Why Did Large-scale Deflation Occur? What Did It Bring About? : From Hong Kong’s Experiences in the First Half of the 2000s 1

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Abstract

This article examines why large-scale deflation occurred in Hong Kong in the first half of the 2000s and what costs it brought about. During the period, the consumer price index fell at an annual rate of nearly 4% (over 5% in terms of GDP deflator). The substantial fall is unparalleled in the history of the postwar world economy, and provides a valuable case study to identify causes and consequences of deflation. One interesting characteristic is that, despite the substantial fall in prices, economic growth rate was high for several years. Hong Kong’s experiences illustrate that deflation does not always coincide with recession, and that economic recovery can be achieved even during a prolonged deflationary period.

Our empirical analysis shows that external shocks, not domestic shocks, were a major factor that caused the substantial fall in domestic prices in Hong Kong. In particular, falls in export and import prices due to the strong Hong Kong dollar had a major effect on the fall in domestic prices. The deflation kept real wages at a high level, thus raising the unemployment rate. However, unlike Japan, Hong Kong experienced practically no debt deflation, so that there were only minor turbulences in its financial market. As a result, Hong Kong achieved relatively high economic growth despite the substantial deflation. Despite its China’s special administrative region, the Hong Kong’s experiences have important lessons for the other economies on what are causes and consequences of large-scale deflation.

Key words: deflation, Hong Kong, exchange rate, import prices, export prices

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I. Introduction

Under great moderation, many countries in the world have experienced substantial stabilization of inflationary rates over the past decades. These countries include those blighted by high inflation in previous periods, yet very few countries (economies) have actually experienced sustainable declines in consumer prices— that is, deflation. The Japanese economy has been one of the exceptions since the early 2000s.\(^1\) The deflation in Japan has been modest, however, amounting to no more than about 1 percent per annum. There are no clear distinctions between Japanese economy and the economies where prices have remained almost unchanged (i.e., economies with almost zero inflationary rates). In contrast, Hong Kong of the early 2000s moved into a deflationary pattern that was much more substantial amounting to almost 4% on an annualized basis (over 5% annually when calculated in terms of the GDP deflator). No other country has had such dramatic price declines since the end of World War II. Hong Kong’s experience may provide a valuable case study that helps clarify the causes and costs of deflation.

This paper sheds light on the reasons behind the substantial deflation in Hong Kong of the early 2000s and the costs that this inflation incurred. Figure 1 shows the changes in inflation of Hong Kong from 1980 to 2009 in terms of consumer price indexes (CPI), the GDP deflator, and the producer price index (PPI). From the 1980s to the early 1990s, the Hong Kong economy often suffered inflation rate approaching 10% at an annualized level. Yet after the Asian crisis, the inflation rate was significantly stabilized. For five years from 1999 to 2004, deflation took place where prices fell steadily. The declines of the PPI were relatively modest over this period, but the declines of the CPI and GDP deflator were substantial except in 2001 and 2004. Prices in Hong Kong finally began to rise in 2005, and inflation recovered to 2% on an annualized basis in 2007.

Hong Kong is a small jurisdiction that has been under the political control of China. Thus, despite its very open and highly liberalized economic structure, Hong Kong may not be comparable with other market economies in strict terms. The Hong Kong’s monetary policy is also unique, as it lacks discretionary policies under the Currency Board System. Yet Hong Kong still maintains an independent economic system under a dual economic system in one country. While a simple-minded comparison would be undesirable, Hong Kong can provide useful anecdotal examples to clarify the causes and costs of deflation.

When analyzing Hong Kong during its deflationary period, it is worthwhile to note that it had remarkable real economic growth for many years in spite of the large declines in prices. Figure 2 summarizes changes in inflation and real economic growth in Hong Kong from 1980 to 2009 using the CPI inflation rate and real GDP growth rate. In the aftermath of the Asian crisis

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\(^1\) As indicated by Bordo and Filardo (2005), deflation often took place in the pre-world-war economy
turmoil, real economic growth in Hong Kong declined by a sharp 6% on an annualized basis in 1998. Yet Hong Kong was on an outstanding recovery track in 1999, when the deflationary cycle emerged. Annualized real economic growth stood at 2.6%. In 2000, Hong Kong experienced the IT bubble under which its economy grew by 8% for the year. But at the same time, Hong Kong moved into a serious deflationary cycle: the growth rates of CPI and GDP deflator for 1999 and 2000 were -3.96% and -3.76%, and -4.46% and -3.64%, respectively. Consequently, an economic boom and deflation co-existed over these two years. The IT bubble collapsed and the real economy stagnated in 2001 and 2002, while a deflationary cycle still persisted in 2003. However, the real economic growth of 2003 in Hong Kong recovered to an annualized rate of 3% in spite of the ongoing deflationary trend.

The historical experiences of Hong Kong clearly show that deflation not always results from economic recession. The history implies that economic recovery can be achieved during prolonged deflation. This then raises a number of questions; Why did deflation appear in Hong Kong? Why did it end? And when the deflation appeared, why were the increased costs so limited from a macroeconomic perspective? The following sections will attempt to answer these questions one by one.

In literature, there are several attempts that have studied the deflationary period in Hong Kong. Many of the studies, including Genberg (2003), attribute the deflation to overseas factors rather than domestic ones. Imai (2010) argues that declines in export prices and import prices both contributed to the price declines. Meanwhile, Schellelens (2005) concludes that external factors contributed to Hong Kong’s deflation to a limited degree, while structural factors at home in Hong Kong were more important. These conflicting arguments cannot be easily compared, as their econometric methods differ and their sample periods are not matched. As such, we will attempt to reassess these studies with a focus on the sample period set during the deflationary period.

