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DEMOCRACY AND ECONOMIC GROWTH IN CHINA: EVIDENCE FROM COINTEGRATION AND CAUSALITY TESTING

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This article considers the relationship between democracy and economic growth in China using the Error-Correction Mechanism test for cointegration, Autoregressive Distributed Lag modelling, Granger causality and dynamic modelling via variance decomposition and impulse response analysis. Our main findings are that in the long run the lack of democracy in China has had a statistically significant negative effect on real income, while in the short run democracy has had a statistically insignificant effect on economic growth. Our results suggest that in the long run growth in capital, labour and democracy Granger cause economic growth, while in the short run there is bi-directional Granger causality between democracy and economic growth.

JEL Classification: *C22, E23.*

Keywords*: China, democracy, economic growth.*

INTRODUCTION

The relationship between democracy and economic growth is contentious. Some studies have found that democracy has a positive effect on economic growth, while other studies suggest a negative relationship or no relationship at all (see the surveys in Przeworski and Limongi, 1993, and Brunetti, 1997). Consistent with the extant literature, democracy here is defined more broadly than whether a country has elections. It also includes factors such as whether there is freedom of the press, an absence of censorship, clear and effective legal institutions and transparency, openness and citizen input in policy making (Rivera-Batiz and Rivera Batiz, 2002).

The objective of this article is to examine the relationship between democracy and economic growth in the People's Republic of China (hereafter China) over the last three decades. China represents an interesting case in the debate over the relationship between democracy and growth. Since market reforms started in the late 1970s it has had one of the highest rates of economic growth in the world. For the two decades up to the Asian financial crisis in 1997, economic growth in China was 9.5 per cent per annum and after the Asian financial crisis it was about 7 per cent per annum.

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However, it scores poorly on the Freedom House ratings of democracy in the world. On a scale of one to seven with a value of one representing the strongest level of democracy and seven the weakest, it has hovered in the six to seven range since the index began in the early 1970s and in 2001 it was still 6.5 (Gastil, 2001). More freedom of speech is tolerated in China now than at any other point since the founding of the People's Republic (Des Forges *et al.* 1993; Ding, 2001). This includes discussion in academic journals on political issues including the meaning of democracy itself.[1] There is also a growing plurality of social interests reflected in the emergence of village self-government and an embryonic, but burgeoning civil society movement. These changes, though, have generally not been reflected in greater tolerance of freedom of association, particularly political association (Gallagher, 2002). Thus China is often held up as an example by those critical of the democracy-growth nexus to illustrate their argument that democracy is not a precondition for economic growth, while being treated by those supportive of the democracy-growth nexus as an 'exception' (Bhagwati, 2002; Stiglitz, 2002).

While economists have tended to focus on the issue of whether democracy generates higher growth rates, beginning with Lipset (1959), political scientists have been interested in whether economic growth results in more democracy. China also represents a puzzle for modernisation theories in political science which posit a causal link between economic growth and democracy. As Gallagher (2002, pp. 339-340) puts it, "the belief that economic growth, development, and greater integration with the outside world will lead to a more liberal and democratic China has been the foundation of U.S foreign policy toward China for the last twenty-five years". This, though, has not happened suggesting that for modernisation theories at least, China appears to represent a significant exceptionalism (Gallagher, 2002, p. 339).

This article makes three contributions to the literature on democracy and economic growth. The first is that we estimate the short run and long run effects of democracy on growth in China within a production function framework which also incorporates capital and labour. To test for cointegration we use the error correction mechanism (ECM) test, proposed by Banerjee *et al.* (1998) and extended by Pesaran *et al.* (2001). Second, we examine the short run and long run causal relationship between democracy and economic growth within China, using multivariate Granger causality tests which also include capital and labour. Most studies by economists have tested for correlation between democracy and economic growth and have failed to adequately address the issue of causation. This issue has been highlighted in studies such as Barro and Sala-i-Martin (1995) and Huber *et al.* (1993). Granger causality tests have received little use in this area, but provide an effective method to simultaneously investigate the economic and political science hypotheses. Third, we go further than the Granger causality tests to explore the effects of shocks of democracy and economic growth beyond the sample period through the use of variance decomposition analysis and impulse response functions.

The balance of the article is set out as follows. The next section provides an overview of the competing hypotheses in the existing literature on democracy and economic growth. Section 3 sets out the model and explains the data. Section 4 presents the results for cointegration, the model estimates and tests for Granger causality. Our main findings are that democracy, income, capital and labour in China are cointegrated. In the long run the lack of democracy in China has a statistically significant negative effect on real income, while in the short run its effect is statistically insignificant. In the long run, growth in capital, labour and democracy Granger

cause economic growth, while in the short run there is bi-directional Granger causality between democracy and economic growth. The results from the variance decomposition analysis and impulse response functions are reported in section 5.

LITERATURE REVIEW

Effect of Democracy on Growth

Sirowy and Inkeles (1990) suggest that there are three major views on the effects of democracy on growth which they label the "conflict", the "compatibility" and the "skeptical". The conflict thesis suggests that democracy and economic growth are incompatible because elected officials longing for popular approval make shortsighted decisions designed to maximize success at the next election. This makes them receptive to rent-seeking interest groups whose objective is to divert resources from productive activities in favour of immediate consumption. Related arguments are that democracy is less conducive to long term stability (World Bank, 1991, pp. 132-133) or long term development (Barro,1996) because of the tendency in majority voting systems to enact rich-to-poor redistribution of income including land reforms.

