend to favor the province where they were born (the aforementioned home-bias of the politicians). Therefore, we find the birth-provinces for all the national government department ministers. We build the province level time series political variable as follows. For instance, during the 1993-1998 period, the minister of the Ministry of Communications is Zhendong Huang who was born in Jiangsu province. Therefore, we assign a value 1 to Jiangsu province and zeros to all the other provinces for our sample period 1993-1998. We repeat the dummy variable operations for all the national government department ministers. However, suppose minister Huang was in office for the period March 1993 to December 1995, then we would assign Jiangsu province a value that equals the ratio of the number of years he is in office to the number of years in the period 1993-1998 (i.e., 6), which is roughly 0.5 in this case. Finally, we add up all the dummy variables to get the provincial level political variable. We repeat the same steps for other two sub-periods. To avoid potential endogeneity problem, we use the lagged values of the political variable. For example, the value of period 1987-1992 is given to period 1993-1998. This makes more sense because it may take a while for the national government department ministers to bargain over and finally set up the deregulation policies. Moreover, it takes time to carry out the deregulation policies.

The last control variable is the logarithm of population. We first take six-year averages of the population data and then take logarithm.

3 Estimation Results

3.1 LSDV (Least squares dummy variables) Estimation

We first use LSDV estimation to test the relationship between financial deregulation and growth with the three financial deregulation indexes. That is, we use OLS (Ordinary least squares) estimation that includes 27 province dummies and 3 time dummies. Table 2 summarizes the results.

Column 2.1 in Table 2 reports the LSDV results with the banking/nonbank deregulation index, $BANK$. One can see that the estimated coefficient on $Growth$ is positive and significant at the 1% level. It means a higher rate of economic growth is associated with a higher degree of banking/nonbank deregulation. The estimated coefficient on the lagged political variable is positive and significant at the 5% level. This shows that the political and cultural factors play an important role in determining banking/nonbank deregulation in China. The estimated coefficient on ln(POP) is positive but insignificant at the 10% level. That is, population size has no impact on banking/nonbank deregulation.

Column 2.2 in Table 2 reports the LSDV results with the financial deregulation index (FD) that quantifies all the financial deregulation policies. The estimated coefficient on $Growth$ is positive and significant at the 5% level. It means a higher rate of economic growth is associated with a higher degree of financial deregulation. The estimated coefficient on the lagged political variable is positive and significant at the 5% level. Therefore,

political and cultural factors have significant effects on financial deregulation in China. The estimated coefficient on ln(POP) is positive but insignificant at the 10% level.

Column 2.3 in Table 2 reports the LSDV results with the stock market deregulation index ($STOCK$). The estimated coefficient on $Growth$ is positive but insignificant at the 10% level. The estimated coefficient on the lagged political variable is positive and significant at the 1% level. This shows that the home-bias political variable also plays an important role in determining the path and logic of stock market deregulation in China. The estimated coefficient on ln(POP) is positive but insignificant at the 10% level. That is, population size has no impact on stock market deregulation.

[Table 2 Here]

3.2 Endogeneity and 2SLS Regression

As argued, the potential reverse causality between growth and financial deregulation, the measurement error on the growth rate of China, and the potential omitted variable bias make the LSDV estimators biased and inconsistent. Therefore, we use the variations of temperature and hours of sunshine as instrumental variables for economic growth. Here we report the results with the banking/nonbank deregulation index, $BANK$. The results with the other two financial deregulation indicators are reported in section 3.4.3. We first report the 2SLS (two-stage least squares) estimation results.

The first-stage results of 2SLS estimation are reported in Table 3. Column 3.1 presents the results without controlling for the political variable and the population size. One can see that each of the variations of the weather indicators has a significant effect on growth at least at the 5% level. The F-test shows that they jointly have a significant effect on growth at the 1% level. The F-statistic on the excluded instruments (the variations of the weather indicators) is slightly smaller than 10. The results are similar when we further control for the political variable and the population size. We will use the LIML (limited information maximum likelihood) estimation to deal with the potential weakness of the instruments.[4] The weak identification (Cragg-Donald) test statistic is always larger than the Stock-Yogo critical value for the 10% maximal LIML size (not reported), meaning we reject the null hypothesis that the instruments are weak. Nevertheless, the second stage results of LIML estimation are reported in column 4.2 in Table 4.

