Risk Premium, Currency Board, and Attacks on the Hong Kong Dollar*

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Abstract

Hong Kong's "linked exchange rate" (also known as the "peg") is a currency board system under which the Hong Kong dollar notes are fully backed by the U.S. dollar at the rate of HK$7.8 per US dollar. In this paper we present an event analysis of the credibility of the peg as measured by the forward premium recovered from forward exchange rates. Based on the forward premium from January 1997 to December1998, the devaluation probability of the Hong Kong dollar as perceived by the foreign exchange market is calculated. We examine the evolution of credibility during this period using the theoretical framework of a target zone model. The relationship between Hong Kong dollar's risk premium during the recent Asian financial crisis and four fundamental economic variables whose deterioration is widely regarded as conducive to currency crisis is explored.

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I. Introduction

In the recent financial crisis that swept across Asia, a common feature was that attacks on the local currencies led to their depreciation or even total collapse. The only East Asian currencies that have thus far not been forced to devalue are the Hong Kong dollar and China's Renminbi. The Hong Kong dollar is pegged to the U.S. dollar via a currency board arrangement called the "linked exchange rate system" (also known as "the peg"), whereas the Renminbi is not a fully convertible currency because China maintains control on cross-border capital movement.

Under Hong Kong's exchange rate system, Hong Kong dollar notes are more than fully backed by U.S. dollars at the rate of HK$7.8 per US dollar. In fact, given the staggering size of Hong Kong's reserve, every Hong Kong dollar note is much more than 100% backed. Even though the system has survived the Asian financial crisis thus far, it does not mean that it did not come under severe speculative pressure. Confidence in the system was actually in doubt during the crisis. In this paper, we analyze the foreign exchange market's perception of the risks of holding the Hong Kong dollar vis-à-vis the U.S. dollar since the peg's inception in October 1983. We shall relate changes in the perceived risks to both development in the global financial markets and policy measures taken by Hong Kong's monetary authority in dealing with attacks on its currency. Special emphasis will be given to the period of the Asian financial crisis.

After an event analysis of the credibility of the peg in the next section, we shall calculate in Section III the market's perceived probability of devaluation of the Hong Kong dollar based on alternative assumptions about the magnitude of devaluation. In Section IV the peg's credibility is examined within the theoretical framework of a target zone model. Section V explores the relationship between Hong Kong dollar's risk premium during the recent Asian financial crisis on the one hand and four fundamental economic variables whose deterioration is widely regarded as conducive to currency crisis on the other. These variables include Hong Kong's real exchange rate, trade balance, foreign reserves, and unemployment rate. The final section summarizes our findings and indicates directions for further research.

II. Risk Premium of the Hong Kong Dollar: An Event Analysis

In this section we analyze the risk premium of the Hong Kong dollar as perceived by the foreign exchange market since the peg's inception in October 1983. Following Bartolini and Bodnar (1992), we shall measure the risk premium, or equivalently the lack of credibility of the peg, by the annualized premia of the 1-month, 3-month, 6-month, and 12-month Hong Kong dollar/U.S. dollar forward exchange rates. By definition, the forward premium is the annualized percentage deviation of the forward exchange rate from the spot exchange rate. A forward discount is understood to be a negative premium.

Under covered interest parity and in the absence of transaction costs, the annualized forward premium would be equal to the difference between Hong Kong interest rate (Hong Kong Inter-bank Offer Rate, or HIBOR for short) and the U.S. interest rate (London Inter-bank Offer Rate, or LIBOR for short) of the corresponding maturity.[1] An examination of the forward premium and interest rate differentials reveals that their differences are not significantly different from zero. Thus, the two measures essentially contain the same information about Hong Kong dollar's risk premium. However, in the presence of transaction costs, the relationship is not exact, so changes in one market would be partially transmitted or spilled over to the other. The Hong Kong Monetary Authority intervenes in both the foreign exchange spot market and the money market but not in the foreign exchange forward market. Thus, in the presence of transactions cost, the forward premium is a better measure of the market's perceived risk of the Hong Kong dollar than the interest rate differential.

The spot exchange rate from November 1, 1983 to December 16, 1998 is given in Figure 1. Three observations are in order. First, the spot rate fluctuated around the official rate of HK$7.8/US$ between November 1983 and mid 1991. During this period, the spot rate remained within 7.75 and 7.85 most of the time, but exceeded 7.85 between July and September of 1984 and fell below 7.75 during July 1985. Second, due to the Hong Kong Monetary Authority's (HKMA, Hong Kong's de facto central bank) adoption of a "first-line defense" at 7.75 towards the end of May 1992, the spot rate has since hovered around 7.74-7.75, but staying below 7.75 more

[1] See Cheng, Kwan and Lui (1999) for an analysis using HIBOR-LIBOR interest differentials.

often than above it.[2] Third, the exchange rate rose above 7.76 in January 1995 as a result of the spillover from the Mexican crisis, but it has remained below 7.75 ever since the onset of the Asian financial crisis.

*** Insert Figure 1 ***

The 1-month forward premium from November 1, 1983 to December 16, 1998 is depicted in Figure 2. As can be seen, the premium was close to zero throughout the entire period with several noticeable exceptions. In the first two years or so of the newly established peg, the market was understandably skeptical and concerned about the possibility of realignments. During December 1987 and the first two weeks of January 1988, the Hong Kong dollar enjoyed a very substantial risk discount, reaching a maximum of over 10% on December 22, 1987. During this period, the U.S. dollar depreciated against the Japanese yen as the U.S. ran a big budgetary deficit. Funds flowed into Hong Kong in anticipation of the Hong Kong dollar's appreciation in the event of a break of the peg. The inflow of hot money abated after the Hong Kong Government considered using negative interest rate to defend the peg.

From the middle of 1988 to the beginning of the Asian financial crisis, the 1-month forward premium remained very close to zero.[3] Even when the system was tested by shock waves such as the June 4 incident in 1989 and the Mexican crisis in January 1995, the risk premium only went up for a brief period and the annualized premium was remarkably below 3%.[4]

*** Insert Figure 2 ***

[2] One can question the wisdom of adopting a first-line defense. If the HKMA fails to maintain its first-line defense of 7.75, it is doubtful that it will be able to defend the ultimate-line of 7.8.

[3] The period of relative tranquility was associated with the introduction of the New Accounting Arrangement by the HKMA. Before the New Accounting Arrangement, the Hong Kong Bank (the largest private bank in Hong Kong) served as a de facto central bank in terms of the banking system's settlement of transactions. With the New Accounting Arrangement, the Hong Kong Bank had to maintain an account with the HKMA for its own settlement. After December 9, 1996, all banks in Hong Kong must maintain a settlement account directly with the HKMA rather than through one of the former "clearing banks."

[4] Between early May and the third week of June 1991, the risk premium of the Hong Kong dollar was in the range of 2-3%. During this period, Hong Kong suffered from double-digit inflation and the prime lending rate went up by a full percentage point. The risk premium dropped after Hong Kong's inflation and growth rates slowed down.

