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# Monetary Control Without a Central Bank: The Case of Hong Kong

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*The traditional critique of the "real bills" doctrine argues that the price level may be unstable in a monetary regime without a central bank and a market-determined money supply. Hong Kong's experience suggests this problem may not arise in a small open economy.*

In our century, it is generally assumed that monetary control exerted by central banks is necessary to prevent excessive money creation and to achieve price stability. More recently, in the 1970s, this assumption is evident in policymakers' concern that financial innovations have eroded monetary controls. In particular, the proliferation of market-created substitutes for money not directly under the control of monetary authorities has led Phillip Cagan (1979) to argue for regulatory reform:

New financial developments may make the past degree of monetary control increasingly more difficult to maintain. Yet pursuit of national policies to restrain inflation and stabilize economic activity appears impossible without effective monetary controls. The creation of a regulatory environment in which the erosion of monetary controls is kept to a minimum is particularly important in the present period of rampant inflation.

While this statement reflects the mainstream view today, it has not always been obvious that the government, rather than the market, should determine the money supply. A market-determined money supply is traditionally associated with the long discredited "real bills" doctrine. This doctrine

proposed that the money supply and inflation could successfully be controlled by the market, without central bank control of the monetary base, as long as banks limited their credit to "satisfy the needs of trade".

The real bills doctrine was severely criticized on the belief that it could lead to instability in the price level. However, a number of leading economists such as Fama (1980) and Sargent and Wallace (1982, 1983) have recently argued in favor of regimes where the money supply is market-determined.

In this respect, Hong Kong provides an interesting example of an economy where there is no central bank, and where, to the extent possible, central banking functions are minimized. Thus, it provides a unique opportunity for ascertaining whether a market-determined money supply is consistent with overall macroeconomic stability, particularly stability in the price level.

Section I reviews the real bills doctrine and discusses how it may be feasible in a small open economy even if it may lead to price instability in a closed economy. The discussion identifies certain testable features that distinguish a stable monetary regime from an unstable one. These features form the basis for an empirical test on the stability of Hong Kong's monetary system in a later section.

Section II discusses three key features of Hong Kong's monetary sector typically believed to influence money creation and monetary control: (1) the note issuance mechanism under fixed and floating

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exchange rates, (2) the interest-setting agreement of the Hong Kong Association of Banks, and (3) liquidity ratios. Section III reviews Hong Kong's macroeconomic performance and includes an empirical test of the stability of Hong Kong's monetary system under floating exchange rates as well as a discussion of exchange rate stability.

The paper concludes that allowing the market to determine the money supply in a small open econ-

omy may be consistent with price level stability under either fixed or floating exchange rates, and that monetary authorities under such conditions may relax their control over monetary aggregates. Furthermore, such a prescription may be most appropriate under a fixed exchange rate regime since, under floating rates, Hong Kong was unable to counteract destabilizing speculation against the value of its currency.

## I. The Real Bills Doctrine and the Price Level

### The Closed Economy

For over two centuries, there was a widespread belief that price stability could be achieved as long as banks extended only short-term self-liquidating loans for business needs. Known as the "real bills doctrine", this viewpoint was once so influential it was a premise underlying the creation of the Federal Reserve System<sup>1</sup>.

While John Law first proposed the real bills doctrine in 1705, the classic statement on this subject was provided by Adam Smith (1776). Smith suggested that an appropriate rule for money creation is for each bank to "discount(s) to a merchant a real bill of exchange drawn by a real creditor upon a real debtor, and which as soon as it is due, is really paid by that debtor." In other words, Smith advocated that banks only finance short-term commercial paper arising from real transactions in goods and services.

The original version of the real bills doctrine appears to have emphasized short-term commercial paper linked to real economic activity to ensure that banks indeed financed only those loans that would be repaid. By so doing, the doctrine also limited the quantity of those loans. However, it may not be necessary to restrict loans to certain types of activities<sup>2</sup> and to short maturities to guarantee repayment. Instead, banks may be allowed to finance any type of activity as long as they can correctly assess credit risk. This last criterion will still satisfy the essential requirements of the real bills doctrine: that loans respond to the requirements of the market, that they be selected in such a manner that they will be repaid, and that the volume of loans be limited. Thus, modern interpretations of the real

bills doctrine, as well as the presentation adopted here, do not restrict loan supply to short-term commercial paper.

The previous discussion also suggests two possible models of the real bills doctrine. In one model, the real loan demand is defined in such a manner that borrowers are assumed always to repay their loans. In such a case, lenders could seek to accommodate any real loan demand by borrowers<sup>3</sup>, and the real money supply thus passively accommodates real money demand. Most presentations of the real bills doctrine<sup>4</sup> implicitly make this assumption, which is equivalent to a monetary regime where a central bank targets interest rates.

The real bills doctrine may also be modelled by assuming that banks limit loan supply according to their perception of default risk. Real loan supply at any given interest rate therefore will not necessarily coincide with real loan demand because banks may ration credit rather than passively accommodate real credit demand. The result would be a loan and money supply function that is upward sloping (over a certain range) in relation to the rate of interest. A money supply function that is upward sloping in relation to interest rates also results if one assumes that bank operations are characterized by rising marginal costs. This is the supply function postulated by Patinkin (1965). As shown in the appendix, the macroeconomic equilibrium of a real bills regime depends significantly on the loan and money supply process assumed.

Most of its early proponents believed that the real bills doctrine would suffice to prevent an overissuance of notes and to maintain a stable price level because, under the doctrine, real loan supply would

be limited by real loan demand in the economy.<sup>5</sup> (Alternatively, loan supply may be limited by the perceived capacity to repay). Loan supply would in turn limit money creation, since banks concerned about the value of their monetary liabilities would seek to ensure that these are not excessive in relation to the loan assets backing them. The flaw in this reasoning is that if the nominal value of bank assets rises with inflation, then banks may also increase the nominal value of their liabilities, and create more money, without penalty.

Critics of the real bills doctrine have emphasized that while the market limits *real* loan supply and *real* money creation, this does not mean that the market will successfully limit *nominal* money supply or the price level. The mistake of the original exponents of the real bills doctrine was to confuse an equilibrium in real terms with an equilibrium in nominal terms. The appendix shows that in a closed economy, an endogenous or market-determined money supply may be inconsistent with price level stability.<sup>6</sup>

Another fault of the real bills doctrine, first found by Henry Thornton (1802), is the possibility of accelerating inflation under a real bills regime. Anticipating Wicksell by almost 100 years, Thornton argued that if interest rates were pegged below the equilibrium there would be a persistent excess demand for loans. Under the first model of the real bills doctrine described above, the nominal increase in loan supply to accommodate this excess demand would result in an increase in money supply and prices. The increase in prices would reduce real loan and money supply below equilibrium, and lead, in turn, to a further increase in nominal loan demand and nominal money. This would set off a process of continued expansion of loans, money and prices.<sup>7</sup> Notwithstanding these shortcomings, economists in recent years seeking to address the implications of unregulated banking have attempted to rehabilitate the real bills doctrine.<sup>8</sup>

## The Open Economy

Smith's analysis avoided traditional objections to the real bills doctrine as the regime he described was a small open economy following a gold standard. Under this system, which closely resembles Hong Kong's monetary regime under fixed exchange

rates, banks may determine the volume of loans and deposits created on the condition that their liabilities be fully convertible to gold at a fixed rate. This condition is sufficient to guarantee that banks will have to limit the amount of money they create according to the availability of gold in the domestic economy.<sup>9</sup>

In an open economy, convertibility to gold implies that the external sector will regulate the supply of money and the price level. The adjustment process in such cases is traditionally described by the classical price specie flow mechanism. An excess supply of money would tend to raise domestic prices and reduce international competitiveness. This, in turn, would tend to produce a gold outflow that would eliminate the excess supply of money and lower domestic prices until a trade balance is restored.

In a modern economy, a system analogous to a gold standard would be one that requires convertibility with some internationally traded asset at a fixed exchange rate (such as sterling or the U.S. dollar) and one in which capital mobility, as well as trade flows, govern the adjustment process. An excess supply of money in this case would tend to lower domestic interest rates and thereby create an incipient capital outflow. In the process of accommodating this capital outflow, the banking sector would supply foreign assets in exchange for its monetary liabilities at a fixed exchange rate.<sup>10</sup> This would preserve the fixed exchange rate while eliminating the excess money supply and preventing any instability in the price level.

Under both the classical gold standard and a modern economy with fixed exchange rates, a market-determined money supply is well-defined and self-limiting. Variations in the supply of the internationally traded asset would, however, induce fluctuations in the domestic price level of a modern economy such as Hong Kong's because the domestic rate of inflation depends on the rate of growth of the internationally traded asset.

