

Hong Kong's business cycle synchronisation with Mainland China and the US

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Co-movements of business cycles in Hong Kong and the Mainland have increased steadily since the 1990s. Although the corresponding co-movements with the US dipped in the late 1990s, there has been a significant increase in the degree of synchronisation since 2000. This raises the question as to what factors drive the co-movements of business cycles among the three economies.

This analysis suggests that in the medium to long term, about 60% of Hong Kong's output variations and 45% of its price changes can be explained by US shocks; while more than one third of Hong Kong's inflation can be explained by the impact of Mainland shocks.

In addition, the results indicate that in the absence of the common US influences, there is little correlation between the business cycles in Hong Kong and the Mainland. In other words, the business cycle co-movements of Hong Kong and the Mainland are largely attributable to the common influence of economic conditions in the United States and possibly their US dollar pegged exchange rate system. The lack of similarity of domestic shocks between Hong Kong and the Mainland is mostly due to their continuing differences in economic structure and stages of economic development. As the similarity of shocks is the most important factor in the choice of an exchange rate regime, it follows that Hong Kong's linked exchange rate system, based on the US dollar, will continue to be preferable in the foreseeable future.

I. Introduction

While Hong Kong's monetary policy is effectively tied to the US, its real economy has been increasingly linked to the Mainland economy through trade, foreign direct investment, tourism, and financial markets. As an *entrepôt* and an international financial centre, Hong Kong intermediates a lion's share of the Mainland's external trade, provides significant flows of foreign direct investment, and acts as the largest overseas fund raising centre for Mainland companies. Hong Kong has also become a favourite tourist

destination for Mainland visitors, whose spending in Hong Kong was equivalent to 5% of Hong Kong's private consumption expenditure in 2004. Empirical evidence suggests that the pace of economic integration between Hong Kong and the Mainland has accelerated greatly since the return of Hong Kong to Chinese sovereignty in 1997.¹ Indeed, it is widely expected that the pace of economic integration will increase further as the Mainland moves to make its exchange rate more flexible and its capital account more open.

Closer economic integration with the Mainland has naturally raised the question of whether the business cycles in the two economies have become more synchronised over time. According to the Optimal

¹ For a detailed documentation of Hong Kong's economic relations with Mainland China and the US, please refer to Genberg, Liu, and Jin (2006).

Currency Area (OCA) theory first developed by Mundell (1961), the degree of business cycle synchronisation between two economies may have important implications for the optimal monetary arrangement between them. The OCA theory suggests that an intra-area fixed exchange rate or a common currency is the most appropriate for a group of economies that are closely integrated via the product, factor, and labour market, that have a similar degree of business cycle synchronisation, and that are subject to common economic shocks. If the business cycles are similar and shocks are common, then a co-ordination of monetary policies can become desirable, with a common currency as the ultimate form of policy co-ordination. However, if shocks are predominantly country-specific or idiosyncratic, then the ability to conduct independent monetary and fiscal policy becomes more important in helping an economy adjust to such shocks.²

This article assesses quantitatively the current state of business cycle synchronisation between Hong Kong and the Mainland. Because the US continues to be one of the most important trading partners as well as investors for Hong Kong and, more importantly, because Hong Kong shares a common monetary policy with the US since 1983 (the Linked Exchange Rate System - LERS), it is useful to compare business cycle synchronisation between Hong Kong and the Mainland with that between Hong Kong and the US. This article then examines

to what extent Hong Kong's output and price developments are affected by shocks from the Mainland and the US, and whether the business cycle co-movements with the Mainland are driven by some common shocks. Section II assesses the degree of business cycle co-movements between these three economies over time. Section III examines how output and price shocks are transmitted across the three economies. Section IV discusses policy implications and concludes.

II. Business cycle co-movements through time

A business cycle is usually defined as fluctuations in real GDP around some measure of its potential level. Business cycle synchronisation refers to the degree of co-movements of output fluctuations across economies and time. Following the conventions of existing literature, the analysis provides two measures of business cycle synchronisation: correlations of real GDP growth rates and their band-pass (BP) filtered cyclical components, and correlations of output gaps and their BP-filtered cyclical components.^{3, 4}

Correlations of GDP growth

Table 1 presents Hong Kong's output correlations with the Mainland and the US from 1979 to 2005. Two observations are made. First, the correlation of Hong Kong's real GDP growth rates with those of

TABLE 1
Output correlation

| HK with: | Correlation of real GDP (YoY growth rates) | | | Correlation of GDP cycles (band-pass filtered) | | |
|----------|---|-----------|-----------|---|-----------|-----------|
| | 1979-1989 | 1990-1999 | 2000-2005 | 1979-1989 | 1990-1999 | 2000-2002 |
| CN | 0.04 | 0.36 | 0.46 | 0.28 | 0.13 | 0.92 |
| US | 0.09 | -0.21 | 0.85 | 0.32 | 0.18 | 0.92 |

Sources: CEIC and staff estimates.

