HONG KONG MONETARY AUTHORITY

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MONEY AND INFLATION IN CHINA

Key points:

- *Recent debates on monetary condition and inflation pressures on the Mainland call for an analysis on the inflation dynamics and their main determinants. A natural starting point for the econometric analysis of monetary and inflation developments is the notion of monetary equilibrium.*

- *This paper presents an estimate of the long-run demand for money in China. The estimated long-run income elasticity is rather stable over time and consistent with that estimated in earlier studies.*

- *The difference between the estimated demand for money and the actual money stock provides an estimate of monetary disequilibria. These seem to provide leading information about CPI inflation in the sample period. At the current conjuncture, the measure suggests that monetary conditions have tightened since the macroeconomic adjustment started in early 2004.*

- *Additionally, an error-correction model based on the long-run money demand function offers insights into the short-run and long-run inflation dynamics. Specifically:*

  - *Over the longer term, inflation is mostly caused by monetary expansion.*

  - *The price level responds to monetary shocks with lags and on average it takes about 20 quarters for the impact of a permanent monetary shock to peak. This suggests the need for early policy actions to curb inflation pressure given the long policy operation lag.*

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I. INTRODUCTION

Concerns have been raised recently about overheating pressures in the economy of Mainland China (see, for example, Kalish 2004, Bradsher 2004, and Ignatius 2004). In particular, from late 2003, CPI inflation started to rise, albeit from a low level, following rising commodity prices, fast asset price appreciation, and rapid increases in investment. Combined with rapid growth in credit and money aggregates, the increase in inflation has cast doubts about the sustainability of the economic growth and led to fear of runaway inflation. In response, the Chinese government has adopted a series of measures aimed to contain the rapid credit growth to certain "overheating" sectors and to tighten liquidity in the banking system.

To assess properly current macroeconomic conditions, it is important to understand the inflation process in Mainland China. Empirically, a strong relationship between the price level and the money stock is well established for many countries. A large body of theoretical and empirical literature emphasising the role of monetary and credit developments in the transmission of monetary policy and the determination of price level lends support to the importance in analysing money aggregates. Furthermore, the timely availability and relative reliability of data on monetary aggregates also make monetary analysis useful for policy makers. A natural starting point for such an analysis is to use a money demand function to gauge the monetary disequilibria.

In the case of Mainland China, monetary aggregates are particularly useful indicators of future inflation because of the dominance of the banking sector in the financial system. Indeed, many observers have focused on the growth rate of money aggregates in China as important indicators of future inflation pressures. In the academic literature, some studies have provided evidence of the importance of money growth as a determinant of inflation in China (Brandt and Zhu 2000). On the other hand, given the structural changes in the economy, it is sometimes argued that money demand may not be stable in China. Instability in money demand would reduce the usefulness of the money aggregates as indicators of economic activity and as intermediate targets for monetary policy.

This paper presents some stylised facts and analysis of these issues, using a simple empirical framework that imposes a minimum of economic theory. Specifically, a long-run money demand function is estimated for China using cointegration methods. Using the estimated demand function and the actual money

stock, a measure of excess liquidity can be constructed. The analysis confirms that a money overhang has emerged in recent periods in China, indicating a build-up of inflationary pressures in the economy. The existence of a long-run money demand function also makes it possible to explore the short-run inflation dynamics in an error-correction model. It appears that inflation responds gradually to monetary disequilibria, and that it takes about 20 quarters for the peak impact of a money supply shock on inflation to be reached.

The rest of the paper is organised as follows. The next section presents a review of existing studies on Mainland China's money and inflation. Section III presents a brief summary of the cycles of monetary expansion and contraction in the Mainland in the last twenty years, and identifies monetary expansion as a main source of inflation in China. Section IV discusses the methods and results, in which a money demand function is estimated, money disequilibria is derived, and its impact on inflation is analysed. Section V concludes.

II. LITERATURE REVIEW

Several studies have estimated a money demand function for Mainland China. However, most used data ending in the mid 1990s and are thus of little help in analysing recent developments. Furthermore, most studies focused on identifying a relationship between some monetary aggregate and real income; the impact of monetary expansion on inflation and the short-run inflation dynamics were not studied.

Chow (1987) pioneered the work on money demand in China by estimating a money demand function derived from the quantity theory using annual data from 1952 through 1983. He finds that the quantity theory provides a "reasonable first approximation" to demand for money in China. Portes and Santorum (1987) estimate money demand using both measures of real and nominal money balances with adjustment specifications and test for homogeneity of money demand with respect to the price level. Using annual data from 1954 to 1983, they find evidence of well-behaved money demand function for M0. Feltenstein and Farhadian (1987), Chan, Cheng and Deaves (1991) and Ma (1992) focused the analysis on the right measure of price level. Given the tight government control, they argued, it is "perceived" rather than "reported" official prices that should be used in the analysis of money demand. Blejer et al. (1991) estimated an error-correction model using quarterly data for 1983 to 1993 and found that the long-run

income elasticities of real money balances with respect to real income are greater than one and remain relatively stable over the sample period. Hafer and Kutan (1994) estimate a long-run money demand function using two different measures of money aggregates, M0 and M2, and two measures of prices, RPI and GDP deflator, and find that using M2 produces better-behaved money demand function. The long-run relation can only be found when using M2 as the money aggregate and the GDP deflator as the price measure. Brandt and Zhu (2000) find a significant positive correlation between inflation and seigniorage, and since money creation generates seigniorage, they conclude that money creation causes inflation.

In sum, the existing literature has provided evidence that some form of well-defined money demand function exists for the Mainland. However, the linkage between inflation and money supply has not been explored, with the exception of the work by Brandt and Zhu (2000).