As shown in the appendix, the money supply may also be self-limiting under flexible exchange rates if two key assumptions hold: domestic output is not fully insulated from the external sector, and the real loan supply — and therefore the real quantity of money supplied by profit-maximizing banks — is

positively related to interest rates. Capital mobility pegs the domestic interest rate to the world rate. This determines the real money supply. At the same time, interaction with the external sector determines an exchange rate and a price level consistent with money market and goods market equilibrium. Since the price level is stabilized by the external sector, bank decisions affecting real loan supply in effect determine nominal loan supply and nominal money balances. The reason this prescription does not work in a closed economy is that a closed economy has no external sector to regulate the price level.

Comparative statics exercises show that, at the exchange rate and price level consistent with equilibrium, an excess supply of money would result in an equilibrating reduction in loans and money because banks would find that real loan supply exceeds real loan demand at the prevailing rate of interest. In contrast, when prices are above equilibrium, the contractionary effects on the trade balance and aggregate demand would result in equilibrating price reductions. This contrasts sharply with the unstable Thornton/Wicksell scenario where money creation leads to price increases, and price increases lead to further money creation. The distinction is the basis for later empirical tests on the stability of Hong Kong's monetary regime.

## II. Money and Monetary Control

A first step towards understanding the process of money creation in Hong Kong is to recognize that government intervention in Hong Kong is generally believed to be ineffective and harmful to growth.<sup>11</sup> This non-interventionist philosophy manifests itself in a conservative fiscal posture that is justified as a means of controlling money creation. Hong Kong's government believes that "the public sector's impact on the growth of the money supply should, on the average, be neutral".<sup>12</sup>

This philosophy is also apparent in the government's reliance on the market to determine the money supply. The market works within a framework of three institutional restrictions thought to influence money creation: the mechanics of note issuance, the interest rate setting agreement of the Hong Kong Association of Banks, and required liquidity ratios. In this section, we review the implications of these restrictions for price stability.

A market-determined money supply under floating rates may lead to price level instability if either of the two key assumptions made above do not hold. If flexible exchange rates fully insulate the domestic economy, the external sector will not stabilize the domestic price level. Price instability is also possible if banks passively accommodate money demand rather than limit money supply at any given interest rate.

Aside from stability in money and prices, policy-makers may be concerned with other implications of an exchange rate regime. For example, in a small open economy with a high degree of capital mobility, there may be sudden shifts in the demand for domestic assets. Under fixed exchange rates, these financial sector shocks can be offset by appropriate variations in domestic money supply. Under flexible exchange rates, these shocks are reflected in variations in the value of the currency. For a small economy where trade represents a large proportion of gross national product, informational advantages may favor a fixed exchange rate regime. Furthermore, persistent fluctuations in the value of the currency may lead to destabilizing speculation. As we shall see, the last consideration, in particular, appears to have influenced the choice of an exchange rate regime in Hong Kong.

### Note Issuance and Currency Backing

In a typical central banking regime, the monetary authorities control the creation of base money, defined as currency and reserves<sup>13</sup>, by limiting its availability to private banks. Given the supply of base money, a money multiplier (a function of the banks' desired holdings of reserves in relation to total deposits and the public's desired ratio of currency to deposit holdings) will then determine the total money supply. In a real bills regime, each bank can either issue its own currency or, on its own initiative, present some asset it holds to the government in exchange for currency. In contrast to a regime with a central bank, where the availability of currency is controlled by the monetary authority, the amount of currency in a real bills regime is determined by the market, as is the total money supply.<sup>14</sup>

Hong Kong's monetary system operates exactly

like a real bills regime. Two note-issuing banks credit the account of a government Exchange Fund and receive the equivalent amount in Hong Kong dollar certificates of indebtedness against which Hong Kong dollar notes may be issued. The currency issue by the note-issuing banks is thus backed by the certificates of indebtedness (CIs) of the Exchange Fund. Under Hong Kong's monetary system, there are no government monetary liabilities other than the CIs, so the domestic monetary base consists only of currency.

It is worth emphasizing that note issuance occurs on the initiative of the private note-issuing banks. In implementing its mandate to "regulate the exchange value of the Hong Kong dollar," the Exchange Fund has not resorted to direct manipulation of the monetary base (through such familiar instruments as open market operations, reserve requirements, or the discount rate). Instead, it has allowed the market to determine the money supply while regulating the terms on which two note-issuing banks issue currency. The basis for note issuance has varied with the exchange rate regime, with potential implications for price level stability.

#### *Fixed Exchange Rates*

In Hong Kong's system of money creation, the Hong Kong dollar has been pegged to the U.S. dollar since October 1983 and the two note-issuing banks are required to hold government-issued certificates of indebtedness as backing for their note issuance. The two banks pay the Exchange Fund in foreign exchange when they desire to issue new bank notes at the fixed rate of HK\$7.80 per U.S. dollar for the certificates required as backing for any increase in note issuance. When bank notes are withdrawn from circulation and the two banks surrender certificates of indebtedness, the Exchange Fund pays the banks the equivalent foreign exchange at the same fixed rate. The sterling standard in force prior to July 1972 operated in a similar fashion.

Under fixed exchange rates, the total money supply depends on total foreign currency deposits in Hong Kong banks — which, in turn, determines the monetary base — and a money multiplier that is a function of the extent to which banks convert their

foreign currency deposits for domestic currency notes and the ratio of vault cash and currency to deposits. This multiplier is illustrated in the box.

The fixed exchange rate regime implemented in Hong Kong is consistent with the conditions for price stability under the real bills regime proposed by Adam Smith. Domestic notes are fully convertible into an internationally traded foreign asset due to 100 percent backing. And banks have to limit deposit and money creation to ensure that their liabilities can be fully converted into foreign currency.

An important difference between Hong Kong's Exchange Fund and a typical central bank is that the former does not actively intervene to achieve fixed exchange rates but relies instead on market arbitrage to do so. If the currency tends to depreciate (as when there is an excess supply of money), banks would have an incentive to redeem notes in exchange for foreign currency at the higher rate offered by the Exchange Fund, and then sell the foreign currency at a profit in the market. This process would lead to a monetary contraction that would preserve the fixed exchange rate (see example provided in box). Furthermore, this fixed exchange rate mechanism guarantees passive control of the monetary base and therefore of total money supply. Note issuance is limited by requiring domestic banks to deposit foreign assets at a fixed price to back currency creation.

#### *Flexible Exchange Rates*

Under the regime in force between July 1972 and October 1983 — a period largely corresponding to that of a floating Hong Kong dollar — note-issuing banks were allowed to issue currency by crediting the Exchange Fund with the equivalent in Hong Kong dollar deposits. The Exchange Fund would then seek to achieve full foreign currency backing of the currency issue by purchasing foreign assets with these deposits; it did not require banks to provide the backing themselves. As a result, during this period, foreign exchange availability no longer constrained the ability of the note-issuing banks to expand loan or money creation. Currency could be created on demand by creating a deposit liability in Hong Kong dollars with the Exchange Fund.

## Hong Kong's Money Supply

Under fixed exchange rates, Hong Kong's money supply depends on total foreign currency deposits, the proportion of foreign assets that banks convert for the purposes of issuing domestic notes, and the banks' vault-cash-to-Hong-Kong-dollar as well as the public's Hong-Kong-currency-to-Hong-Kong-dollar deposit ratios. It can be shown that the multiplier is:

$$M = [(1 - f)(1 + c)/(c + v)] D'$$

where

M = Hong Kong money

D' = Foreign currency deposits in banks

f = the proportion of foreign currency backing of D' (so  $1 - f$  is the proportion of D' used to back domestic note issuance)

c = domestic-currency-to-Hong-Kong-dollar deposit ratio

v = bank domestic-vault-cash-to-Hong-Kong-dollar deposit ratio

We will first assume that banks adjust the proportion of foreign currency backing of foreign currency deposits (f) to accommodate domestic money demand. This implies that foreign currency backing always exceeds the minimum level banks consider appropriate.

Table A illustrates a case where foreign currency

deposits (D') equal HK\$300,  $f = \frac{1}{4}$ ,  $c = \frac{1}{2}$ ,  $v = \frac{1}{4}$ , and the resulting Hong Kong dollar money supply is HK\$450. Suppose there is an excess supply of Hong Kong dollars at this point. The public will then tend to shift out of Hong Kong dollar assets into foreign currency assets. This shift will tend to depreciate the currency.

