

**FINANCIAL DEVELOPMENT, CAPITAL ACCUMULATION AND PRODUCTIVITY
IMPROVEMENT: EVIDENCE FROM CHINA**

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ABSTRACT

Financial sector development may contribute to economic growth by facilitating capital accumulation and by improving productivity. This paper investigates empirically the contribution that financial development may make to these two alternative drivers of economic growth in China. Specifically, we construct a set of instruments for measuring financial development by using annual data from 1952 to 1999. Using cointegration and Granger-causality testing we examine the relationship between financial development and, respectively, capital accumulation and productivity in a time-series vector autoregression (VAR) framework. The substantive findings are that in China financial development contributes to economic growth primarily through facilitating capital accumulation, while the linkage between financial development and productivity improvement is statistically weak.

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1. INTRODUCTION

A considerable body of literature documents a strong positive relationship between financial development and economic growth (Levine 2004). However, the nature and direction of causality of the interaction between the financial system and economic growth remains unclear. There are three competing hypotheses. The first is the “supply-leading” hypothesis, proposed initially by Schumpeter (1912). The term was coined by Patrick (1966) to convey that a well-functioning financial sector stimulates technological innovation by identifying and funding those projects that have the best chance of success and the highest social returns. Financial development, accordingly, is considered exogenous and causality runs from financial development to economic growth. This hypothesis is supported empirically by McKinnon (1973), Shaw (1973) and Fry (1995), which all conclude that financial development is an important driver of economic growth.

Robinson (1952) proposes a “demand-following” hypothesis (again, the term was coined by Patrick, 1966). The underlying argument is that economic growth creates demand for particular types of financial arrangements, and that the financial system accommodates these demands (Levine 1997). Hence, the evolutionary development of the financial system can be regarded as “a continuing consequence of the pervasive, sweeping process of [real] economic development” (Patrick, 1966, p.178). This hypothesis suggests that financial development is endogenous to economic growth and that causality runs from economic growth to financial development.

The third hypothesis of the “irrelevance of finance” was proposed by Lucas (1988) on the grounds that economists tend to exaggerate the role of financial factors in economic growth. Less categorically, Dornbusch and Reynoso (1989, p. 204) argue that “financial factors are important only when financial instability becomes a dominant force in the economy.” This hypothesis denies the existence of a stable long-run relationship between financial development and economic growth.

An important issue related to these hypotheses concerns the transmission mechanism between financial development and economic growth. Accumulation of physical and human capital and productivity improvements are alternative channels for promoting economic growth with potentially diverse implications for the growth pattern. Hence, in order to understand the complex interaction between financial development and economic growth, it is pertinent to examine the relationship between financial development and the two major drivers of growth. The financial system provides five general types of service for the real economy (Levine, 2004):

- producing information *ex ante* about possible investment opportunities and allocating capital to those investments that promise the highest returns;
- monitoring investment and supporting the corporate governance of enterprises;
- facilitating risk trading and diversification;
- mobilizing and pooling savings; and
- facilitating the exchange of goods and services.

Evidently, some functions are more related to capital accumulation (e.g., mobilizing and pooling savings and easing the exchange of goods and services). Others are more conducive to productivity improvement by promoting the efficiency of capital allocation (e.g., producing information about possible investment). Hence, the nature of the transmission process may well vary as different circumstances affect the importance of the alternative functions of the financial sector. For instance, Rioja and Valev (2004) show that in industrialized countries the financial system contributes to economic growth primarily through productivity improvement while in developing countries this occurs mainly through facilitating capital accumulation.

This paper examines the competing hypotheses for China, applying cointegration and Granger causality testing to the most recent consistent data available (1952 to 1999).¹ One contribution of this study is to pay particular attention to the relative contribution of the alternative drivers of growth, examining the interaction between financial development and capital accumulation and productivity improvement, respectively. Section 2 provides an overview of the extant empirical literature which has examined these hypotheses. Section 3 discusses the development of China's financial system since market reforms. Section 4 discusses the data and methodology and presents the results. Section 5 concludes with suggestions for future research.

2. EXISTING EMPIRICAL LITERATURE

The relationship between economic growth and financial development has been investigated in cross-sectional and country-specific time series studies. Particularly influential cross-country studies include the seminal work by Goldsmith (1969) and King and Levine (1993b). For a sample of 35 countries over the period 1860 to 1963 Goldsmith documents a positive association between financial intermediation and economic activity. The study by King and Levine (1993b) of 77 countries over the period 1960-1989 improves on Goldsmith's (1969) work by constructing additional measures of financial development, controlling for more factors associated with economic growth, and covering more countries. They find evidence of strong positive partial correlation between, and of significant predictive power of, each of the financial development indicators and the various growth variables (per capita GDP, per capita capital stock and

productivity). Liang (2005) examines the finance -growth nexus over the period 1990 to 2001 using a panel of 29 Chinese provinces and finds that financial development has significantly promoted China's economic growth. The strong positive relation between financial development and economic growth is supported by other cross-sectional studies (e.g., Roubini and Xavier 1992, King and Levine 1993a, Easterly, 1993, Atje and Jovanovic 1993).

