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MONEY AND THE CONSUMPTION GOODS MARKET IN CHINA

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ABSTRACT

This paper studies the relations between money and other macroeconomic variables as well as excess demand in the consumption goods market for the case of China, 1954-83. We explicitly recognise the endogeneity of money in the CPE and do not impose (but instead test) some common restrictive assumptions; we assess the extent of aggregate excess demand (supply) in a macroeconomic disequilibrium model; and we allow at the macro level for the possible coexistence of micro markets in different states of excess demand or supply (shortages or slacks). We find bidirectional causality between money and income; that M_0 behaves in a manner more suited to building simple, conventional models than does M_2; and that there has been a mixed pattern of excess supplies and demands over the three decades.

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MONEY AND THE CONSUMPTION GOODS MARKET IN CHINA

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1. Introduction

As Chow (1985a) and Peebles (1983) have stressed, basic monetary and macroeconomic data for China are now available for a sufficiently long period to permit serious quantitative analysis. Pioneering work of this kind is already appearing, taking into account some of the special characteristics of the Chinese economy (Chow, 1985b; Feltenstein and Farhidian, 1986; Feltenstein et al., 1986).

It is not surprising that this work has to deal with questions of macroeconomic disequilibrium familiar from the recent literature on East European centrally planned economies (CPEs). We report here some preliminary results on money and the consumption goods market in a framework with several distinctive characteristics: we explicitly recognize the endogeneity of money in the CPE and do not impose some common restrictive assumptions, we assess the extent of aggregate excess demand (supply) in a macroeconomic disequilibrium model, and we allow at the macro level for the possible coexistence of micro markets in different states of excess demand or supply (shortages and slacks).

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We emphasize that this is an initial, exploratory effort. The work on money and on the consumption goods market is not yet fully integrated. Nor have we yet been able to deploy the full array of available tests for the specifications we have tried. Nevertheless, we find the results suggestive and promising, and we believe they raise questions which should be addressed by further work.

2. The demand for money

Disequilibrium macroeconomics typically assumes both that the money stock is exogenous and the demand for money is purely an asset demand, unaffected by transaction requirements. These assumptions seem to hold particularly well for CPEs. In the absence of a bond market, money balances at the end of the period may be identified with forced saving.

Kornai (1982) goes much further and does not even consider money in his model because, he argues, it is not a budget constraint for firms, while for households only real income and real consumption matter. According to Kornai, "a semi-monetized economy in which prices and money do not genuinely influence the macrovariables of production, investment and employment cannot properly be described in terms of its money being stable or inflated, or price increases being repressed or permitted".

We disagree with this statement, and we shall also query the exogeneity of the money stock in both its narrower and broader definition. Price and interest rate shocks as well as changes in expectations about future constraints on the consumption and labour markets might affect the demand for money. On the other hand money holdings might affect future consumer decisions. An unstable demand for money could cause problems for the planners (see Portes, 1983).

The definition of money in a planned economy is still a controversial issue. Since cash is used only for retail sales, wages and state purchases of agricultural products, we identify two monetary circuits: one where cash plays the role of means of exchange and another, restricted to government and production units, where every payment is made by bank transfer. Enterprises and production units in general can keep just a limited amount of cash for unpredictable transactions.

The literature stresses the cash circuit, generally looking for inflationary pressures on the consumption market. Currency is held by households and, in limited amount, by agricultural production units and enterprises.

Households can save income in only two forms of assets: cash and saving deposits; there is no bond market. It is worth noting that in China in 1977 (before the economic reform), currency was 50% of the money stock (defined as M_2, currency plus saving deposits). Only after 1979 did saving deposits increase considerably, reaching 60% of the money stock by 1982. About 82% of the money stock was held by households (Naughton, 1986) and the remaining by agricultural units and enterprises: this percentage has remained very stable over time.

As in other CPEs, before 1984, China had a monobank system: the People's Bank (PB) functioned both as central bank and as commercial bank and firmly controlled all the other banks. The Agricultural Bank (AB) and the Construction Bank had to keep at the central bank some reserves in proportion to their deposits, but apparently the proportion was not fixed, nor did the authorities admit to using them as reserve requirement. There was and still is no discounting operation; therefore the central bank has virtually no means of controlling the money stock, except by changes in the interest rate on savings deposits in order to reduce the currency in circulation.

Currency is put in circulation by the central bank through other banks, state enterprises (directly) and government units, and it is withdrawn through the same institutions. 80% of the currency outflow is due to wage payments (42%) and state procurement of agricultural products (32%). On the other hand, retail sales account for 70% of the cash inflow (People's Bank of China, 1983).

In this kind of financial system, the mechanistic multiplier approach does not work properly; even if banks keep cash as reserve asset and we think of households having a fixed desired ratio in which they hold currency and bank deposits, the multiplier effect is limited to that part of bank loans which are cash loans.

