Terms of Use

PRICE CONVERGENCE BETWEEN HONG KONG AND THE CHINESE MAINLAND

LI NA

MPHIL

LINGNAN UNIVERSITY

JULY 2003

PRICE CONVERGENCE BETWEEN HONG KONG AND THE CHINESE MAINLAND

by
LI Na

A thesis
submitted in partial fulfillment
of the requirements of the Degree of
Master of Philosophy

Lingnan University

July 2003

ABSTRACT

Price Convergence between Hong Kong and

the Chinese Mainland

by

LI Na

Master of Philosophy

Over the past decade, goods and capital flows between Hong Kong and Chinese Mainland have increased substantially, however, there have been few rigorous empirical study on whether and to what extent the two economies integrated. This study intends to fill this gap by testing whether relative prices of different goods and services converge between Hong Kong and Mainland China for the period from 1997 to 2002.

Using a panel of 17 commodity prices from Hong Kong and four major cities of Chinese Mainland (Beijing, hanghai, shenzhen, Guangzhou), I find statistical evidence of price convergence between Hong Kong and Chinese Mainland. So, this study suggests that there is a growing economic integration between Hong Kong and Chinese Mainland. However, the speed of price convergence between them is less than that among four Mainland cities, which might have resulted from the differences in the degree of factor mobility, monetary and tax policy, and government regulations. The speed of convergence also differs significantly across the spectrum of products. In particular, I find that prices converge more quickly for tradable goods. Meanwhile, using Shenzhen as benchmark city, I find prices converged at a much slower speed between Shenzhen and Hong Kong than between Shenzhen and other Mainland cities, though the geographic distance between Shenzhen and Hong Kong is much shorter than that between Shenzhen and other Mainland cities. Thus, this empirical study demonstrates a strong border effect between Hong Kong and Chinese Mainland.

Contents:

Acknowledgement

I would like to express my sincere gratitude to my supervisor, Dr. WEI, Xiangdong. Dr. WEI's patience, guidance and valuable suggestions helped me a lot in completing this thesis. The contribution and generosity of Dr. Wei is gratefully acknowledged. I also thank my parents for supporting me emotionally.

Chapter 1. Introduction

Over the years, Hong Kong has developed close economic links with the Chinese mainland, and has benefited greatly from China's open door policy and economic reforms since 1978. The correlation between the cyclical components of Hong Kong's GDP and industrial production in China rose sharply in the late 1980s and has remained high during the 1990s. This is partly explained by the expansion of bilateral trade flows between Hong Kong and China. With Hong Kong's return to China in 1997, flow of commodities and services is getting even more frequent and with larger volumes. Visible trade between Hong Kong and the Mainland increased by 8% in 2002. The Mainland is now Hong Kong's largest trading partner, accounting for 42% of Hong Kong's total trade value. Reciprocally, Hong Kong was the Mainland's third largest trading partner in 2002, taking a share of 11.1% (after Japan and US, with shares of 16.4% and 15.7% respectively) of China's total external trade value. Hong Kong is a major service center for the Mainland and particularly for Guangdong, providing such supporting infrastructural facilities as ports and airport, and such key business services as banking, insurance and professional services. In 2002, trips made by Hong Kong residents to the Mainland continued to grow by 7%. Meanwhile, trips made by foreign visitors to the Mainland through Hong Kong rose by

9%. Hong Kong is also the largest external investor in the Mainland, the stock of Hong Kong's outward direct investment in the Mainland amount to US$108 billion at end of 2001, accounting for 31% of Hong Kong's total outward direct investment. Since China became a full member of the WTO in 2001, Hong Kong businessmen have extended the scope of their investment from industrial processing to other sectors such as hotels and tourist-related services, real estate, retail trade, infrastructural construction and various business and communication services. (Source: Census and Statistics Department, Hong Kong)

There are many studies on the economic integration between Hong Kong and the Mainland, particularly in the areas of trade and investment. However, studies on how such economic links affect the market integration between these two sides are still in their scarcity. This paper intends to study the extent of market integration between Hong Kong and the Mainland by looking at whether and to what extent prices converge between Hong Kong and the Mainland. Such a study can not only shed light on how closely the economies of Hong Kong and the Mainland are integrated but also provide evidence on the extent of marketization in the Mainland.

Furthermore, the test of price convergence between Hong Kong and the

Mainland can also be viewed as another attempt to test the theory of PPP/Law of One Price in an already well-established field of study in international economics. In recent years, there is a renewed interest on the study of PPP/LOP, fueled by newly found datasets or methodologies. For example, Engel and Rogers (1994) examine the nature of the deviation from purchasing power parity, using price data for the US and Canada. They found that price deviation is much higher for two cities located in different countries than for two equidistant cities in the same countries**,** and national borders are indeed an additional contributor to cross-country price variability beyond transportation costs. Wei and Parsley (1995) used a dataset of 27 tradable goods prices in US and Japan, and showed that a simple average of good-level real exchange rates tracks the normal exchange rate well, suggesting strong evidence of sticky price. Cecchetti et al. (2000) provide an interesting recent twist based on a large cross-section of goods prices in European capital cities in 1985. The result suggested that markets (in Europe at least) may, in fact, be more integrated, and borders may matter less than studies examining the variability of price differences would suggest.

Ha and Fan (2002), using panel data on commodity prices of Hong Kong and four mainland cities, found statistical evidence of price convergence between Hong Kong and the mainland cities, with the

average half-life of price differentials estimated at 6.5 years. My study follows largely of Ha and Fan (2002). Similar to their study, I also investigate price convergence between four mainland cities (Shenzhen, Guangzhou, Shanghai and Beijing) and Hong Kong. However, instead of using annual price data like Ha and Fan, I collect a monthly price data for seventeen homogenous products/services from the China Price Information Centre for the period of Jan 1997 to Sep 2002 to match with Hong Kong's consumer price index data published by the Census and Statistics Department. My dataset is in some way superior to the data employed by Ha and Fan in the sense that it has higher frequency and more observations (see Taylor 2001, for detailed discussions on the potential problems associated with the use of low frequency data to test PPP or law of one price). Moreover, I employed two different panel unit root tests developed by Levin and Lin (1992) and Im, Pesaran and Shin (1999), respectively, whereas Ha and Fan only carry out the Levin and Lin test. As will be discussed later in the thesis, the Levin and Lin test has some obvious disadvantages over the test developed by Im, Pesaran and Shin. On the other hand, the study by Ha and Fan (2002) has the advantage of using more products and covering a longer time period. The result of my study also suggests that prices do converge among these cities, which is consistent with the finding of Ha and Fan. However, the estimated half-life of price differentials ranges from 16 to

38 months, which is considerably shorter than the average half-life of 6.5 years estimated by Ha and Fan. In addition, I also find that prices converge much faster within the Mainland cities than between Hong Kong and the Mainland cities. This finding supports that there exists border effect between Hong Kong and the Mainland.

In what follows, the next chapter summaries previous contributions in this field. Chapter 3 gives some background on the economic reform in the Mainland and the economic integration between Hong Kong and the Mainland. Chapter 4 describes the data, the methodology and empirical analyses are presented. Finally, some concluding remarks are presented in Chapter 5.

Chapter 2. Literature Review

This Chapter starts with the review of basic theories on PPP and/or law of one price, which are the main theoretical background behind why and to what extent prices should convergence across different markets. Next, empirical studies on PPP and law of one price are summarized.

2.1. The Review of Theory

The theory of purchasing power parity (PPP) is relatively simple and straightforward, and amounts to nothing more than applying the law of one price to a comparable market basket of goods and services across countries. In its simplest form, it states that in the absence of government intervention and significant freight charges and tariffs, an internationally traded basket of similar goods should sell for the same effective price when converted into the same currency. If PPP holds, in the long run the real exchange rate between two countries is stable and deviations from equilibrium are not permanent.

Let Ejt denote the nominal exchange rate between country j and a base country at time t. Then multiplying a basket of goods (normalized to one) with the ration of the prices in country j, P_{jt}, and in the base

country, P_{baset}, defines the real exchange rate Q_{jt}:

$$Q_{jt} = P_{jt} / P_{baset} E_{jt}$$

or, taking logs:

$$Q_{jt} = P_{jt} - P_{baset} - E_{jt}$$

Since prices and exchange rates are recognized to be nonstationary time series, a natural way of looking at the problem is to ask if there is linear combination of the series which renders a stationary real exchange rate, i.e. if the prices and exchange rate are cointegrated. Empirically, if real exchange rate series is mean reverting and does not accumulate shocks permanently, PPP is said to hold. Interestingly, the majority of the studies apply tests that have a unit root as a null hypothesis and literally accept stationarity if nonstationarity is rejected, which clearly is a loose interpretation of the unit root rejection.

Although simple in theory, the real world is characterized by a number of complications such as differentiated products, tastes, and costly information. So, the PPP does not always hold by numerous empirical studies. Consider, for example, McDonald's "Big Mac" Hamburgers, which clearly do not transport very well in their final form. True, some components of Big Macs, such as the frozen beef patty and special sauce ingredients, are highly traded. On the other hand, restaurant space and local labor inputs needed to cook and serve the burgers are essentially

nontraded. Big Mac prices are widely disparate across countries, with prices ranging from $5.2 in Switzerland at the high end to $1.05 in China at the low end. (Source : The New York Times, Feb 24,1995)

2.2. Empirical Studies

The modern origins of purchasing power parity can be traced back to the debate on how to restore the world financial system after its collapse during World War Two. Prior to World War Two, most countries adhered to the gold standard, in which their currencies were convertible to gold at fixed parities. The exchange rate between two currencies then simply reflected their relative gold values. When the war ended, countries faced the very real problem of deciding how to reset exchange rates with minimal disruption to prices and government finances. Simply returning to prewar exchange rates made no sense because the various belligerents had such vastly differing inflation experiences during the war.

In a series of influential articles, the Swedish economist Gustav Cassl (1921, 1922) promoted the use of PPP as a means for setting relative gold parities. Basically, he proposed calculating cumulative CPI inflation rates from the beginning of 1914 and using these inflation differentials to calculate the exchange rate changes needed to maintain

PPP. Though purchasing power parity had been discussed previously by classical economists such as John, Stuart Mill, Viscount Goschen, Alfred Marshall, and Ludwig von Mises, Cassel was really the first to treat PPP as a practical empirical theory. Cassel's writing were quite influential and PPP calculations played an important role in the debate over Britain's much criticized decision to try to restore its prewar mint parity with the dollar in 1925.

The first and most important model of long-run deviation from PPP was advanced more than 30 years ago by Balassa (1964) and Samuelson (1964). They argued that empirically, when all countries' prices levels are translated to dollars at prevailing nominal exchange rates, rich countries tend to have higher price levels than poor countries. The reason for this phenomemon, they conjectured, is not simply that rich countries have higher absolute productivity levels than poor countries, but because rich countries are relatively more productive in the traded goods sector. Nontraded goods tend to be more service intensive and there is thus less room for establishing technological superiority. Certainly, if one looks at historical data across most industrialized countries, technological progress in service-intensive goods (education, health, insurance, etc.) has been slower than for manufactures, for example, William Baumol and William Bowen (1966). A related theory

that also predicts that rich countries will have higher exchange rate adjusted price levels than poor countries is due to Kravis and Robert Lipsey (1983), and Jagdish Bhagwati (1984). Their theory depends on the assumption that capital-labor ratios are higher in rich countries (because of imperfect capital mobility) rather than the assumption that rich countries are relatively more productive in tradables.

