A New Monetary Conditions Index: An Empirical Test Using US and HK Data

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I. Introduction

Mishkin(1999) discussed four monetary policy regimes, namely exchange rate targeting, monetary targeting, inflation targeting, and finally, an eclectic approach that considers the overall macroeconomic conditions and then decides if the monetary brakes should be stepped on or relieved. *Exchange rate targeting* refers to a monetary system that ties the domestic currency to some anchor currency such as the US dollar. An example would be the Hong Kong dollar since October 17, 1983 and the Argentine peso before it broke away from the US dollar link early 2002. *Monetary targeting* refers to a policy of managing some monetary aggregate such as M2 in an attempt to contain its growth within a target range. Adherents of this approach include Germany before the European monetary union and Switzerland. *Inflation targeting* is a monetary regime that has gained much popularity in recent years. Pioneered by New Zealand in 1990, it has now been espoused by Canada, the United Kingdom, Sweden, Finland, Australia, and Spain, among others. According to Mishkin, Israel and Chile have also adopted some form of inflation targeting. Ito and Hayashi(2004) reported that "The experience of inflation targeting in Korea, Thailand, Indonesia, and the Philippines has been a positive one."(p.2) Finally, monetary policy in the US under the leadership of Alan Greenspan has adopted an eclectic approach. Without any explicit target, the Fed would look at a range of macroeconomic indicators in its deliberation of monetary policy, while reminding the public that containing inflation over the long run remains always an overriding concern.

Of these four approaches, the first three can be said to be predominantly "rule-based." In contrast, the last approach can be said to be predominantly discretionary.[1] Traditionally economists are wary of discretionary monetary policy because it is uncertain if central bankers can read and interpret the signs correctly and to respond in an appropriate way. As it happens, a monetary conditions index target that is based on a range of macroeconomic indicators could transform the "eclectic approach" into a rule-based policy and thus eliminate this uncertainty. As a corollary, if and when the monetary conditions index has deviated from the target, one could tell if the monetary policy in practice has been too tight or too loose and by how much.

Section II will lay out the theoretical framework laying out conceptual basis for the proposed monetary conditions index. An examination of the determinants of the monetary conditions index suggests that it is strikingly similar to the "financial conditions index" (Goodhart and Hofmann, 2002, Lack, 2003, Gauthier, Graham, and Liu, 2004) that is discussed in the more recent literature even though it is derived from an altogether different approach. Because the proposed index compensates for the effects of changing financial market conditions, the monetary conditions index herein proposed will be called a *compensated* monetary conditions index. The approach proposed in this paper is then compared to the approach used by Gauthier, Graham and Liu(2004) and Goodhart and Hofmann(2002). Section III and Section IV will then present the empirical results we have estimated for the United States. Finally Section VI will draw the conclusions from this analysis.

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[1] Some see this eclectic monetary policy as more or less described by the Taylor rule(Taylor, 1993). See Woodford(2001). Also see Carlstrom and Fuerst(2003) for a more recent assessment.

II. Theoretical Framework

We start with the gross national product income identity:

$$GDP \equiv Yd + T - B' \quad [1]$$

In words, GDP is identically equal to disposable incomes(Yd) plus net (direct) taxes(T)[2] minus interest payment on government debt(B) paid domestically. When aggregate demand is in equilibrium, income must be equal to expenditures, so we have:

$$Yd + T - B' = C + I + G + X - M \quad [2]$$

This has been called the Keynesian cross condition for aggregate demand equilibrium. This terminology is actually quite misleading, because it is really aKeynesian—i.e., it is acceptable to Keynesians and non-Keynesians alike. [2] can be transposed to obtain:

$$T - G - B' = I - S - (M - X) \quad [3].$$

The left side may be interpreted as net government savings, but does not correspond exactly to the government budget surplus as reported, because T does not include indirect taxes and revenues from asset sales. Moreover, B' is, for countries such as the US whose government borrows from abroad, smaller than total interest payment on government debt. Still, [3] represents an alternative way of representing aggregate demand determination and can be depicted by the intersection of GS and PD lines in the following diagram:

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[2] Indirect taxes are included in the prices of final goods and constitute part of consumption or investment spending.

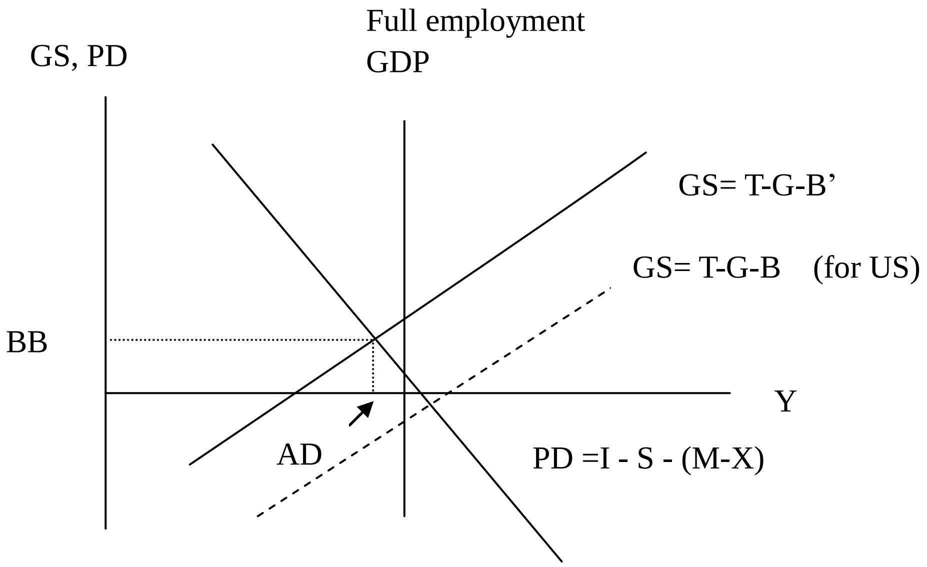

Figure 1: Determination of Equilibrium Aggregate Demand(AD) and Budget Balance(BB) Relative to Full Employment Output

Excess of direct tax revenues (net of transfers) T over government expenditures is by definition government savings. When aggregate demand is in equilibrium Government Savings (GS) = Private Sector Savings Deficiency (PD). If private domestic savings (S) plus foreigners' savings (M-X) cannot meet investment requirements the gap is Private Sector Savings Deficiency(PD). **Figure 1** shows how the intersection of GS and PD determines the level of equilibrium aggregate demand (AD) and the fiscal budget balance(BB)[3].