[Table 3 Here]

The second stage results of 2SLS estimation are presented in column 4.1 in Table 4. One can observe that the estimated coefficient on $Growth$ remains positive but becomes insignificant at the 10% level. It means that economic growth has no causal effect on

[4]Stock and Yogo (2002) show that in the presence of weak instruments, LIML is far superior to 2SLS estimation. Murray (2006) surveys the literature on invalid and weak instruments.

banking/nonbank deregulation. The estimated coefficient on the lagged political variable remains positive and significant at the 1% level. This shows that the political and cultural factors play an important role in determining the path and logic of banking/nonbank deregulation in China. The estimated coefficient on ln(POP) is positive but insignificant at the 10% level. That is, population size has no impact on banking/nonbank deregulation.

[Table 4 Here]

3.3 More on the Validity of the Instruments

In the introduction we have argued why weather variations are valid instruments for economic growth. Nevertheless, with more instruments than endogenous variables, we can test the validity of the instruments. According to column 4.1 in Table 4, the Sargan test yields a p-value 0.73 and the Basamann test yields a p-value 0.83. Both are much above 10%, meaning the over-identifying restrictions tests support the validity of the instruments. Nevertheless, it is commonly known that these tests have little statistical power. Therefore, we should rely on similar arguments in Miguel et al. (2004) for supporting the validity of the instruments. Our introduction has presented the detailed argument on why the variations of weather indicators are valid instruments for our study.

We are aware of the possibility that the variations of weather variables may impact financial deregulation via other channels. However, as stated, it is hard to find variables with available data and with time and provincial variations that may determine the path and logic of financial deregulation in China. Therefore, we focus on the explanatory variables that we have, namely the lagged political variable and the size of population. We have argued in section 2.4 that the lagged political variable is exogenous to the process of financial deregulation. Since the ministers were mainly selected into office based on their performance in war, the political variable is also exogenous to the growth process. This makes it unlikely that the home-bias political variable is influenced by the variations in weather via the channel of economic growth. Nevertheless, we find that the variations of weather variables (alone or jointly) are not significantly associated with either the lagged political variable or the current period political variable, indicating that the political variable cannot be a channel via which the weather variations impact financial deregulation. It is possible that the size of population may be affected by the variations of weather indicators. First, we find that the variations of weather variables (alone or jointly) are not significantly associated with the size of population. Second, even instrumenting the size of population and economic growth with the variations of weather indicators, the results on main explanatory variables remain similar to those in column 4.1 in Table 4.

Miguel et al. (2004) devote a lot of space to refuting the concern that their instrument rainfall directly impacts social conflict. They conclude: "Nonetheless, we acknowledge that we are unable to definitively rule out the possibility that rainfall could have some

independent impact on the incidence of civil conflict beyond its impact working through economic growth." As far as our study is concerned, we argue that variations in temperature and hours of sunshine have no impact on the path and logic of financial deregulation in China. To show this, we directly regress financial deregulation on the variations in temperature and hours of sunshine, controlling for the same variables and time and province effects (regressions not shown). The estimated coefficients on all the three weather indicators are very insignificant. The F-test on their joint significance yields a p-value of 0.88 (this contrasts with the jointly significant effect of the weather variations on economic growth in our first-stage regression in Table 3). The results are robust when we further include growth in the regressions.

3.4 Robustness Checks

We first check whether our results are robust to different estimation methods that deal with different issues. Moreover, we report the results with the other two financial deregulation indicators.

3.4.1 Weak instruments and LIML Estimation

As can be seen from the first-stage results in Table 3, although the variations of the weather indicators alone or jointly have significant effects on economic growth, the F-statistic on the excluded instruments (the variations of the weather indicators) is slightly smaller than 10. It is meaningful to check whether our results are robust to LIML estimation that deals with weak instruments.

The weak identification (Cragg-Donald) test statistic is always larger than the Stock-Yogo critical value for the 10% maximal LIML size, meaning we reject the null hypothesis that the instruments are weak. Nevertheless, one can observe that the second-stage results of LIML estimation reported in column 4.2 of Table 4 are almost identical to those of 2SLS estimation in column 4.1. This is expected because when the instruments are strong the 2SLS and LIML estimations should produce similar results.

3.4.2 Heteroskedasticity and GMM Estimation

As Baum et al. (2003) argue, with strong instruments, one needs to choose between 2SLS and GMM (Generalized method of moments) estimation. This is because of the possible existence of heteroskedasticity. If heteroskedasticity is present, the GMM estimator is more efficient. Baum et al. state that the heteroskedasticity test "statistic has not been widely used in practice, perhaps because it is not a standard feature of most regression packages." The heteroskedasticity test results are presented in columns 4.1 and 4.2. The tests of heteroskedasticity suggest that there is clear evidence of non-i.i.d. errors, given

that both the White and Breusch-Pagan statistics strongly reject. Therefore, we should use robust covariance estimation in this case.

