

Does Financial Development ‘Lead’ Economic Growth? The Case of China

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Using a Vector Autoregression (VAR) approach, we examine the impact of financial development on economic growth in China. Innovation accounting (variance decomposition and impulse response function) analysis is applied to examine interrelationships between variables in the VAR system and, therefore, differs from the more usual approach. We find that financial development comes as the second force (after the contribution from labor input) in leading economic growth in China. This study has supported the view in the literature that financial development and economic growth exhibit a two-way causality and hence is against the so-called “finance-led growth” hypothesis. The study of this kind in the case of China is limited; it therefore provides an interesting advance in the literature on the finance-growth nexus. © 2006 Peking University Press

Key Words: Financial Development; Economic Growth; VAR.

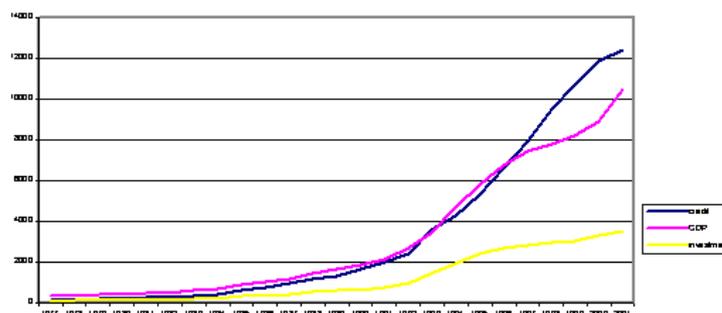
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1. INTRODUCTION

This paper shed further light on the much-debated question of whether financial development leads, in a Granger causality sense, economic growth. This is an important question because it assists in an evaluation of the extent to which the financial deregulation that has occurred in many western countries has spurred economic growth. Further, it gives some guidance as to whether financial sector development is a necessary and sufficient condition for a higher growth rates in developing countries.

This topic is particularly relevant in the case of China where a swift change and reform in the financial sector, aiming to promote further deregulation of China's financial system, open domestic financial market and hence sustain strong economic growth in the past, has brought about significant financial development in China. Along with strong growth in its stock market, liberalization in its banking system, and allowing foreign participation of financial operation in China, one has seen a rising and more liberalized financial sector in China. Figure 1 indicates such swift change.

FIG. 1. Growth of GDP, Credit and Investment in China



Using the ratios of credit, investment, saving, quasi money and total stock market capitalization as indicators of financial development¹, it clearly shows some unsymmetrical results along with a strong real GDP growth and investment² growth during the same period of time in China.

Figure 2 and Figure 3 shows that the investment as percentage in GDP has stayed stable despite a significant increase in the credit/GDP ratio. Further, one can see from Figure 2 that, despite the growth of credit in China, net investment has stayed fairly stable in the last 15 years. It appears that the strong economic growth in China has been accompanied not by an increase in a productive net investment but an expensive use of credit in the economy.

Figure 4 shows that quasi-money/GDP in China has increased significantly in the last 20 years (except in 1985, 1988 and 1994 at the contraction times); It is in fact higher than it in some industrialized economies such as the United States and Japan, and some emerging economies such as Thailand and South Korea. For example, quasi-money/GDP ratio in China reached 146.1 percent in 1999, as opposed to those of the United

¹The choice of using credit as the indicator of financial development will be discussed in the model building section.

²Investment is defined here as the net investment where gross investment minus fixed investment.

