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ECONOMIC EFFECTS OF POLITICAL MOVEMENTS IN CHINA: LOWER BOUND ESTIMATES

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Abstract. We construct a structural econometric model to measure partially the economic effects of political movements in China. Consumption, or equivalently investment, is determined by a central planner trying to maximize a multiperiod objective function. Political events are modeled by exogenous changes in the shocks to productivity and to investment which affect the time paths of major economic variables. Effects of the events are measured by comparing the time paths generated by the model with and without the changes in the shocks. The dynamic optimization model is estimated using data from 1952 to 1993. In contrast with our earlier work, we assume a trend-stationary process for log total productivity rather than a random walk process and estimate that without the Great Leap Forward Movement output per capita in China up to 1993 would have been on average 1.18 to 1.71 times as great. Without the Cultural Revolution the corresponding figure would have been 1.08 to 1.12 times as great.

1. INTRODUCTION

What were the economic effects of the Great Leap Forward Movement in 1958–62 and the Cultural Revolution in 1966–9 in China? In other words, if these two events had not occurred what would have been the time paths of the major economic variables such as consumption, real output and capital stock in the years following 1958? To answer this question one has to compare the historical time paths of these variables with the paths that would have prevailed without the above events. We first construct an econometric model to explain the growth of the Chinese economy which incorporates the shocks from these two political events. Then the shocks are removed and the hypothetical time paths of the major economic variables are generated from the model. Comparing the hypothetical time paths with the time paths incorporating the shocks provides an answer to our question.

The econometric model has only one sector and includes aggregate output, consumption, investment, physical capital stock and total labor force as major variables. Aggregate output is produced by physical capital and labor according to a Cobb–Douglas production function. Output is divided into consumption and net investment (measured by "accumulation" in Chinese official statistics). Capital stock increases by the flow of investment. To determine investment we assume that actual investment equals planned

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investment plus an error. Planned investment is determined by the assumption that a central planner maximizes a multiperiod objective function with consumption per laborer as argument. The error may be affected by political events. The logarithm of total factor productivity follows a trend-stationary autoregressive process in normal years. In abnormal years such as during the Great Leap and the Cultural Revolution the residual of the productivity process can also be affected. Thus the effects of political events are modeled by changes in the error of the investment function and in the residual of the autoregressive process for productivity. Having estimated such a model one can remove the changes in order to measure the economic effects of the two political events.

Section 2 specifies the model and the data. Section 3 presents the method of estimation and the parameter estimates. Section 4 reports on the time paths of major variables obtained by simulating the model without the shocks from the two political events and provides measures of economic losses attributable to them. Section 5 concludes.

2. MODEL AND DATA

The econometric model consists of four equations. A Cobb–Douglas production function determines aggregate real output Q by physical capital stock K and labor L with constant return to scale. Denoting Q/L and K/L by q and k respectively and net investment per laborer by i, we can write the production function, the output identity, the capital accumulation equation and the equation explaining labor-augmenting productivity z as follows:

$$q_t = z_t^{\alpha} k_t^{1-\alpha}, \qquad 0 < \alpha < 1; \tag{1}$$

$$q_t = c_t + i_t; \tag{2}$$

$$k_{t+1} = k_t + i_t; \tag{3}$$

$$\ln z_t = \gamma t + \ln \bar{z}_t,$$
$$\ln \bar{z}_{t+1} = \rho \ \ln \bar{z}_t + \varepsilon_{t+1}, \qquad |\rho| < 1. \tag{4}$$

where ε is a random shock to the productivity process. Equation (4) denotes that the logarithm of labor-augmenting productivity z is a trend-stationary AR(1) process. Note that the capital accumulation equation is obtained by dividing the original identity in aggregate variables by labor L in two adjacent periods and is therefore only an approximation.

In contrast with our earlier work in Kwan and Chow (1996) which assumes $\ln z$ to follow a random walk with drift, we assume in equation (4) that $\ln z$ is a deterministic trend plus a random process with a stationary root ρ. Without the unit root in the productivity process the effects of a shock to $\ln z$ are transitory rather than permanent as the effects die down geometrically with time. Thus the estimates given in this paper can serve as lower bounds whereas the estimates in Kwan and Chow (1996) can serve as upper bounds for the effects of the two political movements in China.

The data for aggregate output Q are national income used (*Statistical Yearbook of China* 1994, abbreviated *SYB*, p. 40) divided by the implicit price deflator of national income. The price deflator is the ratio of national income in current prices (*SYB*, p. 33; measured in 100 million yuan) to national income in 1952 prices; the latter equals 589 (national income in 1952 in 100 million yuan) times the index of real national income (*SYB*, p. 34; = 100 in 1952) divided by 100. In Chinese official statistics national income used equals consumption plus accumulation (net investment) in current prices. In our model this identity is assumed to hold in constant prices. We have estimated real national income used Q, real consumption C and real net investment I by dividing their current values (*SYB*, p. 40) by the above price deflator. Labor L is total labor force (*SYB*, p. 88). Given $K = 2213$ (100 million yuan) in 1952 (an estimate from Chow, 1993b, p. 821), we estimate k in 1952 by K/L and k in later years by equation (3).