Proposition 1: *The Keynesian cross diagram can be re-arranged to show in one diagram both the determination of equilibrium aggregate demand and the incidental fiscal position.*

[3] Again interpreted cautiously as advised in the previous footnotes.

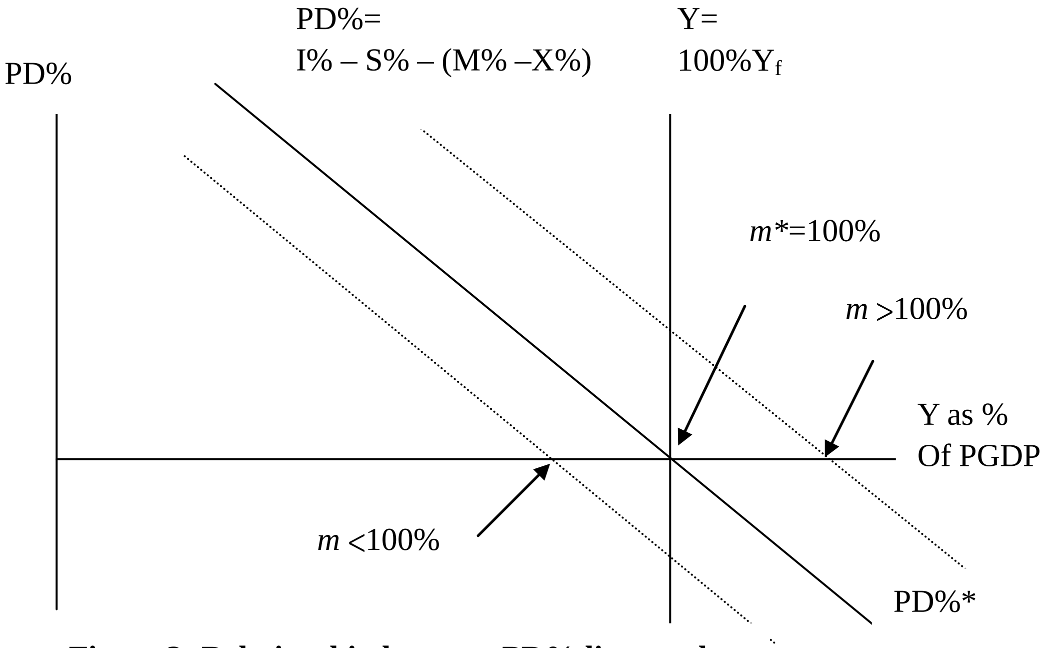

Figure 2: Relationship between PD% lines and Monetary Conditions *m*

Figure 2 expresses the same relations in ratio form. The horizontal axis is GDP expressed **as percentage of the potential GDP**, while all the key variables, namely I, S, X, and M are divided by the GDP and drawn against GDP as a percentage of potential GDP. It is clear that there is a unique position of the PD% line such that PD% = 0 AND Y = 100% potential GDP. This line has great significance, as it offers the potential for simultaneous achievement of a balanced fiscal budget AND full employment, provided that the fiscal policy line GS% is also "well behaved," in the sense of passing the horizontal axis at 100% PGDP.[4] The PD% line may of

[4] Admittedly there is some oversimplification here. In the presence of indirect taxes and additional operational revenues other than direct taxes, PD% should be positioned higher than this to achieve full employment, implying a more expansionary monetary policy would be appropriate, relative to what is required in the absence of such taxes. But that would bring about a surplus. Government expenditures would need to be higher and monetary conditions would need to be more restrictive to have balanced budget and full employment. *For simplicity of the argument, these alternative revenue*

course cut the horizontal axis to the left or to the right of the 100% potential GDP line. The monetary conditions index would be below unity in the former case and above unity in the latter case. PD% can be shown to be a function of the real interest rate, the real exchange rate, the "Cycle Rate" defined as GDP as a percentage of potential GDP, the stock price index expressed as a percentage of the GDP index since some base year, the rate of appreciation in the stock price index weighted by stock market participation among the people, rate of growth of OECD countries, etc.

Proposition 3: The compensated monetary conditions index is obtained by solving for the Cycle Rate such that the PD ratio is equal to zero.

The concept of Monetary Conditions Index was originated by the Bank of Canada. According to Freedman (1995) empirically 1 percentage point change in interest rates has about the same effect on aggregate demand as 3 per cent change in the exchange rate. The MCI is therefore an index based on short-term interest rate and the multilateral exchange rate movements suitably weighted. A more recent paper, by Gauthier et.al., extended the concept and proposed using a "financial conditions index"(FCI[5]) that includes asset prices and risks in additional to real interest rates and real exchange rates, "with weights usually derived using an IS-curve-based model to reflect the relative impact of the variables on aggregate demand."(p.22) As shown

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sources are ignored in the rest of the paper.

[5] We call this the augmented or compensated monetary conditions index, or simply the monetary conditions index.

below, both our theoretical and empirical results essentially vindicate this insight.

It should be reiterated that the monetary conditions index will rise, other things being equal, when interest rate falls or when the exchange rate depreciates. But changes in business confidence or consumer confidence, usually reflected by changes in asset prices, would also lead to a change in the index. In principle, some fiscal variables, such as tax rates, will have an impact on savings and investment behavior, and therefore the effective monetary conditions, by shifting PD (Ho, 1993), but we abstract from these complications in this paper.

One unique feature of our proposed approach is to depict monetary conditions as a percentage or rate, with the implication that a monetary conditions index at unity is desirable. Unlike previously reported monetary conditions indices, our approach allows very easy interpretation. As pointed out by Stevens(1998) the traditional MCIs need to be interpreted relative to some "*desired* or optimal MCI path," which will need to be assessed but which may be subject to changes all the time, involving various shocks interacting with one another in a dynamic context. Our approach recognizes that we are indeed dealing with dynamic relationships, but to the extent that all the underlying relationships can be captured by cointegrating equations, and to the extent that the assumed output gaps are valid, then movements do signal relative tightness or looseness around the "desired" unitary value.

