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Abstract:
The relationship between financial-system reform and growth is of continuing interest and the subject of ongoing research; yet many aspects of it remain unclear. This paper contributes to the literature by an analysis of this relationship using Chinese time-series data. China is a particularly interesting subject for such a study since it has undergone rapid and wide-ranging financial liberalisation since economic reforms began in 1978 thus providing a rich source of data. We construct an index of financial liberalisation by combining the 'Delphi method' and principal components analysis to combine eight aspects of the reform process for 1978 to 2004. We tackle the question of the finance-growth nexus by estimating and simulating a VAR model of growth, saving and liberalisation. We find robust evidence of significant positive effects of liberalisation on growth in the short run and on accumulated growth in the long run but weak and predominantly negative effects of liberalisation on saving. Tests of short-run Granger causality show that liberalisation significantly causes both growth and saving but that there are no significant feedbacks to liberalisation.

Keywords: financial reform, financial liberalisation, economic growth, saving, Delphi method

JEL classification: G18, O16, O43, O53

I. Introduction

While China's financial history can be traced back 1000 years, the current banking system dates from the 1948 establishment of the People's Bank of China (PBC). For the next 30 years, from 1949 to 1978, the PBC was the only and all-inclusive bank and it played very much a subordinate role in a centrally-controlled economy in which the government subjected the banking sector to stringent controls; there was no stock market, the interest rate structure was distorted due to extensive interest rate controls and credit was allocated bureaucratically to preferred end users, notably state-owned enterprises.

As part of the reform and "opening-up" which began in 1978, China's authorities also undertook financial reform, liberalising the tightly controlled financial system. Since then reform of the financial system has proceeded apace and has been wide-ranging; it has included the relaxation of interest-rate controls, the removal of bank credit quotas, the diversification of financial institutions, the establishment of a comprehensive financial regulatory system, the implementation of an exchange rate regime based on a basket of currencies and greatly improved access of foreign financial institutions to Chinese markets.

While there is a growing literature examining the developing Chinese financial system, there has been little work which uses Chinese data to address the finance-growth relationship even though this is an area with a rapidly expanding international literature in recent years, particularly as an outgrowth of the renewed interest in the empirics of economic growth; the recent comprehensive survey of finance and growth by Levine (2005), for example, lists around 300 references. Many of these use the cross-section or panel data sets previously compiled by those working in the empirical analysis of economic growth, albeit supplemented by additional financial variables. Relatively few studies have used time-series data for a single country, partly because of the lack of variation over time of financial development variables due to the slow pace of financial reform in most countries. There have been calls, however, for the use of time-series data to overcome some of the limitations of the dominant panel-data approach and China's experience provides a

rich data set, given the rapid reform which its financial system has undergone since the late 1970s.

We exploit the Chinese experience to make several contributions to the literature. First, we use an approach based on time-series data in contrast to the dominant cross-section methods. This enables us to pay more attention to the exogeneity of the finance variables and address questions of causation. Second, we focus on financial liberalisation rather than the broader notion of financial development. This allows us to be more confident that our finance variable, being largely policy-driven, is exogenous and not likely to be contemporaneously contaminated by economic growth.

A further contribution lies in the way in which we address two difficulties that arise in our focus on policy-driven financial liberalisation: policy changes are often difficult to quantify and are also multidimensional. We overcome both these difficulties in an innovative way, the first by using the "Delphi" method for constructing a number of sub-indexes measuring different aspects of the liberalisation process and the second by using principal-components analysis (PCA) to combine the various sub-indexes into a single financial liberalisation index.

We are able to address three issues widely debated but, as yet, unresolved in the literature – the sign of the effect of liberalisation on growth, the effect of liberalisation on saving and the causality directions between liberalisation, saving and growth. We find, consistent with most other evidence that the growth rate of per capita real output is stationary so that liberalisation cannot affect steady-state growth although it does have a positive effect on the long-run level of output and on growth during the transition. The effect of liberalisation on saving is found to be weak. Finally, liberalisation Granger-causes growth in the short run but there is no causation running from either growth or saving to liberalisation.

This paper is organised as follows. In section II we provide a brief review of the literature on which our work is based, including both theoretical and empirical literature on the finance-growth nexus, although, given space constraints and the availability of the recent Levine (2005) survey, we focus on studies using Chinese

data. Section III briefly describes financial sector policy and financial deregulation in China over the past 30 years to provide a basis for the construction of our financial-liberalisation index (FLI). The modelling framework is set out in section IV. In section V we describe the data, paying particular attention to the construction of the FLI and discussing some of its properties. The results are presented in section VI in which we begin with the presentation of the estimated model, then use the model to address the causality question and end by reporting some sensitivity analysis. Conclusions are drawn in section VII.

II. Literature Review

The past 15 years have seen an explosion of the literature dealing with finance and growth, both theoretical and empirical, which has been comprehensively summarised in the recent survey by Levine (2005). In this section we give only a brief account of the literature dealing with the theory underlying the relationship between growth and financial development and of the international empirical literature and focus, instead, on the relatively few papers dealing with China.

At the outset it is worth making a distinction we will exploit later in the paper, viz., that between financial development and financial liberalisation resulting from the reform of the financial system. In simple terms, we think of financial liberalisation as being the outcome of specific policy action to remove regulations etc. which restrict the way in which the financial system can operate. This will generally lead to financial development in which mechanisms and institutions develop which improve the functioning of the financial system. Thus we think of financial liberalisation as preceding financial development although, of course, not all financial development will be the result of the removal or relaxation of financial regulations and restrictions and in this way financial development will be broader than financial liberalisation.

Most of the literature analyses the effect on growth of financial development; Levine (2005), e.g., sets out to "describe models where market frictions motivate the emergence of distinct financial arrangements [which] … may influence economic

growth" (p.869).[1] But from a policy point of view, the growth effects of financial liberalisation is a more immediate question and we argue that a focus on liberalisation may also reduce the likelihood of econometric endogeneity which has dogged the interpretation of empirical results.

II.1 Financial development and growth: the theory

In the 1950s and 1960s it was widely believed that keeping interest rates (artificially) low would stimulate economic development since interest costs are part of the cost of capital so that keeping rates low encourages capital formation and hence growth. In the 1970s, McKinnon (1973) and Shaw (1973) persuasively challenged the efficacy of such financial repression, and argued that allowing interest rates to rise to market-clearing levels encourages investors to shift from non-financial to financial assets. As a consequence, the domestic financial system is able to extend more loans to investors and the equilibrium rate of investment increases with consequential beneficial effects on economic growth. The analysis by McKinnon and Shaw began a long-term movement in favour of financial liberalisation, the growing view in favour of a market-determined interest rate being reinforced by additional arguments raised by authors such as Kapur (1976), Galbis (1977), Mathieson (1980) and Fry (1980) who pointed to the enhancement of the efficacy of monetary policy resulting from free financial markets.

This view was not without dissenters, however. Neo-structuralists such as Taylor (1983) and van Wijnbergen (1982, 1983a, 1983b) stressed the importance of informal financial markets and argued that if curb or unorganised money markets are important and competitive, an increase in intermediation by the banks may simply move money from one market to another. Moreover, given the likelihood of reserve requirements in the formal market, such a re-allocation may actually reduce the total amount of funds available for investment although Kapur (1992) and Bencivenga and Smith (1992) point out that this argument may be weakened if the central bank makes

[1] A recent exception is the paper by Bekaert, Harvey and Lundblad (2005) which focuses on liberalisation but restricts its attention to the equity market.

efficient use of the banks' reserves.

Stiglitz and Weiss (1981) focused attention on microeconomic underpinnings of credit markets, showing that, although credit rationing may reflect financial repression, it may continue to characterise financial markets even after they are substantially liberalised.

More recent theoretical work in the general area of finance and economic growth has been extensively surveyed by Levine (2005). Like Pagano's (1993) brief survey more than a decade earlier, he distinguished several channels through which financial development may influence economic growth. The main channels distinguished by Levine are (i) the improved information provided by a developed market which leads to more efficient allocation of capital across potential projects, (ii) the improved level of monitoring of investments leads to greater investor confidence which improves the supply of funds to the market, (iii) improved risk spreading, (iv) mobilisation of savings and (v) the facilitation of exchange.

Both the first two effects are likely to stimulate the supply of funds and so the rate of economic growth although, to the extent that the effects work through improving the rate of return to savers, the opposite might be the case due to the well-known off-setting income and substitution effects of a rise in the interest rate on saving. Similarly, as Levine points out, the facilitation of risk pooling may also reduce the supply of savings as agents reduce saving for a rainy day although the ability to pool small savers' funds for investment in large projects is likely to improve the supply of savings and therefore the funds available to investors.