Since the Exchange Fund stands ready to buy Hong Kong dollar notes at the higher fixed rate, note-issuing banks have an incentive to buy Hong Kong currency from the public and to redeem them for foreign currency from the Exchange Fund. Assume that once the public has converted HK\$50 in currency, the domestic money market will be in equilibrium and there will be no further tendency to shift away from Hong Kong dollars or to depreciate the currency.

Assuming the desired vault-cash- and currency-to-deposit ratios remain the same, Table B illustrates the banking sector balance sheet in equilibrium. The money supply has contracted by HK\$150. Banks have lowered the proportion of foreign currency assets they convert to domestic currency ( $1 - f$ ) to  $\frac{1}{2}$ , which is the level consistent with equilibrium at the exchange rate fixed by the government. Table B also shows that the liabilities (in the form of Certificates of Indebtedness) of the

**TABLE A**  
**Illustrative Banking Sector Balance Sheet**  
**Fixed Exchange Rates**  
**(Hong Kong Dollars)**

Assets	Liabilities
<b>Private Sector</b>	
Certificates of Indebtedness	225
Vault cash (V)	75
Loans and Investments	450
Subtotal	<u>750</u>
Foreign currency assets	75
Private Sector Total	825
<b>Public Sector</b>	
Foreign currency assets (*)	225
<b>TOTAL</b>	<b>1050</b>
Private Sector	
Cash held by banks	75
Cash held by public	150
Deposits (D)	300
Subtotal	<u>525</u>
Foreign currency deposits (D')	300
Private Sector Total	825
<b>Public Sector</b>	
Exchange fund foreign currency deposits	225
<b>TOTAL</b>	<b>1050</b>

\*For simplicity, it is assumed that foreign currency assets acquired from Exchange Fund deposits do not affect money creation.

Exchange Fund have fallen by HK\$75, matched by an equivalent decline in public sector foreign currency assets.

In the first stage, the public's holding of domestic currency fell by HK\$50, while its holding of foreign currency assets increased by HK\$50. In the process of liquidating its loan liabilities in a manner consistent with its reduced money holdings, the public decreases the domestic deposit liabilities of banks by HK\$100, and restores HK\$50 in foreign currency assets to the banking sector. Note that in this example, the money supply contracts without reducing the private foreign currency deposits of the banking sector.

Another way of illustrating a monetary contraction is to assume that the proportion of foreign currency backing, vault cash and currency in the hands of the public does not change, while noting that capital inflows (changes in foreign currency deposits) affect domestic interest rates. An excess capital inflow will lower domestic interest rates below the world rate, producing equilibrating reductions in foreign currency deposits. An equivalent monetary contraction to that shown in Table B can

be achieved if we assume the original parameters ( $f$ ,  $c$ ,  $v$ ) are unchanged and that foreign currency deposits fall by HK\$100. Under fixed exchange rates, the actual process of money creation and contraction in Hong Kong probably combines changes in parameters as well as capital flows, and includes secular declines in the vault cash- and currency-to-deposit ratios.

Under floating rates, the monetary base depends on the amount of currency note-issuing banks wish to create, so we may use the textbook multiplier

$$M = [(1 + c)/(c + v)] H$$

where  $H$  is the currency issued by crediting the Hong Kong dollar deposits of the Exchange Fund.

Monetary stability is achieved only if the market-determined money supply limits the monetary base,  $H$ . Under a real bills regime that successfully guarantees price stability, the market should limit  $M$ . Given  $c$  and  $v$ ,  $H$  will then be determined. The conditions under which interaction with the external sector limits the monetary base under floating exchange rates are discussed in the text and the Appendix.

**TABLE B**  
**Banking Sector Balance Sheet**  
**After HK \$150 Monetary Contraction**  
**(Hong Kong Dollars)**

Assets	Liabilities
<b>Private Sector</b>	
Certificates of Indebtedness	150
Vault cash	50
Loans and Investments	300
Subtotal	500
Foreign currency assets	150
Private Sector Total	650
<b>Public Sector</b>	
Foreign currency assets*	150
<b>TOTAL</b>	<b>800</b>
<b>Private Sector</b>	
Cash held by banks	50
Cash held by public	100
Deposits	200
Subtotal	350
Foreign currency deposits (D')	300
Private Sector Total	650
<b>Public Sector</b>	
Exchange fund deposits	150
<b>TOTAL</b>	<b>800</b>

**Change in the Balance Sheet of the Public**

	Assets	Liabilities
Step 1	Currency	-50
	Foreign Assets	50
Step 2	Deposits	-100
	Foreign Assets	-50
		-150
	Loans and Investments of Banks	

\*For simplicity, it is assumed that foreign currency assets acquired from Exchange Fund deposits do not affect money creation.

An immediate effect of the 1972 revision was that domestic monetary issuance by banks need not have any relationship to the exchange rate set by the government. When a government pegs the exchange rate, it will find itself unable to enforce the pegged rate unless that rate was consistent with the market equilibrium rate. Independent money creation by banks could neutralize any effort by the government to fix the exchange rates. This was the sequence of events in Hong Kong between July 1972 and November 1974. The government attempted to peg the currency to the U.S. dollar only to abandon the effort because of the limited impact of its intervention. In effect, Hong Kong went into a floating rate regime by default because it had adopted an institutional arrangement inconsistent with a fixed exchange rate. As we shall show later, this institutional arrangement would have implications for the feasibility of stabilizing exchange rates in response to shocks.

Abandoning the requirement that currency issuance be backed by foreign assets also removed the self-regulating mechanism that limits the monetary base under fixed exchange rates. As discussed earlier (and shown formally in the appendix), in a small open economy such as Hong Kong's, where flexible exchange rates do not fully insulate the domestic economy, interaction with the external sector may nevertheless guarantee price level stability as long as banks limit the loan and money supply at any given interest rate.

If these conditions do not hold, money, prices, and exchange rates in Hong Kong could be indeterminate or unstable. This view is held by a number of observers of the Hong Kong scene. For example, in the December 1983 issue of the *Asian Monetary Monitor*, John Greenwood remarked:

. . . Hong Kong's monetary arrangements (under floating exchange rates) constituted an indeterminate, metastable equilibrium system. This meant that for any given level of money supply and prices in Hong Kong, the exchange rate would adjust to that price level; alternatively, given any level of the exchange rate, money supply and domestic prices would adjust to that exchange rate.<sup>15</sup>

Greenwood's reasoning is analogous to the traditional criticism of the real bills doctrine. The econ-

omy may guarantee that real money demand equals real money supply even as the nominal money supply, prices and exchange rates are indeterminate or unstable.

### Interest-Setting in Hong Kong

Since 1964, banks in Hong Kong have restricted the interest rates they pay on deposits with maturities of less than twelve months to a level determined by the Hong Kong Association of Banks (HKAB) or its predecessor, the Exchange Banks' Association. This restriction was designed to prevent the destabilizing interest rate competition experienced during banking crises in the early 1960s, and was formalized in legislation in 1981 that established the HKAB and empowered it to require banks to observe the interest rates it established. While this agreement was originally established for prudential reasons, subsequent discussions of its function have focused on the implications for price stability and monetary control.

Jao (1984) and Fry (1985) assert that the HKAB set interest rates consistently below the equilibrium determined by the world market. Given our earlier discussion of Wicksell and Thornton, it would seem that such a policy could create the potential for hyperinflation on the assumption that banks would set the loan rate as well as the deposit rate below the market equilibrium. Competition in the loan market could prevent this from happening. Furthermore, given that the loan rate was in fact set below the market equilibrium, the Thornton/Wicksell view also assumes that banks continually seek to accommodate an excess demand for loans. This may not occur if profit-maximizing banks respond to an excess demand for loans by rationing credit rather than continually raising the nominal loan and money supply.

There are also indications that the ability of the HKAB to influence interest rates was limited, particularly as the 1970s progressed, and that it probably had to adjust its interest rates to reflect market conditions. One reason it may have been forced to raise rates is that the profitability of Hong Kong's financial system depends on attracting depositors who have access to the Euromarket. Hong Kong banks must therefore pay internationally competitive rates. By affecting the cost of funds in a

competitive lending environment, the external sector would tend to bring overall Hong Kong interest rates into line with the world market equilibrium, and thereby limit the ability of the HKAB to set deposit rates that were excessively out of equilibrium.