III. INFLATION DEVELOPMENTS IN CHINA

A review of historical inflation developments is useful for understanding the determinants of inflation in the Mainland. Charts 1 and 2 show that the Mainland experienced several large inflation cycles after the initial economic reform in 1978. The analysis below suggests that, at least until the mid-1990s, inflation was driven both by excess demand resulting from rapid credit expansion and reform measures that liberalised market and prices of most goods and services.

The first cycle took place between 1979 and 1981, when certain administered prices (mostly agricultural procurement prices) were adjusted and limited price liberalisation, the "guided pricing" system, was introduced. These reforms led quickly to increases in farmers' income and enterprise profitability, which resulted in increases in aggregate demand. Inflation, mainly on account of the adjustment measures, rose from less than 1% in 1978 to over 6% in 1980. The authorities responded with quantitative credit controls, raising interest rates, and selective approvals of investment projects to prevent the economy from over-heating.

The next cycle started in 1982 and lasted till early 1986. In 1982 and 1983, a further number of commodity prices were liberalised and more prices were brought into the guided system. Other structural reforms in this period provided

state-owned enterprises and banking system with more autonomy. Before long, these enterprises were borrowing heavily to finance investment projects and wage increases. Real GDP growth rebounded sharply, reaching 14.5% in 1984. Credit growth accelerated from 9% in the beginning of 1984 to 76% in the fourth quarter. Retail price inflation rose sharply from a low of 1% in 1984 to 10.9% in the second half of 1985. To offset the inflationary impact of earlier credit expansion, the authorities adopted tight credit controls and raised interest rates.

The third cycle occurred in between 1986 to 1989, when the earlier policy tightening was relaxed as the authorities became concerned about the slowdown in economic growth. Banks were granted more freedom in setting interest rates and a regional interbank market emerged. Economic activity responded immediately to the easing of monetary conditions. Broad money and domestic credit grew by more than 30% by the first quarter of 1987. Inflation rose from around 5% in 1986 to 30% by 1989, partially in response to further adjustments of administered prices. Bottlenecks in key sectors, especially energy, transportation, and raw materials affected the efficiency of the economy. Facing severe overheating pressures, the authorities took decisive steps to restore macroeconomic stability by curbing credit growth, raising interest rates, reducing investment projects, postponing further price liberalisation, and reducing the local governments' control over administered prices. These measures quickly brought down the growth rates in M1 and M2, and inflation fell sharply to around 5% by 1990.

The fourth cycle ran from the middle of 1991 to late 1996. In 1991 and 1992, the authorities undertook major price reforms to further reduce the number of administered prices in agriculture and industrial sectors, and commodity prices were raised as well.[1] Retail price control was significantly abolished. Other measures encouraged foreign direct investment and further reforms of State-Owned-Enterprise (SOEs). Credit growth accelerated during 1992 and 1993, and was associated with an investment boom by SOEs. By 1993, the ratio of fixed asset investment to GDP surged to close to 40%. Inflation remained under control until late 1992, when strong demand pressures pushed inflation from about 6% to over 14% by mid 1993. Realising the overheating pressure, the authorities implemented a "16-point" plan to cool the economy. As usual, the measures

[1] The exchange rate was unified and devalued in 1994, which could have resulted in an one-time jump in import prices, thus also contributing to the inflation pressure. However, existing studies have mostly identified adjustments in administered prices and strong demand as the main factors for inflation in this period.

included raising interest rates, tightening People's Bank of China (PBoC) credit to banks and cracking down on loans made outside of the credit plan. However, it took much longer for the measures to stop inflation. By late 1994, inflation was running at over 27% year on year. It was not until late 1996 before inflation returned to around 5%.

Since then the economy has experienced steady growth with little inflation. The large swings in money aggregates, real GDP growth, and inflation observed in past cycles were noticeably absent in the latest expansion phase. This probably reflects increased sophistication of the PBoC in conducting monetary policy and an improved transmission mechanism, in addition to the fact that most of the price reforms have been completed by mid 1990s. However, the recent increase of CPI inflation combined with rapid broad money and credit growth, and a rapid rise in fixed asset investment have raised concerns about overheating pressures (Charts 3 and 4).[2]

Historical developments suggest that monetary expansions have been closely linked to inflation dynamics on the Mainland, but it is useful to examine more systematically the relationship between money and inflation. The next section presents a formal econometric analysis of money and inflation on the Mainland.

IV. METHOD AND RESULTS

The M2 velocity in China has been steadily declining since measures to reform the Mainland economy were introduced in 1978 (Chart 5). Chart 6 shows that many Asian countries in the early stage of economic transformation also experienced a steady decline in the velocity of money. Nevertheless, a declining velocity of money, which usually reflects increased financial intermediation due to financial deepening (Blejer, et al. 1994), is not inconsistent with the existence of a stable demand for money. Existing studies on estimating money demand functions for developing countries generally find long-run income elasticities above unity.[3] Available estimates for China range from slightly above unity to close to 2,

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[2] Part of the inflation could be due to pass-through from import prices, under the fixed exchange rate regime.

[3] For discussions related to estimating money demand functions for developing countries see Aghevli, et al. (1979) and Bordo and Jonung (1987). For example, in an analysis done by the Economic Planning Agency of Japan (1996), the estimated long-run income elasticities for the four countries—Japan, Korea, Indonesia, and the Philippines—range from slightly above 1 to well over 2.

depending on the choice of the monetary aggregates and the estimated model. Usually, the income elasticity increases with the use of broader money aggregates.