On the other hand, the compatibility thesis proffers that democratic features such as political pluralism, institutional checks and balances and freedom of the press provide safeguards against systemic abuse or predatory behaviour often associated with authoritarian regimes. Friedman (1962) was one of the first to suggest that economic and political freedoms are mutually reinforcing. He postulated that an expansion in political freedom fosters economic freedoms such as secure property rights and certainty of contract, which, in turn, underpin higher rates of economic growth. As Barro (1996) argues, of course there is nothing in principle preventing non-democratic governments from promoting economic freedoms. Examples of autocracies which have increased economic freedoms include the Pinochet regime in Chile and the Fujimora government in Peru. The point, though, made by advocates of the compatibility thesis is that democracy is *more* likely to be conducive to promoting economic freedoms than authoritarianism because the political legitimacy and therefore long-term survival of a democracy depends on maintaining economic rights.

The third perspective, which is the skeptical view, suggests there is no systematic relationship between democracy and economic growth. While it might generally be true that there is more economic freedom under a democracy than an autocracy, there is no guarantee it will be at an optimum (Esposto and Zaleski, 1999). Even in a democracy there will be those whose aim is to challenge the private property status quo if it is in their best interests, and because of the very nature of a democracy they will have more opportunities to do so (Przeworki and Limongi, 1993).

The empirical evidence on the three perspectives is not clear-cut. Sirowry and Inkeles (1990) review thirteen studies; of which, six supported the skeptical view, four suggested qualified or conditional relationships, and three provided unconditional support for the conflict perspective. In a later survey, Brunetti (1997) reviewed 17 empirical studies of the democracy-growth relationship. He found (at p. 167) "nine studies report no relationship, one study a positive, one study a negative, three studies a fragile negative relationship and three studies a fragile positive

relationship between democracy and economic growth". Helliwell (1994), Barro (1996) and Tavares and Wacziarg (2001) found that democracy has either a non-significant or moderately weak negative effect on growth once other growth-determining variables are held constant. On the basis of the mixed findings in the literature, a reasonable conclusion is that: "We do not know whether democracy fosters or hinders growth" (Przeworki and Limongi, 1993, p. 64). However, as a proviso to this, the balance of empirical evidence is with the conflict and skeptical views rather than the compatibility view.

Effect of Growth on Democracy

Political scientists have examined the effect of economic growth on democracy. Most studies have found that economic growth generates demands for political rights (Lipset, 1959; Bollen, 1979; Bollen and Jackman, 1985; Burkhart and Lewis-Beck, 1994). At one level, casual empiricism seems to also support the view that economic growth promotes democracy. As Gupta *et al.* (1998, pp. 589-590) note, "all of the developed, industrialized nations have a democratic political system. In contrast, most of the nations in the poorest segment of the world community operate under various forms of non-democratic political system". However, this is not true in a blanket sense. Casual observation also suggests that economic growth does not necessarily bring about a demand for democracy. There are examples of authoritarian regimes in Southeast Asia and the Middle East where citizens are willing to forego demand for political liberalisation provided their economic needs are being met.

In these instances there is a good argument that it is only when the authoritarian government stops delivering on the economic front that there are calls for more political rights. An example is the fall of the Suharto regime in Indonesia following the Asian financial crisis when spiralling inflation and unemployment prevented Suharto from delivering in the economic sphere. Glasure *et al.* (1999) obtain results that are consistent with this view. Their findings suggest that in developing countries and newly industrializing countries economic development has a significant effect on democratic performance, but contrary to Lipset (1959) economic development leads to lower levels of democracy. Glasure *et al.* (1999, p. 475) conclude: "The sign reversal may stem from the possibility that as nations strive for economic development, the nations tend to trade-off democracy for economic development".

MODEL AND DATA

Consider the simple Cobb-Douglas production function of the form:

$$Y = AL^{\alpha} K^{\beta} \tag{1}$$

Here Y is output, L is labour and K is capital. A, α , and β are the parameters to be estimated. The growth version of Equation (1) can be written as follows:

$$\dot{Y}_t = a + \alpha \dot{L}_t + \beta \dot{K}_t + \varepsilon_t \tag{2}$$

Here $\dot{Y}$, $\dot{L}$, and $\dot{K}$ are the respective growth rates of output, labour and capital. Equation (2) is the classical production function which has been augmented with a number of factors in the

existing literature (see Durlauf and Quah, 1999, Romer, 2001, for reviews). We augment it with a democracy variable *(D)* to examine its impact on output. Several studies have augmented the production function with ordinal variables measuring political instability (see e.g. Fosu, 1992; 2001; 2002 who examines the effect of political stability on economic growth in Sub-Saharan Africa) or the Freedom House index of democracy (see e.g. Gounder, 1999; 2001; 2002) who examines the effect of political instability on economic growth in the Fiji Islands).[2] The augmented version of the model takes the following form:

$$\dot{Y}_t = a + \beta\dot{K}_t + \alpha\dot{L}_t + \psi D_t + \varepsilon_t \tag{3}$$

We expect the coefficients on labour and capital to be positive, while the coefficient on the democracy index is ambiguous. As discussed above, existing empirical studies have reached conflicting results on the impact of democracy on output.

The data used in this article are real GDP (*Y*), real capital stock (*K*), an index of human capital (*L*) and the democracy index (*D*) for the period 1972-1999. The period of analysis was dictated by data availability. While data on human capital, capital stock and real GDP is available from 1952, data on the democracy index is only available from 1972. The democracy index was extracted from Freedom House (Gastil, 1972-1999). Freedom House constructs their democracy indexes with the assistance of local and international printed materials, field visits and other communications with informed observers. Following a checklist of various components of democracy, countries are assigned a value of political rights between one (most free politically) and seven (least free). The series on real GDP is constructed by Hsueh and Li (1999) and updated for the period 1996 to 1999 from the *China Statistical Yearbooks*. We use the Hsueh and Li (1999) data set because it is regarded as more reliable than the official estimates of real GDP up to the 1990s.