Thus, in contrast to the more optimistic conclusions reached in the earlier literature regarding the beneficial effects of financial development on growth, the more recent literature shows that, while there may still be a general presumption to a positive effect, there are sufficient theoretical ambiguities to stimulate empirical research. Empirical analysis has also focussed on the question of the relative importance of the channels through which finance affects growth. It is no surprise, therefore, that the recent upsurge in empirical literature on the determinants of economic growth in general has been extended to include measures of financial

development in an attempt to arrive at an empirical resolution of these theoretical ambiguities.

II.2 Financial development and growth: the empirical evidence

Levine (2005) divides the empirical literature on finance and growth according to the empirical approach used: cross-section or cross-country studies, time-series studies and panel studies.

A substantial body of empirical work assesses the impact of the operation of the financial system on economic growth by using cross-sectional approaches. Building on earlier work by Goldsmith (1969) and the World Bank (1989), an influential study by King and Levine (1993) analysed the relationship between financial development and growth using a data set consisting of 77 countries over the period 1960 to 1989 which was extensive enough to allow them to systematically control for factors other than financial development as well as providing a variety of alternative measures of financial development. They found a strong and robust positive relationship between measures of financial development and economic growth. In addition, they were able to exploit the time-series dimension of their data to conclude that financial depth in 1960 had considerable predictive power for subsequent economic growth, thus going some way to disentangling the correlation/causation conundrum. Work in a similar vein such as that by Amable, Chatelain and de Bandt (2002), Bencivenga and Smith (1991), Bencivenga et al.(1995), Benhabib and Spiegel (2000) and La Porta et al. (2002) generally supported the King and Levine results although extensions to include stock market development by Atje and Jovanovic (1993) and Levine and Zervos (1998) and bond markets by Fink et al. (2003) produced results which show a weaker relationship between development of these markets and economic growth.

Although the existence of a positive relationship between finance and economic growth even after allowing for other growth determinants is now widely accepted, the empirical findings based on cross-country data do not settle the issue of causality. While many researchers would argue that ultimately questions of causality can not be completely resolved empirically, time-series approaches have been employed in the

finance and growth literature to throw additional light on the issue. Moreover, the application to time-series data for a single country often allow for the use of more detailed data on financial development as well as abstracting from country-specific differences which may confound the cross-country studies. Some papers have used data for a single country (Rousseau, 1998, Rousseau, 1999, and Rousseau and Sylla,1999) while others have estimated models individually for a number of countries (Demetriades and Hussein, 1996, Arestis and Demetriades, 1997, Rousseau and Wachtel, 1998, Neusser and Kugler, 1998, Arestis et al., 2001, and Xu, 2000). While the results have been mixed, there is general evidence of Granger-type causality from finance to growth although several studies do not rule out causation in the opposite direction.

Finally, consider a small number of recent studies based on Chinese data. Two early (and similar papers) by Li and Liu (2001) and Liu and Li (2001) examine the relationship between "financial liberalisation and growth in China's economic reform" by regressing aggregate GDP growth on investment growth disaggregated into four components according to the source of funding, the argument being that the source of funding has changed with the development of the financial system so that it provides (indirect) evidence about the effect of such development on growth. Thus, they conclude that a shift from state appropriation to self-raised funds has stimulated economic growth, providing evidence of the positive effects of development on growth.

More recent papers include those by Allen et al. (2005), Hao (2006) and Liang and Teng (2006). Of these, the last two both directly address the finance-growth question, the former using a panel of provincial data and the latter aggregate time-series data. Liang and Teng use traditional financial development measures representing bank credit and the deposit/liability ratio while Hao argues that such measures tell only part of the story and finds that the financing method (the switch from state budget appropriations to loans as in Liu and Li, 2001, above) and the volume of saving are more powerful determinants. Hao concludes that "the development of financial intermediation exerts a positive, causal and economically

large impact on China's economic growth" (p. 361) while the results in the paper by Liang and Teng are more ambiguous: there is no causation from financial development to growth but some evidence that causation runs in the opposite direction.

Finally, we briefly mention several Chinese-language papers: Shen and Sun (2004), Wen, Ran and Xiong (2005) and Zhang and Jin (2005). The first uses aggregate time-series data for the period 1978 to 2002 and find that the connections between the financial system and investment efficiency and the percentage of domestic savings used for investments are limited. The third paper, by Zhang and Jin (2005), uses a provincial level panel data set and concludes that productivity growth is significantly positively related to financial depth.

We may briefly conclude this review of the literature by saying that the international literature, particularly that based on cross-country data sets, points reasonably strongly to a positive relationship between financial development and growth. There are some limitations of the literature, however, which motivate our work. First, most of that literature concentrates on financial development and not liberalisation as such (which is our interest). Second, the results obtained using time-series data suggest greater caution regarding the direction of causation between finance and growth. Finally, empirical work using data on China is very sparse and inconclusive.

Thus, much work remains to be done and we contribute to the literature in various ways. First, we focus on financial liberalisation which, being policy-driven, is likely to suffer less from endogeneity than general measures of financial development and is, therefore, more likely to clearly resolve the causality issue. Moreover, financial liberalisation is more policy-relevant than financial development in general. Secondly, we use time-series data which will better enable us to address the causality issue. Thirdly, we use data for China for the period since reforms began in 1978. The significant and continuing reforms during this period should help us avoid a common problem with the use of single-country time-series data, that there is relatively little variation in the data since in most cases liberalisation proceeds slowly.

Finally, as is clear from the literature survey, little is known about the Chinese case which surely is of interest in its own right.

III. An overview of financial liberalisation in modern China

Economic reform has proceeded apace since 'opening-up' began in 1978 and financial deregulation has been a central part of this reform. We present a brief survey of the main aspects of liberalisation which we classify as follows: the diversification of financial institutions, the reform of credit quotas, interest rate deregulation, the establishment of a financial regulatory system, the development of a stock market, increased openness to the rest of the world, and the development of the financial legal framework.[2]

We begin with institutional diversification. In 1978 the formal financial system consisted of a single bank, the People's Bank of China (PBC) which accepted deposits and channelled funds according to government credit-allocation policy. Subsequent development saw an enormous increase in diversity of financial institutions, beginning with the development of a two-tier banking system between 1979 and 1993 during which four state-owned banks (SOBs) were established to carry out the PBC's banking business, leaving the PBC as a central bank.

The central government also provided for the establishment of a broader range of banking institutions such as the urban credit cooperatives (UCC) which flourished during this period and small- and medium-sized commercial shareholding banks, focussing mainly on regional borrowing and lending. The government encouraged competition between these new institutions and the SOBs, although the latter were still subject to a good deal of policy direction.

In 1994 the SOBs were relieved of their policy-lending obligations with the creation of three specialised policy banks which dealt with policy-lending, leaving the

[2] These correspond to the first seven of eight aspects covered by our financial liberalisation index, the last aspect of which is a general policy variable.

SOBs to concentrate on commercial banking. During this period the rural credit cooperatives (RCCs) and the city commercial banks (CCBs) were allowed to develop rapidly and the first shareholding banks funded completely by private capital were set up, greatly increasing the diversity and competition in the banking system.

By 1997 non-performing loans (NPLs) had reached alarming proportions and there followed a period of consolidation and financial restructuring in the Chinese banking system, including the consolidation of 1,658 RCCs into 81 joint stock city or rural commercial banks.

The final distinct stage of institutional diversification began in 2001 and has been largely outward looking prompted by China's joining the WTO. There was also continued privatisation of the SOBs with two having been listed and the other two in preparation for doing so. Consolidation and rationalisation of existing institutions continues.

The credit allocation system was highly centralised before 1978, being arranged through the PBC and its branches according to the credit plan, which was prepared in the form of a source-and-use-of-funds statement to match the estimated demand for physical resources. After 1984 the specialised banks were allowed a certain freedom in the use of funds although they were still obliged to submit projections on loans and deposits to the PBC for approval with credit quotas being strictly enforced. The PBC finally removed credit quotas for the SOBs in 1998, moving instead to the implementation of management principles based on asset-liability ratios.