² The early OCA literature was not concerned with the possibility that the criteria and the decision to form an OCA can be an endogenous process. Frankel and Rose (1998) demonstrate that as a group of countries adopts a common currency their markets may become increasingly integrated, leading to increased business cycle synchronisation and more symmetrical transmissions of economic shocks.

³ See Frankel and Rose (1998) and Dodsworth, *et al.* (1997).

⁴ The cyclical component of quarterly real GDP is derived by using the band-pass filter proposed by Baxter and King (1999). This filter removes low-frequency trend variation and smoothes high-frequency irregular variation, while retaining the major features of business cycles.

CHART 1

Growth and cycle correlation



Note: For Chart A, the first correlation reported is for the period between 1979:Q1 and 1986:Q4. For Chart B, the first correlation reported is for the period between 1982:Q1 and 1989:Q4 as the BP filter often drops the first three years and the last three years of data in calculation.

Sources: CEIC and staff estimates.

the Mainland has increased markedly over time, while the correlation with the US turned negative in the 1990s before reaching as high as 0.85 during the past five years. The negative correlation in the 1990s was probably due to a sharp drop in GDP growth in Hong Kong associated with the 1997-98 Asian financial crisis. However, after adjusting for the irregular variation using the BP filter, Hong Kong's correlations with the US were even higher than those with the Mainland over the two sub-periods. Secondly, the correlation of cyclical components of GDP showed similar patterns for both pairs of economies. In particular, the correlation rose markedly in 2000-2002 after dipping into its lows in the 1990s from the 1980s. The BP-filtered correlation analysis suggests that Hong Kong's business cycle was equally synchronised with both the Mainland and the US in recent years.

Further investigation, using eight-year moving windows over the sample period,⁵ shows, quite remarkably, that the correlation coefficient of GDP

growth between Hong Kong and the Mainland rose from around minus 0.2 in the early 1980s to almost 0.7 in the mid-1990s (Chart 1A). This was probably driven by rapid trade integration following economic reform and the opening up of the Mainland economy. However, the correlation coefficient dropped significantly from 1997 to 2002, a period when Hong Kong was severely affected by the Asian financial crisis, but to which the Mainland was largely immune. The correlation coefficient has since recovered to around 0.4 in the eight years up to 2004, reflecting the rapid recovery of the Hong Kong economy and continued high growth on the Mainland. While the correlation of GDP growth rates in Hong Kong and the Mainland increased until 1998, those between Hong Kong and the US started to move in the opposite direction after 1988, even reaching minus 0.3 in the eight years to 1998 before a sharp recovery to 0.4 in the eight years to 2004, about the same degree of correlation observed between Hong Kong and the Mainland.

⁵ The rationale of using an eight-year moving window is that a full business cycle in the US usually takes between six quarters and eight years (Baxter and King, 1999).

Compared with their counterparts in panel 1A, the correlations of the BP-filtered GDP growth rates in panel B demonstrate a similar but smoother pattern. While moving together in the same direction, the cyclical correlations between Hong Kong and the US have been persistently higher than those between Hong Kong and the Mainland since 1999.

Correlations of output gaps

Table 2 reports the output gap correlations for the three pairs of economies. It shows that the correlation between Hong Kong and the Mainland in the new millennium rose to 0.52 from 0.32 in the 1990s. Over the same period, the correlation of output gaps between Hong Kong and the US recovered even more strongly and reached 0.51 during the period from 2000 to the present, from a large negative value of -0.57 during the 1990s. Although small, the correlation coefficients of the output gaps between China and the US were positive in the 1990s before turning negative in 2000 to 2005.