Cross-sectional studies are not able to test formally the causality between financial development and economic growth. To address this limitation, another line of research has applied cointegration and Granger causality testing to time series data for specific countries. Rousseau and Wachtel (1998) examine the linkage for the U.S., the U.K., Canada, Norway and Sweden over the period 1870-1929. Cointegration and vector error correction modeling (VECM) yielded evidence of a long-run relationship among various measures of financial development, real per capita output and the monetary base that is consistent with the "supply-leading" hypothesis. Arestis *et al.* (2001) apply a vector autoregressive (VAR) framework in five developed economies for different periods and find that both banks and stock markets have made important contributions to output growth in France, Germany and Japan. However, the linkage is found to be statistically weak in the U.S. and U.K. and, if anything, to run from growth to financial development. Australia provided mixed results for different financial institutions over the period 1960-1999: the "demand-following hypothesis" appears to explain the relationship between economic growth and development of financial intermediaries while the "supply-leading hypothesis" is consistent with the relationship between stock market development and economic growth (Thangavelu and Ang Beng Jinn, 2004).

Evidence from developing countries is also mixed. Demetriades and Hussein (1996) conduct Granger causality tests between financial development and real GDP for 16 countries and find evidence of bi-directional and unidirectional causality. Luintel and Khan (1999) use a multivariate VAR framework for ten sample countries and find evidence of bi-directional causality. Thornton (1996) examines Granger causality and finds no evidence that financial development causes economic growth in 22 Asian, Latin American and Caribbean developing economies.

Time series studies of the relationship between financial development and economic growth for China are relatively scarce. Zhang and Yao (2002) construct two variables - the ratio of bank deposit liabilities to nominal GDP and the ratio of currency to bank deposit liabilities plus currency - to measure financial development. They examine causality between financial development and economic growth both at the national level (1952-1999) and at the provincial level (1978-1999) by using cointegration and Granger-causality analysis and panel data modelling, respectively. They find that financial deepening and economic growth Granger-cause each other. However, their study does not investigate the relationship between financial development and the two alternative

channels of transmission (capital accumulation and productivity improvement). Using an alternative indicator of financial development (monetary base relative to GDP) and applying multivariable VAR models (including GDP, monetary base, and exports and imports for China over the post-reform period from 1987-1999) Chang (2002) also finds evidence of mutual interdependence between financial development and economic growth.

3. OVERVIEW OF CHINA'S FINANCIAL SYSTEM

By way of improving the efficiency of the financial system China established three specialized state-owned commercial banks in 1979. The Bank of China (BOC) retained its pre-reform responsibilities in international transactions and foreign exchange management. A fourth state-owned commercial bank - the Industrial and Commercial Bank of China (ICBC) - was established in the mid-1980s to serve commercial enterprises and supervise urban credit cooperatives. In the mid-1990s three "policy" banks were established to remove responsibility for the implementation of domestic credit policy from the commercial banks. The second half of the 1990s witnessed the emergence of a new genre of commercial banks - joint-stock commercial banks - whose shares are owned by different levels of government, state-owned enterprises (SOEs) and, in some cases, by individuals.

At present China's banking industry consists of the four big state-owned commercial banks, joint-stock commercial banks, policy banks and other national and regional commercial banks, rural and urban credit cooperatives. Notwithstanding the attempts to introduce a diversified banking industry structure, the four big state-owned commercial banks continue to dominate the sector. At the end of 2003 they held 55% of total assets and liabilities, while the second largest category - joint-stock commercial banks - held about 14% of assets and liabilities.ⁱⁱ

The stock exchanges, established in Shanghai and Shenzhen in December 1990, were intended to encourage the restructuring of SOEs and their financing. Within a short period China's stock market has developed rapidly in terms of market capitalization and the number of listed companies. By 2003, 1287 companies were listed on the Shanghai and Shenzhen stock exchanges with an aggregate market capitalization of RMB 4245.8 billion. However, the Shanghai and Shenzhen stock markets continue to remain an insignificant source of business financing, accounting for a mere four per cent of all funds raised by the non-financial sector. Bank loans remain the major source of funding, accounting for 85% of financing.ⁱⁱⁱ

China's financial system continues to be plagued by resource misallocation and inefficiencies (Huang et al. 2005). Government intervention, a high proportion of non-performing loans, unsophisticated banking practices, lack of competition, discrimination against private firms in

access to bank loans and immature stock markets compromise the ability of the financial system to facilitate capital accumulation and enhance productivity. These problems are interrelated in nature and mutually-reinforcing. They are not amenable to a ready solution because reform of the financial system is interrelated with SOE and fiscal reform (Lardy, 1998).

4. DATA AND MEASUREMENT ISSUES

Quantification of financial development requires measures of the ability of financial institutions to identify profitable investments, exert corporate governance, mobilize resources, manage risk and facilitate transactions (Levine and Zervos, 1998). Given that such measures cannot be constructed accurately, the literature employs various measures of the size of the financial sector or volume of activity as proxies for the degree of financial development on the presumption that the size of the financial system is positively related to the breadth and efficiency of financial services.

The most commonly used measure of financial development is “financial depth”, which is usually some measure of broad money, usually M2, deflated by nominal GDP (e.g., King and Levine 1993b). This captures the size of the formal financial intermediary sector relative to economic activity. However, such monetary aggregates do not differentiate between the liabilities of the various financial institutions, and may not be closely related to financial services such as risk management and information processing (King and Levine, 1993b). More sophisticated measures of financial development include the proportion of total credit extended to private enterprise on the grounds that private credit is more productive than credit issued to government or state-owned enterprises (e.g., Rioja and Valev 2004). Alternatively, the ratio of commercial to central bank assets has been used as an indicator of financial development (e.g., King and Levine 1993b).