China has taken a cautious approach to the deregulation of centrally controlled interest rates. During the pre-reform period, interest rates were controlled by the PBC and fixed at very low levels and rarely varied. In 1983 the PBC first allowed some interest-rate flexibility for the SOBs when floating interest rates were introduced for certain types of working-capital loans. In 1986 banks were allowed to adjust lending interest rates within a narrow band about the administered rate, but such flexibility on deposit interest rates was not granted. Since 1993 the PBC has taken steps to widen the floating band on lending rates for financial institutions and to adjust the reference

rates more frequently. The PBC also began to set a reference rate for the inter-bank market in January 1996; the inter-bank bond market was launched in June 1997; and a market-based auction method began to be used in October 1999 for all government bonds. In October 2004, the upper limit on the loan rates charged by commercial banks was removed and that for the rural and urban credit cooperatives was raised to 2.3 times the benchmark rate. A lower limit was no longer applied to the interest rate of RMB deposits. Therefore, by late 2004 interest rates on both sides of bank balance sheets were largely market-determined.

In the area of the financial regulatory system, the PBC as central bank was first designated as the key agent for financial market supervision in 1984 and officially retained this function until 1992. During this period the Bank exercised comprehensive regulatory as well as administrative jurisdiction over the entire financial sector. With the two major stock exchanges emerging in 1990, the State Council Securities Commission (SCSC) was established to develop policies for financial markets, although it did not become a full-blown regulator. This task was assigned to the Chinese Securities Regulatory Commission (CSRC), created in 1993. However, until the strengthening of the CSRC through its merger with the SCSC in 1998, the State Council issued most of the path-setting rules and policies that govern financial markets. The CSRC eventually became the only regulatory and supervisory institution for securities markets in 1999.

In 1998 the China Insurance Regulatory Commission (CIRC) was entrusted with the supervision of insurance companies, including preparations for the opening of the insurance sector to foreign players. In April 2003 the China Banking Regulatory Commission (CBRC) was established to take over the regulatory function of the banking sector from the PBC in order to leave the PBC free to concentrate on monetary policy matters.

The reserve requirements system in China was established in 1984 with the statutory reserve ratio initially very high by the standards of developed financial markets – up to 40% for some deposits. The reserve requirements were unified and reduced to 10 per cent for all deposits in 1985 but increased to 13 per cent in 1987, a

level which was maintained until 1998 when it was reduced to 8 per cent and further to 6 per cent in 1999.

The development of China's stock market is one of the most important elements of China's reform of the financial system and China's stock market has experienced amazing growth since its beginnings in the early 1990s although its capitalisation still accounts for only a small part of total financial assets.

In December 1990 and July 1991, two stock exchanges, the Shanghai Stock Exchange and the Shenzhen Stock Exchange were established. A unique feature of the Chinese stock market is the two types of shares, A shares and B shares traded on each exchange. A shares are exclusively sold to Chinese nationals and trade is carried out in local currency. B shares, the first of which were listed on the Shanghai exchange in February 1992, are traded in foreign currencies (Hong Kong dollars in Shenzhen and US dollars in Shanghai) by foreign investors. Since February 2001, domestic investors are also allowed to trade in B shares, although trading is still in terms of foreign currency. In addition to the A and B shares, Chinese companies can issue H shares on the Hong Kong Stock Exchange, N shares on the New York Stock Exchange and S shares on the Singapore Stock Exchange but these account for relatively little of their capitalisation. Since the late 1990s many state-owned enterprises (SOEs) have listed but with a large proportion of their shares being non-tradable state-owned shares.

In order to increase the supply of funds to the domestic share market, the CSRC instituted the Qualified Foreign Institutional Investor (QFII) system in December of 2002 by which limited access was given to foreign investors in A shares. On June 25, 2004 China launched a new small and medium enterprises board on the Shenzhen Exchange. On April 29, 2005, the CSRC announced the resumption of reforms to address the imbalance between tradable and non-tradable shares and by the end of 2006, 95% of the listed companies issuing A shares had at least begun participation in the reform process. State-owned share holdings are still substantial, however.

China's reform of international financial relations has been slow and cautious. Before 1978, China under Mao Zedong was largely closed to the outside world but

since reform began it has gradually widened its economic relationships with the rest of the world although decision-making concerning external liberalisation has been highly centralised.

In early liberalisation China maintained a dual exchange rate system until the beginning of 1985 when the rates were unified. Strict foreign exchange controls continued in force although these were relaxed to encourage foreign direct investment (FDI) for various coastal cities during the 1980s as part of the "opening-up" process. In 1988, the FDI policies were expanded to another 140 coastal cities and counties. In April 1991, the official exchange rate regime was changed from one of periodic adjustment to a managed float, allowing the authorities to adjust the rate more frequently. In 1994, the foreign exchange retention and quota system was repealed and replaced by a foreign exchange surrender and purchase system which realised conditional current account convertibility. In late 1996 China moved to full current account convertibility.

The Asian financial crisis in the second half of 1997 prompted the strengthening of capital controls and monitoring until 2000 although during this period foreign bank access was improved, a liberalisation which was boosted by China's accession to the WTO. Over the last 5 years external liberalisation has been extensive to include banking, foreign exchange markets and capital markets.

We turn, finally, to the development of the legal framework. Anecdotal evidence of widespread violation of the principles of good governance in Chinese financial markets has been persistent despite considerable advances made by the authorities in establishing and enforcing laws and regulations to control the financial system. Laws covering banking, administration, corporations, bankruptcy and solvency, the stock market and insurance have been drawn up and promulgated particularly since the early 1990s when it became clear that China's integration into the international financial system would require a legal framework conducive to the attraction of foreign capital and foreign expertise. Despite a plethora of legislation and regulatory activity, it must be remembered that this is occurring within the context of a developing and emerging financial system during a period of rapid economic,

financial and political transition. With the deepening of China's financial system, the accelerated opening-up to the rest of the world and the rapid innovations in the financial sector, the legal framework is barely able to keep pace with the changing requirements of the financial sector and great efforts will be required on the part of the authorities to bring China's financial system framework into the 21st century.

In conclusion, there has been rapid, substantial and continual change in the Chinese financial system from 1978 onwards. We have described a system which less than 30 years ago consisted of a single government-owned bank and which has developed into a highly diversified, sophisticated system serving a dynamic economy with over 1.3 billion inhabitants. It may well be argued that there have been significant hiccups in the reform process and that there is still substantial development necessary before China has a smoothly functioning, transparent and modern financial system. Whatever the merits of this argument, from the point of view of the work to be reported below, there is no danger of too little variation in the liberalisation index, making for bland econometrics.

IV The Model

We motivate our empirical model by a simple growth model based on Pagano's (1993) modification of the 'AK' model of economic growth to capture the influence of financial liberalisation. We adapt his model to remove the unattractive feature of the AK model that it implies policy has permanent effects on growth as recognised in the recent semi-endogenous growth literature starting with Jones (1995a).

Before setting out our formal model, we begin by referring to Pagano (1993) and the recent survey by Levine (2005) to identify the main channels through which financial liberalisation may influence growth. They are various and may be summarised as follows.

(a) Liberalisation effects greater economies in financial intermediation which results in greater efficiency of saving-investment conversion.

(b) Improved information collection and processing improves the allocation of funds to competing investment projects and the monitoring of projects so that a given

amount of funds is more efficiently allocated and there is greater growth for a given amount of investment.

(c) Financial liberalisation will improve returns to investment and therefore the rewards for saving (say, by relaxing financial repression) and the volume of saving.

(d) Financial liberalisation will reduce risk associated with investment and therefore the riskiness of returns to saving and therefore the volume of saving.

Following the literature, we recognise that only the first two channels are likely to result in a positive relationship between financial liberalisation and growth while the sign of the relationship between channels (c) and (d) may be positive or negative – in the case of (c) because of the opposite signs of income and substitution effects and for (d) a reduction in risk may lead to smaller precautionary saving.

We capture this informal theorising in an set of equations derived from a simple growth model which starts with based Pagano's (1993) adaptation of the AK model of endogenous growth. We adapt his model to accommodate recent criticism of the implication of the model that in the steady state the growth rate is a function of the level of technology so that, say, exogenous technical progress implies an exponentially increasing growth rate. As Jones (1995a) has pointed out, this is clearly at odds with the stylised fact that the growth rate is constant over long periods of time even when there is continuing technical progress. To anticipate our results, we also find that the rate of growth of real per capita GDP is stationary over our sample period. We therefore modify Pagano's analysis along the lines of Jones (1995a, b).

