

Sudden Stops in Hong Kong: A Two-Sector Neoclassical Model

Paulina Etxeberria Garaigorta Amaia Iza
The University of the Basque Country
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Abstract

We analyze the real effects of the Asian Financial crisis on the Hong Kong economy. *Firstly*, we focus on the phenomenon of the Sudden Stop and on the characteristics that accompany this phenomenon paying special attention to the real exchange rate and the relative price of tradable over non-tradable goods. We find that the dynamics of the real exchange rate and the relative price of tradable over non-tradable goods in Hong Kong is similar, but not identical, to other economies that have suffered a Sudden Stop. *Secondly*, we make a growth accounting analysis that reveals that, as in other economies, the fall and recovery of the GDP in Hong Kong is mostly explained by the TFP. *Thirdly*, we find that the tradable sectors have suffered less from the financial crisis than the non-tradable sectors, and that the recovery of the GDP in Hong Kong is due to the quick recovery in the tradable sector. *Fourthly*, we show that the aggregate TFP can be quite well approximated through the dynamics of the TFP in the tradable and non-tradable sector. Finally, we build a simple neoclassical small open economy model, with two sectors, to quantify at which extent such a simple model is able to mimic the dynamics for the prices, taking as exogenously given, the dynamics of the TFP in both sectors.

1 Introduction

Hong Kong suffered in 1997-98 what is known as Sudden Stop¹. Sudden Stop episodes are characterized by a drop in net capital flows, being accompanied by a current account reversal, a fall in Gross Domestic Product, a collapse in asset prices, and an increase in the country risk premium just at the hit of the crisis. Furthermore, as pointed out by Calvo et. al (2006), most episodes of Sudden Stops are characterized by a drop (increase) in TFP during the crisis (recovery) period, a relatively constant capital stock during the whole crisis-recovery period, collapse in credit in the crisis but creditless recovery just at the hit of the crisis.

In the particular case of Hong Kong, during the Asian financial crisis of 1997-98, there is a sudden collapse in credit accompanied by a dramatic collapse in output, consumption and investment. The Trade Balance deteriorated, the Real Exchange Rate depreciated (but not in a drastic way at the moment of the Sudden Stop, as in other economies, and keeps its depreciation once the Sudden Stop ends), the Hang Seng Index decreased and Hong Kong interest rates increased sharply during the financial crisis period. Recovery to pre-crisis output is relatively rapid. Investment collapses together with output and recovers weakly by the time output recovers to pre-crisis level. Consumption also falls and recovers rapidly.

In order to understand the evolution of the economy from Hong Kong and the effect of the Asian financial crisis on it, it is important to distinguish between the proportion of the economic activity that is due to the production factors, capital and labor, and the proportion that is due to the efficiency of those factors. Therefore, we develop a growth accounting that shows that Total Factor Productivity mimics the behavior of output: it falls sharply during the collapse phase and recovers swiftly afterwards. There is no correspondingly sharp collapse or recovery in either physical capital or the labour force. We show that variations in TFP account for the variation in output throughout the collapse and recovery processes. Total factor productivity (TFP) was growing, on average, at annual rate of 5.07% in the period 1985-1997, suddenly fell by -16.94% in 1998 and then grew at annual rate of 4.33% in the period 1998-2006. Clearly the sudden recession and rapid recovery in GDP coincides with the movement of TFP.

We also make a sectorial analysis, considering 9 sectors: (1) Manufacturing, (2) Wholesale trade, (3) Imports and Export services, (4) Transport, Storage and Communications, (5) Finance and Insurance, (6) Retail, Hotels and Restaurants, (7) Business Services, Rental of machinery and equipment, (8) Real Estate and (9) Community, Social and Personal services. Also, we make an analysis considering two main groups of economic sectors: tradable and non-tradable sectors². Our main results, from the growth accounting exercise, are

¹It refers to sudden stops in capital flows to emerging economies. The expression "Sudden Stop" was first suggested in Dornbusch, Goldfajn and Valdes (1995) "currency crisis and collapses", *Brooking Papers on Economic Activity*, 2, pp. 219-93.

²In the Tradable sector we include: Manufacturing; Wholesale trade; Imports and Ex-

that: *(i)* the tradable sector exhibits the higher average annual growth rate in the whole period 1985-2006, being the Finance and insurance sector the sector with the highest average annual growth rate, *(ii)* except during the period 1997-1998, most of the growth in the tradable sector is mainly explained by the TFP growth, *(iii)* Import and export and manufacturing did not decrease their production during the financial crisis (1997-1998), *(iv)* on average, non-tradable sectors exhibit a very low growth rate in the period 1985-2006, *(v)* the nontradable sectors are the sectors that suffered more the financial crisis (in particular, the sector "Retail, Hotels and Restaurants" and the sector "Business Services, Rental of machinery and equipment"), but their recovery is such that the average annual growth rate in the period 1998-2006 is higher than in the period before the financial crisis (1985-1997), except for the sectors "Construction" and "Business Services, Rental of machinery and equipment".

Furthermore, following Benjamin and Meza (2007), we build an approximate TFP based on the TFP obtained from the 9 sectors mentioned above, which is very similar to the aggregate TFP (the correlation between these two measures is 0.993). The approximation of the aggregate TFP allows to analyze whether the changes in the aggregate TFP may be due to changes in the TFP at the sector level or, instead, due to reallocation of labor among sectors with different TFP's. We obtain that, unlike other countries such as México, the changes in the aggregate TFP in Hong Kong is mainly explained by changes in the TFP at the sectorial level. This is so, even though there has been a reallocation of labor from the high growth TFP sectors (the tradable sectors) to the low growth TFP sectors (the non-tradable sectors). In particular, the fall in the TFP is practically explained by the fall in the TFP of the non-tradable sectors, and the recovery in the TFP is mainly explained by the increase in the TFP in the tradable sectors.

Hong Kong is characterized as a small open economy with a fixed nominal exchange rate and where exports, most of them re-exports from China, could play an important role. Exports and imports accounted for 124,5% and 124% of GDP in 1998 and increased to 197% and 185% in 2005. The weight of exports has increased from accounting 80% of total value of GDP at 1990 constant prices in 1961 to a value of 197% in 2005. The weight of imports has increased from a relative weight of 80-90% of GDP to around 190% in 2005. During the Asian financial crisis, the import and export sector did not suffer a fall, as in the rest of the sectors (except for the manufacturing). In fact, since the weight of the import and export sector in the Tradable sector is slightly higher than one third, this can explain why the tradable sector did not suffer much during the financial crisis as in the non-tradable sector. Apparently, the recovery of the tradable sector is not only due to the import and export sector, whose share has been increasing from 39% in 1996 to 46% in 2005 of total Real Value Added in the Tradable sector, but also to the Finance and Insurance Sector whose share has increased from 23% in 1996 to 31% in 2006.

port services; Transport, Storage and Communications; Finance and Insurance. In the Non-Tradable sector we include: Retail, Hotels and Restaurants; Rental of machinery and equipment; Real Estate; Community, Social and Personal services.

The paper is organized as follows. Section 2 shows the Sudden Stop episode in Hong Kong in 1997-98, that is, there was an abrupt fall of capital flows in the economy. Section 3 presents the growth accounting exercises. Section 4 concludes.

2 Main characteristics of the Sudden Stop in Hong Kong

A growing number of empirical studies document the stylized facts of Sudden Stops³. Based on the main findings from these studies on Sudden Stop phenomenon, we analyze if also the Hong Kong economy experienced a Sudden Stop during the Asian financial crisis of 1997-98⁴. Therefore, this section focuses on providing a detailed analysis and stylized evidence of the magnitude of Hong Kong's Sudden Stop.

Sudden Stops are characterized by large capital flows reversals and a sudden loss of access to international capital markets. Furthermore, the following main empirical regularities are observed during the sudden stops episodes: *(i)* a large reversal of the trade deficit to trade surplus, *(ii)* high bond spreads implying high interest rates, *(iii)* a depreciation of the real exchange rate, *(iv)* a drop in the domestic production followed by rapid recovery of output, *(v)* most of the drop in output during the Sudden Stop (and its quick recovery) is due to TFP.

In the particular case of Hong Kong during the Asian financial crisis of 1997-98, there is a sudden collapse in credit accompanied by a dramatic collapse in output, consumption and investment. The Trade Balance deteriorated, the Real Exchange Rate depreciated, Hong Kong interest rates increased sharply during the financial crisis period and the Hang Seng Index decreased. Investment collapsed together with output and did not recover as quickly as the output did. However, consumption falls and recovers rapidly with output. As in other economies, a growth accounting analysis shows that TFP mimics the behavior of output: it falls sharply during the collapse phase and recovers swiftly afterwards. Most of the pattern of the aggregate TFP is explained by the dynamics of the TFP at the sector level, but not through reallocation of their factors across sectors. In particular, is the TFP in the tradable sector what mainly explain the recovery of the aggregate TFP, and the TFP in the non-tradable sector is the main factor behind the fall in the aggregate TFP. Also, as in México, the tradable sector suffered less and recovery more rapidly than the non-tradable sector.

³Calvo and Reinhart (1999), Calvo, Izquierdo and Loo-Kung (2006), Mendoza (2006) and Kehoe and Ruhl (2008), among others.

⁴The causes and consequences of the Asian financial crisis have been widely documented for all the affected countries (IMF World Economic Outlook, Krugman (1998), Corsetti et al. (1998) among others). More on Echeverria and Iza (2008).