The present study uses two alternative indicators of financial development in China over the period 1952-1999 - bank deposit liabilities and bank domestic credit, each deflated by nominal GDP. By excluding currency in circulation, bank deposit liabilities may capture the development of financial intermediaries, especially during the early “marketisation” phase of economic development when barter transactions are being replaced by market exchange (Demetriades and Hussein, 1996). To the extent that the alternative, domestic credit, measure reflects the typical mode of investment financing it is likely to capture a long-run relationship with output (*idem*). The three variables (M2, bank domestic credit and bank deposit liabilities, all relative to nominal GDP) are widely used in literature.^{iv} In the present study, the M2 data for 1952-1992 are from Yi (1994), updated for the period 1993-1999 from *China’s Statistical Yearbook* (2004). Bank domestic credit and bank deposit liabilities data are from the *Almanac of China’s Finance and Banking* (1998, 2002).^v

It might be argued that one possible weakness of these indicators is their failure to recognize explicitly China's stock market. Various stock market development indicators have been found to explain part of the variation of growth rates across countries (Levine and Zervos 1998). However, the short history and quantitative insignificance of China's stock market suggest that its neglect in the construction of indicators of financial development is not a major limitation.

Following standard practice, economic growth is measured by real GDP per capita. Per capita figures are prone to fewer errors than aggregate figures because some of the errors which affect estimates of the level of GDP also affect estimates of population and tend to cancel out in the per capita measure (Heston, 1994). Our data on real GDP per capita, from Wang and Yao (2003, Appendix A), conforms to the United Nations System of National Accounts. The most commonly used measure of capital accumulation is real physical capital stock per capita. Given the statistical and conceptual problems associated with the measurement of the real physical capital stock, King and Levine (1993b) use real investment flow as an alternative indicator of capital accumulation. We apply this practice as well and use real per capita investment and real physical capital per capita as alternative indicators of capital accumulation. The data are from Wang and Yao (2003, Appendix A).

Productivity is measured as standard total factor productivity (TFP). Assuming a neo-classical Cobb-Douglas production function with constant returns to scale

$$Y_t = A_t K_t^\alpha L_t^{1-\alpha} \quad \text{or} \quad (1)$$

$$\ln A_t = \ln Y_t - \alpha \ln K_t - (1-\alpha) \ln L_t \quad (2)$$

in logarithmic form, where Y is output, A is TFP, K is physical capital, L is the labour force, α is the share of income that accrues to capital, and $(1-\alpha)$ is the share of income that accrues to labour. Hall and Jones (1996) have suggested that economic growth can be attributed to physical capital, human capital and productivity, and show that the contribution of productivity increases substantially after accounting for human capital. Hence, to get a more precise measure of TFP, we assume a Cobb-Douglas production function that incorporates human capital (H):

$$Y_t = A_t K_t^\alpha (H_t L_t)^{1-\alpha} \quad \text{or} \quad (3)$$

$$\ln A_t = \ln Y_t - \alpha \ln K_t - (1-\alpha) \ln L_t - (1-\alpha) \ln H_t \quad (4)$$

Output and physical capital are measured by real GDP and the real capital stock, respectively. The labour force data are from *Comprehensive Statistical Data and Materials on 50 Years of New China*. Human capital is measured by average years of schooling per capita for the population in the age group 15-64.

To measure the two productivity variables, we have to identify the share of income accruing to capital (α). The parameter α normally takes the value of 0.3 for industrialized countries. A number of different values have been applied in the Chinese context.^{vi} In this study we follow Wang and Yao (2003) in assuming $\alpha = 0.5$, complemented by sensitivity analyses based on values of 0.4 and 0.6.

5. METHODOLOGY AND RESULTS

To examine whether there is a long-run equilibrium relationship and Granger causality between financial development, capital accumulation and productivity improvement, we conduct the empirical testing in three stages: (1) unit root testing, (2) cointegration testing and (3) Granger causality testing.

Stationarity of the data was examined with the Augmented Dickey-Fuller and Phillips-Perron unit root tests. We do not report the findings to conserve space, but these tests suggest that all variables are integrated of order one (I(1)). To test for cointegration and causality we apply the Johansen (1988) methodology to the VAR framework. Gonzalo (1994) argues that the Johansen approach has clearly better asymptotical properties to detect long-run equilibrium than a range of other estimators. Specifically, the Johansen procedure performs better than others even when the errors are not normally distributed or when the dynamics are unknown.