In research on the macroeconomic effects of Hong Kong’s deflation, Genberg and Pauwels (2005) conducted interesting studies on the interactions of prices and wages. Meanwhile, Mehrotra (2007) compared the effects of Hong Kong’s deflation and Japan’s deflation from an international perspective. In the present paper, we estimate the cost incurred by deflation based on similar approaches. By doing so, we demonstrate that Hong Kong’s deflation had no significant impact on financial markets as different from Japan’s deflation. We also show that while Hong Kong experienced no “debt deflation”, the Hong Kong’s deflation had some large impacts on its labor market.

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2 See Peng and Fan (2004) for the reasons why the GDP deflator declined more steeply than the CPI at that time.
II. Why did Hong Kong’s deflation appear and why did it end?

(1) Why did Hong Kong’s deflation appear?

As noted above, deflation emerged in Hong Kong in 1999, during Hong Kong’s rapid recovery from the Asian crisis turmoil. The real GDP of 1999 fell short of the pre-crisis level. External economic conditions improved significantly, however, and the Hong Kong Hang Seng Index began to rapidly climb from April 1999. It is unlikely that Hong Kong’s deflation was caused by shortfalls in demand under economic recession.

The mainstream argument from previous studies maintained that changes in external factors, not internal demand factors, precipitated the substantial price declines in Hong Kong. One significant cause, among others, was the downward movement of export and import prices. These declines began gradually in 1996, and then accelerated from 1998 and steadily continued up to 2003 (Figure 3). In 1998, import prices and export prices significantly dropped by 5% and 4%, respectively, on an annualized basis. The decline in import prices eventually led to the declines in consumer prices. Meanwhile, the decline in export prices not only contributed to declines in the GDP deflator, but also pushed down the domestic sales prices of exporters. The external shocks had particularly serious effects on open economies such as Hong Kong.

One may argue that a large decline in export and import prices could be attributed to the supply of cheaper products by China to the world economy (e.g., Kamin, Marazzi and Schindler (2008)). Yet the effect of cheaper products from China was observed in many countries and was not enough to explain why only Hong Kong experienced significant deflation. In this regard, we can identify the appreciation of the effective exchange rate of the HKD as a special factor. Under the Currency Board System, Hong Kong Dollar (HKD) had been pegged to the US dollar (USD) at a rate of 1USD=7.8HKD since 1983. Consequently, when the other Asian currencies were significantly devalued against the USD during the Asian currency crisis, the effective foreign exchange rate of the HKD automatically appreciated. As shown in Figure 4, the nominal effective foreign exchange rate of Hong Kong appreciated by almost 20% from the mid 1990s to the early 2000s. This appreciation was the main source of the declines in Hong Kong’s export and import prices.

Moreover, Hong Kong’s monetary policies lacked flexibility; with the USD peg under the Currency Board System, interest rate in HKD was passively linked to interest rate in USD. Even when the economy entered a deflationary cycle, Hong Kong was unable to cut its interest rate. Instead, the rule-based monetary policy became highly tightening during the early stages of deflation. The US maintained interest rates over a high plateau from 1990 to the early 2000s, and the federal fund (FF) rate was induced to be over 5%. As a result, the short-term interest rate denominated in HKD moved to an identical level, and a tighter monetary policy was adopted in spite of the deflation. The tightening policy, together with external factors, deepened
and prolonged the deflation. The US policy interest began to fall from 2001, and short-term interest rates in HKD therefore lowered as well. It needs time for the lowered interest rates to stimulate the economy. The high interest rate at the early stage was an important factor impeding Hong Kong’s recovery from deflation.

(2) Why did Hong Kong’s deflation end?

The deflation in Hong Kong came to an end in the mid-2000s, about five years after it emerged. The CPI climbed to an annualized 0.91% in 2005 and then to 2% in 2006. The upturn of the GDP deflator into positive territory lagged behind the turnaround of the CPI. Yet the GDP deflator increased by 2.93% for the year 2007.

What factors halted the deflation in Hong Kong? The real GDP grew at a brisk 7 to 8% annually at that time, and the narrowed GDP gap was conceivably one of the factors behind the turnaround from deflation to inflation. However, external factors were more important in halting deflation, just as they had been in incurring it. The turnaround in export and import prices was believed to create an opportunity for price trends to shift from deflation to inflation (Figure 3). Import prices rose by about 3% annually in 2004-2005 and supported the gradual climb of the CPI from 2005. Meanwhile, export prices rose by a modest 1% on an annualized basis and contributed to the upward movement of the GDP deflator from 2007.

The principal factor behind the upward turnaround of import and export was as attributable to the devaluation of the HKD effective exchange rate in 2003 onward. During the recovery from the Asian currency crisis, the effective exchange rate of the HKD fell as the other Asian currencies strengthened against the US dollar. As seen from Figure 4, the nominal effective exchange rate of the HKD was about 10% weaker from the early 2000s to the mid 2000s. This resulted in the increase of export and import prices in Hong Kong.