Another factor that may have limited the ability of the HKAB to determine interest rates was the rapid growth of Deposit Taking Companies (DTCs) in the 1970s. DTCs were financial intermediaries that, up to 1976, had avoided banking restrictions by limiting their business to deposits with maturities in excess of three months. As DTCs were not subject to the interest rate agreement, they undoubtedly made it increasingly difficult for the Hong Kong Association of Banks to fix the interest rate. The frequency with which interest rates were revised suggests that the DTCs were influential. The HKAB revised its deposit rates only once, in 1976 when the Deposit Taking Ordinance was passed. This ordinance allowed DTC deposits of any maturity but imposed other restrictions on their operation. In 1980, however, just before major additional restrictions were imposed on DTCs, the HKAB revised its deposit rates 13 times. Thus, while concern about their inflationary impact was typically associated with DTCs, DTCs probably helped ensure that market considerations prevailed in determining interest rates in Hong Kong. The impact of the HKAB interest-setting agreement may therefore have been limited to some distortion of the term structure of interest rates, and, as in other countries where restrictions of this kind are imposed, may have reduced the availability of savings.

The government could use the interest-setting powers of the HKAB as an instrument for monetary control to the extent that the HKAB was not limited by competition to adjusting interest rates passively in response to market conditions. Variations in the interest rate could induce desired changes in real money demand or supply, and affect prices and exchange rates. However, this approach would not always work, as the criteria used by the HKAB in setting interest rates need not be based on macroeconomic considerations.

Furthermore, the government appears to have been unable to use the interest rate agreement to achieve certain macroeconomic objectives on certain critical occasions. For example, during the

1982-83 episode in which uncertainty about the future government of Hong Kong caused the value of its currency to plummet, a rise in the rate paid on Hong Kong dollar deposits could have dampened the drop in the value of the currency. Instead, the HKAB was reportedly reluctant to raise interest rates, and the government was reluctant to insist.<sup>16</sup>

### Liquidity Ratios

Aside from the mechanics of note issuance and the interest rate agreement, the liquid assets ratio requirement is typically cited as a potential means for limiting the money supply in Hong Kong. Also established for prudential, rather than macroeconomic, reasons, this institutional restriction requires that the ratio of liquid asset holdings (mostly vault cash and foreign assets, given the limited amount of marketable government securities) of banks to deposits exceed twenty-five percent.

In Hong Kong, this requirement is often believed to restrict money creation in a manner analogous to reserve requirements. However, the analogy is invalid since the market, and not the government, determines the creation of liquid assets by the acquisition of foreign currency deposits or the mechanism of note issuance described previously. Thus, the liquid assets ratio has not functioned as a reserve requirement in the sense of requiring banks to hold liabilities of the government monetary authority, the supply of which is determined by policymakers. In particular, base money creation by banks could nullify any effects of liquid assets ratio requirements. In any case, the government has altered the liquid assets requirements very infrequently.

It may also be noted that the liquid assets ratio was not binding on banks, which typically held liquid assets significantly above the required level. For example, between 1972 and 1984, the year-end liquidity ratio of banks averaged well in excess of 40 percent. Up to the early 1980s, deposit-taking companies, which were close competitors of banks, were not subject to liquid assets ratio requirements.

The weakness of liquidity ratios as instruments for monetary policy under floating rates is illustrated by the effort of the government to use them to control money creation at the end of the 1970s. In February 1979, the government imposed a 100

percent liquid assets requirement on deposits of the Exchange Fund. As a result, note-issuing banks had to hold either currency or foreign exchange assets against these deposits.

If the constraint were binding, it would tend to contract the money multiplier, as the banks' vault cash to deposit ratio would have to rise. However, it would not necessarily limit the creation of base money. As the Hong Kong dollar depreciated, a fixed amount of foreign assets used to serve the liquidity requirement could support an increasing amount of domestic currency creation. That is, the effectiveness of this policy as a means for controlling the money supply was diluted because the government did not set a price for the Hong Kong dollar in relation to its foreign currency liquid assets cover.<sup>17</sup>

Our brief review of Hong Kong's monetary regime suggests that the stability of Hong Kong's

money and price level depends on the process governing note issuance, including the pegged exchange rate arrangement, and that other institutional restrictions, such as the interest-setting agreement of the HKAB or liquid assets ratio requirements, are of limited importance.

Unlike most modern economies, base money creation in Hong Kong results from the initiative of two private note-issuing banks whose decisions are based on market considerations. The institutional restrictions on note issuance guarantee that money creation is self-limiting under fixed exchange rates. The stability of Hong Kong's monetary system under floating exchange rates is less obvious. Leading observers believe that the monetary process may have been unstable, and theory is ambiguous on this point. A closer look at the empirical evidence is therefore indicated.

### **III. Hong Kong's Macroeconomic Performance**

#### **Macroeconomic Indicators**

If Hong Kong's monetary system had adverse effects on its economy, it is not apparent in the performance of the real sector. Real gross domestic product (GDP) growth averaged 8.0 percent between 1966-1972 when exchange rates were fixed, and 8.5 percent between 1974-1983 when the Hong Kong dollar was floating. In fact, as shown in Table 1, Hong Kong's economic growth has been among the highest in the world since the early 1960s.

This remarkable growth is partly attributable to a competitive labor market that has resulted in a high degree of real wage flexibility. Between 1974 and 1982, real wage growth averaged only 1.9 percent, and it fell sharply during certain years. For example, real wages fell 12 percent following the first international oil price shock in 1974, and 11 percent during the severe world recession of 1975.

Unemployment data, available on a yearly basis only since 1975, suggest a satisfactory economic performance. The unemployment rate averaged 4.4 percent between 1975 and 1983 notwithstanding periodic surges in the labor force caused by immigration, such as the ½ million immigrants from the Chinese mainland between 1978 and 1981.

One feature of a regime where the money supply is market-determined is that movements in the money supply tend to be procyclical. For example, M1 dropped 5 percent in 1974 and may have contributed to the rise in the unemployment rate to 9.1 percent in 1975. However, the cost of a procyclical monetary adjustment was offset by a drop in the inflation rate from 16 percent in 1974 to 1.6 percent the year after.

Furthermore, flexible real wages have undoubtedly been a major stabilizing influence and reduced the need for countercyclical monetary policy. For example, although annual real GDP growth slowed during the world recessions of 1975 and 1982 (to 2.2 and 2.9 percent, respectively), Hong Kong has not experienced a GDP decline in at least twenty years. While the costs to the real sector of Hong Kong's market-determined monetary regime are not evident, it is also necessary to investigate whether the stability of prices and exchange rates was affected.

As shown in Table 2, Hong Kong's inflation rate averaged 4.7 percent in the period 1966-1972 when fixed exchange rates applied. During the period when Hong Kong's currency floated, the average inflation rate almost doubled to 9.3 percent, but it

**TABLE 1**

**Hong Kong and Selected Countries:  
Average Annual Real GNP Growth  
(Percent)**

<b>Hong Kong and Countries</b>	<b>1966-1972 Hong Kong Fixed Rates</b>	<b>1974-1983 Hong Kong Floating Rates</b>
Hong Kong	8.0	8.5
Brazil	7.9	4.5
Colombia	6.4	3.9
Dominican Republic	8.4	4.5
Philippines	5.0	5.0
South Korea	11.2	7.5
Singapore	13.2	7.8
Thailand	7.5	6.7
United States	3.6	2.1
Japan	10.0	3.8
West Germany	4.1	1.6

**TABLE 2**

**Hong Kong and Selected Countries:  
Average Annual Inflation Rates  
(Percent)**

<b>Hong Kong and Countries</b>	<b>Hong Kong Fixed Rates 1966-1972</b>	<b>Hong Kong Floating Rates 1974-1983</b>
Hong Kong	4.7	9.3
Brazil	25.6	66.2
Colombia	10.5	24.1
Dominican Republic	2.6	9.8
Philippines	7.9	13.2
South Korea	12.5	16.9
Singapore	1.5	5.7
Thailand	2.6	10.1
United States	4.2	8.5
Japan	5.4	7.8
West Germany	3.3	4.8

Source: International Monetary Fund *International Financial Statistics. Monthly Digest of Statistics*, Hong Kong.

remained below that of five of the other six developing countries in the table. Furthermore, it was not much higher than the inflation rate of the U.S. (8.5 percent) or Japan (7.8 percent).

Aghevli and Khan (1980) surveyed some of the countries included in Table 2 (Brazil, Colombia, Dominican Republic and Thailand) and found that fiscal deficits in those countries lead to destabilizing monetary accommodation and inflation. Given the inflationary experience of countries such as Brazil and Colombia, it would seem that fiscal deficits represent a greater problem for monetary policy than does a market-determined money supply.