Given that the variables are I(1), the VAR(p) process with the form of Equation (5) can be represented by the VECM (p-1) as in Equation (6):^{vii}

$$dx_t = A_0 + A_1 x_{t-1} + A_2 x_{t-2} + \dots + A_p dx_{t-p} + \mu_t \quad (5)$$

$$dx_t = A_0 + \Pi x_{t-1} + \Gamma_1 dx_{t-1} + \Gamma_2 dx_{t-2} + \dots + \Gamma_{p-1} dx_{t-(p-1)} + \mu_t \quad (6)$$

where $\mu_t \sim (0, \Omega) \forall t$ and $E(\mu_t, \mu_{t+s}) = 0 \forall s \neq 0$. x_t is a $n \times 1$ vector of endogenous variables and $A_0, A_1, A_2, \dots, \Pi, \Gamma_1, \Gamma_2, \dots, \Gamma_{t-(p-1)}$ are the parameter matrices. Whether or not the I(1) variables are cointegrated, and if so how many cointegrating vectors exist, depends on the rank of the matrix Π . Before estimating the rank of the matrix Π , we need to determine how many lags should be included in Equation (6). Johansen (1992) suggests that the lag length should be specified such that the VAR residuals are empirically Gaussian. As a lag selection strategy, we add lags incrementally until the series correlation of the residuals in the estimated VAR is eliminated.^{viii}

To determine the rank of the matrix Π or the number of cointegrating vectors, Johansen (1988) proposes the trace test and the maximum eigenvalue test.

The trace test takes the following form:

$$TR(r) = -T \sum_{j=r+1}^m \ln(1 - \hat{\lambda}_j)$$

where $\hat{\lambda}_1, \hat{\lambda}_2, \dots, \hat{\lambda}_m$ are the estimated eigenvalues arranged in descending order and T is the number of usable observations. The null hypothesis is that the number of distinct cointegrating vectors is less than or equal to r against a general alternative.

The maximum eigenvalue test takes the following form

$$MX(r) = -T \ln(1 - \hat{\lambda}_{r+1})$$

where $\hat{\lambda}_1, \hat{\lambda}_2, \dots, \hat{\lambda}_m$ are the estimated eigenvalues arranged in descending order and T represents the number of usable observations. The null hypothesis is that the number of cointegrating vectors is r against the alternative of $r+1$ cointegrating vectors. After determining the number of cointegrating vectors r ($0 < r < n$), the matrix Π can be decomposed into two matrices α ($n \times r$) and β ($n \times r$) such that $\Pi = \alpha\beta'$.

Therefore, equation (6) can be rewritten in the form:

$$dx_t = A_0 + \alpha(\beta' x_{t-1}) + \Gamma_1 dx_{t-1} + \Gamma_2 dx_{t-2} + \dots + \Gamma_{p-1} dx_{t-(p-1)} + \mu_t \quad (7)$$

where β is the matrix of cointegrating vectors and α is the matrix of speed of adjustment parameters. The β matrix measures the long-run equilibrium relationship among the variables, and the α matrix measures the responses to deviations from long-run equilibrium. Equation (7) can be estimated using the maximum likelihood method. Once α and β are determined, various restrictions on α and β can be examined by a likelihood ratio (LR) test which compares the maximized value of the log-likelihood function of unrestricted and restricted models. The statistic for this test is given by $2[L_u - L_r]$, where L_u and L_r denote the maximized values of the log likelihood function of the unrestricted and restricted models, respectively.

To test whether a variable enters into long-run equilibrium, we need to test the hypothesis that the coefficients of this variable in all cointegrating vectors are equal to zero. To test for long-run

causality we need to test the restriction on the adjustment coefficient, α . The zero restriction on α for one equation denotes weak exogeneity, which means that the variable does not respond to any deviation from long-run equilibrium. Hall and Wickens (1993) and Hall and Milne (1994) interpret weak exogeneity in a cointegrating system as depicting long-run causality.

Three models are employed to investigate the relationship between financial development and real investment. Each model has three endogenous variables: real GDP per capita ($\ln Y$), real investment per capita ($\ln I$) and a financial development variable - bank deposit liabilities ($\ln D$), bank domestic credit ($\ln C$) and broad money M2 ($\ln M$). The alternative finance proxies are considered in models 1-a, 1-b and 1-c, and the estimated results are presented in Table 1. For models 1-a and 1-b, both maxi-eigenvalue and trace tests suggest at the 1% significance level that there are two distinct cointegrating vectors. For model 1-c, the maxi-eigenvalue test suggests there is only one cointegrating vector. However, the trace test concludes that there are two cointegrating vectors. The trace test shows more robustness to both skewness and excess kurtosis in the residual than the maxi-eigenvalue test (Cheung and Lai, 1993). Thus, Table 1 reports the case with two cointegrating vectors.^{ix} Each of the variables, with the exception of the real investment variable ($\ln I$) in model 1-a, enters the cointegrating vectors at the 1% significance level. The real investment variable ($\ln I$) enters the cointegrating vectors at the 5% level in model 1-a.