The data on capital stock and human capital is compiled by Wang and Yao (2003) and is available in an appendix to their article. The real capital stock series was constructed using the standard perpetual inventory approach. The series on human capital was constructed using the perpetual inventory method in a similar fashion to Barro and Lee (2000). The flow variable that Wang and Yao (2003) use is the number of graduates completing different schooling levels rather than enrollments at five-year intervals as used in other recent estimates of China's human capital stock such as that constructed by Young (2003). The result is a weighted index of educational attainment from five levels of schooling: primary, junior secondary, senior secondary, special secondary and tertiary (see Wang and Yao, 2003, for full details).

COINTEGRATION, MODEL ESTIMATES AND GRANGER CAUSALITY

Cointegration

We use the ECM test for cointegration. The main advantage of the ECM test is that it has a limit distribution which does not depend on nuisance parameters. Thus, it does not suffer in finite samples from possibly invalid common factor restrictions. Banerjee *et al*. (1998) show that when other popular cointegration tests such as the Engle and Granger (1987) and Hansen (1990) approaches are exposed to invalid restrictions, the power properties of these tests may be

very poor. In comparison the ECM test does not impose those restrictions. The ECM test can be described using a simple data generating process (Banerjee *et al.*, 1998, pp. 269-270):

$$\Delta y_t = \alpha' \Delta x_t + \beta(y_{t-1} - \lambda' x_{t-1}) + \in_t \tag{4}$$

$$\Delta x_t = u_t \quad t = 1,...,T \tag{5}$$

where α, λ and x_t are k × 1 vectors of parameters and explanatory variables. The regressand y_t is a univariate process, β is a scalar and *T* is the sample size. Here, the tests for cointegration relies upon some estimate of the parameter β. Under the assumption that x_t is strictly exogenous, non-linear least squares (NLS) can be applied to Equation (4) producing consistent and asymptotically efficient estimates of α, β and λ. However, it has been shown by Banerjee *et al*. (1993) that by adding x_{t-1} to Equation (4) one can achieve a parameter-free distribution for the estimator of β. Then ordinary least squares (OLS) can be used to estimate β. This is because under the alternative hypothesis of cointegration, the true cointegrating slope λ is implicitly estimated when x_{t-1} is included as an additional regressor. In order to correct for serial correlation, Banerjee *et al.* (1998) follow the recommendation in Phillips and Loretan (1991) to augment the model with leads of Δx_t . Thus, it follows that an unrestricted dynamic model can be specified which takes the form:

$$\Delta y_t = \alpha' \Delta x_t + \beta y_{t-1} + \theta' x_{t-1} + \sum_{j=1}^{n} \alpha_j \Delta x_{t+j} + \in_t = \alpha' \Delta x_t + \phi' w_{t-1} + \sum_{j}^{n} \alpha_j \Delta x_{t+j} + \in_t \tag{6}$$

where $w'_t = (y_t, x'_t)$ and $\phi' = (\beta, \theta')$ and n represents the optimal lag length. Since $\beta(1-\lambda') = \phi'$, the non-cointegrating restriction β = 0 implies ϕ = 0 and so the ECM test can be based upon either the OLS estimator of β in Equation (6) or on its *t* ratio. Banerjee *et al.* (1998, p. 268) show that the *t*-ratio form of the ECM test may have better power properties than the normalised bias form, particularly when the common-factor restrictions are grossly violated. The approximate critical values for the *t*-test are provided in Pesaran *et al*. (2001)who develop a bounds testing procedure whereby the asymptotic distribution of their statistics is obtained for cases in which all regressors are I(1) as well as when the regressors are I(0) or mutually cointegrated.

The estimated *t*-statistic on the lag of the growth in income is –4.6971. For cointegration to exist, the absolute value of the estimated *t*-statistic needs to be higher than the upper bound critical values, as reported in Pesaran *et al.* (2001). The absolute value of the calculated *t*-statistic of -4.6971 is higher than the absolute value of the upper bound critical value of –4.37 at the 1 per cent level of significance.[3] This leads us to the conclusion that $[\dot{Y}, \dot{K}, \dot{L}, D]$ are cointegrated.[4]

Long Run and Short Run Results from the ARDL Model

The empirical results for the long run and short run Autoregressive Distributed Lag (ARDL) model are presented in Tables 1 and 2. The error term ECM_{t-1} in the short run model is statistically significant at 1 per cent with a negative sign, confirming that a long run equilibrium relationship exists between the variables. The standard diagnostics for the short run model are also given in Table 2. The short run model passes the diagnostic tests for autocorrelation, functional form, normality of the residuals and heteroskedasticity and the fit of the model is relatively good.

Table 1
Estimated long-run coefficients using the ARDL approach

Regressor	*Coefficient*	*t-ratio*
$\dot{K}_t$	0.8264***	2.8459
$\dot{L}_t$	-0.3265	-1.9081
D_t	-2.9809***	-3.1063
Constant	21.8459***	3.2991

Notes: *** denotes significance at the 1% level.

Table 2
Error Correction representation for the ARDL model - short run model

Regressor	*Coefficient*	*t-ratio*
$\Delta\dot{K}_t$	2.4878***	6.1883
$\Delta\dot{L}_t$	-0.8984	-0.3501
ΔD_t	-1.2722	-0.7101
Constant	0.0844	0.1799
ECM_{t-1}	-1.0000***	-6.0645
Diagnostic tests		
R^2	0.7966	
$\overline{R}^2$	0.7597	
$\chi^2_{Auto}(1)$	0.0329	
$\chi^2_{Auto}(2)$	2.3815	
$\chi^2_{Hetero}(1)$	2.6056	
$\chi^2_{RESET}(1)$	0.0210	

Notes: *** denotes significance at the 1% level. The critical values for $\chi 2(1) = 3.84$ and $\chi^2(2) = 5.99$ at the 5% significance level.