While Hong Kong's inflationary performance was clearly satisfactory when compared to other economies during the floating exchange rate period, such casual observation does not rule out the possibility that the regime was unstable. After all, the rate of inflation was much higher during the period of floating rates, and other factors, such as Hong Kong's rapid growth, may have disguised the effects of an unstable monetary regime. A more formal test is therefore desirable.

## An Empirical Test

Earlier, we noted that in stable monetary regimes, disturbances to money and prices tend to correct themselves. In unstable monetary regimes, however, they do not, so an increase in the money supply leads to an increase in the price level, and an increase in the price level leads to a further increase in the money supply.

If the hypothesis that Hong Kong's monetary regime under floating rates was unstable were correct, money creation should induce inflation and price increases should have led to further money creation after 1972. The Hong Kong government's conservative fiscal stance permits us to rule out government deficits as the source of any monetary accommodation that may be found, and allows us to focus exclusively on whether the operation of the private market leads to instability.

Before proceeding with an empirical test, it is appropriate to remark on certain peculiarities of Hong Kong's statistics. In modern economies, it has become increasingly difficult to determine which monetary aggregate is most related to nominal gross

national product or inflation. In Hong Kong, the problem is complicated by two additional considerations. First, until 1981, money supply data did not distinguish between the Hong Kong dollar and foreign currency. Second, Hong Kong does not separate Eurocurrency operations from domestic financial transactions. As a result, there may be large movements in the reported money supply that are unrelated to domestic economic activity and that would have no inflationary implications.

The measurement error in Hong Kong's monetary statistics implies that reliable estimates of the effect money may have on prices are not possible.<sup>18</sup> Thus, while preliminary tests suggest that money has a very weak influence on prices in Hong Kong — a result that is consistent with our description of a stable monetary regime in an open economy — this result is still open to question.

The measurement error in Hong Kong's monetary statistics do not preclude estimates of the impact of prices on money creation. Inflation leading to money creation is a necessary condition for monetary instability when the money supply is market-determined, and we will focus on it here. Furthermore, as the share of Eurocurrency transactions is much larger for Hong Kong's M2 and M3, tests will be limited to the effect of prices on M1. One technique for ascertaining whether prices "cause" money creation is the test of Granger causality. Prices are said to "Granger cause" money if past values of prices improve the forecast of the current money supply.

There are a number of ways to implement the Granger test<sup>19</sup>, and two different methods were attempted here. The first method involved filtering the monthly series of money and prices for the period of floating exchange rates to remove trend and seasonality and to approximate white noise. Then the cross-correlation of de-trended and de-seasonalized money with prices was estimated for prices lagged backwards and forwards 30 months. A positive cross-correlation between past prices and current money supply would indicate that "innovations" in prices lead to "innovations" in money, and would be consistent with the view that prices "Granger-cause" money. This procedure is discussed in Pierce and Haugh (1977).

Table 3 reports the results of the first test. For the period January 1973–October 1983, the data failed to reject at a 10 percent significance level the hypothesis that the cross-correlation at 29 lags is zero. The hypothesis of zero cross-correlation would be rejected at 17 lags because the cross-correlation between past prices and current money exceeds two standard errors for prices lagged eleven months (with a correlation coefficient of 0.21) and thirteen months (coefficient –0.23). As the filtering procedure did not fully succeed in “whitening” the series, these coefficients probably reflect an annual seasonal factor. “Causality” of prices to money therefore cannot be inferred, and even if it could be, the alternating signs of the coefficients are ambiguous.

One difficulty with the above procedure is that the pre-whitening process may remove any evidence of a relationship between prices and money. As a result, an alternative test of Granger causality is reported below. Furthermore, although it was earlier argued that the imposition of a 100 percent liquid assets ratio requirement on Exchange Fund deposits in February 1979 had certain flaws, it may nevertheless have affected the link between prices and money. Subsequent estimation does not extend beyond this date.

The second test of Granger causality involved regressing the logarithm of money supply on its own

past values as well as past prices lagged 1 to 12 months:

$$M_t = A + \sum_{j=1}^{12} B_{t-j} M_{t-j} + \sum_{j=1}^{12} C_{t-j} P_{t-j}$$

If past prices have significant coefficients, then they can be said to “Granger cause” money. Evidence of Granger causality is a necessary but not sufficient condition for instability in money and prices. Two starting periods were chosen in the second test: (1) January 1973 was some six months after domestic currency assets were permitted as a basis for note issuance. We have argued that this is inconsistent with fixed exchange rates and could lead to monetary instability. (2) November 1974 was when Hong Kong abandoned the effort to peg its currency to the U.S. dollar. After that month, we can be certain that any systematic effort to back domestic currency issuance with foreign assets at a fixed price was abandoned.

The results are shown in Table 4. As can be seen, no significant relationship, in the Granger sense, could be established between past prices and current money supply. The results therefore suggest that Hong Kong's monetary regime was stable even during the period of floating rates.

TABLE 3

**Cross-Correlation Test of Granger Causality  
Lagged Prices to Current Money Supply**

To Lag	Chi Square	df	Prob	Cross-Correlations			
5	6.48	6	0.371	–0.033	–0.137	–0.109	0.140
11	19.14	12	0.085	0.168	–0.157	–0.031	–0.066
17	29.74	18	0.040	–0.033	–0.228*	0.169	0.092
23	32.97	24	0.105	0.030	–0.108	0.007	–0.086
29	36.49	30	0.192	–0.035	–0.026	–0.128	0.084

\*Exceeds two standard errors

Both variables have been pre-whitened by the following filters:

Money:  $(1 + .144499B + .156379B^6)(1 - B)M_t$

Prices:  $(1 - .137484B + .306845B^2 - .092066B^4 - .194804B^6 - .124141B^{12})(1 - B)P_t$   
where  $B^m X_t = X_{t-m}$

TABLE 4

**Regression Test of Granger Causality  
Effect of Prices on Money (M1)**

<b>Period</b>	<b>F statistic for price coefficients (c<sub>t-1</sub>)</b>	<b>Significance Level</b>
January 1973-		
February 1979	.5984	Rejected at 10%
November 1974-		
February 1979	1.0072	Rejected at 10%

### **Exchange Rate Stability**

While Hong Kong's monetary regime under floating exchange rates appeared to be stable (in prices), the inability of the government to enforce a currency peg under floating exchange rates could prove costly.

This is illustrated by the 1982-83 fall in the value of the Hong Kong dollar caused by uncertainty about the future of Hong Kong. This uncertainty provoked a general shift out of Hong Kong dollar-denominated assets into foreign currency assets, and resulted in a drop in the trade-weighted value of the Hong Kong dollar of 27 percent over 15 months. Furthermore, it is quite possible that the crisis put the exchange market on a speculative path, on which expectations about further declines in the Hong Kong dollar created further pressure on the currency and thus tended to be self-fulfilling. In July 1982, when the Hong Kong dollar began its sharp decline, the annualized rate of depreciation was 7.7 percent. By September 1983 — the last month of the crisis — the Hong Kong dollar was depreciating at a 65 percent annual rate. The government was therefore compelled to take steps to break this accelerating erosion in the value of the currency.<sup>20</sup>

While the Exchange Fund could (and possibly did) intervene during the 1982-83 crisis by selling its foreign assets in exchange for Hong Kong dollar notes, note-issuing banks could fully offset this intervention by simply printing more notes to acquire foreign currency assets.<sup>21</sup> As pointed out previously, the ability of the government to influence interest rates through the interest-setting agree-

ment of the HKAB also appears to have been quite limited.

Neither the market mechanism nor the weak instruments available to the government was sufficient to control the speculation against the Hong Kong dollar, so the government halted the Hong Kong dollar's precipitous drop by reforming the terms of note issuance. On October 15, 1983, it announced that it would peg the value of the Hong Kong dollar at 7.8 Hong Kong dollars per U.S. dollar and once more require the note-issuing banks to deposit foreign currency assets with the Exchange Fund to back note issuance.

The immediate result of this policy was that any further efforts to shift away from the Hong Kong dollar would contract the domestic money supply to the point where the supply of Hong Kong money was brought down to the level demanded. Furthermore, it would restore confidence in the Hong Kong currency, which now had foreign asset backing at a fixed price. The peg to a strengthening U.S. dollar was immediately effective and has been successfully maintained, with the result that the Hong Kong dollar has appreciated significantly on a trade-weighted basis since 1983 — reversing the trend of the preceding five years.

This last episode highlights the risk of a market-determined money supply under floating rates. In the absence of discretionary instruments for monetary control, the requirement that note issuance be backed by an internationally traded asset at a fixed price appears to be necessary to offset shocks that prompt speculative attacks against the currency.