Conventional long-run money demand functions are typically assumed to be of the form:

$$m_t = \alpha_0 + \alpha_1 y_t + \alpha_2 p_t + \alpha_3 r_t + \varepsilon_t$$

where m_t and y_t are the logarithms of money stock and real income, p_t is the price level, and r_t is a measure of opportunity cost of holding money. Such a demand function can be derived from the transaction demand, the portfolio balance model, or "overlapping generations" approaches (Goodhart 1989). In this formulation, if α_2 equals 1 then money demand is homogenous of degree one with respect to prices.[4] Due to the lack of reliable market based interest rates as measures for the opportunity cost of holding money, this variable is not used in the analysis below.[5]

It is well known that price levels and real income exhibit non-stationarity in most economies. The existence of a stable money demand function therefore requires that money balances, the price level, and the real income are cointegrated. In other words, even though level variables are individually nonstationary, some linear combination of the variables may be stationary.

To proceed, firstly, the univariate properties of the variables are examined by unit root tests, then a long-run money demand function is estimated and its properties discussed. Secondly, a measure of excess liquidity is derived from the estimated long-run money demand function, which gives an indication of the inflation pressure. Thirdly, both short-run and long-run inflation dynamics will be examined through the error-correction model. The sample for the following analysis is from 1980 Q1 to 2004 Q4, and the data frequency is quarterly.

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[4] According to Goodhart (1989), relating the real level of money balances to real output in the estimation of a money demand function is "probably not the correct econometric procedure". First, the homogeneity assumption needs to be tested. Second, when the estimated demand function involves lags of other explanatory variables, taking the real money balance as the dependent variable implicitly assumes money adjusts to price changes instantaneously while responses to output and interest changes are distributed over time.

[5] Inflation was used as a proxy for the opportunity cost of holding money but carries a wrong sign in the money demand estimation. Similar results have been reported by other studies.

Unit root and cointegration analysis

Augmented Dickey-Fuller tests are performed on all series, which are seasonally adjusted. All variables are found to contain one unit root in the levels, but no unit root when differenced (Table 1). So we proceed with the cointegration test of long-run money demand.

Table 1. Unit Root Tests

Variable	ADF	p-value	Lag	Trend
In levels				
Money balance	-0.06	0.99	1	Y
real income	-3.03	0.13	6	Y
CPI	-1.02	0.74	1	N
First Difference				
Money balance	-3.55	0.01	2	N
real income	-3.48	0.01	6	N
CPI	-3.50	0.01	0	N

Note: Level variables are in logs. A constant is included in all the tests.

Using Johansen's method, we find that there exists one cointegrating relation among money balance, real income and price level (Johansen 1991). The test results for cointegration are reported below (Table 2). The results indicate that a money demand function can be identified in the sample period.[6]

[6] The choice of lags in the error-correction model is of critical importance. Here the lag is set at 6 based on the predictive power of the error-correction model measured by the adjusted R^2 and Schwartz criterion. According to Sims, Stock and Watson (1990), the lag length can also be decided from a simple VAR. Both methods suggest 6 as the best choice.

Table 2. Unrestricted Cointegration Rank Test

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	5% Critical Value	1% Critical Value
None **	0.24	35.70	29.68	35.65
At most 1	0.09	10.58	15.41	20.04
At most 2	0.02	1.84	3.76	6.65

Note: ** denotes rejection of the hypothesis at the 5%(1%) level
Trace test indicates 1 cointegrating equation(s) at both 5% and 1% levels

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen value Statistic	5% Critical Value	1% Critical Value
None *	0.24	25.12	20.97	25.52
At most 1	0.09	8.74	14.07	18.63
At most 2	0.02	1.84	3.76	6.65

Note: * denotes rejection of the hypothesis at the 5%(1%) level
Max-eigenvalue test indicates 1 cointegrating equation(s) at the 5% level
Max-eigenvalue test indicates no cointegration at the 1% level

The estimated unrestricted long-run demand for money function is (t-statistics are in the parentheses):

$$m_t = -8.59 + \underset{(25.7)}{1.80}\, y_t + \underset{(10.3)}{0.83}\, p_t + \varepsilon_t$$

The Wald test of homogeneity of money balance with respect to prices would reject the null of homogeneity at 5% level but not at the 1% level. However, according to Boswijk (1995), linear restrictions on the cointegrating vectors are best tested using the likelihood ratio (LR) test constructed from the restricted and unrestricted models. Since the co-integrating vectors are constructed as a ratio when one parameter is normalised to one and "the denominator has positive density at the origin", which means that even asymptotically normal distribution may not be a good proximation for the distribution of the vectors. Consequently, we imposed the homogeneity restriction on the cointegrating relation and the resulting restricted long-run money demand function is (T-statistic in parentheses):

$$m_t = -8.32 + \underset{(82.5)}{1.65}\, y_t + 1^*\, p_t + \varepsilon_t$$

LR test for binding restrictions (rank = 1):	
Chi-square(1)	2.65
Probability	0.10

The LR test for the restriction of α_2=1 indicates that the hull of homogeneity can not be rejected at 10% significance level for the full sample period. The estimated income elasticity of money demand, 1.65, is within the range of what has been found in the literature.[7] To gauge the stability of the money demand function, we also test the cointegration relation recursively over time. This amounts to a joint restriction of α_1 = 1.65 and α_2 = 1 on the cointegrating vector. The hull hypothesis of a long-run income elasticity equal to 1.65 is rejected for the 1980s but not at the 5% level when the sample is extended to include the 1990s. Given the small sample property of the LR test, we tend to accept that our long-run money demand function is robust over time.[8] Next, we focus on using the estimated money demand function to analyse inflation developments in the rest of the paper.

Are monetary conditions too loose on the Mainland now?

From the long-run money demand function, one can derive measures of excess liquidity (shortfall) due to excessive monetary expansion (contraction). The money overhang or shortfall is defined as the difference between the observed money supply and the "equilibrium" money demand (Masuch, Pill and Willeke 2001). The "equilibrium" money demand is given by substituting the observed values of real income and inflation into the money demand function. The money overhang can be expressed as:

$$m_{actual} - m_{eqm} = m_{actual} - \{\alpha_0 + \alpha_1 y_{actual} + \alpha_2 p_{actual}\}$$

Where α_0, α_1, and α_2 are the estimated coefficients of the money demand function.

