This chapter sheds further light on the much-debated question of whether financial development leads, in a Granger causality sense, to economic growth. This is an important question because it helps to evaluate the extent to which the financial deregulation that has occurred in many western countries has spurred economic growth. Further, it gives some guidance about whether financial sector development is necessary to increase growth rates in developing countries.

These questions are particularly relevant in China, where swift change and reform in the financial sector—aimed at deregulating China’s financial system further and opening up the domestic financial market—has brought about significant financial development. China’s financial sector has been liberalised substantially with permission being granted for foreign entities to participate in the sector (Figure 6.1).

Net credit is a one indicator of financial development.\(^1\) There has a significant increase in net credit since early 1990s, along with strong real GDP growth and investment growth during the same period.\(^2\) However, investment as percentage in GDP has been stable despite a significant increase in the ratio of credit to GDP (Figure 6.2). This result diverges from the finance-led growth literature, which argues that financial development will promote investment and hence increase economic growth.

Does financial growth promote economic development in China? This chapter 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 to investigate the hypothesis that financial development 'leads' economic growth in China.

In the literature, the question of causality between financial development and economic growth has been addressed both theoretically and empirically. The recent focus has been on empirical analysis, where research has been equivocal regarding the hypothesis that financial development leads economic growth. King and Levine (1993) concluded that financial development leads economic growth, and Levine and Zervos (1998) found that stockmarket and banking development lead 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.

The positive view of the finance-led growth hypothesis normally focuses on the role played by financial development in mobilising domestic savings and investment through a more open and liberalised financial system, and in promoting productivity through the creation of 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 1952–99 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 liberalisation 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 2002:59).

Ansari (2002:72), who used a vector error correction model (VECM) to analyse 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'. Strong government ownership of banks, a typical phenomenon in countries such as China, is said to be one of the causes of slow economic growth around the world. La Porta et al. (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 development and slower growth of per capita income and productivity' (La Porta et al. 2002:265).
Figure 6.1 Growth of GDP, credit and investment in China

Figure 6.2 Credit and investment in GDP in China (per cent of GDP)

Source: Calculated using data from *Statistical Yearbook of China*
In the cases of industrial economies, Schich and Pelgrin (2002) have applied panel data for 19 OECD countries from 1970 to 1997 to examine the relationship between financial development and investment levels. Their conclusion 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 panel data from 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’ (2002:138). Further, some literature suggests that financial sector development contributes to poverty reduction in developing economies (see, for example, 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) 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 here accord with the view of the World Bank and other empirical studies that the relationship between financial development and economic growth cannot be generalised across countries (Al-Yousif 2002:131).

More empirical evidence is found for developing economies where no causal relationship exits from financial development to economic growth. Using the Granger causality and cointegration approach for selected Arab countries, Al-Tamimi et al. (2001) found no clear evidence that financial development affects or is affected by economic growth. Cargill and Elliot (2001) discussed the dangers and consequences of financial liberalisation with reference to the experiences in Japan and provided a summary of lessons that China’s reformers should learn from the recent financial experiences of their Asian neighbours.

In the case of industrial 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 (2002) demonstrated that financial liberalisation is a much more complex process than has been assumed by earlier literature and that its effects on economic
development are ambiguous. Arestis et al. (2001) suggested, after an econometric assessment, that the contribution of stockmarkets to economic growth may have been exaggerated by studies that utilise cross-country growth regressions.

Finally, the East Asian financial crisis has cast further doubt on the hypothesis. The rapid economic growth of the ‘Asian Tigers’ has decreased (and in some cases, turned negative) following the East Asian ‘meltdown’, yet this slowing of growth was preceded by considerable, 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, 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 et al. (2001) and Shan, Sun and Morris (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 assumption that countries have common economic structures and technologies. 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.3 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 stockmarket to economic growth. Both noted that a case could be made for reverse causality but 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.
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) had 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.