The situation during the Asian financial crisis appeared to be a break from the past. Figure 3 depicts the 1-month forward premium from April 1, 1997 to December 16, 1998. Compared with the earlier period, the risk premium was substantially higher. As the Hong Kong dollar came under a major speculative attack against the background of the New Taiwan dollar's float, the premium shot up to 15% on October 23, 1997, which is known as the "Black Thursday" in Hong Kong, when the overnight HIBOR at one point reached 280%. The risk premium reached 24% in the period of January 12-20,1998, when the currency came under another major attack. In the next two attacks in June and August 1998, the risk premium was 6-7.4% during June 11-19 and 10% between August 26 and September 2.

*** Insert Figure 3 ***

The movement of the 3-month forward premium is basically identical to that of the 1-month forward premium. The only difference is that the amplitude of the fluctuation of the 3-month premium was smaller than that of the 1-month premium. That is perhaps not surprising given the known analytical results obtained in the literature about the term structure of forward premia (see Bartolini and Bodnar (1992)) or interest rate differentials corresponding to different maturities (see Ozkan and Sutherland (1998) and Svensson (1991)). These results have indicated that the short-term risk premium and interest differential experiences greater fluctuation than their longer-term counterparts.

Given the above results on term structure of forward premium, one would expect the 6-month and 12-month forward premia to experience less fluctuation than their 3-month counterpart. However, that was the case only before the Hong Kong dollar came under serious attack in October 1997. A careful comparison of the forward premia since the middle of November 1997 shows that the 6-month forward premium more often than not exceeded the 3-month premium, and the 12-month premium in turn was above the 6-month premium throughout much of the same period. (See Figure 4 for a comparison of the 3-month and 12-month forward premia.) Thus, the evidence suggests that the market was more concerned about the Hong Kong dollar peg's collapse in the long run than in the short run. That is consistent with surveys of fund managers, many of whom believed that that the peg would go in one or two years even though it was not in immediate danger.

*** Insert Figure 4 ***

In response to renewed attacks on the Hong Kong dollar and selling pressure on the Hang Seng stock futures index, the HKMA, on behalf of the Hong Kong SAR government, started to purchase blue chips on the stock market in the middle of August 1998 to push up the Hang Seng index for that month. Even though the HKMA intervened regularly in the foreign exchange market, the intervention in the stock market was extraordinary, and the government in the process spent about US$15 billion on the stocks. A discussion of the circumstances under which the government took such an unprecedented action can be found in Cheng, Kwan, and Lui (1999). It suffices to say that any alleged need for direct intervention in the stock market could not be dissociated from the government's failure to close some obvious loopholes in Hong Kong's currency board mechanism. The most important loophole was the small Aggregate Balance of the banking system for the purpose of settling their transactions. Until September 1998, the loophole allowed speculators to push up HIBOR sky high by selling about HK$2 billion of Hong Kong dollars in the spot market.

After the stock market intervention in the second half of August 1998, the HKMA announced on September 5 "seven technical measures" to strengthen Hong Kong's currency board system against currency speculation. More than technical, these measures reflected a fundamental reversal of the HKMA's prior conviction that high interest rate was a necessary evil in fighting against currency speculators and signaled an acceptance of the argument that the HKMA needed to take concrete actions, not mere words, to boost confidence in the peg. As far as the mechanics is concerned, the new measures explicitly established a discount window to replace its predecessor the "Liquidity Adjustment Facility."[5] The Aggregate Balance for clearing purposes is enlarged many-fold because banks would be able to borrow from the HKMA through the discount window at known discount rates.[6] In addition, it

[5] The Liquidity Adjustment Facility was first established in June 1992.

[6] According to HKMA's web page, the Aggregate Balance before discount window on December 23, 1998 was HK$2.581 billion and the outstanding Exchange Fund Bills and Notes amounted to HK$97.45 billion. Since these bills and notes can be used for the discount window as collateral, the Aggregate Balance can be enlarged by a maximum of 39 times.

provided an explicit "undertaking" of the convertibility of Hong Kong dollars in the banks' balances with the HKMA at the rate of 7.75.

The 1-month premium dropped precipitously from 10% on September 2, 1998 to 3.3% on the next day as the battle between the HKMA and "market manipulators" (and many ordinary investors) came to a temporary halt. Both HIBOR and the forward premium remained low after the "seven measures" had been introduced. However, due to a concern over the duration of HKMA's commitment to the convertibility undertaking, and upon HKMA's chief executive's suggestion on Monday, September 14, that the undertaking would be changed from 7.75 to 7.8 (the official parity under the currency board) as soon as possible, the market was nervous and HK$9.3 billion was sold for U.S. dollars during the day.[7] The forward premium went up by almost 2% on that day.[8] To calm the market, the HKMA announced in the afternoon of that day that it was committed to the rate of 7.75 for at least six months. The 1-month HIBOR dropped from its intra-day high of 12.25% to close at 8% and the 3-month HIBOR dropped from its intra-day high of 11.75% to close at 9.375%.[9]

Both the "seven measures" introduced by the HKMA on September 5 and the "eighth measure" forced upon it in the afternoon of September 14 were interesting experiments on the impact of government policy. Both showed the importance of confidence in the peg to market behavior and the importance of the government's commitment to the peg by way of actual actions (after the convertibility undertaking of the HKMA was given a clear duration and acquired the legal force of a contract) to the confidence in the peg.[10] The establishment of a new discount window that provides greater liquidity to the banks than its predecessor was useful in calming concerns about interest rate fluctuations in the face of currency speculation. However, the legal and contractual guarantee of the exchange rate to the banks was most crucial

[7] According to Xie and Yam (1998, p.21) HK$1.6 billion was bought back on September 15, HK$7.5 billion on September 16, and HK$1.3 billion on September 17. That is to say, the inter-bank Hong Kong dollar liquidity was increased by HK$1.1 billion after uncertainty about the HKMA's commitment was resolved.

[8] The 3-month and 6-month forward premia went up by 1% and 0.5% higher, respectively. However, as a reflection of the intra-day HIBOR to be reported below, the intra-day forward premia were higher.

[9] Sing Tao Daily, September 16, 1998.

[10] See Cheng, Kwan, and Lui (1999) for a more detailed discussion.

to confidence in the peg itself. Without such a guarantee, the scope and power of both exchange rate and interest rate arbitrage would be severely limited.

