A Tale of Two Currencies: The Asian Crisis and the Exchange Rate Regimes of Hong Kong and Singapore

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Abstract: The economies of Hong Kong and Singapore are alike in many respects. Both are fast growing, export oriented and highly open in both goods and financial markets. But Hong Kong has maintained a pegged exchange rate since 1983, while Singapore has been on a floating regime since the early 1970's. This paper provides an interpretation of the different performance of the Hong Kong and Singapore economy that might be said to be attributable to the differences in their exchange rate regime. A prototype two sector dynamic general equilibrium `dependent economy' model with nominal price rigidities is developed to provide a background interpretation for the discussion. We suggest that the model can help to interpret both the longer run trends in inflation, land prices and real exchange rates in Hong Kong and Singapore as well as the differences in macroeconomic volatility. The model suggests that a small economy should exhibit higher volatility in real GDP under a fixed exchange rate than under floating rates. This is borne out in the data for Hong Kong and Singapore. The differences in the response of the two economies to the Asian crisis is also consistent with our model. Other evidence however suggests that we must be cautious in drawing too firm a conclusion about the importance of the different exchange rate regimes in explaining the macroeconomic performance of Hong Kong and Singapore.

The wrenching experience of the Asian crisis has led many countries in the region to re-evaluate their cherished ideas about economic policy. One of the key areas where new questions are being asked is that of exchange rate policy. Most of the fast-growing East Asian countries have long followed a practice of pegging their currencies to the US dollar. The motivation behind this seems to have been that stable exchange rates would help to foster trade and export growth, especially to the all- important US market. At the same time, the exchange rate pegs were sustainable, at least for a long time, because Asia did not suffer from the `Latin American disease' of uncontrollable government budget deficits and inflation, which periodically have led to the collapse of exchange rate pegs in those countries. With hindsight, it is now clear that the robustness of exchange rate pegs in Asia was susceptible to sudden reversals in short term capital inflows. As documented by Radelet and Sachs (1998), the worst hit Asian countries were those that had the highest ratio of short-term foreign bank liabilities relative to their available foreign exchange reserves, thereby opening themselves up to the possibility of national `bank-runs'.

A full understanding of the Asian crisis is still a long way off, and there is a heated debate on the assignment of causes. But whatever the explanation of the financial and currency crisis, Asian governments are faced with the prospect of re-designing the principles of economic policy in a post-crisis environment. Is it desirable or even feasible for these countries to return to a policy of pegging their exchange rates? While it is unlikely that governments will not have learned from the Thailand experience where a fixed exchange rate was pursued stubbornly for much longer than was warranted, at the same time it is hard to imagine these countries opting for freely floating exchange rates. If some intermediate form of managed exchange rates is chosen, what currencies should be used to form the basket? With the imminent birth of the Euro, the arguments for a rigid peg to the US dollar are probably much weakened. What does seem clear is that in the future, Asian exchange rates will exhibit much more flexibility than they did in the heyday of their fast-growing years.

The consideration of future exchange rate policy in Asia reflects a long debate on the merits of fixed versus floating exchange rates. At least since Friedman (1953), economists have argued that it is better for an economy to let the exchange rate adjust endogenously to foreign macroeconomic shocks. The argument was refined by Mundell's theory of optimal currency areas. That argued that economies that are subject to idiosyncratic disturbances, which require an adjustment of the real exchange rate, are better to allow this to occur through movement of the nominal exchange rate, rather than suffer the painful and protracted movement of domestic prices. On the other hand, different writers have argued that floating exchange rates are prone to excessive volatility of real exchange rates, and the possibility of persistent and costly real exchange rate `misalignments'. The costs of exchange rate volatility are said to be particularly great for small exporting economies such as those in Asia.

Some writers have cast doubt on the very feasibility of fixed exchange rates in a world of unrestricted capital movements (see Obstfeld and Rogoff 1995, and Eichengreen 1996). They argue that the potential for destabilizing capital flows and self-fulfilling exchange rate crises makes it impossible for a country to credibly defend a pegged exchange rate. Eichengreen suggests that the only real exchange rate options for a single country are either to become part of a monetary union, so as to remove the possibility of departing from an exchange rate peg, or to allow its exchange rate to freely float.

However, this argument is weakened by some examples of small and highly open economies such as Hong Kong and the Netherlands, who have followed a policy of rigidly fixed exchange rates for a long time. The key to the success of fixed exchange rates in these countries has been a combination of completely eschewing the use of monetary policy for domestic considerations together with strong macro fundamentals, such as balanced government budgets.

Nevertheless, even if fixed or managed exchange rates are feasible in Asian countries in the post-crisis years, it is still an open question about whether they are desirable. Some light can be thrown on this by looking at the past experience of exchange rate regimes in Asian economies. The example of Hong Kong and Singapore provides a particularly interesting natural experiment. Much has been written about the comparison of these two `city states'. They are both small highly open, export-oriented economies. Both have experienced remarkably fast growth over a long period of time. They both have gone through rapid transformations from being producers of labor intensive low-end manufactures towards skill intensive products and skilled services. Both have had sound fiscal policies, with low taxes and low levels of government spending relative to GDP.

In one respect however, Hong Kong and Singapore differ. Since 1983, Hong Kong has had a Currency Board which pegs its exchange rate to the US dollar. By contrast, Singapore abandoned its Currency Board arrangement at the breakup of Bretton Woods, and has since then followed a policy of loosely managed exchange rates. The differences in the exchange rate regimes is reflected in a much more volatile real exchange in Singapore than Hong Kong over the 1983-present period. But at the same time, the flexibility of the Singapore dollar allows for a much faster real exchange rate adjustment in the face of outside disturbances. Since July 1997, the Singapore dollar has fallen by about 20 percent in value against the US dollar, while the Hong Kong dollar has remained at par. We would expect to see this difference in exchange rate policy to be reflected in different macroeconomic outcomes for Hong Kong and Singapore.

It is always hazardous to ascribe a role for economic policy in historical data. But the similarity of the economies of Hong Kong and Singapore in other respects suggests that it may be possible to understand their different experience as being attributable at least partially to their different exchange rate regimes. An important factor in both cases is the credibility of policy. Both economies have had the credibility and foreign exchange reserves to freely choose their exchange rate regimes. While both countries have been severely affected by the Asian crisis, neither exhibited the problems of poor financial regulation or short-term debt that plagued the newer generation of former Asian Tigers.

In effect, Hong Kong and Singapore have suffered more from `contagion' rather than from the symptoms of the crisis.
While the Hong Kong dollar has been subject to speculative pressure in the last year, the Hong Kong Monetary Authority has effectively demonstrated its ability and resolve to maintain the Currency Board. It is therefore easier to accept that the differences in exchange rate regimes in the two economies is more a matter of deliberate economic policy choices than an endogenous response to other underlying forces.

This paper will explore the role of different exchange rate regimes in small countries, with particular focus on the differing experiences of Hong Kong and Singapore. We begin by constructing a prototype model of the exchange rate in a small, fast growing economy, such as those of Hong Kong and Singapore. The model is a dynamic, general equilibrium `dependent economy' model, where growth is driven by productivity growth in the traded goods sector. The model allows us to understand the longer run trends in GDP growth and real exchange rates, and the interaction between the two. In the long run, the real exchange rate in the model is driven by principles similar to the Balassa-Samuelson model. Our model however includes a role for land as a factor of production, as at least in the case of Hong Kong, it is argued that land prices played an important role in the trend movement in the real exchange rate since the early 1980's. In the long run in this model, all real variables are independent of the exchange rate regime. But the breakdown of real exchange rate movements into nominal exchange rate changes and domestic inflation does depend on the exchange rate regime being pursued.

But we can also use the model to interpret short run dynamics. Because of nominal rigidities (prices in the non-traded goods sector adjust slowly), the *volatility* of GDP, employment and the real exchange rate will be affected by the exchange rate regime. We re-examine the question of how the exchange rate regime plays a role in the adjustment process within this prototype dependent economy model. An important conclusion we will find is that for some types of shocks (foreign interest rate shocks), the exchange rate regime may have little effect on the adjustment of the economy, while for other shocks (foreign price shocks), the exchange rate regime is of central importance in the adjustment process.

The second part of the paper brings the model to bear on the experience of Hong Kong and Singapore. We show that the long run exchange rate and inflation experience of the two cities can be interpreted as a consequence of the different choices of exchange rate regime. Both countries experienced significant real appreciation, but Hong Kong absorbed this through domestic inflation - rising prices of non-traded goods and especially land prices. Singapore on the other hand, experienced very low, US-style inflation rates, but an appreciating nominal exchange rate.

While both economies show considerable real appreciation since 1983, Hong Kong's real exchange rate has appreciated significantly more than that of Singapore. This `unexplained' (by the model) component of Hong Kong's real exchange rate can probably be attributed to the increasing shift of manufacturing, since the late 1980's, from the territory of Hong Kong into Southern China.

We then examine short-term macroeconomic differences between Hong Kong and Singapore. Certainly our model suggests that the response to a world deflation should be significantly different in a floating exchange rate regime than a flexible regime. This relevant to an understanding of the difference between the response of the two economies to the Asian crisis. While Singapore's growth rate has fallen precipitously in 1998, it is still predicted to produce about a zero percent growth rate for the whole year. On the other hand, it has experienced a real depreciation of about 20 percent. On the other hand, Hong Kong has had little real depreciation, but a huge crash in real output, with GDP growth this year predicted to be at least minus 5 percent.

More generally, our model suggests that there is a trade-off between real exchange rate volatility and output volatility. With a floating exchange rate, as in Singapore's case, the economy should be effectively insulated from foreign price shocks. The data confirm that

GDP is indeed less volatile in Singapore than Hong Kong. However, the difference between the two is relatively small.

As regards other macroeconomic aggregates, there is little difference in volatility between the two economies. Both consumption and investment are slightly more volatile in Singapore than in Hong Kong. What this suggests perhaps is that the configuration of external shocks that Singapore and Hong Kong have experienced over the sample period have not been of the type that could effectively dealt with by exchange rate adjustment.

Section 2. The Exchange Rate Regime in a two-sector model

Here we develop a model of the exchange rate regime in fast growing open economies. There is a small open economy where households consume two goods; traded and non-traded goods. The small size of the economy implies that it has no control over prices of traded goods. Non-traded prices however are determined within the domestic country. We assume that non-traded goods prices are sticky, and set by individual producers with an industry of differentiated products.

The demographic structure of the model follows Weil (1989). At any time period, there exists a large number of generations of individuals who have been born at different periods in the past. Population grows at rate n per period. Each new generation lives forever but is altruistically separated from previous or succeeding generations. Each generation faces the same prices and receives the same wage as all other generations. Thus, the only difference between generations is in their accumulated wealth.