In addition to factors noted above, changes in the monetary policies of Hong Kong from October 2003 can be identified as another factor responsible for the end of deflation. Up to that time, interest rate in HKD had been passively linked to the USD interest rate under the Currency Board System. Yet from October 2003, short-term interest rate denominated in HKD was set at levels lower short-term interest rate in USD. For example, Figure 5 shows changes in LIBOR denominated in USD and HIBOR in HKD, two measures of short-term interest rates in the 2000s. Up to September 2003, the LIBOR and HIBOR moved along an almost identical trajectory, with very little deviation from each other. Yet, HIBOR was about 1% lower than LIBOR after October 2003. While LIBOR began rising in line with the interest rate hike of the US after September 2005, HIBOR stayed below 1% until the end of 2004. The shift to an easy monetary policy during the deflationary period might have helped halt the deflation.
III. Cost incurred by Hong Kong’s deflation

In characterizing the Hong Kong economy during the “deflation,” real economic growth was substantial in spite of the large declines in prices. However, it is worthwhile to note that even as the real economy prospered, the deflation may have incurred social costs. As is well known, when nominal wages stay rigid, deflation pushes real wages above the equilibrium level, depresses corporate earnings, and shrinks employment opportunities. Unless nominal interest rates or nominal outstanding debts are adjusted when prices decline, deflation will push up the real interest rate or real outstanding debt, depress the revenues of borrowers, and possibly increase non-performing loans. The cost of deflation is therefore likely to clearly manifest in labor markets and financial markets. In the following analysis, we will highlight these issues.

Figure 6 summarizes changes in real wages and unemployment in Hong Kong. Two of the real wage in the figures were derived by dividing nominal wages per capita and the nominal wage rate of manufacturing industries by the CPI, respectively. The real wage rate of the manufacturing industry remained more or less stable until 1998, but then increased sharply in 1999 and continued increasing throughout the early 2000s without any decline during the period. The real wage per capita accelerated its increase rates from around 1998, and wages hovered on a high plateau throughout the 2000s. Consequently, real wages during the early 2000s were far above those in the period of the Asian crisis. One may argue that the rises and high plateaus of real wages during the early 2000s were attributable to the improvements of productivity during recovery from the crisis. But the increased unemployment rates suggest that this argument is not correct.

In Hong Kong, the unemployment rate stayed low up to 1997, then jumped in 1998 and continued increasing thereafter. The jump in 1998 could be attributed to the Asian crisis. But the unemployment rate kept increasing even during the economic recovery from the crisis. The Hong Kong economy was on a recovery track from 1999 onward, but this was a jobless recovery or a recovery with deteriorating employment conditions. Changing industrial structures were partly responsible for the rise in unemployment rate during this period. Service industries in the Hong Kong economy were recovering steadily during this period, but the recovery of manufacturing industries was delayed. But it is worthwhile to note that rapid hike of unemployment rate was attributable to the significant jump in real wages. Since nominal wages remained unchanged, a large decline in prices pushed up real wages by about 4% on an annualized basis. This gave rise to excess supply in the labor market, which drove up unemployment. Hong Kong enjoyed high economic growth for many years during the period from the late 1990s to early 2000s in spite of the deflation. Yet the labor market incurred significant cost of increasing unemployment as real wages hovered on a high plateau. Consequently, after the IT bubble collapsed, the increasing unemployment might have stifled economic growth in 2002 and 2003.
It is worthwhile to note that despite incurred costs in labor market and hindered improvement in economic conditions, the deflation did not precipitate anything as severe as a deflationary spiral. In particular, there were no increases in non-performing loans during the deflationary period, even though stock prices were sluggish. Figure 7 shows the changes in non-performing loan ratios in Hong Kong. With respect to restructured loans and loans to bankrupt borrowers, the amounts of non-performing loans which increased in the late 1990s remained flat through the early 2000s. But the shares of these loans were not so large in Hong Kong loan markets. In contrast, delinquent loans and loans past due for three months or more, which were more substantial in Hong Kong loan markets, steadily decreased their non-performing loan ratios in the early 2000s. As suggested by Irving Fisher, debt deflation is the most critical cost of deflation. During the Hong Kong’s deflationary period, there was no apparent emergence of debt deflation in the financial markets.

The deflation in Hong Kong incurred costs in the labor market, but it did not create serious problems for the whole economy. This was partly because the deflation was mainly attributable to external factors, rather than sluggish domestic economy. Putting aside the appreciation of the effective exchange rate, Hong Kong faced favorable external economic conditions in the early 2000s. The emergence of China and the recovery of the other Asian economies from the crisis worked in favor of the Hong Kong economy, although low export and import prices were a cost. In addition, Hong Kong’s special industrial structure was favorable in avoiding debt deflation. Based on GDP levels by industry (see Table 1), the service industry accounted for an overwhelming share of the economy. Unlike manufacturing, the service industry is labor-intensive and does not need external borrowings to finance its capital expenditures. In particular, financial sector, which is one the important service industries in Hong Kong, were highly globalized, so that its risk is widely diversified outside of the Hong Kong region. These factors specific to Hong Kong helped curb any apparent emergence of debt deflation in Hong Kong even under the substantial deflation.

IV. Analysis by VAR and GMM

In the preceding sections, we explained that the prolonged and large deflation in Hong Kong was triggered by external factors. We also pointed out that the substantial deflation increased some costs in the labor market but that it did not result in a deflationary spiral. To confirm this tentative conclusion analytically, this section examines the causes of the deflation in Hong Kong by the vector auto regression (VAR) in the subsections (1) and (2), and the determinants of the nominal wage responses by the generalized method of moments (GMM) in subsection

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3 For example, see Chang and Khoo (1998) or Leung and Unteoberdoerster (2008) on the financial industries in Hong Kong.
In particular, the subsections (2) and (3) explore the costs of the labor market by
highlighting differences between Hong Kong and Japan in the late 1990s and the early 2000s.