Each model implies that the three variables are cointegrated. This suggests the presence of a long-run equilibrium relationship among them. All the estimated cointegrating vectors indicate that financial development is positively related with economic growth and real investment. In terms of long-run causality, the hypothesis of “weak exogeneity” can be rejected for all three variables at the 1% significance level in model 1-a. In models 1-b and 1-c, the hypothesis of “weak exogeneity” can be rejected at the 1% significance level for the financial development variables ($\ln C$ and $\ln M$) and at the 5% significance level for economic growth ($\ln Y$) and real investment ($\ln I$). Thus each of these three models suggest that there is bi-directional long-run causality among the three variables. All variables are responsible for restoring long-run equilibrium after a temporary deviation.^x

INSERT TABLE 1

Next we examine cointegration and causality between financial development and real capital stock, the second indicator of capital accumulation. The same three financial variables (lnD, lnC and lnM) are used in the three models, and the results are reported in Table 2. The three models give mixed results. When bank deposit liabilities (lnD) are used as indicator of financial development (model 2-a), both the maxi-eigenvalue test and trace test suggest two distinct cointegrating vectors at the 1% significance level. Economic growth (lnY) and financial development (lnD) enter the cointegrating vector at the 1% significance level and capital stock (lnK) enters the cointegrating vector at the 5% significance level. Therefore, this model suggests that there is a long-run equilibrium relationship between financial development and real capital stock. The hypothesis of “weak exogeneity” can be rejected for all three variables at the 1% significance level, indicating bi-directional long-run causality among the variables. The result from model 2-a is consistent with the conclusion drawn from the models with real investment. However, when financial development is measured by bank domestic credit (lnC) in model 2-b, the capital stock variable does not enter the cointegrating vector even at the 5% significance level, though both the maxi-eigenvalue and trace tests suggest that there are two cointegrating vectors. Given that the capital stock is not significant in the cointegrating vector, we do not proceed to the causality test.

When financial development is measured by broad money M2 (model 2-c), the maxi-eigenvalue test concludes that there is no cointegration among the three variables, while the trace test suggests one cointegrating vector. In the latter case, neither financial development (lnM) nor economic growth (lnY) enter the cointegrating vector significantly. Both models 2-b and 2-c suggest that there is no long-run relationship between financial development and the real capital stock.^{xi}

INSERT TABLE 2

We believe the conclusion drawn from the models with real investment (models 1-a, 1-b and 1-c) is more reliable for evaluating the results of the relationship between financial development and capital accumulation. First, conclusions drawn from the models with real investment are robust to different measures of financial development and possible structural change, while the models with real capital stock are sensitive to different measures of financial development and possible structural change. Secondly, as previously noted, numerous conceptual and statistical problems compromise the integrity of results based on real capital stock data.

Therefore, we draw the conclusion that there is cointegration and bi-directional causality between financial development and capital accumulation. That is to say, China's financial development has helped to promote capital accumulation which, in turn, has contributed to financial development. The long-run positive linkage between financial development and capital accumulation during the sample period is plausible for the following reasons. First, during the pre-reform period, China's financial system helped to mobilize government savings to undertake large-scale investment in support of its rapid industrialization strategy. Secondly, during the post-reform period, China's banking sector has played an increasingly prominent role in channelling large amounts of private savings into public investment.

The finding of bi-directional causality supports neither the "supply-leading" nor the "demand-following" hypothesis. This conclusion is generally consistent with Zhang and Yao (2002) who find positive bi-directional long-run causality between financial deepening and economic growth over the same period in China. This empirical evidence for the Chinese transition economy contrasts with the finding that financial development plays a leading role in many industrialized countries.

INSERT TABLE 3

We also examined the linkage between financial development and productivity improvement. Productivity is measured by two instruments: TFP which controls for labour force and physical capital (P) and TFP controlled for the additional input of human capital (HP). Table 3 describes the estimates for the three models which use the variable P. Each of the three models includes three

variables: economic growth (lnY), productivity (lnP) and financial development. All three models yield quantitatively consistent conclusions. Even though both maxi-eigenvalue and trace tests conclude that there are two cointegrating vectors among the three variables, none of the three financial development variables enters the cointegrating vectors significantly (at 5%). We conclude that there is no long-run equilibrium relationship between financial development and productivity growth in China (obviating the need to conduct the long-run causality tests). Sensitivity analysis suggests that this conclusion is robust to the alternative assumptions of $\alpha = 0.4$ and $\alpha = 0.6$.

INSERT TABLE 4

We repeated the exercise with the more precise productivity measure HP that allows for human capital formation. The results are reported in Table 4. Both maxi-eigenvalue and trace tests suggest that there are two cointegrating vectors for the three models. However, we cannot reject the hypothesis that HP does not enter the cointegrating vector at the 5% significance level. The three models suggest there is no long-run relationship between financial development and productivity improvement. The conclusion does not change with values of α equal to 0.4 or 0.6.

To account for possible structural change, we included a market reform dummy variable (D1). Using P as the productivity measure for all three models, both financial development and productivity enter the cointegrating vectors significantly, indicating a long-run equilibrium relationship between financial development and productivity improvement. Using HP as measure of productivity, the results were mixed depending on the financial indicator chosen. When financial development is measured by bank deposit liabilities (lnD) in model 4-a, the productivity variable (lnHP) does not enter the cointegrating vector significantly, but when financial development is measured by bank domestic credit (lnC) in model 4-b and broad money M2 (lnM) in model 4-c, we find that both the financial development variable and the productivity variable enter the cointegrating vector significantly. However, irrespective of how productivity is measured, we cannot reject the hypothesis of “weak exogeneity” for productivity at the 5% level. This result suggests that in the long run, financial development does not lead to productivity growth in China.

Overall evidence of a relationship between financial development and productivity improvement is rather weak in China, no matter how productivity and financial development are measured. We cannot find any long-run relationship between these variables without including the reform dummy variable. When the reform dummy variable is incorporated, we find evidence of a long-run equilibrium relationship with some financial development indicators, but we cannot reject the hypothesis that productivity is weakly exogenous. Hence, we conclude that the contribution of the financial system to improving productivity in China is very limited.