Figure 1: Trade Balance

2.1 Current Account deterioration, Real Exchange Rate depreciation, Interest rate increases and Credit collapse

Sudden Stops are by definition large reversals in the capital flows from a country. A decrease in net capital inflows can be approximated through the Current Account reversals. Figure 1 presents the annualized Current Account GDP ratio to illustrate the magnitude of the cutback in external financing during the financial crisis in Hong Kong⁵. The Current account deficit fell 18.7% from 1997 to 1998, but it was fully recovered in the years after the Sudden Stop from 5% in 1998 to 16% in 2005⁶. Figure 1 shows the Hong Kong Current Account as a share of GDP. The country moved from being a net lender to being a net borrower. Figure 1 plots the trade balance as a share of GDP from Hong Kong. In 1997 the trade deficit was 3,35 percent and in 1999 Hong Kong had a trade surplus of 5,26 percent. Contrary to what happened in Mexico, the Hong Kong economy did not return to a deficit.

The Sudden Stop of foreign capital inflows and the current account reversal

⁵No data series prior 1997 are available.

⁶By national accounting, capital inflows equal current account deficit plus accumulation of international reserves and Sudden Stops have to be met by lower current account deficits reserve losses.

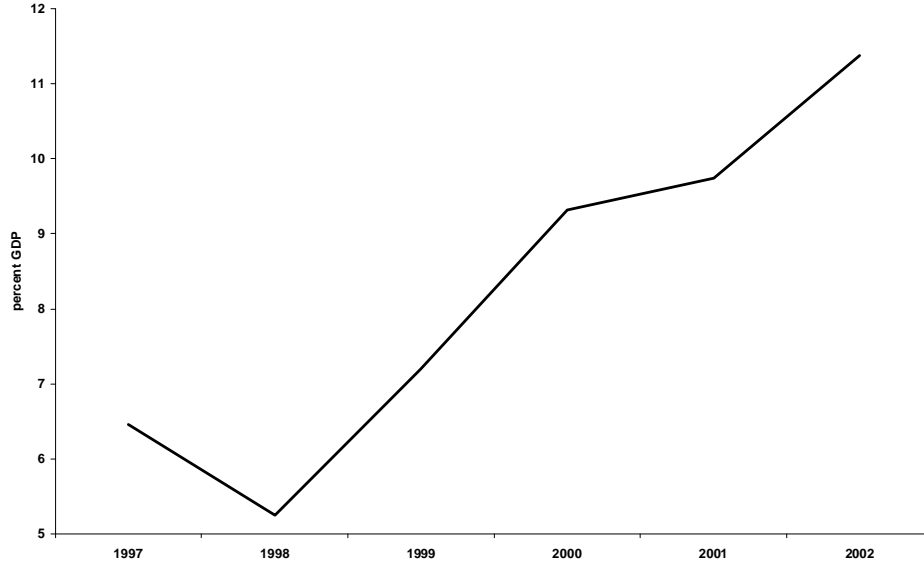


Figure 2: Current Account

were accompanied by a depreciation of the real exchange rate. We define the real exchange rate for Hong Kong following Kehoe and Ruhl (2008):

$$RER_{HK,US,t} = NER_{HK,US,t} \frac{P_{US,t}}{P_{HK,t}}$$

where NER is the Hong Kong dollar-US dollar exchange rate, and P_j is the price inflation in country j . If we plot the logarithm of the real exchange rate from Hong Kong, we observe that the real exchange rate slightly depreciates when the financial crisis hits the economy and, unlike in other economies (e.g. México), the Real Exchange Rate, as defined above, keeps its depreciation, instead of recovering its trend before the financial crisis. Figure 2 shows the Real Hong Kong-US Exchange Rate. During the nineties the real exchange rate appreciated and after the Asian financial crisis in 1997 it has depreciated by 57% from 1997 to 2005.

Nevertheless, as in México (see Kehoe and Ruhl (2005)), the pattern for the Real Exchange Rate can be explained by the changes in the relative price of non-tradables to tradables. In particular, the deflation suffered in Hong Kong during the following 7 years, after the Sudden Stop, can be explained by the decrease in the price of non-tradable goods. If we look at the evolution of prices, we observe a fall in general prices of Hong Kong. The Hong Kong economy suffered a deflation, general prices declined by 2% during years 1997 and 2006.

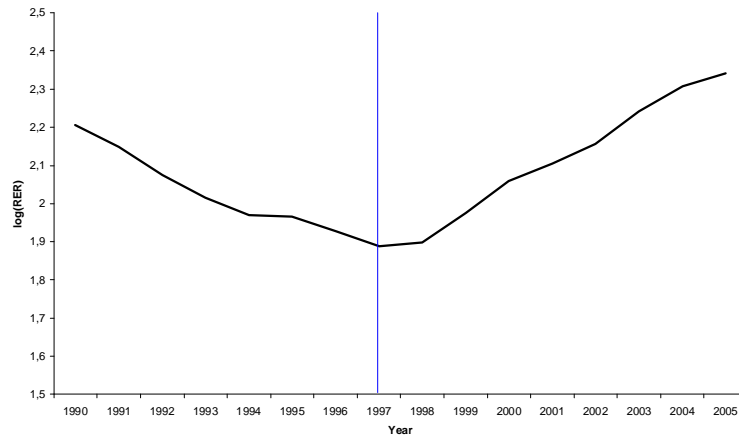
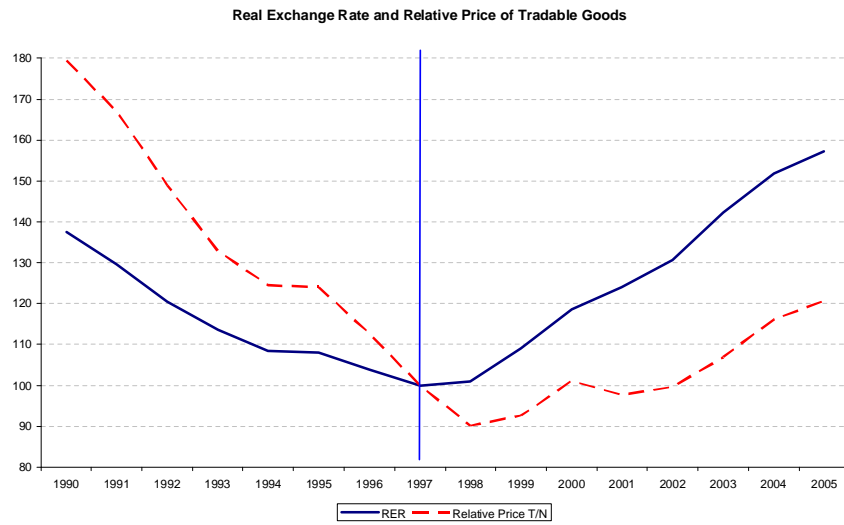


Figure 3: Real Exchange Rate in Hong Kong



Regarding the dynamics of the relative prices of non-tradable goods with respect to the price of tradable goods, in Hong Kong there has been a drop in prices of non-tradable goods relative to tradable goods after 1998. A prominent example is the Real Estate sector which relative prices exhibited a sharp fall during the crisis. In consequence, unlike for the Mexican 1995 crisis (see, among others, Kehoe and Ruhl (2005), Meza and Urrutia (2008), Pratap and Urrutia (2008)), in Hong Kong there is an increase (instead of a drop) in the relative price of non-tradable to tradable goods between 1997 and 1998, but, after 1998, the relative price of non-tradable goods relative to tradable goods starts a decreasing trend.

To decompose the movements of the real exchange rate into sectoral components, we follow Meza and Urrutia (2009) and separate the real exchange rate into tradable and non-tradable sector:

$$RER_{HK,US,t} = \left(NER_{HK,US,t} \frac{P_{US,t}}{P_t^T} \right) \left(\frac{P_t^T}{P_{HK,t}} \right) \simeq \left(NER_{HK,US,t} \frac{P_{US,t}}{P_t^T} \right) \left(\frac{P_t^T}{P_t^N} \right)^{1-\gamma}$$

where the domestic price of traded goods, P^T , is the gross output deflator for the tradable sector, and the domestic price of non-traded goods, P^N , is the gross output deflator for the non-tradable sector. The real exchange rate is divided into the relative price of traded goods with respect to the non-tradable goods and a residual, as in Meza and Urrutia (2009). Between 1997 and 1998, the price of traded goods decreased by 4,28 %, while the price of non-traded goods continued increasing by 6,13%. During the period 1998 and 2006, prices of tradables have decreased by 0,86% and prices from non-traded goods by 4,93%.

If we look at TOT (*Merchandise trade Index*) in Figure 4, calculated as the ratio of the import price deflator and the export price deflator, we find that there was no deterioration during 1997-1998 (deterioration is defined as an upward spike in the terms of trade). It started deteriorating in 1998. In consequence, unlike in México, there was no deterioration in the Terms of Trade in Hong Kong during the financial crisis. As in Kehoe and Ruhl (2008) we check if changes in TOT are correlated with the TFP. We find that the correlation between TOT and TFP for the period 1982q1-2005q4 is -0.2.

Another feature observed during the Sudden Stops episodes in most countries is the increase in the country risk premium. In Hong Kong, interest rates increased simultaneously as the Trade Balance worsened. Figure ?? shows the quarterly Hong Kong real interest rate and the real US 3-month Treasury Bill (both calculated as nominal interest rates less expected inflation). While the US interest rate maintained fairly constant during the Asian financial crisis period, the Hong Kong interest rate increased 2.14% from 7.3% in 1997Q3 to 9.3% (in nominal terms) in 1997Q4, decreased by 2.5% in the next quarter and increased again by 3.6% between 1998Q1 and 1998Q2⁷. As can be seen, during the Asian

⁷It is usually used the J.P. Morgan Emerging Market Bond Index spread on Brady Bonds computed after stripping out the collateralized principal as the country spread to measure country specific risks premia. The sum of the US Treasury bill rate and the Country Spread result in the interest rate on external borrowing from that specific country. Unfortunately, there is no data for Hong Kong.