FIG. 2. Credit and Investment in GDP in China

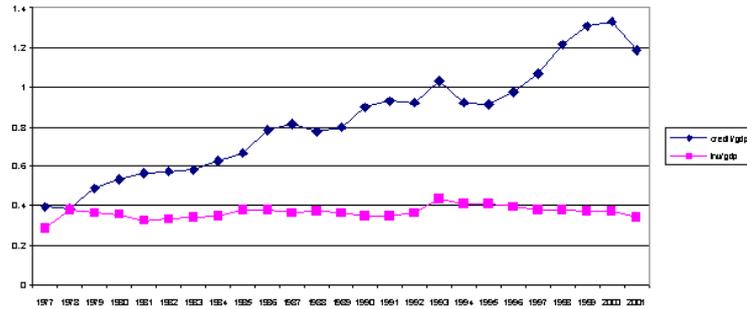
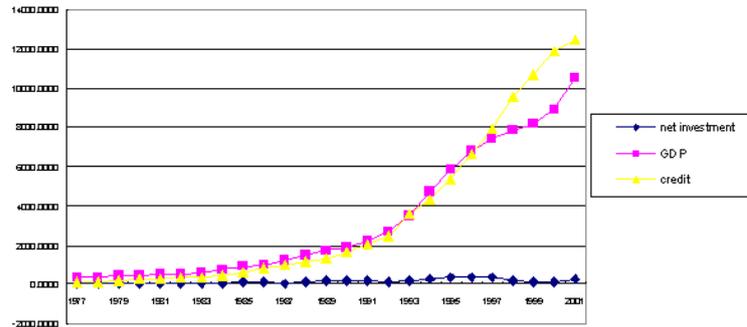
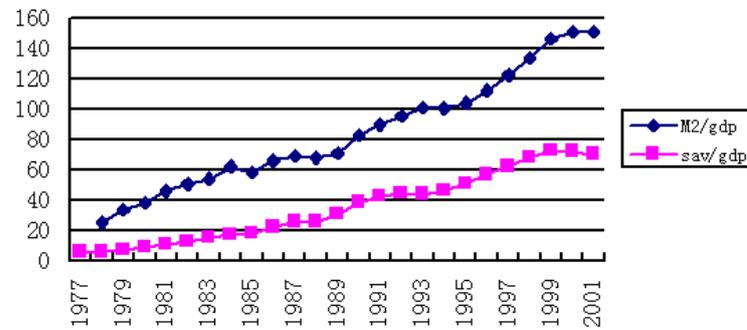


FIG. 3. Net Investment, Credit and GDP in China



States (70.35 percent), Japan (91.35 percent), Thailand (101.58 percent) and South Korea (68.07 percent) in the same year.

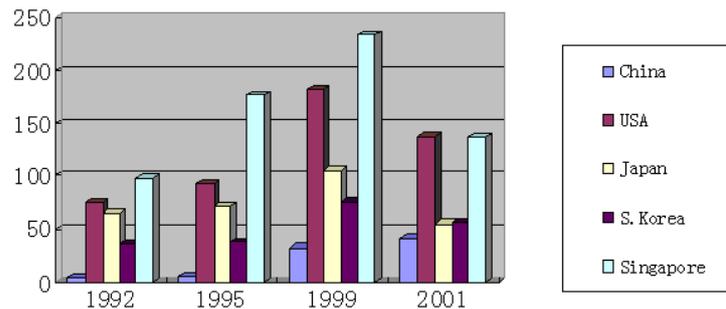
FIG. 4. Net Quasi Money and Savings Deposits in China



However, the growth of this credit expansion in China has not translated into an net productive investment as shown in Figure 2 and 3. Further,

Figure 5 indicates that the ratio of total stock market capitalization in China, as an important indicator of stock market development, has been fairly low compared to the commonly recognized level of 100 percent; It sharply contrasts to those in the countries such as the United States, Japan and some developing economies such as South Korea. It clearly indicates that the growth of deposit and savings in China has not transformed into a robust physical investment. This coincide with the fact that almost 1/2 of its capital formation comes from FDI in China³.

FIG. 5. Net Market Capitalization in China and Other Nations



Above all, there is no doubt that China as a developing nation remains the relatively limited financial development, especially relative to the high level of economic growth. At the same time, one can clearly see from the chronology of economic reform and development in China that the rapid growth of the Chinese economy since the reform in 1979 has not started from the financial sector but its rural sector. The financial reform in China has just started after at least 15 years strong economic growth thanks to its reforms in other areas such as its trade sector and the state-owned enterprises. The similar cases are found in Japan and Korea where economic take-off in the 1970s and 1980s occurred when there was significant underdeveloped, closed and informal financial sector present in both countries. That is to say, this is against the traditional finance-lead growth hypothesis which argues that financial development lead economic growth as the first necessary and sufficient condition.

Therefore, does financial growth promote economic development in China? This paper contributes to the finance-growth debate by investigating the relationship between financial opening and economic growth in China in a VAR econometric context (using the innovation accounting and Granger causality methodology). This is the first attempt to use this methodology

³Shan, Sun and Morris (2001), p.464.

to investigate the hypothesis that financial development "leads" economic growth in China.

2. LITERATURE REVIEW

In the literature, the question of causality between financial development and economic growth has been addressed both theoretically and empirically. The recent focus, however, has been on empirical analysis where research has been equivocal in its conclusions regarding the hypothesis that financial development "leads" economic growth. For example, King and Levine (1993) concluded that financial development "leads" economic growth and Levine and Zervos (1998) found that stock market and banking development "leads" economic growth. In contrast, Arestis and Demetriades (1997), Shan and Morris (2002) and Shan, Sun and Morris (2001) found that the hypothesis was supported in only a few of the countries surveyed and, therefore, that no general conclusions could be drawn.