Study after study, for many years, researchers found it difficult to reject the hypothesis that major-country real exchange rates follow a random walk under floating exchange rate regimes, That is, they found it difficult to prove that there was any convergence toward PPP in the long run. Early tests include Richard Roll (1979), Michael Darby (1983), Michael Adler and Bruce Lehmann (1983), and Edison (1985). Later papers incorporateing now standard unit root tests include John Huizinga (1987), and Meese and Rogoff (1988). Tests using cointegration methods on modern floating rate data have also typically failed to reject the random walk hypothesis. (Cointegration methods relax the assumption of long-run homogeneity between relative prices and exchange rates).

Frankel (1986, 1990) argued that the reason for failure to reject the random walk model of real exchange rates was a lack of power. He

pointed out that if purchasing power parity deviations damp sufficiently slowly, then it may require many decades of data for one to be able to reliably reject the existence of a unit root (a random walk component) in real exchange rates. Therefore, Frankel concluded, one must look at longer data sets. Employing annual data for the dollar/pound exchange rate for the period 1869-1984, Frankel was able to reject the random walk hypothesis with standard Dickey-Fuller tests. His point estimates yielded an estimated rate of decay for real exchange rate deviations of 14 percent per year, implying a half-life for PPP deviations of 4.6 years. Edison (1987) looked at dollar/pound data for the years 1890-1978 using an error-correction approach and obtained slightly weaker rejections, possibly because her sample was slightly shorter. Edison's and Frankel's papers, which mixed fixed and floating rate data, corroborated earlier results on fixed rate data given by Galliot (1970), he found evidence of convergence to PPP using data from eight countries across the years 1900-1967. These earlier papers, admittedly, did not incorporate modern unit root and error-correction methods for testing for random walks. During the 1990s, several more studies of long-horizon PPP data sets have appeared, using a variety of different approaches (including variance ratios, fractional integration, cointegration and error-correction models). These long-horizon data studies almost invariably tend to find evidence of mean reversion in real

exchange rates. Abuaf and Jorion (1990), for example, used 1901-1972 data for eight currencies, and found strong evidence to reject of the random walk model. Jack D.Glen (1992) finds similar results for nine bilateral rates over the years 1900-1987. Further rejections of the random walk model include Diebold et al. (1991), who looked at data from the gold standard period, with data samples ranging from 74 to 123 years. For exchange rates across the six countries in their sample, their findings suggest an average half-life of 2.8 years. Another long-horizon study is Cheung and Lai (1994), who find evidence of mean reversion for real rates across several countries for the period 1900-1992.

Aside from expanding the range of years covered, the other way to enhance the power of unit root tests is to expand the range of countries being considered. An early example is Hakkio (1984), who jointly tests for a random walk in four industrialized-country exchange rates against the dollar. Despite the enhanced power, Hakkio's test still failed to reject the random walk model. A spate of recent work, however, has had more success in finding mean reversion on cross-section floatin-rate data. Frankel and Rose (1995) examine a panel data set including annual data for the years 1948-1992 for 150 countries. They are able to reject the random walk model handily even using only post-1973 floating data, provided a sufficiently broad cross-section of the countries is included.

Interestingly, their results strongly suggest an estimated half-life for purchasing power parity deviations of about four years, which is very much in line with estimates obtained in the long-horizon data. Other recent studies that obtain similar estimates of convergence include Robert and Taylor (1994). Wei and Parsley (1995) address this problem by looking at post-1973 annual data for 14 OECD countries. They focus, however, only on “tradables.” Following Jose (1994), they define a good as tradable if the ratio of its exports to production, averaged over all 14 countries, is at least 10 percent. Wei and Parsley estimate half-lives for deviations from PPP in the range of 4.75 years for non-European Monetary System countries and 4.25 years for real exchange rates across EMS countries.

While there is little doubt that markets are opening worldwide, curiously academic work has begun to focus more on the amount of market segmentation, particularly in goods markets. Engel and Rogers (1996), investigated the relative importance of these type of barriers to market integration. They examined the behavior of prices of fourteen categories of consumer goods and services among 14 cities in the United States, and 10 provinces in Canada. They wonder why the price of a particular category of goods in one location fluctuates relative to the price of similar goods in a different location. They relate a measure of this

volatility to various explanatory variables, including the distance between the pairs of locations, a dummy variable for whether the locations are in different countries, and a variable meant to capture different labor market conditions in the two locations. There is related work that investigates market integration by looking at the adjustment of goods prices. A series of papers by Engel and Rogers separately (Engel 1993, 1995), Rogers and Jenkins (1995) documents that markets are very poorly integrated if final goods prices are the benchmark. Failures of the law of one price account for the vast majority of real exchange rate movements in the short run and longer for industrialized countries. In another co-authored paper, Engel and Rogers (1998), looks at the behavior of a number of categories of goods over a large sample of countries. Relative to Engel and Rogers (1996), the later paper used data from more locations--twenty-three countries and eight North American cities-but fewer goods--only eight categories. They find that relative price volatility (the volatility of prices of similar goods across locations) is a function primarily of exchange rate volatility and distance. Other similar work includes that of Wei and Parsley (1995), who find that the speed of convergence to PPP also depends on the distance between locations.

In the two recent contributions examining the convergence of prices within the U.S., Parsley and Wei (1996) find that the speed of

convergence of prices of goods sold in cities within the U.S is lower more distance the city pairs. Nonetheless, convergence tends to be much faster than is found in international price data, suggesting that national borders somehow affect the speed of convergence. O'Connell and Wei (1997) model price convergence as a non-linear process, in which the speed of adjustment is greater when relative prices lie outside of some band. This model, which fares well empirically, is meant to capture the effect of transportation costs. Goods arbitrage will not occur when prices across locations are close, even if they are not equal. But when they diverge greatly, market forces act more rapidly to cause prices to convergence. Engel and Rogers (1998)'s work on international and intra-national pricing can be considered the complement of the recent work on trade flows with and between counties. They are particularly interested in the effect of the U.S.-Canada free-trade agreement on the volatility of these relative prices. Their basic empirical results show that while distance is a significant deterrent to market integration, national borders impose a much more important barrier. But, trade barriers do not seem to explain the border effect. McCallum (1995), Helliwell (1996), Wei (1996) and Wolf (1997) all find that the volume of trade between countries is significantly less than the volume of trade within counties, taking into account other determinants of trade volumes such as distance and size of the trading unit. Using estimates from a gravity model,

Helliwell (1998) finds that the bias in trade between Canadian provinces (relative to trade between provinces and U.S. states) fell significantly after the free-trade agreement. As in Engel and Rogers (1996), they conclude that there are likely two significant reasons why the border matters so much. First, to the degree that any two markets are segmented, there is opportunity for pricing to market. If, in addition, there is nominal price stickiness and prices are set in the consumers' currencies, then Canadian and U.S. prices can diverge greatly in the short run when the nominal exchange rate fluctuates. However, this nominal price-stickiness effect does not account for all of the border effect. They posit that there are national markets for consumer goods, established by tradition, by national distribution networks, and national marketing campaigns. These national markets would lead to deviation in U.S. and Canadian prices even in the absence of nominal price stickiness.

In the appendix, I presented a summary of total 63 papers. They are summarized in terms of the research topics (PPP or law of one price), the data source, and the main results. In the column of research topics, only 15 out of 63 papers focused on law of one price. The rests all belong to the study of PPP. Among the 15 papers, 11 are finished during the 1990s. So, we can see that the study of law of one price started to

attract more attention only lately. In the late 1990s, the papers on LOP are also concerned with the border effect, namely whether or not price discrepancies are much greater cross-country than intra-country. The most popular ones are Engel and Rogers (1994, 1995) and Parsley and Wei (1996). In the next column, I summarize all the main results, and find that 28 out of 63 papers supported PPP or law of one price. Among them, 23 were done after 1990s, using more recently developed techniques, such as the error-correction model, nonlinear model, multivariate cointegration, and longer span of data or panel data.

Year	Author	Topic	Hold	Methodology
1970	Henry Galliot	PPP	YES	unit root test
1976	Dornbush	PPP	NO	unit root test
1978	Jacob Frenkel	PPP	YES	unit root test
1978	Krugman	PPP	NO	unit root test
1977,78	Ischard and Richardson	LOP	NO	unit root test
1979	Richard Roll	PPP	NO	unit root test
1981	Frenkel	PPP	NO	unit root test
1983	Michael Darby	PPP	NO	unit root test
1984	Craig Hakkio	PPP	NO	unit root test
1985	Edison	PPP	NO	unit root test
1986,90	Frenkel	PPP	YES	standard dickey-fuller test
1987	Edison and Jan. Klovland	PPP	NO	unit root test
1987	Richard C.Marston	PPP	NO	unit root test
1987	Edison	PPP	YES	Error-correction approach
1987	John Huizinga	PPP	NO	modern unit root test
1987	Paul Brenton	LOP	NO	Error-correction approach
1988	Meese and Rogoff	PPP	NO	modern unit root test
1988	Alberto Giovannini	LOP	NO	modern unit root test
1989,93	Michael Knetter	LOP	NO	modern unit root test
1991	Francis, Steve,Mark Rush	PPP	YES	modern unit root test
1991	Froot and Rogoff	PPP	YES	modern unit root test
1992	Jack D.Glen	PPP	YES	modern unit root test
1993	Engel	LOP,Border Effect	NO	modern unit root test
1993	Robert Cumby	PPP	YES	modern unit root test
1994	Feenstra and Kendall	PPP	NO	modern unit root test
1994	P.Asea and E.Mendoza	PPP	NO	modern unit root test
1994	D.Gregorio, Wolf	PPP	NO	modern unit root test
1994	Knetter	PPP	NO	modern unit root test

Year	Author	Topic	Hold	Methodology
1994	Janice Boucher Breuer	PPP	NO	Cointegration methods
1994	Engel and Rogers	LOP,Border Effect	NO	price volatility regression
1994	Cheung and Kon Lai	PPP	YES	modern unit root test
1995	Frankel and Rose	PPP	YES	modern unit root test
1995	Kenneth,Michael, Rogoff	LOP	YES	similar to Engel and Roger (1995)
1995	Wei and Parsley	PPP	NO	Panel Unit Root Test
1995	Engel and Rogers	LOP,Border Effect	NO	regression relating price volatility to distance and border
1995	Rogers and Jenkins	LOP,Border Effect	NO	ditto
1995	John McCallum	Border effect	NO	Gravity-type equation
1996	Helliwell	Border effect	NO	Gravity-type equation
1996	Parsley and Wei	LOP	YES	Panel Unit Root Test
1996	Shangjin Wei	LOP,Border Effect	NO	"Solow residuals" and gravity model
1998	Ping Wang	PPP	YES	ADF Test
1998	Engel and Rogers	LOP,Border Effect	NO	alternative measures of deviation from LOP
1999	M.Ramirez and S.Khan	PPP	YES	Cointegration and Error-correction modeling
2000	Atanas Christev	PPP	YES	Cointegration test
2000	Peter Pedroni	PPP	YES	Modified and Dynamic OLS approach
2000	David and Bernstein	PPP	YES	ADF test
2000	A.Serletis and P.Gogas	PPP	YES	Nonlinear chaotic dynamics
2000	Lucio Sarno	PPP	YES	Developed nonlinear modelling
2000	G.Khoon and D.Mithani	PPP	YES	Multivariate cointegration test
2001	Cushman	PPP	NO	Panel Unit Root Test
2001	Parsley and Wei	LOP,Border Effect	NO	same as Engel and Roger (1995)
2002	Emmanuel Anoruo	PPP	YES	Dynamic error-correction model and ADF test
2002	Alan Taylor	PPP	YES	Multivariate and univariate tests
2002	Paul O'Connell and WEI	LOP	YES	GLS panel unit root test
2002	Hajiming and K.Fan	LOP,Border Effect	YES	unit root test