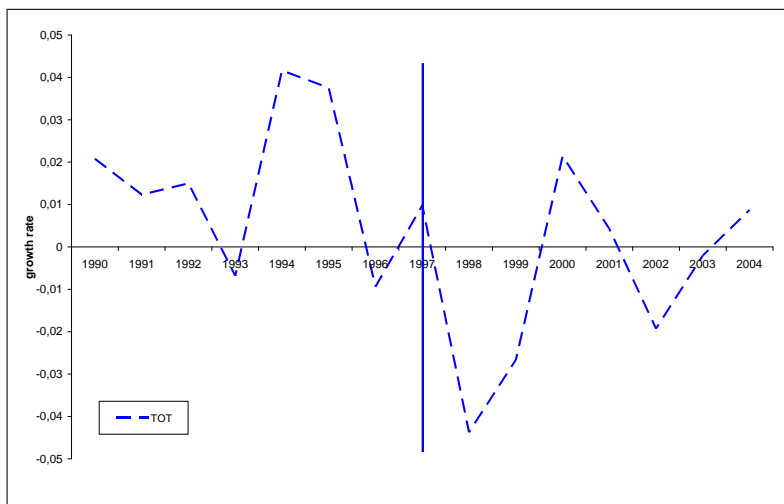


Figure 4: Terms of Trade

financial crisis, the spread increased.

Current accounts reversals, are usually described as a collapse in foreign credit and Sudden Stops are characterized by credit falls during the crisis and credit-less recoveries to the private sector. In Hong Kong the net capital inflow recovered after the Sudden Stop, however, credit to private sector in Hong Kong kept its drop after the financial crisis and has not recovered yet to pre-crisis levels in 2007 (Figure 6). As Calvo (2003) points out, the severity of crises hits the financial sector and, as a result, banks become more cautious and cut their loans, especially to small-and-medium-sized firms. In Hong Kong output grows back to pre-crisis levels rapidly but without any significant recovery in domestic credit⁸.

⁸Calvo, Izquierdo and Talvi (2006) argue that this phenomenon resembles the feat of the proverbial bird “rising from its ashes” and prompted them to call it Phoenix Miracle. The name is based on the fact that there is a dramatic collapse in both output and credit and a fast recovery in GDP but not in credit. Thus, their conjecture is that, faced with a credit crunch, the economy strives to develop new sources of financing that lie outside the formal credit market.

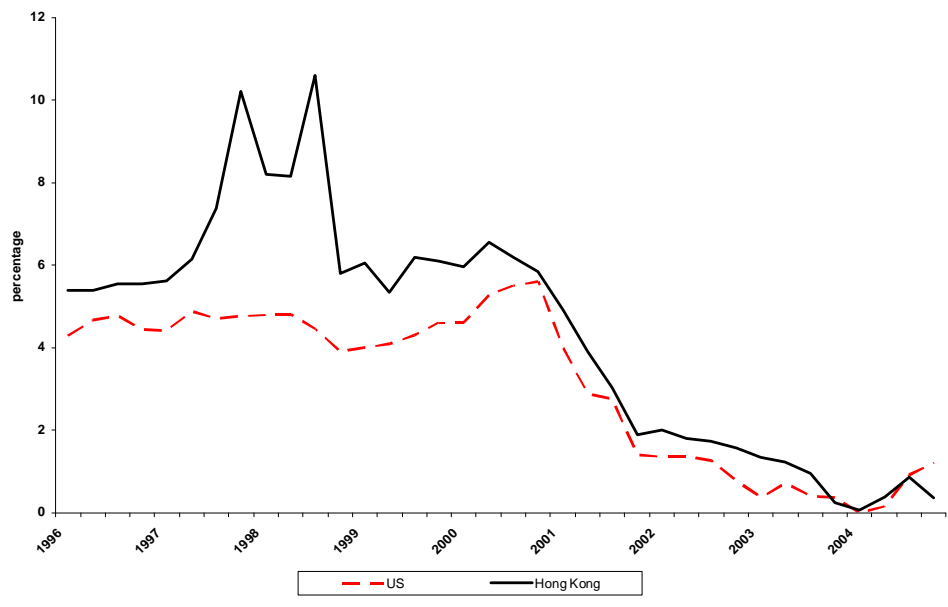


Figure 5: 3-month US Treasury Bill and 3-month Hong Kong Saving rate, 1996-2004

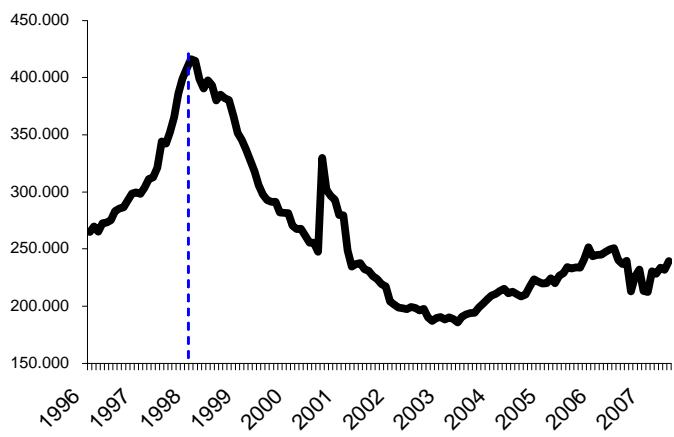
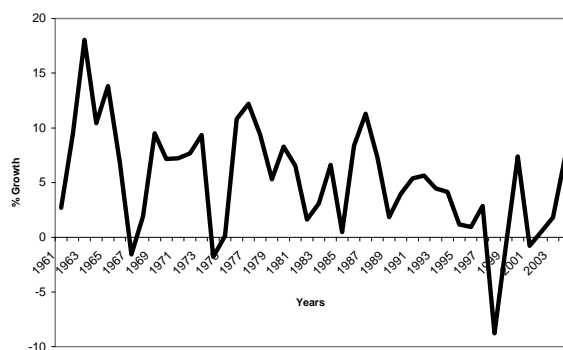


Figure 6: Loans and Advances in Hong Kong (value in HK\$ at end of month), 1996-2007

2.2 Output and its components

It has been widely reported that Hong Kong suffered a recession in 1998⁹. In Hong Kong there has been an extraordinary and sustained output growth, On average, the annual growth rate of per capita GDP has been of 3.48% in the period 1985-2006. A striking feature of the economic downturn in Hong Kong is that after the sudden large drop of GDP in 1998 (a fall in the per capita GDP of 7.39%), output experienced a fast growth rate recovery, as in other economies that have suffered Sudden Stops (e.g. México (1994-1995)). As a consequence of the Asian financial crisis, the Hong Kong economy, that had been growing at an annual average rate of 4.24% between 1985 and 1997, collapsed in 1998 with a reduction of -7.39% and its average annual rate of per capita GDP in the period 1998-2006 has been of 3.70%.



GDP growth per capita in Hong Kong (PWT 6.2), 1961-2004

Consumption fell as much as output in Hong Kong. As other authors have suggested (Otsu, 2008, Aguiar and Gopinath 2007), it is puzzling because it goes against the principle of consumption smoothing. The largest decline among the demand components has been in Investment, which fell nearly 50 percent between 1997 and 2004 and has not recovered yet. Government expenditure did not almost fall. Remarkable is the behavior of exports and imports. They fell the least and recovered the fastest.

⁹ A recession is traditionally defined in macroeconomics as a decline in a country's real Gross Domestic Product (GDP) for two or more successive quarters of a year (equivalently, two consecutive quarters of negative real economic growth). However this definition is not universally accepted. The National Bureau of Economic Research defines a recession more ambiguously as "a significant decline in economic activity spread across the economy, lasting more than a few months, normally visible in real GDP, real income, employment, industrial production, and wholesale-retail sales" (Hall et al. (2003)). A recession may involve simultaneous declines in coincident measures of overall economic activity such as employment, investment, and corporate profits. In a different manner, Rebelo (2005) identifies recessions as periods in which output is below the Hodrick-Prescott (HP) trend for at least three consecutive quarters. QUITAR

One of the main characteristics of the Hong Kong economy is its openness, especially because of its role as the main exit-door of Chinese exports during the last decades (converted in re-exports from the Hong Kong economy). The weight of exports has increased from accounting 80% of total value of GDP at 1990 constant prices in 1961 to a value of 197% in 2005. The weight of imports has increased from a relative weight of 80-90% of GDP to around 190% in 2005. While exports grew at an average annual rate of 5% between 1990 and 1997, during 1997 and 1998 their growth accounted -2% and -7.8%. Nevertheless, the annual average rate of growth has substantially increased to an annual average rate of growth of 11.5% between 1998 and 2005, higher than the figures obtained before the Asian financial crisis. It seems that the importance of exports in Hong Kong has increased.

Very close to the evolution of exports from Hong Kong, is the evolution of re-exports, that is, the exports from China that are re-exported again by Hong Kong. These re-export account for more than 80% of total export from Hong Kong. Between 1990 and 1997, re-exports grew at an average annual rate of 10%. During 1997 they decreased by 0.63% and by 7% in 1998. But, from 1998 on, the annual average rate of growth accounts for 13.73% between 1998 and 2005. With respect to imports, they grew at an average annual rate of 6.6% between 1990 and 1997. They decreased by -2.34% in 1996, by -0.5% in 1997 and by -10.5% in 1998. Nevertheless they recovered after 1998 and the annual average rate of growth accounts for 11.6% between 1998 and 2005.

2.2.1 Disaggregated output: Tradable and Non-tradable sectors

Here we analyze the effects of the Sudden Stop at a more disaggregated level following Kehoe and Ruhl (2008) and Pratap and Urrutia (2008). Following Hsieh and Woo (2005) we build the tradable sector as the sum of Manufacturing; Wholesale trade; Imports and Export services; Transport, Storage and Communications; Finance and Insurance; and the non-tradable sector as the sum of Construction, Retail, Hotels and Restaurants; Rental of machinery and equipment; Real Estate; and Community, Social and Personal services. All data are from the Hong Kong Census and Statistics Department.