Chart 7 presents the money overhang as a percentage of the stock of M2. The identified periods of money overhang indeed correspond to the historical periods of rapid money and credit expansion. For example, significant money

[7] The estimated income elasticity is rather robust to different specification. We also estimated the long run relation using real money balances and real income. The resulting income elasticity turns out to be 1.65.

overhang developed from 1991 till 1993, and subsequently inflation on the Mainland ran over 20% per year in 1995. This suggests that the money overhang has some leading information about future inflation. Granger-causality test indicates for the sample period, money gap Granger-causes inflation (Table 3).

Table 3. Granger-causality Tests

Sample: 1980:1 ~ 2004:4	**Lags: 6**		
Null hypothesis	**Observations**	**F-statistic**	**P-value**
Inflation does not Granger Cause Money Gap	94	1.28	0.28
Money Gap does not Granger Cause Inflation	94	3.34	0.00

The chart shows that a positive gap has developed in recent years, and that this measure of money overhang tends to be positively related with CPI inflation, with a considerable lag. Thus, if the historical relationship continues to hold, the inflationary impact of the recent monetary expansion is unlikely to have been completed and CPI inflation could rise further. However, with the tightening measures adopted so far, the money overhang has declined significantly.

While the measure of money overhang gives an indication of inflation pressure, the movement of inflation in response to such a pressure is not clear. For policy making purposes, the questions of how quickly inflation responds to excess monetary expansion and how persistent the process is are important. To address these concerns, inflation dynamics are examined.

Short-run inflation dynamics

If a cointegration relationship among money balance, real income and price level is established, then we can estimate a vector error-correction model (VECM) that incorporates the long-run equilibrium. By estimating the VECM, we can examine the short-run dynamics of each of the variables in adjusting to deviations from the long-run equilibrium relationship. In particular, we would like to investigate the channel through which inflation adjusts to deviations of money supply from its equilibrium demand and the inherent short-run dynamics in inflation.

[8] Gredenhoff and Jacobson (2001) and Brüggemann and Lütkepohl (2004) found that the asymptotic χ^2 distribution of the LR test is a poor guide for small sample.

A general representation of the VECM is:

$$\Delta Y_t = B_1 Y_{t-1} + B_2 \Delta Y_{t-1} + B_3 \Delta Y_{t-2} + ... + B_k \Delta Y_{t-k+1} + u_t$$

where Y is a vector of the three variables: M2, real GDP, and price level. Δ is the change operator, indicating first difference of the variables immediately behind. B_1 is the product of the adjustment coefficients and the long-run cointegrating coefficients, B_k is the k-th order auto-regressive coefficients. An estimated system of equations is presented in Appendix I.

The estimated VECM suggests that when there is deviation of money supply from the equilibrium money demand, the adjustments toward the equilibrium will take place through both price and real income, but not money stock, as the adjustment coefficients in front of real income and price are highly significant. This indicates that money supply shocks not only have inflationary impact but also impact on growth in the short run.

In particular, the equation for short-run inflation dynamics is given by (t-statistics in parenthesis):

$$\Delta P_t = \underset{(-1.83)}{-0.01} + \underset{(3.10)}{0.08}*(M_{t-1} - 1.65*y_{t-1} - 1*P_{t-1}) + \underset{(5..35)}{0.59}*\Delta P_{t-1} + \underset{(1.67)}{0.18}*\Delta P_{t-6} - \underset{(2.52)}{0.15}*\Delta M_{t-5}$$

The estimated error-correction equation for inflation suggests strong serial correlation in inflation over time, an indication of possible inflation inertia.[9] The equation is quite powerful in explaining the movements in inflation—about 70% of the variation in inflation can be explained by the model. This points to a strong predictability of the movement in inflation in the short-run. The coefficient in front of the long-run equilibrium is highly significant, suggesting that inflation responds to monetary excess or shortfall.

A convenient way of visualising the inflationary impact of monetary shocks is using impulse responses generated by the VECM model. Impulse responses show period-by-period changes in the endogenous variables following a particular shock. To calculate these responses, the VECM system has to be

[9] The inflation inertia refers to a slow, gradual but persistent response of inflation to a permanent monetary shock. The micro-foundations that could lead to such inertia usually hinge on the manner economic agents form their inflation expectations, which is beyond the scope of this paper.

transformed so that there is no cross-equation correlation in the residuals of the transformed equations. A typical transformation is the Cholesky transformation, which depends on the ordering of the equations in the VECM system. In our model, however, cross-equation correlation is so low that the ordering of the system does not affect the impulse responses. This is also confirmed by generating impulse responses using the generalised transformation proposed by Pesaran and Shin (1998). This indicates that the analysis based on the VECM is not affected by changing the ordering of the shock transmission process.

Impulse responses based on the estimated VECM model demonstrate that both price and output respond to a permanent money supply shock (chart 8). While output responds to the monetary shock in the first few quarters, the impact declines over time. The price level responds slowly and gradually but the impact becomes larger over time and peaks after 20 quarters. This seems to confirm the view that inflation process is rather persistent in China and policy operation lag is quite long. The result points to the need for early policy action in containing inflationary pressure in the economy.

Furthermore, variance decomposition of inflation over time indicates that inflation becomes a “monetary phenomenon” in the long run (chart 9). In the short run, most of short-term fluctuations in inflation are due to the persistence of the inflation process. Over the longer term, however, over 80% of the volatility in inflation are explained by monetary shocks.

