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A model of inflation in Taiwan

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ABSTRACT

The model of Chow (1987) for inflation in China is applied to Taiwan. A cointegration relation linear in log price and log ratio of money supply to output is estimated. The change in this log ratio, lagged inflation and the lagged residual of the cointegration relation explain Taiwan's inflation well except during the oil crises of 1973 and 1979–1980.

In this note I explain inflation in Taiwan from 1961 to 2010 using the same model as Chow (1987) and Chow and Wang (2010) for the explanation of inflation in China. The variables are a general price index P, money supply M and real GDP Y as presented in Table 1. P is measured by $P1$, the consumer price index or $P2$, the GDP deflator. M is measured by $M2$ or $M1$.

The first step is to estimate a cointegration relation linear in $\ln P$ and $\ln(M/Y)$. Inflation $\Delta \ln P$ is explained by $\Delta \ln(M/Y)$, $\Delta \ln P(t-1)$ and the lagged residual of the cointegration relation.

Regressing $\ln P1$ on $\ln(M2/Y)$ I obtain

$$\ln P1_t = 4.2697(0.0166) + 0.4918(0.011)\ln(M2_t/Y_t)$$
$$R^2 = 0.9765; \qquad s = 0.10544. \tag{1}$$

Regressing $\ln P1$ on $\ln M2$ and $\ln Y$ separately I find the coefficients to be of opposite sign and about the same order of magnitude, thus confirming the hypothesis that $\ln(M2/Y)$ is an appropriate variable for the cointegration relation. The null hypothesis that the coefficient of $\ln Y$ is the negative of the coefficient of $\ln M2$ cannot be rejected at the 10% level. The result is shown in Eq. (2):

$$\ln P1_t = 7.155(1.593) + 0.6354(0.08)\ln M2_t$$
$$-0.8212(0.1822)\ln Y_t \qquad R^2 = 0.978; \qquad s = 0.10302. \tag{2}$$

We next estimate the error correction equation to explain inflation. As shown in Eq. (3), all coefficients are of the correct sign and statistically significant:

$$\Delta \ln P1_t = -0.0019(0.0141) + 0.343(0.1462)\Delta \ln(M2_t/Y_t)$$
$$+ 0.3148(0.1500)\Delta \ln P1_{t-1} - 0.2029(0.0860)u_{t-1} \tag{3}$$
$$R^2 = 0.2596; \qquad s = 0.0559.$$

However the fit is not good, as seen by the low R^2 and the large standard error of the regression. The corresponding regression for China has an R^2 of 0.72. See Chow (2007, Eq. (7.2), p. 135).

The residuals of Eq. (3) to explain inflation for the years 1973–1974 are 0.011 and 0.264. For the year 1980 the residual is 0.128.

When $M2$ is replaced by $M1$ to explain inflation measured by $P1$, the R^2 is slightly larger but the coefficient of $\Delta \log(M1/Y)$ is not significant. The slight increase in R^2 is associated with a larger partial correlation with u_{t-1}:

$$\Delta \ln P1_t = 0.0215(0.0113) + 0.0122(0.0856)\Delta \ln(M1_t/Y_t)$$
$$+ 0.4246(0.1327)\Delta \ln P1_{t-1} - 0.2467(0.0766)u_{t-1}$$
$$R^2 = 0.2803; \qquad s = 0.0551.$$

I next examine whether inflation as measured by the GDP deflator is more easily explained by performing the same analysis for $P2$, while retaining $M2$ as the measure of money supply. Regressing $\log P2$ on $\log(M2/Y)$ I obtain the following cointegration equation (4):

$$\ln P2_t = 4.336(0.0164) + 0.4823(0.0109)\ln(M2_t/Y_t)$$
$$R^2 = 0.9763; \qquad s = 0.10388. \tag{4}$$

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Table 1
Price index and its determinants.