The following two figures 2.2.1 and 7 show the GDP in tradable and non-tradable sectors and the reallocation of labor from tradable sector to non-tradable sector.

2.3 Prices

Another feature of Sudden Stops is large declines in equity prices (Hang Seng Index). A boom in equity prices in the two years before the Sudden Stop, was followed by a collapse in 1998, and a decline after the crisis. It is well known that the Stock market indexes fell sharply in countries that suffered Sudden Stops. In Hong Kong, the collapse of equity market between September 1 and December 31 1997 averaged 20%.

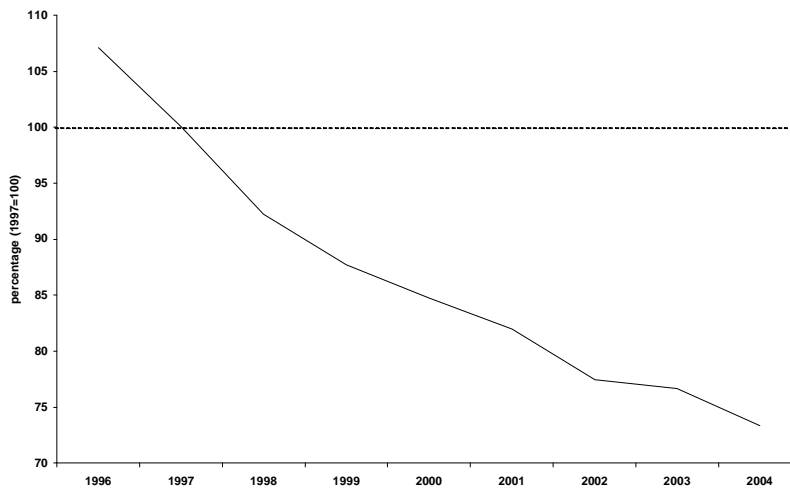
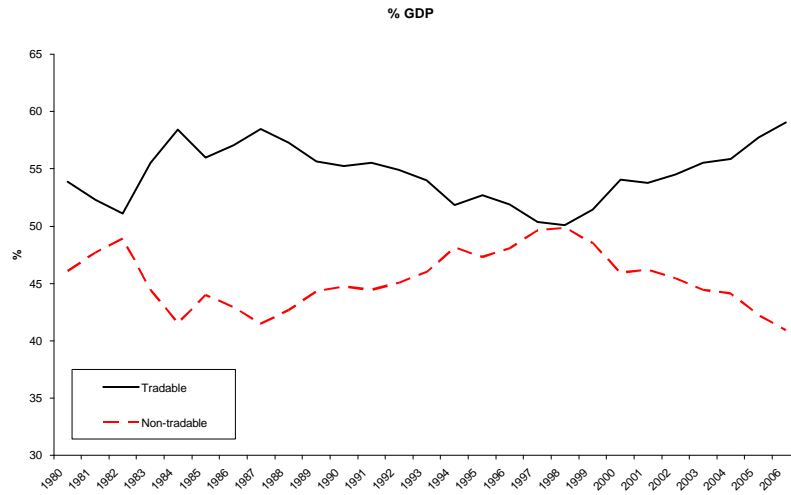


Figure 7: Reallocation of Labor across sectors (Employment in trade sector over Employment in non-trade sector)

If we look at the evolution of prices, we observe a fall in general prices of Hong Kong. The Hong Kong economy suffered a deflation, general prices declined by 2% during years 1997 and 2006.

Regarding the dynamics of the relative prices of non-tradable goods with respect to the price of tradable goods, in Hong Kong there has been a drop in prices of non-tradable goods relative to tradable goods after 1998. A prominent example is the Real Estate sector which relative prices exhibited a sharp fall during the crisis. In consequence, unlike for the Mexican 1995 crisis (see, among others, Kehoe and Ruhl (2005), Meza and Urrutia (2008), Pratap and Urrutia (2008)), in Hong Kong there is an increase (instead of a drop) in the relative price of non-tradable to tradable goods between 1997 and 1998, but, after 1998, the relative price of non-tradable goods relative to tradable goods starts a decreasing trend.

3 Growth Accounting Exercises

3.1 A growth accounting exercise to the aggregate output

In this section we make a growth accounting exercise using the same methodology as in Bergoeing et al. (2002), following Hayashi and Prescott (2002), for the study of Chile and Mexico in the 1980s. Our aim here is to see how much of the output drop was due to changes in inputs, capital or labor, and how much to changes in productivity (Total Factor Productivity (TFP)). We find that the dynamics of the TFP mimics the pattern observed for the GDP per working age population, it falls sharply during the collapse phase and only recovers shifty afterwards.

In order to make the analysis, the data for Gross Domestic Product, Investment (Gross Domestic Fixed capital formation plus changes in inventories), total population, working age population, employment and worked hours are from the Census Bureau of Statistics of Hong Kong.

The technology of the economy is represented by a Cobb-Douglas aggregate production function

$$Y_t = A_t K_t^\alpha L_t^{1-\alpha} \quad (1)$$

where Y_t is production, K_t is capital, L_t is labor, A_t represents the Total Factor Productivity (TFP) and $\alpha \in (0, 1)$ denotes the share of capital income in total income. As we need to assign a value for α to perform the decomposition, we assume that $\alpha = 0.3$, which is a quite standard value.

The series for the stock of capital is calculated using the Perpetual Inventory approach with geometric depreciation:

$$K_{t+1} = (1 - \delta) K_t + I_t \quad (2)$$

where δ is the depreciation rate and K_0 is the chosen initial capital and I_t denotes Gross Investment. We assume that capital depreciates at a yearly

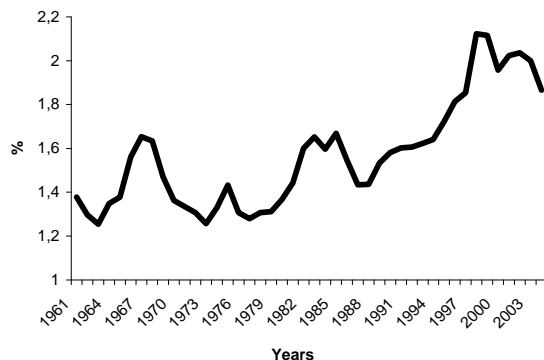


Figure 8: Capital-output ratio in Hong Kong, 1961-2004

depreciation rate of $\delta = 0.1$ ¹⁰.

Along a balanced growth path, in the neoclassical growth model, the capital-output ratio, K/Y , and hours worked per working-age person, L/N , are constant over time, so that per capita output and capital grow at a constant rate, γ . Figure 8 represents the evolution of capital-output ratio for Hong Kong for the period 1961-2004. It can be seen that before 1997, the capital-output ratio was around 1.5.

Following Bergoeing et al. (2002), we use equation (1) to decompose the change in real GDP per working age-person from period t to period $t + s$ in changes in capital and labor inputs and changes in the TFP. Thus, dividing equation (1) by the working-age population, N , and taking natural logarithms from the production function, we rearrange the terms to obtain the following expression:

$$(\ln y_{t+s} - \ln y_t) / s = \frac{1}{1 - \alpha} (\ln A_{t+s} - \ln A_t) / s + \frac{\alpha}{1 - \alpha} \ln(k_{t+s} / y_{t+s}) - \dots \quad (3)$$

$$\dots - \ln(k_t / y_t) / s + (\ln h_{t+s} - \ln h_t) / s \quad (4)$$

The first term on the right hand side is the contribution to growth of changes in TFP, A_t , the second is the contribution of changes in the capital-output ratio, k/y , and the third is the contribution of changes in hours worked per working-age person, L/N .

¹⁰This value is consistent with the depreciation used in the literature. Nevertheless, Kui-Wai Li (2006) chooses a depreciation rate of $\delta = 0.05$ for Hong Kong and Meza and Quintin (2005) choose $\delta = 0.08$ for Mexico and South Korea. *Results do not change with small variations in the depreciation rate.*

Table 1: Decomposition of Average Annual Changes in Real Output per Working-Age Person (%)

Growth 1985-2006		Crisis 1997-1998	
Change in Y/N	3.48%	Change in Y/N	-7.39%
Due to TFP	3.74%	Due to TFP	-16.94%
Due to K/Y	0.01%	Due to K/Y	7.70%
Due to L/N	-0.27%	Due to L/N	1.86%
Growth 1985-1997		Recovery 1998-2006	
Change in Y/N	4.24%	Change in Y/N	3.70%
Due to TFP	5.07%	Due to TFP	4.33%
Due to K/Y	0.19%	Due to K/Y	-1.22%
Due to L/N	-1.02%	Due to L/N	0.59%

Source: Hong Kong Census and Statistics Department.

We present, in Table?? below, the results for the growth accounting exercise for the period 1985-2006 and three different sub-periods; the period between 1985 and 1997, the Sudden Stop period, 1997-1998 and the period of the years posterior to the crisis, 1998-2006¹¹. During the whole period analyzed, the mayor contribution to output per working age population comes from TFP (3.54%), and not so much from changes in capital per working age population (-0.07%) or hours worked (0.21%). As a result to the Asian financial crisis, in the period 1997-1998, TFP and output per working age person decreased but, recovered rapidly in the subsequent years. During this period, it seems that both the downturn and the recovery of output per working-age person are due to the performance of TFP. Figure 9 displays graphically these facts.

We have done a robustness analysis and we have found that the chosen values for the share of capital income in total income and the depreciation rate of the stock of capital, α and δ , do not affect the conclusions.