The central bank determines the money stock on the basis of the credit plan used jointly with the cash plan (see Bortolani and Santorum, 1984). The balance of the People's Bank is something like the following:

People's Bank balance sheet

ASSETS	LIABILITIES
Loans to enterprises	Enterprises' deposits
Loans to government	Government deposits
Loans to non-state sector (private and agric. units)	Saving deposits
Reserves (gold and foreign exchange)	Currency
	Other banks reserves
	Agricultural bank reserves

Cash loans only produce changes in currency. The People's Bank cannot control total credit directly, since it is primarily determined by the economic plan and the government budget. Let us ignore for the moment loans to the non-state sector and the AB reserves, and as a further simplification assume fixed bank reserves.

Under a flow of fund analysis, changes in the money stock result as follows :

$$\Delta CU = (\Delta L_E + \Delta L_G) - (\Delta D_E + \Delta D_G) - \Delta SD$$

$$\Delta CU = \underbrace{(\Delta L_E - \Delta D_E)}_{\text{SEBR}} + \underbrace{(\Delta L_G - \Delta D_G)}_{\text{PSBR}} - \Delta SD$$

where:

CU = currency; L = loans and D = deposits; subscripts E and G are respectively for enterprises and government units; SD = saving deposits;

SEBR = State enterprises' net borrowing requirement; PSBR = public sector net borrowing requirement.

Thus

$$SEBR + PSBR > \Delta SD \quad \rightarrow \quad \Delta CU > 0$$

Both SEBR and PSBR are determined by the economic plan. The central bank has no power over them; it can just ensure that the borrowing requirement does not exceed the plan targets.

Only cash loans will produce changes in the money stock, since any other kind of loan is counterbalanced by a corresponding change in enterprise or government deposits. Cash loans are mainly for wage payments and purchases of agricultural products. They depend on the plan, the enterprises' economic performance (since bonuses have been introduced) and the unpredictable agricultural production. Interest rates on these loans did not have any incentive effects on enterprises or government units until perhaps 1985, when production units' performance became important and interest on loans finally became greater than the corresponding interest rate on deposits.

Now consider the complete balance sheet. The rural sector is very important: we can reasonably suppose that nearly half of the currency in circulation is in rural areas, where production units keep cash for payments to members of the brigade and purchases of various inputs, and peasants are paid just once or twice a year (even if only part of their income is in cash).

Unfortunately, the process of money creation in rural areas is not clear. The rural credit cooperatives (RCC) contributed in recent years to a very large savings deposit increase, lending on the other hand less than one-third of the money they collected. The RCC deposit nearly all the collected savings (e.g. 70% in 1982) at the AB. The AB, in its turn, deposits at the PB a high ratio of its total deposits. This reserve is what in the balance sheet published by the PB is called "rural areas deposits". How it is determined (a fixed ratio? of which items?) is virtually unknown.

Loans to the non-state sector should counter-balance savings deposits, giving a measure of the non-state sector net borrowing requirement (NSBR). Loans to the private sector are particularly important (both in size and effects) since the introduction of the responsibility system in agriculture and the growth of the free market. Since 1979-80 people need and hold cash as working capital. Therefore the flow of funds identity should be read as:

$$\Delta CU = SEBR + PSBR + NSBR$$

where $NSBR = \Delta L_{NS} - \Delta SD$; here SD includes AB deposits at the PB. Thus

$$\Delta CU > 0 \quad \text{when} \quad SEBR + PSBR > - NSBR.$$

The substance is unchanged, but in this perspective, since NSBR is a variable particularly difficult to control, both total credit control and interest-rate policy acquire great importance when the central bank has an M_0 target. This is one reason why the question of exogeneity of M_0 (or M_2) is itself so important.

Before starting any experiment in general model building for the demand for money in China, we conducted two different investigations: first we looked for causality relationships among such key variables as the money stock (both in its narrower, M_0, and broader, M_2, definitions), disposable income and prices; second, we have estimated a well-specified equation for the money stock and tested the restrictions of price homogeneity, income homogeneity, nominal and real adjustment. The choice of the data series, so relevant for the construction of the statistical model, is explained in the Data Appendix.

We stress that we have had to use annual data, which preclude any short-run investigation. The sample used is 1954-83 (30 observations); in evaluating the reported diagnostics, some attention should be paid to the limited number of degrees of freedom available.

For the purpose of investigating causality and lag ordering among the main variables we have carried out Granger causality tests (Granger 1969) and the Cooley-Leroy test (Cooley-Leroy 1985). In Table 1 and 2, we report the results for money and real income interrelations; they are from the only well-defined model we were able to build. The tests we use are properly valid only in the context of a statistical model that has passed appropriate tests of its underlying assumptions (see Spanos, 1986), and we were unable to arrive at such a model for the relation between money and money income.

Using <u>nominal</u> income as a regressor we encountered autocorrelation and misspecification, while the price series is strongly non-stationary, which fundamentally affects the results of the Granger test. Regressing money on prices, however, we did get a relatively well-defined model, for which the results suggest that prices do not cause money (in both its definitions).