(1) Domestic factors and external factors: VAR analysis

In previous literature, Genberg and Pauwells (2005), Genberg (2003), and Mehrotra (2007)
have all spotlighted external economies as factors contributing to the deflation in Hong Kong.
In the following analysis, we restrict our sample period to the deflation period and reexamine
the determinants of price level in Hong Kong over, in conjunction with Genberg and Pauwells
(2005). In particular, we explore how the external factors affected price level at the upper
stream and lower stream by analyzing the movement of the GDP deflator and CPI, respectively.

Table 2 summarizes the data and their sources used for the examination. Property prices were
included in domestic factors in addition to the nominal wages and unemployment rate identified
in preceding sections. Property prices started to decline in mid 1997, ahead of the consumer
price indexes. Genberg and Pauwells (2005) and Schellerlens (2005) noted that this decline
affected the price deflation. As external factors, we used export prices in addition to the 3 month
US T-Bill interest rates and import prices which were used in previous studies. Few previous
studies had explicit discussed on how different effects export and import prices had on domestic
prices. As we mention in the Appendix, export prices and import prices could have contributed
to domestic prices via different mechanisms. Even though both are embraced as external
factors, separate examination of the effects of import prices and export prices would be
desirable in itself.

The sample period was from the first quarter of 1990 to the fourth quarter of 2005. While
Genberg and Pauwells (2005) selected their sample period from the first quarter of 1984 to the
first quarter of 2003, we examined a period inclusive many years in early 2000s, when the
deflation took place. In VAR, we took lags by 4 periods for the explanatory variables. We also
set constant term, time trend, and a crisis dummy variable. The dummy, which takes one from
the fourth quarter of 1997 to the third quarter of 1998 but zero otherwise, was set in response to
rapid changes in economic conditions in the aftermath of the Asian crisis.

In the VAR, we verify determinant factors for the GDP deflator and CPI respectively. Shocks
are identified by imposing recursive Cholesky decomposition. In the Cholesky decomposition,
the external variables come first, followed by the domestic variables. The Cholesky order of the

4 Looking at the year-on-year percent change on a quarterly basis, the CPI turned positive in the third
quarter of 2004 and the GDP deflator turned positive in the third quarter of 2005. Thus, I completed the
estimation in the fourth quarter of 2005 in order to embrace all of the deflationary periods, starting with
1998.

5 A model incorporating lags of each variable by 6 periods was estimated and similar results were
obtained.
variables are as follows: nominal wage per capita, unemployment rate, property price for domestic variables, and the US FF rate, import prices, export prices for external variables. Since Hong Kong is a small open economy, we place the external variables ahead of the domestic variables in the Cholesky decomposition. Table 3 shows the variance decomposition of the GDP deflator and CPI, and Figures 8 and 9 indicate their impulse responses.

From the table and the figures, we see that the impacts of the external factors on the price level were very significant in Hong Kong especially in the long-run. In the table of the variance decomposition, the number denotes how many percentages the forecast error variance can be explained by each factor: the domestic factor, the external factor, and the self-factor. The upper part in Table 3 shows the variance decomposition of the GDP deflator. From the 1st to the 8th period, the impact of the deflator itself was relatively large, and the domestic factors accounted for 44.2% for the 4th period. The role of external factors was limited on a short- and mid-term basis. However, external factors accounted for 50% or more after the 12th period, and it reached 75.5% in the 20th period. This reveals that external factors significantly affected the level of the mid- and long-term deflator. The lower part of Table 3 shows variance decomposition of CPI. We see that the self-factors have a larger impact than the case of deflator. Yet a comparison between domestic factors and external factors reveals that the latter explains a consistently larger percentage than the former, and has impact on a longer period, except in the 16th period. The external factors apparently play an important role in terms of the CPI determinant factors.

The impulse responses of the GDP deflator and CPI are shown in Figures 8 and 9. In the figures, we can identify which factors affected each price level. In the cases of both the GDP deflator and CPI, no significant relationship with the price level is observed in terms of response to domestic variables. Yet the price level has been significantly affected by external factors, especially on a mid- and long-term basis. Judging from the impulse response of the GDP deflator in Figure 8, export and import prices had significantly positive impact and the US FF rate had significantly negative impact. This reflects the external openness of the Hong Kong economy and the monetary policy link to the US dollar. The import prices and US FF rate give the strongest impact, but export prices also give significant impact, especially in the 17th period and later. The export price affected the downstream of price level, that is, GDP deflator. The impulse response of the CPI in Figure 9 also indicates a significant response to export prices and the US FF rate on a mid- and long-term basis. The cogent point is that export prices still affected CPI movements. Though they have less impact compared to the case of deflator, export prices gave rise to significantly positive impact in the 12th period and thereafter. As analytically shown in the Appendix, export firms that face declines in export prices are inclined to reduce domestic sales prices under certain conditions. It is likely that the decline in export prices pushed down the CPI level through this mechanism.

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6 See footnote in Table 2 for the data used for the analysis and their sources.
In Hong Kong, an economy with high openness, the impact of external factors proved to be important on a mid- and long-term basis for the GDP deflator. For CPI, external factors played a more important role than domestic factors. As in many previous studies, our VARs support the view that long-term deflation in Hong Kong was attributable to persistent declines in export and import prices in addition to the tightened monetary policies of the USA. However, unlike previous studies, our VARs explicitly separate the impacts of export prices and import prices by using export prices as additional variable. This allowed us to conclude that the export prices had additional impacts on the price level in Hong Kong. Given import prices, the persistent decline in export prices led to a lowering of not only the GDP deflator, but also the consumer price level.