Short-run inflation forecast

Given the high predictability of inflation suggested by the VECM model, we could use the error-correction model for inflation forecasting. While acknowledging that the inflation process is affected by many other factors and a good inflation forecast should be based on a general-equilibrium model, a simple forecast based on this monetary model can provide the policy makers with an additional tool on analysing future inflation developments.

We estimate the model up to the fourth quarter of 2002, then use the model for in-sample static forecast of inflation from 2003Q1 till 2004Q4. The forecast is static in the sense that actual values of the endogenous variables are used to generate subsequent observations. The static forecast is plotted against the actual inflation in the forecasting period with a 95% confidence band (Chart 10). The standard errors of the forecast are generated by Monte Carlo simulations.

It appears that this short-run dynamic model of inflation captures major trends in actual inflation but can not produce an accurate forecast of the level of the inflation. Furthermore, the wide confidence band suggests that the forecasts are subject to large uncertainties.

V. CONCLUSION

The analysis presented in this paper facilitates discussions concerning the current monetary condition and inflation developments on the Mainland, by providing a formal modelling of the linkages between money and inflation. We are able to identify a stable money demand function for China over the past twenty years despite the rapid structural transformation in the economy. Such a stable money demand function can serve a useful purpose in analysing monetary policy stance and its inflationary impact.

In particular, we find that periods of above-equilibrium money growth tend to increase inflation pressure in the economy. The derived money overhang can be a useful early warning signal of future inflation, which shows a positive gap in recent years. The response of inflation to money supply shocks is gradual and peaks at about 20 quarters. Furthermore, in the short term, inflation is rather persistent but is mostly driven by monetary shocks in the long run; therefore inflation becomes a “monetary phenomenon” in the long run.

In the current conjuncture, our analysis suggests that inflation pressure due to the monetary expansion in earlier periods has been greatly reduced, as indicated by a sharp drop in the estimated money overhang to a low level at the end of 2004. The recent monetary tightening could help to further restrain the inflation pass-through from upstream prices to consumer prices. However, due to the long monetary policy operational lag, inflation development should be monitored closely.

Appendix I

Denoting the long-run equilibrium by EQM, the estimated system of equations is as follows:

$$\begin{bmatrix}\Delta m\\ \Delta y\\ \Delta p\end{bmatrix} = \begin{bmatrix}0.05\ (0.96)\\ 0.06^{*}\ (2.84)\\ 0.08^{*}\ (3.11)\end{bmatrix} EQM_{t-1} + \begin{bmatrix}0.06\ (0.50) & 0.05\ (0.15) & -0.30\ (-1.40)\\ -0.03\ (-0.60) & 0.05\ (0.46) & -0.03\ (-0.39)\\ -0.002\ (-0.02) & 0.08\ (0.50) & 0.59^{*}\ (5.35)\end{bmatrix}\begin{bmatrix}\Delta m_{t-1}\\ \Delta y_{t-1}\\ \Delta p_{t-1}\end{bmatrix} + \begin{bmatrix}-0.12\ (-1.00) & 0.60^{*}\ (2.02) & 0.05\ (0.20)\\ -0.01\ (-0.19) & 0.17\ (1.49) & -0.03\ (-0.35)\\ -0.06\ (-0.87) & 0.15\ (0.95) & 0.20\ (1.55)\end{bmatrix}\begin{bmatrix}\Delta m_{t-2}\\ \Delta y_{t-2}\\ \Delta p_{t-2}\end{bmatrix}$$

$$+ \begin{bmatrix}0.09\ (0.72) & 0.45\ (1.46) & -0.04\ (-0.19)\\ -0.03\ (-0.74) & 0.07\ (0.63) & -0.06\ (-0.68)\\ -0.04\ (-0.68) & 0.23\ (1.40) & -0.06\ (-0.48)\end{bmatrix}\begin{bmatrix}\Delta m_{t-3}\\ \Delta y_{t-3}\\ \Delta p_{t-3}\end{bmatrix} + \begin{bmatrix}0.03\ (0.27) & 0.33\ (0.96) & -0.08\ (-0.33)\\ 0.04\ (0.83) & 0.42^{*}\ (3.30) & -0.02\ (-0.18)\\ 0.08\ (1.38) & 0.08\ (0.43) & 0.04\ (0.34)\end{bmatrix}\begin{bmatrix}\Delta m_{t-4}\\ \Delta y_{t-4}\\ \Delta p_{t-4}\end{bmatrix} + \begin{bmatrix}0.19^{*}\ (1.62) & 0.14\ (0.36) & 0.16\ (0.71)\\ 0.01\ (0.21) & 0.16\ (1.11) & 0.07\ (0.79)\\ -0.15^{*}\ (-2.51) & 0.20\ (1.01) & 0.01\ (0.06)\end{bmatrix}\begin{bmatrix}\Delta m_{t-5}\\ \Delta y_{t-5}\\ \Delta p_{t-5}\end{bmatrix}$$

$$+ \begin{bmatrix}0.03\ (0.26) & -0.03\ (-0.07) & 0.51^{*}\ (2.48)\\ 0.01\ (0.12) & -0.11\ (-0.78) & 0.06\ (0.74)\\ 0.05\ (0.82) & 0.07\ (0.36) & 0.18^{*}\ (1.66)\end{bmatrix}\begin{bmatrix}\Delta m_{t-6}\\ \Delta y_{t-6}\\ \Delta p_{t-6}\end{bmatrix}$$

Where m is the money stock, y refers to real GDP, and p represents CPI price index. * denotes significance at 5% or above.