The weakness of the relationship between financial development and productivity improvement is not surprising. First, the theoretical model of Acemoglu *et al.* (2002) suggests that a developing country that is behind the technological frontier will typically pursue an investment-based growth strategy through copying and adopting best practice technologies from abroad. As the economy approaches the technological frontier, opportunities for such copying and adopting erode and, consequently, the economy switches to an innovation-based strategy. The selection of potential investments is more important for an innovation-based strategy. Hence, investment-based growth at the early stage of development reduces incentives for selectivity in potential investment opportunities. It follows that financial development may not be closely related to productivity improvement. This argument is largely consistent with China's development strategy and economic practice. Almost all researchers agree that capital accumulation has been playing a dominant role in China's economic growth (e.g., Chow 1993, Krugman 1994, Hu and Khan 1997 and Wang and Yao 2003). Using a similar data-set to that used here, Wang and Yao (2003) conclude that physical capital and human capital contributed respectively 51% and 30% to GDP growth over the period 1953-1999.

The second explanation for the weak relationship between financial development and productivity improvement is the relatively rudimentary state of China's financial development. Regulations and controls, and abuses of market power prevent the financial sector from performing its important functions effectively. Our finding of only a weak relationship between financial development and productivity improvement is also consistent with Rioja and Valev (2004) who note that a strong positive influence of finance on economic growth operates primarily through productivity improvement in developed countries, but in developing countries this effect occurs primarily through facilitating capital accumulation.

6. CONCLUSION

This study has explored the interaction in China during the period 1952-1999 between financial development and economic growth, mediated through the alternative processes of capital accumulation and productivity improvement. Our findings suggest a systematic difference in the responsiveness of the two processes. There exists a positive long-run equilibrium relationship and bi-directional causality between financial development and capital accumulation. In contrast, any long-run linkage between financial development and productivity improvement is found to be statistically weak. If there is a relationship, then causality is likely to run from productivity improvement to financial development. These results are generally robust to different measures of financial development and indicators of capital accumulation and productivity. Hence, we conclude that financial development in China contributes to growth primarily through facilitating capital accumulation rather than by improving productivity. This result does not provide unequivocal support for either the “demand-following” or the “supply-leading” hypothesis.

We conclude this paper by emphasizing the limitations of the present study and offering several directions that future research could pursue. First, more precise measures of financial development could strengthen the explanatory power of empirical causality investigations. Measures of financial depth should capture all the institutions that play a prominent role in the particular setting. Specifically, they should not be restricted to the banking sector but incorporate also stock markets, bond markets and, importantly, informal financial institutions. In China, informal financial institutions like Hui - unofficial rotating credit associations - are widespread in some areas such as Wenzhou in the southern coastal province of Zhejiang (Tsai 2002). The PBC has even recognized the positive contribution of these informal financial institutions. For instance, the Deputy Governor of the PBC, Wu Xiaoling, observed in a recent speech that relaxing control over informal financing could promote efficiency of resource allocation (Wu 2005).

Secondly, regional disparities play a prominent role in China (Yao 1997; Yao 1999; Yao and Zhang 2001). These disparities arise from differences in the extent of marketization and openness, tax and trade policies, transportation conditions and human capital formation, among others. Hence, the contribution of financial development to capital accumulation and productivity improvement is likely to vary across regions and provinces and may remain obscure in analysis based on national data. Rigorous formal investigations at the regional or provincial level could offer more information about the mechanism through which financial development affects economic growth, but such studies would encounter even more severe data problems.

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Table 1: Financial Development and Real Investment**Model 1-a: Endogenous variables: lnY, lnI, lnD ; lag length: 4**

Maxi eigenvalue test		Trace test		Coint. Vector 1		Coint. Vector 2	
r=0	r=1	r=0	r≤1	$(\beta_{1lnY} \beta_{1lnI} \beta_{1lnD})$		$(\beta_{2lnY} \beta_{2lnI} \beta_{2lnD})$	
30.68**	15.04**	52.34**	21.65**	(1, 0, -3.324)		(0, 1, -5.930)	
Joint test: not significance in both vectors ($\beta_{1i}=\beta_{2i}=0$)				Weak exogeneity test ($\alpha_{1i}=\alpha_{2i}=0$)			
	lnI	lnD	lnY		lnI	lnD	lnY
LR stat	7.35*	18.04**	16.34**	LR stat	10.28**	15.18**	11.65**
P value	0.0254	0.0001	0.0003	p value	0.0059	0.0005	0.0030

Model 1-b: Endogenous variables: lnY, lnI, lnC ; lag length: 6

Maxi eigenvalue test		Trace test		Coint. Vector 1		Coint. Vector 2	
r=0	r=1	r=0	r≤1	$(\beta_{1lnY} \beta_{1lnI} \beta_{1lnC})$		$(\beta_{2lnY} \beta_{2lnI} \beta_{2lnC})$	
72.01**	16.76**	92.74**	20.73**	(1, 0, -1.800)		(0, 1, -1.426)	
Joint test: not significance in both vectors ($\beta_{1i}=\beta_{2i}=0$)				Weak exogeneity test ($\alpha_{1i}=\alpha_{2i}=0$)			
	lnI	lnC	lnY		lnI	lnC	lnY
LR stat	15.44**	63.56**	37.75**	LR stat	8.86*	54.71**	7.36*
P value	0.0004	0.0000	0.0000	p value	0.0119	0.0000	0.0253