Considering Tables 1 and 2, we see that for M_2, both the Granger test and the Cooley-Leroy test are conclusive: M_2 causes real income and real income causes M_2, revealing as expected a bidirectional causality among the two variables.

There are some doubts, however, about the results relative to M_0: even if a certain degree of independence with respect to real income appears in the Granger test and predeterminedness (but not strict exogeneity in the Cooley-Leroy sense) is revealed, the income coefficients in equation (1) in Table 1 are quite big in their face value and seem to pick up a sort of cycle (as might reflect a control or adjustment rule), while in equation (5), Table 2, the assumption of normality is very close to being rejected.

We stress that these tests are not proper exogeneity tests; exogeneity can be tested only inside a well-defined simultaneous model, involving the specification of equations for each variable, and referring just to that particular model and the data series used (see e.g. Engle, Hendry and Richard, 1983). Nevertheless, our results do cast substantial doubt on whether either M_0 or M_2 (especially the latter) could reasonably be viewed as exogenous.

As a second step, we carried out a less informal test of the hypotheses of income homogeneity, price homogeneity, nominal adjustment and real adjustment, using a quite general specification of the money stock equation, in the form proposed by Hwang Hae-Shin (1985).

According to Hwang, we can estimate the equation

(1) $m_t = \beta_0 + \beta_1 m_{t-1} + \beta_2(P_t - P_{t-1}) + \beta_3 y_t + \beta_4 P_t + \beta_5 R_t$

where all variables are in logs, and m is the real money stock, P is the retail sales price index, y is the real disposable income and R is the nominal interest rate on one year saving deposits. We can then test the following linear restrictions upon the β_is :

H_1: nominal adjustment $\beta_1 + \beta_2 = 0$

H_2: real adjustment $\beta_2 = 0$

H_3: linear homogeneity in P $\beta_4 = 0$

H_4: linear homogeneity in y $\beta_1 + \beta_3 = 1$

As a way to avoid the possibility that the lag coefficients were significant just because of the distinct temporal structure exhibited by both M_0 and M_2, we have estimated first

(2) $m_t = \beta_0 + \beta_1 m_{t-1} + \beta_2 y_t + \beta_3 y_{t-1} + \beta_4 P_t + \beta_5 P_{t-1} + \beta_6 R_t + \beta_7 R_{t-1}$

then testing whether $\beta_3 = \beta_7 = 0$ (H_0) for M_0 and $\beta_3 = \beta_6 = 0$ (H_1) for M_2. H_0 is not rejected for M_0, while H_1 is rejected for M_2: in particular β_3 is different from zero.

According to the results in Table 3, we cannot reject the hypotheses of income homogeneity and price homogeneity with respect to M_0. For M_2, however, since we reject H_0: $\beta_3=0$, all four hypotheses are rejected against the more general model (2). Again, M_0 behaves in a manner more suitable to building simple, conventional models than does M_2. It is worth noting that we could not reject the hypotheses of real adjustment and price homogeneity conditional on $\beta_3=0$. This is a clear warning about imposing unwarranted restrictions on the lag structure of the variables, since we could end up with biased homogeneity tests and, in general, with models that are essentially not well defined.

The information collected from the tests above should then be used for the construction of a more general model, with the main purpose of questioning the degree of exogeneity of M_0 with respect to other major variables and the possibility of using M_0 as an instrument of economic policy.

A broader model should also take into account the disequilibria on the consumption goods market. In particular, when we estimate M_2, since households do not have any alternative investment to money balances and saving deposits, we are actually estimating a saving function, in a logarithmic form and under the implicit constraint

$$y_t = c_t + s_t$$

which implies equilibrium on the consumption market and no forced saving. As we discover in Section 4, this should eventually be removed when dealing with a planned economy, without going to the other extreme by imposing the equally unwarranted constraint of continuous excess demand.

3. Virtual Prices

Our discussion of money in Section 2 did not explicitly model the possibility that with centrally controlled prices, the goods market might be in excess demand or excess supply at the aggregate level or in individual micro markets, and that the specification of money demand functions should be modified accordingly. Similarly, Chow (1985b) estimates a permanent income hypothesis without allowing for disequilibria of this kind. Feltenstein and Farhidian (1986 - hereafter F-F) and Feltenstein, Lebow and van Wijnbergen (1986 - hereafter F-L-W) have sought to relax this assumption, the former in estimating the supply of and demand for money in China, the latter in estimating savings functions for the Chinese household sector.

F-F specify money supply and money demand equations and estimate them separately. In the latter, they suppose that prices are fixed exogenously and that if there are resulting aggregate-level disequilibria, there exists a 'virtual price level' which would cause consumers to hold voluntarily the amount of money they do actually hold given current official prices and possible shortages/surpluses.

Their chosen specification of this relationship is simply that the virtual price index stands in constant loglinear relation to the official price index, so the inflation rate of the former is a constant multiple of the official inflation rate. In the course of estimating the modified demand for money function (adjusted for the virtual price level), this constant multiple is estimated by scanning over a grid of values to find that which maximizes the equation likelihood function. The result, on data from 1955-81, was that the virtual rate of inflation was 2.5 times that of the official rate of inflation (the associated estimate of the true income elasticity of demand for real balances was 1.37).