Several authors have tried to isolate the technology component of the TFP. For example, Basu (1996), Burnside, Eichenbaum, and Rebelo (1996), Baxter and Farr (2001) include variable capital utilization; Greenwood, Hercowitz and Huffman (1988), Burnside, Eichenbaum and Rebelo (1993) and Baxter and Farr (2001) consider variability in labor effort or labor hoarding; Jaimovich (2004) includes changes in markup rates; and Mendoza (2006) points out that “large declines in imported inputs and capacity utilization account for an important share of output collapse in Mexico’s 1995 sudden stop”¹². The incorporation of these extra terms imply that the magnitude of the technology is likely to be much smaller than that of the TFP used in the above exercise.

¹¹There is no available data from Hong Kong Census and Statistics for hours worked before 1985. Moreover, there is a breaking point at that data because Hong Kong was influenced by opening of the Chinese economy.

¹²Mendoza (2006) uses a production function with the form $A_t(m_t k_t)^\beta L_t^\alpha v^\eta$, where v are imported inputs and m is the utilization of capital. As the author argues, if these two terms are included, the contribution of TFP to gross output per worker should fall.

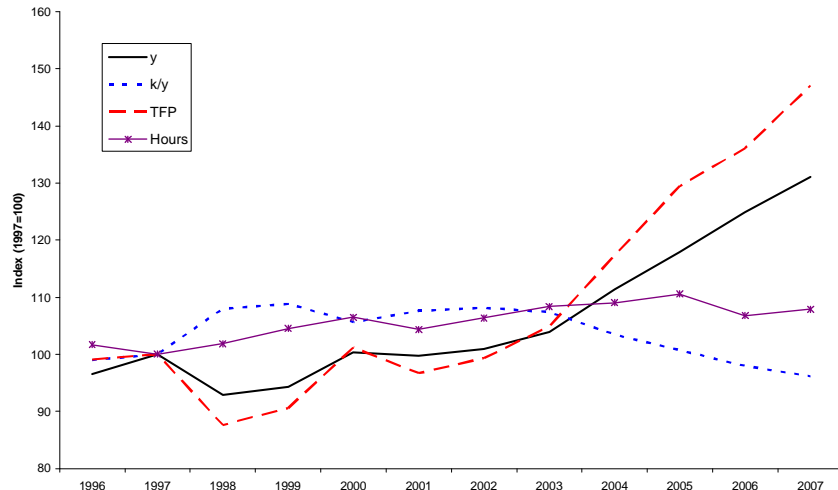


Figure 9: Growth Accounting

3.2 A Growth Accounting exercise at the sectoral level

We also build a growth accounting analysis with disaggregated data. In this exercise, we focus on tradable and non-tradable sectors.¹³ Each of these sectors is also disaggregated in order to identify which sectors have suffered more during the Sudden Stop, and which sectors have experienced a lower drop in their production.

We find that: *i*) the tradable sector suffered no drop in output and recovered faster than the non-tradable sector; *ii*) the non-tradable sector was severely affected by the crisis; *iii*) among the tradable sectors, Wholesale and the Financial sector output fell but was compensated by the strong increase in the Import/eExport sector; *iv*) among the non-tradable sectors, the Retail, Hotels and Restaurants sector and the Real Estate sector suffered the most; *v*) after the crisis, the Real Estate and Construction sectors have not recovered yet.

As in the previous section, we assume a Cobb Douglas production function in each sector, with the same share of capital income in total income:

$$Y_{i,t} = A_{i,t} K_{i,t}^\alpha L_{i,t}^{1-\alpha} \quad (5)$$

The main problem with sectorial analysis is the availability of disaggregated data. In the case of Hong Kong, there is no data of sectorial investment/capital stock neither of sectorial prices (we have price deflators from tradable and non-tradable sectors). In order not to use data on investment (to build the series

¹³More disaggregated data on each sector analysis is available upon request.

for the capital stock in each sector) we make use of the assumption that every sector act in perfect competition, all firms pay the same interest rate per unit of physical capital, and that the total amount of capital is used among all sectors. Under these assumptions (standard in general equilibrium models), the capital output ratio, K_t^i/Y_t^i , for each sector can be expressed as $P_{i,t} \left(\frac{K_t}{Y_t} \right)^{14}$. Concerning price deflators, we are able to build the implicit price deflators for tradable and non-tradable sectors. However, we are not able to construct the implicit price deflators for more disaggregated sectors. Prices for non-tradable sectors decreased substantially more compared to tradable sectors in the period of the recovery after the Sudden Stop.

Expressing the above production functions as follows:

$$Y_{i,t} = A_{i,t}^{\frac{1}{(1-\alpha)}} \left(\frac{K_t}{Y_t} \right)^{\frac{\alpha}{(1-\alpha)}} L_{i,t} \quad (6)$$

and dividing both sides by employment, we make a similar analysis as in the previous section.

If we look at the evolution of Real Value Added, in per worker terms, in the tradable and non-tradable sectors, we observe that, as in México, the non-tradable sector was strongly affected in the period 1997-1998. However, the tradable sector was not affected and it grew at a 2.7% rate (but at a much lower rate than in the period 1985-1997, whose average annual growth rate was of 8.265 percent). The nontradable sector was growing at a very low growth rate in the period 1985-1997, 0.75%, and its production, in per worker terms, fell by 14% in the period 1997-1998.

Why the tradable sector was not affected? At a more disaggregated data one can see that the Import/export sector increased substantially during the Asian crisis and was able to offset the fall in Finance and Wholesale sectors. Among the non-tradable sectors, the one that fell, and recovered, more abruptly during, and after, the crisis was the Retail, hotels and restaurants sector. The Real Estate sector and Construction sectors were also affected, but these two sectors have not recovered yet.

The above evolution of the production can be mainly explained by their respective TFP dynamics. TFP fell during the crisis in both sectors and recovered after the crisis. The fall and subsequent recovery of TFP in the tradable and non-tradable sector was due to: *i)* In tradable sector, import/export was not affected and the Finance sector recovered after the crisis due to a rapid TFP growth; *ii)* In non-tradable sector, Retail, hotels and restaurants' TFP fell abruptly during the crisis but recovered also at a high speed and: *iii)* the TFP from Real Estate and construction fell during the crisis and recovered after, but the production in these two sectors has not recovered yet.

Figure 10 shows the dynamics of TFP in the tradable and non-tradable sectors. During the Asian Financial Crisis, 1997-1998, the TFP in the Tradable sector fell much less (at the rate of -2.22%) than in the non-tradable sector (at

¹⁴See Appendix for a complete analysis of the distribution of capital across sectors.

Table 2: Decomposition of Average Annual Changes in Real GDP per Working-Age person by SECTORS (percent)

	Tradable sector	Non-tradable sector
Growth 1985-1997		
Change in Y/N	6,72%	0,89%
Due to TFP	7,48%	0,11%
Due to K/Y	-0,76%	0,78%
Due to L/N	0,00%	%
Crisis 1997-1998		
Change in Y/N	2.72%	-14.16%
Due to TFP	-2.22%	-24.60%
Due to K/Y	4.95%	10.45%
Due to L/N	0%	0%
Recovery 1998-2006		
Change in Y/N	5.69%	2.36%
Due to TFP	4.92%	3.95%
Due to K/Y	-0.04%	-2.40%
Due to L/N	0.81%	0.81%

Source: Hong Kong Census and Statistics Department. Data from total employment is used for growth accounting from period 1997-2006. Each sector is deflated by its own sectoral GDP deflator. Data from number of persons engaged is used for period 1985-1996 as a proxy of total employment.

the rate of -24.60%). The recovery of the TFP in the Tradable sector has been a little bit higher than in the non-tradable sector. In the period 1998-2006, The TFP in the tradable sector has been growing, on average, at an annual rate of 4.92% and the TFP in the non-tradable sector at the annual rate of 3.95%. As can be observed, the crisis affected more remarkably the non-tradable sector.

Table 3: Decomposition of Average Annual Changes in Real GDP per Working-Age person in TRADABLE sector (percent)

	Manufacture	Wholesale	Import and Export	Finance and Insurance	Transport, Storage and Communications
Growth 1985-2006					
Change in Y/N	5, 36%	3, 91%	4, 44%	6, 35%	4, 24%
Due to TFP	6, 12%	4, 96%	5, 49%	6, 45%	5, 00%
Due to K/Y	-0, 76%	-0, 76%	-0, 76%	-0, 76%	-0, 76%
Due to L/N	0, 00%	-0, 29%	-0, 29%	0, 68%	0, 00%
Growth 1985-1997					
Change in Y/N	7, 90%	5, 67%	4, 22%	7, 31%	5, 14%
Due to TFP	10, 16%	7, 90%	6, 45%	8, 41%	6, 86%
Due to K/Y	-1, 72%	-1, 72%	-1, 72%	-1, 72%	-1, 72%
Due to L/N	-0, 54%	-0, 51%	-0, 51%	0, 62%	0, 00%
Crisis 1997-1998					
Change in Y/N	7, 15%	-10, 32%	5, 71%	-5, 42%	-2, 25%
Due to TFP	0, 00%	-15, 27%	-1, 99%	-15, 02%	-7, 20%
Due to K/Y	4, 95%	4, 95%	7, 70%	4, 95%	4, 95%
Due to L/N	2, 20%	0, 00%	0, 00%	4, 65%	0, 00%
Recovery 1998-2006					
Change in Y/N	2, 81%	3, 22%	5, 71%	7, 61%	3, 40%
Due to TFP	2, 31%	3, 25%	0, 76%	7, 36%	3, 44%
Due to K/Y	-0, 04%	-0, 04%	4, 95%	-0, 04%	-0, 04%
Due to L/N	0, 53%	0, 00%	0, 00%	0, 28%	0, 00%

Source: Hong Kong Census and Statistics Department. Data for 1985-1996 period is from engaged persons (does not include public sector workers). Data for 1996-2006 period is from employed persons.