Year	Author	Data
1970	Henry Galliot	data from eight countries 1900-1967
1977,78	Ischard and Richardson	Disaggregated data on US.Germen,Canadian and Japanese exports for traded goods
1984	Craig Hakkio	four industrialized-country exchange rates against dollar
1986	Luciano Milone	data in the sector of manufacturingfor Italy and UK,1973-80
1986,90	Frenkel	annual data for the dollar/pound exchange rate 1896-1984
1987	Edison and Jan. Klovland	exchange rates1874-1971, Norway and UK
1987	Richard C.Marston	real yen/dollar rate of disaggregatd OECD data
1987	Edison	dollar/pound data 1890-1978
1987	Paul Brenton	unit value trade data at the aggregate,2digit 3digit levels
1989,93	Michael Knetter	7 digit German export unit values from a single source to multiple destinations
1991	Francis, Steve,Mark Rush	data from the gold standard period ffrom 74 to 123 years of six countries
1991	Froot and Rogoff	exchange rates of some EMS countries 1979-90
1992	Jack D.Glen	nine bilateral rates 1900-1987
1993	Engel	relative prices of a large number of similar goods across borbers (US and Canada)
1993	Robert Cumby	25 countries for Big Mac index 1987-93
1994	P.Asea and E.Mendoza	disaggregated sectoral data for 14 OECD countries 1975-90
1994	D.Gregorio, Wolf	same data as above
1994	Engel and Rogers	14 CPI 23 North Ameri cities 1978-1994
1994	Cheung and Kon Lai	real WPI rates across several countries for the period 1900-1992
1995	Frankel and Rose	annual panel data for 150 countries 1948-92
1995	Kenneth,Michael, Rogoff	annual data on prices for grains and dairy products in Holland and England for six centuries
1995	Wei and Parsley	panel of 12 tradable sectors in 14 OECD country pairs
1995	Engel and Rogers	14 categories of disaggregated CPI for 23 cities in US. And Canana,1978-94
1995	John McCallum	Canadian province-level data in 1988
1996	Helliwell	Canadian province-level data in 1988-94
1996	Parsley and Wei	panel of 51 prices from 48 cities in USA
1996	Shangjin Wei	prices on goods markets among OECD countries 1982-94
1998	Ping Wang	CPI of seven Asian countries and nominal exchange rate 1970-1996

Year	Author	Data
1998	Engel and Rogers	Same as Engel and Rogers(1996)
1999	M.Ramirez and S.Khan	spot exchange rate and CPI of 5 major countries 1973-1996
2000	Atanas Christev	prices and exchange rates i in six central and east european countries
2000	Peter Pedroni	panel of post Bretton Woods data
2000	David and Bernstein	quarterly data of exchange rate of EU currency/US dollar and CPI 1979-1996
2000	A.Serletis and P.Gogas	dollar-based real exchange rates for 7 OECD countries 1957-1995
2000	Lucio Sarno	CPI and bilateral exchange rate forTurley,US,UK,France 1980-1997
2000	G.Khoon and D.Mithani	quarterly data of CPI-based(73-97) and WPI-based(84-97)real exchange rate of Malaysia
2001	Parsley and Wei	27traded goods. 88 quarters. 96cities in US and Japan
2002	Emmanuel Anoruo	quarterly data of nominal exchange rates and ratios of 11 developing countries CPI to US 1961-99
2002	Alan Taylor	annual exchange rates and price index of 20 countries 1950-96
2002	Paul O'Connell and WEI	the same with WEI (1996)
2002	Hajiming and K.Fan	panel data on commodity prices of hk and four mainland cities

Chapter 3. Background Information

3.1. Economic Reform and Development of China

During the process of economic transition over the past two decades, China has been pursuing a path of development in line with the reality of the country. Thanks to this approach, China successfully combined a market mechanism with its cardinal public ownership system and in so doing ushered in an era of unprecedented progress. China's gross domestic product (GDP), on average, advanced by 9.3 percent each year from 1978 to 2000. The wide shortage of commodities at the time of the planned economy has gone and the livelihood of Chinese residents has improved significantly.

In 1992, encouraged by Deng Xiaoping’s exhortation during his famous tour of Southern China for the economy to invest and grow, China experienced a major increase in investment and China began to fix the goal of establishing a market-orientated economy. The move was a natural result of the ever-deepening reforms as commodity and labor prices were freed up and the capital, real estate and technology markets took shape. Today the market mechanism is playing a fundamental role in the economic life of China. While the market system was introduced

to replace a rigidly planned economy, the Chinese Government was also taking steps to adapt its role and establish an effective macro-control system in line with the new economic structure. The government reformed the financial system and strengthened the central bank's power to supervise the market and safeguard the stability of currency. It also implemented a proactive fiscal policy to maintain steady economic growth. There were many successes in the government's management of the economy, such as the 1996 "soft landing" which curbed inflation effectively.

This progressive approach also helped China push ahead with an in-depth ownership reform. By fostering non-State economic entities like private firms, China established a multiple ownership system. Some mixed-ownership enterprises, such as share-holding companies and share-holding partnerships now play a very active role in China's economic growth. More, the domestic private sector is currently experiencing a relative boom in growth-both economic growth and growth in its legitimacy and prestige. By 1997, there were 960000 registered private firms in China, employing 13.5 million people. The boom is a result of the 1999 decision to grant the private sector greater constitutional protection and legitimacy. Today, non-State economies account for more than 40 percent of the country's GDP, while the

state-run economy holds a leading position in some key sectors including energy, transportation, telecommunications, the arms industry and high-tech sectors. The reform of State-owned enterprises, designed to introduce a modern corporate system, is now conducted according to law and the market mechanism, rather than by the government's policies or even direct interference as used to be the case. Generally speaking, the success of China's economic transition strategy is attributable to the correct understanding of the reality of the country, as well as the trend of the times. As China lags behind developed countries in economic strength, there is a long way to go to turn this ancient nation into an industrialized modern economy. Therefore, profound reform measures are essential to realize the swift and sustained development of China. Such measures include ownership reform, introduction of a market mechanism, reform of the distribution system to ensure people enjoy the fruits of their labor, and active participation in international co-operation and competition.

In order to extend the regulatory function of the market, the state has gradually reduced the categories of products for planned production, eliminated the restriction that enterprises were only allowed to engage in production but not in business operation, and abolished the practice of the state fixing commodity prices. As a result, the rights of enterprises to

purchase, produce and sell have been extended. Enterprises may organize and establish wholesale markets and trading centers; the wholesale and retail commercial systems are being restructured; and the non-public economy is allowed to take part in commercial activities. Through the reform, the unitary pattern in which the public economy monopolized commercial activities has been broken up step by step, and the commodity market pattern of diversified economic elements and operation forms with the public ownership of commerce as the main body has been established. Before 1978, there were 791 products belonging to means of production allocated according to state plans, but now only five of them remain, and the rest have entered the market. Now, department stores, supermarkets and chain stores are scattered everywhere in both rural and urban areas. In 1999, China had 1,800 China stores, over 2,000 various flea markets, over 1,000 leasing enterprises, and over 1.000 auction enterprises. Meanwhile electronic commercial business has developed rapidly; the agent system has been widely adopted by various trades; great progress has been made in the circulation and delivery of commodities, and modern material circulation enterprises have replaced traditional storage and transport enterprises. A great variety of food, clothing and other commodities satisfy the needs of consumers. The total market sales grow with each passing year. In 1999, the rural market achieved 1,204.3 billion

yuan-worth of sales of consumer goods, 11.4 times the figure in 1978; the urban market achieved 1,909.2 billion yuan-worth of sales of consumer goods, 37.8 times the figure in 1978. At the same time a buyer's market has appeared in the commodities sector in which the supply and demand of most commodities are kept in balance, the supply of some goods exceeds the demand, price trends are steady, and the guiding function of the market for producers has been strengthen.

The price reform was carried out in much the same way. The control of grain price was first loosened in 1979, when the prices of nearly all commodities and labour costs were fixed by the government. But since the start of the reform and opening, along with the expansion of the commodity market scale and the change of the relations between commodity supply and demand, the state has carried out price reform step by step and according to plan. The fixing of prices by the state follows three forms: the fixing of price by the state, state guiding prices and market regulatory prices. The government started to deregulate the prices of most commodities in 1985. In 1992, the number of categories of government-priced commodities was slashed to 89 from 737, which marked the formation of a market-based pricing system in China. The market regulatory price has been gradually relaxed-By 1999 the pricing of 95 percent of consumer goods and 80 percent of investment goods had been relaxed. These prices were regulated mainly through the

relations between market supply and demand. A socialist market pricing mechanism is gradually taking shape. In the pricing system the irrational state of basic product prices being too low has been improved, and the pricing structure is becoming more rational, step by step. Comparing 1998 with 1978, the index of the retail sales prices of rural industrial products increased by 3.88 times; and the index of the synthetic relative prices between industrial and agricultural commodities was 59.7 percent. Besides, the price scissors in the exchange of industrial products for agricultural products were alleviated. In 1998, the prices of agricultural products increased by 5.83 times, compared with those of 1978, and the prices of industrial products by 2.95 times, and their price ratio was 0.6 : 1. In accordance with the requirements of the socialist market economy, China has been establishing a pricing mechanism that is macro-regulated and controlled by the government, and fixes prices through the market.

In summary, the policy of “reform and openness” first promoted by Deng Xiaoping in the late 1970s is, of course, widely seen as a great success. So successful, in fact that by the late 1990s, the Chinese leadership was aggressively pursuing membership in the World Trade Organiztion. Accession to the WTO (2001) marks the China’s full fledged acceptance into the global economy and shows the leadership’s determination to continue to pursue increased openness, increased

foreign investment, and dramatically increased competition within the domestic economy. Meanwhile, China's economy relationship with Hong Kong is getting strengthened year by year, especially after the Hong Kong's return to China in 1997.

3.2. Economic Integration between the Chinese Mainland and Hong Kong

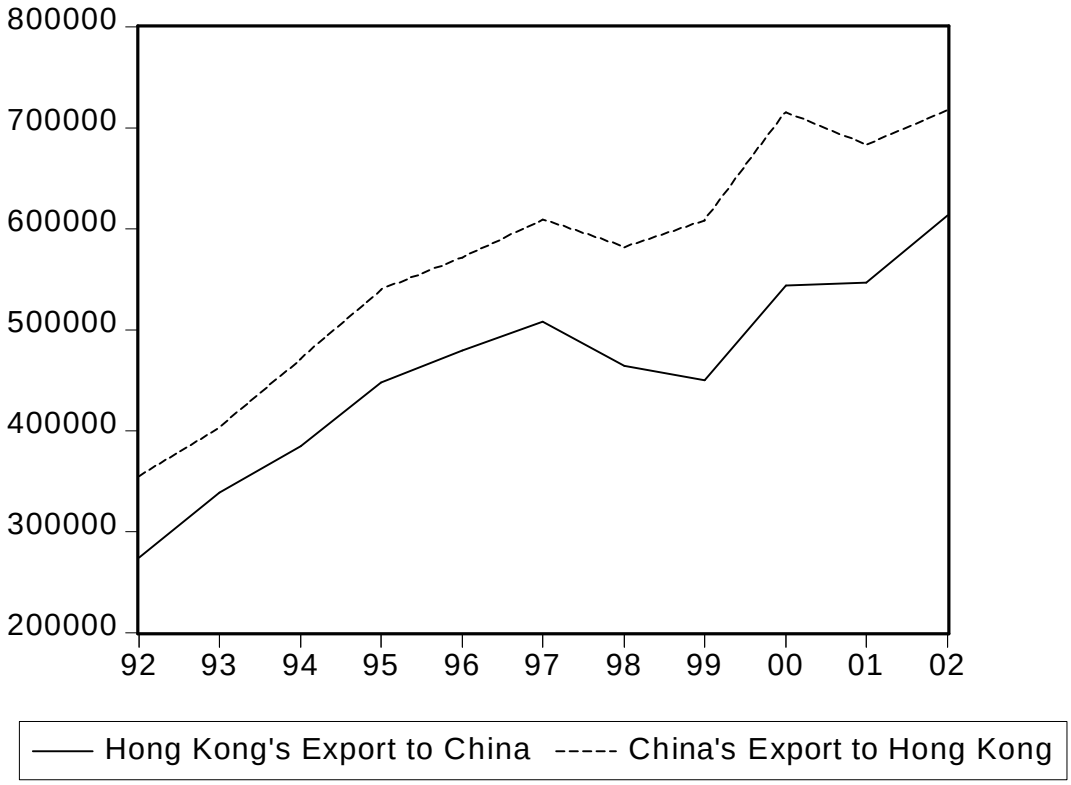
During the 1960s and 1970s, an abundant supply of inexpensive lab or supported the rapid growth of Hong Kong's manufacturing sector. By the late 1970s, however, Hong Kong's competitiveness in manufacturing had started to erode as land and labor cost rose, When China began its policy of economic reform in 1978, manufacturing started to relocate from Hong Kong to southern China, where labor and facility costs were much lower. By the mid-1990s, according to private estimates, about 25000 Hong Kong firms were operating plants, employing a total of 45 million workers, in southern China.