We begin with a simple Cobb-Douglas production function with constant returns to scale:

(1) $Y = A.K^{\alpha}.L^{(1-\alpha)}, \qquad 0<\alpha<1$

where Y is real output, A is the productivity or knowledge, K is the capital stock and L employment. In intensive form:

(2) $y_t = A.k^{\alpha}.$

The rate of growth of per capita output is determined by productivity growth and the rate of growth of the capital-labour ratio. Using G_x to denote the proportional rate of growth of x, we have:

(3) $G_y = G_A + \alpha G_k$

Capital accumulation is driven by investment, I less depreciation. We follow Pagano (1993) and allow some saving to be lost in the process of financial intermediation so that investment is some proportion, Φ, of saving S so that the rate of growth of the capital stock is given by:

(4) $G_K = \Phi s A k^{(\alpha-1)} - \delta$

where s is the saving rate, S/Y and δ is the depreciation rate. Finally, the growth rate of the per capita capital stock is given by:

(5) $G_k = \Phi s A k^{(\alpha-1)} - \delta - n$

where n is the exogenous rate of population growth. This is a standard result in the basic neoclassical growth model apart from the inclusion of the parameter Φ and produces a stable equilibrium in which the steady-state level of k satisfies the condition:

(6) $k^{(\alpha-1)} = (n+\delta)/\Phi s A$

so that all of n, δ, Φ, s, and A may influence the steady state level of k (and therefore of y) but its rate of growth is determined by:

(7) $G_k = (1/(1-\alpha))G_A$

and the steady-state rate of growth of per capita real output is given by:

(8) $G_y = G_A/(1-\alpha)$

which is independent of the level of technology as well as of the saving rate and the saving conversion rate, all of which may be affected permanently by financial liberalisation policy. Thus, we have a model with an equilibrium in which the level of per capita real output may be influenced by policy (through s, A and Φ) but in which the growth rate is determined solely by the rate of technical progress which we take to be exogenous.

To formulate our empirical model, we focus on the saving rate, s, the efficiency with which saving is converted to investment, Φ, and the efficiency of investment, A to write the per capita output growth equation (dropping the y subscript) as:

(9) $G_t = G(\Phi_t, A_t, s_t)$

We use the model above to constrain the effects of these variable son the growth rate to be only temporary. From our earlier discussion of the influence of financial liberalisation on growth, we could assume that each of the arguments of equation (9) is a function of a financial liberalisation index, *FLI*:

(10) $\Phi_t = \Phi(FLI_t)$

(11) $A_t = A(FLI_t)$

(12) $s_t = s(FLI_t)$

Substituting these into equation (9), produces a single equation for *G* in terms of *FLI*:

(13) $G_t = G(FLI_t)$

which would provide a basis for a simple bivariate model involving the growth rate and a measure of financial liberalisation. But recall that the different channels do not all have the same unambiguous sign so that there is something to be gained by keeping *s* as a separate variable in the model to enable us to test whether the effect of *FLI* on *G* through its effect on *s* is positive or negative and whether this effect dominates that through the other two channels. We, therefore work with the slightly less aggregated model consisting of:

(14) $G_t = G(FLI_t, s_t)$

(15) $s_t = s(FLI_t)$

In this model the direct effect of *FLI* on *G* (through the presence of *FLI* in the *G* function) captures the effects through both *A* and Φ in equation (9).

To estimate this model we need to address some important econometric issues. Apart from the need to specify the functional form, a core question is that of endogeneity which has played a central role in the empirical growth literature. If *FLI* were a general indicator of financial development such as are commonly used in the empirical literature, there would be a strong presumption of endogeneity for all three variables. We will, however, focus on largely policy-driven financial liberalisation (rather than financial development) and, while this might be endogenous in a political sense over the longer term, it is less likely to be so within the period (a year for our data set) than would be the case for financial development. This would leave both *G* and *s* potentially endogenous. Despite our presumption of the

exogeneity of *FLI*, we will specify a model in which all three variables are potentially endogenous. In particular, we will use a VAR model in *G, s* and *FLI* as our empirical framework which allows all three variables to be endogenous and will also allow us to test the direction of causation between the variables using standard Granger causality tests. Given our time-series approach to the issue and the relatively short sample period after financial-system reforms began in 1978, we are precluded form using additional control variables commonly found in the growth literature using large cross-section data sets. To some extent some, of these influences such as stock market developments and the increasing openness of the economy will be captured in the *FLI* index to be explained below but ultimately we are data-constrained – with a maximum lag length of four, three variables require the estimation of 13 parameters per equation with only 27 observations using up one half of the degrees of freedom. Adding even one control variable would add a further four parameters to each equation as well as an equation to the model.

Our econometric procedure will therefore be to linearise the model, test the variables for stationarity with our final model specification depending on the outcome of the stationarity and, if appropriate, cointegration tests. To anticipate that outcome, we find *G* to be stationary and *s* and *FLI* to be non-stationary and not cointegrated so that we estimate a vector autoregressive (VAR) model of the form:

$$\boldsymbol{x}_t = \boldsymbol{a}_0 + \boldsymbol{A}(L)\boldsymbol{x}_{t-1} + \boldsymbol{\varepsilon}_t, \qquad t = 1,2, \ldots,T \tag{8}$$

where $\boldsymbol{x}_t = (G_t, \Delta s_t, \Delta FLI_t)'$, $\boldsymbol{a}_0$ is a 3-element vector of constants, $\boldsymbol{A}(L)$ is a matrix polynomial in the lag operator, L, $L\boldsymbol{x}_t = \boldsymbol{x}_{t-1}$, and $\boldsymbol{\varepsilon}_t$ is a 3-element vector of random error terms, each with zero mean and no autocorrelation.

With this general modelling approach, we will be able to avoid the complicated debate in the growth literature surrounding endogeneity, the appropriate treatment of this problem from an econometric perspective and the interpretation of the resulting estimates. The model's implications for the interactions between *FLI*, *G* and *S* will be explored using impulse-response functions (IRFs) which show the effect on each of the endogenous variables over time of a shock to one of the equation errors. We will also use pairs of bivariate equations to test short-run Granger causality between

each pair of variables and so address the important question of whether liberalisation causes growth (in the Granger sense) or vice versa and whether saving causes growth or not.

V The data

The data we need for the estimation of the model specified in the previous section are relatively modest since it has only three variables: *G, s* and *FLI*.

Our data are annual and the sample period runs from 1978, the beginning of the reform period, to 2004. The growth rate, *G*, was measured by the proportional change in real GDP per capita, the saving rate, *s*, was measured by the ratio of saving to GDP where saving was derived as the difference between GNP and total consumption (including government consumption). The source of data for both these series was *China Statistical Abstract* (State Statistical Bureau, various issues).

The construction of the liberalisation variable requires a more extensive description. The measurement of financial liberalisation in a form suitable for econometric investigation is problematical for at least two reasons: how can the process of financial liberalisation be measured numerically and how can the multi-dimensional nature of liberalisation be accommodated in a single or relatively few variables?

The most common response to the measurement problem has been to use readily observable financial variables such as the ratio of bank loans to GDP. While this may be an acceptable approach for the measurement of financial *development*, for the purposes of measuring the extent of financial *liberalisation* it seems unsuitable. At best, as we have already argued, it measures the outcome of the liberalisation process and not the process itself and, moreover, it is likely to be the outcome of the interaction between liberalisation and growth rather than a driver of growth itself.

An alternative resolution of the measurement problem is to examine the history of liberalisation itself and construct an artificial index of liberalisation by assigning numerical values to particular deregulatory events although this is limited by a certain arbitrariness in the assignment of numbers to events. This difficulty notwithstanding,

a similar approach has been widely used in the literature on institutions and growth to capture the evolution of the political environment (see Glaeser et al., 2004, for a recent example) and in the recent paper by Bekaert et al. (2005) on the growth effects of equity market liberalisation.

The second problem associated with the construction of a liberalisation variable is that of the multi-dimensional nature of liberalisation. In contrast to much of the literature on finance and growth which uses a single or a limited number of measures entered as regressors simultaneously, we construct a variable which combines in a single measure the multiplicity of components. An early application of this approach to a cross-country study of stock market development is by Demirguc-Kunt and Levine (1996), and subsequently by Love (2003). Single index-based measures of varying degrees of sophistication have been used in work by Bandiera et al. (2000), Laeven (2003), Koo and Shin (2004) and Koo and Maeng (2005). It has also been used in literature in political science; see Quinn (1997), Adsera et al. (2001) and Abiad and Mody (2005).

We build on this literature and proceed by constructing sub-indexes for eight aspects of the liberalisation process, thus covering the multiple facets of the liberalisation process. The eight aspects are:

- 'institutions': the diversification of financial institutions,
- 'allocation': the reform of credit allocation,
- 'interest': interest rate deregulation,
- 'regulations': the establishment of a financial regulatory system,
- 'stock': the development of a stock market,
- 'open': increased openness to the rest of the world,
- 'legal': the development of the financial legal framework, and
- 'policy': major central government policy shifts.