TABLE 2

Output gap correlation

| Based on Y gap: | 1980-1989 | 1990-1999 | 2000-present |
|-----------------|-----------|-----------|--------------|
| HK-CN | | 0.32 | 0.52 |
| HK-US | 0.24 | -0.57 | 0.51 |
| CN-US | | 0.12 | -0.19 |

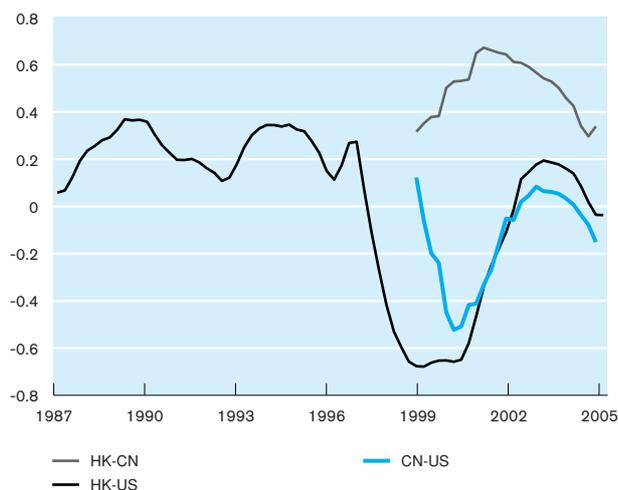
Source: Staff estimates.

Chart 2 presents the time-varying correlation coefficients using the eight-year rolling windows. Chart 2A indicates that the output gap correlations for the Hong Kong-Mainland pair were higher than those for the Hong Kong-US pair. It is interesting to note that the correlation between Hong Kong and the US appeared to track closely with that between the Mainland and the US from 1999 to 2005.

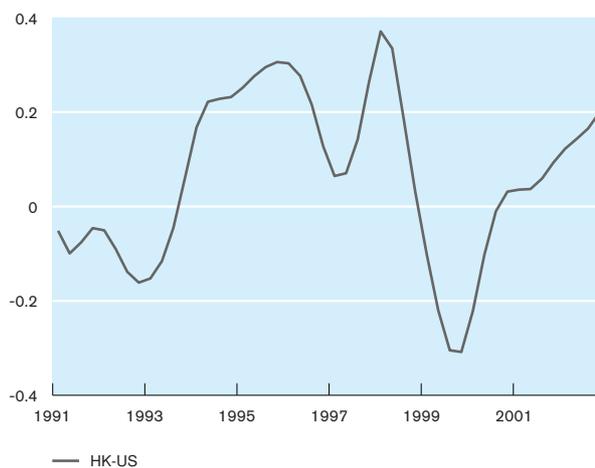
CHART 2

Output gap and cycle correlation

A. Output gap correlation



B. BP-filtered output gap correlation



Note: For Chart A, the first correlation reported is for the period between 1980:Q1 and 1987:Q4. For Chart B, the first correlation reported is for the period between 1984:Q1 and 1991:Q4.

Source: Staff estimates.

III. The transmission of economic shocks

The correlation analysis in the previous section reveals important information on the degree of business cycle synchronisation. However, it does not show how economic shocks are transmitted across the three economies, which is more appropriately handled using a structural economic model, in this case a structural vector auto regression (SVAR) model. This analysis follows most closely the approach adopted in Genberg, Salemi, and Swoboda (1987), Cushman and Zha (1997) and, for East Asia, Genberg (2005). Because of the size of the US economy, it is reasonable to assume that US output, price, and interest rate shocks will affect both Hong Kong and the Mainland, but not vice versa. Similarly, because of the relative sizes of Hong Kong and the Mainland we assume that Mainland shocks are transmitted to Hong Kong, but that economic developments in Hong Kong have no influence on the Mainland.

Our VAR system contains seven variables: US real GDP growth and CPI inflation, three-month US Treasury bill rate, inflation and real GDP growth in Mainland China, and finally inflation and real GDP growth in Hong Kong. The contemporaneous correlation between the error terms in each variable is assumed to obey the causal structure illustrated in equation (1):