Gauthier *et.al.* used the AA corporate bond risk premium or the US high yield bond spread to proxy risks. They adapted the framework from Goodhart and Hofman(2000), which uses a reduced form model with an IS curve that relates the output gap to interest rates, exchange rates, and other asset prices, and a Phillips curve that relates inflation to the output gap. They found FCIs, which have incorporated the effects of asset prices, superior to the earlier MCI that ignores asset prices in forecasting output gaps and output growth. The present paper also incorporates the effects of asset prices, and further takes the potential GDP as exogenous. This is probably reasonable especially when we are considering monetary policy in the short run. In our exercise, however, I have not introduced the tax parameters nor any risk proxy variables into the estimation of the PD% function owing to the complexity of the estimation exercise. Still, the results turn out to be quite intuitive. In particular, in years when the US MCI was 1 or above fiscal positions were strong, suggesting that US fiscal deficits are often related to tight monetary conditions.

III: Results for the United States and Hong Kong

With PD% defined as I/Y - S/Y + X/Y - M/Y, we can estimate the parameters underlying each of these ratios along mainstream economic theory lines. We will first report results for the United States.

Gross private saving/GDP (S/Y) is a function of U.S prime rate (PR), the cycle rate (CYC), and the ratio of the Stock Price Index(Dow Jones) to US GDP Index (both

1970Q4 =100) (SPR). If the interest rate goes up, the opportunity cost of immediate consumption rises, so there is a substitution effect toward future consumption thus raising the savings rate. There is however also an income effect that tends to raise consumption both present and future. However, we expect the substitution effect to dominate. As the economy moves from trough to peak, under the permanent income hypothesis consumption would rise at a rate lower than GDP, so the effect of the "cycle rate" on savings is expected to be positive. If stock prices rise faster than the GDP, on the other hand, the wealth effect is expected to reduce the savings rate. In the cointegration test, for the US the nominal prime rate is found to work better than the real prime rate in explaining savings, suggesting that consumers are subject to some form of money illusion and tends to discount the effects of inflation. Another reason may be that CPI inflation may not be offset by wage increases and thus actually raises the cost of spending and undermines consumption.

Gross private investment/GDP (I/Y) is a negative function of the real prime rate (RPR). A higher real interest rate would reduce the present value of an income stream and would thus discourage investment. Since investment is more related to expectations than with current income, as the economy approaches the peak of the economic cycle investment also tends to fall. Here the real prime rate RPR is defined as the prime interest rate (PR) minus inflation expectations, where inflation expectation is estimated as the annualized rate of change in the 3-month moving average of the CPI in the quarter.[6] Along with Tobin's q theory, if stock prices increase we expect investment to go up. For our ratio estimation, we use the stock price index expressed as a percentage of the GDP index since some common base year (i.e., in the base year stock price index = GDP index = 1) to capture this effect.

Total Exports/GDP (X/Y) is a negative function of the real exchange rate (RRER), and a positive function of the OECD real GDP growth.

The computation of the RRER is based on the formula:

$$RRE(iw) = \frac{P_i}{P_w}\frac{e_i'}{e_w'}$$

as proposed by Ho (2010). Here real effective exchange rate is the exchange value of the US dollar relative to the exchange value of a standard currency basket multiplied to the ratio of the US consumer price index to the GDP-weighted average of the consumer price indices (translated to a common currency for comparability) of the countries represented in the standard currency basket. A rise in RRER represents a real appreciation of the currency.

Total Imports/GDP (M/Y) is a function of RRER and CYC. A rise in RRER is expected to increase imports while imports is expected to be negatively related to the cycle rate. The exports ratio falls with currency real appreciation (a rise in RRER) and rises with the growth rate of the GDP of OECD countries.

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[6] If m_i is the moving average for months m_{i-1},m_i, and m_{i+1}, and q_i is the average of m_i in the quarter, inflation expectation is assumed to be equal to $(1+r)^4$ - 1 where r is equal to $q_i – q_{(i-1)}//q_{(i+1)}$.

We compute the PD ratio by combining the above four equations.

$$PD\%_t = I/Y_t - S/Y_t + X/Y_t - M/Y_t \qquad [4]$$

In order to obtain the Monetary Conditions Index (MCI) we set [4] equal to zero and solve for CYC. Before we conduct the cointegration tests, unit root tests are performed. Results of cointegration tests are reported in Table 1.

1) ADF unit root test

Empirical results for variables involved in functions of are reported in Table 2. ADF test shows that the null hypothesis of I(1) series cannot be rejected for all variables I/Y, S/Y, IM/Y, EX/Y. The number of augmented terms included is selected by Akaike Information Criteria (AIC). Computer output is available on request.

2) Johansen and Juselius Cointegration test

As shown in Table 1a and 1b, both TRACE and λmax test statistics indicate 1 or 2 significant cointegrating relations(CR) for all equations for the US and Hong Kong. The null hypothesis of no CR (r=0) is always rejected at the 1% or 5% level, while that of 1 CR ($r \le 1$) is not rejected at various commonly used significance levels. The analysis will proceed assuming only one cointegrating relation.

3) Johansen cointegration relation estimate

Table 2a and Table 2b present the results for the Johansen cointegration relation estimate. All the coefficients are found to carry the expected signs and they are all statistically significant. For the U.S., we have:

Gross private investment function:

$$I/Y_t = 7.37 - 0.0357 * RPR_t - 7.2698 * CYC + 0.1893 * SPR_t + \varepsilon_t$$

[5]

For the savings(ratio) function, we use the interactive variable SPIRC*TREND to capture the fact that participation in the stock market has gone up over the years, so that SPIRC would have a greater impact more recently than in the earlier years. We also found the nominal prime rate works better than the real prime rate in the equation, suggesting that higher inflation will not increase consumption through reducing the real prime rate:

Gross private saving function:

$$S/Y_t = -0.89 + 0.0095 * PR_t + 1.0139 * CYC_t - 0.0188 * SPIRC_t * TREND + \varepsilon_t$$

[6]

Total exports function:

$$X/Y_t = 0.2002 - 0.0015 * RRER_t + 0.0004 * OGDPR_t + \varepsilon_t$$

[7]

Total imports function:

$$M/Y_t = 1.81 + 0.0061 * RER_t - 2.1288 * CYC_t + 0.0169 * PR_t + \varepsilon$$

[8]

Hence the PD% function is derived as I/Y – S/Y + X/Y – IM/Y. After simplifying we obtain:

