Money Demand in China Revisited: Some New Empirical Evidence

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1. INTRODUCTION

Over the last decade, the Chinese economy has begun to experience a shift from a system of direct macroeconomic control to a more indirect one. At the same time, rapid growth in currency stocks in circulation has been taking place. The ability of the central bank to forecast the quantity of money that Chinese consumers will demand while maintaining a certain level of national income and an acceptable rate of inflation has become an important issue faced by bank officials and policy makers. Failure in this regard can lead to economic instability and its consequences. Thus, the development of a demand for money equation appropriate for China is of the utmost concern.

Pioneering work along these lines has been undertaken by Chow (1987) and Feltenstein and Farhadian (1987). Chow argued that his evidence indicates that the quantity theory provided a reasonable first approximation for the demand for money in China. Feltenstein and Farhadian theorized that, since Chinese prices were controlled by the central authority and shortages at these prices were commonplace, the appropriate money demand function would have as arguments perceived prices and perceived anticipated inflation, not the comparable magnitudes which were in fact released to the public.1 The purpose of this article is to continue this exploratory work with an updated sample which runs to the end of 1987. A reasonably general demand for money equation is specified which admits approaches implied by previous work as special cases.

Since the intention in this study is to focus on household demand for money, we use the most narrowly defined concept of money possible, namely currency in circulation. The reason is that in China currency in circulation is the only true medium of exchange. Demand deposits are not checkable and in fact can best be considered equivalent to savings deposits in the U.S.2

The remainder of this article is organized as follows. In the second section we
specify a general demand for money function. Estimations are presented in the third section and interpretation is made in light of previous results. The fourth section presents our conclusions.

II. SPECIFICATION OF MONEY DEMAND

An appropriate specification for money demand in China is

$$m_t^d = a + by_t^p + cr_t + p_t^* + d\pi_{t+1}^t$$

where

- $m_t^d$ = log of nominal money demand,
- $y_t^p$ = log of permanent real national income,
- $r_t$ = interest rate on next best alternative asset
- $p_t^*$ = log of perceived price level,
- $\pi_{t+1}^t = E_t(p_{t+1}^*) - p_t^*$ (i.e., anticipated perceived inflation from $t$ to $t+1$).

Conventionally, we should have $b > 0$ and $c,d \leq 0$. Notice that contrary to typical practice for free-market economies, both the interest rate and expected inflation appear independently. The reason is that in China interest rates are mandated and movements in them (which have occurred infrequently) bear little resemblance to changes in reported inflation.

We assume, using a permanent-income approach, that the appropriate scale variable for expected transactions is a log-linear function of current and past values of national income:

$$y_t^p = \alpha + \sum_{i=0}^{u} \alpha_i y_{t-i} \quad i = 0,1,2, \ldots u$$

where $y_t = \log$ of real national income at $t$.

In an economy with controlled prices such as exists in China, the publicly announced price level and that perceived by economic participants are potentially very different magnitudes. The gap between them is a function of aggregate excess demand in goods markets at controlled prices.

It is, of course, the perceived price level and perceived inflation that potentially influence the public’s holdings of nominal money balances, and thus these appear in equation 1. The perceived price level is proxied by a log-linear function of current and past announced prices:

$$p_t^* = \beta + \sum_{i=0}^{v} \beta_i y_{t-i} \quad i = 0,1,2, \ldots v$$

where $p_t$ = announced price level at $t$. The case where the perceived price level is
identical to the announced price level of course implies $\beta_0 = 1$ and $\beta = \beta_i = 0$ for $i = 1,2, \ldots , w$.

As a proxy for anticipated perceived inflation, we use a linear function of current and lagged values of perceived inflation:\footnote

$$\pi_{t+1}^e = \gamma + \sum_{i=0}^{w} \gamma_i \pi_{t-i} \quad i = 0,1,2, \ldots , w$$

where $\pi_t = p_t^* - p_{t-1}^*$.

Substituting equation 3 into equation 4 yields

$$\pi_{t+1}^e = \gamma + \sum_{i=0}^{w} \gamma_i \left[ \sum_{j=0}^{v} \beta_j p_{t-i-j} - \sum_{j=0}^{v} \beta_j p_{t-1-i-j} \right]. \tag{4a}$$

Next, assuming that Chinese desired nominal money demand is always equal to the existing nominal stock and substituting equations 2, 3, and 4a into equation 1 yields a reduced-form money demand equation which can be estimated from observable variables, in particular current and lagged values of national income and the announced price level, and the current level of the interest rate:

$$m_t = a + b\alpha + \beta + d\gamma + b \sum_{i=0}^{u} \alpha_i y_{t-i} + c r_t + \sum_{i=0}^{v} \beta_i p_{t-i}$$

$$+ d \sum_{i=0}^{w} \gamma_i \left[ \sum_{j=0}^{v} \beta_j p_{t-i-j} - \sum_{j=0}^{v} \beta_j p_{t-1-i-j} \right] \tag{5}$$

where $m_t = \log$ of nominal money supply.