The virtual price inflation rates so calculated are shown as FPI in our Table 4 below, together with other indices of market tension - we shall discuss these jointly. Here we make only two points. First, whereas the F-F model includes a money supply equation in which wages and agricultural procurement payments (along with government deficits) determine the money supply - just as they form almost all of the income variable in the money demand equation - the equations are estimated separately, and results and simulations are discussed as if the government set the money supply exogenously. Second, the F-F specification, though perhaps necessarily crude, has the objectionable feature that it never permits that open inflation might eliminate excess demand. On the contrary, open inflation is in effect automatically magnified to show even more simultaneous repressed inflation.

This objection applies to the related work of F-L-W. They test various savings functions using a similar virtual price index to deflate nominal savings, then to include a real interest rate. The construction of the virtual price index is here backed by a theoretical derivation from an intertemporal model with goods rationing. The index derived relates the ratio of the virtual and actual price levels inversely to the velocity of money. Different estimates give different values for the elasticity, and we have chosen that from the equation which appears to give the best results on statistical criteria. The corresponding annual inflation rates are shown in Table 4 as WPI. The use of this index related to velocity as an indicator of tensions on the consumption goods market provides an appropriate transition to the final section of this paper.

4. The Consumption Goods Market

The theory and measurement of macroeconomic disequilibrium in CPEs, with primary attention to the consumption goods market, are surveyed in Portes (1986). Our own approach, applied to the East European economies, is set out in several papers cited individually in the References below. Despite the caution of Peebles (1983), we thought it worthwhile using similar techniques on the Chinese data now available, simply to see whether one could establish empirical regularities and obtain results not obviously inconsistent with prior information.

Portes and Winter (1980 - hereafter P-W) estimated a 'canonical' disequilibrium model (Quandt, 1982), without a price or plan adjustment equation, for the consumption goods markets of four East European CPEs. There are equations representing the aggregate demand for and supply of consumption goods as well as the 'minimum condition' requiring that actual consumption equal the minimum of supply and demand. The demand function was a simple transformation of the Houthakker-Taylor savings function; the supply function was a somewhat ad hoc representation of planners' behaviour, justified from the CPE literature. The three equations are estimated jointly using maximum likelihood methods. The particular specifications are discussed extensively in P-W and other references cited, and we shall simply state them below, without wishing to defend them with excessive vigour. Note that although plan variables play an important role in our analysis, we do not have independent data on plans in China, like those used by Portes et al. (1987) for Poland, so we cannot add a plan adjustment equation like theirs, and we must use a constructed series for plan variables as in the original P-W paper.

Following criticism by Kornai (1980, 1982) of any such aggregative macroeconometric work on CPEs, in which both 'shortages and slacks' (excess demands and supplies) might coexist at the micro level, Burkett (1986) sought to implement Kornai's implied research proposal. P-W had themselves anticipated the criticism with a heuristic 'smoothing by aggregation' argument, but Burkett rightly recognized that this had to be tested empirically against Kornai's assertion. He developed an ingenious method to take account of simultaneous micro-level excess demands and supplies while using aggregate data, rather than going to the explicit submarkets model, as we may do in future work (Martin, 1986). Burkett applied his method to the

East European countries studied by Portes and associates, using the same specification of demand and supply function for consumption goods. The model arrives at a simple equation with an additive error term:

(7) $C = (1/2)(\alpha x + \beta y) - (1/2)[(\alpha x - \beta y)^2\ 4\gamma^2(\alpha x)(\beta y)]^{1/2} + u$

where for our purposes here we may write

(8) $CD = \alpha x = a_1 S1 + \alpha_2 DYD + \alpha_3 YD1$

(9) $CS = \beta y = \beta_1 CT + B_2 CYX + \beta_3 RNFA + \beta_4 IFX$

The variables are defined as follows:

C = observed consumption

CD = household desired expenditure on consumption goods and services in the current period

CS = supply of consumption goods and services in the current period

S1 = household saving in the previous period

DYD = change in disposable income, previous to current period

YD1 = disposable income in the previous period

CT = fitted second-order exponential time trend in C

CYX = (CT/NMPT)(NMP-NMPT)

NMPT = fitted second-order exponential time trend in national income

RNFA = deviation of household net financial assets from second-order exponential time trend

IFX = (IT/NMPT)(NMP-NMPT)

IT = fitted second-order exponential time trend in investment

Burkett estimates the single equation (7), with the minor modification that his representation of βy = CS omits the fourth term. In Burkett's model, it can be shown that a test of the hypothesis that $\gamma = 0$ is a test of the aggregative discrete switching model used by P-W, which can be written

