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Abstract

This paper extends the single-asset target-zone model pioneered by Krugman (1991) to include both bonds and equities. The new model provides a convenient framework for investigating a 'puzzle' recently noted in Hong Kong. While the economy has experienced persistently lower interest rates relative to the US, it has been able to maintain a stable peg between the Hong Kong dollar and the US counterpart under an environment of free capital flows. This is in apparent contradiction with the 'impossibility trinity' in the theory of international finance. Our modified analytical structure presents a plausible route to a meaningful answer to the 'conundrum' and hopefully yields a certain degree of theoretical generality.

Keywords: Target Zone, Uncovered Interest Rate Parity
JEL Classification: E42, G14

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1. Introduction

The original target-zone (TZ) model developed by Krugman (1991) indicates that when the spot exchange rate is close to the boundary of the zone, the monetary authority would engage in infinitesimal interventions as the credibility of the target rate on either side comes under tests. Historically, the implementation of target zones in the formation of the European Exchange Rate Mechanism (ERM), apparently consistent with Krugman's assumption of interventions with only public announcements but no firm or irreversible commitments, has not been very successful. There have been frequent realignments of the central parities and changes in the bandwidths of the ERM under speculative attacks (Bertola and Svensson, 1993; Ma and Kanas, 2000).

The current setup of Hong Kong's Linked Exchange Rate System (LERS), with the Hong Kong dollar pegged to the US dollar at the rate of 7.80, is quite different, although it can be analyzed as a target-zone model with upper and lower bounds. As a currency board arrangement, its early operation from 1983 to 1998 was not based on a convertibility guarantee other than a reserve requirement on banknote issuance, which supposedly facilitated cash arbitrage. It experienced various tensions, especially during the Asian financial crisis (Tsang and Ma, 2002). However, the post-crisis target-zone arrangements in Hong Kong have been based on explicit convertibility undertakings (CU), as initially suggested by Tsang (1996). The enhanced system has proved to be fully robust on the downside since September 1998 as well as on the upside since May 2005 (see Genberg and Hui, 2009) despite alternate devaluation and revaluation pressures.

The explicit convertibility undertakings in Hong Kong's LERS mean that they will be automatically triggered by market participants, rather than by government interventions, as conceived in Krugman's original 1991 model. Arbitrage activities will ensure the sanctity of the bounds even beyond the monetary base (for details of how arbitrage activities work under the Hong Kong's LERS, see Tsang, 1996, 1998, 1999; Legislative Council, 1998; Tsang and Ma, 2002). Rational agents would anticipate the announced policy rule and engage in self-interested transactions that would result in both boundaries of the zone being fortified. As a result, full credibility reigns and the spot rate would never move out of the band.

Contrary to the situation during the Asian financial crisis in 1997-98, the recent development in Hong Kong is that of revaluation pressure: domestic interest rates have been consistently below the US counterparts. Yet there has been persistent capital inflow into Hong Kong (Chan, 2010). While the integrity of the link is unimpaired after the institution of strong-side CU since May 2005,[1] it would be rather difficult for economists to reconcile this phenomenon with the original target-zone model of Krugman

[1] Yam (2005) describes the details and economic background of the institution of the strong-side convertibility undertaking in the LERS.

(1991), which has just one type of assets: domestic and foreign bonds. Such a circumstance in Hong Kong is also in apparent contradiction with the 'impossibility trinity' in the theory of international finance.

The 'impossibility trinity' thesis was based on the theoretical framework of the IS/LM model, developed originally by Hicks (1937) to summarize a Keynesian view of macroeconomics, and later extended for open economies by Mundell (1963) and Fleming (1962). The trinity refers to the trilemma in which it would be impossible to achieve all of the three following targets for an authority at the same time: a fixed exchange rate, free capital movement, and an independent monetary policy. Since the Hong Kong dollar is pegged to the US dollar, and the Hong Kong government adopts no capital controls at all, one would expect that Hong Kong's interest rates should follow those in the US closely, albeit with occasional and temporary deviations due to short-term liquidity shocks. However, the persistently lower interest rates observed in the Hong Kong monetary system posit a 'puzzle', or an apparent contradiction to the theory of the impossible trinity.