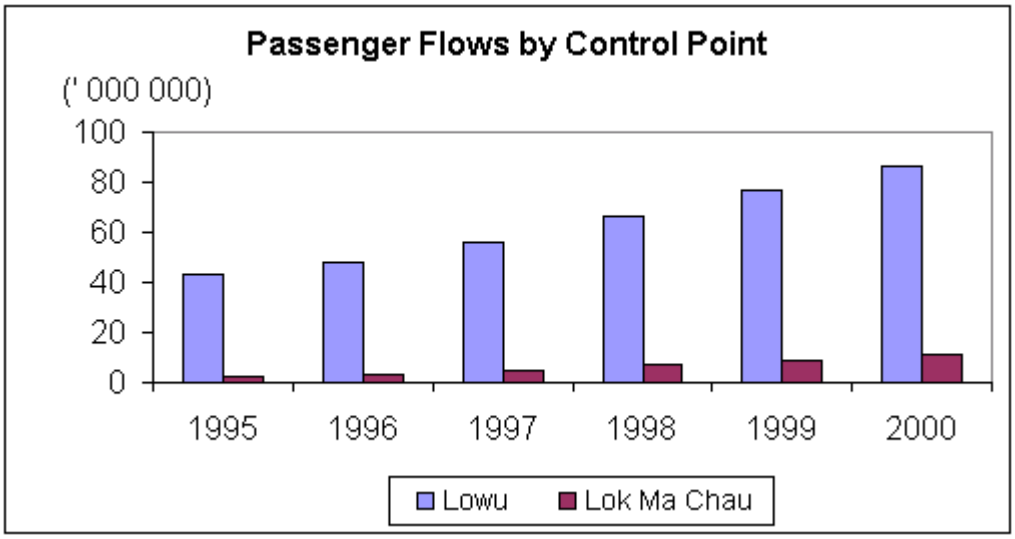
The extensive transfer of manufacturing operations and sustained rapid increase in China's export activity boosted the development of supporting service industries in Hong Kong, most notably in trade and financial services. With the relocation of manufacturing operations to China and the development of supporting services industries in Hong

Kong, the two economies have become more closely linked. The correlation between the cyclical components of Hong Kong's GDP and industrial production in China rose sharply in the late 1980s and has remained high during the 1990s. In part, this is explained by the expansion of bilateral trade flows between Hong Kong and China. (see the chart) The share of Hong Kong's total exports going to China rose from 6 percent in 1980 to one third in 1996. (Figures from World bank)

One major force shaping Hong Kong is its economic integration with the Pearl River Delta area. The relocation of Hong Kong's manufacturing facilities to the north of the boundary over the past two decades has to a great extent tied Hong Kong's export performance to manufacturing activities undertaken in its immediate hinterland. Re-exports now account for nearly 90% of Hong Kong's exports, the bulk of which either originate from or goes to the Mainland. As such, the gradual shift in the Mainland's export gravity from the Pearl River Delta area to eastern and northern China in recent years is a cause for concern. In the first 10 months of 2001, Hong Kong's re-export declined by 3.4%, while Mainland's exports rose by 6.1%, reflecting this trend as well as an improvement in port facilities in Shenzhen. (Figures from Hong Kong 2002)

With China’s WTO accession in 2001, it is possible for Hong Kong and other overseas companies to be major stakeholders in mainland entities across a wide range of sectors. They will have access to the mainland market as domestic entities enjoying national treatment. Accession will be a defining moment in terms of the mainland’s further integration with the world economy and for Hong Kong’s pivotal role in that process. Hong Kong is the mainland’s most important trade partner, handling over 40 percent of China’s trade, it is also the mainland’s largest source of foreign direct investment. The economy fortunes of both China and Hong Kong will be influenced more and more by the performance of each other’s economy, and both must continue to adjust to the rapidly changing environment in order to realize growth potential.


800000
700000
600000
500000
400000
300000
200000
92
93
94
95
96
97
98
99
00
01
02
Hong Kong's Export to China
China's Export to Hong Kong


Passenger Flows by Control Point
(' 000 000)
100
80
60
40
20
0
1995
1996
1997
1998
1999
2000
Lowu
Lok Ma Chau

Chapter 4. Empirical Studies

In this Chapter, I first describe the data. Then, I discuss the empirical approaches used for this study, i.e. the two panel unit root tests developed by Levin and Lin (1992) and Im, Persaran and Shin (1999), respectively. Finally, I present my findings and analyse the results.

4.1. The Data

The study used a panel data set of monthly product prices from- Hong Kong, Beijing, Shanghai, Shenzhen, and Guangzhou for the period January 1997 to September 2002. The price data for Chinese mainland cities were collected from the China Price Information Centre (under the National Development and Reform Centre). These are actual price data for products ranging from agricultural products, industrial materials and services. For the Hong Kong data, I used monthly consumer price index data published by the Hong Kong Census and Statistics Department. I only select those price indexes that are for very specific type of goods or services to match with the corresponding goods or services in Chinese Mainland (e.g. price index for beef in Hong Kong is used to derive price for beef in Hong Kong and then matches with price for beef in the mainland). As the Hong Kong data are not actual price data but indexes,

I went to markets to obtain the Hong Kong spot price data in September 2002. Then, I converted all price indexes into actual prices. I further converted all Hong Kong prices into Renminbi (yuan) and also with the same measurement unit as the corresponding prices for the products in the mainland.

For the purpose of studying price convergence, I really need to choose prices for reasonably homogeneous products across these cities. For the mainland products, they were all meant to be specific homogeneous products when collected by the government. However, the Hong Kong data were mostly for different categories of products, rather than specific product. So, I only managed to match seventeen products and services from these two data sources, which were all by and large quite specific and could be reasonably view as homogeneous. This list of these seventeen products and services and their simple descriptive statistics can be found in Table 1.

In Table 1, I further group these seventeen products and services into three groups: tradable, semi-tradable and services. Within the tradable, I have Pork, Beef, Rice, Eggs, Sugars, Edible oils, Chinese wines, Beer, Cigarettes, Motor fuel, totally ten kinds. Semi-tradable goods include Jewelry, Electricity and Hair-dressing, they are so classified as it is

debatable on whether they can be traded or not. For example, Hong Kong imports electricity from Dayawan nuclear power station, within the Mainland. There are also electricity networks across different regions that belong to some large state-owned electricity suppliers. Someone could also argue that since so many Hong Kong residents go to Shenzhen for hair-cut services regularly, Haircut may also be viewed tradable at least between Shenzhen and Hong Kong. Jewelry was listed under this category simply due to the fact that the Chinese Custom set limit on the quantity of jewelries any traveler can bring into China. The remaining four categories fall into the category of services, they are Medical services (hospital in-patient fee per day), School tuition fee, Taxi fares, Liquefied petroleum gas. For the purpose of testing market convergence, the use of tradable goods is already sufficient. I also include some apparently non-tradable goods or services in my dataset for the following two reasons. First, it is increasing more difficult to draw a clear line between tradable and non-tradable goods now, especially facing rapid increase in economic ties between Hong Kong and the mainland. Secondly, the inclusion of some of the non-tradable goods may enable us also to look at other aspects of convergence, such as living standards and institutional arrangements. In what follows, I test price convergence based on both individual product and these product groups. So the classification here should not greatly influence the results

of my study.

4.2. The Methodology

Panel unit root tests have been the widely applied in the testing of PPP/LOP in recent years. This is due partly to the fact that they are more powerful than unit root tests for a single time series data and partly to the availability of panel data with long time span. I also apply two popular panel unit root tests in my study, i.e. the test developed by Levin and Lin (1992, thereafter the LL test), and the test developed by Im, Perasan and Shin (1997, thereafter IPS test).

Specifically, the test of price convergence is typically carried out by estimating the following equation:

$$\Delta q_{i,k,t} = a_{i,k} + b_i q_{i,k,t-1} + \sum_{n=1}^{N} g_n \Delta q_{i,k,t-n} + e_{i,k,t}$$

where $q_{i,k,t}$ is the log-difference in the price of product i in city k, relative to the mean price of all cities for commodity i at time t, and Δ is the first difference operator. The length of lags N, used to account for possible serial correlation in the error term.

Central to the test of convergence is the estimated value of b_i. If $b_i \geq 0$, the price differential $q_{i,k,t}$ is non-stationary, implying persistent or

explosive price divergence. A negative and significant value of b_i suggests price convergence, and its magnitude determines the speed of convergence. Specifically, the half-life of a shock to the price differential is computed as $-\ln(2)/\ln(1+b_i)$. If equation is estimated using annual data, an estimated value of b_i, say –0.5, suggests that the price differential is to be reduced by half in 1 year, other things being equal. The estimated value of $a_{i,k}$ can be used to test the hypothesis of long-run price equalization. A value of $a_{i,k}$ not significantly different from zero suggests that the price of product i in the benchmark city will eventually be equal to that in city k. On the contrary, a value of $a_{i,k}$ significantly positive suggests that the price of product i in the benchmark city will be persistently higher than that in city k.

The distribution of price differentials provides important information about how different price discrepancies across products and cities are. If price differentials (in percentage terms) are not much different across products, they are more likely to be explained by factors such as transportation cost. However, if price differentials differ significantly, the distribution will have a large standard deviation, suggesting a broader range of factors behind the differentials. For basic information on price deviation, mean absolute value of price differentials can be used. The price differential $q_{i,k,t}$ is defined as the log difference in the

price of commodity i at time t between city k and the mean price of all cities for commodity i at time t, i.e.

$$q_{i,k,t} = \ln(p_{i,k,t} / \bar{p}_{i,t})$$

At any given point of time, the standard deviation and the mean absolute value of $q_{i,k,t}$ across products and cities provide measures of price dispersion of that time.

The analysis of unit roots and cointegration in panel data has been a fruitful area of study in recent years, with Levin and Lin (1992) and Im, Pesaran and Shin (1999) being the seminal contribution in this field. In my study, I carry out both of these tests, not only because they are widely used by international scholars, but also the two tests have distinctive features. The LL test can be seen as a natural extention of the Dickey and Fuller (1981) test for a unit root to a set of time series. It extends the method previously suggested by Quah and Breitung and Meyer (1991). In the light of the criticism by Perasan and Smith (1995) on the use of pooled regression of the LL, Im et al. (1999) developed a test to allow for heterogeneity of the series under the alternative. Their approach do not make use of traditional panel estimation techniques but a group-mean Lagrange multiplier test and a group-mean t-test based on the individual ADF test statistics.