Model 1-c: Endogenous variables: lnY, lnI, lnM ; lag length: 4

Maxi eigenvalue test		Trace test		Coint. Vector 1		Coint. Vector 2	
r=0	r=1	r=0	r≤1	$(\beta_{1lnY} \beta_{1lnI} \beta_{1lnM})$		$(\beta_{2lnY} \beta_{2lnI} \beta_{2lnM})$	
28.06**	13.12	45.95**	17.89**	(1, 0, -8.427)		(0, 1, -15.900)	
Joint test: not significance in both vectors ($\beta_{1i}=\beta_{2i}=0$)				Weak exogeneity test ($\alpha_{1i}=\alpha_{2i}=0$)			
	lnI	lnM	lnY		lnI	lnM	lnY
LR stat	11.61**	16.21**	17.05**	LR stat	6.72*	14.28**	6.98*
P value	0.0030	0.0003	0.0002	p value	0.0347	0.0008	0.0305

Table 2 Financial Development and Real Capital Stock

Model 2-a: Endogenous variables: lnY, lnK, lnD ; lag length: 6

Maxi eigenvalue test		Trace test		Coint. Vector 1		Coint. Vector 2	
r=0	r=1	r=0	r≤1	$(\beta_{1lnY} \beta_{1lnK} \beta_{1lnD})$		$(\beta_{2lnY} \beta_{2lnK} \beta_{2lnD})$	
42.42**	24.33**	71.06**	28.64**	(1, 0, -0.590)		(0, 1, -0.131)	
Joint test: not significance in both vectors ($\beta_{1i}=\beta_{2i}=0$)				Weak exogeneity test ($\alpha_{1i}=\alpha_{2i}=0$)			
	lnK	lnD	lnY		lnK	lnD	lnY
LR stat	9.06*	28.78**	17.52**	LR stat	16.56**	35.01**	20.03**
P value	0.0108	0.0000	0.0001	p value	0.0003	0.0000	0.0000

Model 2-b: Endogenous variables: lnY, lnK, lnC ; lag length: 7

Maxi eigenvalue test		Trace test		Coint. Vector 1		Coint. Vector 2	
r=0	r=1	r=0	r≤1	$(\beta_{1lnY} \beta_{1lnK} \beta_{1lnC})$		$(\beta_{2lnY} \beta_{2lnK} \beta_{2lnC})$	
51.95**	33.11**	96.73**	44.78**	(1, 0, -5.560)		(0, 1, -13.204)	
Joint test: not significance in both vectors ($\beta_{1i}=\beta_{2i}=0$)							
	lnK				lnC		lnY
LR stat		1.44			23.88**		7.26**
P value		0.4869			0.0000		0.0266

Model 2-c: Endogenous variables: lnY, lnK, lnM ; lag length: 3

Maxi eigenvalue test		Trace test		Coint. Vector 1	
r=0	r=1	r=0	r≤1	$(\beta_{1lnY} \beta_{1lnK} \beta_{1lnM})$	
32.00	12.43	19.57*	12.14	(1, -1.025, -0.068)	
Test: not significance in the one vectors ($\beta_i=0$)					
	lnK			lnM	lnY
LR stat		4.39*		0.08	3.00
P value		0.0362		0.7723	0.0833

Table 3: Financial Development and Productivity Improvement without Incorporating Human Capital

Model 3- a: Endogenous variables: lnY, lnP, lnD ; lag length: 4

Maxi eigenvalue test		Trace test		Coint. Vector 1	Coint. Vector 2
r=0	r=1	r=0	r≤1	(β_{1lnY} β_{1lnP} β_{1lnD})	(β_{2lnY} β_{2lnP} β_{2lnD})
35.62**	20.51**	65.45**	29.84**	(1, 0, -7.186)	(0, 1, -2.916)
Joint test: not significance in both vectors ($\beta_{1i}=\beta_{2i}=0$)					
		lnP		lnD	lnY
LR stat		12.98**		2.47	8.07**
P value		0.0015		0.2913	0.0176

Model 3-b: Endogenous variables: lnY, lnP, lnC ; lag length: 4

Maxi eigenvalue test		Trace test		Coint. Vector 1	Coint. Vector 2
r=0	r=1	r=0	r≤1	(β_{1lnY} β_{1lnP} β_{1lnC})	(β_{2lnY} β_{2lnP} β_{2lnC})
37.84**	17.05**	65.72**	27.87**	(1, 0, -8.178)	(0, 1, -3.378)
Joint test: not significance in both vectors ($\beta_{1i}=\beta_{2i}=0$)					
		lnP		lnC	lnY
LR stat		17.24**		3.12	13.27**
P value		0.0002		0.2104	0.0013