Table 1 presents some selected studies in the literature regarding the finance-growth debate. It is clear from the table that the conclusions regarding the finance-growth debate are mixed and inconclusive.

The positive view of the finance-led growth hypothesis normally focuses on the role played by financial development in mobilizing domestic savings and investment through a more open and more liberalized financial system, and in promoting productivity via creating an efficient financial market. Chen (2002), for example, has examined the causal relationship between interest rates, savings and income in the Chinese economy over the period 1952 to 1999, using the cointegration test and Bayesian vector autoregressions (BVAR) model. He argues that "it is therefore important to establish well-developed financial institutions-particularly the independence of the Central Bank-interest rate liberalization and sound financial intermediation, all of which are important for the efficient allocation of capital, which, in turn, can help to establish sustainable economic growth" (Chen, 2002, p.59).

In the cases of other developing economies, Ansari (2002), who has used a vector error correction model (VECM) to analyze the impact of financial development, money and public spending on Malaysian national income, argues that Malaysian experience has shown "an unambiguous support for the supply-leading view of financial development, implying the importance of financial sector development" (Ansari, 2002, p.72). Strong government ownership of banks, which is a typical phenomenon in the countries such as China, is said to be one of the sources of slow economic growth around the world. La Porta, Lopez-de-Silanes and Shleifer (2002) have assembled data on government ownership of banks around the world and concluded that "higher government ownership of banks is associated with slower financial

TABLE 1.

Summary of Selected Studies on the Finance-led Growth Hypothesis

Authors	Sample	Methods	Main Findings
Al-taimi, Hussein, Al-Awad and Charif 2001	Selected Arab countries	Cointegration, Granger causality, and the IRF technique ⁴	No clear evidence that financial development affect or is affected by economic growth.
Al-Yousif 2002	1970-1999/30 developing countries	Granger causality test	Causality is bi-directional; the finance-growth relationship between cannot be generalized across countries.
Ansari 2002		VECM ⁵	Support the 'supply-leading' view of financial development
Arestis 2002	6 developing countries.	Standard econometric techniques	Financial liberalization is a much more complex process, the effects on financial development are ambiguous.
Arestis, Demetriade and Luintel 2001	5 developed economies	Time series methods	Banks and stock market promote economic growth, but banks are more important
Deidda and Fattouh 2002		Threshold regression model	Non-linear and possibly non-monotonic relationship between financial development and economic growth
Evans, Green and Murinde 2002	82 countries for 21 year time series data	Translog production function	Significant evidence of such interactions Human capital and financial development to economic growth in
Jalilian and Kirkpatrick 2002low income countries	Regression	Support the contention that financial sector leads economic growth
Kang and Sawada 2000	Time series data for 20 countries	Endogenous growth model	Financial development and trade liberalization are shown to increase the economic growth rate by increasing the marginal benefits of human capital investment.
Lensink 2001	1970-1998/developing and developed economies	Cross-country growth regression	The impact of policy uncertainty on economic growth depends on the development of the financial sector.

TABLE 1—*Continued*

Luitel and Khan 1999	10 sample countries	VAR	Bi-directional causality between financial development and economic growth
Nourzad 2002	3 panels of a number of countries in different stages of development	Stochastic production frontier	Financial deepening reduces productive inefficiency in both developed and developing countries, although the effect is larger in the former.
Wang 2000	1961-1996/ financial liberalization and industrial growth in Taiwan	Production function theory and Feder's two versions of the two-sector (the financial sector and the real sector) model	The financial-supply-leading version is more prevailing in the studies case.
Shan and Morris (2002)	OECD and Asian countries	VAR and granger causality test	The bi-directional causality between finance and growth in some countries and the one-way causality from growth to finance in other countries
Levine and Zervos (1998)	Developed economies	Cross-sectional regression	Support the hypothesis
Rajan and Zinglas (1998)	Developing and developed economies	Cross-sectional regressions	Support the hypothesis

development and slower growth of per capita income and productivity” (La Porta, et al. 2002, p.265).