(2) Cost of deflation in the labor markets: VAR analysis

Since the Hong Kong economy was highly open, it did not experience a long-term slump in spite of the prolonged and heavy deflation. Yet the labor market saw growing unemployment in the early 2000s, and some costs of deflation. Applying the VAR estimation, this subsection examines how the deflation incurred costs for the labor market. In particular, we attempt to clarify the adjustment of the Hong Kong’s labor market to the deflationary trend in comparison with the adjustment of Japan’s.

Using the impulse response of the VAR, we first analyze how the unemployment rate was determined. The sample period was from the first quarter of 1990 to the fourth quarter of 2005. Figure 10 shows the impulse response of unemployment rate when the GDP deflator is used as domestic prices. Except that unemployment rate is included as an additional variable, the variables were set to remain the same as those in the last subsection. The figure shows no significant impact of prices on unemployment on a mid-term basis. Yet on a short-term basis (about one year), the decline in prices significantly pushed up the unemployment rate. This is consistent with the gradual decrease of the unemployment rate during the recovery from the deflation. On the other hand, we could significantly identify that the rise in the nominal wage increased unemployment, particularly on a mid-term basis. The sustainable declines of prices and the high and rising nominal wage increased the real wage, imposing costs to the economy, mainly in the form of unemployment.

As I explained in section 3, the rise of the real wage per capita continued until around 2003 because the nominal wage per capita hovered on a high plateau during that period. Downward rigidity of the nominal wage was one of the significant characteristics of the deflation experienced by Hong Kong. We can more clearly perceive this feature by attempting a comparison with the experience of Japan. Figure 11 shows the nominal wage per capita and CPI in Japan from 1995 to 2008 to the comparable figures in Hong Kong during the deflationary period. The nominal wage in Japan began declining ahead of the CPI and
continued to decline faster than the CPI. On the other hand, the nominal wage in Hong Kong remained at the same level even after 1998, when the CPI started to decline, and in some phases it slightly rose. The differences between the two countries are clearly represented by the impact of nominal wage on deflation. As discussed in the preceding subsection, we cannot observe a significant impact of the nominal wage on the determination of the price level in Hong Kong. In Japan, however, the nominal wage did affect the price level.

Figure 12 shows the estimation results derived by the VAR incorporating the interest rate, nominal wage per capita, CPI, nominal effective exchange rate, and real GDP as variables (see Table 2 for their details and the data sources). Except for the additional variables, the estimation of the Hong Kong uses the same sample period, lags, constant term, time trend, and the crisis dummy as in the preceding section. For the Japanese economy, the estimation period spans from first quarter of 1990 to the fourth quarter for 2006, and the estimation of the model includes lags by four periods, constant term, and time trend. An analysis of impulse responses of CPI shows that the responses to nominal wage are clearly different in Hong Kong and Japan. When the nominal wage is added to the variables, no large change emerges for Hong Kong. As such, we could robustly reaffirm that the nominal wage did not have significant impact on price level in Hong Kong. In contrast, when adding nominal wage as a variable for Japan, the nominal wage had a significant positive CPI response, particularly on a short- and mid-term basis. This suggests a Hong Kong’s unique characteristic that the nominal wage and price diverged from each other during the deflationary period.

(3) Determinant factor of nominal wage: GMM analysis

In the analysis of the preceding subsection, we confirmed that the deflation in Hong Kong incurred costs for the labor market because of downward nominal wage rigidity. However, the result raises a question why the nominal wage hovered on a high plateau during the deflationary period in Hong Kong but not in Japan? In this section we attempt to analyze the determinants of the nominal wage rigidity by comparing the cases of Hong Kong and Japan. Following Genberg and Pauwells (2005), we assume that the change of nominal wage is a function of the expected inflation, excess demand, growth rate of productivity and deviation of the real wage from equilibrium level. We then explore the determinants of nominal wage in Hong Kong and Japan by estimating the following equation:

\[
\ln(w_t) - \ln(w_{t-1}) = \alpha_0 + \alpha_1[\ln(p_t) - \ln(p_{t-1})] \\
+ \alpha_2\ln(E_D_t) + \alpha_3\ln(P_G_t) + \alpha_4[\ln(w_{t-1} / p_{t-1}) - \ln(\omega_{t-1})]
\]

where \(w_t\) represents nominal wage at period \(t\), the left term of the equation is the growth rate of the nominal wage, \(p_t\) is the price index, \(E_D_t\) is excess demand, \(P_G_t\) is the growth rate of
productivity, and \( \omega_t \) is the equilibrium level of real wage.

In the estimation, we use the CPI as the price index, the real GDP per hours worked as a measure of productivity, and the real GDP gap as excess demand. For the deviation from the equilibrium level of real wage, we use the residuals regressing the real wage on productivity and a constant term. For the expected inflation, we use the estimated realized inflation rate by GMM with lagged variables as instrumental variables. The estimation periods for Hong Kong and Japan are from the first quarter of 1990 to the fourth quarter of 2005 and from the first quarter of 1995 to the fourth quarter of 2008, respectively.

Table 4 reports the GMM estimation results of the nominal wage determination equation in Hong Kong and Japan. The coefficient of the expected inflation rate \( (\alpha_1) \) was positive for both countries, suggesting that the nominal wage decreases when the expected inflation rates are negative. However, when comparing coefficients between two economies, Hong Kong’s coefficient is estimated to be smaller. This means that given the other variables constant, a 3% decline of the expected inflation coincides with a 3.84% decline of the nominal wage for Japan versus a 1.89% decline for Hong Kong. To the extent that the expected inflation is rationally formed, this indicates that the adjustment of the nominal wage to the price change is more rigid in Hong Kong than in Japan. The difference in the instantaneous responses of the nominal wage will result in larger difference in consideration of subsequent adjustment process.