(10) $CD = \alpha x + u_1$ (11) $CS = \beta y + u_2$ (12) $C = \min(CD, CS)$

We have estimated both the P-W and the Burkett models for China over the period 1954-1983. The results are shown in Tables 4 and 5. They appear to be remarkably good. All estimated coefficients satisfy the a priori sign restrictions (and lie in prescribed intervals, where required), and they are quite well determined. In each case, we report estimates with and without the constraint $\beta_1 = 1$; this was imposed by Portes et al. (1987) but not by Burkett. We also report estimates with the constraint $\alpha_3 = 1$, imposed by Burkett but not by Portes et al.; and with both coefficients constrained. On the whole, likelihood ratio tests reject the restriction $\beta_1 = 1$ and accept $\alpha_3 = 1$; but some other features of the constrained estimates are preferable. The implied household and planners' behaviour is reasonable and very similar to that shown in the earlier work on Eastern Europe. Moreover, in the Burkett test of P-W, the estimated γ is tiny and insignificantly different from zero, so that we can accept the P-W discrete switching model. Its coefficient estimates are in fact quite close to those found with the Burkett technique.

So much for the technical background. The economically interesting output is in Table 6. Here we find comparisons of various indicators of tension on the consumption goods market: the official rate of inflation PI, the F-F virtual price rate of inflation FPI, the F-L-W virtual price rate of inflation WPI, Burkett's index of relative shortage BSH, and the P-W index of percentage excess demand PWXD. We have added for comparison the index of percentage shortage calculated by Naughton (1986), using quite different methods and data.

Recall that Burkett's index BSH measures the shortage only, without netting out slack, and is therefore non-negative by definition. In that light, the only apparent inconsistencies between BSH and the P-W index of excess demand appear in 1963 and possibly 1965-6 and 1972-3; in 1963, the P-W estimates show excess supply and the Burkett index shows shortage, while in the other periods, P-W show excess demand and Burkett shows no shortages.

Lest it be thought that P-W or Burkett tend systematically to underestimate excess demand, note that Naughton shows much more excess supply than either.

Thus the picture these measures give is fairly consistent. It suggests excess demand in 1956-58, 1960, 1964, 1967, 1971, 1976, and 1980-83. There is a clear relation with the Great Leap Forward, the Cultural Revolution, the stormy year of Mao's death, and the economic reforms. The price indices are much more erratic. One must conjecture that in years like 1961-62, for example, the open inflation was sufficient to eliminate excess demand within the period. Conversely, in 1964 deflation may have created excess demand. In any case, <u>none</u> of these indices suggests that excess demand dominated the entire period - and <u>all</u> suggest significant excess demand under the recent reforms.

Table 1: Granger causality test, sample 1958-83.

$$X_t = \alpha_0 + \sum_{i=1}^{\lambda} \alpha_i X_{t-1} + \sum_{j=1}^{\lambda} \beta_j Z_{t-1} \qquad Z \rightarrow X \text{ if } \beta_j \neq 0 \qquad \lambda = 4$$

	(1) M_0	(2) M_2	(3) y on M_0	(4) y on M_2
α_0	-1.19	0.81	0.11	0.05
	(.58)	(.46)	(.20)	(.23)
α_1	0.94	0.91	1.35	1.50
	(.20)	(.25)	(.19)	(.22)
α_2	-0.10	0.68	-0.45	-0.56
	(.31)	(.37)	(.31)	(.36)
α_3	-0.42	-0.86	0.06	-0.06
	(.36)	(.39)	(.26)	(.33)
α_4	0.21	0.08	-0.02	0.07
	(.23)	(.26)	(.16)	(.19)
β_1	0.76	1.74	-0.27	-0.30
	(.58)	(.45)	(.07)	(.12)
β_2	-0.65	-1.74	0.46	0.58
	(.93)	(.74)	(.10)	(.18)
β_3	0.57	-0.05	-0.28	-0.46
	(.77)	(.67)	(.12)	(.19)
β_4	-0.18	0.37	0.19	0.25
	(.48)	(.39)	(.08)	(.12)
R^2	0.964	0.986	0.993	0.992
s	0.105	0.080	0.035	0.039
BJ	0.42	0.64	1.74	0.31
LM 1	1.37	0.39	0.15	0.01
LM 2	0.93	2.09	1.08	2.20
ξ^2	2.99	1.73	0.81	0.88
ξ^3	0.18	0.30	1.22	0.30
F-test H_1: $\beta_j=0$	2.81	4.55	9.98	7.10

Note: OLS has been used for estimation. BJ is the Bera-Jaques normality test; LM 1 and LM 2 are Lagrange multiplier tests against first-order and second-order autocorrelation; ξ^2 is a linearity test distributed F(2,n-k) and obtained regressing the residuals on fitted values:

$$\hat{u} = \lambda_0 + \lambda_1 \hat{y} + \lambda_2 \hat{y}^2 + \lambda_3 \hat{y}^3$$

ξ^3 is a homoskedasticity test, distributed F(3,n-k), obtained regressing $\hat{u}^2 = \lambda_0 + \lambda_1 \hat{y} + \lambda_2 \hat{y}^2 + \lambda_3 \hat{y}^3$. Restrictions are tested using the F-test. Standard errors in brackets. T =26