Table 4: Decomposition of Average Annual Changes in Real GDP per Working-Age person in NON-TRADABLE sector (percent)

	Construction	Retail, Hotels and Restaurants	Real Estate, and Machinery rental Business	Community
Growth 1985-2006				
Change in Y/N	2, 15%	-1, 03%	-2, 12%	0, 27%
Due to TFP	1, 68%	-1, 52%	-3, 58%	-0, 51%
Due to K/Y	0, 78%	0, 78%	0, 78%	0, 78%
Due to L/N	-0, 31%	-0, 29%	0, 68%	0, 00%
Growth 1985-1997				
Change in Y/N	1, 84%	-4, 55%	-2, 46%	-0, 66%
Due to TFP	-0, 26%	-6, 14%	-5, 18%	-2, 22%
Due to K/Y	2, 10%	2, 10%	2, 10%	2, 10%
Due to L/N	0, 00%	-0, 51%	0, 62%	-0, 54%
Crisis 1997-1998				
Change in Y/N	-9.80%	-31.96%	-24.10%	-2.86%
Due to TFP	-11.55%	-42.41%	-39.20%	-13.31%
Due to K/Y	10.45%	10.45%	10.45%	10.45%
Due to L/N	-8.70%	0.00%	4.65%	0.00%
Recovery 1998-2006				
Change in Y/N	-0.52%	5.56%	-1.34%	3.28%
Due to TFP	1.60%	7.96%	0.78%	4.88%
Due to K/Y	-2.40%	-2.40%	-2.40%	-2.40%
Due to L/N	0.28%	0.00%	0.28%	0.80%

Source: Hong Kong Census and Statistics Department. Data for 1985-1996 period is from engaged persons (does not include public sector workers). Data for 1996-2006 period is from employed persons.

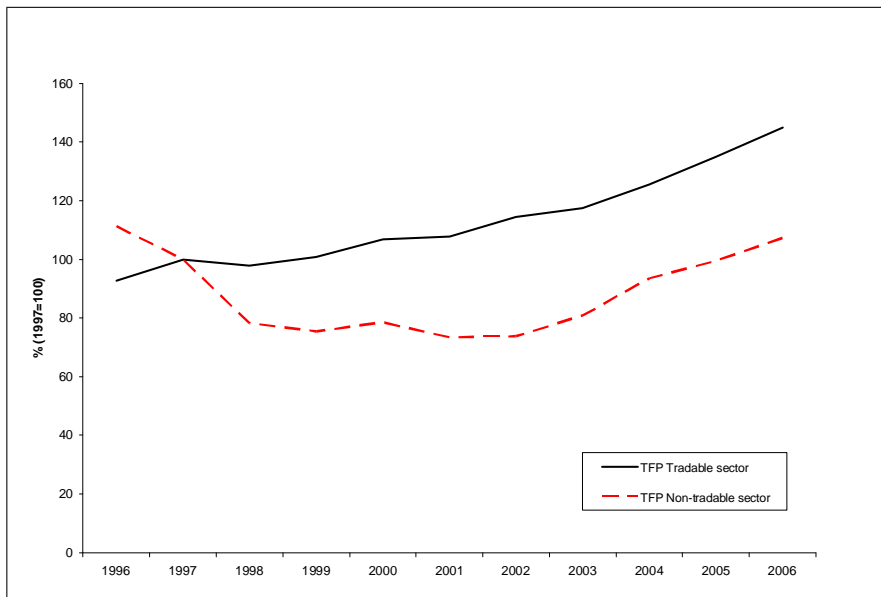


Figure 10: TFP in Tradable and Non-tradable sectors in Hong Kong.

On summary, we find similar results as in the literature on Sudden Stops: *i)* output per worker grows faster in the tradable sector due to faster TFP growth; *ii)* the tradable sector suffered less, and recovered at a higher rate, than the non-tradable sector, *iii)* the sector that suffered less the Sudden Stop episode was the Import/Export sector, *iv)* the sector that recovered at a higher rate was the Finance and Insurance Sector, *v)* there is a substantial reallocation of labor from the tradable sector towards the non-tradable sector during and after the crisis period.

3.3 Aggregate TFP and Approximate TFP

In this section, we will make an analysis, following Benjamin and Meza (2007), to quantify the composition of the reallocation of factors (in particular the reallocation of labor), and the dynamics of the TFP in the tradable and nontradable good sectors, in the aggregate TFP. Therefore, we make experiments with an approximate TFP series holding constant at the 1997 level either the labor reallocation or the sector specific productivity, $p_i A_{it}$. Therefore, next, we compare aggregate TFP, the sum of TFP from tradable and non-tradable sectors, and the approximate TFP, A_t^a , with which we carry out the experiment.

Assuming both sectors have the same share of capital income in total income, we can write their respective production functions as follows:

$$Y_{i,t} = A_{i,t} K_{i,t}^\alpha L_{i,t}^{(1-\alpha)}$$

where $A_{i,t}$, $K_{i,t}$ and $L_{i,t}$ are, sector i TFP, capital and hours worked, respectively.

Aggregate Real GDP will be given by the aggregation of all sectoral outputs, using a set of constant prices of each sector, p_i :

$$Y_t = \sum_{i=1}^2 p_i Y_{i,t}$$

To get a relationship between the aggregate TFP and the approximate TFP, we recover the aggregate TFP that we have obtained previously:

$$A_t = \frac{Y_t}{K_t^\alpha L_t^{(1-\alpha)}}$$

where A_t , K_t and L_t are, the economy TFP, capital and hours worked, respectively.

Analogously, the TFP in each sector is

$$A_{it} = \frac{Y_{it}}{K_{i,t}^\alpha L_{i,t}^{(1-\alpha)}}$$

and, assuming that all firms behave in perfect competition in both sectors, there is freely mobility of factors and markets clear for both factors (capital and labor), it can be shown that the ratio of capital over labor are equal for all firms (in both sectors), then, the following equation will be satisfied¹⁵:

$$A_t^\alpha = \sum_{i=1}^2 p_i A_{it} \frac{L_{i,t}}{L_t} \quad (7)$$

where, $\frac{L_{1,t}}{L_t} + \frac{L_{2,t}}{L_t} = 1$.

Therefore, an approximate to the aggregate TFP can be obtained using (7).

In the following Figure 11 we show the aggregate and the approximate TFP. As can be seen, both graphs are very similar. The correlation coefficient between these two variables is 0.94.

3.3.1 Some Experiments

During the crisis period there has been a fall in the labor share in the tradable sector and an increase in the non-tradable sector. Moreover, the tradable sector was the high productivity sector while the non-tradable sector had lower productivity. We try to examine if changes in sector specific TFPs or movements of labor from the productive to the unproductive sector can explain the fall in aggregate TFP. Therefore, in this subsection we will make 2 experiments: 1) First we compute the approximate TFP keeping constant the reallocation of labor across sectors at the observed level in 1997 on the one hand, and keep

¹⁵See Ohanian (1991), Benjamin and Meza (2007).



Figure 11: Aggregate and Approximate TFP

the TFP from both sectors constant on the other; 2) Second, we compute the approximate TFP keeping constant the TFP of the tradable good sectors at the observed level in 1997, and the approximate TFP keeping constant the TFP of the non-tradable good sectors at the observed level in 1997. We compare the results to the approximate TFP.

Experiment 1 We compute the aggregate TFP, the approximate TFP keeping constant the reallocation of labor across sectors at the observed level in 1997 and allowing sector specific TFP changes as in the data, and the approximate TFP keeping constant the productivity of both sector and allowing the shares of labor in each sector to change as in the data. Figure 12 shows the results.

The resulting approximate TFP when labor shares are kept constant is similar to the approximate TFP from the economy. On the other hand, the resulting approximate TFP when TFP is kept constant is significantly lower after the crisis. Therefore, the reallocation of labor does not help to understand the dynamics of the aggregate TFP and does not play any role on it.

Experiment 2 In this experiment we compare three different scenarios. We compute the approximate TFP, the approximate TFP keeping constant the TFP of the tradable good sectors at the observed level in 1997 and the TFP keeping constant the TFP of the non-tradable sector. Figure 13 shows the results.

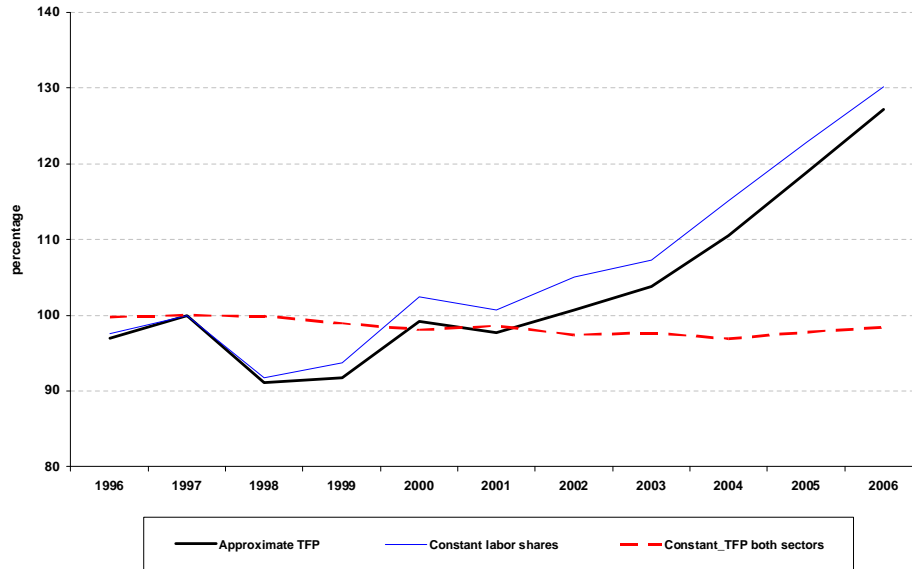


Figure 12: Decomposition of TFP

The TFP of the non tradable goods is helpful only to explain the fall of the aggregate TFP. The TFP of the tradable goods does not help to explain the fall of the aggregate TFP, but it is able to explain the recovery of the aggregate TFP.