Beginning with the long run coefficients in Table 1, as expected, the coefficient on growth in capital stock is positive and significant at 1 per cent. The coefficient on the human capital

index has an unexpected negative sign, but is statistically insignificant at 5 per cent. The coefficient on the democracy index is negative and significant at 1 per cent. A negative sign on the democracy index points to the detrimental effect of authoritarianism on economic growth. A shift up the index from the democratic end (Freedom House's 1) towards the authoritarian end (Freedom House's 7) would reduce growth rates. This result is consistent with the compatibility perspective. Turning to the short run, the sign and statistical significance for growth in capital stock and human capital are the same as in the long run. The democracy index again has a negative coefficient, but in the short run it is insignificant. Thus, the short run result for the democracy index is supportive of the skeptical perspective.

Parameter Stability

Parameter stability tests have been given increasing attention in the recent past in recognition of the fact that systemic instability, which is filtered to the parameters of the estimated model, can lead to misleading inference or forecasting. To test for parameter stability we use the Pesaran and Pesaran (1997) test. The Pesaran and Pesaran (1997) test amounts to estimating the following error correction model.

$$\Delta\dot{Y}_t = \alpha_0 + \sum_{i=1}^{m}\beta_i\Delta\dot{Y}_{t-i} + \sum_{i=1}^{n}\varphi_i\Delta\dot{K}_{t-i} + \sum_{i=1}^{p}\gamma_i\Delta\dot{L}_{t-i} + \sum_{i=1}^{q}\omega_i\Delta D_{t-i} + \kappa ECM_{t-1} + \varepsilon_t \tag{7}$$

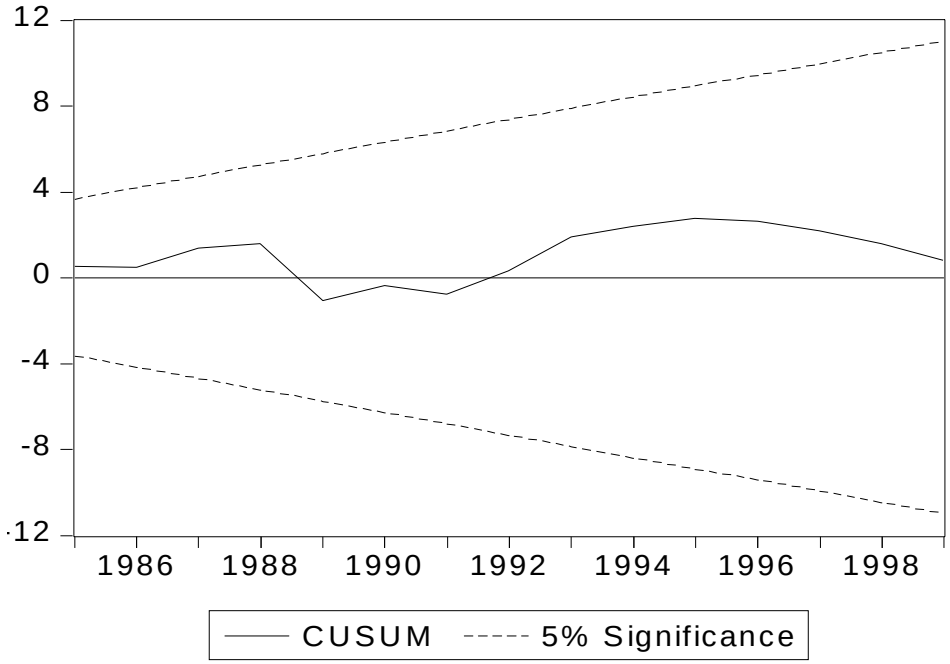
Once Equation (7) is estimated using OLS, Pesaran and Pesaran (1997) suggest applying the cumulative sum of recursive residuals (CUSUM) and the CUSUM square (CUSUMSQ) tests proposed by Brown *et al.* (1975) to assess the parameter constancy. Figure 1 plots the CUSUM and CUSUMSQ tests for Equation (7). We do not find any evidence of fluctuations of the CUSUM and CUSUMSQ statistics beyond the 5 per cent critical bounds of parameter stability. Fluctuations within the 5 per cent critical bounds are evidence in favour of parameter stability.

Granger Causality

In this section we examine the long run and short run causal relationship between democracy and economic growth in China using Granger causality tests within a multivariate framework. While, unlike most cointegration tests, the ECM test for cointegration does not depend on pre-testing the order of integration of the variables, all variables need to be integrated of the same order to conduct the Granger causality tests. To ascertain the order of integration we apply the Augmented Dickey-Fuller (ADF) and Phillips Perron (PP) unit root tests. Table 3 reports the results of the unit root tests. The ADF and PP statistics for the levels of output, labour, capital and democracy $\left[\dot{Y}, \dot{K}, \dot{L}, D\right]$ do not exceed the critical values (in absolute terms). However, when we take the first difference of each of the variables, the ADF and PP statistics are higher than the respective critical values (in absolute terms). Therefore, we conclude that $\left[\dot{Y}, \dot{K}, \dot{L}, D\right]$ are each integrated of order one or I(1).