PD%= (6.6516-0.0357*RPR +0.0079*PR+0.1893*SPR +0.0187*SPIRC*TREND
-0.001504*RRER-0.0061*RER+0.0004*OGDPR)=6.1549*CYC

[9]

Setting equation [9] to zero, we can solve for CYC, and then re-label this as the MCI:

MCIUS= (6.6516-0.0357*RPR +0.0079*PR+0.1893*SPR +0.0187*SPIRC*TREND
-0.001504*RRER-0.0061*RER+0.0004*OGDPR)/6.1549

[10]

Similarly for HK, we have:

Gross private investment function:

$$I/Y_t = 2.8160 - 0.0273 * RPR_t - 2.6557 * CYC + 0.5186 * SPR_t - 0.0044 * TREND_t + \varepsilon_t$$

[5']

For Hong Kong, the form of the gross savings(ratio) function is slightly modified from that of the US. Upon testing, it is found that higher inflation expectation in Hong Kong does increase consumption (reduce savings). This result may have to do with the fact that there is much more variation in the rate of inflation in Hong Kong than in the US:

Gross private saving function:

$$S/Y_t = -4.1539 + 0.0364 * PR_t + 4.4965 * CYC_t - 0.0996 * SPIRC_t * TREND --$$
$$- 0.0254 * INFLEXP_t + \varepsilon_t$$

[6']

The Hong Kong exports(ratio) function differs slightly from that of the US by the presence of a trend variable, which has a significant positive coefficient suggesting that exports rise relative to GDP independently of the real exchange rate or world economic growth.

Total exports function:

$$EX/Y_t = 0.9463 - 0.0185 * RRER_t + 0.1336 * OGDPR_t$$
$$+ 0.0153 * TREND_t + \varepsilon_t$$

[7']

The Hong Kong imports function is found to differ from that of the US importantly in that the real exchange rate is found to be not significant in explaining total imports. This clearly has to do with the fact that much of Hong Kong's imports is exports and thus is influenced by exports, which respond negatively to an appreciation of the real exchange rate:

Total imports function:

$$IM/Y_t = -1.7836 + 5.8267 * CYC_t - 0.3406 * PR_t + \varepsilon_t$$

[8']

Hence the PD function is :

PD%t = (9.6998-0.0272*RPR+0.3042*PR+0.5186*SPR+0.0254*INFEXP

+0.0996*SPIRC*TREND+0.011*TREND-0.0185*RRER+0.1335*OGDPR)

=12.9789*CYC

[9']

Again, setting PD% equal to 0, and solving for CYC and simplifying gives us the MCI for Hong Kong:

MCIHK= (9.6994-0.0272*RPR+0.3042*PR+0.0254*INFEXP +0.5186*SPR

+0.0996*SPIRC*TREND +0.0110*TREND-0.0185*RRER+0.1335*OGDPR)

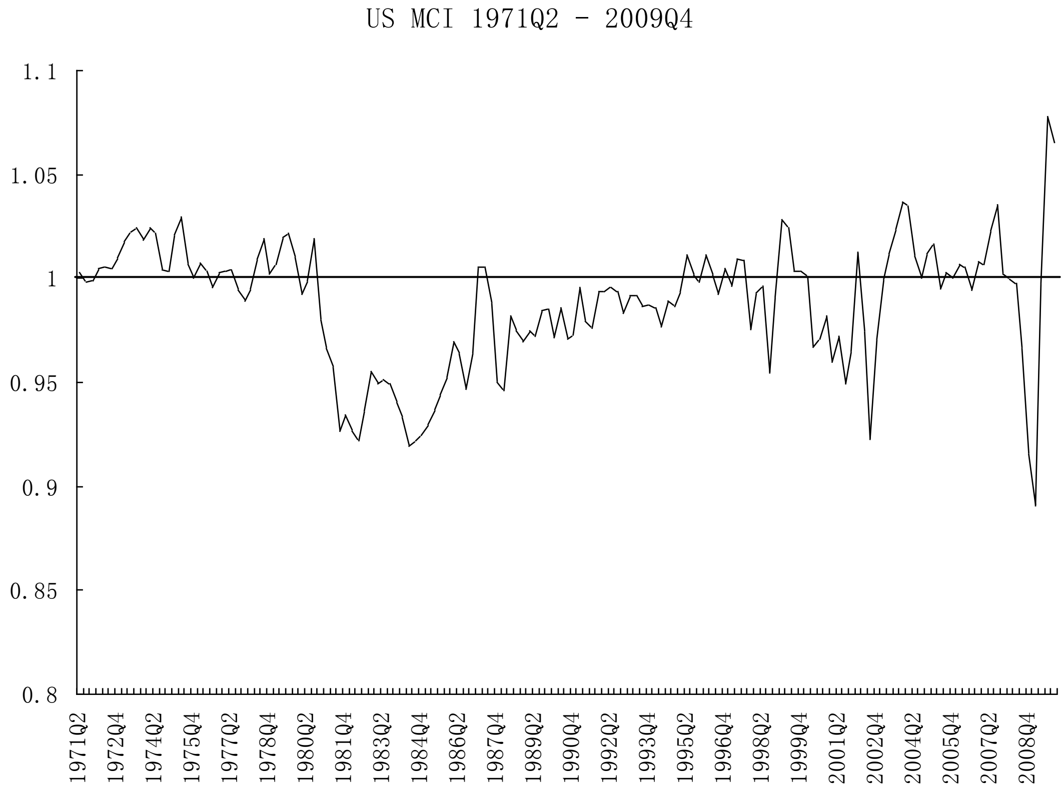
/12.9789

[10']

As it turns out, for the United States, the effects of an interest rate change on the monetary conditions index is more than seven times the effects of an exchange rate change.