In the cases of developed economies, Schich and Pelgrin(2002) have applied a panel data for 19 OECD countries from 1970 to 1997 to examine the relationship between financial development and investment levels. Their conclusion arising from a panel error correction model indicates that financial development is significantly linked to higher investment levels. Deidda and Fattouh (2002) who used a model allowing a non-linear and non-monotonic relationship between financial development and economic growth have supported the hypothesis of King and Levine (1993).

Nourzad (2002) has also used a panel data by a stochastic production function to investigate the impact of financial development on productive efficiency and concludes that “financial deepening reduces productive inefficiency in both developed and developing countries, although the effect is larger in the former” (2002, p.138).

Further, some literature suggests that financial sector development make contribution to poverty reduction in developing economies (see., eg., Jalilian and Kirkpatrick (2002).

However, there is a large volume of literature which provides empirical evidence against the finance-led growth hypothesis. Al-Yousif (2002), for example, has used both time series and panel data from 30 developing economies to examine the causal relationship between financial development and economic growth. He found that “financial development and economic growth are mutually causal, that is, causality is bi-directional. The findings of the present paper accords with the view of the World Bank and other empirical studies that the relationship between financial development and economic growth cannot be generalized across countries” (Al-Yousif, 2002, p.131).

More empirical evidence is found for developing economies where no causal relationship exists from financial development to economic growth. Using Granger causality and cointegration approach for selected Arab countries, Al-Tamimi, Al-Awad and Charif (2001) found that there is no clear evidence that financial development affects or is affected by economic growth. Cargill and Parker (2001) have discussed the dangers and consequences of financial liberalization using the experiences in Japan and provided a summary of lessons that China’s reformers should learn from the recent financial experiences of their Asian neighbors.

In the case of developed economies, Luintel and Khan (1999) investigated the finance-growth nexus in a multivariate VAR model and found a bi-directional causality between financial development and economic growth in all the sample countries. Arestis, et. al. (2002) demonstrated that financial liberalization is a much more complex process than has been assumed by earlier literature and its effects on economic development are ambiguous.

Arestis, Demetriades and Luintel (2001) suggested, after an econometric assessment, that the contribution of stock markets to economic growth may have been exaggerated by studies that utilize cross-country growth regressions.

Finally, the financial crisis that occurred in Asia has cast further doubt on the hypothesis. The rapid economic growth of the "Asian Tigers" has decreased (and in some negative growth has occurred) following the Asian "meltdown" yet this slowing of growth was preceded by considerable, and perhaps excessive, development of their financial sectors. In short, financial development appears to have led to reduced growth rates and, arguably, was partly responsible for the "meltdown".

Empirical studies adopt either of two general broad econometrics methodologies. Gelb (1989), King and Levine (1993), Fry (1995), Levine (1997 and 1998), Levine and Zervos (1998) and Rajan and Zingales (1998) used a cross-sectional modelling approach and their work tends to support the hypothesis.

Others, including Sims (1972), Gupta (1984), Jung (1986), Demetriades and Hussein (1996), Demetriades and Luintel (1996), Arestis and Demetriades (1997), Arestis, Demetriades and Luintel (2001) and Shan, Morris and Sun (2001), and Shan and Morris (2002) have used time-series modelling to test the hypothesis. Arestis and Demetriades, in advocating time-series modelling, argued that a cross-sectional approach is based on the implicit assumptions that countries have common economic structures and technologies and this, quite simply, is not true. The time-series studies have been equivocal in their conclusions regarding the hypothesis. Demetriades and Hussein observed that causality patterns differ between countries and it follows that any inferences drawn are about "on average" causality across the sample.⁶ Shan et al. found that in most of their sample of nine OECD countries and China, financial development did not "lead" economic growth except in a small minority of the countries studied.

Cross-sectional studies have failed to address the possibility of reverse causality from economic growth to financial development. Levine (1998) and Levine and Zervos (1998) examined causality from the development of banking, the legal system and the stock market to economic growth. Both noted that a case could be made for reverse causality however they did not test this empirically and concluded, instead, that banking development "leads" economic growth. Ahmed (1998) argued that, whilst the direction of causality is an important matter, cross-sectional studies are not capable of revealing the dynamic relationships necessary to establish it.

⁶Any significant "on average" relationship across different countries is likely to be sensitive to the addition or deletion of a few observations in the sample.

Gujarati (1995) and Shan and Sun (1998) noted that the neglect of reverse causality in either a cross-sectional or time-series modelling framework might introduce simultaneity bias. Earlier, Cole and Patrick (1986) observed that the relationships between financial development and economic growth are complex and are likely to contain “feedback interactions”.