Model 3-c: Endogenous variables: lnY, lnP, lnM ; lag length: 4

Maxi eigenvalue test		Trace test		Coint. Vector 1	Coint. Vector 2
r=0	r=1	r=0	r≤1	(β_{1lnY} β_{1lnP} β_{1lnM})	(β_{2lnY} β_{2lnP} β_{2lnM})
27.27*	19.05*	52.57**	25.30*	(1, 0, -3.000)	(0, 1, -1.246)
			*		
Joint test: not significance in both vectors ($\beta_{1i}=\beta_{2i}=0$)					
		lnP		lnM	lnY
LR stat		11.46**		4.72	7.81*
P value		0.0032		0.0946	0.0201

Table 4: Financial Development and Productivity Improvement Incorporating Human Capital**Mode 4-a: Endogenous variables: lnY, lnHP, lnD ; lag length: 4**

Maxi eigenvalue test		Trace test		Coint. Vector 1	Coint. Vector 2
R=0	r=1	r=0	r≤1	($\beta_{1\ln Y}$ $\beta_{1\ln HP}$ $\beta_{1\ln D}$)	($\beta_{2\ln Y}$ $\beta_{2\ln HP}$ $\beta_{2\ln D}$)
30.25**	21.90**	52.35**	22.10**	(1, 0, -0.936)	(0, 1, -0.695)
Joint test: not significance in both vectors ($\beta_{1i}=\beta_{2i}=0$)					
		lnHP		lnD	lnY
LR stat		4.49		21.76**	22.18**
P value		0.1061		0.0000	0.0000**

Model 4-b: Endogenous variables: lnY, lnHP, lnC ; lag length: 4

Maxi eigenvalue test		Trace test		Coint. Vector 1	Coint. Vector 2
R=0	r=1	r=0	r≤1	($\beta_{1\ln Y}$ $\beta_{1\ln HP}$ $\beta_{1\ln C}$)	($\beta_{2\ln Y}$ $\beta_{2\ln HP}$ $\beta_{2\ln C}$)
22.02**	16.30**	39.13**	17.11**	(1, 0, -1.515)	(0, 1, -1.191)
Joint test: not significance in both vectors ($\beta_{1i}=\beta_{2i}=0$)					
		lnHP		lnC	lnY
LR stat		1.45		17.54**	17.00**
P value		0.4838		0.0002	0.0002

Model 4-c: Endogenous variables: lnY, lnP, lnM ; lag length: 4

Maxi eigenvalue test		Trace test		Coint. Vector 1	Coint. Vector 2
R=0	r=1	r=0	r≤1	($\beta_{1\ln Y}$ $\beta_{1\ln HP}$ $\beta_{1\ln M}$)	($\beta_{2\ln Y}$ $\beta_{2\ln HP}$ $\beta_{2\ln M}$)
32.27**	14.57**	47.05**	14.78**	(1, 0, -0.777)	(0, 1, -0.832)
Joint test: not significance in both vectors ($\beta_{1i}=\beta_{2i}=0$)					
		lnHP		lnM	lnY
LR stat		5.84		19.15**	16.00**
P value		0.0540		0.0001	0.0003

NOTES

ⁱThe data for several variables (e.g., capital stock, real investment and human capital) used in this study are from Wang and Yao (2003). Their data only covers the period 1952-1999. For China different data sources usually have substantial differences for the same variables. Hence, to avoid mixing different data sources, this study only covers the period from 1952 to 1999.

ⁱⁱ <http://www.cbrc.gov.cn>

ⁱⁱⁱ <http://www.csrc.gov.cn>; <http://www.pbc.gov.cn>

^{iv} For example, King and Levine (1993a, 1993b) and Chang (2002) use the ratio of money to GDP as an indicator of development of the banking sector. Arestis et al. (2001) and Levine and Zervos (1998) use the ratio of domestic bank credit to GDP to measure development of the bank sector. Thornton (1996), Demetriades and Hussein (1996), Thangavelu and Ang Beng Jiunn (2004) and Zhang and Yao (2002) use the ratio of bank deposit liabilities to GDP as a measure of financial development.

^v Banks include, before 1990, state-owned banks and rural credit cooperatives and after 1990, state-owned commercial banks, joint stock commercial banks, city commercial banks, policy banks, rural commercial banks, urban credit cooperatives and rural credit cooperatives.

^{vi} Chow (1993) used a value 0.4 for the share of labor income for 1952-1980 while Li et al (1993) used the average values of 0.462 and 0.536 for the pre-reform and post-reform periods, respectively.

^{vii} Since all the variables appear to have a deterministic trend, an intercept is included both inside and outside the cointegrating equation(s), i.e., in EVIEWS vector error correction specification the third option (intercept, no trend in CE and VAR) is chosen.

^{viii} This is a “specific to general strategy”. An alternative model specification strategy is “general to specific”. Both these strategies have received some criticism in the literature (Hoover 2005). This study follows the ‘specific to general strategy’ as employed, e.g., in Arestis et al (2001).

^{ix} In the one cointegrating vector case, the results are quantitatively similar except that we cannot reject weak exogeneity for $\ln M$.

^x To ensure that the results are robust to possible structural change caused by China’s economic reform we also included a dummy variable that takes the value of 1 before 1978 and 0 after 1978 in the three models. The results, which were quantitatively similar, are available on request.

^{xi} To account for possible structural change resulting from China’s economic reform we also included a dummy variable. The general result was that the financial development variable and the capital stock level cannot enter the cointegrating vectors significantly together. This means that there is no cointegration relationship between financial development and the real capital stock.