Figure 3: Augmented Monetary Conditions Index for the United Stated

US MCI 1971-2009Q4



It is interesting to note that the US runs a relatively balanced budget during all those episodes when the MCI is around unity, i.e., 1973-74, 1978-1979, and 1999-2000. It is also interesting to note that as the MCI drops below unity the US fiscal deficit typically deteriorates. Apparently in recent years US monetary policy conditions had been *too tight while fiscal conditions had been too loose.*

Figure 3: Augmented Monetary Conditions Index for Hong Kong MCI 1984-2009Q4

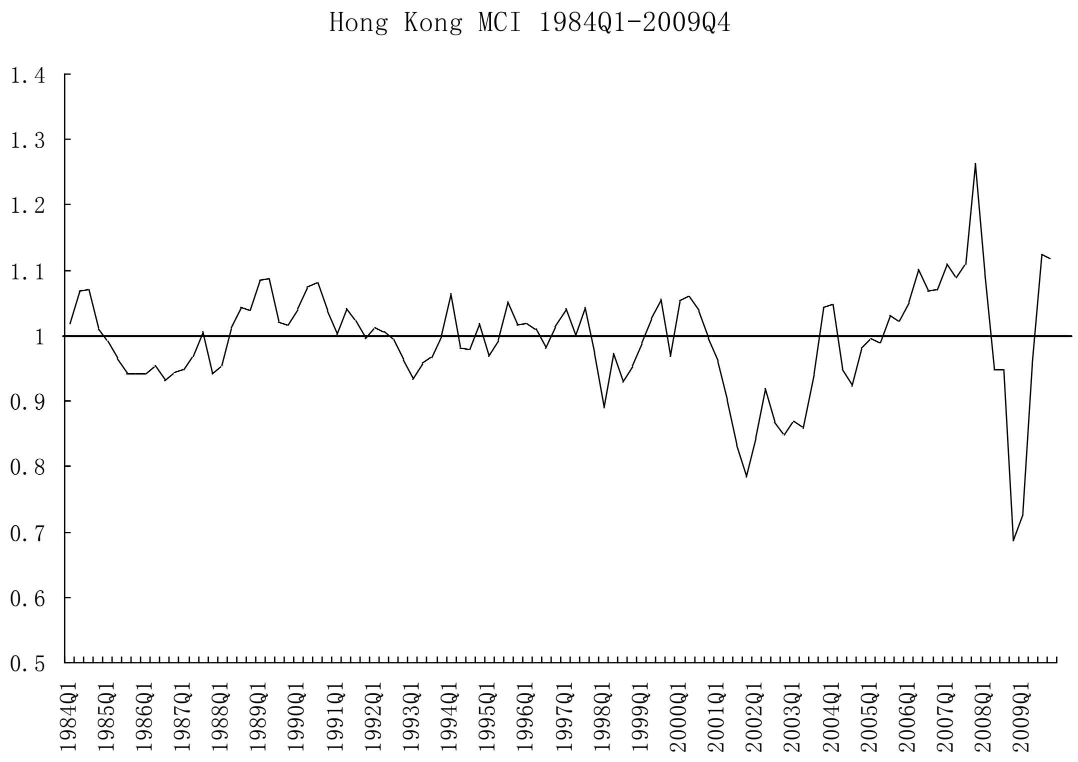


Table 1a. Johansen cointegrating test result (Period 1970Q4 to 2009Q4) US

Variables	Null Hypothesis	Alternative Hypothesis	Test Statistics	Prob
I/Y, RPR, CYC, SPR	Trace tests:		Trace Value	
	r > 0	r > 0	50.46**	0.0278
	r > 1	r > 1	24.45	0.1817
	λ max tests:		λ max Value	
	r = 0	r = 1	26.00*	0.0784
	r = 1	r = 2	15.71	0.2424
S/Y, PR, CYC, SPIRC*TREND	Trace tests:		Trace Value	
	r > 0	r > 0	134.43***	0.0000
	r > 1	r > 1	38.07***	0.0045
	λ max tests:		λ max Value	
	r = 0	r = 1	96.36***	0.0000
	r = 1	r = 2	21.36**	0.0464
M/Y, RER, PR, CYC	Trace tests:		Trace Value	
	r > 0	r > 0	70.84***	0.0001
	r > 1	r > 1	25.09	0.1261
	λ max tests:		λ max Value	
	r = 0	r = 1	44.75***	0.0001
	r = 1	r = 2	17.04	0.1699
X/Y, RRER, OGDPR	Trace tests:		Trace Value	
	r > 0	r > 0	53.16***	0.0000
	r > 1	r > 1	19.07**	0.0138
	λ max tests:		λ max Value	
	r = 0	r = 1	34.09***	0.0005
	r = 1	r = 2	19.05***	0.0081

Notes:
1. ***, ** denotes significance at 1% & 5% level respectively 2. r indicates the number of cointegrating vectors. 3.Number of Lag in VAR is determined by AIC criterion

Table 1b. Johansen cointegrating test result (Period 1984Q1 to 2009Q4) Hong Kong

Variables	Null Hypothesis	Alternative Hypothesis	Test Statistics	Prob
I/Y, RPR, CYC, SPR	Trace tests:		Trace Value	
	r > 0	r > 0	61.77*	0.0742
	r > 1	r > 1	31.51	0.4155
	λ max tests:		λ max Value	
	r = 0	r = 1	30.27*	0.0826
	r = 1	r = 2	15.69	0.5724
S/Y, PR, CYC, SPIRC*TREND, INFEXP	Trace tests:		Trace Value	
	r > 0	r > 0	118.30***	0.0000
	r > 1	r > 1	58.37***	0.0038
	λ max tests:		λ max Value	
	r = 0	r = 1	59.93***	0.0000
	r = 1	r = 2	29.67**	0.0266
M/Y, PR, CYC	Trace tests:		Trace Value	
	r > 0	r > 0	28.76*	0.0665
	r > 1	r > 1	9.87	0.2904
	λ max tests:		λ max Value	
	r = 0	r = 1	18.88*	0.1004
	r = 1	r = 2	9.56	0.2425
X/Y, RRER, OGDPR,	Trace tests:		Trace Value	
	r > 0	r > 0	64.81***	0.0001
	r > 1	r > 1	23.09	0.1069
	λ max tests:		λ max Value	
	r = 0	r = 1	41.72***	0.0002
	r = 1	r = 2	20.69**	0.0322

Notes:
1. ***, ** denotes significance at 1% & 5% level respectively 2. r indicates the number of cointegrating vectors. 3.Number of Lag in VAR is determined by AIC criterion

Table 2a. Normalized long-run cointegrating coefficients and test of restrictions -US

	I/Y	S/Y	EX/Y	IM/Y
	1	1	1	1
Constant	-7.3727	0.8880	-0.2002	-1.8094
PR	-	-0.0096*** (-3.8403)	-	0.0169*** (4.7919)
RPR	0.0358*** (4.0443)	-	-	-
CYC	7.2698*** (3.5552)	-0.1014* (-1.7399)	-	2.1288** (2.6682)
SPR	-0.1894** (-2.0864)	-	-	-
SPIRC*TREND		0.0188*** (11.1670)	-	-
RER			-	-0.0169*** (-5.0642)
RRER	-	-	0.0015*** (6.7127)	
OGDPR	-	-	-0.0004*** (-6.0427)	-

Notes:

1. *** and ** denote significance at 1% and 5% level respectively.
2. optimal lags are determined by AIC criterion.
3. I/Y and S/Y each are cointegrated with 1 r. X/Y and IM/Y are in one VECM model with 2 cointegrating relations with restriction based on theory.