The response to the GDP gap diverges more substantially between the two countries. The coefficient of the excess demand \( (\alpha_2) \) was significantly negative in Hong Kong, while it was significantly positive in Japan. To the extent that excess demand which pushes up the price level leads to the increase in the nominal wage at the same time, the estimated coefficient would be positive as in Japan. The negative coefficient suggests that this was not the case in Hong Kong. In case of Hong Kong, the nominal wage was very rigid, so that it shows no positive respond to excess demand once a positive respond to the expected inflation was taken into account.

The nominal wage rigidity in Hong Kong is also supported by the other estimated coefficients. With respect to the coefficient of productivity growth \( (\alpha_3) \), it was positive for both countries but smaller in Hong Kong. This implies that the adjustment of nominal wages shows slower response to the productivity shocks in Hong Kong than in Japan. The coefficient of real wage gap \( (\alpha_4) \) was negative for both countries, suggesting that the nominal wage for the current period declines when the real wage of the previous period exceeds the equilibrium level, and vice versa. However, its absolute value is smaller in Hong Kong than in Japan. For example, when the real wage gap is 3%, the nominal wage in the next period adjusts by 0.12% in Hong Kong and by 0.75% in Japan. Overall, the estimation results suggest that various sources of the nominal wage rigidity contributed to the high wage level in spite of the precipitating prices and increased cost to the economy imposed by rising unemployment in Hong Kong.
V. Conclusion

This paper sheds light on the experiences of Hong Kong in the early 2000s by highlighting why deflation took place and what consequences it brought about. Our investigation of what factors gave rise to the substantial price declines in Hong Kong showed that the changes in external factors had large impacts on domestic prices, while domestic factors did not. Especially, reflecting the appreciation of the real effective exchange rate in HKD, the declines in export and import prices played an important role for the prolonged deflation. The deflation kept the real wage at a high plateau, so that the unemployment rate rose. Yet in contrast to the experience from the deflationary period in Japan, the impact on the financial markets was very limited and debt deflation was not observed.

Table 5 summarizes the estimation results by the regressing the real interest rate on the CPI and GDP deflator, the GDP gap, and the productivity growth rate. Due to the limited data availability, the sample period was from the first quarter of 1991 to the fourth quarter of 2005 for Hong Kong and from the first quarter of 1996 to the fourth quarter of 2008 for Japan. According to the table, the coefficients (\(\alpha_1, \alpha_2\)) of inflation for both the CPI and GDP deflator were significantly negative in Japan, suggesting that the deflation pushed up the real interest rate. Meanwhile, the coefficients for these variables were not significant in Hong Kong, and the coefficient of the CPI inflation (\(\alpha_1\)) was significantly smaller in Hong Kong (0.61) than in Japan (0.97) in absolute value. This implies that unlike in Japan, the effect of deflation was limited in increasing the real interest rate in Hong Kong, and thus that deflation had no material impact on the financial markets.

Even though the deflation in Hong Kong was substantial, it was caused by external factors rather than domestic ones. Hence without debt deflation, relatively high economic growth was achievable in Hong Kong. Yet the absence of debt deflation might largely have been attributable to special conditions in the industrial structure and financial markets of Hong Kong. We therefore need a careful consideration to see whether the experience of Hong Kong could apply to the other countries.
Appendix: the Relationship between Export Prices and Domestic Selling Prices

We will discuss a simple monopolistic competition model for the domestic market and foreign markets to assess how a decline in export prices will affect domestic selling prices. Each firm sells its products both domestically and overseas. Demand functions $D_j$ and $D_j^*$ for the products of firm $j$ on the domestic market and on foreign markets are represented, respectively, by:

$$D_j = Y \left( \frac{P_j}{P} \right)^{\theta}, \quad D_j^* = Y^* \left( \frac{P_j^*}{P^*} \right)^{\theta}. $$

where, $P_j$ and $P_j^*$ represent the selling prices of firm $j$ denominated in foreign currency on the (j’s) domestic market and foreign markets, $P$ and $P^*$ are the average foreign currency prices on the domestic and foreign markets, and $Y$ and $Y^*$ are the average incomes in the domestic and foreign markets. For simplicity, the price elasticity of demand $\theta (>1)$ is common to both domestic and foreign markets.

The cost function of firm $j$ depends on the total production of firm $j$ (i.e., the total sales in domestic and foreign markets) and is represented by:

$$C(D_j + D_j^*) = \left( \frac{1}{2} \right) (D_j + D_j^*)^2. $$

In this case, if the exchange rate in the domestic currency is $e$, the profit of firm $j$ ($\Pi_j$) can be expressed as:

$$\Pi_j = P_j D_j + e P_j^* D_j^* - C(D_j + D_j^*). $$

Thus, following the first order condition from profit maximization, we obtain:

$$P_j = e P_j^* = \frac{\theta}{(\theta - 1)} (D_j + D_j^*). $$

That is, the equilibrium domestic and foreign prices can be expressed as:

$$P_j = e P_j^* = \left[ \frac{\theta}{(\theta - 1)} \right] \left\{ Y P^\theta + Y^* (e P^*)^\theta \right\}^{1/(1+\theta)}. $$

The above equation indicates that $\partial P_j / \partial (e P^*) = \partial P_j^* / \partial (e P^*) > 0$ holds for all the selling prices of domestic firm $j$. The products an export firm sells on foreign markets do not necessarily cover all of the products sold on the foreign markets. But if the products an export firm sells serve well as alternatives to other products sold on foreign markets, export prices in the domestic currency will move almost in parallel with $P^*$. Thus, the decline in export prices denominated in domestic currency proves to be capable of pushing domestic prices down.
References


Bordo, M., and A. Filardo, (2005), "Deflation and Monetary Policy in a Historical Perspective: Remembering the Past or Being Condemned to Repeat It?" Economic Policy, 20(44), pages 799-844.