.We overcame the subjectivity of the assignment of numbers to deregulatory events by using the Delphi method. This involved choosing 15 experts (a mixture of academics in the area of finance and economics, commercial bankers, central bankers and government officials) and asking them to rate each of this set of eight aspects of

liberalisation over the sample period, assigning a value between 0 and 1 for each aspect for each year of the sample. The resulting 15 individual responses were averaged to derive a sub-index for each aspect ranging between 0 at the beginning of the sample to 1 at the end.

We analysed the individual responses to detect outliers and it was interesting (and reassuring) that the individual responses were highly correlated, indicating a high degree of common assessment of the regulatory changes over the period. Thus, e.g., the correlation matrix for the individual assignments for the first aspect, "institutions", (reported in Panel A of Table A1 in the Appendix) shows that most correlations are well in excess of 0.9. Average correlations for the remaining aspects (Panel B of Table A1) show similar results and indicate that there are no respondents who are consistent outliers. We are reasonably confident, therefore, that the responses are reflective of generally perceived changes in the regulatory structure of Chinese financial markets over the sample period.

We then proceeded to combine the eight sub-indexes into a single index, *FLI,* using principal-components analysis, a technique that has been used for the same purpose in some of the paper cited above. Principal-components analysis is a method of long standing to assess and summarise the common contents of a set of variables. Consider a set of K variables $\boldsymbol{X}_k$ (k=1,2,…,K), each with T observations, combined in the matrix $\boldsymbol{X}$. The cross-products matrix $\boldsymbol{X'X}$ has K eigenvectors $\boldsymbol{a}_k$ and associated eigenvalues λ_k. If we arrange the eigenvectors and eigenvalues in decreasing order of magnitude of the eigenvalues we can define the kth principal component of the $\boldsymbol{X}$ matrix as

$$\boldsymbol{Z}_k = \boldsymbol{X}.\boldsymbol{a}_k$$

and the ratio $(\lambda_k/\sum\lambda_k)$ measures the proportional contribution of the kth principal component to the total variation in the $\boldsymbol{X}$ variables. Then if, as is usually the case, the first one or two principal components capture most of the variation in the $\boldsymbol{X}_k$s, we can use them (individually or in a linear combination) to summarise the information in the data set.

In Table 1 we report the eigenvalues of the eight possible components as well as

the proportion and the cumulative proportion of the variation in the variables explained by each. It shows that the first principal component explains by far the greatest proportion of the variation in the individual sub-indexes and that the first two principal components explain over 97 per cent of total variation. We use a weighted average of the first two principal components as the *FLI,* with the weights being the proportion which each explains of total variation. In the last two columns of the table we report the loadings on the eight variables for the first two principal component (the elements of $\boldsymbol{a}_1$ and $\boldsymbol{a}_2$); they show that the first principal component is roughly a simple average of the eight variables while this is not true of the second.[3]

Table 1 about here

A graph of the first two principal components and the *FLI* is given in Figure 1 below.

Figure 1 about here

The *FLI* clearly increased monotonically over the sample period reflecting the general impression that reform is cumulative on the whole – while there may be particular reforms which are wound back (temporarily), the general thrust of reform of the financial system in China has been a continuing one. There have, however, been several episodes when reform appears to have accelerated (or, more precisely, has been perceived by the experts surveyed to have accelerated).

In the early years following the demise of Mao Zedong and the consolidation of power by Deng Xiaoping in 1978, reform seems to have proceeded slowly and cautiously. There was a spurt, however, starting in 1984 which reflects the establishment of the People's Bank of China as the central bank in April 1984. This event affected the *FLI* in various ways – through the credit control, institution building and prudential regulation components of the index. The establishment of the People's Bank coincided with the institution of a system of statutory reserve requirements for the banks – the ratio was initially set very high but substantially reduced in 1985.

[3] Note that, for the purposes of the second, third and fourth columns, the numbers in the first column refer to the components, the $\mathbf{Z}_k$s (of which there are a maximum of eight), whereas for the purposes of the last two columns the numbers in the first refer to the $\boldsymbol{X}_k$s.

Reform seems to have faltered somewhat between 1985 and the early 1990s. The first half of the 1990s saw steady institution building and diversification, relaxation and modernisation of the system of credit controls as well as the opening up of the financial system to the world economy with the move to a managed floating exchange rate. The brief reform spurt in 1998 coincided with the removal of direct credit controls, the consolidation of the system of reserve requirements and the greater flexibility in the way in which banks could set their interest rates. Finally, an acceleration of reform in the two last years of the sample reflects continued institution building, the further relaxation of interest rate controls and, in 2005, the substantial changes to the foreign exchange arrangements.

The overall behaviour of the index therefore looks plausible in the light of events in the Chinese financial system over the period. Before turning to the use of the index in our econometric analysis, we briefly consider the relationship between *FLI* and more common measures of financial development to assess our conjecture that liberalisation is likely to precede financial development. W e use three measures of financial development commonly used in the literature: *FIR* (financial assets to GDP ratio), *DEPTH* (the ratio of M2 to GDP) and *CREDIT* (total credit to GDP). Table 2 reports the results of tests of Granger causality between these variables and *FLI*. It provides strong evidence that *FLI* Granger causes all of these variables but is caused by none over our sample period.

Table 2 near here

In each case the null hypothesis is that the first variable does not cause the second; so, for example, 7.4057 is the value of the F-statistic for a test that *FLI* does not Granger-cause *CREDIT*. The associated marginal significance level of less than 1 per cent means that the null hypothesis can be rejected and we conclude that *FLI* Granger causes *CREDIT*. On the other hand, *CREDIT* does not Granger-cause *FLI*. This pattern is repeated for each of the other two measures of financial development we use. Thus, there is strong statistical support for our earlier proposition that financial liberalisation precedes financial development and we argue that *FLI* is, therefore, less likely to be plagued by endogeneity than common measures of

financial development are.

VI Results

We begin by testing each of our variables for stationarity. Since the model does not constrain the form of the variables, we experiment with both the levels and logs of the *s* and *FLI* variables. Augmented Dickey-Fuller statistics are reported in Table 3.

Table 3 near here

In each case we start with a test equation with the lags chosen to maximise the Schwarz Information Criterion and no trend and then add a trend. The table reports the ADF statistic as well as corresponding 5% critical values for each of *G*, *s*, *FLI*, *lns*, and *lnFLI* for a test with and without trend. We also report the lags used. Where the level or log of the variable is clearly non-stationary, we also report the ADF test for the first difference with the first-difference operator being denoted by Δ. In this case we do not include a trend and report results for tests with and without an intercept. It is quite clear from the table that the growth rate is I(0). The saving rate in both level and log forms is clearly non-stationary and the first difference of its log is stationary with and without an intercept while in level form the first difference is effectively stationary at 5 per cent. We conclude that *s* is I(1). *FLI* is clearly non-stationary whether in log form or not and the first difference is stationary in level form with an intercept (which is significant using a standard t-test in the Dickey-Fuller equation) and in log form without an intercept (which is insignificant in this case). We conclude that *FLI* is also I(1).

[Figures 2 and 3 near here]

Our finding of the stationarity of the growth rate is consistent with the weight of the evidence for other countries and supports our model specification that constrains the steady state growth rate to be unaffected by either the pace of financial liberalisation or the saving rate. A graph of the growth rate is given in Figure 2 which shows that growth has no perceptible trend and that, while it fluctuates widely, it appears to return to its mean of a little over 8 per cent. The findings that the saving rate and the *FLI* index are non-stationary is not surprising in the light of the

graphs of the two variables in Figures 1 and 3. Both have a distinct upward trend and the saving rate in particular has wide highly autocorrelated fluctuations about this trend. While the saving rate is bounded above and must eventually level, there appears little evidence that this has begun to happen during our sample period. In the steady state therefore it must be stationary as assumed in our growth model of section IV even though over our sample it clearly is not. A possible characterisation would be in the distinction in Jones (2002) between the long run and the steady state where in the long run some variables may grow which in the steady state are constant. A similar argument may be made with respect to the *FLI* index – eventually the opportunities for financial liberalisation will become limited and the index would be expected to level off.

Given that two of our three variables are I(1), we proceed next to tests of cointegration for *s* and *FLI*. Johansen trace and eigenvalue tests of cointegration are reported in Table 4 for two pairs of variables, (*s*, *LFI*) and (*lns*, *lnFLI*).