Table 2b. Normalized long-run cointegrating coefficients and test of restrictions –Hong Kong

	I/Y	S/Y	EX/Y	IM/Y
	1	1	1	1
Constant	-2.8161	4.1539	-0.9463	1.7836
PR	-	-0.0464 (-1.5479)**	-	0.3406*** (5.2605)
RPR	0.0273*** (4.0135)	-	-	-
CYC	2.6558*** (3.6196)	-4.4965 (-3.5600)	-	-5.8267 (-1.9131)**
SPR	-0.5186*** (-5.2069)	-		
SPIRC*TREND		0.0996 (7.8516)***	-	-
INFEXP		0.0254 (2.4949)*		
RRER	-	-	0.0185*** (9.6183)	-
OGDPR	-	-	-0.1336*** (-7.0914)	-
TREND	0.0044*** (3.8502)	-	-0.0015*** (-14.8894)	-

Notes:

1. *** and ** denote significance at 1% and 5% level respectively.
2. optimal lags are determined by AIC criterion.
3. I/Y and S/Y each are cointegrated with 1 r. X/Y and IM/Y are in one VECM model with 2 cointegrating relations with restriction based on theory.

IV: Conclusions

The empirical tests for in-sample produced very intuitive results both for the US and for Hong Kong. For the US, there was a gigantic "monetary trough" from 1981 through 1986, coinciding with the Volcker monetary squeeze and a huge surge in the US fiscal deficit. Monetary conditions improved noticeably after the Plaza Accord for the US, and the 1987 stock market crash did lead to a plunge in the MCI, but only for a little while. Aggressive easing soon brought the MCI back on track to normalization, paving the way for a budgetary surplus and apparently sustainable economic boom during the Clinton years. The burst of the dotcom bubble and the financial tsunami were two episodes seeing major plunges in the MCI. The latest plunge due to the financial tsunami was the most serious ever, but the rebound was equally spectacular, bringing the economy back to life after a close call to depression.

The results for Hong Kong are also interesting. There was a monetary trough mirroring that of the US, and also a notable decline after the 1987 stock market crash, and then a similar recovery in the MCI similar to that of the US, only stronger. What is surprising, however, is that the decline in the MCI immediately after the Asian Financial Crisis was not nearly as deep and as long as that from 2001-2003. But very aggressive fiscal spending helped push economic growth to positive territory despite the monetary conditions. The surge in effective monetary conditions in 2006 and 2007 was quite spectacular, as was the plunge after 2008 and the rebound in 2009. The surge in monetary conditions prior to 2008 is unsustainable and would definitely point to inflation. The plunge following the global financial crisis broke all records and would predict a severe recession that did occur. The surprising thing is that the recession was actually milder than that in 1998 following the AFC. This suggested a need for alternative explanations for the deep recession of 1998, as suggested in Ho and Wong(2006, 2008, 2009). The rapid rebound in the MCI in 2009 meant that the recession though deep was short.

With the MCI equations estimated, it is straightforward to plug in the requisite variables to estimate current MCI in the out-of-sample period. This largely suggested a slowdown in early 2010 followed by a pick up in the second half of the year. As US and Hong Kong enter 2011, MCIs are well in the expansionary territory, paving the way for continued solid growth in 2011.

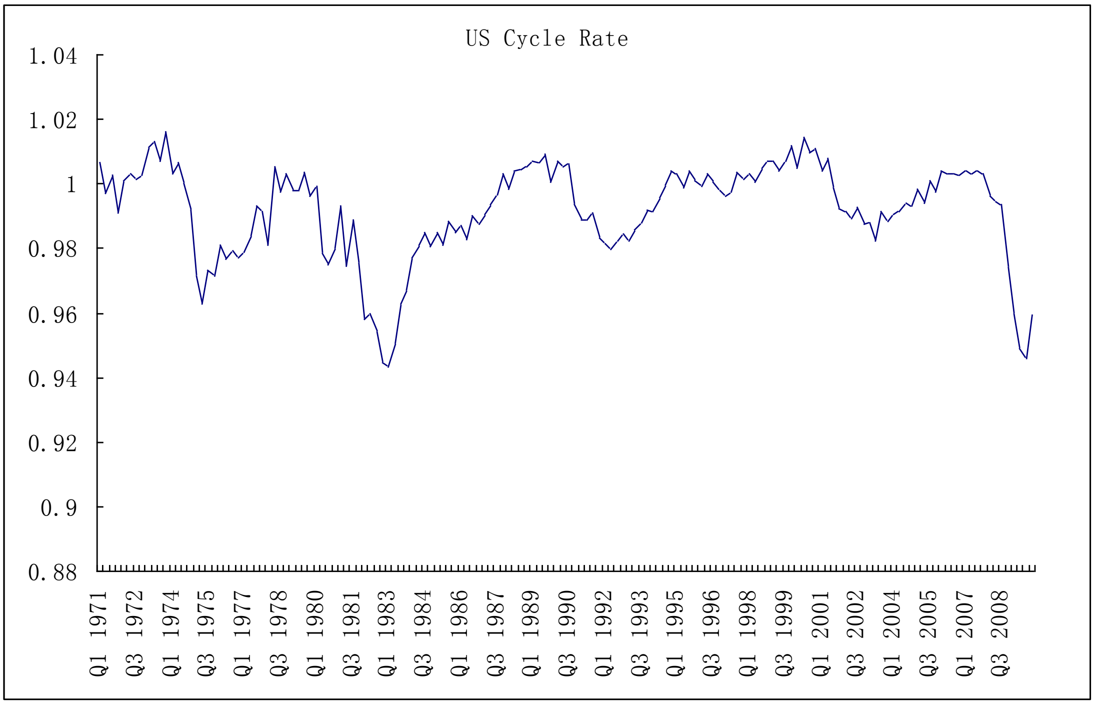
Appendix Data source

All quarterly data are averaged 3 months data for a quarter if the original came from monthly data.