Clearly, this is a fairly general demand for money equation. For example, we have left the appropriate lag lengths indeterminate. Given, however, the lack of observations and the associated need to keep the number of lags at a reasonable number, let us consider a parsimonious case. Letting $u = v = w = 1$, equation 5 can be expressed as

$$m_t = a^* + b\alpha_0 y_t + b\alpha_1 y_{t-1} + c r_t + (\beta_0 + d\beta_0 \gamma_0) p_t$$

$$+ (\beta_1 + d\beta_0 \gamma_1 - d\beta_0 \gamma_0 + d\beta_1 \gamma_0) p_{t-1}$$

$$+ (-d\beta_0 \gamma_1 + d\beta_1 \gamma_1 - d\beta_1 \gamma_0) p_{t-2} - d\beta_1 \gamma_1 p_{t-3} \tag{5a}$$

where $a^* = a + b\alpha + \beta + d\gamma$.

Note that all of the relevant structural parameters except for the interest rate elasticity are underidentified. One advantage to this specification, however, is that it allows for ready testing of certain a priori restrictions.
III. ESTIMATION AND INTERPRETATION

Annual data on currency stocks, real income, and the reported price level (General Index of Retail Prices) were taken primarily from the *Statistical Yearbook of China: 1988*. Interest rates were obtained from various issues of *Chinese Finance* (People's Bank of China). Following is the ordinary least-squares estimate of equation 5a for 1952–1987, with absolute t statistics presented below the coefficient estimates:

\[
m_t = -16.1730 + .1896y_t + .8110y_{t-1} + .0628r_t + 2.6367p_t + .5766p_{t-1} - .6349p_{t-2} + .5688p_{t-3}
\]

\[
(12.4210) \.6974 
(2.8935) 
(.7714) 
(3.1119) 
(.4827) 
(.5891) 
(.8461)
\]

\[R^2 = .9900; \quad DW = 1.6276; \quad SEE = .1027.\]

It is clear that government-mandated interest rates play virtually no role in the public's demand for cash balances, as the interest rate coefficient estimate is not only insignificant but also has the wrong sign. Thus, we drop interest rates from our estimation. In addition, since coefficients on lagged prices are, both individually and as a group, insignificantly different from zero, we exclude these as well and reestimate the equation (now with two additional years of data):

\[
m_t = -15.5720 + .3358y_t + .6721y_{t-1} + 3.0434p_t
\]

\[
(17.8400) 
(2.0341) 
(3.8257) 
(14.3960)
\]

\[R^2 = .9906; \quad DW = 1.5603; \quad SEE = .0963.\]

Some interpretation is in order. Notice that current income is now marginally significant at 5%. Unexpectedly, however, lagged income has a higher coefficient than current. The coefficients of current income and lagged income sum to about 1.08. Since we would also expect \(\alpha_0 + \alpha_1\) to be a little more than one (due to income growth), this estimation is perfectly consistent with unitary income elasticity (\(b = 1\)). Compare this to Chow's long-run income elasticity (inherent in his equation 5) of 1.35 and Feltenstein and Farhadian's 1.37.

Our estimation implies that publicly reported prices are not adequate representations of perceived prices. Recall that their equivalence would imply that \(\beta_0 = 1\). Inspection of equation 5a reveals that this implies that the coefficient on current prices should be bounded above by one (since logically \(d \leq 0\) and \(\beta_0, \gamma_0 \geq 0\)). This is clearly rejected in equation 7.