Having established that all variables are integrated of the same order we can now proceed to conduct the Granger causality tests. Following Granger (1969) Y_t is said to be Granger-caused

Figure 1
CUSUM and CUSUMSQ plots for parameter stability



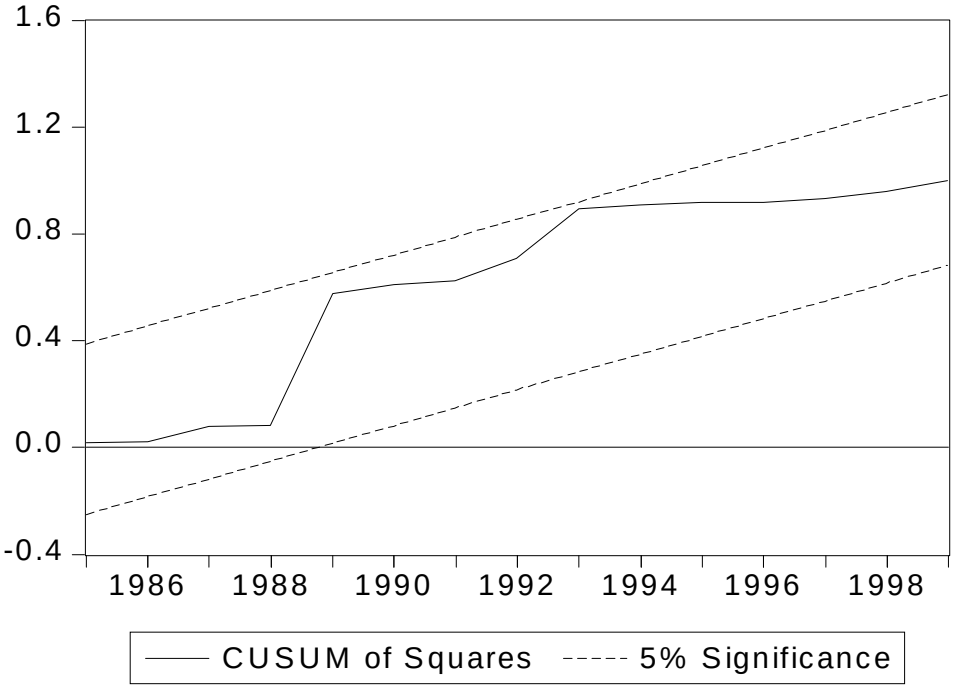


Table 3
Unit Root tests: ADF and PP

Variables	*ADF statistic [LL}*	*CV*	*PP statistic [BW]*	*CV*
$\dot{Y}_t$	-2.6039 [1]	-2.8910	-3.6129 [0]	-3.6998***
$\Delta\dot{Y}_t$	-4.4290 [1]	-2.9862	-8.9421 [5]	-2.9810
$\dot{L}_t$	-1.8889 [6]	-3.6449	-2.0061 [2]	-3.5875
$\Delta\dot{L}_t$	-7.2797 [5]	-3.6449	-3.7521 [2]	-3.5950
$\dot{K}_t$	-2.7170 [1]	-2.8910	-2.1669 [2]	-2.9763
$\Delta\dot{K}_t$	-4.0678 [6]	-3.0207	-3.5294 [0]	—2.8910
D_t	-1.4237 [0]	-2.9762	-1.4668 [1]	-2.9762
$\dot{D}_t$	-4.8989 [0]	-2.8989	-4.8989 [0]	-2.8910

Notes: LL is Lag Length; CV is Critical values at 5% level; *** CV at the 1% level; and BW is the Bandwidth.

by D_t if the information in the past and present values of helps to improve the forecast of the variable, i.e. if, MSE (Y_t |Ωt) < MSE (Y_t| Ω'_t where MSE is the conditional mean square root of the forecast of Y_t . Ωt denotes the set of all relevant information up to time *t*, while Ω'_t excludes the information in the past and present values of Y_t. The Granger causality test involves specifying a multivariate *p*th order vector error-correction mechanism (VECM) as follows:

$$(1-L)\begin{bmatrix}\dot{Y}_t\\ \dot{K}_t\\ \dot{L}_t\\ D_t\end{bmatrix}=\begin{bmatrix}\alpha_1\\ \alpha_2\\ \alpha_3\\ \alpha_4\end{bmatrix}+\sum_{i=1}^{p}(1-L)\begin{bmatrix}\beta_{11i}\beta_{12i}\beta_{13i}\beta_{14i}\\ \beta_{21i}\beta_{22i}\beta_{23i}\beta_{24i}\\ \beta_{31i}\beta_{32i}\beta_{33i}\beta_{34i}\\ \beta_{41i}\beta_{42i}\beta_{43i}\beta_{44i}\end{bmatrix}\begin{bmatrix}\dot{Y}_{t-i}\\ \dot{K}_{t-i}\\ \dot{L}_{t-i}\\ D_{t-i}\end{bmatrix}$$
$$+\begin{bmatrix}\theta\\ \vartheta\\ \psi\\ \varpi\end{bmatrix}\left[ECT_{t-1}\right]+\begin{bmatrix}\varepsilon_{1t}\\ \varepsilon_{2t}\\ \varepsilon_{3t}\\ \varepsilon_{4t}\end{bmatrix} \tag{8}$$

Here, in addition to the variables which are defined above, α_1, α_2, α_3 and α_4 denote constant drifts, (1–*L*) is the lag operator, ECT_{t-1} represents the lagged error-correction term derived from the cointegrating vector and ε_{1t}, ε_{2t}, ε_{3t} and α_{4t} are serially independent random errors with mean zero and finite covariance matrix. The optimal lag length *p* is chosen on the basis of the Schwarz Bayesian Criterion.

The existence of a cointegrating relationship among economic growth, growth in capital stock, growth in human capital and democracy suggests that there must be Granger causality in

at least one direction, but it does not indicate the direction of causality. Table 4 examines short run and long run Granger causality, within an ECM framework. The *F* tests on the explanatory variables indicate the significance of the short run causal effects. The *t*-statistics on the coefficients of the lagged error-correction terms indicate the significance of the long run causal effects.