Households

We can begin describing the model by writing household preferences for a representative individual born at date v as of time $t \geq v$

$$(1) \quad U^{v} = \sum_{s=t}^{\infty} \beta^{(s-t)} (\ln C_s^v + \chi \ln(\frac{M_s^v}{P_s}) + \eta \ln(1 - L_s^v))$$

where C_s^v represents composite consumption, $\frac{M_s^v}{P_s}$ is real balances, and L_s^v is labor supply. Here C_s^v can be subdivided into the consumption of traded and nontraded goods as in $C_s^v = \phi \, (C_{Ns}^v)^{\alpha} \, (C_{Ts}^v)^{1-\alpha}$, where $\phi = \alpha^{-\alpha} (1-\alpha)^{-(1-\alpha)}$, and in turn, we define

$$C_s^v = \left(\int_0^1 C_s^v(i)^{\frac{\rho - 1}{\rho}} \, di \right)^{\frac{\rho}{\rho - 1}}$$

Thus, non-traded goods are differentiated, with an elasticity of ρ between any two categories of goods. Within the non-traded goods sector firms are monopolistic competitors. Associated with this definition of consumption will be a price indices given by

$$P_t = P_{Nt}^{\alpha} P_{Tt}^{(1-\alpha)} \qquad P_N = \left(\int_0^1 P_N(i)^{1-\rho} \, di \right)^{\frac{1}{1-\rho}}$$

Households hold four assets; capital, foreign bonds, money, and land. An individual households in this economy will face the following budget constraint at any time $t \geq v$.

$$(2) \quad \begin{aligned} & P_t C_t^v + P_t I_t^v + e_t B_{t+1}^v + M_t^v + q_t T_{t+1}^v \\ & = W_t L_t^v + \Pi_t + R_t K_t^v + R_{Lt} T_v^t + (1 + i_t^*) e_t B_t^v + M_{t-1}^v + TR_t^v \end{aligned}$$

Households receive income from wages, profits from the non-traded goods firms, rentals on their holdings of capital, rentals on their ownership of land, interest on their holdings of foreign bonds initial money holdings, and transfers from the domestic government. They divide up this income in consumption, investment, purchases of new foreign bonds, purchases of land, and new money holdings. The exchange rate is e_t. It is assumed that the law of one price holds continually for traded goods, so that $P_{Tt} = e_t P^*_{Tt}$.

Capital accumulation is subject to costs of adjustment. The formation of new capital is determined by the process

(3) $K^v_{t+1} = \varphi\left(\frac{I^v_t}{K^v_t}\right)K^v_t + (1-\delta)K^v_t$

where the function $\varphi\left(\frac{I^v_t}{K^v_t}\right)$ governs the importance of adjustment costs. It is assumed that $\varphi'(.) > 0$, and $\varphi''(.) < 0$.

Firms

Firms in the traded good sector are competitive, and take prices as given by world goods markets. The aggregate production technology in traded goods is

(4) $Y_{Tt} = \theta_t A K^{\gamma}_{Tt} L^{1-\gamma}_{Tt}$

where $\theta_t A$ represents total factor productivity, where A is constant. K_{Tt} is capital, and L_{Tt} is labor utilization in the traded goods sector. We let $\theta_t = (1+g)\theta_{t-1}$, where g is the rate of growth of productivity in the traded goods sector.

The nontraded goods sector is imperfectly competitive. An individual firm in the nontraded goods sector has production technology given by

(5) $y^i_{Nt} = (K^i_{Nt})^{\varepsilon_1}(L^i_{Nt})^{\varepsilon_2}(T^i_t)^{1-\varepsilon_1-\varepsilon_2}$

Production in non-traded goods requires capital, labor, and land. Land is assumed to be in fixed supply in the economy as a whole.

Government and the Exchange Rate Regime

The government prints money and gives transfers to the domestic private sector. In a floating exchange rate regime, the supply of money is determined independently by the government. In a fixed exchange rate regime, the supply of money is determined by private sector demand and is outside the control of government. We take the view that exchange rate credibility is not an issue. A fixed exchange rate is assumed to be permanently sustainable either due to the presence of large reserve holdings, or because the appropriate domestic credit policies are being followed. This means that we don't need to be specific about the path of reserve holdings or the dynamics of domestic credit, since if the exchange rate is fixed, it will continue to be so forever.

Optimal Household Behavior

The problem facing the household of any generation is by now quite a standard one. Given composite consumption C_t^v, the household of generation v will choose consumption of traded goods equal to

(6) $$C_{Tt}^v = \alpha \frac{P_t}{P_{Tt}} C_t^v$$

Consumption of individual nontraded good i is given by

(7) $$C_{Nt}^{iv} = (1-\alpha)\left(\frac{P_{Nt}^i}{P_{Nt}}\right)^{-\rho} \frac{P_t}{P_{Nt}} C_t^v$$

The household's choice of money balances will result in the money demand relationship

(8) $$\frac{M_t^v}{P_t} = \chi \frac{C_t^v}{(1-d_t)}$$

where $d_t = (1+i_t^*)^{-1} \frac{e_t}{e_{t+1}}$ represents the nominal interest rate factor. The household's intertemporal consumption choice will determine

(9) $$P_{t+1}C_{t+1}^v = \beta(1+i_{t+1}^*)\frac{e_{t+1}}{e_t} P_t C_t^v .$$

Optimal labor supply will imply

$$(10) \quad \frac{\eta}{(1-L_t^v)} = \frac{W_t}{P_t C_t^v}$$

For the household to hold capital, foreign bonds, and land in its portfolio, returns on all three assets must be the same. Thus it must be the case that the following `no arbitrage' condition holds

(11)

$$(1+i_{t+1}^*)\frac{e_{t+1}}{e_t} = \frac{P_{t+1}}{P_t}\varphi'(\frac{I_t^v}{K_t^v})\left[\frac{R_{t+1}}{P_{t+1}} + \frac{1}{\varphi'(\frac{I_{t+1}^v}{K_{t+1}^v})}\left(1-\delta+\varphi(\frac{I_{t+1}^v}{K_{t+1}^v}) - \varphi'(\frac{I_{t+1}^v}{K_{t+1}^v})\frac{I_{t+1}^v}{K_{t+1}^v}\right)\right]$$

The left hand side of equation (11) is the return on a dollar of foreign investment. The right hand side is the return on a dollar invested in the domestic capital stock, taking into account the costs of investing.

In addition, there must be a similar condition for the return on land

$$(12) \qquad (1+i_{t+1}^*)\frac{e_{t+1}}{e_t} = \frac{q_{t+1}+R_{Lt+1}}{q_t}$$

Aggregation

The above discussion refers to the behaviour of individual households of generation $v \leq t$. To derive the implications for the economy as a whole it is necessary to aggregate across individuals. Since generations all face the same wages and prices, and have log utility, aggregation is possible. If we assume that the initial population at date 0 is 1, then we may define aggregate consumption as (see Obstfeld and Rogoff 1996)

$$C_t = \frac{C_t^0 + nC_t^1 + n(1+n)C_t^2 + n(1+n)^2 C_t^3 + ...n(1+n)^{t-1}C_t^t}{(1+n)^t}$$

where C_t^0 represents the consumption of generation 0 at time t, etc. The total population at time t is $(1+n)^t$. Thus, C_t represents consumption per-capita over all generations.

We may write the analogue of equation (9) in per-capita terms. Following the procedure of Obstfeld and Rogoff (1996), it can be shown that

(13)

$$C_{t+1} = (1+r^*_{t+1})\left(\frac{P_{Tt+1}}{P_{t+1}}\right)\left(\frac{P_{Tt}}{P_t}\right)^{-1} C_t - n(1-\beta)\left[\left(\frac{P_{Tt+1}}{P_{t+1}}\right)b_{t+1} + K_{t+1} + \left(\frac{q_{t+1}}{P_{t+1}}\right)L\right](1+r^*_{t+1})$$

In equation (13), r^*_{t+1} represents the exogenous foreign real interest rate, where $(1+r^*_{t+1}) = (1+i^*_{t+1})\frac{P^*_{Tt}}{P^*_{Tt+1}}$. Consumption growth depends also on total wealth, because new generations are born without any wealth holdings.

We can aggregate (8) and (10) in a similar fashion to arrive at

(14) $$\frac{M_t}{P_t} = \chi \frac{C_t}{1-\delta_t}$$

(15) $$\eta C_t = \frac{W_t}{P_t}(1-L_t)$$

Optimal Firm Behaviour

Firms in the traded goods sector are price takers, and will choose employment and capital usage to maximize profits. The profit maximizing conditions are then

(16) $$R_{Kt} = P_{Tt}\gamma\theta_t K_{Tt}^{\gamma-1} L_{Tt}^{(1-\gamma)}$$

(17) $$W_t = P_{Tt}(1-\gamma)\theta_t K_{Tt}^{\gamma} L_{Tt}^{-\gamma}$$

In the non traded goods sector, firms are monopolistic competitors. They will set prices to maximize their expected profits, taking as given the demand curves for their particular industries, represented by (7). But it is assumed that prices must be set in advance. Following the procedure of Calvo (1983), employment by many recent authors, we introduce price stickiness in the model by the assumption that individual firms have the option to alter their price at random time periods. Within any period, a given firm has a probability $(1-\kappa)$ that it can alter its price, no matter how long its price has been set for in the past. Once the price is set, the firm faces the same probability of being able to change it in future periods. In the aggregate, this means that exactly $(1-\kappa)$ of all firms in the nontraded goods sector will be altering their price within any period.

Because prices must be set in advance, unanticipated disturbances may imply that current prices are not the optimal, profit maximizing prices. But firms in the non-traded sector will still hire labor and capital to minimize costs. Thus, each firm i will choose K_{Nt}^{i}, L_{Nt}^{i} and T_{Tt}^{i} such that

(18) $$R_{Kt} = MC_t \epsilon_1 K_{Nt}{}^{\epsilon_1 - 1} L_{Nt}{}^{\epsilon_2} T_{Nt}{}^{1-\epsilon_1-\epsilon_2}$$

(19) $$W_t = MC_t \epsilon_2 K_{Nt}{}^{\epsilon_1} L_{Nt}{}^{\epsilon_2 - 1} T_{Nt}{}^{1-\epsilon_1-\epsilon_2}$$

(20) $$R_{Lt} = MC_t (1-\epsilon_1-\epsilon_2) K_{Nt}{}^{\epsilon_1} L_{Nt}{}^{\epsilon_2} T_{Nt}{}^{-\epsilon_1-\epsilon_2}$$

where MC_t represents nominal marginal cost, which must be common for all firms in the non-traded goods sector, since they have common technologies and face the same factor prices.

The details of the price setting decision faced by firms in the non-traded goods sector have been spelled out in detail elsewhere (see Yun 1996, Betts and Devereux 1998).
Since we are considering an environment with ongoing inflation, firms will set a price path that is adjusted upwards for predictable inflation π_t. Thus, the that sets a new price $\tilde{P}_{Nt}^{j}$

at time t will have a price $\tilde{P}^{j}_{Nt}(1+\pi_{t+1})$ at time $t+1$, unless it sets a new price in that period, and so forth for later periods. Then, when it chooses its price to maximize the present value of expected profits, the firm will set a price which satisfies the recursive formula

(21) $$\tilde{P}^{j}_{Nt} = (1-E_t\vartheta_t)MC_t + E_t\vartheta_t\tilde{P}^{j}_{Nt+1}$$

where

$$\vartheta_t = \frac{\kappa(1+i_{t+1})^{-1}\sum_{k=t+1}\Omega(k,t)\kappa^{k-(t+1)}x^{j}_{k}(1+\pi_k)}{\sum_{k=t}\Omega(k,t)\kappa^{k-t}x^{j}_{k}(1+\pi_k)}$$

, i_t is the home country nominal interest rate, x^{j}_{k} is the demand curve facing the firm, and $\Omega(k,t)=\Pi^{k}_{i=t}(1+r_t)^{-1}$, with $\Omega(t,t)=1$.

Equation (21) says that the firm will set a price such that, loosely speaking, the price will equal the present value of future expected marginal costs, adjusted for trend inflation.

All firms in the nontraded sector will set prices in the same way. Moreover, due to symmetry, all firms will choose the same newly set price. This means that the aggregate price level in nontraded goods will behave as

(22) $$P^{1-\rho}_{Nt} = (1-\kappa)\tilde{P}^{1-\rho}_{Nt} + \kappa(1+\pi_t)^{1-\rho}P^{1-\rho}_{N-1t}$$

Equation (22) says that when firms have a constant and identical probability of altering prices in any period, the aggregate price level in non-traded goods will obey a partial adjustment rule, adjusted for predictable inflation.