The second-stage results of robust covariance GMM estimation are presented in column 4.3 of Table 4. One can see that the results remain very similar to those of 2SLS and LIML estimations in columns 4.1 and 4.2.

3.4.3 Results on the Other Financial Deregulation Indicators

We have two more financial deregulation indicators. One is on the stock market and the other measures all the financial deregulation policies (the banking/nonbank sector and the stock market). The second-stage results of 2SLS, LIML and GMM estimations are reported in Table 5. Generally, the patterns of the results are similar to those in Table 4. The estimated coefficient on growth is negative and insignificant in columns 5.1 to 5.3, meaning economic growth has no significant effect on stock market deregulation. The estimated coefficient on growth is positive and insignificant in columns 5.4 to 5.6, showing that economic growth has a positive but insignificant effect on financial deregulation.

[Table 5 Here]

4 Conclusions

In this paper we use the Chinese gradual financial deregulation experience to investigate whether growth causes finance. Using the variations of contemporary weather variables to overcome the endogeneity of economic growth, we find that growth has no significant effect on financial deregulation after controlling for lagged home-bias political variable, the logarithm of population size, and time and province effects. The home-bias political variable has a significant effect on financial deregulation, which shows that political and cultural factors are important driving forces in determining the path and logic of Chinese financial deregulation. Despite that our measurement of main indicators and the empirical strategy may not be perfect, our study contributes to solving the direction of causality between economic growth and financial deregulation in China.

The next step, for instance, would be to examine whether financial deregulation has a causal effect on growth, which is left to future research.

Appendix: Data on Average Annual Growth Rate, Financial Deregulation and Home-bias Politics

Province	Annual Growth	BANK	FD	POLITICS	Province	Annual Growth	BANK	FD	POLITICS
Beijing (1981-86)	6.0	1.25	1.25	0	Shandong	7.2	0.19	0.19	6
Beijing (1987-92)	5.0	6.76	7.92	1.5	Shandong	5.7	1.07	1.07	8.2
Beijing (1993-98)	9.5	8.76	11.05	2.3	Shandong	9.5	2.71	2.71	7.9
Tianjin	5.6	1.54	1.54	0	Henan	5.9	0.02	0.02	2
Tianjin	4.2	6.24	7.08	0.4	Henan	3.8	0.16	0.16	2.6
Tianjin	12.0	6.33	7.33	1.2	Henan	7.8	0.12	0.12	2.8
Hebei	6.2	0.42	0.42	9	Hubei	7.5	0.45	0.45	3
Hebei	5.6	1.29	1.29	5	Hubei	4.6	1.81	1.99	1.2
Hebei	9.5	1.26	1.26	5.9	Hubei	10.2	1.97	2.18	5.2
Shanxi	7.7	0.01	0.05	3	Hunan	5.4	0.03	0.03	1
Shanxi	3.5	0.10	0.31	2.1	Hunan	3.4	0.22	0.22	0.4
Shanxi	7.8	0.05	0.27	4.8	Hunan	7.6	0.18	0.18	3.4
Inner Mongolia	7.5	0	0	1	Guangdong	7.7	0.85	0.86	1
Inner Mongolia	4.6	0	0	0	Guangdong	8.9	3.48	3.60	1.5
Inner Mongolia	8.1	0	0	0	Guangdong	9.0	4.70	4.85	3
Liaoning	6.0	0.51	0.55	4	Guangxi	3.6	0.01	0.01	0
Liaoning	4.3	2.40	2.81	1	Guangxi	5.2	0.03	0.03	1
Liaoning	8.2	3.39	3.83	2.6	Guangxi	6.9	0.03	0.03	0.2
Jilin	4.2	0.01	0.01	0	Guizhou	6.5	0	0	1
Jilin	2.6	1.03	1.03	0	Guizhou	2.4	0	0	0.2
Jilin	10.3	2.14	2.14	1.4	Guizhou	5.2	0	0	0
Heilongjiang	2.9	0.03	0.03	0	Yunnan	6.1	0	0	0
Heilongjiang	3.7	0.82	0.95	0	Yunnan	5.1	0	0	0
Heilongjiang	4.9	1.76	1.91	1	Yunnan	6.8	0	0	0
Shanghai	6.3	1.79	3.29	2	Shaanxi	6.6	0.14	0.14	1
Shanghai	6.6	8.40	15.73	3.2	Shaanxi	4.3	0.97	0.97	0.6
Shanghai	11.7	11.49	20.49	7.5	Shaanxi	6.3	0.93	0.93	2.5
Jiangsu	7.9	0.49	0.49	8	Gansu	5.1	0	0	1
Jiangsu	7.9	1.86	1.86	6.6	Gansu	4.7	0.10	0.10	0.5
Jiangsu	11.0	2.86	2.93	10.3	Gansu	6.5	0.06	0.06	0
Zhejiang	8.2	0.57	0.57	3	Qinghai	6.5	0	0	0
Zhejiang	6.8	2.08	2.08	5.4	Qinghai	2.2	0.24	0.24	0
Zhejiang	11.0	3.13	3.13	6.1	Qinghai	5.8	0.24	0.24	0
Anhui	6.9	0	0	4	Ningxia	6.7	0	0	0
Anhui	2.0	0.29	0.29	1.8	Ningxia	3.2	0.11	0.11	0
Anhui	9.6	1.25	1.25	5.1	Ningxia	5.0	0.11	0.11	0
Fujian	6.0	0.60	1.43	3	Xinjiang	8.7	0.01	0.01	0
Fujian	6.9	2.95	2.95	2.26	Xinjiang	7.2	0.17	0.17	0.5
Fujian	10.7	5.11	5.16	1.7	Xinjiang	6.3	0.13	0.13	1
Jiangxi	6.0	0.33	0.33	2					
Jiangxi	5.2	1.29	1.29	0					
Jiangxi	6.5	2.25	2.25	0.6					