MODELLING FRAMEWORK

This work uses a Vector Autoregression (VAR) modelling 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. It differs from previous Granger causality literature, however, 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 that is attributable to its own earlier 'shocks' and the proportion attributable to '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. The technique breaks down the variance of the forecast errors for each variable following a 'shock' to a particular variable. In this way, it is possible to identify which variables are strongly affected and which are not. If, for example, a 'shock' in total credit leads subsequently to a large change in economic growth in the estimated VAR, but a 'shock' in economic growth has only a small effect on total credit, we would have support for the hypothesis that financial development leads economic growth.

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 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.

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 proposes a dynamic framework based on the production function theory and consists of two-sectors (the financial sector and the real sector), and extends it by combining financial development, external openness and factor inputs.

Therefore, the VAR model considers factor inputs such as labour and physical capital as well as trade sector and a monetary factor, for example, total credit, deriving from the theory of money in the production function. 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, and 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 \( \text{TRADE} \), defined as the ratio of the sum of imports and exports to GDP. Further, because economic output depends on inputs, and labour in particular, we include the rate of change of the labour force \( \text{LAB} \) 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 to the economy \( \text{TC} \) as a measure of financial development. Credit is an appropriate measure of financial development because it is associated with mobilising savings to facilitate 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, 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 (1994:110), 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'. 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 (1998:542) 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'. 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.\(^6\)
Our 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 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

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

where $V_t = \{\hat{EG}_t, \hat{TC}_t, \hat{INV}_t, \hat{LAB}_t, \hat{TRADE}_t\}$, $\varepsilon_t$ is a vector of error terms. $\hat{EG}_t$ = real GDP in logarithm, $\hat{TC}_t$ = total credit to the economy in logarithm, $\hat{LAB}_t$ = labor force in logarithm, $\hat{INV}_t$ = net investment in logarithm and $\hat{TRADE}_t$ = total trade as per cent of GDP in logarithm.

We use annual data from China for 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's World Tables through DX-Data, Australia.

**EMPIRICAL EVIDENCE**

It is important to note that restrictions need to be imposed on the VAR to identify the particular 'shocks' and account for correlations in innovations across equations and to decompose the forecast error variances to identify the impulse responses. We use Cholesky's decomposition method to impose identification restrictions since it precludes contemporaneous correlations between time-series in the system and ensures that the variance–covariance matrix of the residuals is block recursive and provides a minimal set of restrictions that identify the primitive model.7

We first report the results of using Cholesky's method, which demonstrates 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 labour. The forecast error variance decomposition of unrestricted VAR(3) models were estimated over a three year forecast horizon (results are shown in Table 6.1).

As expected, each time series explains the preponderance of its own past values: for example, GDP growth explains over 60 per cent of its forecast error variance, whereas total credit explains nearly 70 per cent 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 to GDP growth as compared to other variables such as TRADE, INV and LAB. It is interesting to note that labour input explains 15.5 per cent of the forecast error variance of GDP (EG_t) and is thus the most important influence on economic growth. Total credit (TC_t) comes second, explaining 12.2 per cent of forecast error variance of GDP, followed by trade openness (TRADE_t, 7.1 per cent) and investment (INV_t, 4.8 per cent).

Interestingly, we also found that trade openness had a larger effect on GDP growth (TRADE_t explains 7.1 per cent of forecast error variance of EG_t) than investment (INV_t explains only 4.8 per cent of forecast error variance of EG_t). This clearly supports the hypothesis that economic openness promotes economic growth.

Trade and investment both appear to have strong lagged effects and are, to a large extent, explained by their own past values (Table 6.1).

The fact that labour contributes the most to GDP growth in China suggests that the Chinese economy is still a labour-intensive economy and that its primary source of growth comes from the extensive use of labour. At the same time, this study

| Table 6.1 Variance decomposition percentage of 36-month error variance |
|-------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Percentage of forecast error variance in | Variables | Typical shock in | EG_t | TC_t | INV_t | LAB_t | TRADE_t |
| GDP | EG_t | 60.3 | 12.2 | 4.8 | 15.5 | 7.1 |
| Total credit | TC_t | 14.6 | 65.1 | 10.4 | 3.7 | 6.5 |
| Investment | INV_t | 15.7 | 8.9 | 67.2 | 3.0 | 5.3 |
| Labour | LAB_t | 12.6 | 2.8 | 3.2 | 80.5 | 1.1 |
| Trade openness | TRADE_t | 16.2 | 2.0 | 4.1 | 10.3 | 78.5 |

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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. 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 productive net investment.