We assume that the Chinese economy evolves as if there were a central planner who, knowing the parameters of the model as we have specified, tries to maximize the following objective function at the beginning of each period t:

$$E_t \sum_{i=1}^{\infty} \beta^{t+i} \log c_{t+i} \tag{5}$$

subject to the constraints in (1)–(4). This dynamic optimization problem can be solved by defining the control variable as either consumption per laborer c, or investment per laborer i, or even next-period capital stock, as they are related by the identities (2) and (3). This maximization assumption might be questioned. A critic might argue that economic planners in China are not so rational as to have a specific objective function. She or he would say: just look at what happened to rational economic planning during the Great Leap and the Cultural Revolution. Our response is that during these abnormal periods there were exogenous shocks to the production and investment processes in China (caused to a large extent by the behavior of Chairman Mao!) which the economic planners could not control. However, given these shocks the planners still attempted in each period to maximize the above objective function from that period onward.

Among the possible shortcomings of this model are the treatment of technology, population and labor force as exogenous and the failure to incorporate possible effects through effects on human capital formation. Despite these possible shortcomings we believe that the present study is an important step towards measuring the economic effects of the two major political events and can serve as a benchmark for incorporating other important effects in future research.

3. STATISTICAL ESTIMATION

As discussed in the last section, the observed Chinese time series data on output, consumption and capital are interpreted as the outcome of a dynamic optimization process. The solution to the dynamic optimization problem will depend on the parameters $(\alpha, \beta, \gamma, \rho)$ and the process governing the evolution of productivity. When we estimate the parameters by the method of maximum likelihood, we are in fact searching for a set of parameters for which the solution to the dynamic optimization problem and the observed series are as close as possible. A dynamic optimization problem is thus embedded within each evaluation of the likelihood function. More precisely, calculating the likelihood value for a given parameter setting proceeds in two stages. First, an optimal decision function for investment is determined by assuming that the central planner in China maximizes the objective function (5) subject to the constraints of the model (1)–(4) at each period t. Second, the optimal decision function is combined with the original model to form an econometric model for which the likelihood value can be calculated.

The dynamic optimization problem as stated in (1)–(5) can be converted into an equivalent version involving only stationary processes. The idea is to detrend all variables along their balanced growth paths. Define:

$$\bar{k}_t = k_t/e^{\gamma t}, \qquad \bar{c}_t = c_t/e^{\gamma t}, \qquad \bar{z}_t = z_t/e^{\gamma t}. \tag{6}$$

Replacing i by $q - c$ and q by the production function, we can write the capital accumulation equation as

$$k_{t+1} = k_t + z_t^{\alpha} k_t^{1-\alpha} - c_t,$$

or, in terms of the detrended variables defined in (6),

$$\bar{k}_{t+1} e^{\gamma} = \bar{k}_t + \bar{z}_t^{\alpha} \bar{k}_t^{1-\alpha} - \bar{c}_t. \tag{7}$$

Similarly the productivity equation (4) can be written as

$$\ln \bar{z}_{t+1} = \rho \ln \bar{z}_t + \varepsilon_{t+1}, \tag{8}$$

Since z_t is exogenous, we may replace the objective function (5) by

$$E_t \sum_{i=1}^{\infty} \beta^{t+i} \ln \bar{c}_{t+i}. \tag{9}$$

Maximizing (9) subject to (7)–(8) is equivalent to the non-stationary version in (1)–(5). We approach the dynamic optimization problem by first substituting (7) into (9) to eliminate the detrended consumption variable, and then define the control variable to be $\ln \bar{k}_{t+1}$, and two state variables $\ln \bar{z}_t$ and $\ln \bar{k}_t$. With state and control so defined, we obtain numerically an approximate solution in the form of a log-linear first-order difference equation:

$$\ln \bar{k}_t = g + G_1 \ln \bar{z}_{t-1} + G_2 \ln \bar{k}_{t-1}. \tag{10}$$

The coefficients (g, G_1, G_2) may be regarded as reduced form parameters, as they are implicit functions of the three structural parameters (α, β, γ). The solution procedure and numerical algorithm can be found in the appendix.