Note: Growth rates are in percentage.

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Table 1: Descriptive statistics

	Mean	Standard deviation	Minimum	Maximum
BANK	1.41	2.24	0	11.49
FD	1.73	3.34	0	20.49
STOCK	0.33	1.31	0	9
Growth (annual, %)	6.47	2.26	2.00	12.00
POLITICS	2.19	2.53	0	10.3
ln(POP)	7.98	0.79	5.99	9.12

Observations: 81. The data are six-year averages for 27 provinces.

Table 2. LSDV Regressions between Financial Deregulation and Economic Growth

	Regression number		
	2.1	2.2	2.3
	Dependent variable as		
Independent Variable	*BANK*	*FD*	*STOCK*
Growth	0.34***	0.44**	0.10
	(0.12)	(0.18)	(0.08)
POLITICS	0.31**	0.58**	0.27***
	(0.14)	(0.22)	(0.09)
ln (*POP*)	5.83	11.65	5.82
	(8.22)	(12.56)	(5.36)
Time Fixed Effects	Yes	Yes	Yes
Province Fixed Effects	Yes	Yes	Yes
R^2	0.85	0.84	0.81
Observations	81	81	81

***Significant at the 0.01 level, ** at the 0.05 level, * at the 0.10 level

(standard errors in parentheses)

Table 3. Regressions between Financial Deregulation and Economic Growth

First-stage Results. Dependent variable: average annual growth 1981-87, 1988-92, 1983-98

	Regression number	
Independent Variable	3.1	3.2
Sunvar	0.0007^{***}	0.00056^{**}
	(0.0002)	(0.00023)
Tempdiff	1.48^{***}	1.64^{***}
	(0.54)	(0.53)
Tempvar	-0.14^{**}	-0.15^{***}
	(0.056)	(0.056)
$POLITICS$		0.22
		(0.15)
$\ln(POP)$		-21.60^{**}
		(8.77)
Time Fixed Effects	Yes	Yes
Province Fixed Effects	Yes	Yes
F-test on weather indicators	F(3,49)=6.53	F(3,47)=6.62
(p-value)	(0.0008)	(0.0008)
R^2	0.81	0.84
Observations	81	81

***Significant at the 0.01 level, ** at the 0.05 level, * at the 0.10 level

(standard errors in parentheses)

Table 4. Regressions between Financial Deregulation and Economic Growth
Second-stage results. Second-stage dependent variable: $BANK$

	Regression number		
	4.1	4.2	4.3
	Estimation Method		
Independent Variable	$2SLS$	$LIML$	GMM
Growth	0.13	0.12	0.10
	(0.17)	(0.17)	(0.15)
$POLITICS$	0.38***	0.38***	0.43***
	(0.13)	(0.13)	(0.16)
$\ln(POP)$	1.66	1.54	0.65
	(7.20)	(7.22)	(8.19)
Time Fixed Effects	Yes	Yes	Yes
Province Fixed Effects	Yes	Yes	Yes
OverID Test: p-value	Sargan $chi^2(2)$: 0.73	Anderson-Rubin $chi^2(2)$: 0.7	Hansen's J $chi^2(2)$: 0.6
OverID Test: p-value	Basmann $chi^2(2)$: 0.8	Basmann F(2, 48): 0.83	
White/Koenker nR^2 test	p-value: 0.01	p-value: 0.01	
Breusch-Pagan	p-value: 0.0000	p-value: 0.0000	
R^2	0.84	0.84	0.84
Observations	81	81	81

Note: endogenous variable: Growth.