Chart 1. M2 and GDP

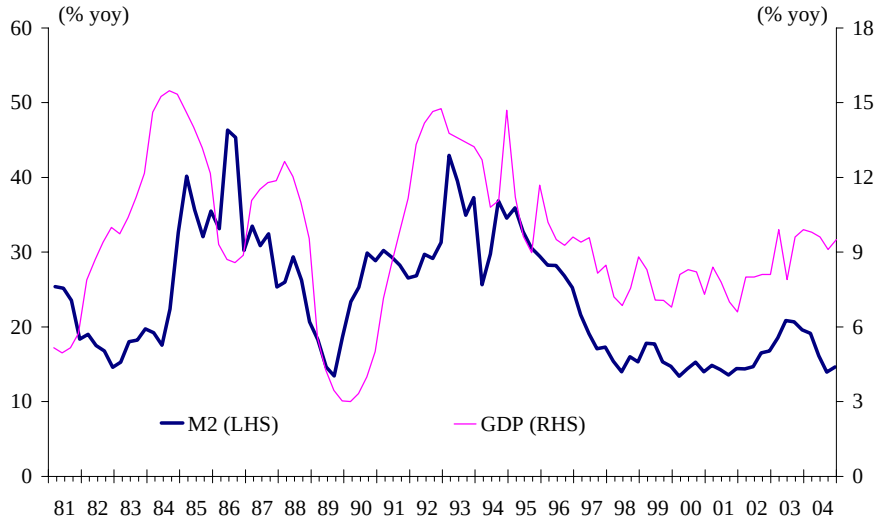


Chart 2. M2 and Inflation

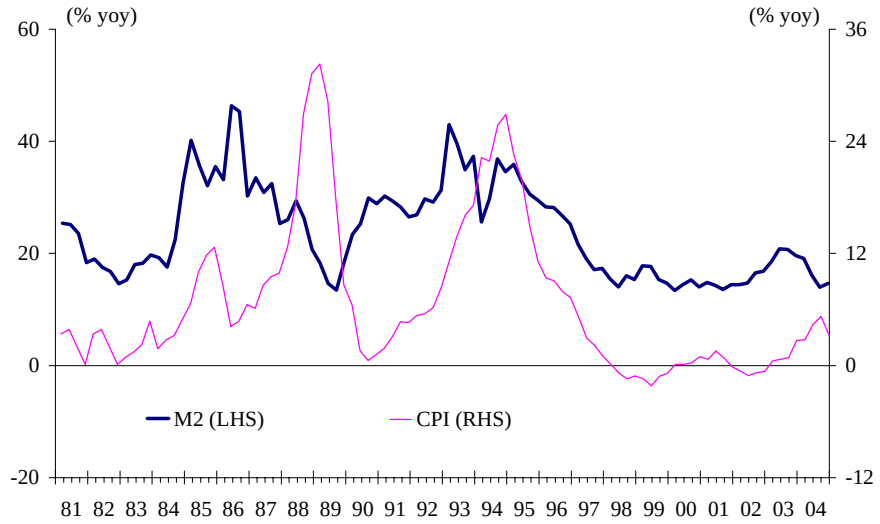


Chart 3. Different Measures of Inflation

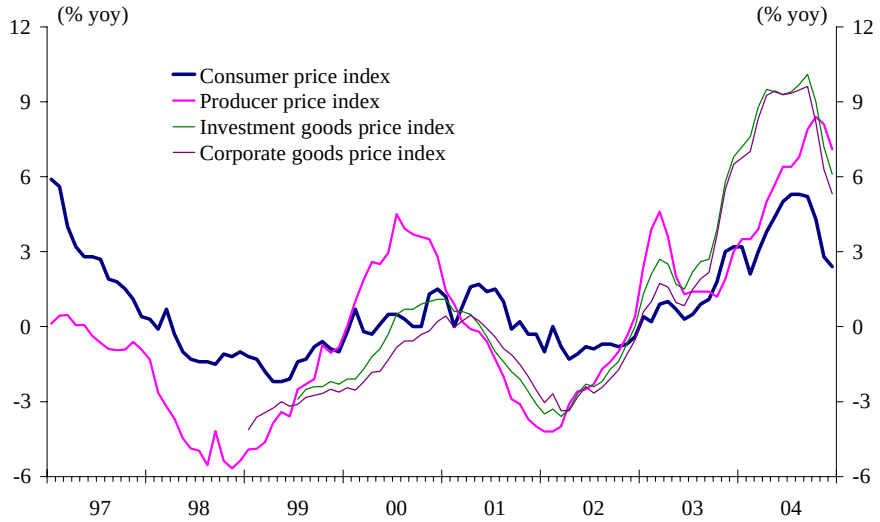


Chart 4. Money and Credit

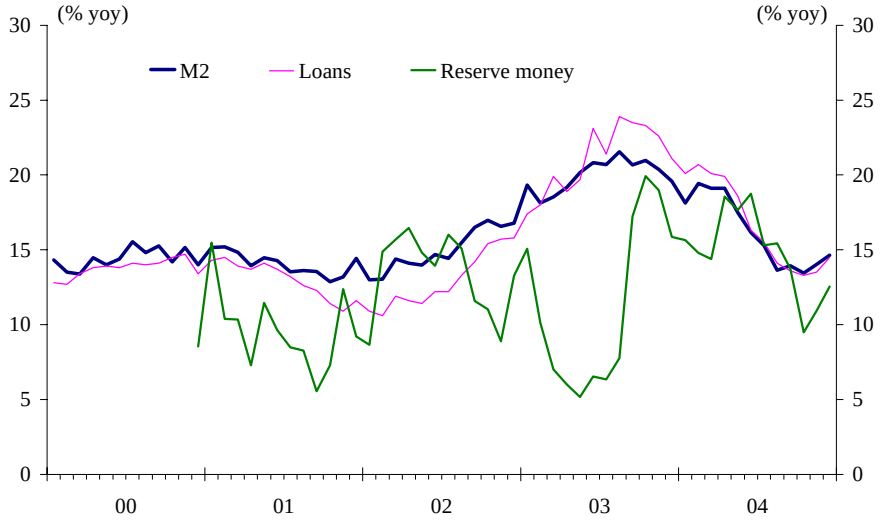