Having derived the planned capital stock as described by (10), we allow actual capital stock to differ from planned capital by an error e, due partly to failure of the planner to execute the plan and partly to failure of our simple model to capture the complicated economy completely. The econometric model to be estimated consists of two equations, an equation for $\ln \bar{z}_t$ and an equation for $\ln \bar{k}_t$, which can be written as a system of two regression equations:

$$y_t = \Gamma x_t + \xi_t, \tag{11}$$

where $y_t = (\ln \bar{z}_t, \ln \bar{k}_t)'$, $x_t = (1, \ln \bar{z}_{t-1}, \ln \bar{k}_{t-1})'$ and

$$\Gamma = \begin{bmatrix} 0 & \rho & 0 \\ g & G_1 & G_2 \end{bmatrix} \qquad \xi_t = \begin{bmatrix} \varepsilon_t \\ e_t \end{bmatrix}. \tag{12}$$

With n observations, (11) can be stacked up as

$$Y = X\Gamma + \Xi, \tag{13}$$

with the transpose of (11) being the tth row of (13).

The left-hand side of (11) involves the unobserved productivity variable z which can be constructed from the Cobb-Douglas production given data in output and capital. In writing down the likelihood function we have to take into account the Jacobian of transformation from the two residuals to the logarithm of output and capital. It is straightforward to check that (11) implies a Jacobian of $1/\alpha$.

Assuming normal and serially uncorrelated residuals, and ξ_t having covariance matrix Σ, after taking into consideration the Jacobian, we can use the well-known concentrated log-likelihood function (Chow, 1983, pp. 170–171)

$$\ln L = const - (n/2) \ln |\hat{\Sigma}| - n \ln (\alpha), \tag{14}$$

where

$$\hat{\Sigma} = n^{-1}(Y - X\Gamma)'(Y - X\Gamma). \tag{15}$$

To calculate likelihood value for the parameters $(\alpha, \beta, \gamma, \rho)$ we use these parameters and the data on output and capital to compute z from the production function, $\bar{z}_t$ and $\bar{k}_t$ from equation (6), and the coefficients in equation (10). Thus the likelihood function (14) can be computed from the parameters and the data. We maximize the likelihood function by the MAXLIK package in GAUSS. To make sure that we have indeed located the global maximum, we have also used the simulated annealing algorithm as implemented by Goffe et al. (1991) to maximize the likelihood function. The sample period is from 1953 to 1993.

The maximum-likelihood estimates of $(\alpha, \beta, \gamma, \rho)$, with standard errors given in parentheses, are

$$\begin{aligned}(\hat{\alpha}, \hat{\beta}, \hat{\gamma}, \hat{\rho}) &= [0.5252\ (0.0799),\ 0.9573\ (0.0094),\ 0.0189\ (0.0153),\ 0.8552\ (0.0986)]\\ &\text{mean log likelihood} = 5.7699,\ \text{sample size} = 41.\end{aligned} \tag{16}$$

The estimate 0.5252 for labor elasticity of production is reasonable. It is slightly higher than the estimate of about 0.4 reported in Chow (1993b, especially Table VII); but the latter study used a sample period ending in 1980 whereas the current estimate is based on a sample period extending to 1993. The estimate 0.9573 for the annual discount factor is also reasonable in view of the high value that Chinese planners are supposed to place on future consumption or current investment at the expense of current consumption. This parameter is considered difficult to estimate statistically and is often imposed *a priori* in empirical studies of real business cycles in the United States. The positive but statistically insignificant drift of log-productivity is consistent with Chow (1993b) which found no improvement in total factor productivity during the sample period from 1952 to 1980. Unlike Chow (1993b), the present study not only extends the sample period to 1993 but in estimating model parameters does not exclude any observations that are considered abnormal.

4. MEASURING THE EFFECTS OF TWO POLITICAL EVENTS

To estimate the economic effects of the Great Leap Forward alone we change the estimated residuals of the two reduced form equations in the years 1958–62 to the mean values of the corresponding residuals in the remaining years; see figures 1 and 2. Figure 3 depicts actual output per laborer q_t (which

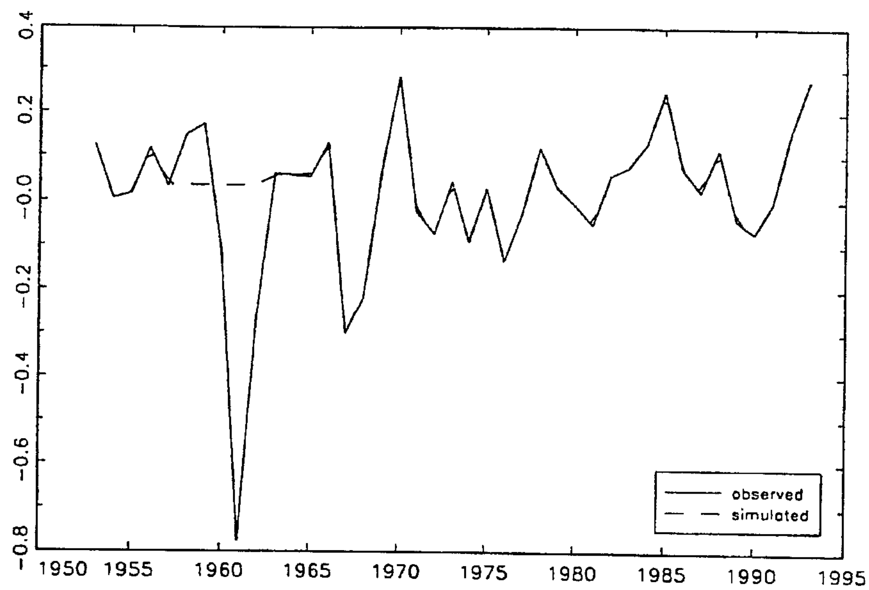

Figure 1. Observed and Simulated Residual 1 (ε_t)