Table 2: Cooley-Leroy test, sample 1958-83.

$$X_t = \alpha_0 + \sum_{i=1}^{\lambda} \alpha_i X_{t-1} + \theta Z_t + \sum_{j=1}^{\lambda} \beta_j Z_{t-j} \qquad \lambda=4$$

X_t is predetermined if $\theta=0$

X_t is strictly exogenous (in the C-L sense) if $\theta=0$ & $\beta_j=0$

	(5) M_0	(6) M_2	(7) y on M_0	(8) y on M_2
α_0	-1.32 (.56)	-0.87 (.37)	0.28 (.20)	0.29 (.20)
α_1	1.24 (.27)	1.29 (.24)	1.24 (.19)	0.97 (.25)
α_2	0.61 (.43)	-0.06 (.38)	-0.42 (.30)	-0.03 (.34)
α_3	-0.11 (.40)	-0.28 (.37)	0.11 (.26)	-0.04 (.27)
α_4	0.01 (.25)	-0.23 (.23)	-0.07 (.15)	-0.04 (.16)
θ	1.12 (.69)	1.26 (.41)	0.17 (.07)	0.30 (.10)
β_1	-0.75 (1.09)	0.15 (.71)	-0.44 (.09)	-0.58 (.13)
β_2	-0.14 (.94)	-1.04 (.64)	0.45 (.10)	0.38 (.16)
β_3	0.50 (.73)	0.02 (.55)	-0.20 (.12)	-0.20 (.18)
β_4	-0.15 (.46)	0.28 (.32)	0.16 (.07)	0.22 (.10)
R^2	0.967	0.991	0.995	0.994
s	0.100	0.065	0.031	0.030
BJ	2.99	0.23	0.18	3.01
LM 1	0.04	0.01	0.02	0.08
LM 2	1.71	2.04	1.69	2.65
ξ^2	2.49	0.45	0.18	0.20
ξ^3	1.21	0.85	0.57	0.59
$H_1: \theta=0$	1.62	3.15	2.43	3.00
$H_2: \theta=0; \beta_j=0$	2.99	7.52	11.07	10.63

Note: t-test has been used for H_1 and F-test for H_2. Also see notes to Table 1.

Table 3: Hwang test, sample 1955-83.

Coefficients	(1) $\hat{m}_0$	(2) $\hat{m}_0$	(3) $\hat{m}_2$	(4) $\hat{m}_2$
c	-2.07	-2.29	0.32	-1.16
	(.98)	(.49)	(.66)	(.50)
m_{t-1}	0.42	0.35	1.17	0.79
	(.31)	(.14)	(.17)	(.13)
y_t	0.81	0.73	1.46	0.50
	(.52)	(.14)	(.35)	(.15)
y_{t-1}	-0.16		-1.51	
	(.78)		(.51)	
P_t	2.34	0.74	-0.07	-0.35
	(.74)	(.44)	(.63)	(.41)
P_{t-1}	-1.75		-1.06	
	(.71)		(.52)	
ΔP		1.64		0.41
		(.52)		(.54)
R_t	-0.17	-0.12	-0.21	-0.08
	(.13)	(.06)	(.10)	(.10)
R_{t-1}	0.07		0.28	0.18
	(.14)		(.09)	(.10)
R^2	0.976	0.978	0.990	0.986
s	0.089	0.086	0.073	0.085
BJ	1.86	0.97	0.50	0.09
ξ^2	2.07	1.95	1.27	1.56
ξ^3	2.15	3.03	1.03	3.66
LM 1	0.30	0.58	2.08	0.40
LM 2	0.20	0.31	1.01	0.80
CHOW (T_1=15;T_2=14)	2.44	2.03	2.56	2.73
F-tests				
H_1: nomin.adj.	5.01	16.03	8.11	5.66
H_2: real adj.	3.15	9.96	4.68	0.57
H_3:P-homogen.	0.94	2.80	4.80	0.74
H_4:y-homogen.	0.56	1.08	16.16	14.82

Note: Diagnostics are as in Table 1. Restrictions are tested against each model using the F-test. OLS has been used for estimation. Standard errors in brackets. T =29.

Table 4: Portes-Winter Model, 1954-83.