Market Clearing Conditions

The supply and demand for non-traded goods must be equal at all time periods. This implies that, in the aggregate,

$$(23)\quad K_{Nt}^{e_1} L_{Nt}^{e_2} T^{1-e_1-e_2} = \frac{P_t}{P_{Nt}}(C_t + I_t)$$

We can aggregate the individual budget constraints (2), using both (23) and the government budget constraint, to get the balance of payments condition for the economy as

$$(24)\quad (1+n)b_{t+1} = q_t K_{Tt}^{g} L_{Tt}^{1-g} + (1+r_t^*)b_t - \frac{P_t}{P_{Tt}}(C_t + I_t)$$

Here b_t represents the real value of foreign bonds, i.e. $b_t = \frac{B_t}{P_{Tt}}$.

In each period also, both the labor and capital markets must clear, so that

$$(25)\quad K_t = K_{Nt} + K_{Tt}$$

$$(26)\quad L_t = L_{Nt} + L_{Tt}$$

The equilibrium of the economy is described by the 17 equation (3) (in its aggregate version), (11)-(20), and (21)-(26) under floating exchange rates. This may be solved for the 17 endogenous variable $C_t, b_t, P_{Nt}, P_{Tt}, K_t, L_t, K_{Nt}, K_{Tt}, L_{Nt}, L_{Tt}, q_t, R_{Kt}, R_{Lt}$, $W_t, I_t, \tilde{P}_{Nt}$ and MC_t. Note that the solution for P_{Tt} gives us the path for the exchange rate, since domestic traded goods prices must equal the exogenous foreign prices.

Under fixed exchange rates, P_{Tt} is exogenous, but equation (8) then determines the endogenous money supply.

In the presence of trend inflation and trend growth, it is necessary to transform the equations to write them in stationary form.

Steady State Growth Path

Here we focus on the characteristics of growth and inflation along a balanced growth path. Because the price setting rules encompass trend inflation adjustment, the real economy in a balanced growth path is independent of the monetary sector. The characteristics of the balanced growth path can be described as follows[1]. From (16) and (18), the returns to capital in each sector must be equated. Letting $p_n \equiv \frac{P_N}{P_T}$, we then have that

$$(27)\quad \hat{p}_n + (\varepsilon_1 - 1)\hat{K} = g + (\gamma - 1)\hat{K}$$

where $\hat{x}$ denotes $\frac{dx}{x}$.

From (11), assuming that the foreign real interest rate is constant along a balanced growth path, it must be that the real rental rate to capital, R_K / P, is constant. Therefore, we derive the condition

$$(28)\qquad (1-\alpha)\hat{p}_n + (\varepsilon_1 - 1)\hat{K} = 0$$

Putting (27) and (28) together, obtain

$$(29)\qquad \hat{p}_n = \frac{(1-\varepsilon_1)g}{\Delta}$$

$$(30)\qquad \hat{K} = \frac{(1-\alpha)g}{\Delta}$$

[1] It is not guaranteed that a balanced growth path will have diversified production. The economy will always produce nontraded goods. They are essential for consumption and investment. They cannot be purchased abroad. But traded goods might not be produced in a balanced growth path. With a high enough stock of foreign assets, the economy might stop producing traded goods. We could easily analyze this case. But it is

where $\Delta = (a(1-e_1) + (1-a)(1-g))$.

It is easy then to show that consumption C, the real wage $\frac{W}{P}$, and the real land price $\frac{q}{P}$ all grow at the same rate, equal to the growth of the capital stock. Equation (29) shows the Balassa-Samuelson effect in this economy. When growth is driven by traded goods productivity growth, the relative price of traded goods rises over time. This model also has the added implication that the real land price must be rising over time.

Inflation Implications of the Balanced Growth Path

While the real growth rate of the economy in a steady state growth path is independent of the exchange rate regime, this is not true for the nominal rates. The rate of inflation of the prices of traded goods, nontraded goods, and land prices will depend on the exchange rate regime. First let's look at the case of floating exchange rates. Assume that the foreign price of traded goods is rising at rate m^* in the steady state. In addition, assume that the growth rate of the domestic money supply is m. Then from (8) it must be that

$$a\hat{p}_n + \hat{e} + m^* + \hat{C} = m$$

where $\hat{e}$ is the steady state rate of depreciation of the exchange rate. It follows that the exchange rate in a balanced growth path will satisfy

$$(31) \quad \hat{e} = -\frac{(a(1-e_1) + (1-a))g}{\Delta} + m - m^*$$

The CPI inflation, land price inflation, and inflation in nontraded goods can then be derived as

probably not of too much interest, realistically. Therefore, we restrict attention to a diversified production equilibrium.

(32) $\hat{P} = \dfrac{-(1-a)g}{\Delta} + m$

(33) $\hat{q} = m$

(34) $\hat{P}_N = \dfrac{-e_1(1-a)g}{\Delta} + m$

In a floating exchange rate regime, the underyling growth rate of the traded goods sector will impose pressure for nominal appreciation, described by (31). If domestic money growth is no higher than foreign money growth, the exchange rate will appreciate persistently. This nominal appreciation allows the relative price of nontraded goods to rise at the rate given by (29). Land prices will rise by the rate of money growth, but the overall CPI inflation will be less than that. Note that we have the following rankings of inflation rates

(35) $\hat{q} > \hat{P}_N > \hat{P}_T$

In a fixed exchange rate regime, traded goods prices must rise at rate m^*. Then nontraded goods prices, land prices, and the CPI inflation must satisfy

(36) $\hat{P}_N = \dfrac{(1-e_1)}{\Delta} g + m^*$

(37) $\hat{q} = \dfrac{(1-ae_1)}{\Delta} g + m^*$

(38) $\hat{P} = \dfrac{a(1-e_1)}{\Delta} g + m^*$

In contrast to the floating exchange rate regime, fixed exchange rates impose fundamental inflationary tendencies in this model. For the relative price of non-traded goods to rise over time, inflation in non-traded goods must exceed that of traded goods. For the land price to rise at a rate than nontraded good prices, the rate of inflation in land prices must exceed that of nontraded or traded goods.   Overall, the CPI inflation rate must be positive (for $m^* \geq 0$). Thus, the rate of inflation in the fixed exchange rate regime must be higher than under floating exchange rates, as long as the money growth rate in a floating regime is no higher than that under a fixed exchange rate regime.

These results help us to interpret the experience of Hong Kong and Singapore over the last 15 years. As described in the previous section, both economies exhibited fast growth rates of GDP and exports. Both also experienced strong real exchange rate appreciation against the US.   But Hong Kong fixed its exchange rate against the US dollar, while Singapore followed a floating exchange rates policy. The Singapore dollar appreciated in nominal terms. This appreciation allowed Singapore to maintain low average rates of inflation. On the other hand, the real appreciation in Hong Kong took the form of a higher domestic inflation rate than the US. With traded goods inflation tied to US rates, the inflation must be concentrated in non-traded goods prices. In addition, while real land prices rose in both economies, the inflation in land prices in Hong Kong was much higher than that in Singapore.

Our model then implies that the starkly different inflation experiences of Hong Kong and Singapore can be interpreted fundamentally as a consequence of different exchange rate regime choices, in an environment of high export oriented growth.

Short Run Properties of the Model under Alternative Exchange Rate Regimes

In the short run, the model behaves very differently. In response to outside macro shocks, such as foreign price shocks, or foreign interest rate shocks, the response of domestic GDP will reflect the presence of short run price rigidity. But the exchange rate regime will be of critical importance for this response. We will illustrate the workings of the model by looking at the response to two foreign disturbances; coming form prices and interest rates; in the presence of each exchange rate regime.

Figures (1)-(3) show the response of GDP in the floating exchange rate regime. With floating exchange rates, the economy is in fact completely insulated from foreign price disturbances. A fall in the foreign price level will be reflected in an immediate appreciation of the nominal exchange rate, leaving P_T unchanged. Neither GDP nor the real exchange rate respond at all.

In response to a foreign real interest rate shock however, exchange rate adjustment cannot insulate the economy. Figure (1) shows the response of the floating exchange rate regime to a temporary rise in the foreign real interest rate. The rise in the foreign interest rate reduces domestic consumption and investment, and leads to a fall in domestic GDP. The nominal exchange rate must depreciate, facilitating a real depreciation.

The behaviour of the economy under fixed exchange rates is described in Figures (2)-(3). In contrast to the floating exchange rate regime, the response to a fall in the foreign price level will imply a fall in domestic GDP. Since the nominal exchange rate cannot adjust, a fall in foreign prices must require a fall in the nominal domestic price level. This requires that nontraded goods prices must be reduced. But this can only happen over time. The immediate effect of the fall in foreign goods prices must be to raise the relative price of nontraded goods in the economy. As a result, there will be a fall in demand in the nontraded sector, leading to fall in output. GDP falls sharply, as in Figure (2). The real exchange rate first appreciates, as traded goods prices fall while nontraded goods prices are sticky. Over time, the real exchange rate will fall back to its original level, as prices in the nontraded sector come down. Land prices also fall sharply, as the demand for land in the nontraded sector shrinks. The severity of the recession will depend on the length of price stickiness, governed by the parameter κ.

The response of the fixed exchange rate economy to a real interest rate shock is illustrated in Figure (3). GDP falls by virtually the same amount as under floating exchange rates.

Section 3. The Economic Performance of Hong Kong and Singapore

This section provides very informal discussion of the economic performance of Hong Kong and Singapore in the light of the model set out above. The two main questions we'd want to address are; a) Does the longer run GDP growth/real exchange rate/inflation pattern for Hong Kong and Singapore reflect the features of the steady state distinctions between exchange rate regimes? b) Does Hong Kong pay a price in terms of higher real volatility in order to stabilize its exchange rate? With respect to the second question, an important issue is the difference in the response of the two economies to the current Asian crisis.

Figure 4 illustrates the GDP of Hong Kong and Singapore since 1983. Clearly both economies have grown at very fast rates over the period. Both experienced slow growth in the mid 1980's, with Hong Kong suffering a sharp recession in 1985-86. Singapore's growth fell short of Hong Kong's in the late 1980's, but since 1992 has grown considerably faster than Hong Kong. Over the whole sample period, Hong Kong achieved an average growth rate of 5 percent, while Singapore had a 6.7 percent average growth rate. The Figure also shows quite graphically the difference in response to the Asian crisis. Singapore real GDP is relatively flat since mid-1997. Hong Kong has experienced a rapid and large contraction.

Figure 5 shows the path of total exports for Hong Kong and Singapore, starting from a 1983 base. The Figure shows the remarkable export orientation of growth in these economies. Their real export performance was remarkably similar. Annual export growth over the 15 year period was about 12 percent in both. By 1998, exports had risen by 600 percent over the 1983 base.

Our model implies that growth should be coincident with real exchange rate appreciation. There has been considerable doubt about the empirical relevance of the Balassa Samuelson effect for Asian countries (see Chinn 1997). But Figure 6 shows that both Hong Kong and Singapore did undergo considerable real appreciation, relative to the US, over the 1980's and 1990's. This real appreciation was significantly greater in Hong Kong. Hong Kong's CPI-based real exchange rate vis-à-vis the US is 90 percent higher than in 1983 [2] Singapore by contrast, by early 1997 had experienced about 40 percent real appreciation since 1983.