The issue of whether anticipated inflation should properly appear in the money demand function cannot be resolved so readily, but an argument will be made that \(d = 0\) is a reasonable conclusion. Suppose we set equal to zero all coefficients in equation 5a, which as estimated in equation 6 are insignificantly different from zero. First assume \(d \neq 0\). This implies that either \(\beta_1\) or \(\gamma_1\) equals zero (since the coefficient on \(p_{t-3}\) is insignificantly different from zero). The assumption, however, that either \(\beta_1 = 0\) or \(\gamma_1 = 0\) leads to the conclusion that \(\gamma_0 = \gamma_1 = 0\). This clearly is
unpalatable since it signifies that anticipated inflation does not depend on inflation rates from the recent past. Thus, the only satisfactory alternative is that \( d = 0 \).\(^{11}\)

Suppose we impose the latter. In this case, identification of the structural parameters is straightforward. The coefficient on \( p \) is \( \beta_0 \), and that on \( p_{t-1} \) is \( \beta_1 \). The finding that the latter is insignificantly different from zero leads us to a result which is very similar to that concluded by Feltenstein and Farhadian, namely that perceived inflation is merely a constant multiple (here \( \beta_0 \)) of reported inflation, with the only difference being their estimate of the multiple as 2.5 versus ours of 3.0.\(^{12}\)

Fortes and Santorum (1987) rightly criticized this approach. The problem is that atypical episodes, such as relatively open inflation (serving to reduce excess demand in goods markets) or stricter than average price controls in the face of ongoing or even increasing monetary expansion, are not permitted by this constant proportionality factor. Our model can be readily adapted to allow for this possibility. First respecify equation 3 as the following:

\[
p_t^* = \beta + \beta_t + \sum_{i=0}^{\nu} \beta_i p_{t-i} \tag{3a}
\]

where \( \beta_t \) = time-specific mean shift in relationship between perceived price level and reported price level. Next substitute equations 2, 3a, and 4a into equation 1, while setting \( c = d = 0 \) and maintaining the restriction of a maximum of one lag, to yield

\[
m_t = a^* + \beta_t + b\alpha_0 y_t + b\alpha_1 y_{t-1} + \beta_0 p_t + \beta_1 p_{t-1} \tag{5b}
\]

where \( a^* = a + b\alpha + \beta \).

An iterative procedure is used to search for years with nonzero \( \beta_t \). Intercept indicator variables are specified for each year in the sample, and then a series of regressions is run with each indicator variable being included as a regressor in turn. A mean shift is deemed to have taken place in the year corresponding to the highest absolute \( t \) statistic for these indicator variables (provided it is significant at the 1% critical value). With this year maintained, the procedure is redone for all other years in the sample, until no further significant mean shifts are found. Our final estimated equation is\(^{13}\)

\[
m_t = -15.3970 + .2818 y_t + .7246 y_{t-1} + 3.0059 p_t
\]

\[
(25.3510) \quad (2.3421) \quad (5.6878) \quad (20.5000)
\]

\[
+ .2057 D68 + .2614 D69 + .2639 D84
\]

\[
(2.9560) \quad (3.7748) \quad (3.7620)
\]

\[R^2 = .9959; \quad DW = 2.3692; \quad SEE = .0666\]

where \( D68, D69, \) and \( D84 \) are indicator variables set equal to unity for 1968, 1969, and 1984, respectively, and zero otherwise.
Notice that previous conclusions regarding unitary income elasticity and the importance of using perceived rather than publicly reported prices are unchanged by the consideration of mean shifts. The years 1968–1969 and 1984 have been selected on statistical grounds, but they can readily be justified on an a priori basis. The positive indicator coefficients imply that during these years perceived prices were even higher than would have otherwise been expected based on reported prices. The years 1968–1969 witnessed the height of the turmoil of the Cultural Revolution, and shortages in the Chinese consumer market were severe. This was because prices were strictly fixed by the government, while the money supply was steadily growing and the supply of consumer goods declining. As for 1984, this was the first year of the Chinese urban reform program whereby enterprises were permitted to increase wages to an unusual degree. Over the same year, the money supply increased by 26,200 million yuan, which was more than the total increase from 1952 to 1979.

**IV. CONCLUSION**

We have found no evidence that interest rates and anticipated inflation are important explanatory variables in the demand for money function in China. This, coupled with unitary income elasticity, implies the validity of a simple quantity theory approach. What necessitates a departure from simplicity, however, is the demonstrated need to use in the model perceived prices rather than those publicly announced.

The estimation of economic relationships such as money demand is especially important when policy decisions can have an impact on economic development and stability and inappropriate policy can lead to adverse consequences. This is true not only in free-market economies, but also in those with a high degree of central control. This research shows that neoclassical tools can be employed fruitfully in either context.