$CD = \alpha_1 S1 + \alpha_2 DYD + \alpha_3 YD1 + u_1$

$CS = \beta_1 CT + \beta_2 CYX + \beta_3 RNFA + \beta_4 IFX + u_2$

$C = \min(CD, CS)$

	1	2	3	4
	unconstr.	$\alpha_3 = 1$	$\beta_1 = 1$	$\alpha_3, \beta_1 = 1$
a_1	-.6685	-.5796	-.6282	-.3105
	(.081)	(.088)	(.097)	(.189)
a_2	.6582	.7252	.5790	.8271
	(.0357)	(.035)	(.0409)	(.068)
a_3	1.0119	1.000	1.0208	1.000
	(.0039)		(.0049)	
s_1	1.143	1.239	.946	1.129
	(.092)	(.098)	(.095)	(.111)
b_1	1.0501	1.0505	1.000	1.000
	(.005)	(.006)		
b_2	.2003	.1993	.3261	.2075
	(.040)	(.039)	(.112)	(.094)
b_3	.2840	.2815	.6176	.7252
	(.046)	(.047)	(.105)	(.088)
b_4	-.3923	-.3920	-.5601	-.4750
	(.043)	(.043)	(.122)	(.136)
s_2	.805	.812	1.895	1.907
	(.118)	(.117)	(.218)	(.192)
LogL	-46.40	-50.68	-59.27	-64.53

Numbers in parentheses beneath parameter estimates are asymptotic standard errors.
s_1 and s_2 are the equation standard errors.

GQOPT (Goldfeld-Quandt) is used for estimation. Optimum is reached in all models

Table 5: Burkett Model, 1954-83.

Estimated equation:

$$c = \frac{(\alpha x+\beta y)}{2} - \frac{1}{2}\left[(\alpha x-\beta y)^2 + 4\gamma^2(\alpha x)(\beta y)\right]^{(1/2)} + u$$

$\alpha = (\alpha_1, \alpha_2, \alpha_3)$

$x = (S1, DYD, YD1)$

$\beta = (\beta_1, \beta_2, \beta_3, \beta_4)$

$y = (CT, CYX, RNFA, IFX)$

	1	2	3	4
	unconstr.	$\alpha_3 = 1$	$\beta_1 = 1$	$\alpha_3, \beta_1 = 1$
a_1	-.6302	-.5511	-.9053	-.4200
	(.072)	(.059)	(.060)	(.313)
a_2	.6576	.7111	.6566	.7251
	(.032)	(.030)	(.052)	(.072)
a_3	1.0096	1.000	1.0170	1.000
	(.003)		(.001)	
b_1	1.0493	1.0481	1.000	1.000
	(.004)	(.007)		
b_2	.2548	.2227	.3301	.2942
	(.073)	(.036)	(.066)	(.088)
b_3	.2541	.2778	.6118	.6332
	(.059)	(.064)	(.063)	(.076)
b_4	-.4168	-.3632	-.4567	-.4663
	(.034)	(.047)	(.036)	(.088)
g	$.4\times10^{-8}$	$.4\times10^{-5}$	$.1\times10^{-6}$	$.3\times10^{-11}$
	(.000)	(.001)	(.001)	(.003)
LogL	-45.24	-49.38	-65.90	-67.08

Numbers in parentheses beneath parameter estimates are asymptotic standard errors.
GQOPT (Goldfeld-Quandt) is used for estimation. For models 1 and 2, we approach convergence (the optimum is approximated but not reached); for model 3, the gradient of α_3 differs from zero; for model 4, the optimum is reached.

Table 6. Prices and excess demand.

Year	PI	FPI	WPI	PWXD	BSH	NSI
1955	1.1	0.8	5.8	-1.7	0.0	n.a.
1956	0.0	-0.2	38.1	4.2	2.7	2.6
1957	1.5	6.6	4.1	2.8	1.9	-12.1
1958	0.2	-2.7	54.3	8.1	5.6	-2.9
1959	0.9	0.8	2.0	-0.3	0.0	-8.3
1960	3.0	6.5	13.7	2.5	0.6	9.2
1961	16.2	45.4	69.5	-2.6	0.0	3.6
1962	3.8	9.8	-29.4	-4.3	0.0	-7.0
1963	-5.9	-14.2	-19.7	-1.1	0.6	-3.4
1964	-3.7	-9.0	-11.7	0.7	1.0	-3.6
1965	-2.6	-3.0	20.3	0.6	0.0	-3.6
1966	-0.2	-3.0	13.2	0.9	0.0	-3.6
1967	-0.7	-1.6	1.3	1.0	0.9	2.9
1968	0.0	0.2	25.6	-1.9	0.0	-2.7
1969	-1.1	2.4	-10.9	-2.2	0.0	0.3
1970	-0.2	0.0	-15.1	0.6	0.0	-7.7
1971	-0.7	-0.2	8.5	2.0	0.7	-7.0
1972	-0.2	0.4	5.5	1.1	0.0	-2.1
1973	0.6	0.2	8.1	1.4	0.0	-7.1
1974	0.5	1.6	6.5	0.0	0.0	-3.0
1975	0.1	1.1	-2.8	-0.7	0.0	-3.4
1976	0.3	0.7	7.6	2.3	2.0	0.8
1977	2.0	6.9	-2.4	-4.5	0.0	-7.7
1978	0.7	1.7	8.3	-1.8	0.0	-8.6
1979	2.0	4.7	23.4	0.8	0.0	n.a.
1980	6.0	19.9	31.4	7.2	4.5	n.a.
1981	2.4	6.4	22.7	3.7	2.7	n.a.
1982	1.9	5.2	23.5	5.5	4.2	n.a.
1983	1.5	5.1	21.7	5.1	3.5	n.a.