Table 4 near here

We conducted the tests with both one and two lags. We also report results with and without a trend term in the cointegrating vector. Clearly *s* and *FLI* are not cointegrated and this does not depend on whether there is a trend in the cointegrating vector or whether a trace or an eigenvalue test is used or whether one or two lags are used in the VECM framework. The results for the logs of the variables are not quite so clear-cut, there being weak evidence that there is cointegration at 10 per cent when there is no trend in the cointegrating vector and the VECM has one lag and at the 5 per cent level when there are two lags. However, examination of the VECM shows that one lag is sufficient to ensure the absence of autocorrelation in the model errors. Hence we conclude that the balance of the evidence is clearly on the side of no cointegration and we proceed to the estimation of a model in *G*, Δlns, and $\Delta lnFLI$. We also experimented with a model in *G*, Δs, and ΔFLI (although we do not report these results) and found that the overall implications of the model do not depend on whether the variables are in logs or not.

The lag length for the VAR model was selected on the basis of the usual list of

criteria (the values of which are reported for various lags in Table A2 in the Appendix). The criteria clearly point to a lag length of three; tests for autocorrelation in the residuals show that we cannot reject the absence of autocorrelation in the model residuals at lags higher than one but that there is substantial autocorrelation with only one lag. All the results considered, therefore, we use a lag length of three, although we also explore the dynamics of models with one, two and four lags to assess the robustness of our conclusions. The estimated model (which is reported in Table A3 in the Appendix) shows a satisfactory degree of explanation (given that the equations are either growth rates or log differences) and no autocorrelation so that it adequately explains the time-series variation in the data.

For the examination of the model's implications for the dynamic interaction between the three variables, we rely on the impulse response function (IRF). In particular, we are interested in the effects on *G* and *s* of a shock to *FLI*. The three (cumulative) IRFs for an *FLI* shock are pictured in Figure 4. The IRFs are based on the Choleski decomposition of the model's covariance matrix. This ensures that the errors which are shocked are independent but has the well-known limitation that the resulting IRFs may be sensitive to variable ordering if the equation errors are strongly contemporaneously correlated (see, e.g., Enders, 2004, Chapter 5). Our preferred ordering is *FLI*, *s* and *G* so that within the period, *FLI* may affect both other variables, *s* may affect *G* but not *FLI* within the period and *G* itself affects the other two variables only with a one-period lag. This seems most in keeping with our model in which liberalisation affects growth in the transition both directly and through its effect on saving, while saving and growth have no obvious contemporaneous effect on liberalisation although it is possible that high growth may generate an environment where liberalisation is more likely to occur. To assess the sensitivity of our results to this assumption we reverse the order of *s* and *G* in the model and also check for Granger causality between each pair of variables.

Figure 4 near here

The IRFs show that the effect of the shock to *FLI* has the largest effect on itself and that this effect is positive. An increase in liberalisation also has a significant

positive long-term cumulative effect on growth but a predominantly negative effect on saving, although the effect on saving is not significant. The positive cumulative effect on growth is consistent with the model's implication that a change in *FLI* can have a level but not a growth effect since the accumulation of growth is simply the effect on the (log) level of per capita GDP.

The ambiguity of the sign of *FLI* in the saving function of the model is resolved in the positive at a short horizon but this positive is more than offset by a subsequent negative effect by four years after the shock and, besides, is relatively small. However, this predominantly negative effect of liberalisation on saving is not sufficient to offset the direct positive effect on output.

These conclusions are not affected by (i) reversing the order of *s* and *G*, (ii) varying the lag length in the underlying VAR from three to two or four, (iii) estimating the model in levels rather than logs of saving and liberalisation. In all cases the increase in liberalisation significantly boosts real output per capita over a substantial period but has little effect on saving – the saving effect tends to be negative and insignificant. There is therefore strong evidence that liberalisation has been of significant and long-term benefit to China in terms of permanent output effects without influencing steady-state growth.

This conclusion is further enhanced by the results of our tests for Granger causality. In Table 5 we report the results of pair-wise tests for short-run Granger causality. The results show that, in the short run at least, the change liberalisation Granger-causes both growth and the change in saving, although the growth effect is significant only at a marginal significance level of 8 per cent. There is no reverse causality in either case – the change in liberalisation is not caused by either growth or the change in saving. Finally there is no causation running from growth to the change in saving and only very weak causation from that change in saving to growth providing further evidence that the effect of liberalisation on growth captured by the IRFs must run through channels other than the saving effect.

Table 5 near here

These results are in stark contrast to those reported by Liang and Teng (2006)

who also use aggregate time-series data for China and find that there is causality running from growth to financial development but not from development to growth. Liang and Teng, however, use two measures of *financial development* (ratios of bank credit to GDP and bank liabilities to GDP) rather than a *liberalisation* index as we do and we have argued above that there are theoretical reasons to believe that financial development variables of the type they use are likely to be the joint outcome of growth and liberalisation and so obscure (and possibly reverse) the causality analysis. Moreover, they use data back to 1952 whereas we start with the beginning of reforms in 1978. Since they do not entertain a break in the process at 1978, we can only speculate as to the effect of the pre-1978 data on the results.

VII Conclusions

This paper has analysed the relationship between financial liberalisation and economic growth using aggregate time-series data for China from 1978 to 2004.

We constructed a unique liberalisation index based on the Delphi method in which 15 experts assigned index values to each of eight different aspects of liberalisation for each year of the sample period. The correlation of the respondents' allocation of values to the aspects were found to be highly correlated with each other, showing a remarkable degree of agreement as to the pace and timing of liberalisation.

In our empirical work we estimated and simulated a VAR model based on a simple neoclassical growth model adapted to include the influence of financial liberalisation. Our results show that the growth rate is stationary which is consistent with the recent criticism by, e.g., Jones (1995a, 1995b), of the implications of the endogenous growth model. Thus growth cannot be affected in the steady state by liberalisation although there may be transitional effects and steady-state effects on the level of per capita GDP. Our simulations show that this is indeed the case. A permanent increase in liberalisation has a positive cumulative effect on growth so that long-term per capita output is boosted. However there are weak and predominantly negative effects of liberalisation on saving providing strong evidence that the effect on output occurs through direct channels rather than indirectly through saving. These results were shown to be robust to variable definition, to VAR specification and

variable ordering. In subsequent tests of short-run Granger causality we found that the change in liberalisation significantly causes both growth and the change in saving but that there are no significant feedbacks from either of these variables to the liberalisation index.

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Table 1: Eigenvalues and scores of principal components

Component /Variable	Eigenvalue	% of Variance explained	Cumulative % of variance explained	Score principal component 1	Score principal component 2
1	7.379	92.232	92.232	0.132	0.044
2	0.411	5.134	97.366	0.134	-0.052
3	0.084	1.053	98.420	0.124	0.926
4	0.057	0.714	99.134	0.129	-0.691
5	0.031	0.386	99.520	0.131	-0.521
6	0.016	0.204	99.724	0.134	-0.125
7	0.012	0.155	99.879	0.126	0.833
8	0.010	0.121	100.000	0.132	-0.341

Table 2: Tests of Granger causality between FLI and financial development

Variables	F statistic	p-value
FLI → CREDIT	7.4057	0.0039
CREDIT → FLI	0.4007	0.6751
FLI → DEPTH	3.8050	0.0398

DEPTH → FLI	1.0210	0.3783
FLI → FIR	12.1080	0.0004
FIR → FLI	0.7126	0.5024

Table 3: Tests of stationarity

Variable	Test (C,T,L) [1]	ADF test statistic	5% Critical value	Stationary?
G	(C,0,3)	-3.5573	-2.9981	Yes
	(C,T,3)	-3.6262	-3.6220	Yes
s	(C,0,1)	-1.1213	-2.9862	No
	(C,T,3)	-3.0034	-3.6220	No
Δs	(C,0,0)	-2.9756	-2.9862	No
	(0,0,0)	-2.7821	-1.9550	Yes
lns	(C,0,1)	-1.2475	-2.9862	No
	(C,T,3)	-2.9704	-3.6220	No
Δlns	(C,0,0)	-3.1238	-2.9862	Yes
	(0,0,0)	-2.9564	-1.9550	Yes
FLI	(C,0,0,)	2.1782	-2.9810	No
	(C,T,0)	-1.2747	-3.5950	No
ΔFLI	(C,0,0)	-3.5855	-2.9862	Yes
	(0,0,1)	-0.7823	-1.9557	No
lnFLI	(C,0,6)	-2.5605	-3.0207	No
	(C,T,6)	-2.7273	-3.6584	No
ΔlnFLI	(C,0,6)	-2.0434	-3.0300	No
	(0,0,1)	-2.5314	-1.9557	Yes

[1] 'C' indicates an intercept, 'T' a trend and 'L' lag length. In all cases lag length is chosen to maximise the Schwarz Information Criterion for the "Dickey-Fuller equation".