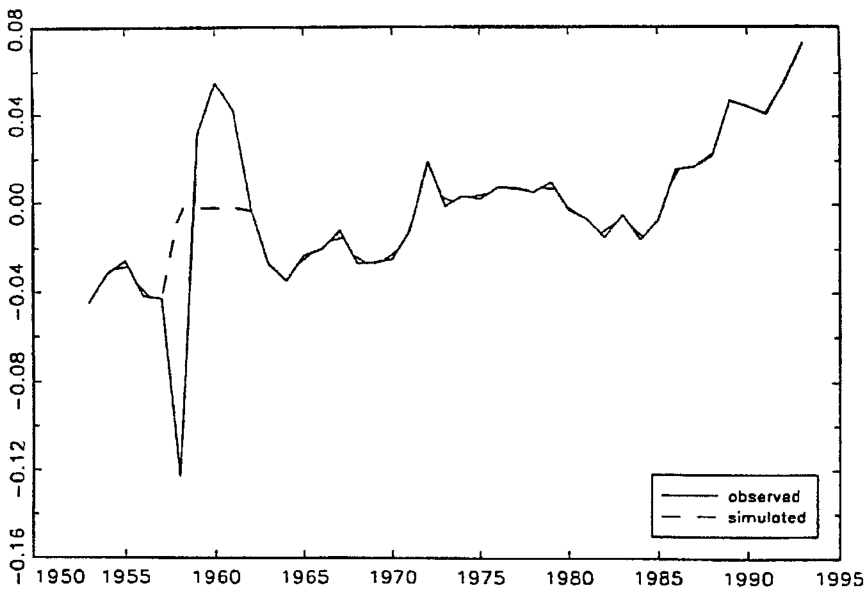

Figure 2. Observed and Simulated Residual 2 (e_t)