More specifically, the LL test assumes that each individual unit in the panel shares the same AR(1) coefficient, but allows for individual effects, time effects and possibly a time trend. Lags of the dependent variable may be introduced to allow for serial correlation in the errors. The test may be viewed as a pooled Dickey-Fuller test, or an Augmented Dickey-Fuller test when lags are included, with the null hypothesis that of nonstationarity. After transformation, the t-star statistic is distributed standard normal under the null hypothesis of nonstationarity. The structure of the LL test analysis may be summarized in the following equation:

$$\Delta Y_{i,k,t} = a_u + d_i t + q_t + b_i\ Y_{i,k,t-1} + x_{i,t}, i = 1,2.....N, t = 1,2....T.$$

It allows for fixed effects and unit-specific time trends in addition to common time effects. The unit-specific fixed effects are an important source of heterogeneity here since the coefficient of the lagged dependent variable is restricted to be homogeneous across all units of the panel. The Levin and Lin tests amount to testing for the null hypothesis

$H_0 : b_i = 0$ for all i, against the alternative $H_A b_i \langle 0$ for all i, with auxiliary assumptions under the null also being required about the coefficients relating to the deterministic components. The main theorem in Levin and Lin relate to deriving the asymptotic distributions of the panel estimator of b under different assumptions on the existence of

fixed effects or heterogeneous time trends. The simplest cases to consider are for $x_{i,t} \sim IID(0, s^2)$ for fixed i, the errors are also assumed to be independent across the units of the sample. For example, if $a_i = d_i = o$ for all i and there are no common time effects, then the asymptotic distribution of the ordinary least squares pooled panel estimator b is given by

$$T\sqrt{N}\,b \Rightarrow N(0,2), T, N \to \infty \qquad t_{b=0} \Rightarrow N(0,1)$$

Here the convergence rate to normality of the coefficient estimator is faster as $T \to \infty$ than as $N \to \infty$.

In summary, the Levin and Lin contained the elements: the demonstration of asymptotic normality subject to suitable scaling and corrections, the necessity of focusing on the rates at which T and N tend to infinity, the issue of homogeneity versus heterogeneity (under the null and the alternative hypotheses). The Levin and Lin framework was restrictive in this sense in requiring b to be homogeneous across i, the maintained assumption of independent across cross-section units and the correction or modifications required to allow for dependent and heteroscedastic error processes and the resulting endogeneity of the regressors.

The main extension by Im et al. (1999) of the LL test framework was to allow for heterogeneity in the value of b under the alternative

hypothesis. A small modification of the above equation makes the point clearer. Let:

$$\Delta Y_{i,t} = a_i + b_{i,k} Y_{i,t-1} + x_{i,t}, i = 1,2..., N; t = 1,2,...T.$$

The null and alternative hypotheses are defined as:

$H_0 : b_{i,k} = 0$ for all i,k against the alternatives

$H_A : b_{i,k} \langle 0$ there is at least one $k,$ such that

and the errors $x_{i,t}$ are serially autocorrelated with different serial correlation properties across units. In view of the well-known objections of Pesaran and Smith on the use of pooled panel estimators, such as those used by Levin and Lin, for processes which display heterogeneity of the kind given above, Im et al. propose the use of a group-mean lagrange multiplier statistic to test for the null hypothesis.

The IPS statistics is defined as:

$$Z = \sqrt{N}(t - E(t)) / \sqrt{Var(t)}$$

where $t = (1/N)\sum_{i=1}^{N} t_i$; t_i is the t statistic of $b_i = o$; and $E(t)$ and $Var(t)$ are the mean and variance of t, respectively. As $E(t)$ and $Var(t)$ cannot be directly calculated, they have to be bootstrapped. The exact bootstrap procedure is provided by the IPS test routine in STATA. It is also worth noting that IPS test, in some ways, is better than LL test, for it relaxes the restriction on uniformity of b as well as using a less restrictive alternative hypothesis.

4.3. Empirical Results and Implications

This part begins with a statistical analysis of the data, focusing on changes of price dispersion over time and the current level of average price differential. It then tests the hypothesis of price convergence between Hong Kong and the Mainland using the LL and IPS panel unit root tests, and calculates the half-life of price convergence. Lastly, It tests if there exists border effect between Hong Kong and the Mainland, i.e. if differences in speed of price convergence are somehow related to the existence of a border between Hong Kong and the Mainland.

Basic Statistics:

Before discussing my regression results, it is useful to look at some summary statistics of the price data. The distribution of price differentials provides important information about how different price discrepancies across products and cities are. If price differentials are not much different across products, they are more likely to be explained by factors such as transportation cost. However, if price differentials differ significantly, the distribution will have a large standard deviation, suggestion a broader range of factors behind the differentials. In this study, I use Shenzhen as the benchmark city, for it is nearest to Hong Kong and so can be best used to test the border effect. This choice of benchmark city is entirely arbitrary, and should not affect the results at

all.

Table 1 shows the descriptive statistics of prices commodity by commodity. Column one shows mean prices of four mainland cities while Column two lists mean price for Hong Kong alone. We can see at first glance that except the category of Edible oils and Jewelry, for the remaining fifteen categories, the mean prices are always higher for Hong Kong relative to Mainland cities. The significance of t-tests for differences in means shown in column three proves that there exist price discrepancies between Hong Kong and the mainland for all products in my dataset. However, it does not necessarily mean that prices do not convergence as price convergence is not equivalent to zero price gap. Price convergence, as it called, means the price differentials follow the mean-reverting and stationarity process. In order to give a structural description, I sort all the commodities into two category in Table two, tradable goods (including 10 commodities) and semi-tradable and services (the remaining 7). In the upper panel of the table for tradable goods, the mean value and standard deviations for prices are similar for Beijing, Shenzhen and Shanghai and Guangzhou. It indicates that tradable goods prices are more likely to converge in China. However, in the lower panel of the table for service group, something seems to be a bit puzzling. For Shenzhen, Shanghai and Guangzhou, the most open cities in China, have little discrepancies in mean values and standard

deviations exist just like before, but much lower values are found for Beijing. The reason for such big gap lies in the fact that in the category of high school tuition fee, Beijing's data is substantially collected from common high school, while other cities' are from famous and expensive private school. Hong Kong's mean value and standard deviation are much different from the four mainland cities'. It is not surprising, for Hong Kong has much higher income level and living standards than the rest.

Next, I calculate the mean absolute values of price differentials with respect to the benchmark city and the corresponding standard deviations. Likewise, I first present the statistics for each of the seventeen commodities. Table 3 shows the price dispersion by pooling the data for Hong Kong and Mainland together while Table 4 shows the price dispersion within the mainland cities only. It is clear by comparison that for all these seventeen categories both the mean absolute values of price differentials and standard deviations are to some extent, bigger when Hong Kong is included than when it is not. Note also with or without of Hong Kong the corresponding figures are always much greater than that across US cities or countries in Euro area (the standard deviation of price differentials is 0.17 for the US cities and 0.11 for the European countries, see Ha and Fan (2002)). Differences in income levels, degree of factor mobility, and monetary and tax policies are probably the

factors behind a larger price dispersion between Hong Kong and the Mainland, as well as amongst Chinese cities. The contents of two tables can also be best illustrated in a series of graphs. For each product/service, I draw one graph for the following city pairs: Beijing-shenzhen, Shanghai-shenzhen, Guangzhou-shenzhen, and Hong Kong-shenzhen again Shenzhen is the benchmark city. We can see, without exception, the price differentials between Hong Kong and Shenzhen are the greatest, thought the two cities are the closest geographically. This probably indicates some border effect, which will be discussed in details later. The four lines in each graph seem anomalous at first glance. However, if we observe carefully, we could also find the tendency of these lines to follow a mean-reverting. The discrepancies are gradually diminishing. This finding offers a first impression that price convergence may exist between Hong Kong and China.

Secondly, I examine price dispersion by grouping commodities into two groups, i.e. tradable s vs. non-tradable (semi-tradable and services). Table 5 reveals that tradable goods have much smaller mean variability and mean absolute values in price differentials than non-tradable goods. This coincides with what was put forward by Engel (2000).

Regression Analysis of Price Convergence:

I now turn to the regression analysis. As discussed before, to test price convergence is equivalent to test if the price differential series are stationary or not. Practically, this requires us to carry out unit root test for the price differential series, $q_{i,k,t} = \ln(p_{i,benchmark,t} / p_{i,k,t})$, where $p_{i,k,t}$ is the the price of product i in city k at time t). Following Parsley and Wei (1996), we also run panel unit root test as it can significantly raise the power of unit root test (see Levin and Lin, 1992).

First, I carry out the LL test for seventeen categories separately. The results are presented in Table 6 and 7. In Table 6, we include Hong Kong as one cross-sectional unit (there are in total 4 cross-sectional units here as Shengzhen is the benchmark city and has to be dropped). The results indicate that for seven out of ten tradable goods and one out of four services we can reject the null hypothesis of having a unit root, In other words, their prices converge. The estimated half-lives for these converged prices range from 0.43 month (eggs) to 6.93 months (hospital in-patient fee), with generally shorter half-lives for tradable goods. Furthermore, I also pool all the prices together and run an overall unit root test. The result shown at the bottom of Table 6 indicates that there is an overall price convergence at significance level below 1%. The overall half-life is 16.29 months. Table 7 simply repeats the work for the

mainland cities only. It emerges that for the mainland cities alone the prices for an additional semi-tradable good (Jewellery) and one service (High school tuition fee) converge, too. More importantly, The estimated half lives for almost all converged prices are shorter in Table 7 than in Table 6 (Edible oil is the only exceptional case), and the overall half-life is 8.37 months, which is about half of the length in Table 6.

It is interesting to compare my results here with those of Ha and Fan (2002) as we all look at the same cities and use the same LL test. Based on the annual price data collected by the Economists Intelligent Unit, they found that the average half-life of price differentials is estimated to be around 3 years amongst Chinese cities, and 6.5 years when Hong Kong was included. The much longer half-life estimated from their study may be attributable to the fact that they used annual price data. The monthly price data used in my study should be more closely matched with the actual time-span needed for price arbitrage, and therefore are subject to less measurement problem (see Taylor (2001) for the discussion on the pitfall of using low frequency data to study price convergence). Similarly, Parsley and Wei (1996), using quarterly data, found that average half-life of price differentials among a group of 48 US cities was about 1-1.25 years for goods, and 5 years for services. This was also somewhat longer than my results here. Overall, if my

estimated results are true it demonstrated that not only there is strong evidence to support price convergence both within Chinese cities and between Hong Kong and the mainland but also the speed of price convergence could be on the par with that in the US.

Then I repeat the LL test with an added city-specific fixed effect in the model. The inclusion of the fixed effect can better capture any city-specific heterogeneity in transaction cost, institutional settings and etc., and hence should result in even stronger support for price convergence. Indeed, results in Table 8 (with Hong Kong in) and 9 (without Hong Kong) demonstrate that more product prices now converge. However, it is a little bit puzzling especially for the results with Hong Kong that for some of the tradable goods their prices are found to be convergence without fixed effect but not so with fixed effect. It is also the case that the speed of convergence based on the estimated half-life is now generally longer with the fixed effect (overall 38.57 months with Hong Kong prices) than without the fixed effect (only 16.29). Such results, although are consistent with those found by Parsley and Wei (1996), are hard to be interpreted.

Next, I employ the IPS test as an alternative approach to test panel unit root. As explained before, the main difference between the LL test and

the IPS test lies in whether or not the coefficients under test are restricted to be the same across different cross-sectional units. In other words, the rejection of unit root under the LL test means that prices across all cities have to converge and also at the same speed. On the contrary, the IPS test rejects the unit root hypothesis if the price differentials in any one of the cities are stationary. Table 10 and 11 show the results for the IPS test, with the former includes Hong Kong. Not surprisingly, with the relaxation of the restrictions imposed on the coefficients, more evidence of price convergence can be established. In the case of with Hong Kong data, I find price convergence for one more tradable good (Motor fuel) and one semi-tradable good (Hair-dressing). For the case without Hong Kong, there are also two more prices (Motor fuel and Hair-dressing) that converge. These results all fall into my expectation and further enhance the claim that there is strong evidence to support price convergence within the major mainland cities and between Hong Kong and the major mainland cities.