Chart 5. M2 and Velocity

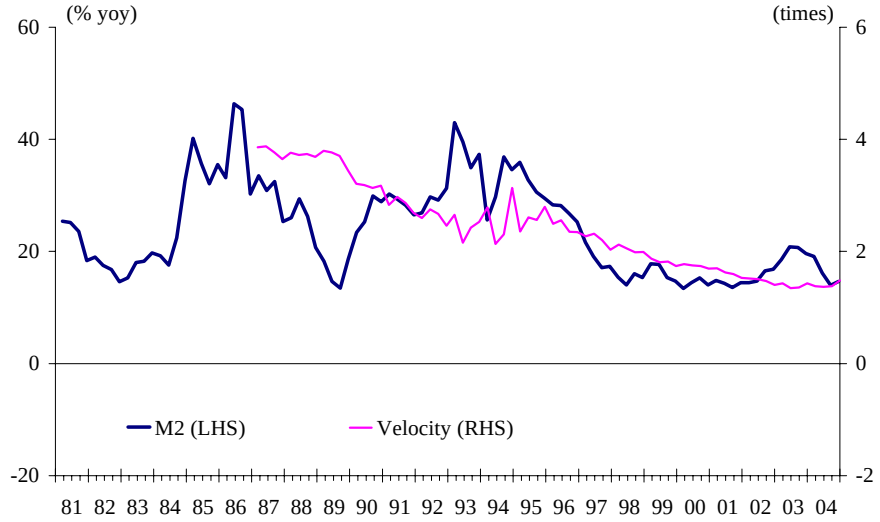


Chart 6. Velocity of M2 in Selected Countries

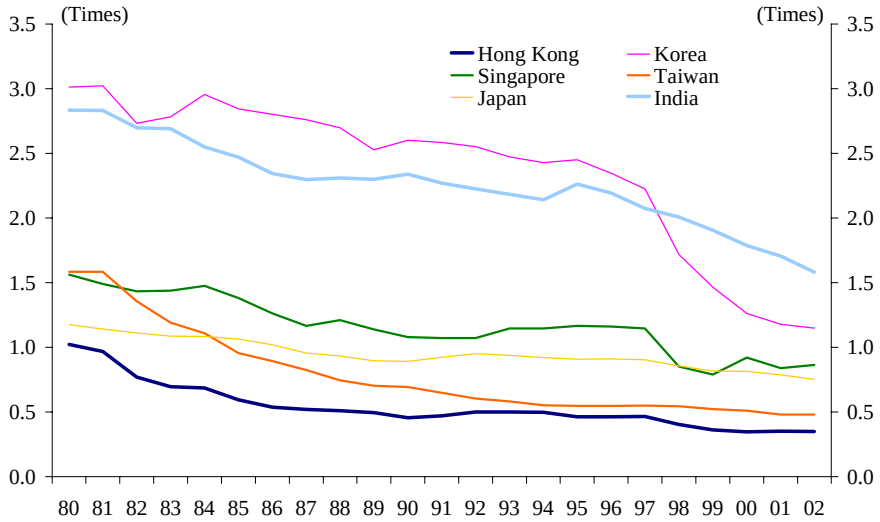


Chart 7. Money Gap and Inflation

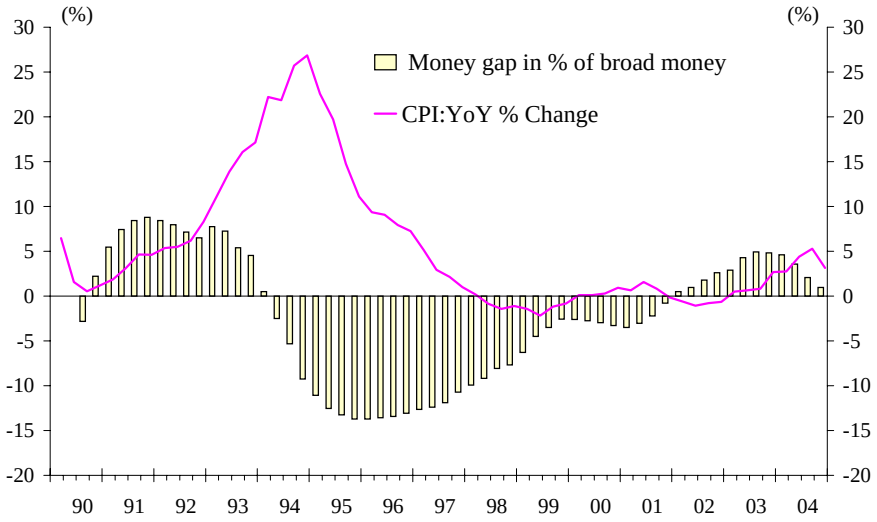