One explanation is the China factor, which enhances Hong Kong's economic prospects as an international financial centre. Shares of the Chinese firms listed in Hong Kong account for roughly 60% of the total market capital capitalization and 70% of average daily turnover in the local stock exchange. Hence investors with Hong Kong dollars get returns not just from the money market (via interest yields) but also from equities. This extra benefit is not considered in Krugman's (1991) model.

In this paper, we try to elucidate this phenomenon by an extended target-zone model with two types of assets including both bonds and equities. Agents in our model would hold both a domestic portfolio and a foreign one. Each portfolio includes both bonds and equities. The relaxation of the assumption of the agent keeping a single-type asset would allow would allow us to explain the recent capital inflows to Hong Kong when the domestic interest rate is below the US interest rate as agents are compensated by a higher return from domestic equities. Evidence based on simulations provides some empirical support to our theoretical model (Yiu, Ho, Ma, and Tsang, 2010) and highlights the importance of equity markets in a developed financial system.

The remaining part of the paper is organized as follows. Section 2 presents the theoretical development of our target-zone model with two types of assets. Section 3 provides some illustrative graphical analysis of the circumstances in which the Hong Kong interest rate may stay persistently below the US interest rate. Section 4 concludes.

2. Theoretical Target-Zone Model with Two Types of Assets

We extend the set-up of Mark and Wu (1998) with single-type asset of bonds to assume that a representative agent with initial wealth W_t would hold domestic and foreign portfolios with two types of assets of bonds and equities. He takes the interest rate and the exchange rate as given and can invest a fraction α of the total value of his domestic portfolio in a domestic bond with interest rate i_t, with next period payoff $\alpha(1+i_t)$. The remaining $1-\alpha$ fraction is invested in a domestic equity, with future payoff $(1-\alpha)r_{t+1}$. This forms the general composition of the domestic portfolio with both bonds and equities.

Assume that the spot exchange rate Q_t is defined as the foreign currency per unit of home currency, i.e., a higher value of Q_t indicates an appreciation of the home currency. Similarly, the agent holds a fraction β of their foreign portfolio uncovered in the foreign bond with the next period payoff $\beta(1 + i^*_t)Q_t/Q_{t+1}$ in the home currency. The remaining $1-\beta$ fraction is invested in foreign equity, with future payoff $(1-\beta)r^*_{t+1}Q_t/Q_{t+1}$. The representative agent then divides his current wealth with a fraction δ in the domestic portfolio and the remaining fraction $(1-\delta)$ in the foreign portfolio.

In the next period, nominal wealth is the payoff from the two portfolios:

$$W_{t+1} = \{ \delta [\alpha(1+i_t) + (1-\alpha) r_{t+1}] + (1-\delta) [\beta(1+i^*_t) + (1-\beta)r^*_{t+1}]Q_t/Q_{t+1}\}W_t \tag{1}$$

In the wider markets, we assume that traders are mean-variance optimizers with a risk-adjusted return defined as follows:

$$\max J = E_tW_{t+1} - ½\theta Var(W_{t+1}) \tag{2}$$

where θ is the degree of risk aversion of agents, and

$$\begin{aligned} Var(W_{t+1}) = W_t^2\, [&\delta^2 (1-\alpha)^2 Var(r_{t+1}) + (1-\delta)^2 \beta^2 (1 + i^*_t)^2 Q_t^2 Var(1/Q_{t+1}) \\ &+ (1-\delta)^2 (1-\beta)^2 Q_t^2 Var(r^*_{t+1}/Q_{t+1}) \\ &+ 2\delta(1-\delta)(1-\alpha)\, \beta\, (1+i^*_{t+1})\, Q_t \operatorname{cov}(r_{t+1}, 1/Q_{t+1}) \\ &+ 2\delta(1-\delta)(1-\alpha)(1-\beta)\, Q_t \operatorname{cov}(r_{t+1}, r^*_{t+1}/Q_{t+1}) \\ &+ 2(1-\delta)^2 \beta(1-\beta)(1+i^*_{t+1})\, Q_t^2 \operatorname{cov}(1/Q_{t+1}, r^*_{t+1}/Q_{t+1})\,] \end{aligned} \tag{3}$$