III. Probability of Devaluation

We can extract from the forward premium data the implicit risk of devaluation as perceived by the foreign exchange market, using the drift adjustment method developed in the target zone literature.[11] Given the devaluation risk, we can calculate the implicit probability of devaluation conditional on a given size of realignment. Let s_t and c_t be the natural logarithms of the spot exchange rate and the central parity, respectively. Then one can write down an identity $s_t \equiv c_t + x_t$, where x_t is by construction the spot rate's (log) deviation from the central parity. Write $\Delta c_{t+\tau} = c_{t+\tau} - c_t$ and the average rate of realignment from time t to $t + \tau$ as $\Delta c_{t+\tau}/\tau dt$, and similarly for s_t and x_t. It follows from the identity that

$$E_t \Delta c_{t+\tau} / \tau dt \equiv E_t \Delta s_{t+\tau} / \tau dt - E_t \Delta x_{t+\tau} / \tau dt \qquad (1)$$

The left-hand-side in (1) is the implicit risk of devaluation as perceived by the foreign exchange market. The two expected rates on the right-hand-side can be recovered from observed data. First, we identify the expected rate of total depreciation, $E_t \Delta s_{t+\tau}/\tau dt$, with the observed forward premium by appealing to covered interest parity. Second, following Bertola and Svensson (1993), we estimate the expected rate of drift from parity, $E_t \Delta x_{t+\tau}/\tau dt$, by the linear projection of $\Delta x_{t+\tau}/\tau dt$ on x_t, with the projection standard error computed from a Newey-West heteroskedasticity-autocorrelation consistent matrix of τ lags. That is, the implicit devaluation risk is estimated by the observed forward premium adjusted for drift from the central parity. (See Figure 5 for the drift-adjusted 3-month forward premium from January 1, 1997 to December 16, 1998.)

*** Insert Figure 5 ***

[11] See for example Svensson (1993), Bertola and Svensson (1993) and Rose and Svensson (1994).

Given an estimate of the devaluation risk (drift-adjusted forward premium), we can recover the implicit probability of devaluation perceived by the market. Let p_t^{τ} be the probability at time t of a realignment of random size $\Delta c_{t+\tau}$ during the period from time t to t + τ. The expected change in central parity (expected devaluation) can be written as

$$\begin{aligned} E_t[\Delta c_{t+t}] &= (1 - p_t^{t})0 + p_t^{t} E_t[\Delta c_{t+t} \mid realignment] \\ &= p_t^{t} E_t[\Delta c_{t+t} \mid realignment] \end{aligned} \tag{2}$$

In terms of rate of changes, (2) can be rewritten as

$$E_t[\Delta c_{t+t}]/t\,dt = n_t^{t} E_t[\Delta c_{t+t} \mid realignment] \tag{3}$$

where $\nu_t^{\tau} \equiv p_t^{\tau}/\tau dt$ is by definition the expected average frequency of realignment during the period from time t to t + τ. To illustrate how the devaluation probability can be calculated, suppose that the drift-adjusted 3-month forward premium is 7% and the expected devaluation size is 5%. In annual terms τdt = ¼ year. Using (3), ν_t^{τ} = 7/5 = 1.4, and p_t^{τ} = 1.4/4 = 0.35.

We calculate devaluation probabilities for three different sizes of possible devaluation: 5%, 10%, and 15%. Figure 6 shows the probability that the Hong Kong dollar would be devalued by 15% within one month, three months, six months, and twelve months during the period from January 1, 1997 to December 16, 1998.

*** Insert Figure 6 ****

As can be expected from theory, the probability of devaluation of the same magnitude within a given period is higher if the period is longer. Among other things, the diagram shows that the probability of devaluation was highest during January 1998. For instance, the market's predicted probability that the Hong Kong dollar would be devalued by 15% within one month was about 10%. The probability that devaluation would occur within three months, six months, and a year was about 20%, 35%, and 70%, respectively.

If the size of devaluation were 10%, then the implied probability of devaluation would be higher uniformly across all four periods without changing their relative position. In particular, in January 1998 the market expected the Hong Kong dollar to devalue 10% within a year with almost certainty. If the size of devaluation were 5%, then during the same period in January 1998, the market expected the peg to go within six months with almost certainty.

On the other hand, if the size of devaluation were 30% instead, then the probabilities shown in Figure 6 would be halved. Among other things, it means the market perceived the peg to go within one year with probability no higher than 35%.

Judged by the extent of devaluation by the New Taiwan dollar and Singapore's dollar, the Hong Kong dollar would not likely devaluate by more than 30%. That is to say, while the probability of its devaluation was nowhere close to certainty, it was still quite high.

IV. Is the Linked Exchange Rate a Credible Target Zone?[12]

How credible was the peg? We see the actual operation of the peg as no different from a target zone exchange rate system even though its currency board arrangement has imposed strict discipline on money supply.[13] In this section, we test the credibility of the peg along the lines suggested by Bartolini and Bodnar (1992). Specifically, we shall examine the empirical relationship between deviation of the spot rate from its parity and the forward premium. The results are summarized in Figure 7. In the figure there are four graphs depicting that relationship between the annualized forward premium (on the vertical axis) and deviation of the spot rate from its parity (on the horizontal axis) for the following four sub-periods:

(a) The period immediately before the Asian financial crisis (January 1 – April 30, 1997);

(b) The period before the Hong Kong dollar crisis (May 1 – October 22, 1997);

[12] An estimation of the expected drift of the spot rate as a function of the spot rate and interest rate differential has found a significant relationship between expected appreciation (depreciation) and interest rate differential before (after) the HKMA developed its tools of intervention. The dividing line is taken to be April 1, 1992, since by this time the HKMA had acquired almost all of its tools of intervention (namely, the New Accounting Arrangements, the Exchange Fund Bills and Notes, and the Liquidity Adjustment Facility). For a detailed description of the estimation results, see Cheng, Kwan, and Lui (1999). Qualitatively similar results were obtained if the interest rate differential was replaced by the forward premium.

[13] Leung (1996) studies the Linked Exchange Rate system from the point of view of a target zone model using data up to 1993.

(c) The Hong Kong dollar crisis (October 23, 1997 – September 6, 1998), and
(d) The period after the HKMA's new measures (September 7 – December 16, 1998).

*** Insert Figure 7 ****

Notice that in drawing the above diagrams, we used 7.74 as the central parity, which should not be too far away from the (implicit) parity targeted by the HKMA. Moreover, we show only the risk premium based on the 1-month forward premium, but the diagrams based on 3-month, 6-month, and 12-month forward premia are qualitatively similar.

As shown by Bartolini and Bodnar (1992), if an exchange rate system is fully credible and the central bank engages in infinitesimal intervention to enforce the exchange rate's target zone, then there must be a negative relationship between the forward premium and deviation of the spot rate from its parity (as in their Fig. 4). It is clear that none of the diagrams in Figure 7 exhibits any negative relationship, implying that the peg was not as credible to the foreign exchange market participants as many people think. Moreover, the four sub-periods have exhibited different degrees of credibility, or confidence crisis. The 1-month premium for the first sub-period lied between –0.45% and 0.27%. In the second period, i.e. after the onset of the Asian financial crisis but before the Hong Kong dollar became a target of attack by currency speculators, the premium varied between –2% to 4%. Then during the Hong Kong dollar crisis, the risk premium fluctuated between 0% and 25%. In the last sub-period, after measures were introduced to strengthen the peg against currency speculation and to boost confidence in the peg itself, the upper range of the risk premium fell back to 5%, similar to that during the second sub-period.

The empirical observations from the last three periods basically lie above the horizontal axis and primarily on the right-hand side of the vertical axis. Thus, the evidence seems to best fit the case of "Asymmetric Credibility, Discrete Intervention" analyzed by Bartolini and Bodnar (1992, Fig. 10, p. 388). This result suggests that the HKMA was more credible about preventing appreciation than about preventing depreciation.