Excluded instruments: Sunvar, Tempdiff, Tempvar

***Significant at the 0.01 level, ** at the 0.05 level, * at the 0.10 level

(standard errors in parentheses)

Table 5. Regressions between Financial Deregulation and Economic Growth
Second-stage results.

	Regression number					
	5.1	5.2	5.3	5.4	5.5	5.6
	Second-stage Dependent variable as					
	$STOCK$			FD		
	Estimation Method					
Independent Variable	$2SLS$	$LIML$	GMM	$2SLS$	$LIML$	GMM
Growth	−0.001	−0.003	−0.04	0.13	0.13	0.09
	(0.11)	(0.11)	(0.04)	(0.26)	(0.26)	(0.18)
$POLITICS$	0.30***	0.30***	0.20	0.68***	0.68***	0.68**
	(0.08)	(0.08)	(0.13)	(0.19)	(0.19)	(0.29)
$\ln(POP)$	3.81	3.76	0.62	5.47	5.42	1.99
	(4.62)	(4.63)	(2.55)	(10.97)	(10.98)	(9.53)
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Province Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
OverID Test: p-value	Sargan: 0.74	A-R: 0.74	J: 0.18	Sargan: 0.91	A-R:: 0.91	J: 0.82
Basmann OverID Test: p-value	0.84	0.84		0.94	0.94	
R^2	0.81	0.81	0.79	0.83	0.83	0.83
Observations	81	81	81	81	81	81

Note: endogenous variable: Growth.

Excluded instruments: Sunvar, Tempdiff, Tempvar

***Significant at the 0.01 level, ** at the 0.05 level, * at the 0.10 level

(standard errors in parentheses)

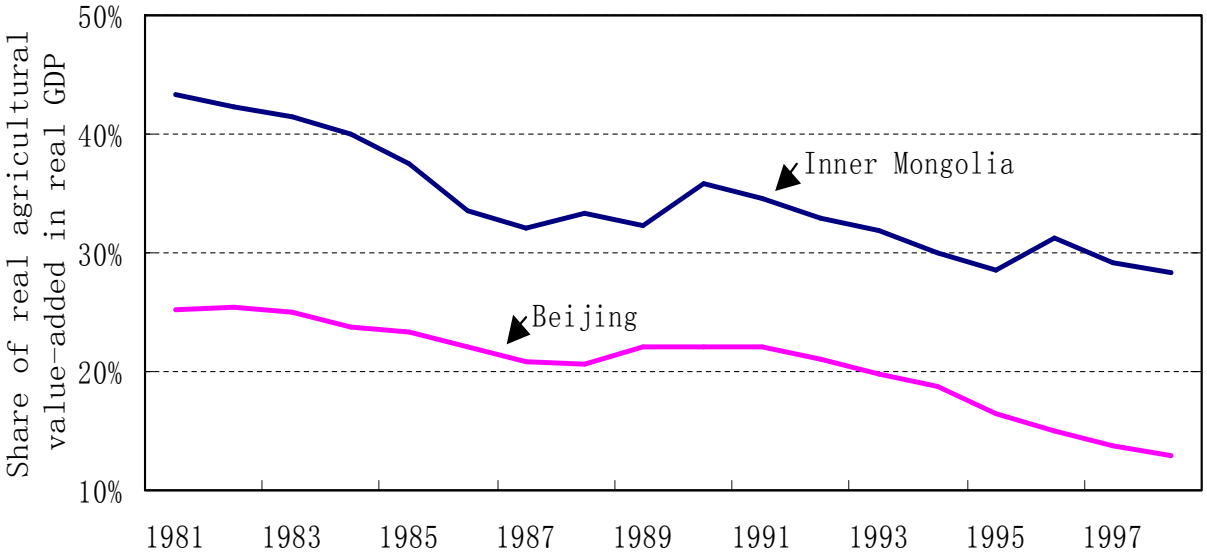

Figure 1. Agricultural Dependence in China (1981-1998).