Perhaps the most serious shortcoming of cross-sectional analysis is that it is inherently incapable of examining lagged relationships and, therefore, is inappropriate for testing Granger causality. Notwithstanding the increasing globalisation of national economies, there appears to be sufficient diversity remaining to render invalid the implicit assumption of cross-sectional analysis that the same constant parameters apply to all countries in the sample.

3. MODELING FRAMEWORK

This work uses a VAR modeling framework to capture the dynamics of the relationship between financial development and economic growth whilst avoiding the pitfalls of endogeneity and integration of the variables. However, it differs from previous Granger causality literature in investigating the finance-growth nexus by using the innovation accounting technique (impulse response function and variance decomposition) to investigate causality.

Enders (1995) proposed that forecast error variance decomposition permits inferences to be drawn regarding the proportion of the movement in a particular time-series due to its own earlier “shocks” vis-à-vis “shocks” arising from other variables in the VAR. After estimating the VAR, the impact of a “shock” in a particular variable is traced through the system of equations to determine the effect on all of the variables, including future values of the “shocked” variable.⁷ The technique breaks down the variance of the forecast errors for each variable following a “shock” to a particular variable and in this way it is possible to identify which variables are strongly affected and those that are not. If, for example, a “shock” in total credit leads subsequently to a large change in economic growth in the estimated VAR, but that a “shock” in economic growth has only a small effect on total credit, we would have found support for the hypothesis that financial development “leads” economic growth.⁸

Impulse response function analysis, on the other hand, traces out the time path of the effects of “shocks” of other variables contained in the VAR on a particular variable. In other words, this approach is designed

⁷The Microfit program sets the “shock” equal to one standard deviation of the particular time-series used to “shock” the VAR system.

⁸This is not a test of hypothesis in the manner of a Granger causality test that has well defined test statistics and critical values.

to determine how each variable responds over time to an earlier "shock" in that variable and to "shocks" in other variables. Together these two methods are termed innovation accounting and permit an intuitive insight into the dynamic relationships among the economic variables in a VAR.

In this paper we use variance decomposition to break down the variance of the forecast errors for economic growth, GDP growth (EG), into components that can be attributed to each of the other variables including the measure of financial development, total credit (TC). If total credit explains more of the variance amongst the forecast errors for economic growth than is explained by other variables, we would find support for the hypothesis that financial development Granger causes economic growth. Similarly, we would find support for the hypothesis that economic growth Granger causes financial development if the economic growth variable explains more of the variance in the forecast errors for total credit.

We use the impulse response function to trace how the economic growth variable responds over time to a "shock" in total credit and compare this to responses to "shocks" from other variables. If the impulse response function shows a stronger and longer reaction of economic growth to a "shock" in total credit than "shocks" in other variables, we would find support for the hypothesis that financial development "leads" economic growth. Similarly, if the impulse response function shows a stronger and longer reaction of total credit to a "shock" in economic growth than "shocks" in other variables, we would find support for the hypothesis that economic growth "leads" financial development.

The particular VAR model in which the innovation accounting technique is applied, is motivated by Feder's two-sector model concerning exports and growth. This article intends to propose a dynamic framework, which bases on the production function theory and consists of two-sector (the financial sector and the real sector), and extends it by combining financial development, external openness and factor inputs.

Therefore, the VAR model proposed in this study considers the factor inputs such as labor and physical capital as well as trade sector and a monetary factor (eg., total credit, deriving from the theory of money in the production function). The similar treatment can be found in Wang (2000), Kang and Sawada (2000) and Evans, Green and Murinde (2002).

From growth theory, we define economic growth (EG) as the rate of change of real GDP, investment (INV) as the rate of change of net investment. In accordance with modern growth theory, we propose that openness to international trade may facilitate economic growth by enlarging the markets of domestic firms and by permitting them to purchase inputs at world prices. To capture openness, we use the rate of change of the trade ratio (TRADE) defined as the ratio of the sum of imports and exports to GDP. Further, because economic output depends on inputs, and labor in

particular, we include the rate of change of the labor force (LAB) in the model.

The literature suggests a considerable range of choice for measures of financial development. Sims (1972), King and Levine (1993) and Cole et al. (1995) have used monetary aggregates, such as M2 or M3 expressed as a percentage of GDP. Recently, Demetriades and Hussein (1996) and Levine and Zervos (1998) have raised doubts about the validity of the use of such a variable to test the hypothesis that financial development “leads” economic growth because GDP is a component of both focus variables.