## IV. Conclusion

Our inability to find results consistent with monetary instability in Hong Kong is somewhat surprising given the traditional critique of the real bills doctrine. The result expected from a real bills regime did not occur for one of two reasons. First, Hong Kong's monetary regime may actually not have satisfied the real bills doctrine. This would be the case if note-issuing banks did not base their loan decisions only on market considerations but cared about the price level and behaved as if they were a modern central bank. Second, proponents of the real bills doctrine may have been correct in arguing it would not result in price indeterminacy or instability.

The idea that the private note-issuing banks, particularly Hongkong and Shanghai Bank, acted like a central bank is appealing. As the major bank in Hong Kong, Hongkong and Shanghai Bank presumably could be affected by macroeconomic considerations such as price stability. However, decisions based consistently on public policy considerations could pose insurmountable problems for a bank accountable to its stockholders. There is no evidence, for example, that the Hongkong and Shanghai Bank voluntarily contracted note issuance, or that the HKAB sought to

raise interest rates to stabilize exchange rates in 1982-83. Instead, the government had to *impose* a fixed exchange rate regime that would accomplish the necessary results.

Our findings are therefore consistent with the view that a market-determined money supply in a small open economy need not be associated with price level instability or indeterminacy. They suggest that monetary authorities under circumstances similar to those in Hong Kong could successfully relax their direct control over monetary aggregates. Casual observation suggests that certain features of Hong Kong's economy, such as a conservative fiscal posture and real wage flexibility, may help this monetary regime work.

However, the exchange rate regime and the institutional arrangements underlying it also are important to Hong Kong's monetary regime. Under the monetary system in force during the period of floating exchange rates, Hong Kong had essentially no instruments to prevent destabilizing speculation against the Hong Kong dollar. It did not control interest rates or the monetary base, and could not rely on the market to stabilize the value of the currency. Only through the current pegged regime do these problems appear to have been solved.<sup>22</sup>

## APPENDIX

### Formal Treatment of Regimes with An Endogenous Money Supply

In the case of a classical closed economy, a regime with an endogenous money supply may be characterized as follows (see Patinkin 1965, Sargent 1979):

$$G(y, r) = 0 \quad \text{Goods market} \quad (\text{A.1.1})$$

$$(M/P) = m(r, y) \quad \text{Money market} \quad (\text{A.1.2})$$

Given output ( $y$ ), equation A.1.1 can determine the interest rate ( $r$ ). Equation A.1.2 can determine combinations of money ( $M$ ) and prices ( $P$ ) that satisfy money market equilibrium. However, since money supply is endogenous, both nominal money and the absolute price level are indeterminate. Loosely speaking, the number of equations is not sufficient to determine the number of unknowns.

Somewhat less familiar is the applicability of these conclusions to an open economy with flexible prices. This may be illustrated in the simplest possible manner by modifying equations A.1.1 - A.1.2 to incorporate the effects of the external sector in a small open economy.

The price level in an open economy depends on both domestic and foreign prices adjusted for the exchange rate, that is,

$$P = P_H E^{1-\alpha}$$

where  $P_H$  represents the price of goods produced at home,  $E$  is the domestic currency price of foreign exchange, and the foreign price is set equal to one.

We may begin by assuming perfect capital mobility as such a case is the easiest to illustrate. Under fixed exchange rates, the domestic interest rate equals the foreign rate of interest, and equilibrium is given by

$$y = y(E) \quad \text{Aggregate Supply} \quad (\text{A.1.3})$$

$$G[y, A(y, r_F), B(y, y_F, P_H/E)] = 0 \quad \text{Goods Market} \quad (\text{A.1.4})$$

$$(M/P) = m(r_F, y) \quad \text{Money Market} \quad (\text{A.1.5})$$

where the signs under the arguments correspond to those of the partial derivatives and

$r_F$  = world rate of interest

$y, y_F$  = domestic and foreign output, respectively

$A$  = domestic absorption

$B$  = net exports

Equation A.1.3 applies because exchange rates affect aggregate supply in an open economy. A depreciation will raise consumer prices and reduce labor supply while not affecting labor demand.

Under fixed exchange rates, equation A.1.4 can determine the combinations of output and home prices consistent with equilibrium in the goods market. Equation A.1.3 determines  $y$  with fixed exchange rates, and, given the foreign interest rate and the home price, it is possible to determine nominal money supply in equation A.1.5.

While loan supply is still determined by loan demand, as was the case in the closed economy described by equations A.1.1 - A.1.2, the problem of price level indeterminacy does not arise here. The reason is that an increase in loans, and therefore of  $M$ , will result in an offsetting money supply contraction to maintain the fixed exchange rate. The fixed exchange rate guarantees a determinate quantity of money. Adam Smith was aware of this result and, while he subscribed to the real bills doctrine and a market-determined money supply, he also would have required banks to ensure that their monetary liabilities were fully convertible with gold at a fixed price.

Consider now the case of flexible exchange rates with an endogenous money supply. The reader may verify that equations A.1.3 to A.1.5 cannot determine the nominal levels of  $M$ ,  $P$  or  $E$ . This problem is compounded by the fact that even output is now indeterminate. Once more, we may loosely say that there are too many unknowns given the number of equations. Reducing one plausible unknown does

not solve the problem. For simplicity, assume initially that domestic output is fixed, and insulated from the external sector so equation A.1.3 does not apply. Then the reader may verify that equations A.1.4 and A.1.5 can determine the optimal real money balances but not the nominal quantities M and P, or E.

The above provides a formal interpretation of a prevalent view that Hong Kong's monetary regime under flexible exchange rates was indeterminate. It also appears to be the rationale for the view of the *Asian Monetary Monitor*, quoted in the text.

Equation A.1.5, and equation A.1.2, assume that real money supply passively adjusts to accommodate real money demand. This is the standard way of modeling how a real bills regime operates in an economy with a central bank. It is also an appropriate way of modeling a market-determined money supply under fixed exchange rates, as it is consistent with the view that banks exploit any arbitrage opportunities arising from deviations from the fixed rate set by the Exchange Fund.

Hong Kong, however, has no central bank to take the initiative in adjusting money supply, and equation A.1.5 does not appear to portray accurately the behavior of profit-maximizing banks under a closed economy or in an open economy with flexible exchange rates. In particular, under flexible exchange rates, A.1.5 suggests that the real money supply always will be set by banks to equal the real money demand. At any given interest rate, however, it is more likely that private banks will only be willing to supply a limited amount of credit based on considerations of cost or default risk. Thus, they would follow the rule:

$$M/P = S(r) \quad (A.1.6)$$

Substituting  $S(r)$  for  $M/P$  into A.1.5, it can be seen that, under floating rates, the behavior of profit-maximizing banks ensures an equilibrium. In particular, A.1.5 and A.1.6 determine the level of output and, through A.1.3, the exchange rate that would be consistent with equilibrium. Equation A.1.4 then determines the prices of home goods and therefore the price level. This will suffice to determine the nominal money supply.

Except for Patinkin (1965), most of the literature uses A.1.5 rather than A.1.6 to model the real bills doctrine. However, A.1.5 is not necessarily consistent with profit-maximization, and more appropriately describes the behavior of a central bank pegging the interest rate rather than the behavior of private banks.

A well-defined level of money, prices, and exchange rates occurs because we have assumed in equation A.1.3 that the domestic economy is not fully insulated from the external sector even under floating rates. If we assumed instead that exchange rates did not influence the level of output at all, and that output is fixed, we would once more have a situation where equation A.1.4 determines the ratio  $P_H/E$ , and equation A.1.6, the ratio  $M/P$ . However, neither the level of M nor P can be determined.

Another problem is that if interest rates were determined abroad, there would be no reason to suppose that the money supply given by equation A.1.6 is consistent with the money demand of equation A.1.5.

However, it is implausible to assume that the external sector does not influence domestic activity in a small open economy like Hong Kong's. Thus, it is likely that Hong Kong's nominal money and price level were well-defined even under floating rates.

We may now examine how similar results can be obtained if we relax the strong assumption that domestic and foreign assets are perfect substitutes. A more elaborate framework will also permit us to analyze the implications of the interest-setting agreement of the Hong Kong Association of Banks.