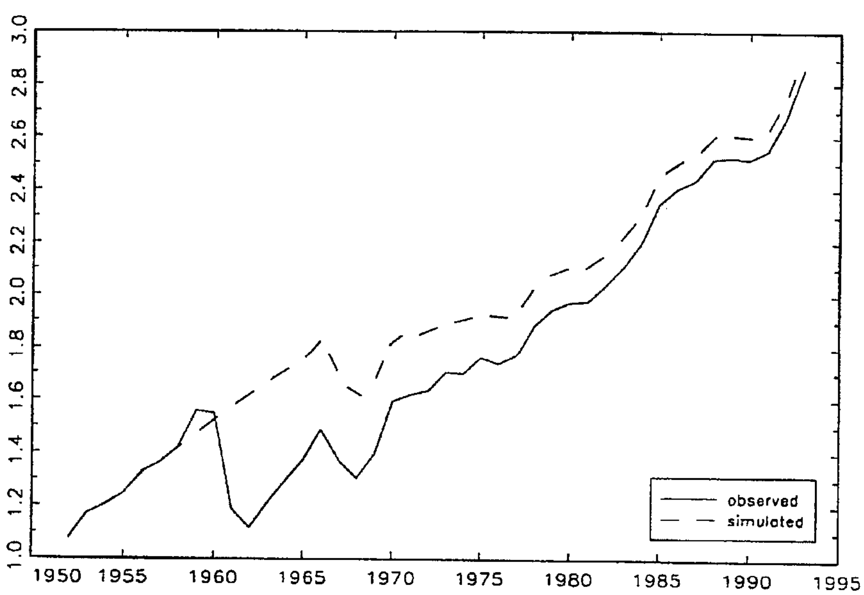

Figure 3. Observed and Simulated Log-output

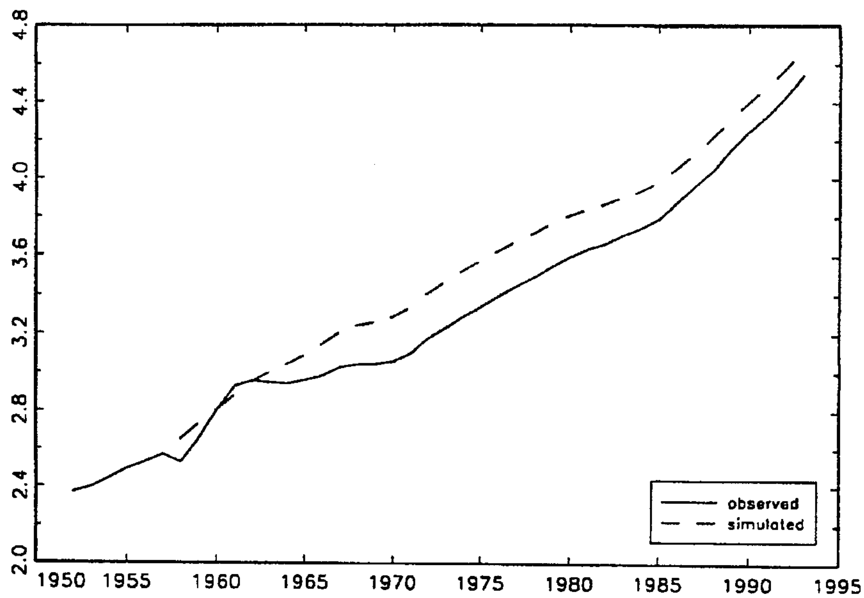

Figure 4. Observed and Simulated Log-capital

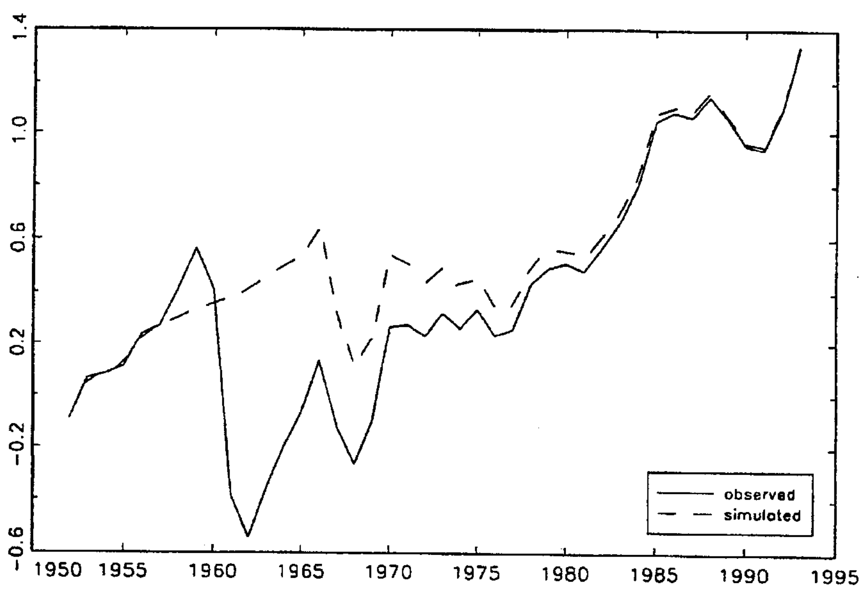

Figure 5. Observed and Simulated Log-productivity

can be generated by our model if the estimated residuals are used in the two equations) and simulated output q_t^* which is generated by our model if the estimated residuals in the years 1958–62 are changed to the mean values of the remaining years. Figures 4 and 5 are the corresponding actual and simulated series for capital stock and log-productivity. To assess the effect of the Cultural Revolution and the combined effect of the two Movements, we have performed similar simulation exercises by removing residuals of the turbulent years.

From figure 3 we observe that the gap between simulated output (which would have obtained absent the Great Leap) and actual output is narrowing towards the end of the sample period. In fact the two series will converge to the same balanced growth path if we continue the simulation many periods beyond 1993. This is a characteristic of our model as equation (4) is a trend-stationary process which implies a *transitory* shift in total factor productivity when its residual changes. The transitory shift in productivity in turn implies that output, consumption and capital will all undergo transitory shifts in level and growth rate. There is however no *permanent* effect on the balanced growth path of each variable.

The trend-stationary formulation therefore captures the presumption that the Chinese economy will eventually recover from the negative impact of political movements modeled as adverse productivity shock. This is in sharp contrast to Kwan and Chow (1996) in which the productivity process is modeled as a random walk with a drift, thus implying that damages inflicted by negative shock are permanent and there is no recovery. The two models represent two polar cases and they together provide an interval estimate. Table 1 and figures 6–8 report the simulated to actual output ratio under the two models with the random walk model labeled by "permanent" and the trend-stationary model labeled by "transitory." Absent the Great Leap Forward Movement alone, China's output up to 1993 would have been on average 18 per cent to 71 per cent higher than otherwise if the movement had never occurred. The corresponding figures for the Cultural Revolution and both Political Movements are 8–12 per cent and 32–112 per cent respectively.

Absent the Cultural Revolution, output in China up to 1993 would have been on average 8–12 per cent higher than the actual figure. This estimate might be considered too small. The possibility of underestimation is mainly due to the omission of the effect on human capital formation in our model. Given that human capital is not considered, and within the confines of our model, the measured effect appears reasonable. The disruption of the Cultural Revolution in the production of physical output in China is recognized to be much smaller than the disruption of the Great Leap. The Cultural Revolution is known for its effect on the production of human capital when many schools and universities were closed or ceased to function properly. The interval estimate of 1.08 to 1.12 can serve as a benchmark for studying the effects of the Cultural Revolution through its effect on the accumulation of human capital.