Differentiating J with respect to δ and re-arranging the first-order conditions yields:[2]

$$[\alpha(1 + i_t) + (1-\alpha) r_{t+1}] - [\beta(1 + i^*_t) + (1-\beta)r^*_{t+1}]\, Q_t/Q_{t+1} = \rho_t \tag{4}$$

where the risk-premium

[2] We derive the first-order condition for an optimum with respect to δ (the share of foreign assets in the portfolio) only. We did not attempt to optimize the choice of α and β for bonds and equity respectively. Relaxing this assumption would bring in non-linearity to our prototype multi-asset model. The complexity would cloud out the essential message and is beyond the scope of our current research project.

$$\begin{aligned}\rho_t = \theta W_t [\ & \delta\ (1-\alpha)^2\ Var(r_{t+1}) - (1-\delta)\ \beta^2\ (1 + i^*_t)^2\ Q_t^2 Var(1/Q_{t+1}) \\ & - (1-\delta)(1-\beta)^2\ Q_t^2 Var(r^*_{t+1}/Q_{t+1}) \\ & + (1-2\delta)(1-\alpha)\ \beta\ (1+i^*_{t+1})\ Q_t\ cov(r_{t+1},\ 1/Q_{t+1}\ ) \\ & + \delta(1-2\delta)(1-\alpha)(1-\beta)\ Q_t\ cov(r_{t+1},\ r^*_{t+1}/Q_{t+1}) \\ & - (1-\delta)\ \beta\ (1-\beta)(1+i^*_{t+1})\ Q_t^2 cov(Q_{t+1},\ r^*_{t+1}/Q_{t+1})\ ] \end{aligned} \tag{5}$$

By assuming either that the risk-premium ρ_t is negligible, or that agents are just slightly risk-averse, i.e., $\theta \cong 0$, so that we have $\rho_t \cong 0$ and obtain the following:

$$Q_t/Q_{t+1} = [\ \alpha(1 + i_t) + (1-\alpha)\ r_{t+1}]\ /\ [\ \beta(1 + i^*_t\ ) + (1-\beta)r^*_{t+1}\ ] \tag{6}$$

Hence

$$\begin{aligned}\dot{e} &= \ln(Q_{t+1}/Q_t) = -\ \ln[\ \alpha(1 + i_t) + (1-\alpha)\ r_{t+1}] + \ln\ [\ \beta(1 + i^*_t\ ) + (1-\beta)r^*_{t+1}\ ], \text{ and} \\ \dot{e} &\cong -\ [\ \alpha(1 + i_t) - \beta(1 + i^*_t\ )\ ] - [\ (1-\alpha)\ r_{t+1} - (1-\beta)r^*_{t+1}\ ] + a_s \end{aligned} \tag{7}$$

where e = lnQ, and a_s is a parameter, which effectively is the risk premium.
The above is the extended uncovered return parity for the two types of assets.

Following Krugman (1991), we postulate that the domestic and foreign demands for money respectively are as follows:[3]

$$m - p = \phi y - a\ i + a_0 \tag{8}$$

$$m^* - p^* = \phi^* y^* - a^*\ i^* + a_0^* \tag{9}$$

where m (m^*), y (y^*), p (p^*) are domestic (foreign) money, income, and price, respectively. ϕ, a_0, and a are parameters.

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3 The specification of the demand for money functions in our model may not fit very neatly with the mean-variance approach to deriving demand functions for stocks and bonds, as an anonymous referee points out. We acknowledge that our model is not a general equilibrium model that builds all things under one umbrella (neither was Krugman's original paper). We instead construct a very simple partial equilibrium model that specifically focuses on the domestic and foreign markets of bonds and equity. The money demand is a standard set-up in the mainstream monetary literature, which can also be derived from a utility maximization framework such as a cash-in-advance model.