In conclusion, even before the Asian financial crisis, the peg was not regarded as fully credible by foreign exchange market participants. Against the background of the Asian financial crisis, confidence in the system suffered, indicating that the Hong

Kong currency was not considered a safe haven for the turbulent Asia economies. Confidence in the peg was eroded further when the Hong Kong dollar came under attack by currency speculators. Fortunately, loopholes in Hong Kong's currency board system were plucked and a contractual commitment was made to the exchange rate. As a result, confidence in the peg was restored to the level that had prevailed before the Hong Kong dollar crisis. In other words, whatever the exact arrangement of the exchange rate system, be it a currency board or a target zone, confidence in the exchange rate cannot be taken for granted.

V. Relationship between Perceived Risks and Negative Fundamentals

An interesting question about the Asian financial crisis in general and the Hong Kong dollar crisis in particular is whether or the extent to which they were caused by a deterioration of their fundamental economic factors. If they were not caused by fundamentals, then some sort of systemic failures such as contagion effect may be responsible. In this section, we examine four fundamental variables whose deterioration is widely regarded as conducive to currency crisis.

First, let us look at Hong Kong's real exchange rate index to see if deterioration in its international competitiveness could have contributed to the crisis. The real exchange rate is obtained as a weighted average of the bilateral real exchange rates of Hong Kong vis-à-vis its major trading partners. Real exchange rate is defined as nominal exchange rate adjusted for relative inflation, and the weights are their respective shares of Hong Kong's domestic exports. The movement of the index of real exchange rate is depicted in Figure 8 with 1992 as the base year. Hong Kong has lost its international competitiveness throughout the entire period, but there were no dramatic changes in the trend before or during the Hong Kong dollar crisis. In fact, the currency crisis occurred only after the Asian financial crisis had gained sufficient momentum.

The dotted line is obtained by ignoring China's official devaluation in January 1994. The rationale for this is that the 1994 devaluation merely allowed the official rate, which by 1994 governed only a small fraction of exports and imports in China, to move toward the market-based "swap rate" that was far more important in export and import decisions.[14]

[14] Foreign exchange swap markets had been operating for many years in China before the government devalued its grossly over-valued "official" exchange rate to unify with the swap rate.

Thus, there was no strong evidence to suggest that deterioration in Hong Kong's international competitiveness was a key contributing factor to the Hong Kong dollar crisis. Nevertheless, we cannot rule out the possibility that the accumulation of the deterioration of international competitiveness may have reached a threshold by October 1997.

**** Insert Figure 8 ****

The real exchange rate index measures Hong Kong's international competitiveness in prices but not in quantities. As a supplement to the real exchange rate index, let us see how Hong Kong's trade balance developed over the relevant period. Trade balance is defined to be merchandise and service exports less merchandise and service imports. As Figure 9 has shown, Hong Kong's trade balance showed signs of decline since the third quarter of 1994. There was a deficit during the entire 1997 (which might reflect the cumulative effect of appreciation in the real exchange rate), and it might be a possible fundamental variable underlying the speculative attacks on the Hong Kong dollar.

*** Insert Figure 9 ***

Next consider foreign reserves, a variable whose reduction may contribute to exchange rate instability. Hong Kong's foreign reserves since 1991 are given in Table 1. As can be seen, the foreign reserves continued to rise from the beginning of the period up to October 1997, when a major currency attack occurred. Thus, unlike other economies whose currencies were targets of speculation, there was no significant reduction in Hong Kong's foreign reserves at all. Quite to the contrary, Hong Kong's foreign reserves were rising. Even with a loss of some reserves between February and October of 1998, Hong Kong's foreign reserves ranked the third largest in the world, only after Japan and China at the end of November 1998.[15] Thus, changes in foreign reserves could not possibly be a factor behind the Hong Kong dollar crisis.

*** Insert Table 1 ***

[15] At the end of December 1998, Taiwan displaced Hong Kong as the third largest holder of foreign reserves at US$90,3 billion (see p.2 of Business Post, South China Morning Post, January 29, 1999).

Finally, let us examine the behavior of Hong Kong's unemployment rate, a variable that is often thought to be critical in the central banks' decision to devaluate their currencies in order to reduce the pain of unemployment. Hong Kong's unemployment figures are depicted in Figure 10. As is apparent from the figure, the unemployment rate in Hong Kong before the Hong Kong dollar crisis was low even by historical standard. Thus, there was no pressure from the employment front to suggest a devaluation of the Hong Kong dollar to reduce unemployment. Unemployment during the crisis did creep up continuously, but instead of being a cause for possible devaluation, it was a result of the credit crunch that followed the currency crisis. Thus, unemployment did not seem to be a significant contributor to the Hong Kong dollar crisis. If anything, it was one of the crisis' major casualties.

*** Insert Figure 10 ***

Needless to say, the above analysis is exploratory rather than conclusive. In order to formally test the hypothesis whether the Hong Kong dollar crisis was caused by deterioration in its economic fundamentals, or by bad policies, or due to the contagion effect, we need to develop a formal model for statistical testing.

VI. Summary of Results and Directions for Further Research

In the above we showed how the risk premium of the Hong Kong dollar under the peg evolved from its inception in October 1983 to December 1998, and in particular how it has responded to changes in the global environment and Hong Kong's own exchange rate policy during the Asian financial crisis. Even before this crisis, the peg was not regarded as fully credible. During the crisis, confidence in the peg suffered, and eroded further after the peg came under speculative attacks. After measures were introduced by the HKMA to increase confidence in the peg and to enhance interest rate stability, confidence was restored to its earlier levels. The market responses have demonstrated quite convincingly that appropriate government measures were key in signaling the Hong Kong SAR government's commitment to the peg. In any event, with the accumulation of new "experimental" results from future crises, we would be able to gain additional understanding of their impact.

In Section III we calculated the probability of devaluation based on the forward premia by making alternative assumptions about the magnitude of devaluation. It seems that one direction of further research would be to estimate a stochastic process that governs both the timing and magnitude of devaluation by making use of the forward premia corresponding to the four different transaction times and the HIBOR-LIBOR differentials for maturities less than one month.

Another direction of further research would be to formulate a model suitable for Hong Kong's currency board system, including endogenous money supply (for example, as in Chan and Ngiam (1998)), the Aggregate Balance maintained by banks with the HKMA for clearing purposes under a "Real Time Gross Settlement" system, and the policy rules followed by the HKMA with regard to liquidity provision before the introduction of new measures in September 1998. It is conjectured that the exchange system featuring these elements would admit self-fulfilling crises. Statistical testing of such a model can help to answer the question as to whether and which of the four fundamental economic variables discussed in Section V had contributed to the Hong Kong dollar crisis. More specifically, using the probability of devaluation we have obtained, we plan to estimate a structural model of speculative attack along the lines of Jeanne (1997).