Table 1. Simulated/Observed output ratios

	Great Leap		Cultural Revolution		Both Movements	
Year	Permanent	Transitory	Permanent	Transitory	Permanent	Transitory
1952	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
1953	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
1954	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
1955	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
1956	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
1957	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
1958	1.0053	0.9983	1.0000	1.0000	1.0117	1.0071
1959	0.9318	0.9173	1.0000	1.0000	0.9437	0.9329
1960	1.0002	0.9747	1.0000	1.0000	1.0196	0.9986
1961	1.5233	1.4674	1.0000	1.0000	1.5630	1.5135
1962	1.7383	1.6530	1.0000	1.0000	1.7954	1.7156
1963	1.7524	1.5772	1.0000	1.0000	1.8107	1.6320
1964	1.7661	1.5135	1.0000	1.0000	1.8254	1.5619
1965	1.7793	1.4596	1.0000	1.0000	1.8397	1.5026
1966	1.7920	1.4136	0.9330	0.9535	1.7572	1.4062
1967	1.8043	1.3742	1.0967	1.1412	2.1145	1.6557
1968	1.8161	1.3402	1.2265	1.2951	2.4207	1.8526
1969	1.8275	1.3106	1.1731	1.2532	2.3698	1.7707
1970	1.8385	1.2847	1.1751	1.2305	2.3909	1.6940
1971	1.8491	1.2621	1.1769	1.2108	2.4112	1.6284
1972	1.8593	1.2420	1.1787	1.1934	2.4309	1.5719
1973	1.8691	1.2243	1.1804	1.1782	2.4498	1.5230
1974	1.8786	1.2085	1.1821	1.1646	2.4682	1.4803
1975	1.8877	1.1943	1.1837	1.1526	2.4858	1.4428
1976	1.8965	1.1816	1.1852	1.1419	2.5029	1.4097
1977	1.9049	1.1701	1.1867	1.1323	2.5193	1.3804
1978	1.9130	1.1596	1.1881	1.1237	2.5351	1.3541
1979	1.9208	1.1501	1.1894	1.1158	2.5504	1.3306
1980	1.9283	1.1414	1.1907	1.1088	2.5651	1.3094
1981	1.9356	1.1335	1.1919	1.1023	2.5793	1.2901
1982	1.9425	1.1262	1.1931	1.0964	2.5929	1.2727
1983	1.9492	1.1194	1.1942	1.0910	2.6061	1.2567
1984	1.9556	1.1131	1.1953	1.0860	2.6187	1.2421
1985	1.9618	1.1073	1.1964	1.0814	2.6309	1.2287
1986	1.9677	1.1019	1.1974	1.0772	2.6426	1.2163
1987	1.9734	1.0969	1.1983	1.0732	2.6539	1.2048
1988	1.9788	1.0922	1.1993	1.0695	2.6647	1.1941
1989	1.9841	1.0877	1.2001	1.0661	2.6752	1.1842
1990	1.9891	1.0836	1.2010	1.0629	2.6852	1.1750
1991	1.9940	1.0797	1.2018	1.0599	2.6948	1.1663
1992	1.9986	1.0760	1.2026	1.0571	2.7041	1.1582
1993	2.0031	1.0725	1.2033	1.0544	2.7130	1.1506
Mean	1.7101	1.1831	1.1225	1.0823	2.1279	1.3272
Std dev	0.3694	0.1740	0.0949	0.0817	0.6367	0.2461
Steady state	2.1074	1.0000	1.2204	1.0000	2.9238	1.0000