Assuming generalized purchasing power parity (PPP) to hold[4], i.e.,

$$p = a_1 + a_2p^* - a_3e \tag{10}$$

where a_1 , a_2 , and a_3 are parameters, we have

$$\alpha(1 + i_t) - \beta(1 + i^*_t) = (\alpha\phi/a)y - (\beta\phi^*/a^*)y^* - (\alpha/a)m - (\beta/a^*)m^*$$
$$-(a_3\alpha/a)\, e + (\alpha a_2/a - \beta/a^*)p^* + \alpha - \beta + a_1\alpha/a \tag{11}$$

For the equity market, we follow Campbell, *et al.* (1997, p. 256) to suppose that the Gordon growth model holds for the equity price:

$$P_t = (1+G)D_t/(R-G) \tag{12}$$

where P_t is the equity price level, D_t is the dividend, G is the constant growth rate of the dividend, and R is the constant discount rate.

Hence,

$$r_{t+1} = \ln(P_{t+1}/P_t) = \ln(D_{t+1}/D_t) = \dot{d}_t \tag{13}$$

Similarly, we have the Gordon growth model for the foreign equity market:

$$r^*_{t+1} = \ln(P^*_{t+1}/P^*_t) = \ln(D^*_{t+1}/D^*_t) = \dot{d}^*_t \tag{14}$$

Therefore, we come up with:

$$(1-\alpha)\, r_{t+1} - (1-\beta)r^*_{t+1} = (1-\alpha)\,\dot{d}_{t+1} - (1-\beta)\,\dot{d}^*_{t+1} = f_{e,t}/\mu \tag{15}$$

where $\mu = a/(\alpha a_3)$, and $f_{e,t} = \mu\,[(1-\alpha)\,\dot{d}_{t+1} - (1-\beta)\,\dot{d}^*_{t+1}]$, the notation is defined in such a way that will be convenient for the subsequent analysis [see equ. (16)].

In other words, a positive equity market shock to the Hong Kong dollar spot rate would occur if Hong Kong's equity fundamental, mainly driven by the China factor, becomes increasingly better than that of

4 This is a simplifying assumption for our partial equilibrium attempt. A more comprehensive model should consider the exchange rate pass-through and price rigidity under a general setting, which is beyond the scope of the current research.

the US, i.e., $f_{e,t}>0$. However, a strong recovery in the US equity market might reverse the sign and induce a negative equity shock to the Hong Kong dollar spot rate, i.e., $f_{e,t}<0$.

As a result, the exchange rate dynamic is given by the following stochastic differential equation:

$$\begin{aligned}\dot{e} &= -[\alpha(1+i_t) - \beta(1+i^*_t)] - [(1-\alpha) r_{t+1} - (1-\beta)r^*_{t+1}] + a_s \\ &= (-f_m + e - f_e)/\mu \end{aligned} \tag{16}$$

where $\mu = a/(\alpha a_3)$, and

$$f_m = \mu\,[(\alpha\phi/a)y - (\beta\phi^*/a^*)y^* - (\alpha/a)m - (\beta/a^*)m^* + (\alpha a_2/a - \beta/a^*)p^*\alpha - \beta + a_1\alpha/a - a_s] \tag{17}$$

As a result,

$$e = f_m + f_e + \mu\,\dot{e} \tag{18}$$

A negative money market shock to the Hong Kong dollar spot rate would occur if Hong Kong's interest rate is lower than that of the US, i.e., $f_m<0$. Furthermore, a strong recovery in the US economy would induce the Fed to raise its interest rate and generate a bigger negative money market shock to the Hong Kong dollar spot rate, i.e., $f_m<<0$.

Assume that the fundamentals follow the diffusion processes (Mark, 2001, p. 244)

$$\begin{aligned} df_m(t) &= \eta_m dt + \sigma_m dz(t), \text{ and} \\ df_e(t) &= \eta_e dt + \sigma_e dz(t). \end{aligned} \tag{19}$$

Hence

$$d(f_m(t) + f_e(t)) = (\eta_m+\eta_e)dt + (\sigma_m+\sigma_e)dz(t) \tag{20}$$

where η and σ are constants, and $dz(t) = u\sqrt{dt}$ is the standard Wiener process.