Border Effect:

In this part, I focus the test of price convergence for four city-pairs, to show which factor, geographic distance or the existence of border, is more important to determine the speed of price convergence. For if the distance is the more important factor behind the speed of price

convergence, we should observe that prices converge quicker between Hong Kong and Shenzhen than between Shenzhen and any of the other Mainland cities, as Hong Kong is at no distance from Shenzhen. Otherwise, it can be said that the existence of a border between Hong Kong and the mainland may have a major role to play on price convergence. In the panel of Table 12, I estimated the speed of price convergence for four distinctive city-pairs: Shenzhen-Beijing, Shenzhen-Shanghai, Guangzhou-Shenzhen, Shenzhen-Hong Kong. The results show that overall prices converge for all these city pairs. More importantly, the speed of convergence based on the estimated half-life is substantially greater for Shenzhen and Hong Kong than for any of the other pairs. Furthermore, there seems to be little differences in speed of price convergence across the three mainland city pairs, indicating strongly that geographic distance plays a minor rule here to explain the speed of price convergence. The existence of border effect may be contributed by any differences in institutional settings, consumer preferences and living standards, etc. This finding is also consistent with the study for the US and Canadian cities conducted by Engles and Rogers (1996).

Chapter 5: Conclusions

To summarize, there are a few noteworthy observations. First, I found statistical evidence of price convergence between Hong Kong and China, using a panel monthly data of commodity prices in Beijing, Shanghai, Shenzhen, Guangzhou, and Hong Kong for the period 1997 to 2002. Secondly, tradable goods are generally more likely to show price convergence than services, and the speed of price convergence for tradable goods are also generally faster than for services. It is also the case that the speed of price convergence based on estimated half-life is faster within Mainland cities than within Mainland cities and Hong Kong Finally, based on the estimated speed of price convergence for city pairs, I also find that is a strong border effect between Hong Kong and the mainland. The nature of such a border effect may be due to big income gaps between the two places. Our tests of price convergence are also robust for two different panel unit root tests as well as for different model specification (with or without fixed effects).

The current evidence suggests that there is already high level of integration between the markets in Hong Kong and the mainland. Looking into future, one would have the confidence to say that the speed of price convergence might accelerate in future years, owing to the

increased economic integration of Hong Kong and the mainland, and reduced income and productivity gap.

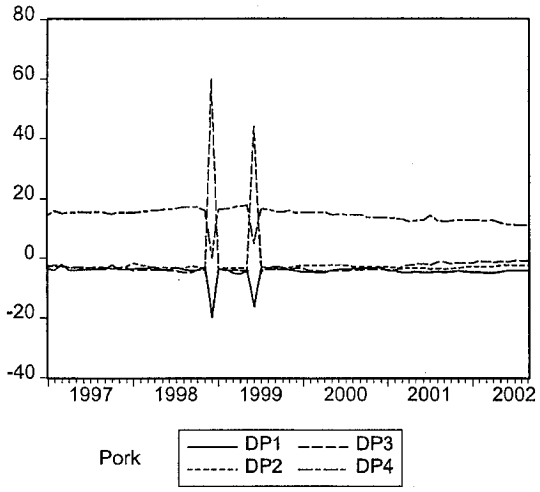
Future researches on this subject may be developed alone the following lines. First, more products and longer time series data may be collected to carry out the study, especially for more product as the current study has only managed to use seventeen products. Secondly, more elaborated panel unit root tests may be developed and applied to overcome the problem with overly restricted and relaxed null hypotheses under the LL test and the IPS test, respectively. Furthermore, one may also consider test price convergence using a non-linear framework as propose by Taylor (2001).

TABLE 1: Descriptive Statistics of Prices (1)			
	Mean (Mainland)	Mean(HK)	Significance
Tradable:			
Pork ($/Jin)	8.328	25.94	***
Beef ($/Jin)	8.399	37.5	***
Rice ($/Jin)	1.5	4.28	***
Eggs ($/Jin)	2.907	8.177	***
Sugar ($/Jin)	2.367	5.387	***
Edible oils ($/kg)	4.025	0.735	***
Motor fuel ($/litre)	3314.8	11809	***
Chinese Wines ($/bottle)	17.712	41.737	***
Beer ($/tin)	3.802	9.352	***
Cigarettes ($/pack)	9.704	38.69	***
Semi-tradable			
Jewellery ($/g)	111.333	63.18	***
Electricity ($/Joule)	58.363	109.243	***
Hair-dressing ($/one)	12	121.3	***
Service			
Petroleum Gas ($/bottle)	4.604	54.344	***
Taxi fares ($/km)	2.152	7.447	***
High school tuition fee ($/semester)	482.75	5494	***
Hospital fee ($/day)	21.732	47.822	***
Sample Size: 276 for Mainland China, 69 for Hong Kong .			
Column Three is: Significance of Test of Differences in Means.			
***** means at 0.01 level of significance**			

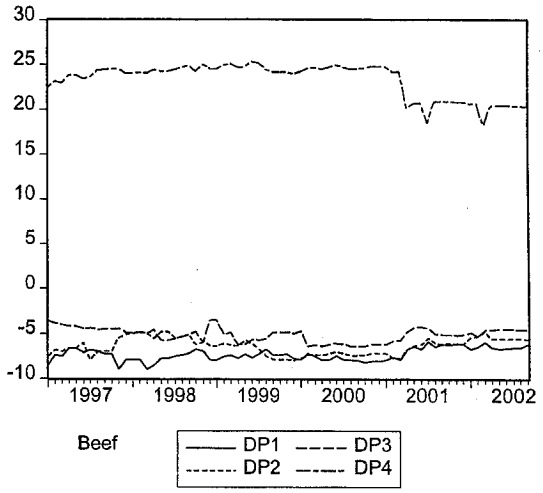
TABLE 2: Descriptive Statistics of Prices (2)					
Tradable goods					
	Beijing	**Shenzhen**	**Shanghai**	**Guangzhou**	**HongKong**
Mean	335.6	336.9	339.7	337.4	1197.4
Std. Dev	1002.5	1014.8	1015.9	1024.8	3546
Obs	690	690	690	690	690
Semi-tradable and Services					
	Beijing	**Shenzhen**	**Shanghai**	**Guangzhou**	**HongKong**
Mean	55.1	111.9	108.4	120.4	842.6
Std. Dev	83.8	211.7	213.6	211.2	1924.5
Obs	483	483	483	483	483
Sample Size: 690 for Tradable goods					
483 for Semi-tradable and Services					

TABLE 3: Variability of Price Differential, Hong Kong and Mainland China			
	Mean	Abs(mean)	Std. Dev
Tradable:			
Pork	1.031899	6.769	9.245
Beef	1.080551	10.56	12.92
Rice	0.070894	1.15	1.398
Eggs	0.167246	2.046	2.572
Sugar	0.05337	1.256	1.647
Edible oils	0.658428	1.975	2.035
Motor fuel	427.9986	1969	3715.954
Chinese Wines	-2.43051	15.41	16.23
Beer	0.383732	2.07	2.569
Cigarettes	1.685145	1.15	19.976
Semi-Tradable			
Jewellery	-1.09123	18.35	22.86
Electricity	-0.42215	20.87	26.375
Hair-dressing	7.215942	36.51	46.78
Service			
Petroleum Gas	1.73	19.89	23.07
Taxi fares	0.202754	1.915	2.374
High school tuition fee	216.5362	1788	2235
Hospital fee	0.260043	10.22	12.66
Sample Size: 276 observations			
Cross Section: 4			

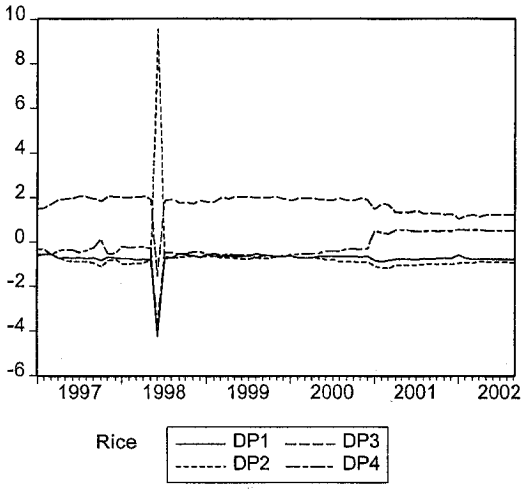
TABLE 4: Variability of Price Differential, within the Mainland China		
	Mean	Abs(mean)	Std. Dev
Tradable			
Pork	0.201594	1.51	5.845
Beef	-0.49981	1.075	1.154
Rice	-0.17174	0.31	0.903
Eggs	-0.128	0.339	1.16
Sugar	-0.13029	0.782	0.979
Edible oils	1.097379	1.115	0.809
Motor fuel	4.373188	262.8	312.52
Chinese Wines	-4.84251	10.22	11.574
Beer	0.141848	0.86	1.099
Cigarettes	0.311836	0.31	0.811
Semi-tradable			
Electricity	-3.95478	9.866	12.319
Hair-dressing	2.33333	5	4.933
Jewellery	1.758454	5.46	6.386
Service			
Taxi fares	-0.08261	0.369	0.3934
High school tuition fee	-45.41	173.2	210.4
Petroleum Gas	-3.31617	3.316	0.685
Hospital fee	-1.39686	3.39	3.867
Sample Size: 207 observations			
Cross Section: 3			