PI = percentage change of official price index

FPI = percentage change of virtual consumer price index proposed by Feltenstein-Farhidian (1986)

WPI = percentage change of virtual consumer price index proposed by Feltenstein-Lebow-van Wijnbergen (1986) calculated according to the estimates of equation (c), page 26 of their paper

PWXD = Portes-Winter (1980) percentage of excess demand $[100(\hat{CD}-\hat{CS})/]$, from model 4 estimated in Table 4 (α_3 and β_1 constrained)

BSH = Burkett (1986) index of relative shortage $[100(\hat{CD}-\hat{C})/\hat{C}]$, from model 4 estimated in Table 5 (α_3 and β_1 constrained)

NSI = Naughton (1986) index of percentage shortage (column 4 of his Table III-2, p.109)

n.a.= not available

DATA APPENDIX

Data from the Statistical Yearbook of China, 1984 (English edition):

- net material product (current prices), p.29
- personal consumption (current prices), p.33
- investment in fixed assets (capital construction) from state owned units, p.301
- retail price index, p.425

Saving deposits and currency are from Byrd (1983) and the Statistical Yearbook.

The chosen rate of interest is the one-year saving deposit interest rate, taken from Hsiao (1971), from Byrd (1983) and, for recent years, from the BBC Bulletin Summary of World Broadcasts, Part 3, The Far East.

M_0 is equal to currency.

M_2 is equal to currency plus personal savings deposits.

Disposable income (at current prices) has been constructed adding current year changes in net financial assets to personal consumption. Real income is this series deflated by retail price index.

REFERENCES

Bortolani, Sergio, and Anita Santorum, 1984, Moneta e banca in Cina (Milano, Finafrica).

Burkett, John, 1986, Slack, shortage and discouraged consumers in Eastern Europe: estimates based on smoothing by aggregation, Review of Economic Studies, forthcoming.

Chow, Gregory, 1985a, The Chinese economy (New York, Harper and Row).

Chow, Gregory, 1985b, A model of Chinese national income determination, Journal of Political Economy 93, 782-92.

Chow, Gregory, 1986, Money and price level determination in China, paper presented to the Arden House Conference on Chinese Economic Reform, New York, October 9-12.

Cooley, T.F. and S.F. Leroy, 1985, Atheoretical Macroeconomics, Journal of Monetary Economics 16, 283-308.

Engle, Robert F., David F. Hendry and Jean-Francois Richard, 1983, Exogeneity, Econometrica 51, 277-304.

Feltenstein, Andrew, and Z. Farhidian, 1986, Fiscal policy, monetary targets and the price level in a centrally planned economy: an application to the case of China, Journal of Money, Credit and Banking forthcoming.

Feltenstein, Andrew, D. Lebow and Sweder van Wijnbergen, 1986, Savings, commodity market rationing and the real rate of interest in China, CPD Discussion Paper No 1986-27, World Bank.

Granger, C.W.J., 1969, Investigating causal relations by econometric models and cross spectral methods, Econometrica 37, 424-438.

Hsiao, Katherine H., 1971, Money and monetary policy in Communist China (New York, Columbia University Press).

Hwang, Haeshin, 1985, Test of the adjustment process and linear homogeneity in a stock adjustment model of money demand, Review of Economics and Statistics 67, 689-692.

Kornai, Janos, 1980, The economics of shortage (Amsterdam, North-Holland).

Kornai, Janos, 1982, Growth, shortage and efficiency (Berkeley, University of California Press).

Martin, Chris, 1986, General linear rationing models, Birkbeck Discussion Paper No. 184.

Naughton, Barry, J., 1986, Saving and investment in China: a macroeconomic analysis, PhD dissertation, Yale University.

Peebles, Gavin, 1983. Inflation, money and banking in China: in support of the purchasing power approach, The ACES Bulletin 25:2, 81-103.

Portes, Richard, 1983, Central planning and monetarism: fellow travellers? in Desai, P. ed., Marxism, central planning and the Soviet economy (Cambridge, Mass., MIT Press), 149-65.

Portes, Richard, 1986, The theory and measurement of macroeconomic disequilibrium in centrally planned economies, Centre for Economic Policy Research Discussion Paper No. 91 (London).

Portes, Richard, and David Winter, 1978, The demand for money and for consumption goods in centrally planned economies, Review of Economics and Statistics 60, 8-18.

Portes, Richard, and David Winter, 1980, Disequilibrium estimates for consumption goods markets in centrally planned economies, Review of Economic Studies 47, 137-159.

Portes, Richard, Richard Quandt, David Winter and Stephen Yeo, 1987, Macroeconomic planning and disequilibrium: estimates for Poland, 1955-80, Econometrica forthcoming.

Quandt, Richard, 1982, Econometric disequilibrium models, Econometric Reviews 1, 1-63.

Spanos, Aris, 1986, Statistical foundations of econometric modelling (Cambridge, CUP).