Following Tobin and de Macedo (1980), we used a modified IS-LM approach in which all asset markets satisfy flow as well as stock equilibrium. If we assume that the government maintains fiscal balance, there are four markets: the market for private domestic bonds or commercial paper, the market for foreign bonds, the money market, and the goods market. By Walras's law, equilibrium in the first three guarantees equilibrium in the fourth. Thus, we may characterize the overall equilibrium by:

$$y = y(E) \quad \text{Aggregate supply} \quad (A.1.3)$$

$$A^H(r_H, r_F, E, y, a) - q_H(r_H)K_{-1} = I(r_h, y) \quad \text{Domestic Bond Market} \quad (\text{A.1.7})$$

$$A^F(r_H, r_F, E, y, a) - EF_{-1} = T(E/P_H, y) \quad \text{Foreign bond market} \quad (\text{A.1.8})$$

$$m(r_H, r_F, E, y) = M/P \quad \text{Money market} \quad (\text{A.1.9})$$

where

- $r_H$  = domestic interest rate
- $a$  = asset preference shift parameter involving the relative desirability of domestic and foreign bonds
- $q_h$  = the market valuation of a domestic bond
- $K_{-1}$  = the pre-existing capital (or private domestic bond) stock of foreign bonds
- $F_{-1}$  = the pre-existing stock of foreign bonds
- $A(\cdot)$  = asset demand
- $I(\cdot)$  = investment
- $T(\cdot)$  = trade balance
- $m(\cdot)$  = money demand

The arguments of the demand functions and their signs are generally familiar. The exchange rates enter to represent capital gains or losses from holding assets denominated in different currencies. If Hong Kong were a net creditor, the net holding of foreign assets would be positive and capital gains obtained from holding assets during a depreciation would be reflected in a rise in a demand for all assets. The reverse applies if Hong Kong were a net debtor.

The domestic interest rate,  $r_H$ , and output can be determined by substituting  $S(r)$  from A.1.6 into equation A.1.9 and using equation A.1.7. The corresponding nominal exchange rate follows from A.1.3, while equation A.1.8 can then determine the price of home goods. This is sufficient information

to determine the absolute price level  $P$ , and the nominal money supply  $M$  in equation A.1.6. Thus, in a small open economy with flexible exchange rates and imperfect capital mobility, the price level, nominal money supply, and exchange rates are determinate.

## Implications of the Interest-Setting Agreement

The HKAB sets the interest rates it pays on deposits, and this rate-setting may affect the corresponding loan rate. If we assume that the interest-setting agreement of the HKAB were effective in determining domestic interest rates, there would be no indeterminacy if banks passively supplied money according to this interest rate (that is, we could ignore equation A.1.6). This arrangement is equivalent to a central bank with an interest rate target.

In fact, given such a money supply rule, a fixed interest rate would be required to obtain a well-defined nominal equilibrium in money, prices, and exchange rates. Furthermore, this money supply rule would permit the use of interest rates as a policy tool.

Consider the 1982-1983 attack on the Hong Kong dollar which may be described as an effort to shift from domestic to foreign bonds (a persistent decline in the  $a$  parameter in equations A.1.7 and A.1.8). Comparative statics analysis reveals that the shift would lead to an exchange rate depreciation. Although not explicitly modeled here, if the depreciation in turn leads to further efforts to shift away from the Hong Kong dollar, we would have an unstable process. In contrast, an increase in interest rates by the HKAB would create an offsetting tendency towards exchange rate appreciation that may restore stability.

If we more realistically assume that the money supply function of profit-maximizing banks is upward sloping with respect to interest rates (equation A.1.6) when exchange rates are floating, the money market equilibrium could not be guaranteed unless the Hong Kong Association of Banks sets  $r_H$  in such a way as to ensure that money supply equals money demand. This is not a trivial calculation, and

the HKAB may set interest rates to create a persistent excess demand for or excess supply of money.

In the text of this article, we have noted that price instability may then result in line with Thornton and Wicksell's reasoning. Thornton and Wicksell, however, appear to have been describing a regime consistent with A.1.5 rather than A.1.6. If equation A.1.6 applies, banks may ration credit rather than create money given an excess demand for loans, and it is not obvious that price instability will necessarily follow. Furthermore, the relative weakness of the HKAB in a small open economy would favor price stability. Note, however, that the inability of the HKAB to determine interest rates in this regime would mean that there are no policy instruments available to offset an attack on the value of the Hong Kong dollar, as occurred in 1982-83.

One limitation of the discussion in this Appendix is that the models used — modifications of standard

approaches — do not fully capture the role and motivation of banks in creating money in an open economy. For example, it would be desirable to reconcile A.1.5, which we assumed applies under fixed exchange rates, with A.1.6, assumed to determine money creation under floating rates. Both reflect efforts to exploit profit opportunities under different exchange rate regimes.

Furthermore, in light of the discussion of the money multiplier in the text, it would be desirable to spell out explicitly what determines the proportion of foreign currency deposits banks will convert for note issuance under fixed exchange rates. Such exercises would clarify the process by which a market-determined money supply in an open economy achieves stability, given the profit-maximizing behavior of banks. In the meantime, the examples used serve to illustrate the feasibility of stable, market-determined monetary regimes.

#### FOOTNOTES

1. One of the purposes of the Federal Reserve Act of 1913, according to its introduction, is "to furnish an elastic currency, (and) to afford means of rediscounting commercial paper". In line with this, Section 13 of the Act states that Federal Reserve Banks "may discount notes, drafts and bills of exchange arising out of actual commercial transactions; that is, notes, drafts and bills of exchange issued or drawn for agricultural, industrial or commercial purposes . . ." Note the similarity of this concept to Adam Smith's definition of the real bills doctrine, quoted in the next paragraph of the text of this article.
2. For example, the Federal Reserve Act sought to enforce application of the real bills doctrine according to this narrow concept by forbidding the discount of "notes, drafts or bills covering merely investments or issued or drawn for the purpose of carrying or trading in stocks bonds or other investment securities, except bonds and notes of the government of the United States".
3. Whether banks would succeed in accommodating real loan demand would depend on the real savings resources available in the economy. If at a given interest rate, the real savings resources are less than the demand for loans, the effort to accommodate loans may lead to the price instability described by Thornton and Wicksell, and discussed later in the text.
4. Sargent (1979) and McCallum (1984).
5. This view was not necessarily shared by Adam Smith, however. See Laidler (1981) and the discussion of the open economy under fixed exchange rates which follows.
6. As shown in the Appendix, the problem is that the level of nominal money balances and the price level become indeterminate. As this concept is less familiar than that of instability, in the text the term "instability" will be used

loosely to refer to either indeterminacy or instability. Patinkin (1965) observed that indeterminacy arises because a change in prices does not affect the excess demand for goods in the economy. In particular, because the money supply is market-determined under a real bills regime, the equilibrium in the money market applies independently of the equilibrium in the goods market. This would not be the case if the money supply were determined by a central bank that sought to limit the nominal quantity of money.

7. The dynamic instability of a real bills regime has been succinctly described in a recent paper by Thomas Humphrey (1982), who showed that it may be associated with hyperinflation, hyperdeflation or an indeterminate price level.

8. For example, Fama (1980) solves the problem of price stability by suggesting that the chosen numeraire be one with a value that does not depend on the volume of deposits outstanding in the financial sector. Sargent and Wallace (1982) suggest that a real bills regime has certain welfare properties that make it in some sense superior to a regime with "quantity theory" restrictions consistent with price level stability. While not endorsing the real bills doctrine, McCallum (1984) shows conditions under which it may be consistent with price level stability.

9. The description of the operation of the gold standard in an open economy is attributed to Hume. However, Laidler (1981) observes that Hume had little to say about the operation of the financial sector under a gold standard. It was Adam Smith who first pointed out that full convertibility of the monetary liabilities of banks with gold was required to prevent note overissuance. He also recognized that any excess supply of money would "spill over" into the external sector.