Year	*P*1	*M*2	*Y*	*P*2	*M*1	*res P*1
1961	15.85	17,350	436,985	16.34	7,699	
1962	16.22	19,965	472,129	16.64	8,086	
1963	16.58	26,119	518,452	17.11	10,355	−0.02882
1964	16.55	33,192	578,462	17.89	13,979	−0.04983
1965	16.53	38,503	641,207	17.83	16,159	−0.02605
1966	16.87	46,541	697,100	18.32	18,147	−0.03023
1967	17.44	57,535	769,666	19.16	23,605	−0.03301
1968	18.81	64,729	838,906	20.48	26,316	0.028705
1969	19.77	77,641	911,591	21.85	30,431	−0.02132
1970	20.48	94,031	1,008,247	22.75	34,985	−0.02468
1971	21.05	120,500	1,133,818	23.51	45,702	−0.04353
1972	21.67	158,217	1,282,919	24.91	61,267	−0.05318
1973	23.45	204,530	1,434,647	28.93	92,155	−0.01141
1974	34.58	254,970	1,461,291	38.07	101,758	0.264318
1975	36.39	325,897	1,540,574	38.79	131,037	−0.10859
1976	37.29	410,477	1,747,790	41.03	163,869	−0.00763
1977	39.92	540,504	1,938,019	43.39	218,861	0.015886
1978	42.22	707,963	2,199,476	45.77	299,867	−0.00355
1979	46.34	772,760	2,375,737	51.16	322,937	0.080002
1980	55.16	939,982	2,549,742	59.61	396,193	0.127942
1981	64.16	1,119,070	2,714,355	66.71	450,513	0.106765
1982	66.05	1,398,336	2,822,229	68.78	516,312	−0.01326
1983	66.95	1,762,328	3,057,050	70.92	611,424	0.008341
1984	66.93	2,110,629	3,341,961	72.24	668,000	0.007666
1985	66.83	2,588,288	3,477,891	72.38	749,504	−0.02335
1986	67.29	3,191,344	3,860,608	76.26	1,134,857	−0.01103
1987	67.64	3,925,486	4,272,887	77.04	1,563,139	−0.02461
1988	68.51	4,722,373	4,510,963	77.33	1,945,181	−0.03456
1989	71.53	5,589,437	4,974,759	80.47	2,062,782	0.003518
1990	74.49	6,201,891	5,316,579	83.33	1,925,647	0.004453
1991	77.18	7,402,961	5,735,769	86.44	2,158,413	−0.01714
1992	80.63	8,813,714	6,169,225	89.71	2,425,843	−0.01034
1993	83	10,170,199	6,584,559	92.79	2,797,140	−0.02087
1994	86.41	11,702,786	7,084,404	94.37	3,139,270	−0.00313
1995	89.58	12,805,365	7,536,283	96.57	3,163,101	0.00392
1996	92.33	13,973,876	7,953,510	99.40	3,426,058	0.002162
1997	93.17	15,094,359	8,389,017	102.21	3,715,252	−0.0111
1998	94.73	16,386,722	8,679,815	106.04	3,854,784	−0.00574
1999	94.9	17,745,013	9,198,098	104.90	4,507,180	−0.01529
2000	96.09	18,897,797	9,731,208	104.69	4,492,072	0.003407
2001	96.08	19,736,946	9,570,584	103.76	5,025,860	−0.029
2002	95.89	20,247,014	10,074,337	103.35	5,491,589	−0.00348
2003	95.62	21,425,529	10,443,993	102.42	6,552,832	−0.01745
2004	97.17	23,001,200	11,090,474	102.48	7,368,000	0.002403
2005	99.41	24,507,974	11,612,093	101.10	7,871,148	0.003079
2006	100	25,798,757	12,243,471	100.00	8,222,626	−0.00647
2007	101.8	26,039,380	12,975,985	99.50	8,219,977	0.028318
2008	105.39	27,863,217	13,070,681	96.55	8,153,704	0.012398
2009	104.47	29,462,914	12,818,935	97.33	10,511,586	−0.04041
2010	105.48	31,036,123	14,213,925	95.71	11,457,126	0.025768

The scatter diagram for this regression as displayed in Fig. 2 also shows that log $P2$ is well explained by log$(M2/Y)$. Compared with Fig. 1, the step in 1974 is somewhat smaller.