In fact, we have built an approximate TFP keeping constant the TFP of the tradable goods for the years 1997 and 1998, and keeping constant the TFP in the non-tradable goods, at its level in 1997, for the following years. The approximate for the aggregate TFP that we get is very similar to the aggregate TFP. The correlation between these two variables is very high.

4 The Benchmark model: a two-sector model

In this section we present a two sector small open economy dynamic general equilibrium model. The two sectors are tradable and non-tradable sectors. The idea is to quantify to what extent the behavior of the prices in the tradable and nontradable sectors can be explained in an standard neoclassical small open economy, taking as given the dynamics for the TFP in both sectors.

The model is based on Meza and Urrutia (2009): a small open economy with two sectors, but, unlike Meza and Urrutia (2009), with no cost in reallocating labor across sectors. We will assume that at the initial period the economy was

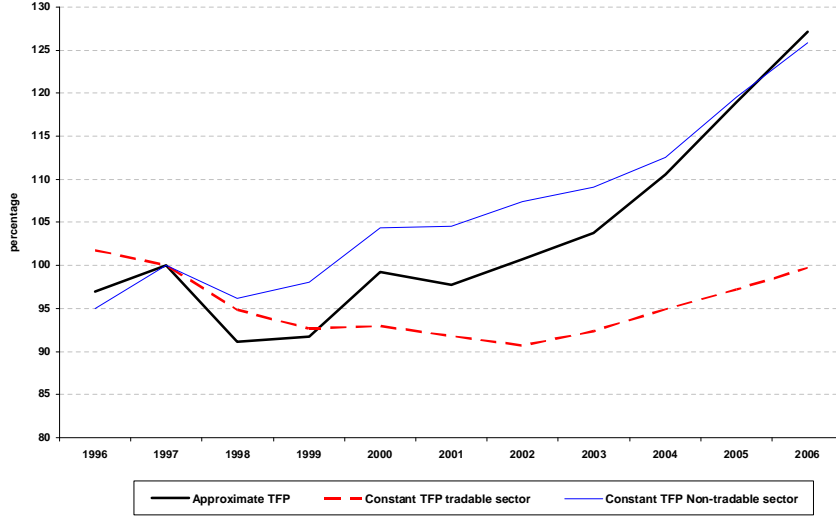


Figure 13: Decomposition of TFP

in its stationary equilibrium, and the dynamics of the economy from 1997-2005 will be obtained through the observed paths of the TFP's in the tradable and non-tradable sectors.

4.1 Households

The economy is populated by a measure one of identical infinitely-lived individuals. All of them are endowed with a unit of time at each period of their life, that supply inelastically to the production sector. Households do not value leisure. We assume no population growth.

We assume that households' preferences can be represented by the following utility function:

$$\sum_{t=0}^{\infty} \beta^t \left[\frac{(c_t)^{1-\sigma} - 1}{1-\sigma} \right]$$

where $\beta^t \in (0, 1)$ is the discount factor, c_t is consumption of the final good.

Households decide how much to consume and how much to invest (in physical capital and foreign bonds) out of their income (labor, capital and bonds income).

The households' budget constraint at each period will be given by:

$$C_t + K_{t+1} + p_t^T B_{t+1} = w_t + (1 + r_t - \delta)K_t + (1 + r_t^*)p_t^T B_t$$

4.2 Firms

As in Meza and Urrutia (2009), there are intermediate goods producers, tradable and non-tradable sectors, and one final goods producer. All sectors act in perfect competition.

4.2.1 Intermediate goods producers

The economy produces two intermediate goods, a tradable and non-tradable good. Each intermediate good is produced combining capital and labor through a Cobb-Douglas production function:

$$Y_t^i = A_t^i (K_t^i)^\alpha (L_t^i)^{(1-\alpha)} \quad i = T, NT.$$

Capital and labor are rented from households.

The problem can be solved by a representative firm, in each sector, which takes prices as given. The profit-maximization problem for the intermediate producer is

$$\begin{aligned} \max p_t^i Y_t^i - w_t L_t^i - r_t K_t^i \\ \text{s.t. } Y_t^i &= A_t^i (K_t^i)^\alpha (L_t^i)^{(1-\alpha)} \end{aligned}$$

The First order Conditions are standard:

$$\begin{aligned} r_t &= \alpha p_t^i A_t^i (K_t^i/L_t^i)^{\alpha-1} \\ w_t &= (1-\alpha) p_t^i A_t^i (K_t^i/L_t^i)^\alpha \end{aligned}$$

where w_t and r_t are measured in terms of the final good (whose price has been taken as numeraire).

4.2.2 Final good producer

A final good is produced using only tradable and non-tradable goods as inputs, using the CES aggregator:

$$Y_t = [\theta (T_t)^\rho + (1-\theta) (NT_t)^\rho]^{\frac{1}{\rho}}$$

where Y_t is the final good output, T_t and NT_t are quantities of each intermediate good and ρ determines the elasticity of substitution, $1/(1-\rho)$.

The producer of the final good solves each period the static problem:

$$\begin{aligned} \max Y_t - p_t^T Y_t^T - p_t^N Y_t^N \\ \text{s.t. } Y_t &= [\theta (T_t)^\rho + (1-\theta) (NT_t)^\rho]^{\frac{1}{\rho}} \end{aligned}$$

The final good can be either consumed or invested.

4.3 Equilibrium

The market clearing conditions are as follow:

$$\begin{aligned}
Y_t &= C_t + K_{t+1} - (1 - \delta)K_t + B_{t+1} - (1 + r_t^*)B_t p_t^T \\
B_{t+1} - (1 + r_t^*)B_t p_t^T &= NX_t^T \\
K_t^T + K_t^N &= K_t \\
L_t^T + L_t^N &= 1 \\
T_t + NX_t^T &= Y_t^T \\
NT_t &= Y_t^N
\end{aligned}$$

where:

$$GDP_t = p_t^T Y_t^T + p_t^N Y_t^N$$

In order to solve the model, we have to take into account that the wage rate and the rental rate of physical capital are the same across sectors

$$\begin{aligned}
r_t &= \alpha p_t^T A_t^T (K_t^T / L_t^T)^{\alpha-1} = \alpha p_t^N A_t^N (K_t^N / L_t^N)^{\alpha-1} \\
w_t &= (1 - \alpha) p_t^T A_t^T (K_t^T / L_t^T)^\alpha = (1 - \alpha) p_t^N A_t^N (K_t^N / L_t^N)^\alpha
\end{aligned}$$

and that from the household problem, the following conditions must hold:

$$\begin{aligned}
1 + r_t - \delta &= (1 + r_t^*) \frac{p_{t+1}^T}{p_{t+1}^T} \\
\left(\frac{c_{t+1}}{c_{t+1}} \right)^\sigma &= \beta(1 + r_t - \delta)
\end{aligned}$$

4.4 Solving the Model with exogenous dynamics for TFP's

We have calibrated some of the parameters, but not all, and, following Meza and Urrutia (2009), we have simulated the economy taken 1996 as the initial period, assuming that Hong Kong was in its stationary equilibrium in 1996.

We have chosen the initial relative TFP between the two sectors A_t^T / A_t^N such that the initial ratio L_t^T / L_t^N is equal to the date in Hong Kong in 1996. The sequence for $\{A_t^T, A_t^N\}$ is built from the initial ratio and the growth for A_t^T and A_t^N observed in the Hong Kong economy in the period 1996-2005. On the other hand, in order to obtain the dynamics for K_t , we assume that r_t^* follows the same pattern as the one observed in Hong Kong in the same period: 1996-2005.

Focusing on the dynamics for the relative price of tradable to non-tradable goods, it can be seen in the following graph.

5 Conclusions

In this paper we analyze the real effects of the Asian Financial crisis on the Hong Kong economy. First of all, we focus on the phenomenon of the Sudden Stop and on the characteristics that accompany this phenomenon paying special attention to the real exchange rate and the relative price of tradable over non-tradable goods. We find that the dynamics of the real exchange rate and the relative price of tradable over non-tradable goods in Hong Kong is similar, but not identical, to other economies that have suffered a Sudden Stop.

Secondly, through a growth accounting analysis we find that, as in other economies, the fall and recovery of the GDP in Hong Kong is mostly explained by the TFP.

Thirdly, we find that the tradable sectors have suffered less from the financial crisis than the non-tradable sectors, and that the recovery of the GDP in Hong Kong is due to the quick recovery in the tradable sector.

Fourthly, we show that the aggregate TFP can be quite well approximated through the dynamics of the TFP in the tradable and non-tradable sector.

Finally, we build a simple neoclassical small open economy model, with two sectors, to quantify at which extent such a simple model is able to mimic the dynamics for the prices, taking as exogenously given, the dynamics of the TFP in both sectors.

6 Appendix A. Data construction

The Hong Kong data is from Census and Statistics Department in Hong Kong.

7 References

Bergoeing, R., Kehoe, P., Kehoe T.J. and R. Soto (2002), "Decades Lost and Found: Mexico and Chile Since 1980", Federal Reserve Bank of Minneapolis Quarterly Review.

Burnside C. and M. Eichenbaum. 1996. "Factor-hoarding and the propagation of business-cycle shocks." *American Economic Review* 86, 1154-1174.