$$\begin{pmatrix} \Delta y_t^{US} \\ \Delta p_t^{US} \\ TB_t^{US} \\ \Delta y_t^{CN} \\ \Delta p_t^{CN} \\ \Delta y_t^{HK} \\ \Delta p_t^{HK} \end{pmatrix} = \begin{pmatrix} 1 & a_{12} & a_{13} & 0 & 0 & 0 & 0 \\ a_{21} & 1 & a_{21} & 0 & 0 & 0 & 0 \\ a_{31} & a_{31} & 1 & 0 & 0 & 0 & 0 \\ a_{41} & a_{42} & a_{43} & 1 & a_{45} & 0 & 0 \\ a_{51} & a_{52} & a_{53} & a_{54} & 1 & 0 & 0 \\ a_{61} & a_{62} & a_{63} & a_{64} & a_{65} & 1 & a_{66} \\ a_{71} & a_{72} & a_{73} & a_{74} & a_{75} & a_{76} & 1 \end{pmatrix} \begin{pmatrix} \varepsilon_{yt}^{US} \\ \varepsilon_{pt}^{US} \\ \varepsilon_{tb}^{US} \\ \varepsilon_{yt}^{CN} \\ \varepsilon_{pt}^{CN} \\ \varepsilon_{yt}^{HK} \\ \varepsilon_{pt}^{HK} \end{pmatrix} \quad (1)$$

where Δy_t^* and Δp_t^* denote the quarterly real GDP growth rate and CPI inflation for these three economies and TB_t^{US} represents the quarterly average of three-month US treasury bills. ε_t^* represents corresponding shocks.

The equations are estimated using the seemingly unrelated regression method (SUR) over the sample period from the first quarter of 1990 to the last quarter of 2005 with the number of lags set to four. To fully identify the system we set $a_{12} = a_{13} = a_{21} = a_{45} = a_{66} = 0$.⁶

Panel A of Table 3 presents the variance decompositions of the Hong Kong variables to show the extent to which Hong Kong's output and inflation variations can be explained by US shocks, Mainland shocks and its own shocks. A few observations emerge from this table. First, Hong Kong's output and price developments are mostly affected by its own domestic factors in the short term (1 year). Secondly, for the medium (5 years) and long term (10 years), US shocks (combining shocks from GDP, CPI, and 3-month interest rates (TB)) appear to have explained 60% and 45% of Hong Kong's output and price variations respectively. Thirdly, the Mainland has only limited impact on real GDP growth in Hong Kong. However, it appears that Mainland shocks can explain more than one third of Hong Kong's inflation developments over the medium and long term. Fourthly, Hong Kong's own shocks account for about 30% and 20% of its output and price variations respectively over the medium to long term.

These findings appear to be consistent with our intuitions. Besides the fact that the US market is a key one for exports from both Hong Kong and the Mainland, the choice of the exchange rate regime in Hong Kong and on the Mainland may have played a role in explaining the increased business cycle synchronisation. That is, the *de facto* peg of the Hong Kong dollar and the renminbi (up to July 2005)

⁶ Although this implies a causal structure between the shocks within each economy, we do not make use of this in the analysis that follows.

TABLE 3

Variance decomposition of shocks

| Panel A. Impact on Hong Kong | | | | | | |
|------------------------------|--------|-------|-------|-------|-------|-------|
| | Output | | | Price | | |
| | US | CN | HK | US | CN | HK |
| In 1 quarter | 37.63 | 7.69 | 54.68 | 2.22 | 1.71 | 96.06 |
| One year | 56.27 | 7.62 | 36.11 | 21.47 | 10.03 | 68.51 |
| 5 years | 57.92 | 8.47 | 33.61 | 41.74 | 34.49 | 23.77 |
| 10 years | 60.92 | 8.00 | 31.08 | 44.57 | 35.91 | 19.52 |
| Panel B. Impact on China | | | | | | |
| In 1 quarter | 19.21 | 80.79 | 0.00 | 0.32 | 99.68 | 0.00 |
| One year | 33.09 | 66.91 | 0.00 | 5.49 | 94.51 | 0.00 |
| 5 years | 67.11 | 32.89 | 0.00 | 27.31 | 72.69 | 0.00 |
| 10 years | 78.79 | 21.21 | 0.00 | 30.65 | 69.35 | 0.00 |

Source: Staff estimates.

to the US dollar could reinforce the transmission of shocks in these two pairs of economies. This is indeed confirmed when examining the US effect on the Mainland economy in Panel B of Table 3. Over the medium to long term, the US output effect explains about 67% and 79% of Mainland output variations, surprisingly higher than that in Hong Kong, although the US shocks only explain less than one-third of the variations of Mainland prices. This result suggests that other than the external demand channel (as the US is currently the Mainland's second largest trading partner), the Mainland's *de facto* US dollar pegged exchange rate regime may also help explain the large US effect. The Mainland's inflation rate exerts a considerable impact on Hong Kong's domestic price development, partly because the real economy channel currently dominates economic integration between Hong Kong and the Mainland. Whereas on the Mainland, its own domestic factors tend to explain most of its own price developments.