To what can we attribute the `excessive' real appreciation in Hong Kong? Figure 7 shows a breakdown of exports in Hong Kong into `domestic' and `re-exports'. Re-exports mainly reflect the increasing importance of the displacement of manufacturing in Hong Kong into Guangdong province in Southern China. Domestic exports in Hong Kong have stagnated since the late 1980's, while re-exports have grown extremely rapidly. This increasing shifting of production to lower cost locations has probably facilitated a higher real appreciation in Hong Kong, without a more serious erosion of its competitiveness in export markets.

Figure 6 also clearly illustrates the different responses of the real exchange rate in Singapore and Hong Kong to the Asian crisis. The Singapore dollar has fallen in real terms by over 20 percent in the last 18 months. By contrast, the real exchange rate in Hong Kong has continued to appreciate until very recently.

Figures (8) and (9) show how the trend of real appreciation has been accomplished in Singapore and Hong Kong. Singapore's nominal exchange rate appreciated consistently since the late 1980's, while the Hong Kong dollar was tightly pegged to the US dollar since late 1983. But Hong Kong has far higher inflation than Singapore. As shown in

[2] There is an interesting quirk about the measure of Hong Kong' s real exchange rate. The famous Economist Big-Mac index consistently reports that, based purely on the Hamburger parity standard, the Hong Kong dollar has been undervalued for most of the1990's. This seems hard to reconcile the with Figure above. The answer is simply that Macdonald's in Hong Kong is the bargain of the century. The Macdonald's pricing policy in Hong Kong has been to go for high volume and low prices. Relative to most other consumer goods in Hong Kong, Macdonald's is extremely cheap. The Economist is always careful to heavily qualify the significance of their

Figure (9), Singapore's inflation rate over the 1983-1998 period was lower than that of the US, while Hong Kong's inflation rate, despite the peg to the US dollar, was much higher. Singapore's average inflation over the sample was 1.6 pecent. Hong Kong's average was 6.8 percent.

This seems to accord quite closely with the model set out above. Both countries had high growth and substantial real exchange rate appreciation. But with Hong Kong, the real appreciation implied high rates of inflation in nontraded goods prices, while Singapore absorbed real appreciation by nominal appreciation.

Figure 10 shows the inflation in the house price index of the CPI in both countries. Since 1983, this component of the CPI increased by 25 percent in Singapore. In Hong Kong, the increase was 340 percent - far higher than the average rate of inflation. To the extent that this index reflects increasing land prices, this is also in line with the predictions of the model. Relative to the overall CPI, housing prices in Hong Kong increased by 50 percent over the period. In Singapore however, housing prices rose roughly in line with the CPI.

Figures 11 and 12 show the volatility of GDP and exchange rates in Hong Kong and Singapore over the sample period. The series in the Figure is a deviation of quarterly, seasonally adjusted GDP from a Hodrick Prescott trend. Relative to the G7 countries, GDP in these economies is highly volatile. The quarterly standard deviation of Singapore GDP is 2.6 percent. Hong Kong's is 3 percent. The picture also shows that Hong Kong's GDP is more volatile than that of Singapore. This is consistent with the predictions of our model. In the face of foreign shocks, at least foreign price shocks, nominal exchange rate adjustment will help to stabilize the economy. As shown the second Figure, the Singapore nominal exchange rate was considerably more volatile.

Thus, the model seems to be relevant in understanding not just the trends in GDP, inflation and real exchange rates for Hong Kong and Singapore, but also for the macroeconomic

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index for as a measure of the real exchange rate. This seems to be a case where the qualifications are volatility. Obviously, without a more detailed measure of the type of shocks that both economies were exposed to, it is difficult to draw firm conclusions. In addition, while output volatility was higher in Hong Kong than Singapore, Table 1 shows that both consumption and especially investment volatility was higher in Singapore.

Nevertheless, the very sharp divergence in the response to the Asian crisis of Hong Kong and Singapore seems to at least partially reflect the differences in their exchange rate regimes. This draws a stark picture of the differential properties of fixed versus floating exchange rate regimes for small economies suffering from negative macroeconomic shocks.

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particularly relevant.