Following Levine (1997) and the World Bank (1998) we use total credit as a measure of financial development. We use total credit to the economy (TC) as an indicator of financial development. Credit is an appropriate measure of financial development because it is associated with mobilising savings to facilitating transactions, providing credit to producers and consumers, reducing transaction costs and fulfilling the medium of exchange function of money. In recent years, financial sectors have undergone rapid changes resulting from deregulation, technological innovation and new financial products (including widespread use of credit cards, telephone banking and Internet banking). These changes, in particular the abandonment of credit rationing, seem likely to have facilitated greater volumes of credit being created by financial systems.

Juttner (1994), in arguing against the use of monetary aggregates to measure financial development, noted that “credit creation does not necessarily entail money creation and vice versa” [p.110]. This suggests that M2/GDP and M3/GDP are not appropriate measures of financial development if the researcher is seeking to investigate how financial development might bring about economic growth. Levine and Zervos (1998) argued that M3/GDP only measures financial depth and “does not measure whether the liabilities are those of banks, the central bank or other financial intermediaries, nor does this financial depth measure identify where the financial system allocates capital” [p. 542]. In other words, they suggest that increases in M3/GDP are not necessarily associated with increases in credit, and credit is clearly one of the aspects of financial development that might generate economic growth.⁹

Our foregoing arguments suggest that financial development is unlikely to be more than a contributing factor and probably not the most important in increasing economic growth rates. Our VAR framework also accommodates the hypothesis that rising levels of real income give rise to demands for financial services from both the household and business sectors. The so-called reverse causality hypothesis is that increases in the demand for

⁹Our measure is slightly different from Levine and Zervos (1998) who differentiate between credit to the public and private sectors. Because of data limitations, we use total credit.

TABLE 2.

Variance Decomposition Percentage of 36-month Error Variance

Percentage of forecast error variance in	Typical shock in				
	EG_t	TC_t	INV_t	LAB_t	$TRADE_t$
EG_t	60.3	12.2	4.8	15.5	7.1
TC_t	14.6	65.1	10.4	3.7	6.5
INV_t	15.7	8.9	67.2	3.0	5.3
LAB_t	12.6	2.8	3.2	80.5	1.1
$TRADE_t$	16.2	2.0	4.1	10.3	78.5

financial services lead businesses in the financial sector to expand their activities and/or governments to ease restrictions on the financial sector.

In view of the considerations outlined above, we establish a VAR system that takes the following form:

$$V_t = \sum_{i=1}^k A_i V_{t-i} + \varepsilon_t \quad (1)$$

where $V_t = \langle EG_t, TC_t, INV_t, LAB_t, TRADE_t \rangle$,

$\varepsilon_t = \langle \varepsilon_{EG_t}, \varepsilon_{INV_t}, \varepsilon_{TC_t}, \varepsilon_{LAB_t}, \varepsilon_{TRADE_t} \rangle$,

$A_1 - A_k$ are five by five matrices of coefficients and ε_t is a vector of error terms. EG_t = real GDP in logarithm, TC_t = total credit to the economy in logarithm, LAB_t = labor force in logarithm, INV_t = net investment in logarithm and $TRADE_t$ = total trade as % in GDP in logarithm.

We use annual data from China for the period of 1978-2001 to construct VAR models to examine the causality hypotheses between financial development and economic growth. The data was obtained from the World Bank, World Tables, subscribed online through DX-Data, Australia.

4. EMPIRICAL EVIDENCE

The model (1) was estimated using Microsoft and the results are reported in table 2. The forecast error variance decomposition of unrestricted VAR(3) models were estimated over a 3 year forecast horizon.

We first report the results which demonstrate how the forecast error variance of our focus variables can be broken down into components that can be attributed to each of the variables in the VAR. In particular, we examine the relationships between total credit and economic growth, compared to the contributions to GDP from investment, trade openness and labor.

As expected, each time series explains the preponderance of its own past values: for example, EG_t explains over 60% of its forecast error variance, whereas TC_t explains nearly 70% of its forecast error variance. The fact that GDP growth is explained predominately by its past values suggests that current period economic growth influences future growth trends or that the phenomenon is due to a strong “lag effect” in the business cycle.

For the purpose of our study, however, we are more interested in the contribution of total credit (TC_t) to GDP (EG_t) as compared to other variables such as trade ($TRADE_t$), investment (INV_t) and labor (LAB_t). It is interesting to note that labor input explains 15.5% of the forecast error variance of GDP (EG_t) as the most important one affecting economic growth whereas total credit (TC_t) comes as the second one explaining 12.2% of forecast error variance of GDP, followed by trade openness ($TRADE_t$, 7.1%) and investment (INV_t , 4.8%).