To understand whether US shocks are responsible for the business cycle synchronisation between Hong Kong and the Mainland, we estimate two separate VAR specifications, one containing only the US and Mainland variables and the other containing only the US and Hong Kong variables. These two

TABLE 4

Correlations of domestically generated growth and inflation in Hong Kong and the Mainland

| | 1994-2005 | 1994-1997 | 1998-2000 | 2000-2005 |
|---------------|-----------|-----------|-----------|-----------|
| GDP | 0.09 | -0.01 | 0.11 | 0.12 |
| CPI Inflation | 0.09 | 0.26 | -0.29 | 0.14 |

Source: Staff estimates.

SVAR systems will permit us to distinguish between common US shocks and idiosyncratic domestic shocks.

We proceed by investigating how synchronised the economies of Hong Kong and the Mainland would be if there were only domestic shocks, that is, if the common effect from the United States were absent. The results are presented in Table 4 and they reveal little correlation between the two economies resulting from their purely domestic shocks. This is in sharp contrast to the much higher correlations reported in Table 1, which refers to the actual data. The conclusion is that the high actual correlation between the Hong Kong and the Mainland growth rates found earlier must have come from the effects of shocks originating in the United States.

TABLE 5

Correlations of growth and inflation in Hong Kong and the Mainland generated exclusively by US shocks

| | 1994-2005 | 1994-1997 | 1998-2000 | 2000-2005 |
|---------------|-----------|-----------|-----------|-----------|
| GDP | 0.43 | 0.48 | 0.53 | 0.62 |
| CPI Inflation | 0.63 | 0.60 | -0.39 | 0.59 |

Source: Staff estimates.

Table 5 reports the correlations between the evolution of inflation and growth in the two economies due exclusively to US shocks. These correlations are generally much higher (except for inflation in 1998-2000) implying that the high business cycle co-movements between the economies of Hong Kong and the Mainland after the 1990s could be driven mainly by their high correlation with the US economy.

Overall, the structural VAR analysis reveals that in the medium and long term, US shocks appear to have strong effect on both output and inflation developments in Hong Kong. The Mainland shocks affect Hong Kong's inflation significantly, but still less than shocks in the US. In addition, it appears there is little correlation between the components of both output growth and inflation that are domestically generated in Hong Kong and on the Mainland. Hence, the generally high degree of synchronisation of output growth between Hong Kong and the Mainland presented in the previous section is largely due to the common US factor. The common high correlation with the US leads to the high correlation between Hong Kong and the Mainland.

IV. Conclusion and policy implications

We found that the co-movements of business cycles in Hong Kong with those of the Mainland and the US have increased markedly since 2000, following some low and even negative correlations with the US in the 1990s. This high correlation naturally raises the question as to what drives the co-movements among the three economies. Our structural VAR analysis suggests that over 60% of the variations in output shocks and over 45% of the variations in price

changes in Hong Kong can be explained by US shocks; whereas Mainland China shocks explain over one third of Hong Kong's price movements. Using a methodology that permits us to distinguish between the effects of common US shocks and idiosyncratic domestic shocks, we have found that there is little correlation between the components of the business cycles attributable to domestic shocks in Hong Kong and the Mainland. However, the influence of the US shocks on these two economies leads to a high degree of synchronisation. In other words, the business cycle co-movements of Hong Kong and the Mainland are largely due to the common influence of economic conditions in the United States and possibly their US dollar pegged exchange rate systems.

It should be kept in mind that the results of this study are mostly drawn from a time period when the Mainland economy was under tight capital control and its exchange rate largely pegged to the US dollar. As the Mainland progressively liberalises its capital account by encouraging capital outflows (for example, through the Qualified Domestic Institutional Investor scheme), economic shocks, specifically financial market shocks, from the Mainland to Hong Kong are likely to increase progressively over time. This may increase synchronisation of real growth and inflation, but due to the continuing structural differences between the two economies and different stages of economic development, the domestic shocks will not necessarily become more similar. As the similarity of shocks is the most important factor in the choice of an exchange rate regime, it follows that the LERS based on the US dollar will continue to be preferable in the foreseeable future.

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