The equation to explain inflation is

$$\Delta \ln P2_t = -0.0033(0.0111) + 0.2821(0.1240)\Delta \ln(M2_t/Y_t) + 0.4559(0.1508)\Delta \ln P2_{t-1} - 0.1279(0.0722)u_{t-1} \quad (5)$$

$R^2 = 0.3687; \qquad s = 0.0431.$

All coefficients have the correct sign and are statistically significant. The R^2 of 0.3687 is larger than 0.2596 for Eq. (3) when $P1$ is used. The standard error of the regression is 0.0431 as compared with 0.0559 when $P1$ is used. The residuals of this regression to predict inflation for 1974, 1979 and 1980 are still large, but not as large as for Eq. (3). The residual in 1974 is 0.14 as compared with 0.26 when CPI is used.

The failure of our equation to predict inflation in 1974 and in 1980 is due to the oil crises. Kuo (1999, p. 64) describes the oil crises as follows.

"During 1961–1971, the real GDP grew at an average rate of 10.2%. Prices were stable, increasing at annual average of 1.6% as measured by the wholesale price index, 2.9% as measured by the consumer price index .... This outstanding performance was

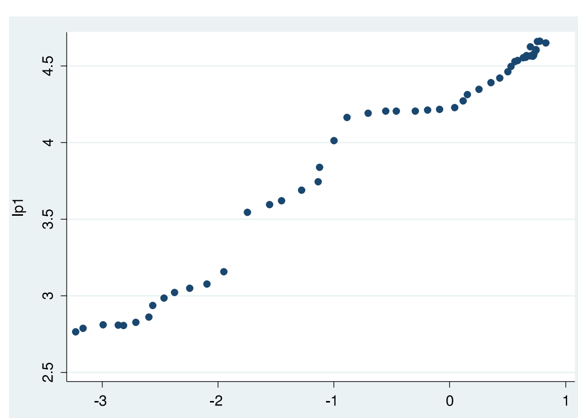

Fig. 1. Relation between ln $P1$ and ln$(M2/Y)$.

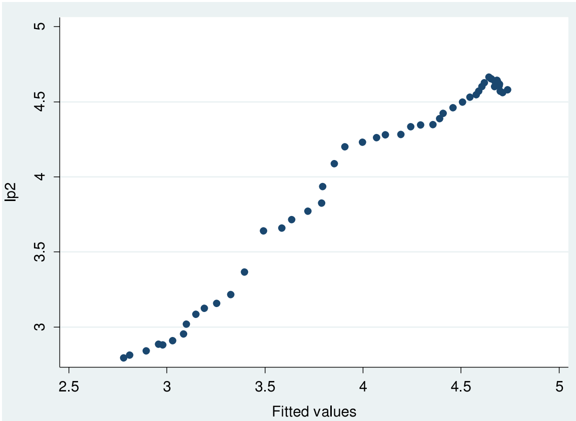

Fig. 2. Relation between $\ln P2$ and $\ln(M2/Y)$.

interrupted by the 1973 oil crisis. The abrupt 22.9% rise in prices in 1973 was a severe shock .... In 1974 the inflation rate jumped to 40.6%, and the growth rate dropped to 1.1%''.

"The rise in oil prices in 1979 and 1980 again shocked the Taiwan economy. Prices rose at annual rates of 13.8% in 1979 and 21.5% in 1980 .... Thus the inflation rate during the second oil shock was about half of the first oil shock''.

These two oil crises can account for the large residuals in our equation to explain inflation during the corresponding years.

Conclusions

First, the model to explain inflation in China as presented in Chow (1987) and updated in Chow and Wang (2010) can also explain inflation in Taiwan from 1961 to 2010. All coefficients are of the correct sign and statistically significant. Second, the goodness of fit for Taiwan is not as good as for China mainly because the model fails to explain the large inflation rates during the oil crises of 1973 and 1979–1980.

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