Table 4
Results of Granger causality

Dependent variable	$\Delta\dot{Y}_t$	$\Delta\dot{K}_t$	$\Delta\dot{L}_t$	ΔD_t	ECT_{t-1}
[*t*-statistics]					
$\Delta\dot{Y}_t$	-	1.8011	0.7676	4.4997**	-1.0000***
		[0.1909]	[0.5278]	[0.0448]	[-6.0645]
$\Delta\dot{K}_t$	0.1076	-	1.4004	0.4927	-0.5264***
	[0.8985]		[0.2697]	[0.6182]	[-4.8917]
$\Delta\dot{L}_t$	2.4938*	0.3379	-	1.6816	-0.2850***
	[0.0948]	[0.7172]		[0.2113]	[-4.0852]
ΔD_t	3.6017*	0.3177	0.6199	-	-0.0183
	[0.0703]	[0.7314]	[0.5480]		[-0.1755]

Note: *(**)*** denotes statistical significance at the 10%, 5% and 1% levels respectively.

Beginning with the results in the short run, the democracy index is significant in the income equation and the income variable is significant in the democracy and labour equations. This suggests that in the short run there is bilateral Granger causality running between democracy and economic growth and unidirectional Granger causality running from economic growth to growth in human capital. There is neutrality between democracy and human capital, democracy and capital stock, human capital and capital stock and between economic growth and capital stock.

In the long run, the coefficient on the lagged error correction term is significant with a negative sign in the income, capital and labour equations. This implies that economic growth, growth in capital and human capital are functions of disequilibrium in the cointegrating relationship. Thus, in the long run growth in capital, human capital and democracy Granger cause economic growth; economic growth, growth in human capital and democracy Granger cause growth in capital stock and economic growth, growth in capital stock and democracy Granger cause growth in human capital.

VARIANCE DECOMPOSITION AND IMPULSE RESPONSE FUNCTIONS

Granger causality tests are within sample tests which can discern the plausible Granger exogeneity or endogeneity of the dependent variable in the sample period, but are unable to deduce the strength of the Granger causal chain or degree of exogeneity of the variables beyond the sample period. In order to ascertain the relative strength of the Granger-causal chain we consider the decomposition of variance.

The strength of variance decomposition lies in its ability to provide information about the relative importance of random innovations. Specifically, it provides information on the percentage of variation in the forecast error of a variable explained by its own innovations and the proportion explained by innovations in other variables. Sims (1980) notes that if a variable is truly exogenous with respect to the other variables in the system, own innovations will explain all of the variable's forecast error variance.

The variance decomposition results are summarised in Table 5 over a 10-year period. In the short and long run, income is the most exogenous variable. After two years, 75.6 per cent of the

Table 5
Variance Decomposition

Period	*Income*	*Capital stock*	*Labour*	*Democracy*
Variance decomposition of income				
1	100.00	0.00	0.00	0.00
2	75.62	0.00	5.34	19.03
3	74.08	0.06	5.36	20.48
4	71.61	1.28	7.19	19.90
5	71.10	2.26	7.23	19.39
6	68.90	5.14	8.05	17.89
7	67.48	6.57	8.45	17.48
8	63.04	7.21	9.39	20.34
9	60.22	7.15	9.88	22.74
10	58.30	7.01	10.35	24.32
Period	*Income*	*Capital stock*	*Democracy*	*Labour*
Variance decomposition of capital stock				
1	79.69	20.30	0.00	0.00
2	71.55	24.69	0.10	3.64
3	69.82	27.29	0.15	2.72
4	69.35	28.43	0.15	2.06
5	68.37	29.07	0.19	2.35
6	68.68	27.57	0.23	3.50
7	70.64	25.45	0.20	3.69
8	72.92	23.55	0.19	3.31
9	74.45	22.13	0.23	3.17
10	75.03	21.42	0.25	3.28
Period	*Income*	*Capital stock*	*Democracy*	*Labour*
Variance decomposition of labour				
1	30.53	3.39	0.00	66.06
2	56.38	1.53	0.02	42.05
3	61.65	6.41	1.41	30.52
4	64.05	11.89	2.94	21.10
5	60.03	16.89	5.82	17.24
6	57.82	18.94	7.26	15.96
7	55.79	19.11	8.63	16.45
8	55.74	18.19	9.14	16.91
9	56.08	17.22	9.57	17.11
10	57.08	16.47	9.76	16.68

contd.

Period	*Income*	*Capital stock*	*Democracy*	*Labour*
Variance decomposition of democracy				
1	22.56	1.46	13.91	62.06
2	9.55	0.92	11.56	77.95
3	6.28	0.86	10.54	82.30
4	4.78	1.22	10.43	83.55
5	4.06	1.80	9.85	84.27
6	3.68	2.04	9.76	84.51
7	3.53	2.20	9.66	84.59
8	3.30	2.18	9.72	84.78
9	3.14	2.13	9.75	84.96
10	2.97	2.04	9.83	85.14

variation in the forecast error for income is explained by own innovations, while at the end of 10 years, the forecast error variance for income explained by own innovations is 58.3 per cent. Labour is the next most exogenous variable, followed by capital stock, and democracy is relatively endogenous. Democracy is more important than either capital stock or human capital in explaining shocks to income; however human capital is much more important than either capital stock or income in explaining the relative variation in democracy. Moreover, the contribution of human capital increases over time. After two years 78 per cent of the variation in the democracy index is explained by human capital, while after 10 years 85.1 per cent of the variation in democracy is explained by human capital.

An alternative way of obtaining information regarding the relationships among the variables included in the variance decomposition analysis is via generalized impulse response functions. The impulse response of income, capital stock, democracy and labour to one-standard deviation shocks in income, capital stock, democracy and labour over a 10-year period are presented in Figures 2-5. Beginning with Figure 2, the results suggest that a shock to democracy exerts a negative effect on income for the first five years and has a positive effect thereafter. A shock to capital first exerts a small positive effect on income, but later has a negative impact. A shock to human capital has a positive effect on income in the short run and long run.