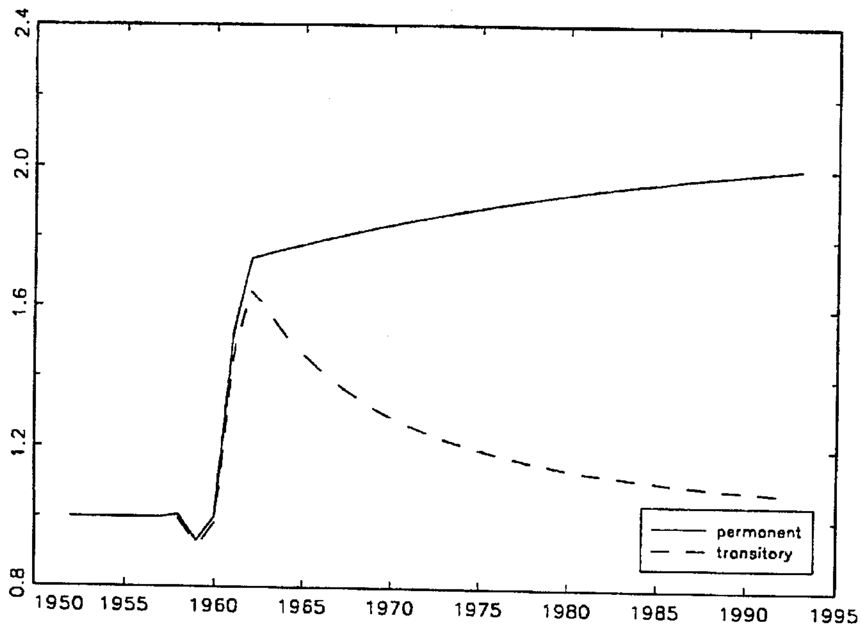

Figure 6. Great Leap Forward Effect on Output

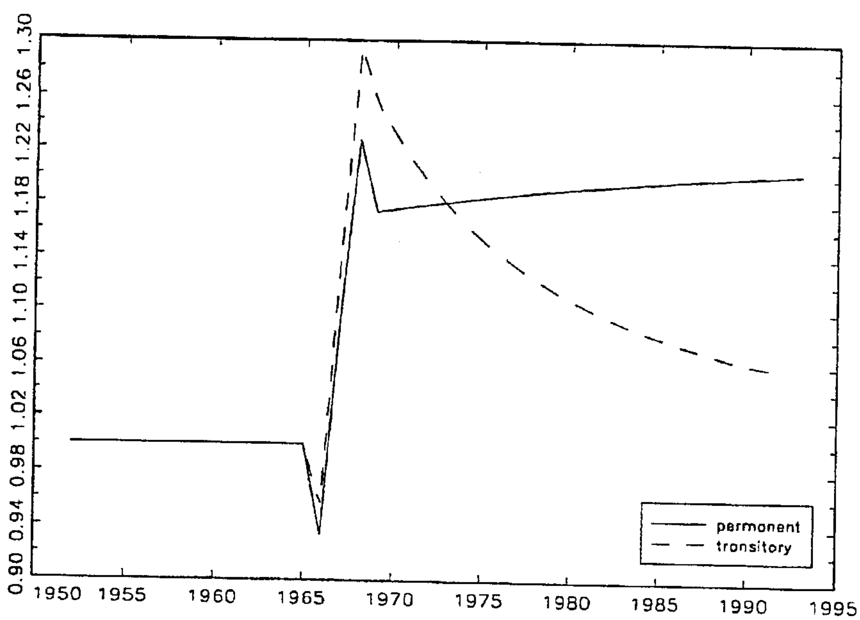

Figure 7. Cultural Revolution Effect on Output

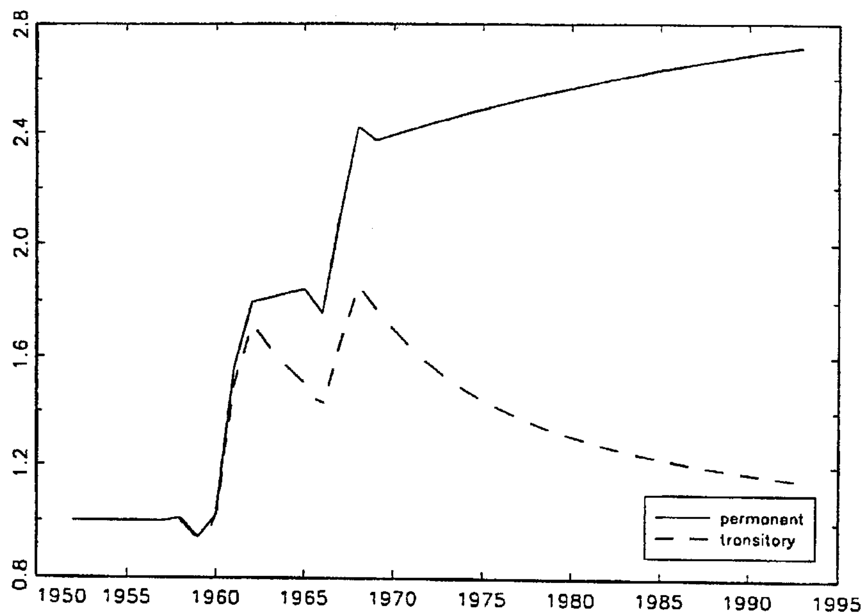

Figure 8. Effect of Both Movements on Output

5. CONCLUSIONS

We have constructed a very simple econometric model to measure the effects of two major political events in China. The model is based on a dynamic optimization framework. It is assumed that an economic planner in China tries to maximize a multiperiod object function in making consumption and investment decisions. The values of the parameters of the optimization model as estimated by maximum likelihood are reasonable. The dynamic optimization framework is useful for studying economic behavior and the effects of political events in China as in other countries.