Following Krugman (1991) and Mark (2001, p. 246) (pdf file p. 315), the solution of the exchange rate under the target-zone $[\underline{e}, \overline{e}]$ is duly obtained:

$$e(t) = (\eta_m+\eta_e)\mu + f_m(t) + f_e(t) + A\exp[\lambda_1(f_m(t) + f_e(t))] + B\exp[\lambda_2(f_m(t) + f_e(t))] \tag{21}$$

where

$$\lambda_1 = -(\eta_m+\eta_e)/ (\sigma_m+\sigma_e)^2 + \{ (\eta_m+\eta_e)^2/ (\sigma_m+\sigma_e)^4 + 2/[\mu(\sigma_m+\sigma_e)^2] \}^{1/2} > 0,$$
$$\lambda_2 = -(\eta_m+\eta_e)/ (\sigma_m+\sigma_e)^2 - \{ (\eta_m+\eta_e)^2/ (\sigma_m+\sigma_e)^4 + 2/[\mu(\sigma_m+\sigma_e)^2] \}^{1/2} < 0.$$

The parameters of A, B, $\underline{f}$, and $\bar{f}$ are determined by solving the following four simultaneous equations:

$$A = \frac{\exp(\lambda_2 \bar{f}) - \exp(\lambda_2 \underline{f})}{\lambda_1[\exp(\lambda_1 \bar{f} + \lambda_2 \underline{f}) - \exp(\lambda_1 \underline{f} + \lambda_2 \bar{f})]} < 0,$$

$$B = \frac{\exp(\lambda_1 \underline{f}) - \exp(\lambda_1 \bar{f})}{\lambda_2[\exp(\lambda_1 \bar{f} + \lambda_2 \underline{f}) - \exp(\lambda_1 \underline{f} + \lambda_2 \bar{f})]} > 0,$$

$$\underline{e} = (\eta_m+\eta_e)\mu + \underline{f} + A \exp(\lambda_1 \underline{f}) + B \exp(\lambda_2 \underline{f})$$

$$\bar{e} = (\eta_m+\eta_e)\mu + \bar{f} + A \exp(\lambda_1 \bar{f}) + B \exp(\lambda_2 \bar{f}) \tag{22}$$

Given the upper and lower bounds of the spot rate, there are corresponding upper and lower bounds of fundamentals f_m+f_e: [$\underline{f}$, $\bar{f}$]. If fundamental f_m+f_e reaches its upper or lower border, the spot rate would touch upon its corresponding upper or lower limit [$\underline{e}, \bar{e}$]. Any shock that shifts the fundamental f_m+f_e beyond either bound would trigger the relevant convertibility undertaking (CU) and arbitrageurs would enter into the exchange market. Those activities would maintain the spot rate within the pre-specified target zone.

3. Graphical Analyses of Different Combinations of Shocks in the Two-Asset Target-Zone Model

To illustrate the impacts on the Hong Kong dollar exchange rate due to different shocks in the money and equity markets, we draw the following figures. The spot exchange rate *e* is defined as US$ per HK$, i.e., a higher value of *e* indicates an appreciation of HK$. To facility the discussion of money supply changes in Hong Kong, we decompose the Hong Kong fundamental into

$$f_m = -m + u_m, \tag{23}$$

where

$$u_m = \mu [(\alpha\phi/a)y - (\beta\phi^*/a^*)y^* - (\beta/a^*)m^* + (\alpha a_2/a - \beta/a^*)p^*\alpha - \beta + a_1\alpha/a - a_s] \tag{24}$$

is defined as the shock to the money market fundamental.

Therefore, either a decrease in Hong Kong money supply m or an increase in the shock u_m would increase the f_m and would push up the Hong Kong dollar and raise the spot rate *e*.

Figure 1 is the standard target-zone (TZ) model of Krugman (1991) without any equity market shock. Given the monetary stance, the spot exchange rate is supposed to move along the *S*-shaped curve within the TZ. A moderate negative money market shock $u_m<0$ shifts the exchange rate from point O to A′. A big shock of $u_m<0$ would shift the exchange further down to the weak side of the currency board boundary at point A. Any bigger shock would trigger the convertibility undertaking (CU) in the case of Hong Kong or in the case of perennial interventions by the monetary authority which pre-announces a target without providing a firm CU. The spot rate would shift along the weak side to point A″.