Table 1: Hong Kong’s GDP composition by sector (production basis in nominal terms)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Amount</td>
<td>Amount</td>
<td>Amount</td>
<td>Amount</td>
</tr>
<tr>
<td>Agriculture, forestry</td>
<td>1,171</td>
<td>1,002</td>
<td>847</td>
<td>824</td>
</tr>
<tr>
<td>and fishery</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mining and quarrying</td>
<td>307</td>
<td>136</td>
<td>100</td>
<td>96</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>63,358</td>
<td>51,396</td>
<td>45,547</td>
<td>38,710</td>
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<tr>
<td>Electricity, gas and</td>
<td>35,960</td>
<td>39,609</td>
<td>39,924</td>
<td>38,421</td>
</tr>
<tr>
<td>water</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Construction</td>
<td>65,560</td>
<td>51,534</td>
<td>38,538</td>
<td>47,922</td>
</tr>
<tr>
<td>Services</td>
<td>1,028,417</td>
<td>1,079,476</td>
<td>1,207,873</td>
<td>1,441,908</td>
</tr>
<tr>
<td>Total</td>
<td>1,266,668</td>
<td>1,277,314</td>
<td>1,382,590</td>
<td>1,675,315</td>
</tr>
</tbody>
</table>

Source: Hong Kong Census and Statistic Department (http://www.censtatd.gov.hk/)
Table 2: Data used in the analysis

<table>
<thead>
<tr>
<th>Variables</th>
<th>Source</th>
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<th>GMM</th>
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<tbody>
<tr>
<td><strong>Hong Kong Prices</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GDP deflator</td>
<td>IMF, International Financial Statistics</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Consumer price index</td>
<td>IMF, International Financial Statistics</td>
<td>○</td>
<td>○</td>
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<tr>
<td><strong>Domestic factors</strong></td>
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<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Nominal wage per capita</td>
<td>Hong Kong Census and Statistics Department</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Property price index</td>
<td>Hong Kong Rating and Valuation Department</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Unemployment rate</td>
<td>Hong Kong Census and Statistics Department</td>
<td>○</td>
<td>○</td>
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<td>Yields of 3-month Exchange Fund Rate</td>
<td>Hong Kong Monetary Authority</td>
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<td>Real GDP</td>
<td>IMF, International Financial Statistics</td>
<td>○</td>
<td>○</td>
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<tr>
<td>Hours worked per week</td>
<td>Hong Kong Census and Statistics Department</td>
<td>○</td>
<td>○</td>
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<tr>
<td>Landing rate</td>
<td>IMF, International Financial Statistics</td>
<td>○</td>
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<td><strong>External factors</strong></td>
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<td>FF 3-month T-Bill Rate</td>
<td>Board of Governors of the Federal Reserve System</td>
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<tr>
<td>Import price</td>
<td>IMF, International Financial Statistics</td>
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<tr>
<td>Export price</td>
<td>IMF, International Financial Statistics</td>
<td>○</td>
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</tr>
<tr>
<td>Nominal effective exchange rate</td>
<td>IMF, International Financial Statistics</td>
<td>○</td>
<td></td>
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<tr>
<td><strong>Japan Prices</strong></td>
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<tr>
<td>GDP deflator</td>
<td>IMF, International Financial Statistics</td>
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<td>○</td>
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<tr>
<td>Consumer price index</td>
<td>IMF, International Financial Statistics</td>
<td>○</td>
<td>○</td>
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<tr>
<td><strong>Domestic factors</strong></td>
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<td>○</td>
<td>○</td>
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<tr>
<td>Nominal wage per capita</td>
<td>Ministry of Health, Labor and Welfare</td>
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<td>○</td>
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<td>3-month intererest rate on the certificate of deposits</td>
<td>OECD, Main Economic Indicators Database</td>
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<tr>
<td>Real GDP</td>
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<td>○</td>
<td>○</td>
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<tr>
<td>Hours worked per month</td>
<td>Ministry of Health, Labor and Welfare</td>
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<tr>
<td>Landing rate</td>
<td>IMF, International Financial Statistics</td>
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<tr>
<td><strong>External factors</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Nominal effective exchange rate</td>
<td>Bank of Japan</td>
<td>○</td>
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Table 3: Dispersion decomposition (price)

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<th>Period</th>
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<th>External factor</th>
<th>Self-factor</th>
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<tr>
<td>1</td>
<td>0.0</td>
<td>12.7</td>
<td>87.3</td>
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<td>4</td>
<td>44.2</td>
<td>7.3</td>
<td>48.5</td>
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<td>8</td>
<td>29.6</td>
<td>19.1</td>
<td>51.4</td>
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<tr>
<td>12</td>
<td>17.5</td>
<td>55.3</td>
<td>27.2</td>
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<tr>
<td>16</td>
<td>14.8</td>
<td>69.8</td>
<td>15.4</td>
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<td>20</td>
<td>13.5</td>
<td>75.5</td>
<td>11.0</td>
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</table>

<table>
<thead>
<tr>
<th>Period</th>
<th>Domestic factor</th>
<th>External factor</th>
<th>Self-factor</th>
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<tbody>
<tr>
<td>1</td>
<td>0.0</td>
<td>2.2</td>
<td>97.8</td>
</tr>
<tr>
<td>4</td>
<td>7.4</td>
<td>14.1</td>
<td>78.5</td>
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<tr>
<td>8</td>
<td>11.2</td>
<td>32.4</td>
<td>56.4</td>
</tr>
<tr>
<td>12</td>
<td>6.0</td>
<td>36.5</td>
<td>57.5</td>
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<tr>
<td>16</td>
<td>4.2</td>
<td>35.9</td>
<td>59.9</td>
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<tr>
<td>20</td>
<td>5.9</td>
<td>38.2</td>
<td>55.9</td>
</tr>
</tbody>
</table>

Note 1. Variables are used in the following order: US three-month interest rate, import price, export price, property price, GDP deflator/CPI, nominal wage per capita, and unemployment rate.