In Figure 3, consistent with the variance decomposition, own shocks and shocks to income explain most of the variation in capital stock. Both have a large positive effect over the whole period. Shocks to democracy have a small positive effect on capital stock for the first seven years and then have a small negative effect thereafter. Shocks to human capital exert a positive effect on capital stock up to the fourth year and after the eighth year, but a negative effect in the intervening period. In Figure 4 own shocks and shocks to labour have a stable positive and negative effect respectively on democracy over the entire period, while shocks to capital stock and income have negligible effects. In Figure 5 shocks to capital stock and democracy have a large positive effect on labour and shocks to income have a large negative effect. Own shocks have a positive effect up to the fourth year and then have a negative effect.

Figure 2
Impulse Response of Income to a One Standard Deviation Shock in Income, Capital Stock, Labour and Democracy

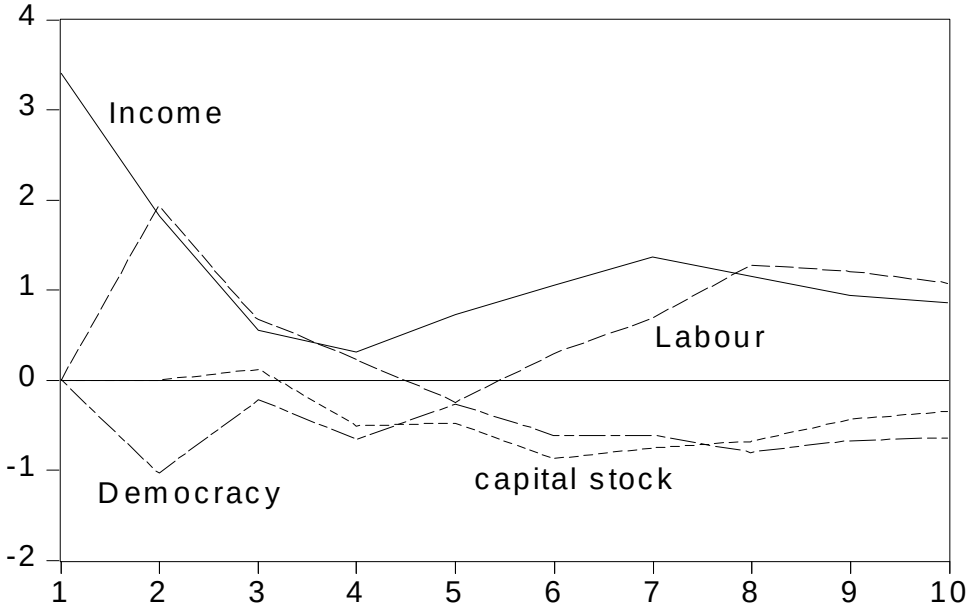


Figure 3
Impulse Response of Capital Stock to a one Standard Deviation Shock in Capital Stock, Income, Labour and Democracy

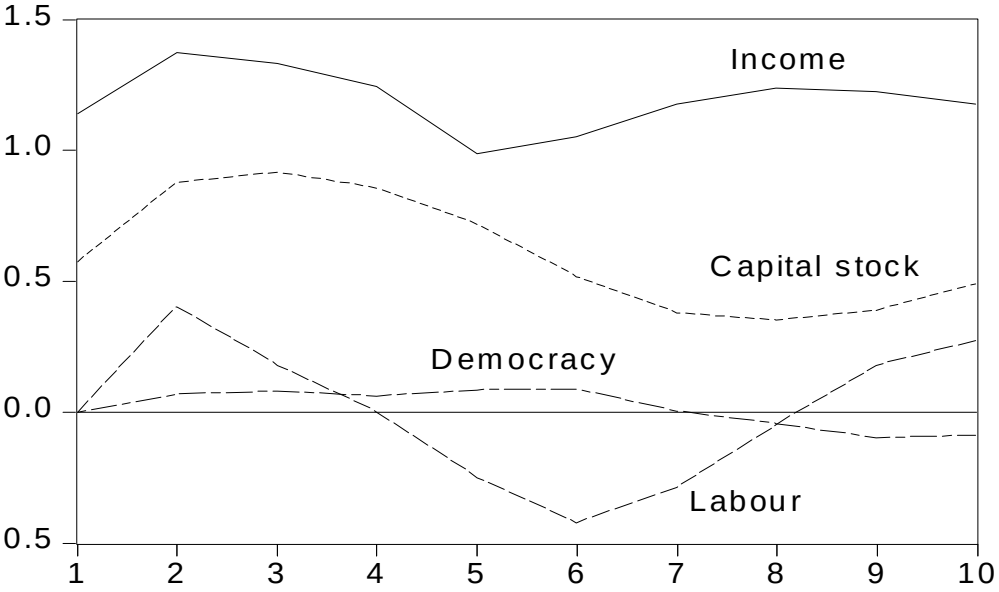


Figure 4
Impulse Response of Democracy to a one Standard Deviation Shock in Democracy, Income, Labour and Capital Stock