This standard TZ model, nevertheless, could not explain the situation in Hong Kong in the period from the fourth quarter of 2008 to the end of 2009 where the spot rate was always on the strong side of the Convertibility Zone, although there had been a persistent negative money market shock $u_m<0$.[5]

To introduce equity market shocks into our extended TZ model, we start with equity shocks that are *independent* of the money market. Then we will discuss more complicated correlated shocks of the two markets.

Figure 2 is our extended target-zone model with two types of assets: bonds and equities. The current Hong Kong situation is a negative money market shock $u_m<0$, which we assume it to be a constant for simplicity. This assumption will be relaxed later.

Now we introduce a positive equity market shock $f_e>0$. A moderate positive equity shock $f_e>0$ would shift the exchange rate from point A to B. A big shock of $f_e>0$ would shift the exchange further up to the strong side of the currency board boundary at point C. Any bigger shock would trigger the convertibility undertakings (CU) by arbitrage activities, which would shift the spot rate along the strong side of the HK$ to point D.

Here, we discuss some counterfactual scenarios in which we assume that the US economy rebounds strongly, the Fed starts to increase the interest rate, and the US equity market also recovers rapidly. An increase in the US interest rate implies $u_m<0$ and would shift the spot rate from point E to F. A moderate US equity recovery implies that $f_e<0$ and would shift the spot rate further down to G. A big bounce in the US securities would depress the spot rate down the weak side of the link at point H. Then the

5 Chen, Funke, and Glanemann (2009) extended the Krugman's target-zone paper to model the perceived uncertainty of market participants as to the currency board arrangements and the Hong Kong Monetary Authority's determination to defend both sides of the Convertibility Zone. They relaxed the standard assumption that the peg and the hard edge boundaries are credible in Krugman's model to analyze the dynamics of the spot exchange rate. However, their model did not investigate the persistent capital inflow to Hong Kong during the period from the fourth quarter of 2008 to the end of 2009 where the spot rate was always on the strong side of the zone, although Hong Kong's interest rates were below the US counterparts.

convertibility undertaking (CU) would be triggered and arbitrage activities would spare Hong Kong of any further shocks and maintain the HK$ at the weak side, say, at point K.

Now we relax the assumption that the shocks of equity and money markets are independent and introduce some correlated shocks to our extended TZ model. We first look at positively correlated shocks of equity and money markets. The two types of shocks would bend the *S*-shaped curve of the spot exchange rate closer to its two edges, i.e., the slope of the *S*-shaped curve would become steeper. For any money market shock, there is likely to be an associated equity market shock that generates a similar impact on the spot rate. That would shorten the time that the spot rate touches its edge.

However, negatively correlated shocks of the equity and money markets would bend the *S*-shaped curve of the spot exchange rate further away from its two original edges, i.e., the slope of the *S*-shaped curve would become flatter. For any money market shock, there is likely to be a negatively correlated equity market shock that reduces the strength of the impact on the spot rate. That would prolong the time that the spot rate reaches its edge.

4. Conclusion

In this paper we extend the single-type asset target-zone model developed by Krugman (1991) to include both bonds and equities. Our new model provides a convenient framework to tackle the recent ‘conundrum’ in Hong Kong with a strong exchange rate amidst very low interest rates, a phenomenon which is in apparent contradiction with the ‘impossibility trinity’ in the theory of international finance.

A plausible explanation is the China factor, which enhances Hong Kong’s economic prospects as an international financial centre. Investors with Hong Kong dollars get returns not just from the money market but also from equities. This extra yield is not considered in Krugman’s (1991) original investigation. Our two-asset target-zone model provides an analytical framework for regimes of fixed exchange rates free of capital controls, which at the same time are developed in financial instruments attractive to foreign investors. Hopefully, it might produce some theoretical generality.

References

Bertola, G. and L. E. O. Svensson (1993), “Stochastic Devaluation Risk and the Empirical Fit of Target Zone Models,” *Review of Economic Studies*, 60: 689-712.

Campbell, John Y., Andrew W. Lo and A. Craig MacKinlay (1997), *Econometrics of Financial Market*, New Jersey: Princeton University Press.