10. The equilibrium of this system is described in the simplest terms in the Appendix, using the flexible price version of the Mundell-Fleming model.
11. This is a traditional government viewpoint, according to a former Financial Secretary. See Philip Haddon-Cave (1984).
12. Philip Haddon-Cave (1984). As a result of this fiscal conservatism, Hong Kong had no marketable government debt outstanding in 1982.
13. Wallace (1983) argues that reserve requirements would also be necessary to ensure that banks hold the currency liabilities of the government. However, if hand-to-hand currency were legal tender and the circulation of foreign notes forbidden, as it is in Hong Kong, these conditions may suffice to create a demand for the legal tender. For a related discussion, see Keeley and Furlong's paper in this issue of the *Economic Review*, and Fama (1983).
14. This of course does not preclude a central bank from following a policy that accommodates the market demand for money by targeting exchange rates or interest rates. However, it is still the central bank rather than the private sector that retains the initiative for money creation in this case.
15. Using a different framework, Beers, Sargent and Wallace have argued that the exchange rate was indeterminate in Hong Kong during the period of floating rates. Exchange rates could also be indeterminate under floating rates if Hong Kong money and foreign money were perfect substitutes, as shown by Kareken and Wallace (1981) in the context of an overlapping generations model. Maxwell Fry (1985) has also argued that Hong Kong's monetary regime in the floating rate period was unstable. Our general description of Hong Kong's monetary system under fixed and floating rates is closer to that of the *Asian Monetary Monitor*.
16. *Asian Monetary Monitor*, Vol. 7, No. 6.
17. A similar problem applied to the objective of the Exchange Fund of maintaining full foreign asset backing of note issuance. Under floating exchange rates, it is not clear what "full backing" means, since a fixed amount of foreign assets may "back" an increasing quantity of note issuance as the currency depreciates. Thus, the "backing" would not limit note issuance under floating rates, and, as argued in the text, would not be effective in pegging the exchange rate because note issuance would not be limited by the availability of foreign exchange assets.
- In contrast, under fixed exchange rates, the Hong Kong dollar is fully backed in the sense that at the rate set by the government, the Exchange Fund always has enough foreign currency assets to redeem on demand any quantity of Hong Kong dollar notes in circulation. The fact that Hong Kong dollar note issuance is limited by foreign asset availability at the fixed rate ensures that the currency peg is enforceable.
18. Technically, the measurement error in the money series implies that when used as an explanatory variable for prices, it is correlated with the error term. This "errors in variables" problem implies that the estimated coefficient on money would be inconsistent.
19. Sims (1972) and Haugh and Pierce (1977).
20. The exchange rate drop was precipitated by a crash in the real estate market that reduced the loan collateral of banks and consequently their net worth. Beers, Sargent and Wallace (1983) present the intriguing hypothesis that the government may have allowed the exchange rate to depreciate to reduce the Hong Kong dollar deposit liabilities of banks and thus to improve their balance sheets. Ketkar and Sweet (1984) discuss the balance sheet structure under which a depreciation will actually benefit banks, and suggest there is an optimal rate of depreciation (or appreciation) depending on the particular balance sheet structure of banks. As a general point, it should also be noted that, to benefit from a depreciation, the foreign assets of banks should exceed their foreign liabilities. In this way, their wealth increases from capital gains induced by a depreciation (see discussion of the Tobin-de Macedo model in the Appendix).
- Although it is not clear that the balance sheet structure of banks in Hong Kong would have benefited from a depreciation in 1982-1983, the Beers, Sargent and Wallace argument highlights the potential use of exchange rate policy to satisfy certain objectives in the financial sector. This novel point raises many interesting questions for policy, but our discussion suggests that during the period of floating rates, the Hong Kong government simply did not have the instruments to conduct a deliberate exchange rate policy of the sort described by Beers, Sargent and Wallace.
21. In fact, note-issuing banks could speculate against the value of the currency by increasing the rate of note issuance to purchase foreign assets. The data on currency creation during 1982-1983 suggest that this did not happen at the time of the attack on the Hong Kong dollar, but in principle, this could be a destabilizing source of note issuance.
22. This is not to say that a fixed exchange rate regime has no disadvantages. It is not obvious that pegging to a strongly appreciating currency such as the U.S. dollar was the best course. Furthermore, Hong Kong's money creation and domestic inflation rate are particularly vulnerable to external disturbances under this regime.

## REFERENCES

- Aghevli, B.B. and Khan M.S. "Government Deficits and the Inflationary Process in Developing Countries" in Warren L. Coats and Deena R. Khatkhate, eds. *Money and Monetary Policy in Less Developed Countries*. Pergamon Press, 1980.
- Asian Monetary Monitor*. Various issues. Hong Kong.
- Beers, David T., Thomas J. Sargent and Neil Wallace. "Speculations about Speculation Against the Hong Kong Dollar." Federal Reserve Bank of Minneapolis. Quarterly Review, 1983.
- Cagan, Phillip in William Fellner, ed. *Contemporary Economic Problems*. Washington, D.C.: American Enterprise Institute for Public Policy Research, 1979.
- Chen, Edward K.Y. "The Economic Setting" in Lethbridge, D. *The Business Environment in Hong Kong*. Hong Kong: Oxford University Press, 2nd ed., 1984.
- Dale, Richard. "Regulating the Euromarkets." *The Regulation of International Banking*. Cambridge: Woodhead-Faulkner, 1984.
- Fama, Eugene F. "Banking in the Theory of Finance." *Journal of Monetary Economics* 6, January, 1980.
- Fama, Eugene F. "Financial Intermediation and Price Level Control," *Journal of Monetary Economics* 12, 1983.
- Fry, Maxwell J. "Financial Structure, Monetary Policy and Economic Growth in Hong Kong, Singapore, Taiwan and South Korea. 1960-1983" in A. Krueger, V. Corbo, and F. Orso, eds. *Export Oriented Development Strategies*. Colorado: Westview Press, 1985.
- Haddon-Cave, Sir Philip. "Introduction" in Lethbridge, D. *The Business Environment in Hong Kong*. Hong Kong: Oxford University Press, 2nd ed., 1984.
- Haugh, Larry D. and David A. Pierce. "Causality in Temporal Systems: Characterizations and a Survey." *Journal of Econometrics* 5, 1977.
- Humphrey, Thomas M. "The Real Bills Doctrine." *Economic Review*, Federal Reserve Bank of Richmond, September/October 1982.
- Hong Kong Monthly Digest of Statistics*. Various issues. Hong Kong: Census and Statistics Department.
- Jao, Y.C. "A Libertarian Approach to Monetary Theory and Policy," *Hong Kong Economic Papers* No. 15, Hong Kong Economic Association, 1984.
- Jao, Y.C. *Banking and Currency in Hong Kong*. London: The MacMillan Press, 1974.
- Jao, Y.C. and Lee, S.Y. *Financial Structures and Monetary Policies in Southeast Asia*. New York: St. Martin's Press, 1982.
- Jao, Y.C. "The Financial Structure" in Lethbridge, D. *The Business Environment in Hong Kong*. Hong Kong: Oxford University Press, 2nd ed., 1984.
- Kareken, John and Neil Wallace. "On the Indeterminacy of Equilibrium Exchange Rates," *Quarterly Journal of Economics*, Vol. 96, No. 2, May, 1981.
- Ketkar, Suhas and Lawrence M. Sweet. "Speculations About Speculation Against the Hong Kong Dollar — A Comment." Manuscript, 1984.
- Laidler, David. "Adam Smith as a Monetary Economist," *The Canadian Journal of Economics*. Vol. XIV, No. 2, May, 1981.
- Lethbridge, David G. *The Business Environment in Hong Kong*. Hong Kong: Oxford University Press, 2nd ed., 1984.
- McCallum, Bennett T. "Some Issues Concerning Interest Rate Pegging, Price Level Determinacy, and the Real Bills Doctrine." Working Paper No. 1294. Massachusetts: National Bureau of Economic Research, Inc., 1984.
- McCarthy, Ian S. "Financial System of Hong Kong" in Robert C. Effros, ed., *Financial Centers, Legal and Institutional Framework*, International Monetary Fund, 1982.
- Patinkin, Don. "Money, Interest and Prices," *An Integration of Monetary and Value Theory*. New York: Harper and Row, 2nd ed., 1965.
- Sargent, Thomas J. *Macroeconomic Theory*. New York: Academic Press, 1979.
- Sargent, Thomas J. and Neil Wallace. "Rational Expectations, the Optimal Monetary Instrument, and the Optimal Money Supply Rule," *Journal of Political Economy* Vol. 83, 1975.
- Sargent, Thomas J. and Neil Wallace. "The Real-Bills Doctrine versus the Quantity Theory: A Reconsideration," *Journal of Political Economy* Vol. 90, No. 6, 1982.
- Sims, Christopher. "Money, Income and Causality," *American Economic Review*, Vol. 62, No. 4, 1972.
- Smith, Adam. *An Inquiry into the Nature and Causes of the Wealth of Nations*, London 1776. Reprinted. New York: Random House, 1937.
- Thornton, Henry. *An Enquiry into the Nature and Effects of Paper Credit of Great Britain*. Reprinted in 1939. London: London School of Economics.
- Tobin, J. and J. Braga de Macedo. "The Short-Run Macroeconomics of Floating Exchange Rates: An Exposition" in John Chipman and C. Kindleberger, *Flexible Exchange Rates and the Balance of Payments*. North Holland, 1980.
- Wallace, Neil. "A Legal Restriction Theory of the Demand for 'Money' and the Role of Monetary Policy," *Quarterly Review*, Federal Reserve Bank of Minneapolis, Winter, 1983.