Figure 1 Interest Rate Shock: Output

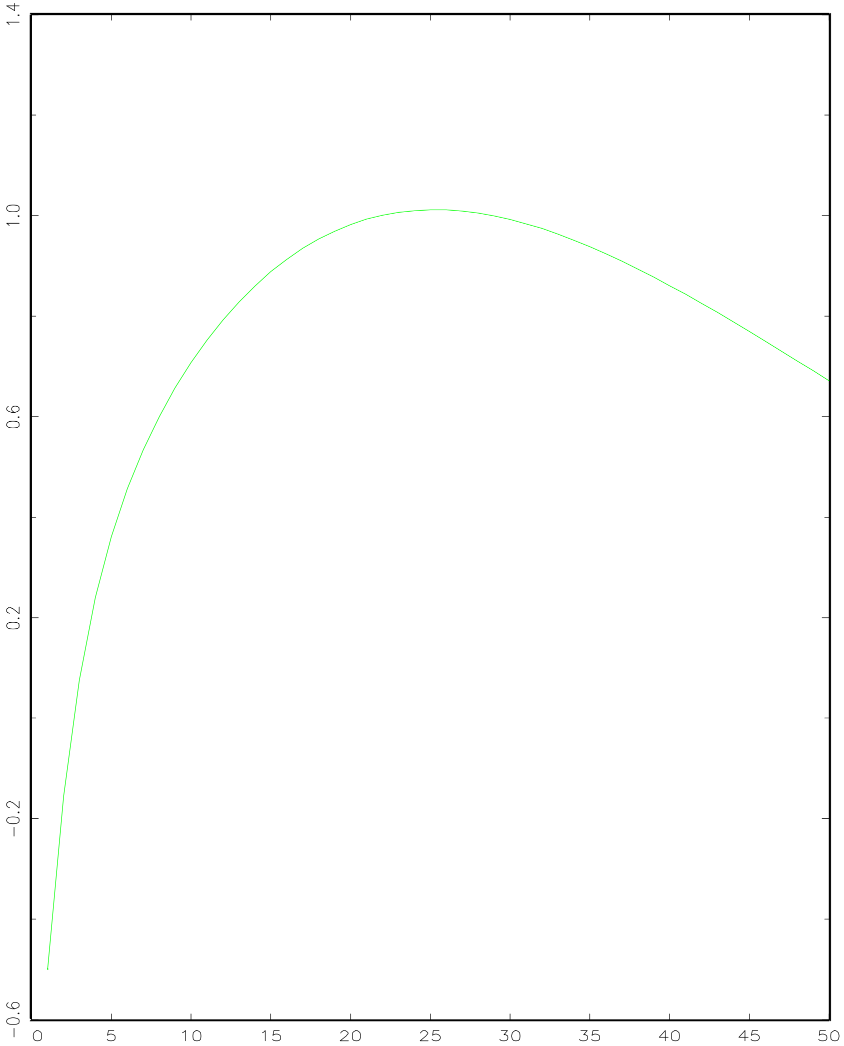


Figure 1 Interest Rate Shock: Real Exchange Rate

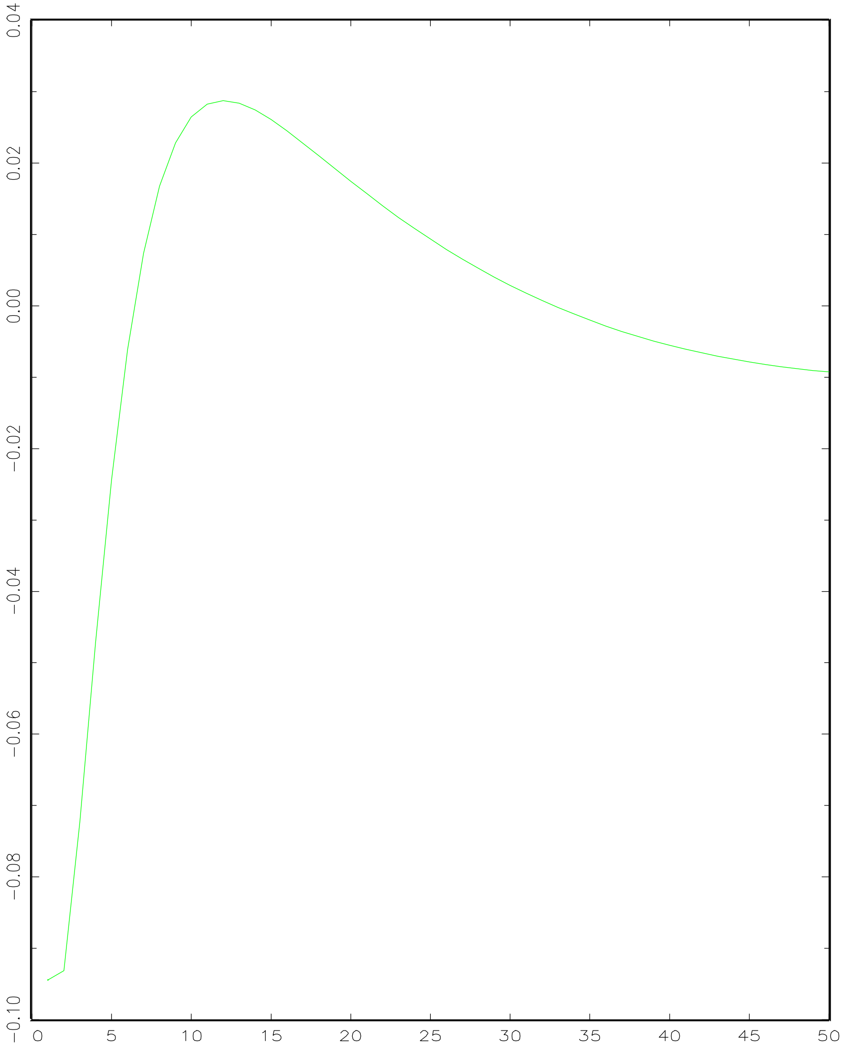


Figure 2 Price Shock: Output

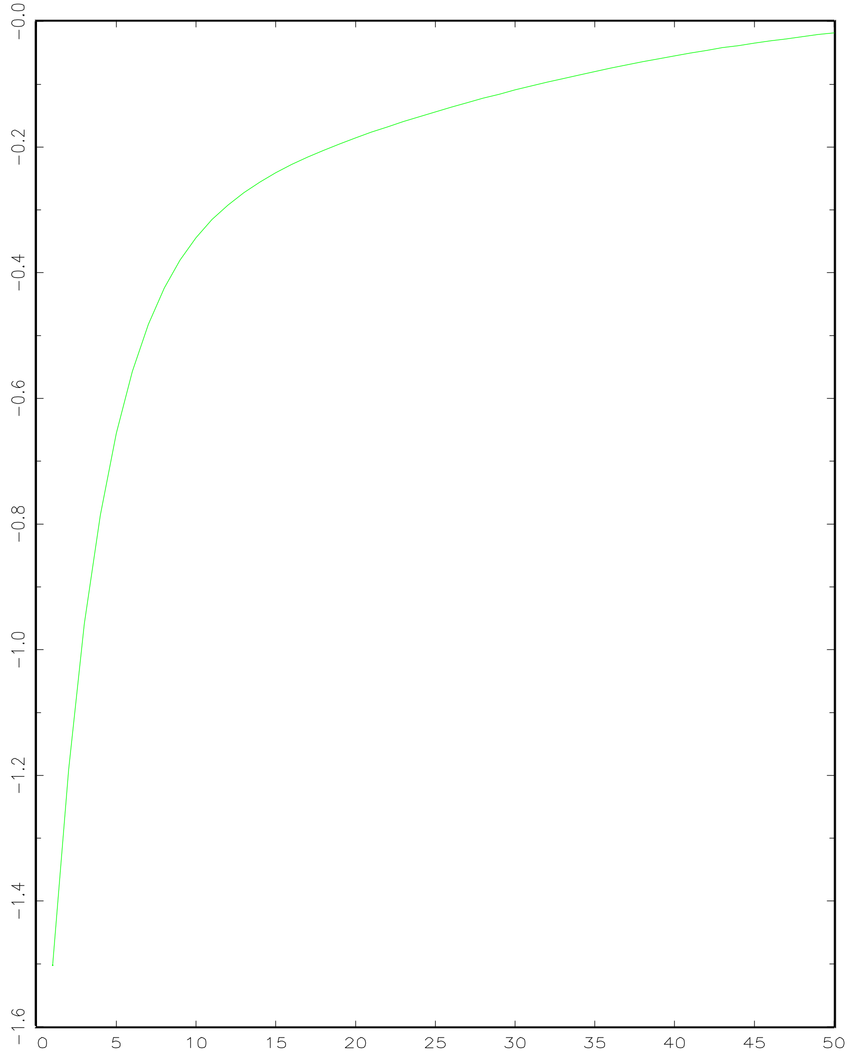
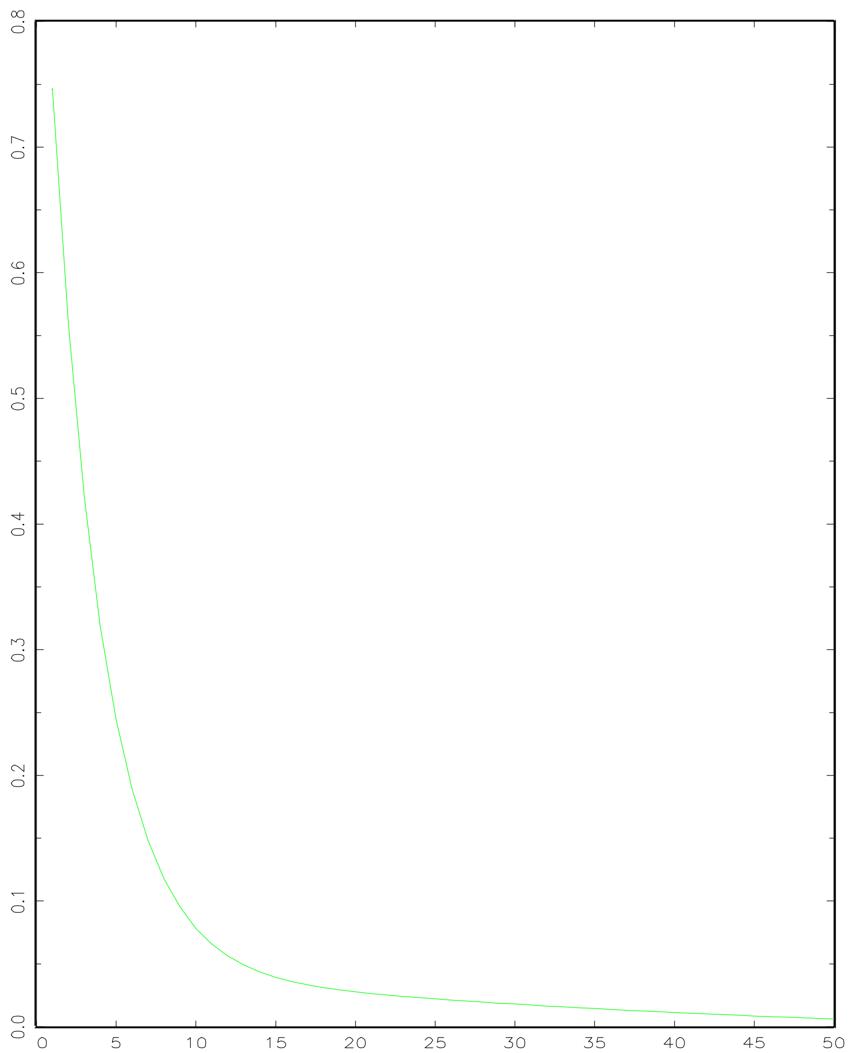


Figure 2 Price Shock: Real Exchange Rate



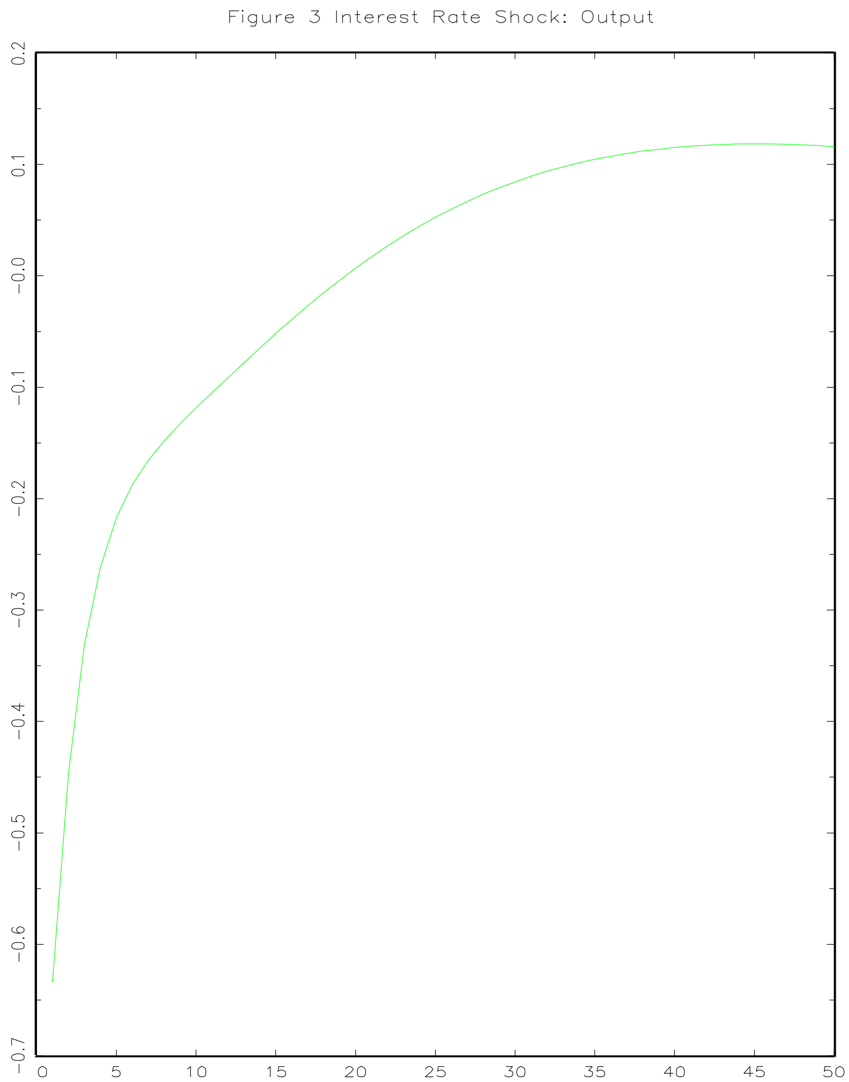


Figure 3 Interest Rate Shock: Output
0.2
0.1
−0.0
−0.1
−0.2
−0.3
−0.4
−0.5
−0.6
−0.7
0
5
10
15
20
25
30
35
40
45
50

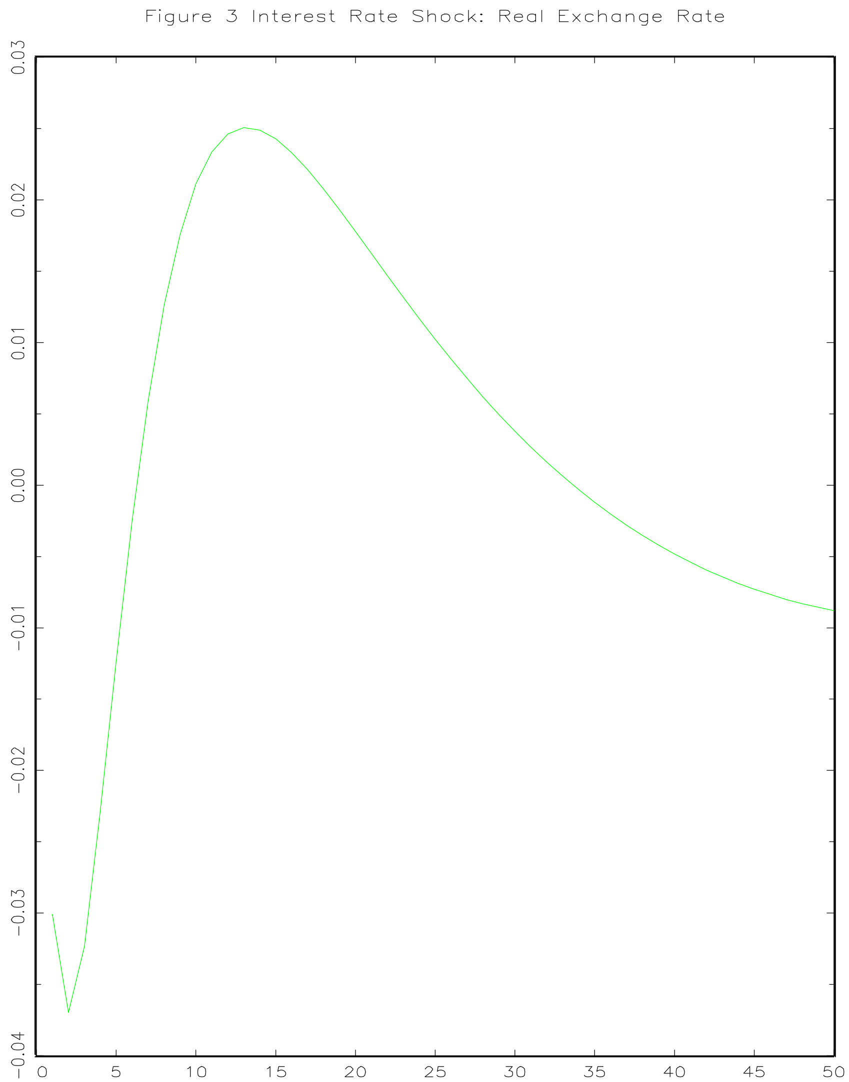


Figure 3 Interest Rate Shock: Real Exchange Rate
0.03
0.02
0.01
0.00
−0.01
−0.02
−0.03
−0.04
0
5
10
15
20
25
30
35
40
45
50