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Table 1: Foreign Reserve (US$ million)

	1991	*1992*	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*
Jan							65,864	80,333
Feb							63,813	78,637
Mar				46,405	52,418	58,062	63,395	78,512
Apr							63,558	77,643
May							66,629	77,893
Jun				47,121	53,633	57,308	67,622	77,858
Jul							66,071	77,844
Aug							69,516	73,408
Sep				47,274	51,762	55,375	71,441	69,300
Oct							73,992	69,400
Nov							79,133	88,600
Dec	28,889	35,250	43,013	49,277	55,424	63,840	75,341	89,600

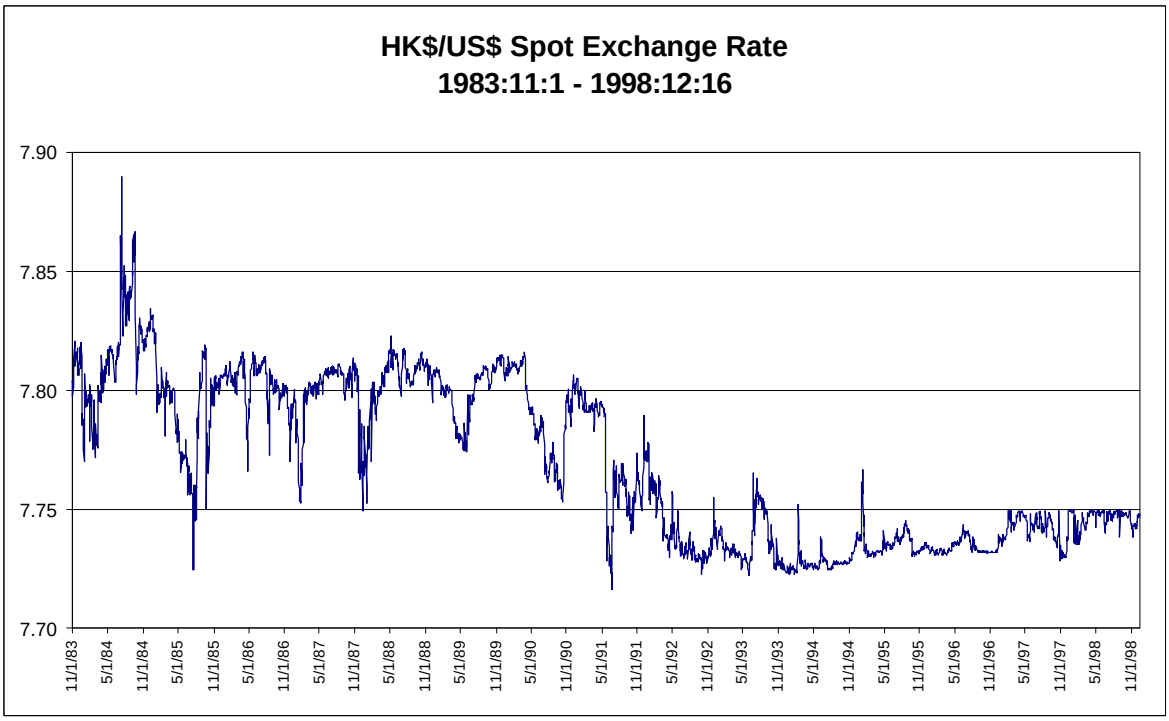

Figure 1: Spot exchange rate

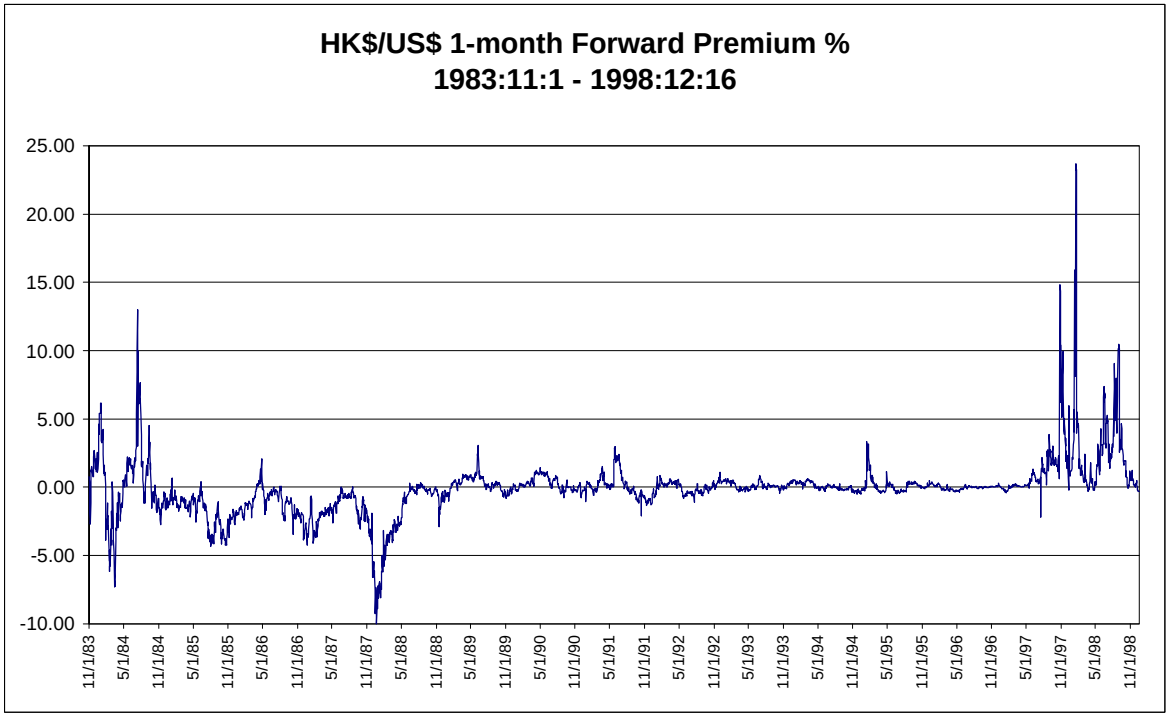

Figure 2: 1-month forward premium

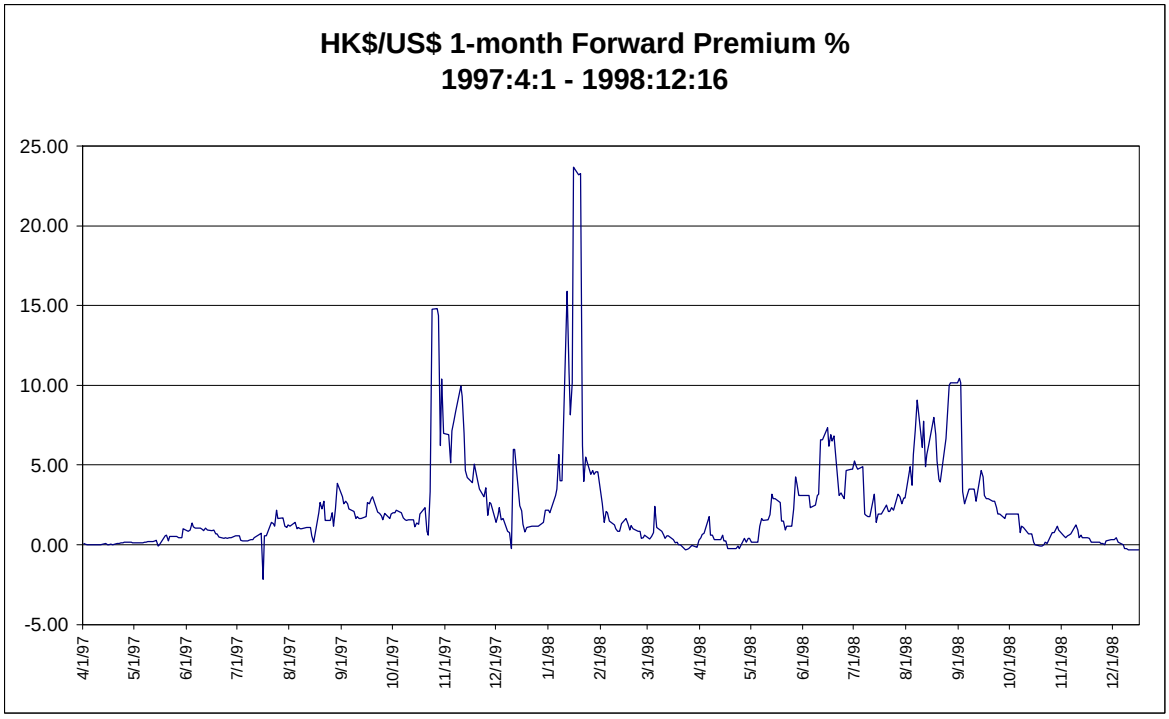

Figure 3: 1-month forward premium

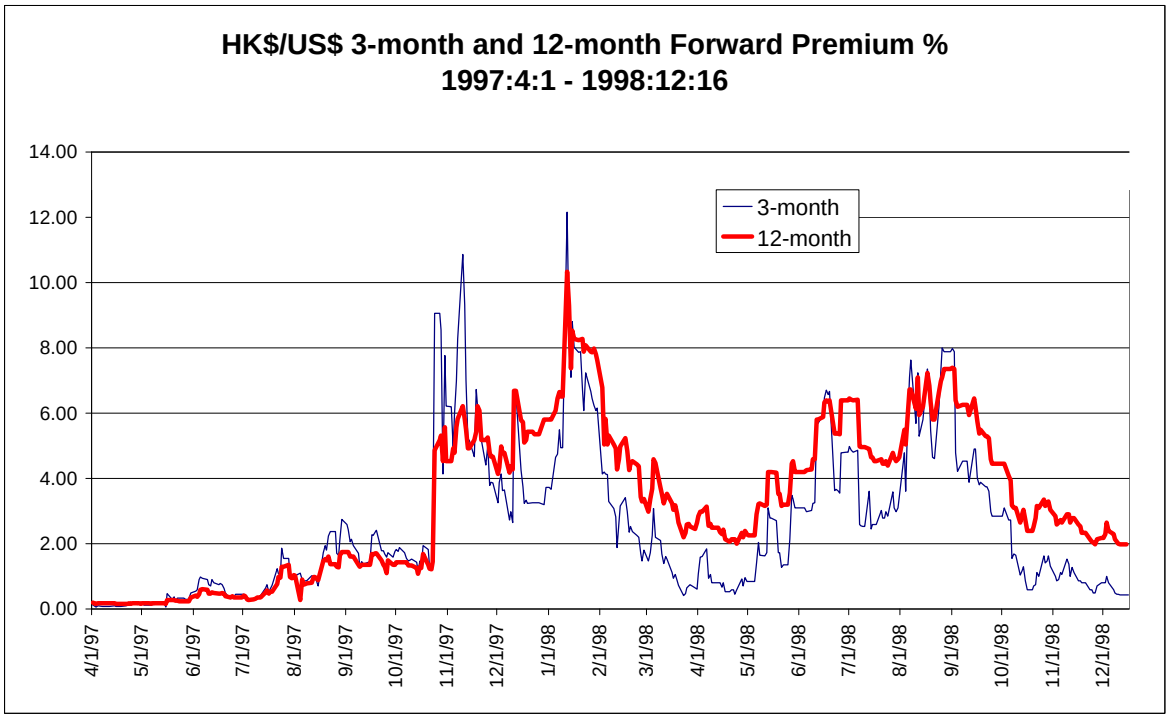

Figure 4: 3-month and 12-month forward premium

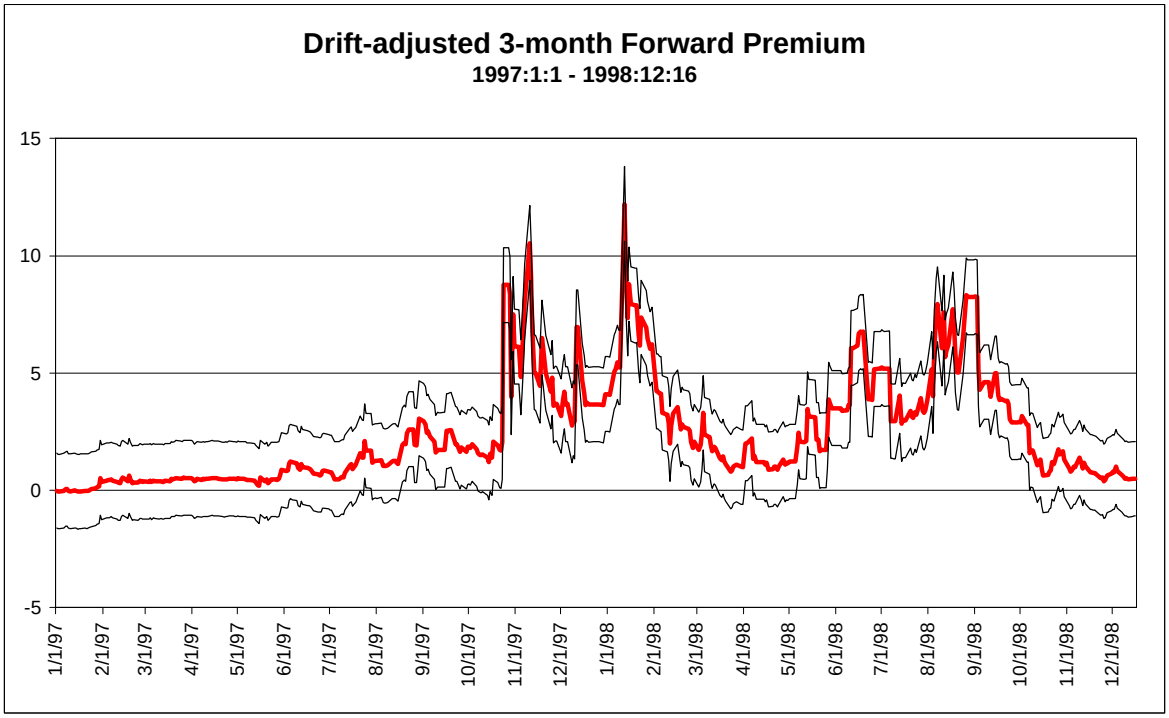

Figure 5: Drift-adjusted 3-month forward premium with 2-standard-deviation confidence band