Chart 8. Impulse Responses

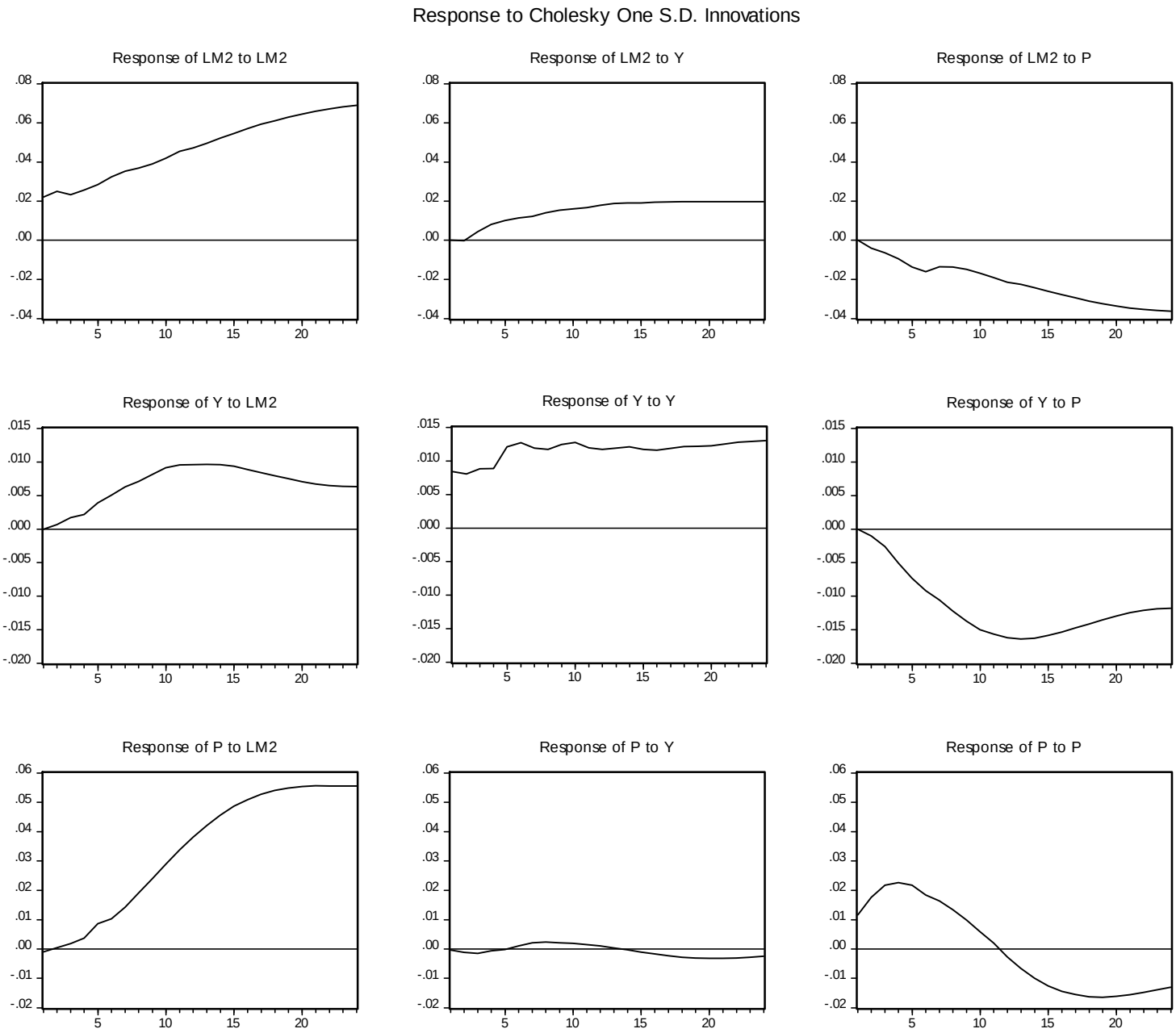


Chart 9. Sources of inflation

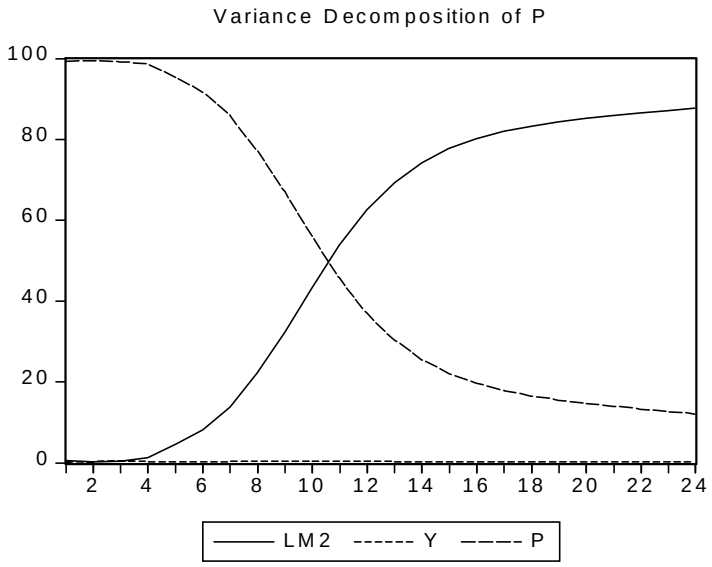
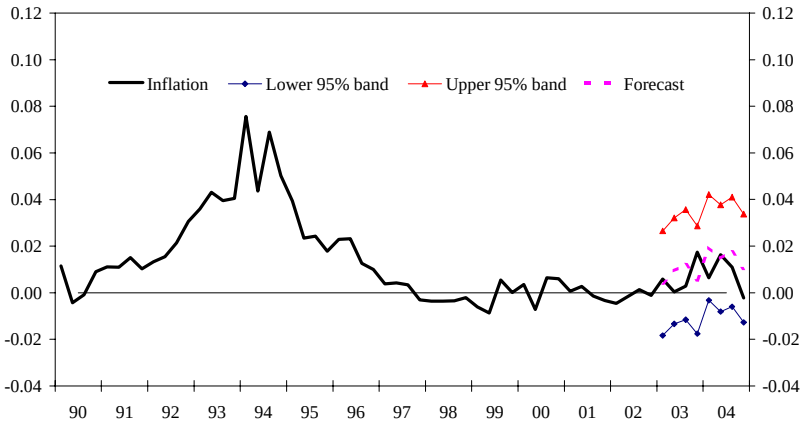


Chart 10. In- sample inflation forecast



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