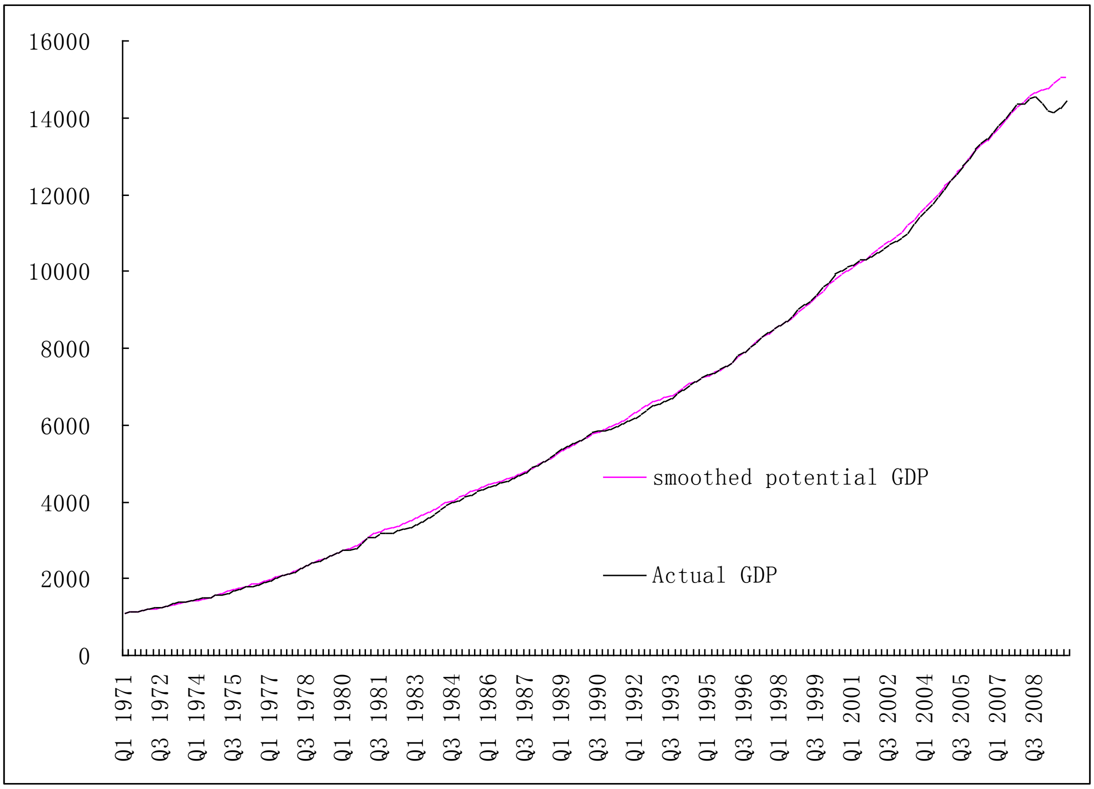
Variable	Description	Data source
I	Gross private investment, Current price, SA US$ Billion	Bureau of Economic Analysis, U.S. Department of Commerce Census & Statistics Dept, HKSAR
S	Gross private saving, Current price, SA, US$ Billion	Bureau of Economic Analysis, U.S. Department of Commerce Census & Statistics Dept, HKSAR
IM	Imports of goods and services, Current price, SA, US$ Billion	Bureau of Economic Analysis, U.S. Department of Commerce Census & Statistics Dept, HKSAR
X	Exports of goods and services, Current price, SA, US$ Billion	Bureau of Economic Analysis, U.S. Department of Commerce Census & Statistics Dept, HKSAR
GDP	Gross domestic product, Current price, SA, US$ Billion	Bureau of Economic Analysis, U.S. Department of Commerce Census & Statistics Dept, HKSAR
OGDPR	OECD GDP Volume Index, quarter to quarter change, per cent, at annual rate	obtained from Datastream
CYC	Cycle Rate, full employment =1	Estimated based on Actual GDP and Unemployment Data Output Gap date from HKIMR for HK And from Congressional Budget Office
SPR	Stock Price Index /GDP Index 1970Q4=100	U.S. Dow Jones Industrial Average Stock Index http://www.forecasts.org/data/data/djiaM.htm

		Hang Seng Index: obtained from datastream
SPIRC	Quarter-to-Quarter Change in 2-quarter moving average of the Stock Price Index, per cent, at annual rate	U.S. Dow Jones Industrial Average Stock Index http://www.forecasts.org/data/data/djiaM.htm
		Hang Seng Index: obtained from datastream
RPR	PR – Inflation expectation, per cent	Inflation expectation: annualized rate of quarterly change in moving average of 3 months US CPI
PR	U.S. Bank Prime Loan Rate, per cent	http://www.forecasts.org/data/data/MPRIME.htm
INFEXP	Inflation Expectation, per cent	Inflation expectation: annualized rate of quarterly change in moving average of 3 months Hong Kong CPI
RRER	Real Relative Exchange Rate Index 2000=100	Centre for Public Policy Studies, Lingnan University

Appendix 1. US Cycle Rate



Appendix 2 Potential and Actual GDP (US Billions)