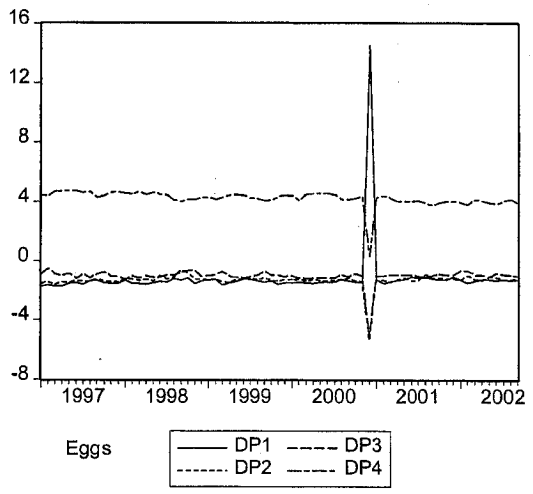
Pork



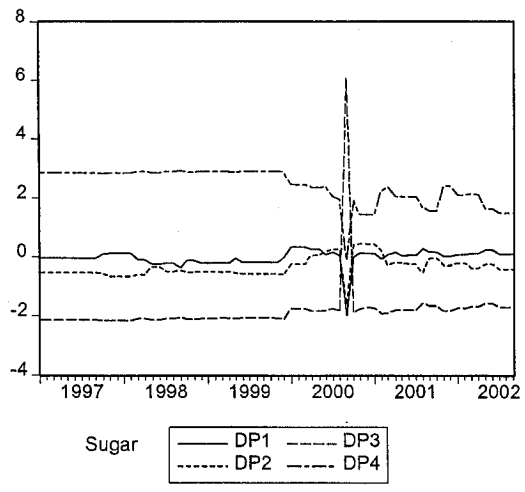
Beef



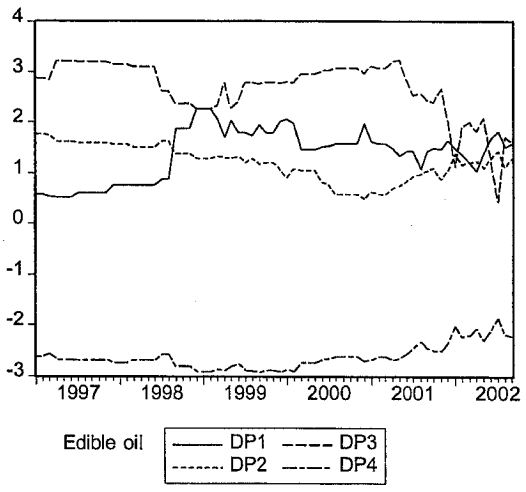
Rice



Eggs

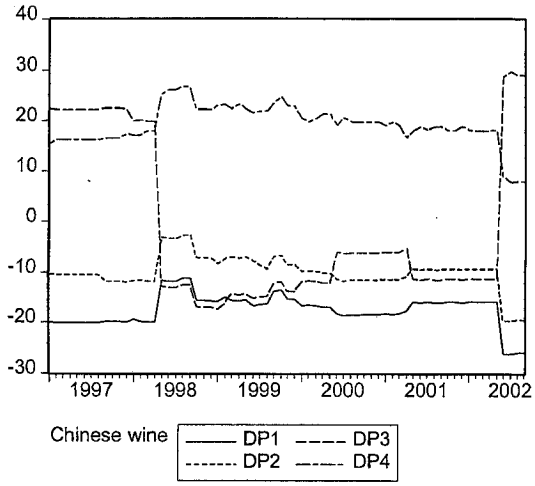


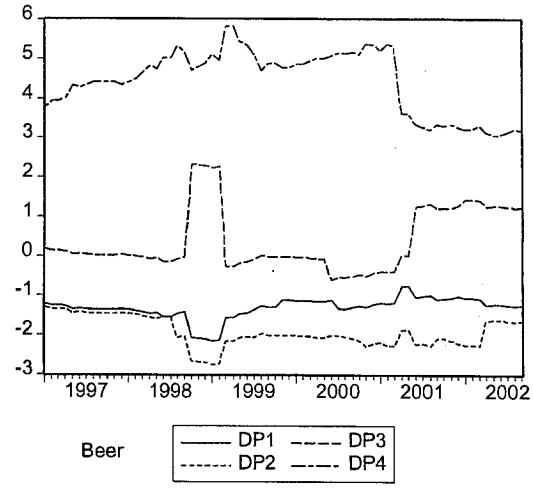
Sugar

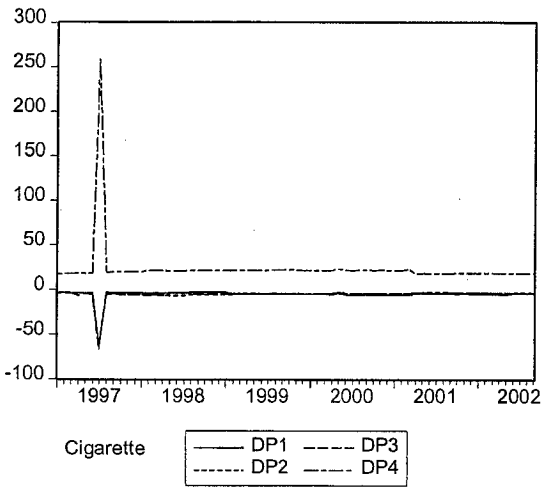


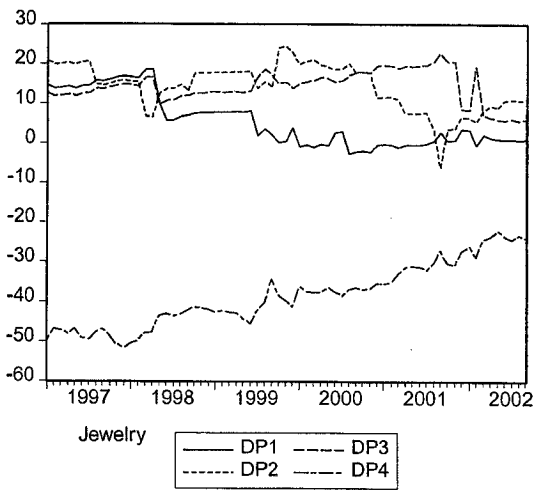
Edible oil

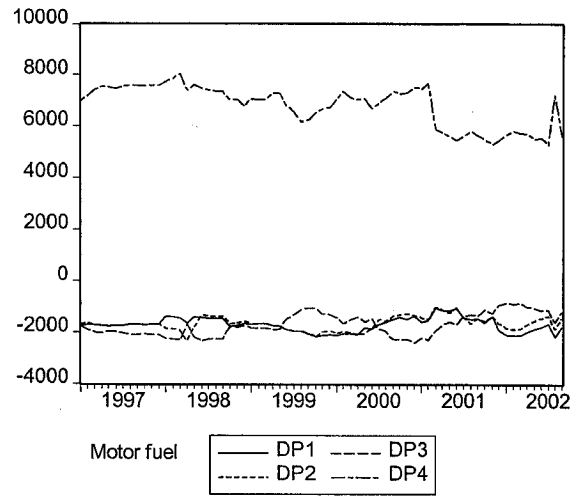
Note: Price Differentials in City-pairs, DP1: Beijing-Shenzhen, DP2: Shanghai-Shenzhen, DP3: Guangzhou-Shenzhen, DP4: Shenzhen-Hong Kong



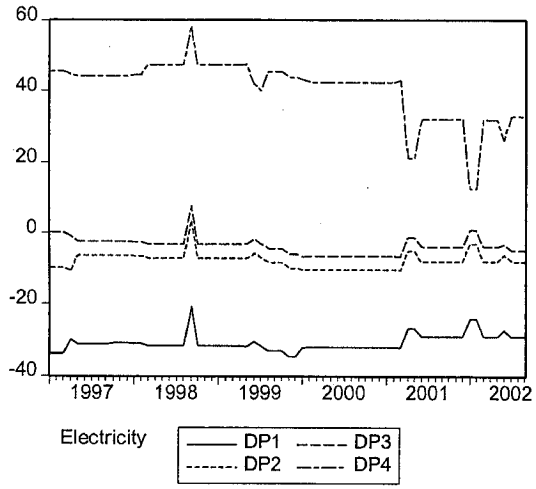






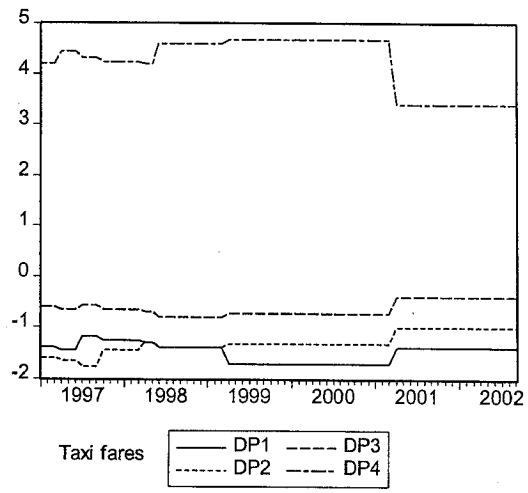


Note: Price Differentials in City-pairs, DP1: Beijing-Shenzhen, DP2: Shanghai-Shenzhen, DP3: Guangzhou-Shenzhen, DP4: Shenzhen-Hong Kong



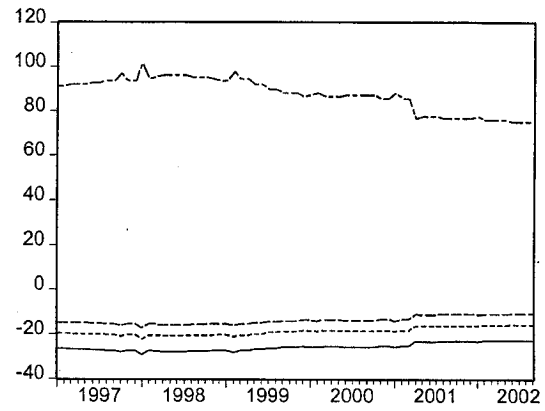
Electricity

DP1 DP3
DP2 DP4



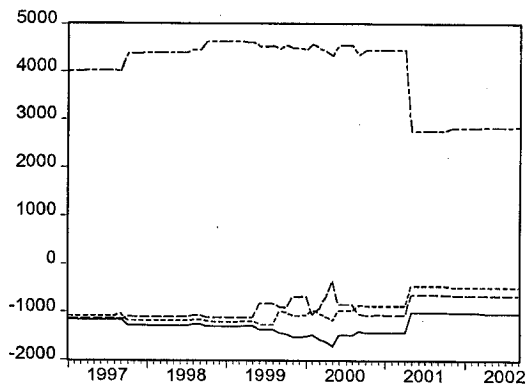
Taxi fares

DP1 DP3
DP2 DP4



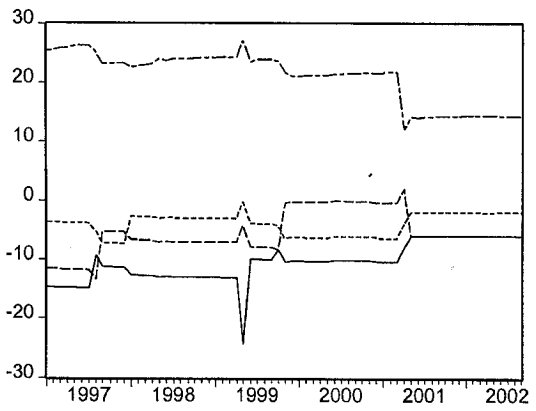
Hair-dressing

DP1 DP3
DP2 DP4



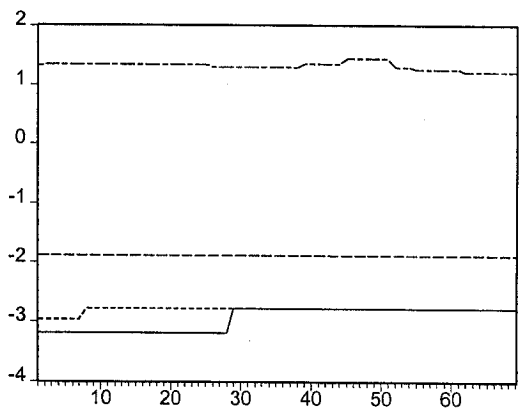
Tuition fee

DP1 DP3
DP2 DP4



hospital fee

DP1 DP3
DP2 DP4



Petro gas

DP1 DP3
DP2 DP4

Note: Price Differentials in City-pairs, DP1: Beijing-Shenzhen, DP2: Shanghai-Shenzhen, DP3: Guangzhou-Shenzhen, DP4: Shenzhen-Hong Kong

TABLE 5: Comparison of Tradable goods and Non-tradable goods								
			Mean		**Std. Dev**		**Observations**	
Variability of Price Differential								
	Tradables		1.06		31.09		3381	
Semi-tradable and services			183		2361		2277	
Mean absolute of Price Differential								
	Tradable		20.78		23.12		3381	
Semi-tradable and services			1486		1835		2277	

TABLE 6: Levin-Lin-Chu Test for Price Differential, Hong Kong and Mainland China							
	belta	t-value	t-star	probability		half-life
Tradable						
Pork	-0.78537	-13.26	-12.5	0	***	0.45
Beef	-0.23563	-5.357	-2.097	0.018	**	2.58
Rice	-0.76332	-11.305	-10.46	0	***	0.48
Eggs	-0.80313	-13.55	-12.74	0	***	0.43
Sugar	-0.66559	-11.623	-10.7	0	***	0.63
Edible oils	-0.15395	-5.049	-2.908	0.0018	***	4.15
Motor fuel	-0.10861	-3.819	-1.078	0.14		
Chinese Wines	-0.0883	-3.39	0.42358	0.6641		
Beer	-0.11302	-4.056	-1.21	0.1131		
Cigarettes	-0.66988	-11.739	-10.81	0	***	0.63
Semi-tradable						
Electricity	-0.10522	-2.939	0.28129	0.61		
Hair-dressing	0.00992	0.622	2.81	0.997		
Jewellery	-0.06803	-2.889	-0.954	0.17		
Service						
Taxi fares	-0.05759	-2.987	-0.634	0.2629		
Petroleum Gas	-0.05957	-3.177	-0.96327	0.1677		
High school tuition fee	-0.05537	-2.882	-1.117	0.132		
Hospital fee	-0.09513	-4.621	-2.953	0.0016	***	6.93
Overall	-0.04253	-9.192	-3.497	0.0002	***	16.29
Note: * 10% significant, ** 5% significant, *** 1% significant						