Chan, Norman T. L. (2010), “Latest Analysis of Fund Inflows into the Hong Kong Dollar,” Insight, Hong Kong Monetary Authority, http://www.info.gov.hk/hkma/eng/insight/20100201e.htm

Chen, Yu-Fu, Michael Funke and Nicole Glanemann (2009), “A Soft Edge Target Zone Model: Theory and Application to Hong Kong,” Bank of Finland Discussion Papers 21/2009, http://www.bof.fi/bofit/tutkimus/tutkimusjulkaisut/dp/2009/dp2109.htm

Fleming, J. M. (1962), “Domestic Policies under Fixed and under Floating Exchange Rates,” IMF Staff Papers 9: 369-79.

Hicks, John R. (1937), “Mr. Keynes and the "Classics"; A Suggested Interpretation,” *Econometrica*, 5(2): 147-59.

Krugman, Paul R. (1991), “Target Zones and Exchange Rate Dynamics,” *Quarterly Journal of Economics*, 106: 669-82.

Legislative Council (1998), “HKMA's Response to Views of Market Practitioners and Academics on the Linked Exchange Rate System,” Papers of Panel on Financial Affairs, CB(1)636/98-99(01), 17 December 1998.
http://www.legco.gov.hk/yr99-00/english/panels/fa/papers/fa_e.htm
http://www.legco.gov.hk/yr98-99/english/panels/fa/papers/fa1712_1.htm

Ma, Yue and A. Kanas (2000), “Testing Nonlinear Relationship among Fundamentals and Exchange Rates in the ERM,” *Journal of International Money and Finance*, 19(1): 135-52.

Mark, Nelson C. (2001), *International Macroeconomics and Finance: Theory and Econometric Methods*, Oxford: Blackwell Publishers.

Mark, Nelson C. and Yangru Wu (1998), “Rethinking Deviations from Uncovered Interest Parity: The Role of Covariance Risk and Noise,” *Economic Journal*, 108: 1686-706.

Mundell, Robert A. (1963), "Capital Mobility and Stabilisation Policy under Fixed and Flexible Exchange Rates," *Canadian Journal of Economics*, 24: 475-85.

Tsang, Shu-ki (1996), "A Study of the Linked Exchange Rate System and Policy Options for Hong Kong," A report commissioned by the Hong Kong Policy Research Institute (published in January 1999).

Tsang, Shu-ki (1998), "The Case for Adopting the Convertible Reserves System in Hong Kong," *Pacific Economic Review*, 3: 265-75.

Tsang, Shu-ki (1999), "Fixing the Exchange Rate through a Currency Board Arrangement: Efficiency Risk, Systemic Risk and Exit Cost," *Asian Economic Journal*, 13: 239-66.

Tsang, Shu-ki and Yue Ma (2002), "Currency Substitution and Speculative Attacks on a Currency Board System," *Journal of International Money and Finance*, 21(1): 53-78.

Yam, Joseph (2005), "Refinements to the Linked Exchange Rate System," Hong Kong Monetary Authority, Viewpoint, 16-06-2005. http://www.info.gov.hk/hkma/eng/viewpt/20050616e.htm

Yiu, Matthew S, Wai-Yip Alex Ho, Yue Ma and Shu-Ki Tsang (2010), "An Analytical Framework for the Hong Kong Dollar Exchange Rate Dynamics under Strong Capital Inflows," Hong Kong Monetary Authority, Working Paper 5/2010.
http://www.info.gov.hk/hkma/eng/research/working/pdf/HKMAWP10_05_full.pdf