To investigate further the impact of credit on GDP growth compared with other variables, we have used an impulse response function to trace the time paths of GDP in response to a one unit shock to variables such as credit, investment, labour and trade. An 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 their 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 6.3 depicts the time paths of the responses of GDP growth to 'shocks' in total credit, investment, trade and labour. Credit again ranked as the second most important input after labour—the response of GDP to a shock in labour has a longer and stronger effect than the response of GDP to total credit. The effect of labour on GDP lasts until the seventh year, whereas credit's impact on economic growth is smaller and 'dies out' quickly from the third year.

After labour and credit, trade is the next most important factor in GDP. The impact of net investment on GDP is small and not dynamically longer. This is consistent with the earlier finding in this study.

Therefore, we could argue financial development, as measured by total credit, does promote economic growth in China. However, two things are worth mentioning here: first, credit was only one of several sources of 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 was found to have a greater impacts on investment (EGt explained 15.7 per cent of forecast error
variance of \( \text{INV}_t \) than did total credit (\( \text{TC}_t \) explains 8.9 per cent of forecast error variance of \( \text{INV}_t \)). This suggests that economic growth has a greater influence on investment behaviour than the availability of funds.

Second, if one looks at the impact of GDP on credit, we can see that GDP growth also affects financial development; that is, total credit. GDP growth (\( \text{EG}_t \)) explains about 14.6 per cent of forecast error variance of total credit, and is the most important influence on total credit over a three year forecast horizon (Table 6.1). Economic growth also affects financial development because the response of credit to a shock in GDP has a longer and stronger effect than to shocks in any other variables in the VAR system (Figure 6.4). The effect of GDP growth (\( \text{EG}_t \)) on credit lasts until the ninth year whereas the impacts of investment, trade openness and labour on credit are smaller and 'die out' quickly from the second year.

Therefore, the above findings suggest that the causality between GDP growth and financial development is bi-directional. In other words, the empirical evidence provided in this study supports 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.

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**Figure 6.3** EG responses to a 'shock' in TC, LAB, INV and TRADE

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To further verify this finding, we have conducted a Granger causality test, which is a modified Wald test proposed by Toda and Yamamoto (1995). 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 (Table 6.2).

Financial development in China was found to be the second most important factor after labour affecting economic growth. Given this, swift reform and change in the Chinese financial system have brought significant credit resources to the economy and hence contributed to GDP growth in China. However, we also found that strong economic growth in the last 20 years has had a significant impact on financial development by providing a solid credit base (through rising personal income and

Figure 6.4 TC responses to a ‘shock’ in EG, LAB, INV and TRADE

Table 6.2 Granger causality test

<table>
<thead>
<tr>
<th>Variables</th>
<th>P-values</th>
</tr>
</thead>
<tbody>
<tr>
<td>TC=&gt; GDP</td>
<td>0.05*</td>
</tr>
<tr>
<td>GDP=&gt;TC</td>
<td>0.01**</td>
</tr>
<tr>
<td>EG=&gt; INV</td>
<td>0.05*</td>
</tr>
<tr>
<td>INV=&gt;EG</td>
<td>0.06**</td>
</tr>
<tr>
<td>INV=&gt;TC</td>
<td>0.04*</td>
</tr>
<tr>
<td>TC=&gt;INV</td>
<td>0.05**</td>
</tr>
</tbody>
</table>

Note: => indicates the direction of causality. * significant at 5 per cent; ** significant at 1 per cent.
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 that credit growth has not helped increase the growth of net investment. Labour is the most important factor affecting economic growth in China.

To a limited extent our findings suggest some support for the hypothesis that financial development 'leads' economic growth in China. It seems clear, however, that financial development is no more than a contributing, and almost certainly not the most important, factor in GDP growth.

Whatever causality may exist, it is not uniform in direction or strength, and highlights the inappropriateness of cross-sectional analysis. The results 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.

NOTES

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

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

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

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

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

6 Our 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.

7 For details, see Lutkepohl (1991).

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