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**NOTES**

1. Feltenstein and Farhadian spoke in terms of the *true* price level and inflation rate. They defined (on p. 145) the latter as the "rate of inflation which would cause consumers, in the absence of commodity shortages, to hold the same quantity of money as they are observed to hold at the existing official prices and existing shortages." These definitions correspond to our constructs, namely perceived prices and inflation.

2. For more information on the Chinese monetary system, see Zhao (1987). As noted by Chow, the use of aggregate income (which includes spending on producer goods) as an argument in household money demand is justifiable if it is highly correlated with consumer spending.
3. It can be shown that equations 3 and 4 together imply a forecast of the reported price level, namely:

$$E_x(p_{t+1}) = \frac{1}{\beta_0} \left[ \gamma + \sum_{i=0}^{\infty} \theta_i \rho_{t-i} - \sum_{i=0}^{\infty} \delta_i \rho_{t-i} + \beta \rho_{t-w} \right]$$

(1N)

where

$$\delta_i = \beta_{i+1} - \beta_i$$

$$\theta_i = \begin{cases} \beta_0 \gamma_0 & i = 0 \\ \beta_0 \gamma_i + \sum_{j=1}^{i} \gamma_{i-j} (\beta_{i+1-j} - \beta_{i-j}) & i = 1, 2, \ldots, w. \end{cases}$$

4. Real income is from Section 2 (general indexes), currency stocks from Section 12 (banking, finance and insurance) and prices from Section 13 (price indexes). Until 1979, currency stocks were only available in Trade and Prices Material (Statistical Publishing House of China, 1985).

5. The interest rate used in the reported estimate is that on savings deposits. Essentially identical results were found using the time deposit rate.

A correction for first-order serial correlation yielded essentially unchanged results and an insignificant correlation coefficient. Introducing additional lagged income terms (e.g., $u = 3$) renders all income terms insignificant due to multicollinearity.

6. That deposit rates have recently been tied to the rate of inflation may establish a role for this opportunity cost variable in future money demand specifications.

7. The null that all lagged price coefficients were zero yielded an $F(3, 25)$ statistic of 0.271. Again, correction for first-order serial correlation left the results virtually unaltered.

8. If equation 7 is reestimated with lagged income dropped as a regressor, the coefficient on current income is .9491 with a standard error of .0470. Thus, even with this simpler specification, unitary income elasticity cannot be rejected.

9. It is still the case that we can reject the view that reported prices are an accurate representation of perceived prices, when we follow Chow in assuming an adjustment lag. Real balances (deflated by the publicly released General Index of Retail Prices) are regressed on a constant, real income, lagged real balances, and the same publicly released current price level. The coefficient estimate on the latter is significantly different from zero (1.0208 with a $t$ statistic of 2.3678).

10. We also have

$$\beta_1 + d \beta_0 \gamma_1 - d \beta_0 \gamma_0 + d \beta_1 \gamma_0 = 0$$

(2N)

$$-d \beta_0 \gamma_1 - d \beta_1 \gamma_1 - d \beta_1 \gamma_0 = 0.$$  

(3N)

If $\gamma_1 = 0$, then from (3N) $\beta_1 \gamma_0 = 0$, or either $\beta_1 = 0$ or $\gamma_0 = 0$ or both. If the former, then from (2N) we have $\gamma_0 = \gamma_1$. This implies that $\gamma_0 = 0$. Thus, $\gamma_1 = 0$ implies that $\gamma_0 = 0$ as well. It is also true that $\beta_1 = 0$ implies $\gamma_0 = \gamma_1 = 0$. From (2N) we must have $\gamma_0 = \gamma_1$, and from (3N) we must have $\gamma_1 = 0$ (recalling that our estimation rejected that $\beta_0 = 0$).

11. This is contrary to Feltenstein and Farhadian’s finding that the anticipated inflation coefficient is negative ($-4.02$). It should be pointed out, though, that their definition of money (M2) differed from ours.

12. Our factor is certainly credible. From 1953 to 1987, compounded average annual monetary growth was 11.2%, real income grew at 6.5%, and reported inflation averaged 1.6%. Tripling the latter would imply roughly constant velocity over the sample.

13. The search was done both with and without $\rho_{t-1}$, without any difference in the results. Since
this variable was always insignificant, only results without lagged prices are presented. A Chow test investigating coefficient stability over the sample was conducted with the hypothesized break at 1979 (when the economic reforms began). The $F(4,27)$ test statistic of 1.53 was smaller than a reasonable critical value.

14. Reported prices indicate deflation over these two years.
15. For more information on these episodes, see Xue (1986) and Ma (1987).

REFERENCES


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