Table 4: Tests of cointegration

Panel A: *s* and *FLI*

Trend/ no trend	Lags	Test type	p-values for H_0: no. of cointegrating vectors		No. of CVs
			None	At most 1	
Trend	1	Trace	0.3338	0.0485	0
		Eigenvalue	0.6828	0.0485	0
No trend	1	Trace	0.6395	0.5680	0
		Eigenvalue	0.7224	0.5680	0
Trend	2	Trace	0.1748	0.1515	0
		Eigenvalue	0.2405	0.1515	0
No trend	2	Trace	0.2458	0.8805	0
		Eigenvalue	0.1195	0.8805	0

Panel B: *lns* and *lnFLI*

Trend/no trend	Lag	Test type	p-values for H_0: no. of cointegrating vectors		No. of CVs
			None	At most 1	
Trend	1	Trace	0.0955	0.0208	0
		Eigenvalue	0.3557	0.0208	0
No trend	1	Trace	0.5067	0.2887	0
		Eigenvalue	0.7983	0.2887	0
Trend	2	Trace	0.0436	0.0719	1
		Eigenvalue	0.0885	0.0719	0
No trend	2	Trace	0.2622	0.6911	0
		Eigenvalue	0.6911	0.6911	0

Table 5: Tests of Granger causality between growth, saving and FLI

Explanatory variable	Dependent variable		
	G	*Δlns*	*ΔlnFLI*
G	NA	0.7673 (0.3810)	3.4754 (0.1759)
Δlns	1.8393 (0.1750)	NA	4.6787 (0.3219)
ΔlnFLI	5.0474 (0.0802)	17.336 (0.0017)	NA

Note: the table contains F-statistics (with p-values in parentheses) for a test of Granger causality from the row variable to the column variable.

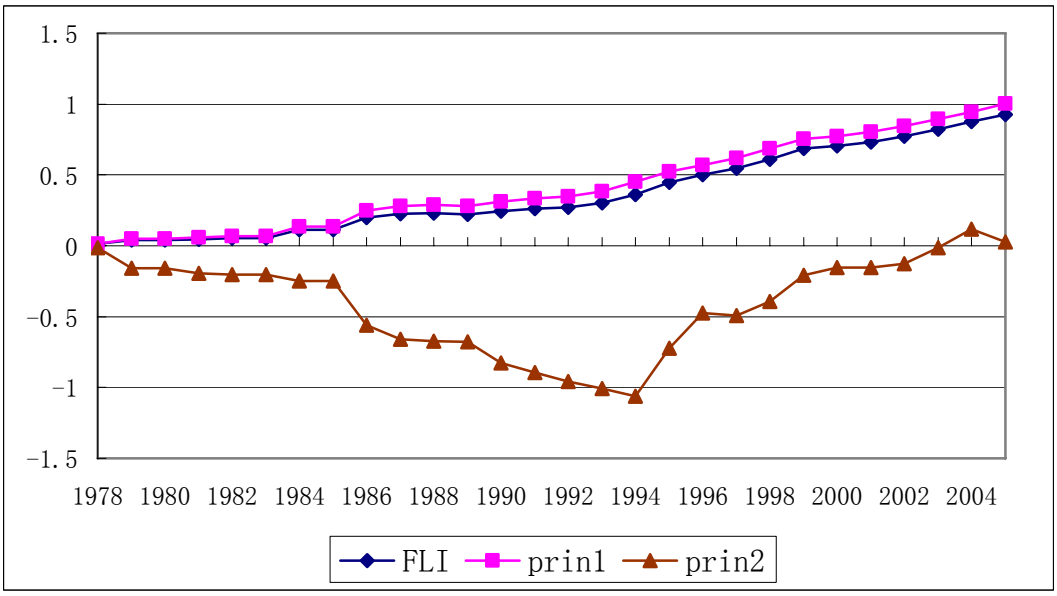

Figure 1: The Financial Liberalisation Index

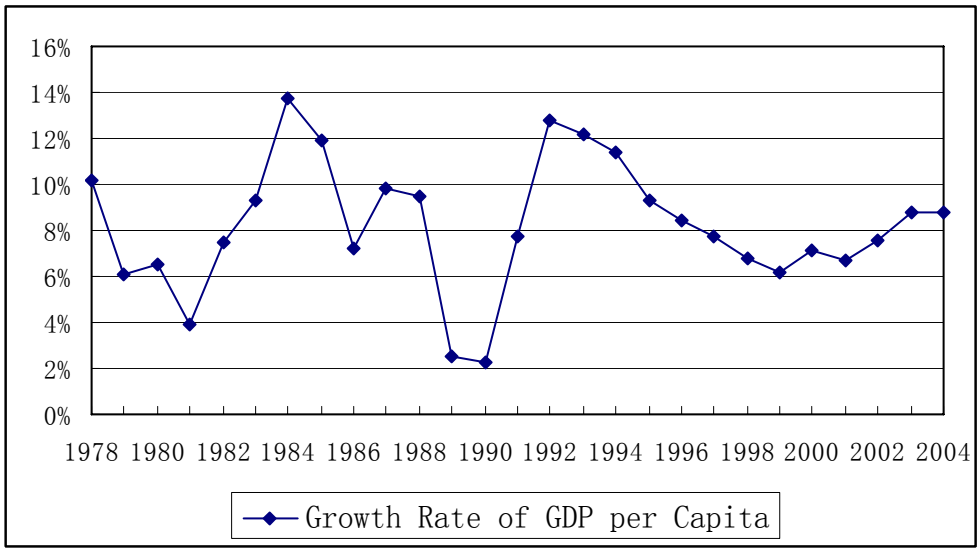

Figure 2: The Growth Rate of GDP per Capita (G)