Concerning the effects of the Great Leap and the Cultural Revolution, the result in this paper together with our earlier work indicate that:

- absent the former, output per laborer up to 1993 would have been on average 1.18–1.71 times as large as the observed;
- absent the latter, output would have been 1.08–1.12 times as large;
- if neither had occurred, output would have been 1.32–2.12 times the actual amounts.

APPENDIX

A standard dynamic optimization problem is to choose a sequence of $q \times 1$ control vectors $\{u_t, t = 0, 1, 2, \ldots\}$ to solve

$$\max E_0 \sum_{t=0}^{\infty} \beta^t r(x_t, u_t) \tag{A1}$$

subject to

$$x_{t+1} = f(x_t, u_t) + \varepsilon_{t+1}. \tag{A2}$$

E_0 is the conditional expectation operator given information at time 0, x_t is a $p \times 1$ vector of state variables, and ε_t is an i.i.d. random vector with mean zero and covariance matrix Σ. Our problem is to solve

$$\max E_0 \sum_{t=0}^{\infty} \beta^t \ln \{\bar{k}_t^{1-\alpha} \bar{z}_t^{\alpha} - \bar{k}_{t+1} e^{\gamma} + \bar{k}_t\} \tag{A3}$$

subject to

$$\ln \bar{z}_{t+1} = \rho \ln \bar{z}_t + \varepsilon_{t+1}. \tag{A4}$$

The problem can be mapped into standard form by defining the states and control as

$$x_t \equiv (x_{1t}, x_{2t})' = (\ln \bar{z}_t, \ln \bar{k}_t)', \; u_t = \ln \bar{k}_{t+1}. \tag{A5}$$

The objective function and the constraint are respectively

$$r(x_t, u_t) = \ln\{\exp((1-\alpha)x_{2t} + \alpha x_{1t}) - \exp(u_t + \gamma) + \exp(x_{2t})\} \tag{A6}$$

and

$$f(x_t, u_t) = Ax_t + Cu_t + b, \tag{A7}$$

where

$$A = \begin{bmatrix} \rho & 0 \\ 0 & 0 \end{bmatrix}, \quad C = \begin{bmatrix} 0 \\ 1 \end{bmatrix}, \quad b = \begin{bmatrix} 0 \\ 0 \end{bmatrix}.$$

The steady state $(\bar{u}, \bar{x})$ can be found by solving a deterministic, time-invariant version of the first-order conditions. For our choice of state and control as in (A5), the steady-state values are

$$\bar{u} = -\frac{1}{\alpha} \ln [\beta^{-1}\exp(\gamma) - 1] + \frac{1}{\alpha} \ln (1-\alpha), \qquad \bar{x}_1 = 0, \qquad \bar{x}_2 = \bar{u}. \tag{A8}$$

Only in exceptional cases would one be able to find an analytical solution for the optimal control function. In most applications one has to rely on numerical approximation. One convenient way to do so has been developed in Chow (1992, 1993a). We now describe briefly the solution procedure. Consider the first-order conditions:

$$r_2(x_t, u_t) + \beta f_2'(x_t, u_t) E_t \lambda_{t+1} = 0, \tag{A9}$$

$$r_1(x_t, u_t) + \beta f_1'(x_t, u_t) E_t \lambda_{t+1} = \lambda_t, \tag{A10}$$

$$x_{t+1} = f(x_t, u_t) + \varepsilon_{t+1}. \tag{A11}$$

The subscripts 1 and 2 of the functions r and f denote derivatives with respect to the first and second arguments respectively. λ is a vector of random

Lagrange multipliers. We proceed by linearizing the nonlinear functions in (A9)–(A11) around the steady-state $(\bar{x}, \bar{u})$:

$$f = Ax + Cu + b; \qquad r_1 = K_{11}x + K_{12}u + k_1; \qquad r_2 = K_{21}x + K_{22}u + k_2. \tag{A12}$$

Given the linear functions above, if λ is assumed to be linear, say equal to $Hx + h$, substituting these functions in the first-order conditions will yield a linear control function

$$u = Gx + g, \tag{A13}$$

where

$$G = -(K_{22} + \beta C'HC)^{-1}(K_{21} + \beta C'HA); \tag{A14}$$

$$g = -(K_{22} + \beta C'HC)^{-1}(k_2 + \beta C'(Hb + h)); \tag{A15}$$

and the coefficient matrices of the Lagrangean function are respectively

$$H = K_{11} + K_{12}G + \beta A'H(A + CG); \tag{A16}$$

$$h = (K_{12} + \beta A'HC)g + k_1 + \beta A'(Hb + h). \tag{A17}$$

Iterating the matrix equation system (A14)–(A17) until convergence gives the required matrices G, g, H and h. We have accelerated such a direct iteration scheme by incorporating a modified version of the doubling algorithm described in Anderson and Moore (1979, p. 159). A detail discussion of the algorithm and numerical examples will be reported elsewhere.

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