Appendix 3- Figures for US MCI

1971Q2	1.00265	1986Q1	0.96967	2000Q4	0.981895
1971Q3	0.998299	1986Q2	0.963477	2001Q1	0.959771
1971Q4	0.999027	1986Q3	0.946775	2001Q2	0.972453
1972Q1	1.004903	1986Q4	0.964187	2001Q3	0.949612
1972Q2	1.005711	1987Q1	1.005725	2001Q4	0.964827
1972Q3	1.004701	1987Q2	1.005421	2002Q1	1.012896
1972Q4	1.010216	1987Q3	0.988145	2002Q2	0.973818
1973Q1	1.018146	1987Q4	0.949807	2002Q3	0.922796
1973Q2	1.022258	1988Q1	0.94627	2002Q4	0.970958
1973Q3	1.024119	1988Q2	0.981949	2003Q1	0.999461
1973Q4	1.018367	1988Q3	0.974514	2003Q2	1.012099
1974Q1	1.024382	1988Q4	0.969788	2003Q3	1.023376
1974Q2	1.021776	1989Q1	0.974489	2003Q4	1.036578
1974Q3	1.003899	1989Q2	0.972403	2004Q1	1.034855
1974Q4	1.003202	1989Q3	0.984589	2004Q2	1.010886
1975Q1	1.021293	1989Q4	0.984932	2004Q3	1.000252
1975Q2	1.029585	1990Q1	0.971687	2004Q4	1.012111
1975Q3	1.006754	1990Q2	0.986126	2005Q1	1.01655
1975Q4	1.000205	1990Q3	0.970666	2005Q2	0.994674
1976Q1	1.007328	1990Q4	0.973054	2005Q3	1.002859
1976Q2	1.003602	1991Q1	0.995684	2005Q4	1.000194
1976Q3	0.995956	1991Q2	0.979091	2006Q1	1.006901
1976Q4	1.002721	1991Q3	0.976132	2006Q2	1.00571
1977Q1	1.003373	1991Q4	0.99339	2006Q3	0.994475
1977Q2	1.003966	1992Q1	0.993719	2006Q4	1.007801
1977Q3	0.994333	1992Q2	0.995705	2007Q1	1.006773
1977Q4	0.989293	1992Q3	0.993966	2007Q2	1.023052
1978Q1	0.994836	1992Q4	0.983024	2007Q3	1.035632
1978Q2	1.009164	1993Q1	0.99157	2007Q4	1.00211
1978Q3	1.018836	1993Q2	0.991563	2008Q1	0.999261
1978Q4	1.002199	1993Q3	0.986739	2008Q2	0.997628
1979Q1	1.006697	1993Q4	0.987336	2008Q3	0.966165
1979Q2	1.019908	1994Q1	0.98561	2008Q4	0.915327
1979Q3	1.021714	1994Q2	0.976804	2009Q1	0.890892
1979Q4	1.009766	1994Q3	0.989045	2009Q2	0.997707
1980Q1	0.992241	1994Q4	0.986485	2009Q3	1.077666
1980Q2	0.998993	1995Q1	0.993581	2009Q4	1.064853
1980Q3	1.018946	1995Q2	1.011533		
1980Q4	0.979687	1995Q3	1.001768		
1981Q1	0.966565	1995Q4	0.99827		
1981Q2	0.957184	1996Q1	1.011446		
1981Q3	0.926256	1996Q2	1.001673		

1981Q4	0.934164	1996Q3	0.992334
1982Q1	0.926375	1996Q4	1.004915
1982Q2	0.9222	1997Q1	0.996151
1982Q3	0.936153	1997Q2	1.009457
1982Q4	0.955208	1997Q3	1.008534
1983Q1	0.949287	1997Q4	0.975681
1983Q2	0.951237	1998Q1	0.992721
1983Q3	0.949053	1998Q2	0.996152
1983Q4	0.940084	1998Q3	0.954267
1984Q1	0.933304	1998Q4	0.991023
1984Q2	0.919606	1999Q1	1.028236
1984Q3	0.921813	1999Q2	1.024561
1984Q4	0.924453	1999Q3	1.003534
1985Q1	0.92947	1999Q4	1.003354
1985Q2	0.937013	2000Q1	1.000939
1985Q3	0.943915	2000Q2	0.966642
1985Q4	0.952559	2000Q3	0.970859

Appendix 3- Figures for HK MCI

1984Q1	1.017922	1994Q1	1.063667	2004Q1	1.048041
1984Q2	1.06804	1994Q2	0.980397	2004Q2	0.948307
1984Q3	1.070365	1994Q3	0.978209	2004Q3	0.922225
1984Q4	1.00914	1994Q4	1.017945	2004Q4	0.980256
1985Q1	0.992424	1995Q1	0.969295	2005Q1	0.99628
1985Q2	0.964986	1995Q2	0.993124	2005Q2	0.99005
1985Q3	0.941353	1995Q3	1.051822	2005Q3	1.030967
1985Q4	0.942495	1995Q4	1.015879	2005Q4	1.023362
1986Q1	0.941207	1996Q1	1.018804	2006Q1	1.052123
1986Q2	0.954579	1996Q2	1.010466	2006Q2	1.101359
1986Q3	0.931055	1996Q3	0.982086	2006Q3	1.067564
1986Q4	0.943215	1996Q4	1.014183	2006Q4	1.07119
1987Q1	0.947124	1997Q1	1.041237	2007Q1	1.108716
1987Q2	0.968104	1997Q2	0.998766	2007Q2	1.089079
1987Q3	1.006841	1997Q3	1.044051	2007Q3	1.108904
1987Q4	0.941959	1997Q4	0.973341	2007Q4	1.263199
1988Q1	0.953365	1998Q1	0.889816	2008Q1	1.095027
1988Q2	1.011247	1998Q2	0.972838	2008Q2	0.948608
1988Q3	1.042802	1998Q3	0.92893	2008Q3	0.948696
1988Q4	1.039512	1998Q4	0.954617	2008Q4	0.687665
1989Q1	1.084273	1999Q1	0.989035	2009Q1	0.72841
1989Q2	1.087013	1999Q2	1.027448	2009Q2	0.957697
1989Q3	1.020903	1999Q3	1.054789	2009Q3	1.124097
1989Q4	1.017136	1999Q4	0.968038	2009Q4	1.117812
1990Q1	1.04183	2000Q1	1.054604		
1990Q2	1.0741	2000Q2	1.060697		
1990Q3	1.081649	2000Q3	1.036538		
1990Q4	1.037399	2000Q4	0.994938		
1991Q1	1.002839	2001Q1	0.961343		
1991Q2	1.040601	2001Q2	0.899316		
1991Q3	1.022023	2001Q3	0.831815		
1991Q4	0.994947	2001Q4	0.784845		
1992Q1	1.012125	2002Q1	0.843616		
1992Q2	1.00702	2002Q2	0.918452		
1992Q3	0.993891	2002Q3	0.866302		
1992Q4	0.963086	2002Q4	0.848597		
1993Q1	0.933183	2003Q1	0.869087		
1993Q2	0.958698	2003Q2	0.858692		
1993Q3	0.966655	2003Q3	0.942305		
1993Q4	1.000011	2003Q4	1.043468		

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