Burnside, Craig, Martin Eichenbaum and Sergio Rebelo. 1993. "Labor Hoarding and the Business Cycle." *Journal of Political Economy*, Vol. 101, No. 2. 245-273.

Burnside, Craig, Martin Eichenbaum, and Sergio Rebelo, 1995. "Capital Utilization and Returns to Scale," in *NBER Macroeconomics Annual 1995*, pages 67-110.

Calvo, G. A. (1998), "Capital Flows and Capital Market Crises: The Simple Economics of Sudden Stops", *Journal of Applied Economics* 1, November, 35-54.

Calvo, G.A. and C.M. Reinhart (1999), "When Capital Inflows come to a Sudden Stop: Consequences and Policy Options", mimeo, Center for International Economics, Department of Economics, University of Maryland.

- Calvo, Guillermo A, and Carmen Reinhart (2002), "Fear of Floating," *Quarterly Journal of Economics*, (117)2: 379-408.
- Calvo, G A, Izquierdo A, and Talvi E (2003) "Sudden Stops, the Real Exchange Rate and Fiscal Sustainability: Argentina's Lessons", in Alexander V, Méltiz J, von Furstenberg G M (Eds), *Monetary Unions and Hard Pegs*; Oxford University Press, Oxford, UK, pp 150-81.
- Calvo, G A, Izquierdo A, and Mejía, L F (2004): "On the Empirics of Sudden Stops: The Relevance of Balance-Sheet Effects" NBER Working Paper 10520.
- Calvo, G A, and Talvi, E (2005): "Sudden Stop, Financial Factors and Economic Collapse in Latin America: Learning from Argentina and Chile" NBER Working Paper 11153.
- Calvo, G A, Izquierdo A, and Loo-Kung R (2005): "Relative Price Volatility under Sudden Stops: The Relevance of Balance-Sheet Effects" NBER Working Paper 11492, *Journal of International Economics*.
- Chari, V.V., P.J. Kehoe and E.R. McGrattan. 2004. "Business Cycle Accounting." Federal Reserve Bank of Minneapolis Staff Report 328.
- Cole, Harold, and Lee E. Ohanian, 2001, "The Great U.S. and U.K. Depressions Through the Lens of Neoclassical Theory", *American Economic Review*, May, pp. 28-32.
- Conesa, J.C. and T.J. Kehoe (2007), "Modeling Great Depressions: The Depression in Finland in the 1990s", *Federal Reserve Bank of Minneapolis Quarterly Review* Vol. 31, No. 1, 16-44.
- Conesa, J.C. and T.J. Kehoe (2007), "Productivity, taxes, and hours worked in Spain, 1970-2005", Manuscript. University of Minnesota.
- Cooley, T. F. and E. C. Prescott. 1995. "Economic growth and business cycles." In T. F. Cooley, ed., *Frontiers of Business Cycle Research*. Princeton University Press, 1-38.
- Fisher, Irving, 1933, "The Debt-Deflation Theory of Great Depressions", *Econometrica*, Vol 1, No 4, pp 337-57.
- Fu et al (1999),
- Greenwood, Jeremy, Zvi Hercowitz and Gregory W. Huffman. 1988. "Investment, Capacity Utilization, and the Real Business Cycle" *American Economic Review*, Vol. 78, No. 3, 402-417.
- Hansen, G. D. 1985. "Indivisible labor and the business cycle." *Journal of Monetary Economics* 16, 309-327.
- Herrendorf, B. and Valentinyi, A. (2006), "Which Sectors Make the Poor Countries so Unproductive?", mimeo
- Hsieh, C.T. (2002), "What Explains the Industrial Revolution in East Asia? Evidence From the Factor Markets", *The American Economic Review*, Vol. 92, No 3.
- Hsieh, C.T. and K.T. Woo (2005), "The Impact of Outsourcing to China on Hong Kong's Labor Market", *The American Economic Review*, Vol. 95, No 5.
- Kehoe T.J. and E.C. Prescott (2007), "Great Depressions of the Twentieth Century", *Federal Reserve Bank of Minneapolis*.
- Kehoe, T.J. and K.J. Ruhl (2008a), "Sudden Stops, Sectoral Reallocations and the Real Exchange Rate", *Federal Reserve Bank of Minneapolis Staff Report*

391, January.

Kehoe, T.J. and K.J. Ruhl (2008b), "Are Shocks to the Terms of Trade Shockss to Productivity?", Federal Reserve Bank of Minneapolis Staff Report 414, October.

Li, Kui-Wai (2005), "The economic strategy for the Hong Kong SAR: Evidence from productivity and cost analysis", *Journal of Asian Economics*, No. 16, 737-754.

Mendoza, E.G., and K.A. Smith (2002), "Margin Calls, Trading Costs, and Asset Prices in Emerging Markets: The Financial Mechanics of the 'Sudden Stop' Phenomenon", NBER Working Paper 9286.

Mendoza, E. G., and K.A. Smith (2005), "Quantitative Implications of a Debt Deflation Theory of Sudden Stops and Asset Prices"; *Journal of International Economics*,

Mendoza, E.G. (2006), "Endogenous Sudden Stops in a Business Cycle Model with Collateral Constraints: A Fisherian Deflation of Tobin's Q",

Meza, F. and E. Quintin (2007), "Factor Utilization and the Real Impact of Financial Crises", *The B.E. Journal of Macroeconomics*, 7(1).

Meza, F. and C. Urrutia (2009), "Great Appreciations: Accounting for the Real Exchange Rate in Mexico, 1988-2002", Discussion Paper series from Instituto Tecnológico Autónomo de México.

Neumeyer, P A, and F Perri (2005): "Business Cycles in Emerging Economies: The Role of Interest Rates" *Journal of Monetary Economics*, Volume 52, Issue 2, Pages 345-80.

Ngai, L.R. and C. Pissarides (2007), "Structural Change in a Multi-Sector Model of Growth", *American Economic Review*, Vol 97 (1), pp.429-443.

Perri, F. and V. Quadrini (2002), "The Great Depression in Italy: Trade Restrictions and Real Wage Rigidities", *Review of Economic Dynamics* 5, 128-151.

Pratap, S. and C. Urrutia (2008), "Financial Frictions and Total Factor Productivity: Accounting for the Real Effects of Financial Crises", mimeo.

Raffo, A. (2008), "Net Exports, Consumption Volatility, and International Real Business Cycle Models", *Journal of International Economics*, Vol 75, Issue 1, Pages 14-29.

Schneider, M. and A. Tornell (2004), "Balance Sheet Effects, Bailout Guarantees and Financial Crises", *Review of Economic Studies*, 71(3), 883-913.

Tornell, A. and F. Westermann (2002), "Boom-Bust Cycles in Middle Income Countries: Facts and Explanations", NBER Working Paper 9219.

8 Appendix A: Data Sources and Description

This appendix provides details on the data sources.

National Accounts Data on nominal and real GDP, GDP deflator, Consumption, Government expenditure, Gross fixed capital formation, Exports and

Imports, for the period 1961-2005 are obtained from the *Census and Statistics Department* from the Hong Kong Government¹⁶

Sectoral output Value-added at current prices by economic activity (production-based GDP) was provided by the *Census and Statistics Department* from the Hong Kong Government. We classify tradable and non-tradable sectors summing up different sectors: tradable: manufacturing, wholesale trade, import and export trades, transport, storage and communications, financing, insurance, and business services. The non-tradable sector is the aggregation of retail, Real Estate, construction...

Sectoral GDP Deflators The deflator for the tradable sector is a composite of the implicit price deflator for domestic exports of goods and the implicit price deflator for exports of services. The composite deflator is calculated following Kehoe and Ruhl (2008). The non-tradable sector GDP deflator is obtained as the geometric difference of the tradable sector deflator and the (whole economy) GDP deflator.

Sectoral capital stock Gross Investment is the sum of gross fixed capital formation plus changes in inventories. Both from the *Census and Statistics Department*. We deflate it to 1985. Perpetual Inventory approach... A low rate of depreciation (5%) is adopted.

In the absence of sectoral data, we assume the capital stock to be equal for all sectors. "Considering high factor mobility in Hong Kong, this assumption may be a good approximation over a relatively long period of time."

Population and Employment Population and Working-Age population (14-65 age) from 1979 to 2005 are from *Census and Statistics Department* from the Hong Kong Government.

Sectoral Labor Input/ Employment Numbers of persons engaged since 1980.

Employed persons data desaggregated from 1996 on.

Hours of work by sectors provided by the *Census and Statistics Department* from the Hong Kong Government: statistics on the average hours are the median hours of work during the seven days before enumeration of employed persons by industry of main employment. These figures are then multiplied by a total of 365/7 days to obtain the average number of hours worked per employee per year.

Hours worked

¹⁶Further information in the website of the Census and Statistics Department of Hong Kong at <http://www.censtatd.gov.hk>

Terms of Trade There are two alternatives as to use the Terms of Trade. The Terms of Trade Index and we calculate TOT as the price of imports over the price index of exports. All data provided by the *Census and Statistics Department* from the Hong Kong Government.

Real interest rates We use the Three-month real interest rate (Hong Kong dollar Inter-bank Offered rate at three months). It refers to the middle closing rate quoted by the Standard Chartered Bank in the interbank money market) from the *Hong Kong Monetary Authority* (HKMA). The periods covered for the analysis of the real interest rate series go from 1982Q1 to 2004Q4.

The real interest rate is obtained by dividing nominal interest rate by the expected inflation rate:

$$1 + r_{t+1} = \frac{1 + i_{t+1}}{1 + \pi_{t+1}}$$

where r_{t+1} is real interest rate, i_{t+1} is nominal interest rate and π_{t+1} is inflation rate. Expected inflation in period t is calculated as the average of previous three quarters' inflation rate of the GDP deflator.