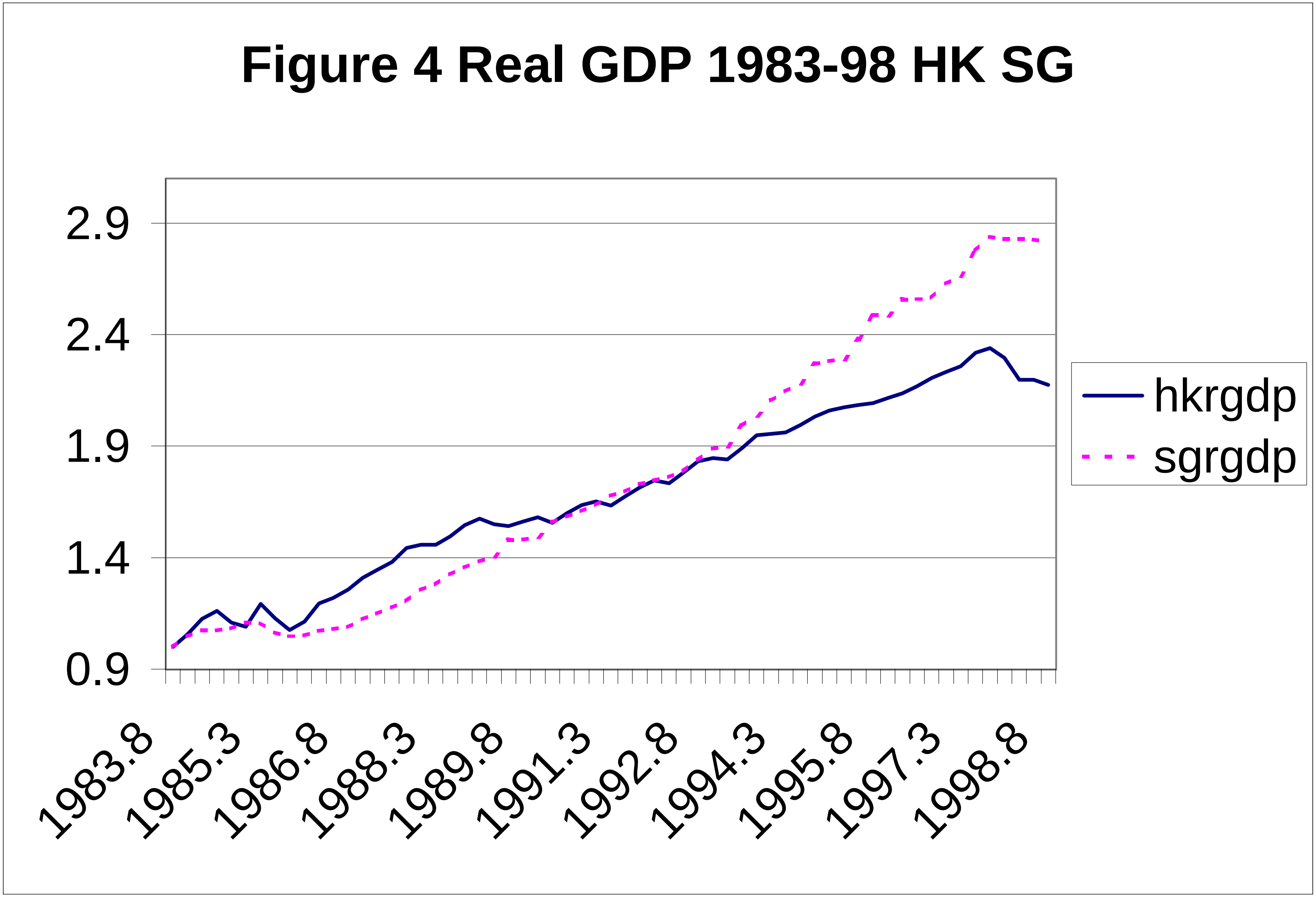
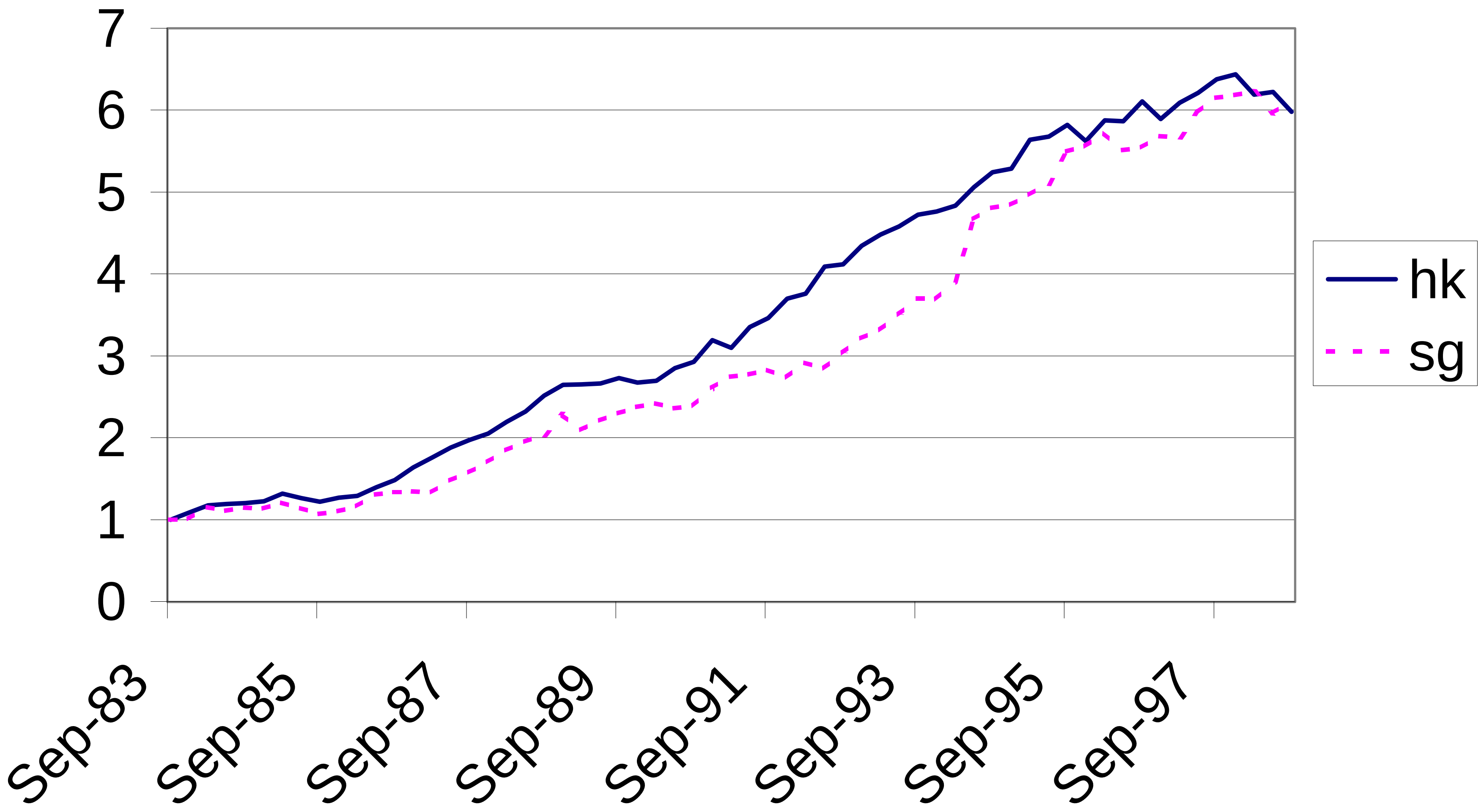


Figure 4 Real GDP 1983-98 HK SG
2.9
2.4
1.9
1.4
0.9
1983.8
1985.3
1986.8
1988.3
1989.8
1991.3
1992.8
1994.3
1995.8
1997.3
1998.8
hkrgdp
sgrgdp

Figure 5   Exports 1983-1998



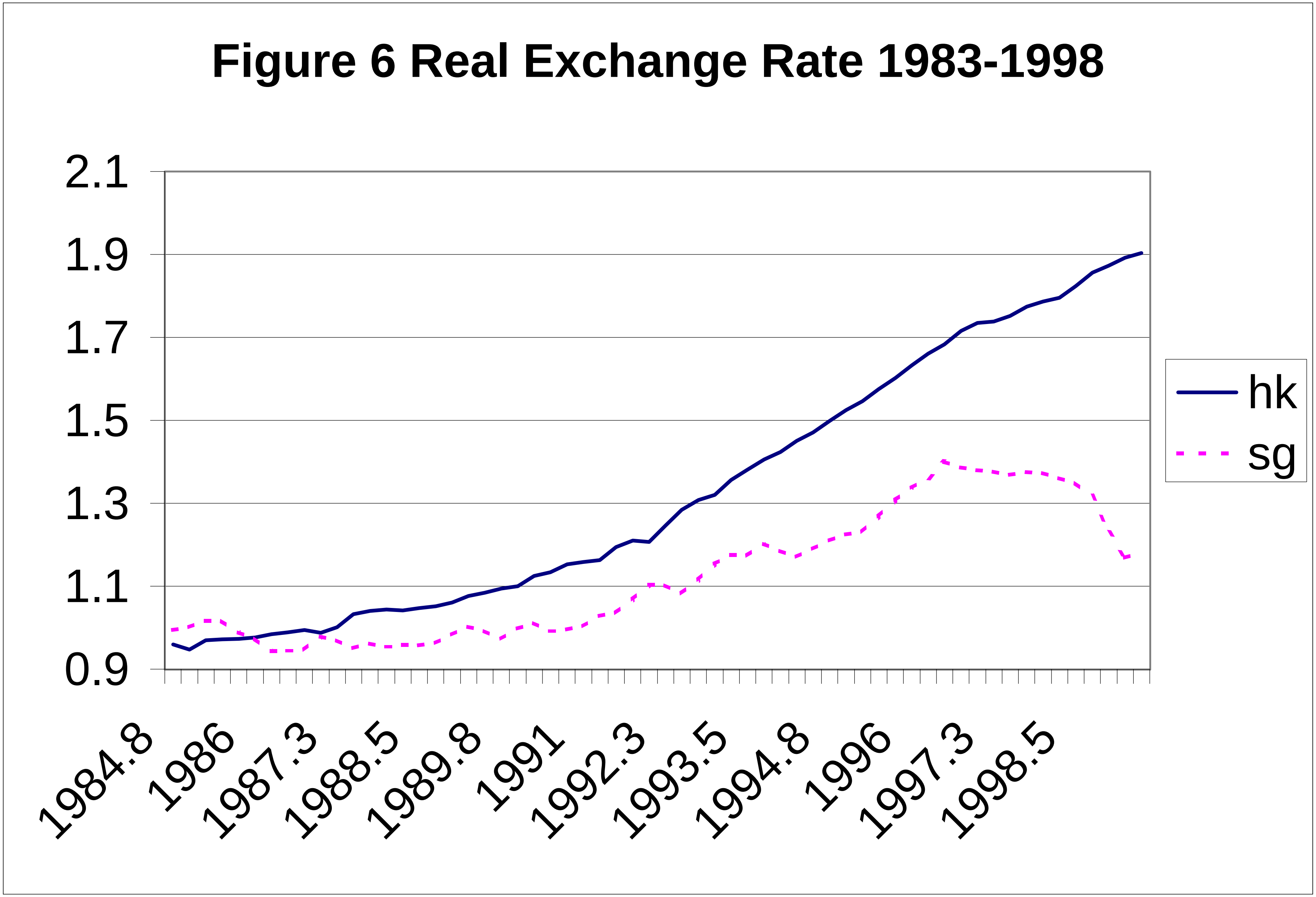
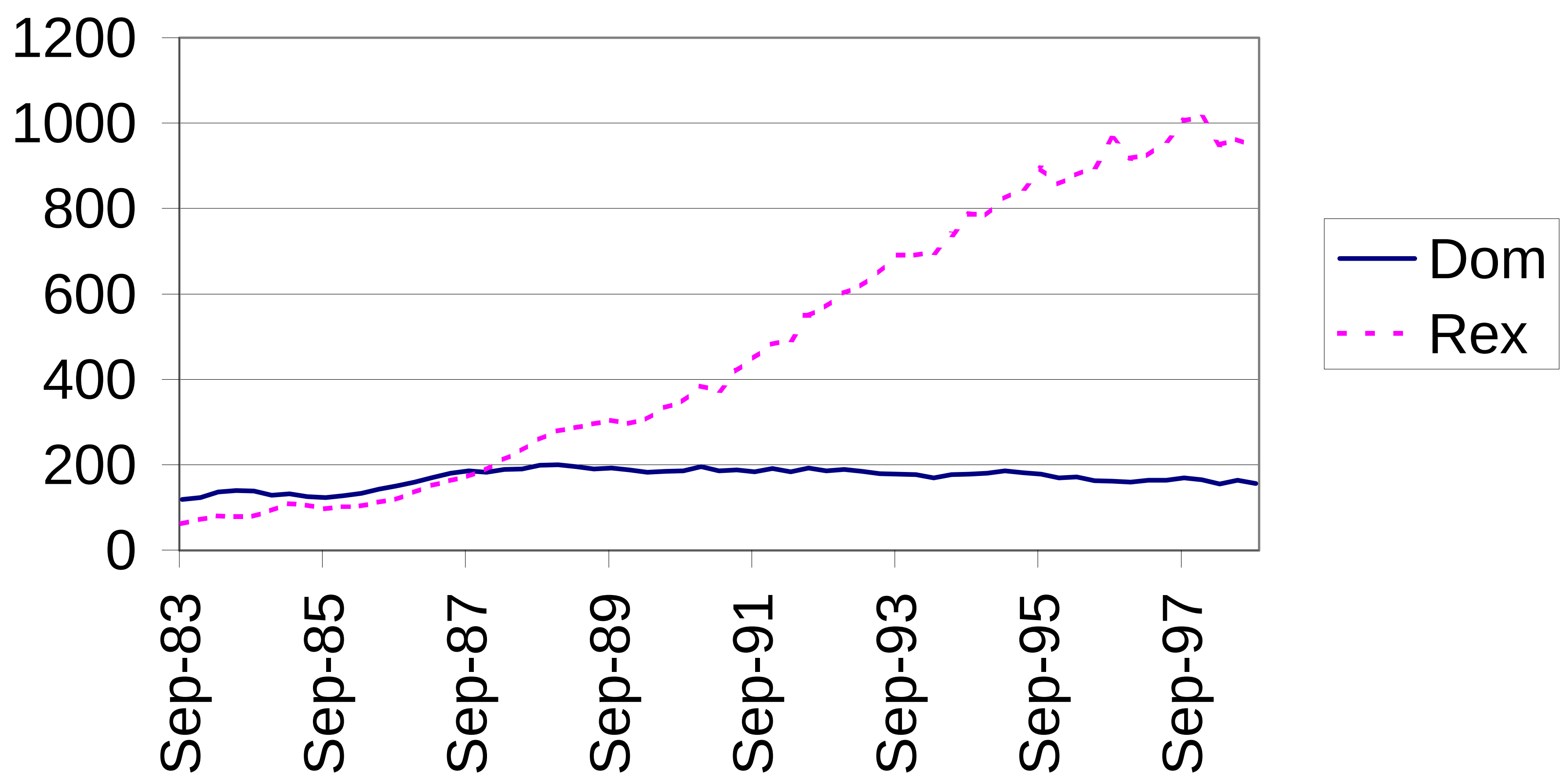