Interestingly, we also find from Table 1 that trade openness, $TRADE_t$ is found to have a larger effect on GDP growth, EG_t ($TRADE_t$ explains 7.1% of forecast error variance of EG_t) than investment, INV_t (INV_t explains only 4.8% of forecast error variance of EG_t) and hence supports the hypothesis that the openness of an economy promotes economic growth.

Table 2 also shows that both trade and investment appeared to have strong lagged effects and are, to a large extent, explained by their own past values (around 70% of its forecast error variance and is more than that of EG_t and TC_t).

The fact that labor contributes most to GDP growth in China suggests that the Chinese economy is still a labor-intensive economy and its primary source of growth comes from extensive use of labor. At the same time, this study suggests that financial development has indeed promoted GDP growth in China and the swift change in Chinese financial system has brought about significant credit inputs to the Chinese economy.

However, the fact that total credit contributes more than net investment to GDP growth in China implies that its primary source of growth also comes from extensive use of credit/resources at the expense of a more productive net investment.

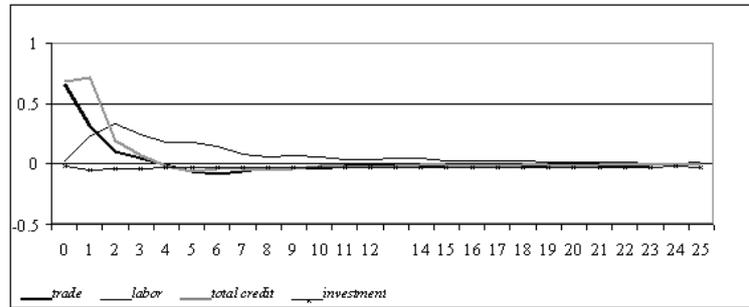
To investigate further the impact of credit on GDP growth as compared to other variables, we then have used impulse response function to trace the time paths of GDP in response to a one-unit shock to the variables such as credit, investment, labor and trade. A graphical illustration of an impulse response function can provide an intuitive insight into dynamic relationships because it shows the response of a variable to a “shock” in itself or another variable over time. For example, it allows us to examine how GDP growth responds over time to a “shock” in total credit and compare it with the effects on other variables.

The responses of the variables can be judged by the strength and the length over time. If the response of economic growth to a “shock” in total credit exhibits a larger and longer effect than the response of total credit to a “shock” in economic growth, we would find support for the hypothesis that financial development “leads” economic growth.

Figure 6 depicts the time paths of the responses of GDP growth to “shocks” in total credit, investment, trade and labor. It shows again that credit ranks as the second force (after the contribution from labor) which affects GDP growth. The response of GDP to a shock in labor has a longer and stronger effect than the response of GDP to total credit. The effect of labor on GDP lasts until the 7th year whereas credit’s impact on economic growth is smaller and “dies out” quickly from the 3rd year.

Thus, total credit comes again as the second important variable affecting GDP growth, followed by the contribution from trade. The impact of net investment on GDP is small and not dynamically longer and this is consistent with the earlier finding in this study.

FIG. 6. GDP growth responses to a “Shock” in Total Credit, Labor, Investment and Trade



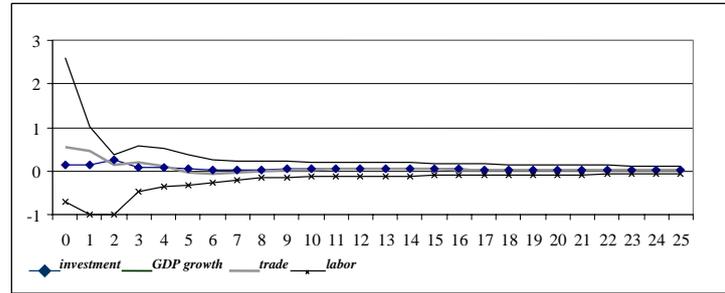
Therefore, we could argue financial development, as measured by total credit, does promote economic growth in China. However, two things worth mentioning here:

First, credit was only one of several sources of the innovations in economic growth and was not the most important factor (setting aside past values of economic growth). The innovations in total credit were not the most important source of the variance of forecast errors for economic growth. Similarly, economic growth, EG_t was found to have greater impacts on investment, INV_t (EG_t explaining 15.7% of forecast error variance of INV_t), than did total credit, TC_t (TC_t explains 8.9% of forecast error variance of INV_t). This suggests that economic growth have a greater influence on investment behavior than the availability of funds.