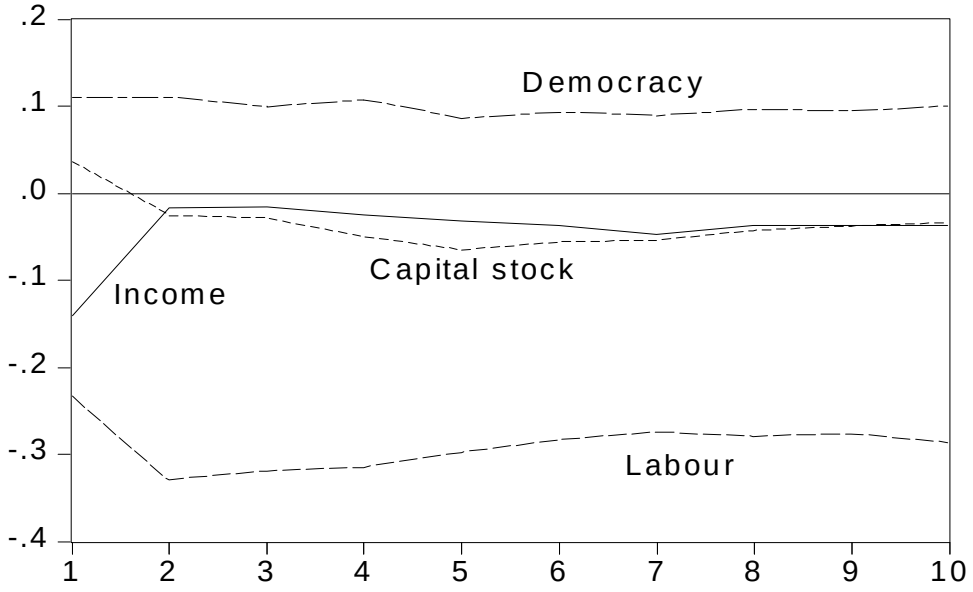
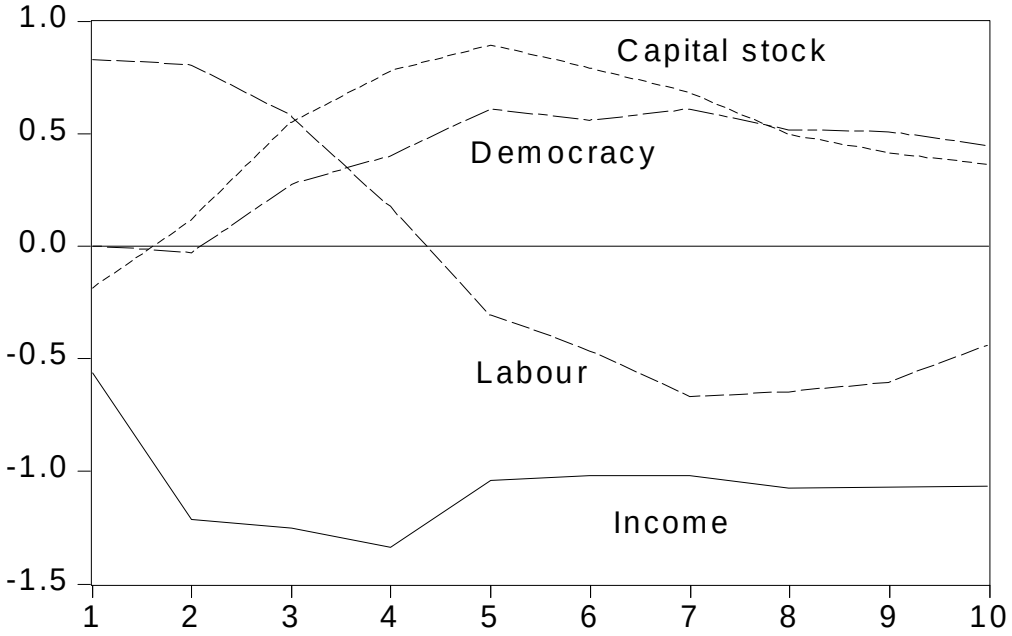


Figure 5
Impulse Response of labour to a one Standard Deviation Shock in Labour, Capital Stock, Income and Democracy



CONCLUSION

A question that continues to occupy the minds of development economists and political scientists is whether democracy is growth enhancing or growth inhibiting and vice-versa. China is a particularly interesting case in this debate given that on the surface it has achieved high rates of economic growth in the absence of democracy. In this article, within a time series cointgeration framework we have examined the democracy-growth relationship in China. Amongst our key results we find that democracy, income, capital and labour in China are cointegrated. The ARDL modelling reveals that in the long run, consistent with the compatibility argument, lack of democracy in China has had a statistically significant negative effect on real income. However, in the short run democracy has had a statistically insignificant effect on economic growth, which is consistent with the skeptical view. The Granger causality results suggest that in the long run growth in capital, labour and democracy Granger cause economic growth, while in the short run there is bi-directional Granger causality between democracy and economic growth in China.

Our results from the variance decomposition analysis suggest that democracy is more important than either capital stock or human capital in explaining shocks to income. The findings from the impulse response analysis suggest that shocks in democracy have a negative impact on income for the first five years. These results are broadly consistent with our findings from the long run model and Granger causality. Taken together these results point to one important conclusion. The results suggest that China's lack of democracy has curtailed economic growth. While it is true that China has had one of the most phenomenal growth performances over the last two decades, an interesting finding from our empirical study is that China's economic growth could have been even higher if there had been more political freedom.

NOTES

1. For example see the articles collected in the symposium on "economic democracy versus economic freedom", published in The Chinese Economy vol. 32, no. 4. July-August 1999.
2. There are, of course, a multitude of factors which might affect economic growth other than democracy such as trade embargoes. The purpose of this study, however, is to examine the effect of democracy on growth, rather than these other factors, which we leave to other studies.
3. The asymptotic critical value bounds of the t-statistics for the ECM test for cointegration with three regressors from Pesaran et al. (2001, Table 2) are 10% (I(0) -2.57, I(1) -3.46), 5% (I(0) -2.86, I(1) -3.78), 1% (I(0) -3.43, I(1) -4.37).
4. For other studies which have applied cointegration to continual and ordinal data see, inter alia, Gounder, ((1999), (2001), (2002)) and Nieswiadomy and Strazicich, (2004).

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