Note 2. The estimation period is from Q1 of 1990 to Q4 of 2005.
Table 4: Changes in nominal wages

<table>
<thead>
<tr>
<th>Coefficient</th>
<th>Variables</th>
<th>Hong Kong</th>
<th>Japan</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>∆ln(wt)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>α₀</td>
<td>Constant</td>
<td>0.006</td>
<td>0.012</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.002)※</td>
<td>(0.002)※</td>
</tr>
<tr>
<td>α₁</td>
<td>∆ln(pₜ)</td>
<td>0.63</td>
<td>1.28</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.10)※</td>
<td>(0.29)※</td>
</tr>
<tr>
<td>α₂</td>
<td>Real GDP gapₜ</td>
<td>-0.05</td>
<td>0.09</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.03)※※</td>
<td>(0.03)※</td>
</tr>
<tr>
<td>α₃</td>
<td>Productivity growthₜ</td>
<td>0.20</td>
<td>0.45</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.07)※</td>
<td>(0.16)※</td>
</tr>
<tr>
<td>α₄</td>
<td>Real wage gapₜ</td>
<td>-0.04</td>
<td>-0.25</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.01)※</td>
<td>(0.12)※</td>
</tr>
</tbody>
</table>

Note 1. ※ denotes 5% significance and ※※ denotes 10% significance. The figure in parentheses refers to the standard error.

Note 2. For instrumental variables, lags by fourth periods of explanatory variables and dependent variables are used.

Note 3. The estimation period is from Q1 of 1990 to Q4 of 2005 for Hong Kong and from Q1 of 1995 to Q4 of 2008 for Japan.
### Table 5: Changes in the real interest rate

<table>
<thead>
<tr>
<th>Coefficient</th>
<th>Variables</th>
<th>Hong Kong</th>
<th>Japan</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>△lnrt</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>△ln(CPt)</td>
<td>-0.61</td>
<td>-0.97</td>
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<tr>
<td></td>
<td>△ln(Deflator, t)</td>
<td>-0.01</td>
<td>-0.20</td>
</tr>
<tr>
<td></td>
<td>Real GDP gap, t</td>
<td>-0.03</td>
<td>-0.04</td>
</tr>
<tr>
<td></td>
<td>Productivity growth, t</td>
<td>0.43</td>
<td>0.37</td>
</tr>
</tbody>
</table>

#### Note 1.
- * denotes 5% significance and ** denotes 10% significance. The figure in parentheses refers to the standard error.

#### Note 2.
The estimate period is from Q1 of 1990 to Q4 of 2005 for Hong Kong and from Q1 of 1995 to Q4 of 2008 for Japan.
Figure 1: Inflation rate in Hong Kong

![Graph showing inflation rate in Hong Kong with data points from 1980 to 2008.]


Figure 2: Inflation rate and economic growth rate in Hong Kong

![Graph showing inflation rate and economic growth rate in Hong Kong with data points from 1980 to 2008.]

Figure 3: Export and import prices in Hong Kong (2005=100)


Figure 4: Hong Kong's effective exchange rate (2005=100)

Figure 5: Short-term interest rates for the USD and HKD

Source: DataStream.

Figure 6: Real wages and unemployment rate in Hong Kong

Figure 7: Non-performing loans in Hong Kong

Source: DataStream.
Figure 8: Impulse response (GDP deflator)

Note 1. Variables are presented in the following order: US three-month interest rate, import price, export price, property price, GDP deflator, nominal wage per capita, and unemployment rate.

Note 2. The estimate period is from Q1 of 1990 to Q4 of 2005.
Figure 9: Impulse response (CPI)

Note 1. Variables are presented in the following order: US three-month interest rate, import price, export price, property price, CPI, nominal wage per capita, and unemployment rate.

Note 2. The estimate period is from Q1 of 1990 to Q4 of 2005.
Figure 10: Impulse response (unemployment rate)

Note 1. Variables are presented in the following order: US three-month interest rate, import price, export price, property price, CPI, nominal wage per capita, and unemployment rate.

Note 2. The estimate period is from Q1 of 1990 to Q4 of 2005.
Figure 11: Nominal wages and consumer prices in Hong Kong and Japan

Source: IMF, International Financial Statistics, Hong Kong Monetary Authority.
Figure 12: Effect of nominal wage on price level

Hong Kong (excluding nominal wage)

Hong Kong (including nominal wage)
Note 1. In order to identify the error terms, different constraints are applied to Japan and Hong Kong in accordance with Mehrotra (2007).

Note 2. Variables are presented in the following order: Real GDP, CPI, domestic interest rate, nominal wage per capita, nominal effective exchange rate.

Note 3. The estimate period is from Q1 of 1990 to Q4 of 2005 for Hong Kong and from Q1 of 1995 to Q4 of 2008 for Japan.