Figure 6 Real Exchange Rate 1983-1998
2.1
1.9
1.7
1.5
1.3
1.1
0.9
1984.8
1986
1987.3
1988.5
1989.8
1991
1992.3
1993.5
1994.8
1996
1997.3
1998.5
hk
sg

Figure 7 Domestic Exports/Re-Exports 1983-98



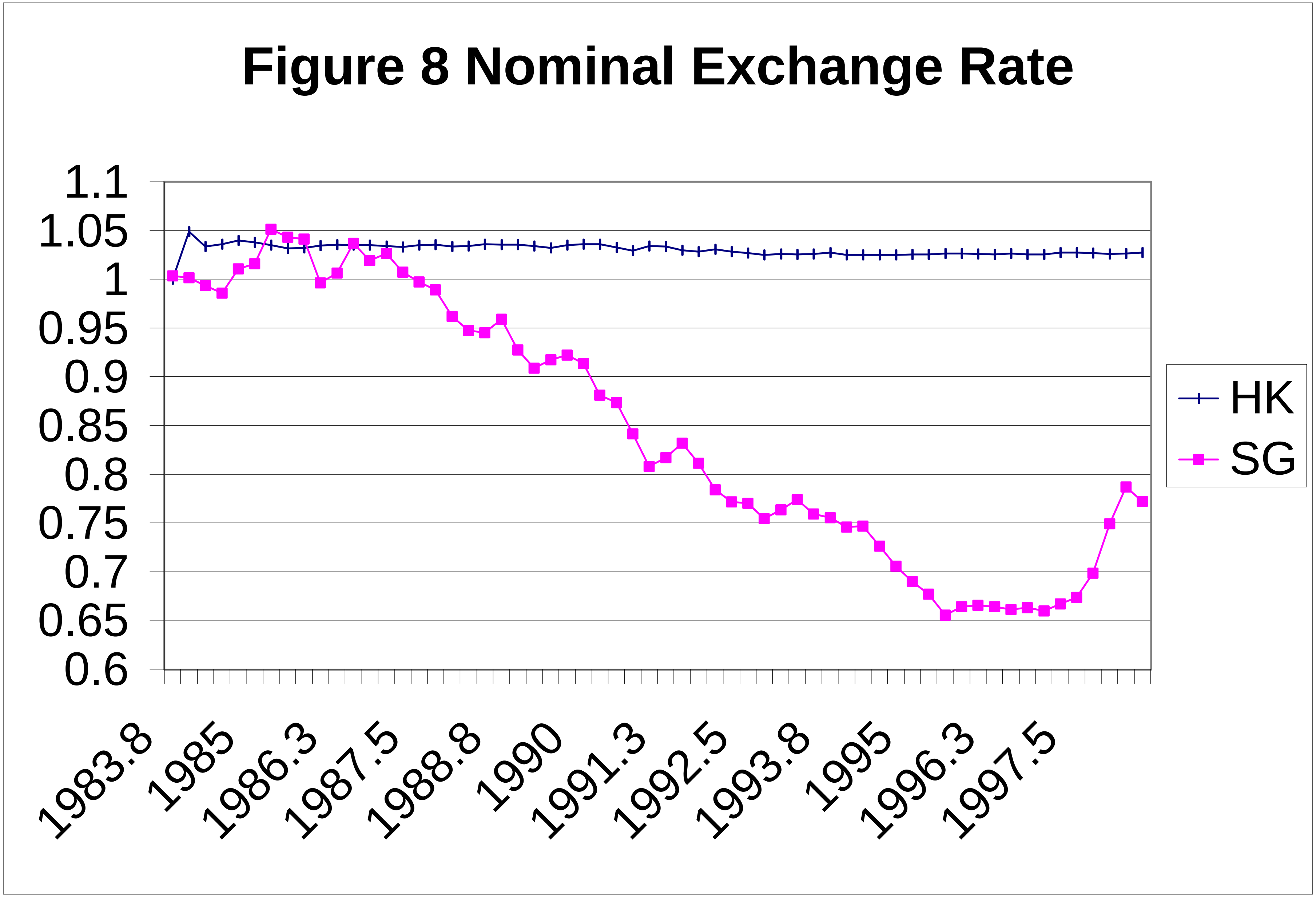


Figure 8 Nominal Exchange Rate
1.1
1.05
1
0.95
0.9
0.85
0.8
0.75
0.7
0.65
0.6
1983.8
1985
1986.3
1987.5
1988.8
1990
1991.3
1992.5
1993.8
1995
1996.3
1997.5
HK
SG

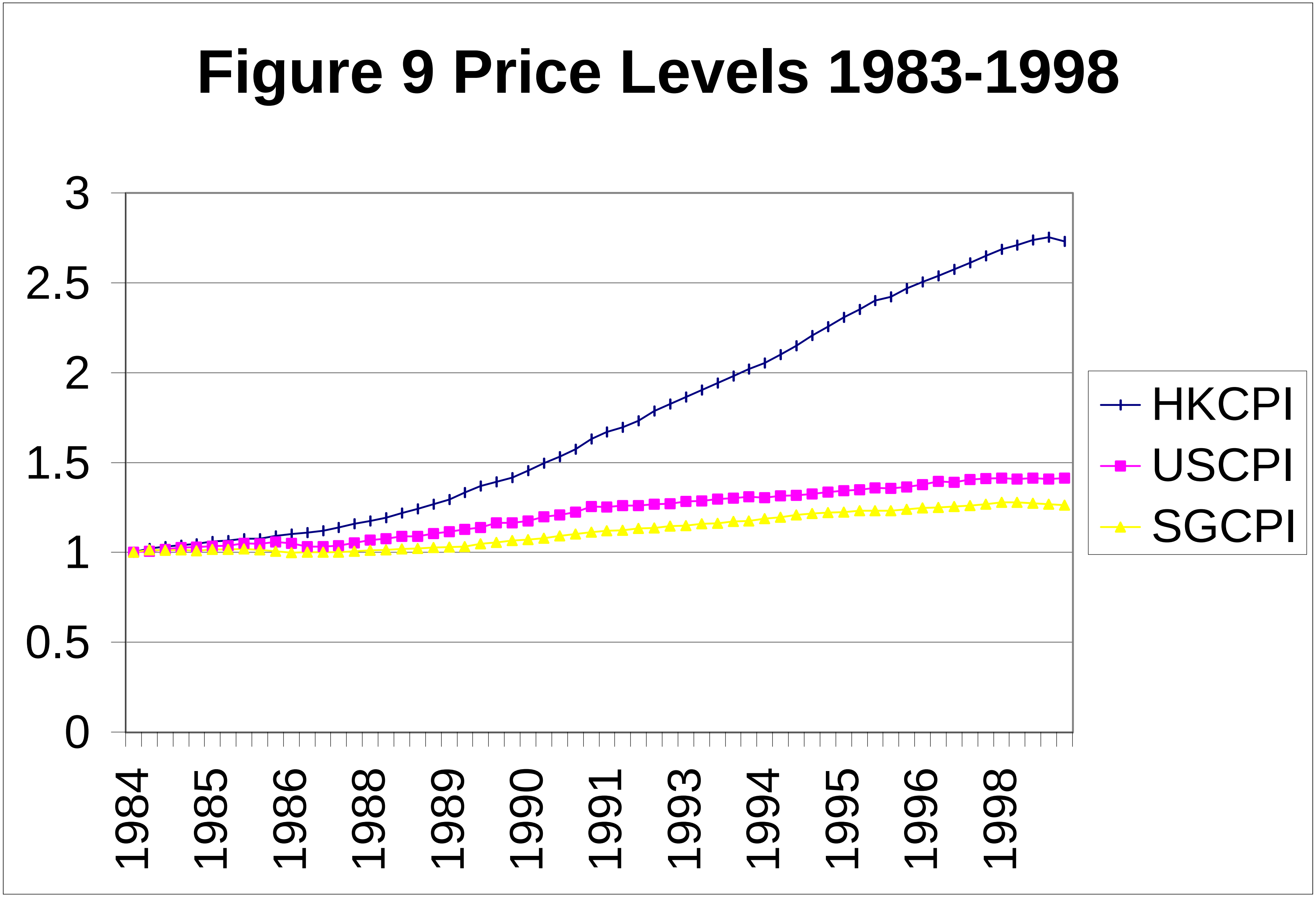


Figure 9 Price Levels 1983-1998
3
2.5
2
1.5
1
0.5
0
1984
1985
1986
1988
1989
1990
1991
1993
1994
1995
1996
1998
HKCPI
USCPI
SGCPI