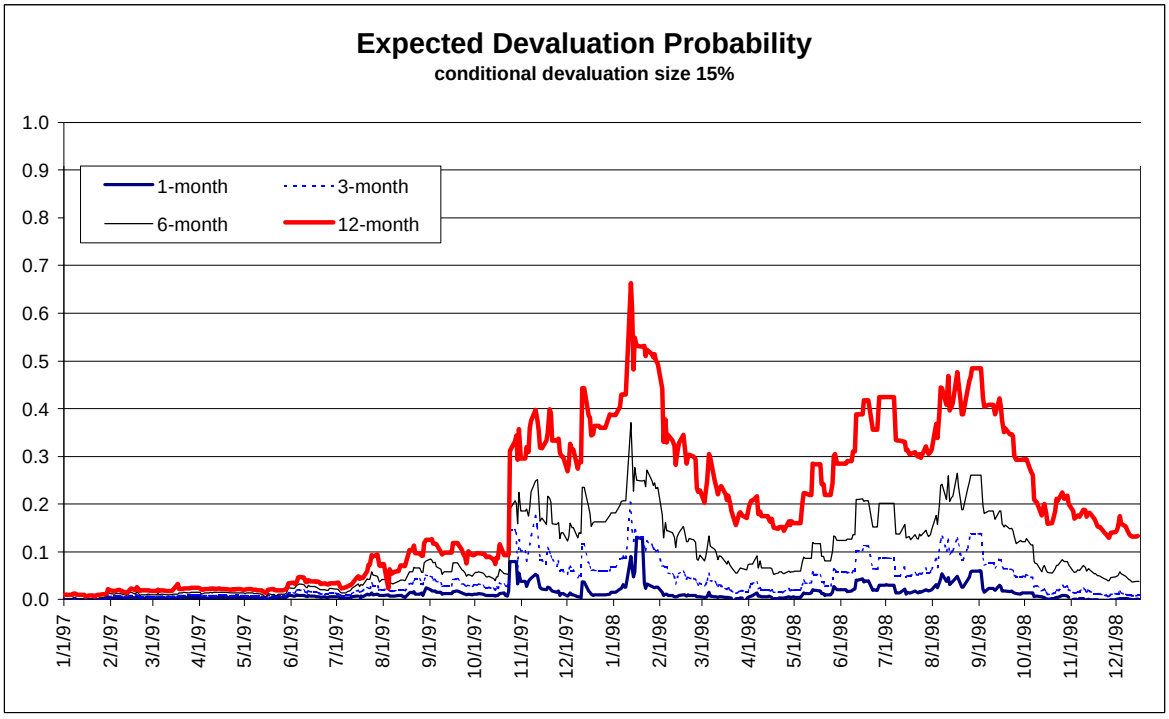

Figure 6: Devaluation probability inferred from drift-adjusted forward premium

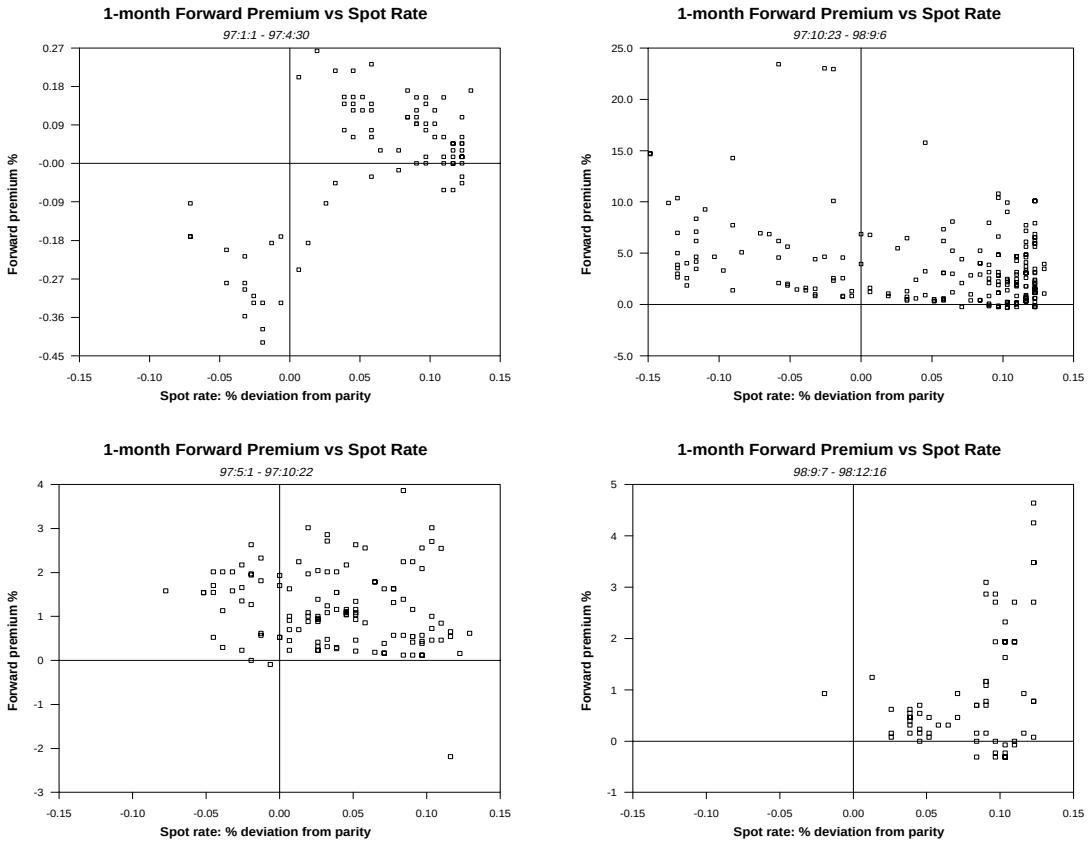

Figure 7: 1-month forward premium vs. spot rate