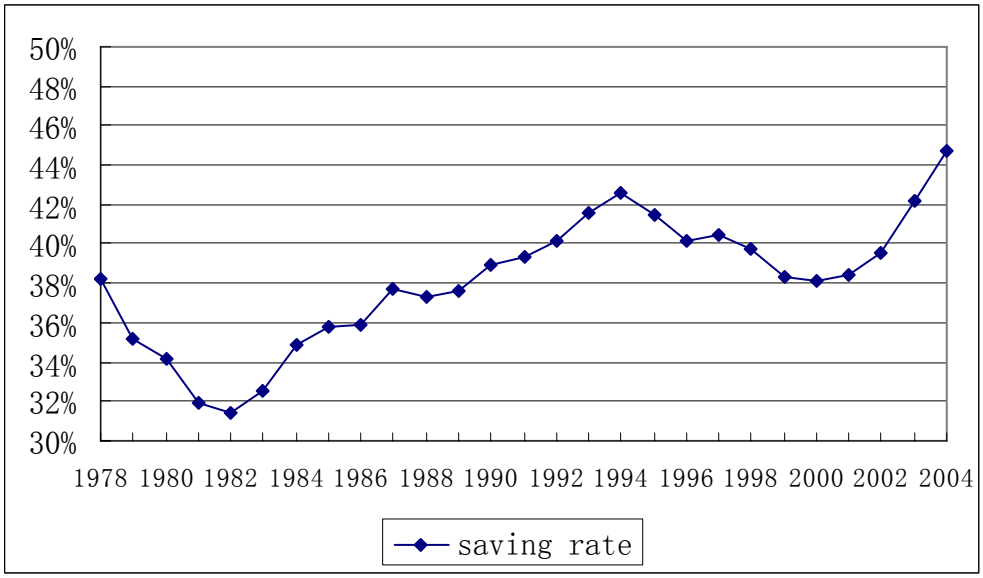

Figure 3: The Saving Rate

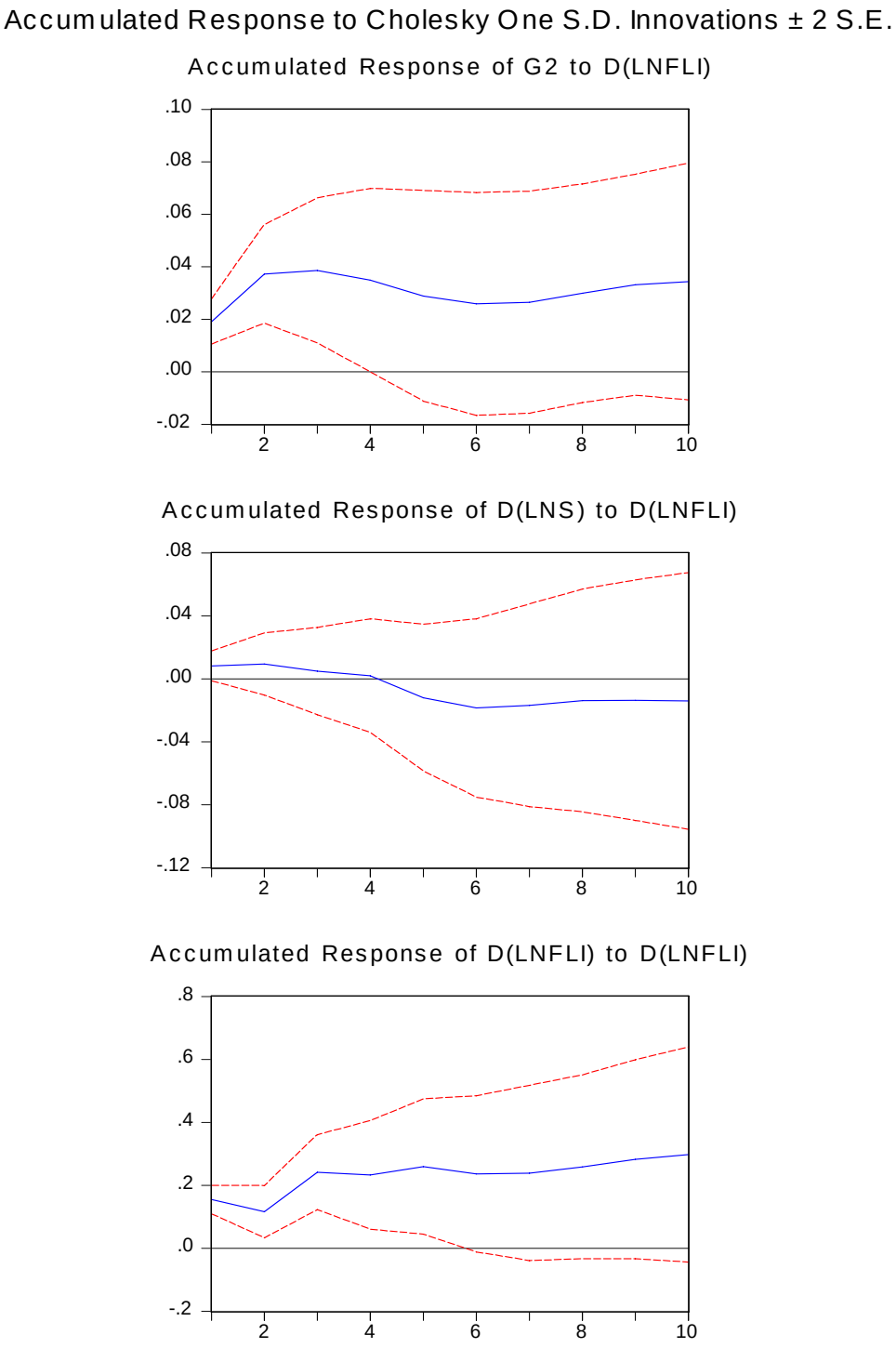

Figure 4: Cumulative IRFs following a shock to *ΔlnFLI*

APPENDIX

Table A1: Correlation of individual responses

Panel A: Correlations for “Institutions”														
1.000														
0.989	1.000													
0.980	0.985	1.000												
0.983	0.989	0.980	1.000											
0.979	0.988	0.953	0.981	1.000										
0.952	0.950	0.932	0.971	0.966	1.000									
0.946	0.950	0.913	0.967	0.977	0.993	1.000								
0.940	0.974	0.935	0.957	0.913	0.923	0.944	1.000							
0.943	0.942	0.936	0.978	0.957	0.989	0.979	0.929	1.000						
0.986	0.996	0.993	0.994	0.980	0.946	0.940	0.970	0.951	1.000					
0.879	0.838	0.840	0.823	0.857	0.774	0.766	0.763	0.770	0.838	1.000				
0.950	0.976	0.965	0.934	0.957	0.941	0.930	0.812	0.906	0.961	0.862	1.000			
0.977	0.998	0.972	0.977	0.996	0.953	0.960	0.888	0.943	0.990	0.871	0.974	1.000		
0.985	0.994	0.977	0.998	0.994	0.974	0.974	0.977	0.973	0.993	0.824	0.962	0.994	1.000	
0.979	0.987	0.963	0.994	0.996	0.983	0.986	0.976	0.978	0.983	0.812	0.958	0.991	0.998	1.000

Table A1 continued

Panel B: Average correlation coefficients														
0.965	0.970	0.955	0.968	0.966	0.950	0.948	0.927	0.945	0.968	0.835	0.939	0.965	0.975	0.972
0.967	0.975	0.969	0.975	0.982	0.947	0.969	0.907	0.967	0.971	0.972	0.979	0.980	0.980	0.978
0.984	0.984	0.972	0.977	0.983	0.984	0.971	0.969	0.987	0.941	0.982	0.978	0.982	0.988	0.985
0.971	0.985	0.974	0.974	0.981	0.971	0.982	0.972	0.974	0.972	0.981	0.976	0.976	0.983	0.971
0.962	0.936	0.945	0.965	0.924	0.949	0.960	0.871	0.944	0.898	0.965	0.966	0.961	0.960	0.949
0.973	0.973	0.965	0.976	0.888	0.963	0.962	0.958	0.970	0.936	0.970	0.962	0.963	0.955	0.967
0.984	0.988	0.987	0.987	0.975	0.972	0.961	0.978	0.987	0.987	0.989	0.956	0.986	0.979	0.989
0.981	0.967	0.921	0.972	0.957	0.956	0.979	0.939	0.967	0.978	0.941	0.979	0.959	0.975	0.978

Panel A contains correlations coefficients for respondent i's responses (over time) for the "institutions" aspect with those of respondent j for i, j, = 1,2,…,15.. Panel B contains the average of correlations for each aspect. Thus, row 1 of Panel B contains the average correlations for each of the 15 respondents for the first aspect, the second row for the second aspect and so on for the eight aspects.

Table A2: VAR lag length criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	102.6826	NA	2.33e-08	-9.062055	-8.913276	-9.027007
1	112.3246	15.77780	2.22e-08	-9.120417	-8.525303	-8.980226
2	125.8942	18.50406	1.55e-08	-9.535840	-8.494390	-9.290505
3	145.4242	21.30544*	6.90e-09*	-10.49311	-9.005326*	-10.14263
4	157.7805	10.10969	6.96e-09	-10.79823*	-8.864107	-10.34261*

"LogL" gives the value of the log likelihood function, "LR" is the value for a likelihood ratio test of the indicated number of lags against the alternative of 0 lags, "FPE" is the final prediction error, "AIC" is the value of the Akaike Information Criterion, "SC" the value of the Schwarz Criterion and "HQ" the Hannan-Quinn criterion. An asterisk indicates lag order selected by the relevant criterion

Table A3: The estimated VAR model

	G	Δlns	ΔlnFLI
G_{t-1}	0.531917	-0.467372	-3.267427
	[1.43507]	[-1.33035]	[-1.40997]
G_{t-2}	-0.304242	0.400769	5.496997
	[-0.85879]	[1.19355]	[2.48182]
G_{t-3}	-0.189087	-0.854446	-3.141841
	[-0.56530]	[-2.69510]	[-1.50236]
Δlns_{t-1}	0.160173	0.725492	1.288262
	[0.68585]	[3.27754]	[0.88231]
Δlns_{t-2}	-0.132306	-0.442176	-0.248501
	[-0.54768]	[-1.93114]	[-0.16453]
Δlns_{t-3}	0.017611	0.384939	-2.136607
	[0.08604]	[1.98424]	[-1.66965]
$\Delta lnFLI_{t-1}$	0.043247	0.028062	0.086700
	[0.89628]	[0.61360]	[0.28739]
$\Delta lnFLI_{t-2}$	0.000295	-7.39E-05	0.539642
	[0.00747]	[-0.00197]	[2.18341]
$\Delta lnFLI_{t-3}$	0.000361	0.026012	-0.066729
	[0.01175]	[0.89257]	[-0.34712]
CONST	0.074434	0.077132	0.126693
	[2.33233]	[2.54991]	[0.63496]
R^2	0.549612	0.646242	0.570679
Adjusted R^2	0.237804	0.401332	0.273456
LM Test of system autocorrelation			
	Lags	LM	p-value
	1	11.81997	0.2237
	2	5.836710	0.7561
	3	11.25527	0.2586
	4	11.32813	0.2539

Note: estimated coefficients have t-statistics in brackets.