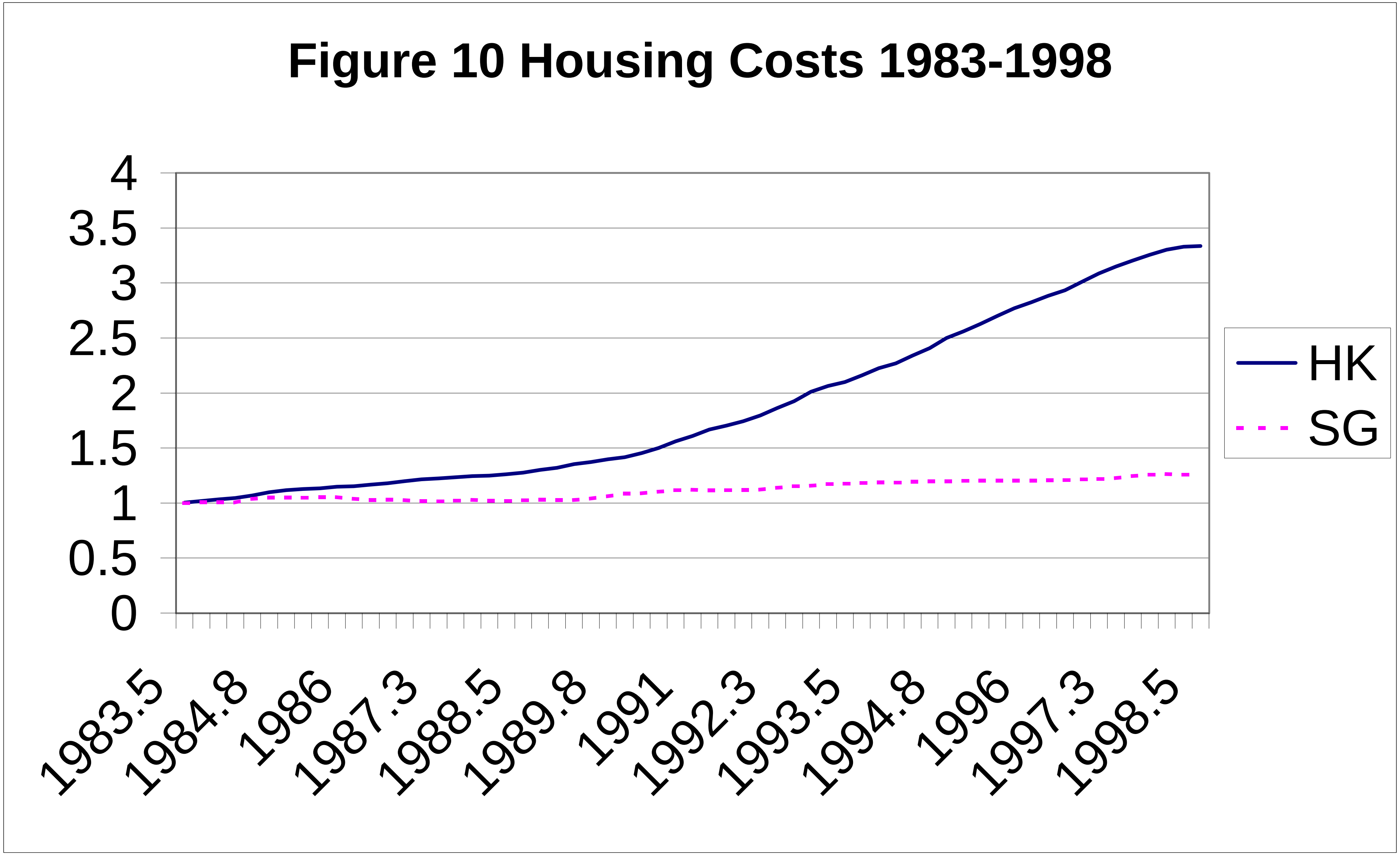


Figure 10 Housing Costs 1983-1998
4
3.5
3
2.5
2
1.5
1
0.5
0
1983.5
1984.8
1986
1987.3
1988.5
1989.8
1991
1992.3
1993.5
1994.8
1996
1997.3
1998.5
HK
SG

Figure 11 Real GDP 1983-1998

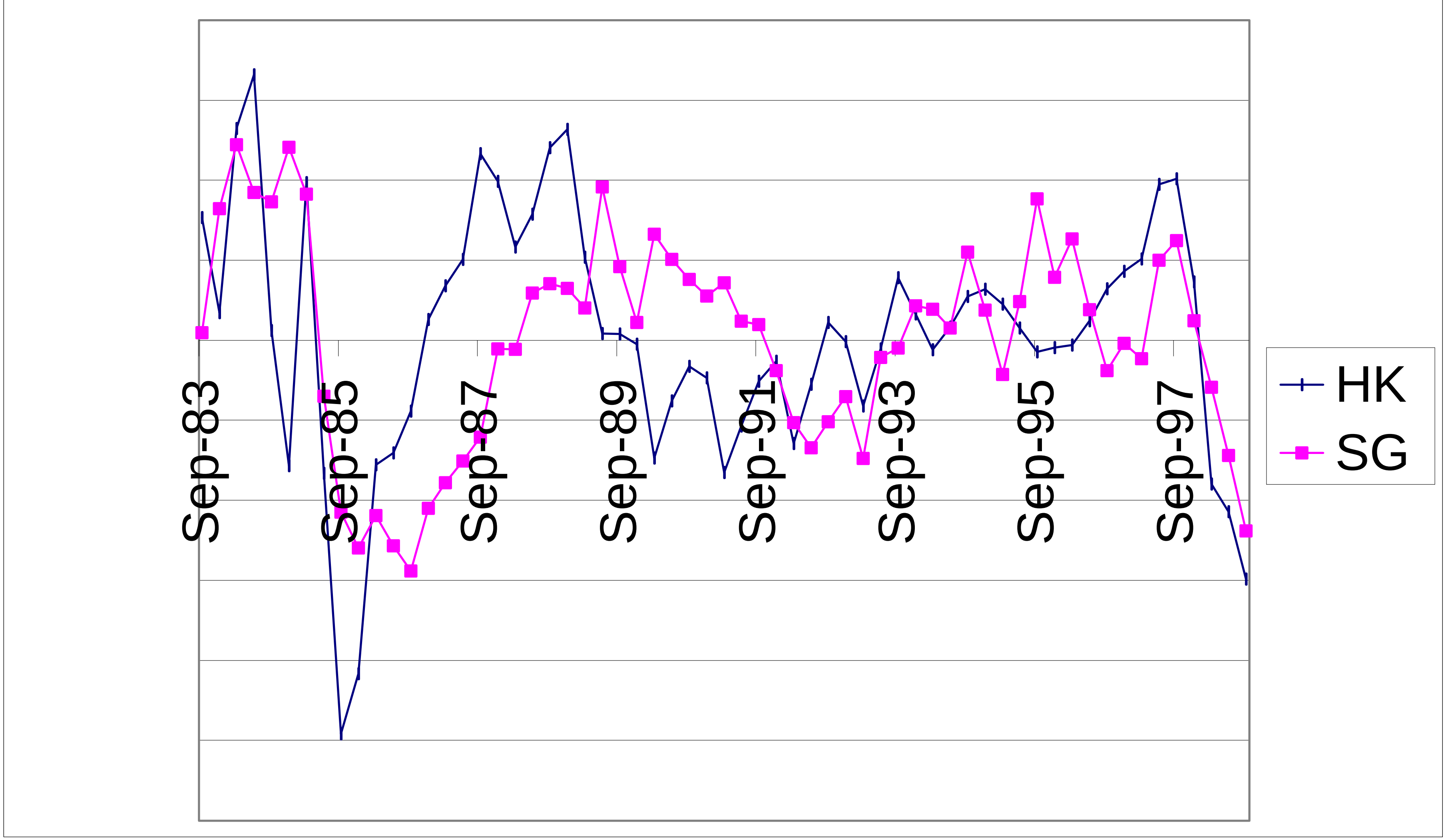


Figure 12 Monthly Exchange Rate Changes

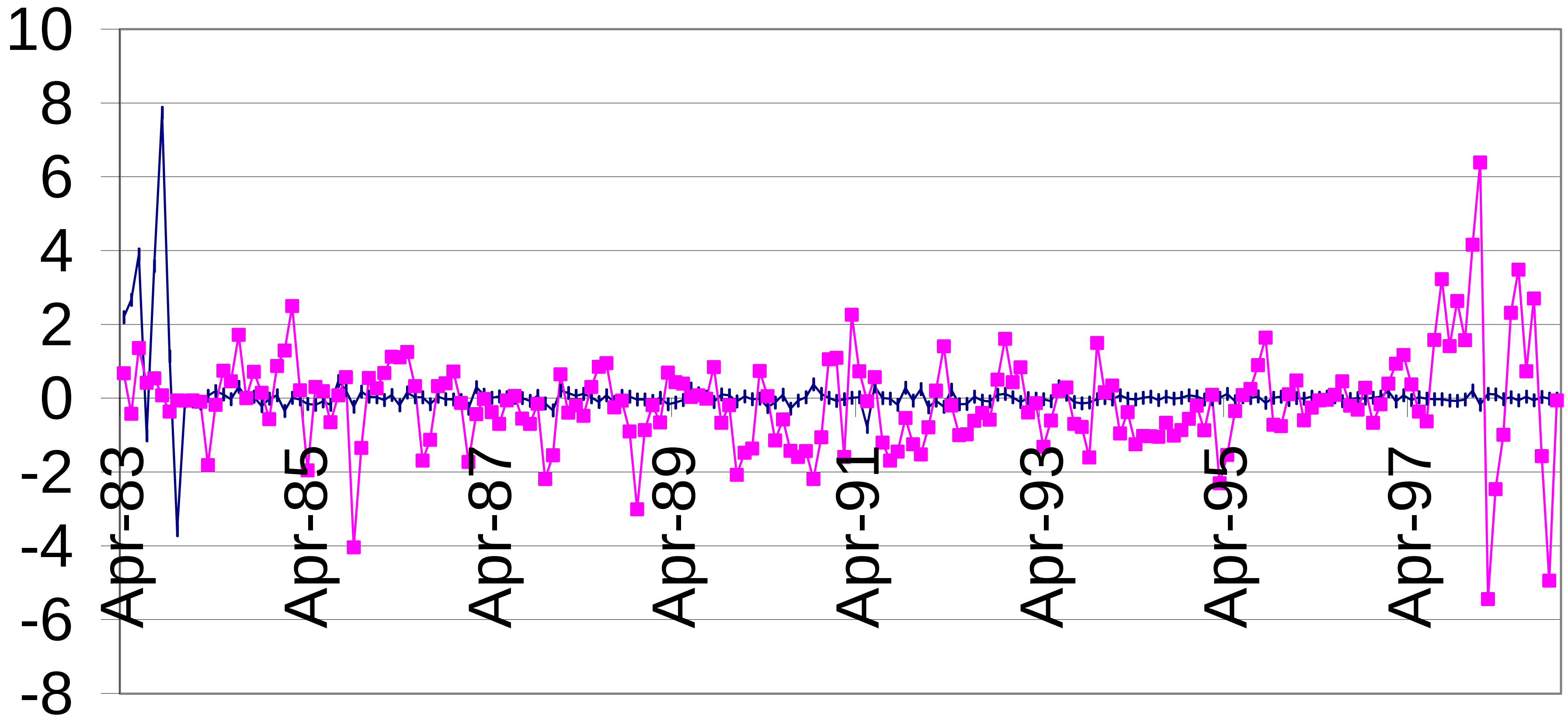


Table 1 Standard Deviations/Correlations			
	Hong Kong	Singapore	Correlations
GDP	3.1	2.6	0.48
Consumption	2.3	2.7	0.18
Investment	3.9	6.2	0.057