Second, if one looks at the impact of GDP on credit, he would see that GDP growth, EG_t also affects financial development, total credit, TC_t .

Table 2 shows that EG_t explains about 14.6% of forecast error variance of total credit being the most important one effecting total credit over a 3-year forecast horizon. Figure 7 depicts the time paths of the responses of total credit to “shocks” in GDP growth, investment, trade and labor. It confirms that economic growth, EG_t also affects financial development, TC_t , because the response of credit to a shock in GDP has the longest and strongest effect than the response of total credit to any other variables in the VAR system. The effect of EG_t on credit lasts until the 9th year whereas the impacts of INV_t , $TRADE_t$ and LAB_t on credit are smaller and “dies out” quickly from the 2nd year.

FIG. 7. Total credit responses to a “Shock” in GDP growth, Labor, Investment and Trade



Therefore, the above findings suggest that there is a bi-directional causality between GDP growth and financial development. In other words, the empirical evidence provided in this study has supported the view in the literature that financial development and economic growth exhibit a two-way causality and hence is against the so-called “finance-led growth hypothesis. However, it is also clear that the impact of GDP on credit is stronger than the reverse situation as suggested by the above impulse response function analysis.

To further verify this finding, we have conducted Granger causality test which is a modified Wald test proposed by Toda and Yamamoto (1995) to see whether exists a causality (either one-way or two-way) between financial development and economic growth using the data from China in the model we presented earlier”:

$$V_t = \sum_{i=1}^k A_i V_{t-i} + \varepsilon_t$$

$$\text{Recall } V_t = \langle EG_t, TC_t, INV_t, LAB_t, TRADE_t \rangle, \\ \varepsilon_t = \langle \varepsilon_{EG_t}, \varepsilon_{INV_t}, \varepsilon_{TC_t}, \varepsilon_{LAB_t}, \varepsilon_{TRADE_t} \rangle,$$

TABLE 3.

Granger Causality Test

Variables	P-values
$TC \Rightarrow GDP$	0.05*
$GDP \Rightarrow TC$	0.01**
$EG \Rightarrow INV$	0.05*
$INV \Rightarrow EG$	0.06**
$INV \Rightarrow TC$	0.04*
$TC \Rightarrow INV$	0.05**

Note: \Rightarrow indicates the direction of causality. * significant at 5%; ** significant at 1%.

$A_1 - A_k$ are five by five matrices of coefficients. Thus, to test the hypothesis that "Granger causality from financial development to economic growth", we need to test whether the coefficient of TC , the measure of financial development, is significant in the VAR for economic growth. To test whether the hypothesis that "Granger causality from economic growth to financial development", we test whether the coefficient of EG , the measure of economic growth, is significant in the VAR for financial development.

The results are shown in Table 3. They indicate that financial development and GDP growth are mutually affected and this clearly suggests that one cannot overestimate the impact of financial development on economic growth in China. It is interesting to note that the Granger causality from GDP growth to financial development (TC) is stronger than the causality from finance to GDP growth.

5. CONCLUDING REMARKS

This paper has used the VAR techniques of innovation accounting or variance decomposition and impulse response function analysis, including a Granger causality test, to provide a quantitative assessment of the relationship between financial development and GDP growth in China.

Financial development in China was found to be the second force (after the contribution from labor) affecting economic growth and the swift reform and change in the Chinese financial system have brought about significant credit resources to the economy and hence has contributed to GDP growth in China. However, we also found that strong economic growth in the last 20 years has significant impact on financial development by providing a solid credit base (through rising personal income and private and public

resources) in China. This indicates a two-way causality between finance and growth in the context of the so-called “finance-led growth” debate.

We also found that trade promotes GDP growth in China but credit growth has not helped increase net investment growth. Labor input is the most important force in leading economic growth in China.

To the limited extent that we did find some support for the hypothesis that financial development “leads” economic growth using the finding from this study on China, it seems clear that financial development is no more than a contributing factor and, almost certainly, not the most important factor to GDP growth.

It is clear that whatever causality may exist, it is not uniform in direction or strength, and highlights the inappropriateness of cross-sectional analysis in this regard. The results presented here provide evidence, from a different methodological perspective, that the hypothesis that financial development “leads” economic growth is not generally supported by time-series analysis, at least not from the experience of China.

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