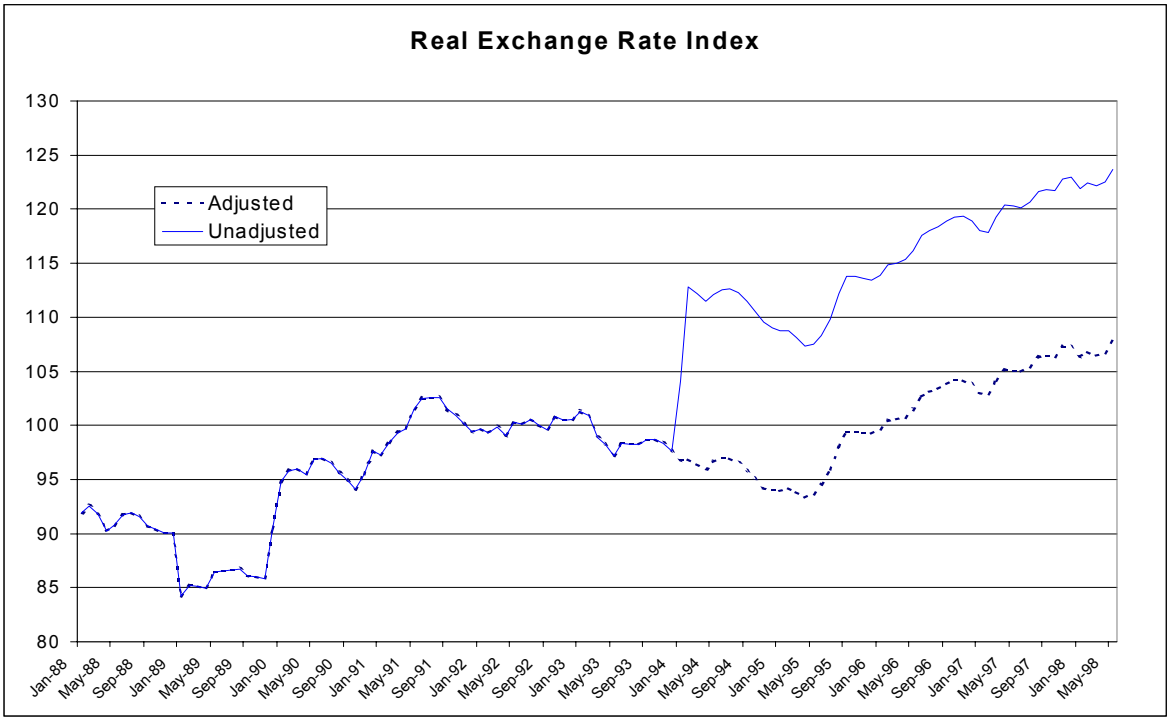

Figure 8: Real exchange rate

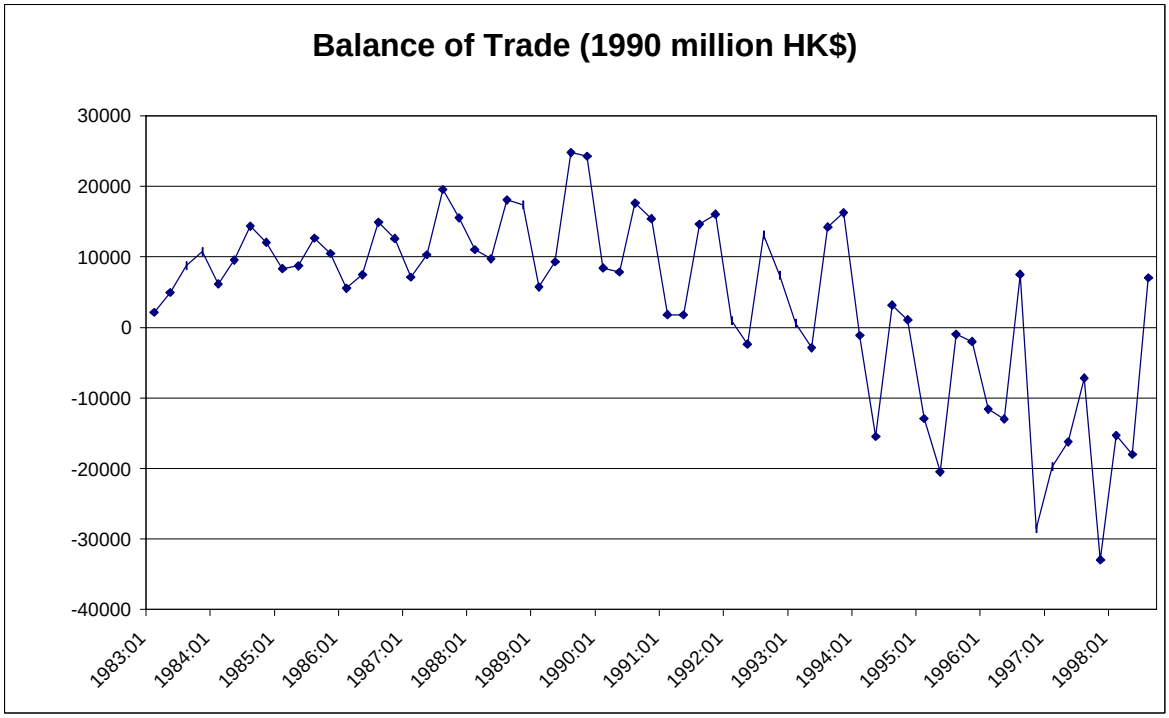

Figure 9: Balance of trade

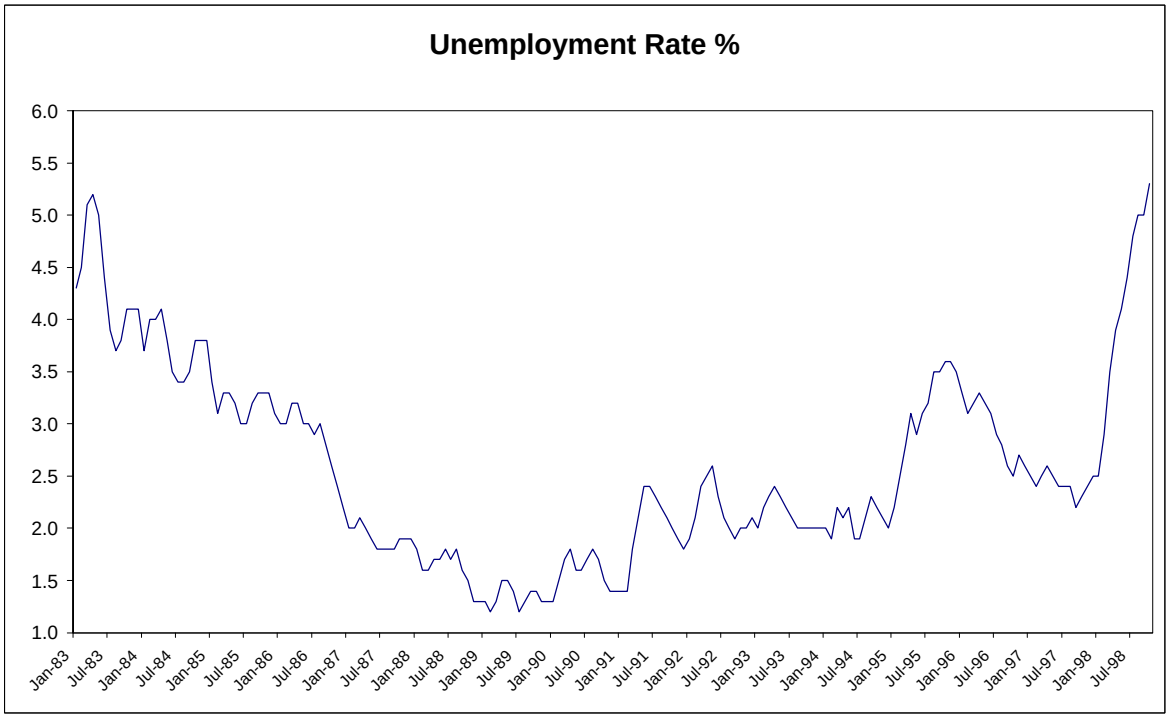

Figure 10: Unemployment rate