Figure 1. No Equity Market Shock

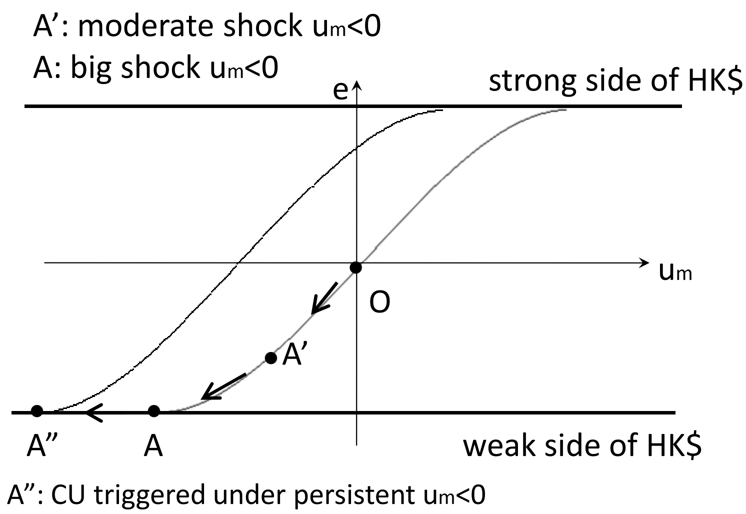

Figure 2. Equity Market Shock (Given $u_m < 0$)

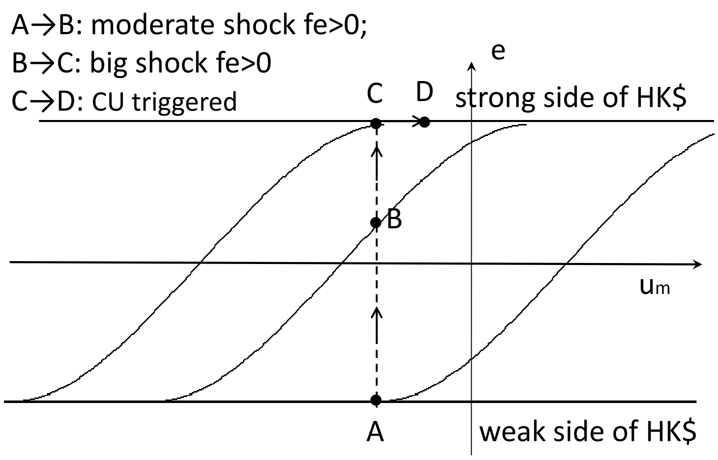

Figure 3. A Double Negative Shock

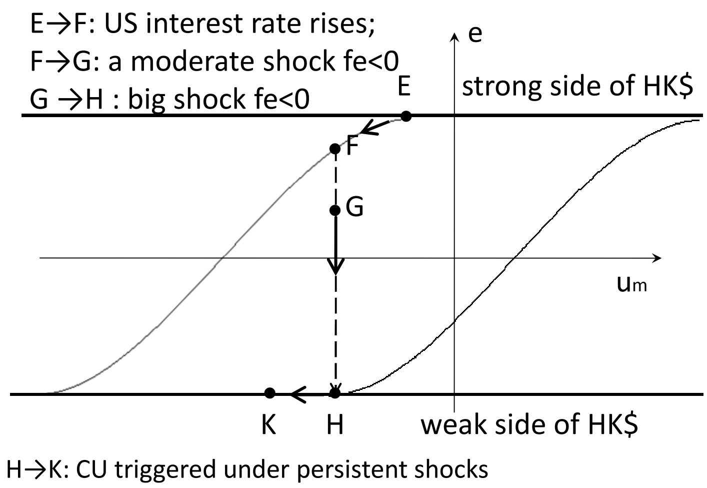

Figure 4. Positive Correlated Shocks

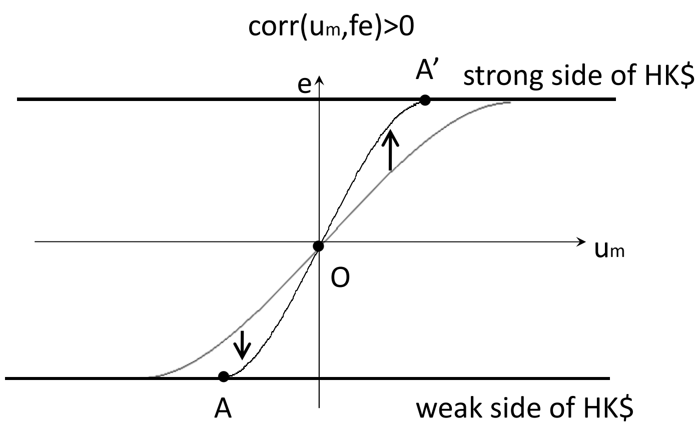

Figure 5. Negative Correlated Shocks