TABLE 7: Levin-Lin-Chu Test for Price Differential, within Mainland							
	belta	t-value	t-star	probability		half-life
Tradable						
Pork	-0.87435	-12.568	-12.13	0	***	0.33
Beef	-0.33091	-5.472	-2.315	0.01	***	1.72
Rice	-0.83641	-9.89	-9.5	0	***	0.38
Eggs	-0.96072	-13.745	-13.52	0	***	0.21
Sugar	-0.95772	-13.687	-13.59	0	***	0.22
Edible oils	-0.12407	-3.83	-1.84	0.0329	**	5.23
Motor fuel	-0.14654	-3.945	-0.927	0.1769		
Chinese Wines	-0.09085	-2.948	0.424	0.6644		
Beer	-0.12276	-3.644	-1.144	0.1263		
Cigarettes	-0.14265	-3.924	-2.16	0.0154	**	4.5
Semi-tradable						
Jewellery	-0.13541	-3.938	-1.638	0.05	**	4.76
Electricity	-0.02835	-1.579	1.99	0.98		
Hair-dressing	-0.1126	-4.109	-1.285	0.2314		
Service						
Taxi fares	-0.06638	-3.02	-1.163	0.122		
High school tuition fee	-0.1226	-3.755	-1.2442	0.1	*	5.29
Petroleum Gas	-0.05267	-2.585	-0.83	0.2037		
Hospital fee	-0.1353	-4.284	-2.318	0.01	***	4.77
Overall	-0.08283	-10.683	-6.65312	0	***	8.37
Note: * 10% significant, ** 5% significant, *** 1% significant						

TABLE 8: Levin-Lin-Chu Test for Price Differential, Hong Kong and the Mainland							
	(fixed effect)						
	belta	t-value	t-star	probability			half-life
Tradable							
Pork	-0.045	-2.471	-2.45	0.007	***		15.4
Beef	-0.00186	-0.548	-0.544	0.2932			
Rice	-0.02226	-1.175	-1.165	0.122			
Eggs	-0.01457	-1.078	-1.069	0.1425			
Sugar	-0.02485	-1.685	-1.672	0.0473	**		27.9
Edible oils	-0.00413	-1.168	-1.158	0.1232			
Motor fuel	-0.00703	-1.412	-1.4	0.0807	*		98.6
Chinese Wines	-0.00706	-0.909	-0.9017	0.1836			
Beer	-0.01295	-0.913	-0.90552	0.1826			
Cigarettes	-0.02814	-4.562	-4.52575	0	***		24.6
Semi-tradable							
Jewellery	-0.01224	-2.144	-2.12667	0.0167	**		56.2
Electricity	-0.00718	-1.85	-1.83529	0.0332	**		96.5
Hair-dressing	-0.00134	-2.842	-2.819	0.0024	***		517.3
Service							
Taxi fares	-0.00394	-1.458	-1.446	0.074	*		175.9
High school tuition fee	-0.01168	-2.371	-2.35182	0.0093	***		59.3
Petroleum Gas	-0.00118	-1.353	-1.342	0.0897	*		587.4
Hospital fee	-0.02552	-3.541	-3.5133	0.0002	***		27.2
Overall	-0.01797	-5.975	-5.974	0	***		38.57
Note: * 10% significant, ** 5% significant, *** 1% significant							

TABLE 9: Levin-Lin-Chu Test for Price Differential, within the Mainland (fixed effect)							
	belta	t-value	t-star	probability		half-life
Tradable						
Pork	-0.757	-11.094	-11.01	0	***	0.92
Beef	-0.111	-3.834	-3.803	0.0001	***	6.24
Rice	-0.697	-6.505	-6.453	0	***	0.99
Eggs	-0.73	-8.304	-8.237	0	***	0.95
Sugar	-0.02119	-0.87	-0.86323	0.194		
Edible oils	-0.04726	-2.316	-2.297	0.0108	**	14.67
Motor fuel	-0.13456	-3.5	-3.473	0.0003	***	5.15
Chinese Wines	-0.03121	-1.704	-1.69	0.0455	**	22.2
Beer	-0.0146	-1.031	-1.02252	0.1553		
Cigarettes	-0.08733	-2.709	-2.687	0.0036	***	7.94
Semi-tradable						
Hair-dressing	-0.1212	-3.413	-2.134	0.372		
Jewellery	-0.03783	-1.532	-1.519	0.0643	*	18.32
Electricity	-0.00352	-1.817	-1.80256	0.0357	**	196.9
Service						
Taxi fares	-0.00798	-1.238	-1.2279	0.1097		
High school tuition fee	-0.03134	-1.72	-1.706	0.044	**	22.12
Petroleum Gas	-0.00596	-1.862	-1.847	0.0324	**	116.3
Hospital fee	-0.07931	-3.654	-3.625	0.00001	***	8.74
Overall	-0.06689	-9.575	-9.575	0	***	10.36
Note: * 10% significant, ** 5% significant, *** 1% significant						

TABLE 10: Im-Pesaran-Shin test for Price Differentials, HK and Mainland China		
	t-bar	**P-value**	**Significance**
Tradable			
Pork	-6.568	0	***
Beef	-2.821	0.001	***
Rice	-6.45	0	***
Eggs	-6.765	0	***
Sugar	-6.112	0	***
Edible oils	-3.006	0	***
Chinese Wines	-1.683	0.356	
Beer	-2.036	0.116	
Cigarettes	-6.05	0	***
Motor fuel	-2.092	0.097	*
Semi-tradable			
Electricity	-1.851	0.197	
Hair-dressing	0.301	0	***
Jewellery	-1.665	0.371	
Service			
Taxi fares	-1.463	0.444	
High school tuition fee	-1.664	0.372	
Petroleum Gas	-1.619	0.389	
Hospital fee	-2.444	0.017	**
Note: 10% Critical Value is **-2.02,** 5% Critical Value is **-2.15**, 1% Critical Value is **-2.4**			
* 10% significant, ** 5% significant, *** 1% significant			

TABLE 11: Im-Pesaran-Shin test for Price Differentials, within Mainland China		
	t-bar	P-value	Significance
Tradable			
Pork	-7.146	0	***
Beef	-3.127	0.001	***
Rice	-6.894	0	***
Eggs	-7.821	0	***
Sugar	-7.889	0	***
Edible oils	-2.284	0.062	*
Motor fuel	-2.394	0.04	**
Chinese Wines	-1.679	0.377	
Beer	-2.063	0.138	
Cigarettes	-2.689	0.009	***
Semi-tradable			
Electricity	-0.877	0.126	
Jewellery	-2.322	0.054	*
Hair-dressing	-2.145	0.008	***
Service			
Taxi fares	-1.755	0.32	
High school tuition fee	-2.224	0.079	*
Petroleum Gas	-1.442	0.459	
Hospital fee	-2.464	0.03	**
Note: 10% Critical Value is **-2.02,** 5% Critical Value is **-2.15**, 1% Critical Value is **-2.4**			
* 10% significant, ** 5% significant, *** 1% significant			

TABLE 12: Price Convergence for City-pairs						
Overall goods						
		Shenzhen-Beijing		**Shenzhen-Shanghai**		
Obs			1173		1173	
Std.Dev			91.99		75.42	
beta			-0.0863		-0.157	
Converge			***		***	
Half life			7.68		4.06	
		Guangzhou-Shenzhen		**Shenzhen-HK**		
Obs			1173		1173	
Std.Dev			105.3		1137	
beta			-0.1		-0.015	
Converge			***		**	
Half life			6.58		45.8	

References:

Abuaf, Niso, and Jorion, Philipe (1990). "Purchasing Power Parity in the Long Run", *Journal of Finance*, XLV: 157-174.

Andrson, James E. (1979). "A Theoretical Foundation for the Gravity Equation", *American Economic Review*, 69(1): 106-116.

Anderson, James and Windoop, Eric van (2001). "Borders, Trade, and Welfare", *NBER working paper series*, no. 8515.

Andrson, James E. and Wincoop, Eric van (2001). "Gravity with Gravitas: A solution to the Border Puzzle*" NBER working paper series*, no. 8079.

Asea, Patrick K. and Mendoza, Enrique G. "The Balassa-Samuelson Model: A General-Equilibrium Appraisal," *Review of International Economics*, Oct. 1994, 2(3), 244-67.

Baldwin, Richard E. (1988). "Hysteresis in Import Prices: the Beachhead Effect", *American Economic Rewiew*, September: 773-85.

Balassa, Bela (1964). "Purchasing Power Parity Doctrine", *Journal of Political Economy*, 72, 584-96.

Cecchetti, Stephen G., Mark, Nelson C. and Sonora, Robert J. (2000). "Price Level Convergence among United States Cities: Lessons for the European Central Bank", *NBER working paper series*, no. 7681.

Cheung, Yin-Wong and Lai, Kon S. (1998). "Parity Revision in Real Exchange Rates During the Post-Bretton Woods Period", *Jounal of International Money and Finance*, 17: 597-614.

Cheung, Yin-Wong and Lai, Kon S. (2000). "On the Purchasing Power Parity Puzzle", *Journal of International Economics* 52 321-330.

Cumby, Robert, (1993). "Forecasting Exchange Rates on the Hamburger Standard: What you see is what you get with McParity" Mimeo, Stern School of Business.

Darby, Michael, (1983). "Movement in Purchasing Power Parity: The short and long runs," in *International transmission of inflation*, 462-77.

Davutyan, N. and Pippenger, J. (1985). "Purchasing Power Parity did not collapse during the 1970s", *American Economic Review*, 75(5): 1151-1158.

De Gregorio, Giovannin, Alberto and Wolf, Holger (1994). "International Evidence on Tradables and Nontradables Inflation," *European Economic Review*, 38(6): 1225-44.

Diebold, Francis, Husted, Steve and Rush, Mark (1991). "Real Exchange Rates under the Gold Standard", *Journal of Political*

Economy, 99: 1252-71.

Dixit, Avinash (1989). "Hysteresis, Import Penetration and Exchange Rate Passthrough", *Quarterly Journal of Economics*, May: 205-28.

Doganlar, Murat (1999). "Testing Long-Run Validity of Purchasing Power Parity for Asian Countries", *Applied Economics Letters*, 6(3): 147-151.

Dornbsch, Rudiger (1976). "Expectations and Exchange Rate Dynamics," *Journal of Political Economy*, LXXXIV: 1161-76.

Dornbsch, Rudiger (1987). " Exchange Rates and Prices", *American Economic Review*, March: 93-106.

Edison, Hali (1985). "Purchasing Power Parity: A Quantitative Reassessment of the 1920s Experience," *J. Int. Money Finance*, 4(3): 361-72.

Edison, Hali (1987). "Purchasing Power Parity in the Long Run: A Test of the Dollar/Pound Exchange Rate (1890-1978)", *Journal of Money, Credit and Banking*, XIX: 376-87.

Edison, Hali and Klovland, Jan Tore (1987). "A Quantitative Reassessment of the Purchasing Power Parity Hypothesis", *Journal of Applied Econometrics*, 2: 309-333.

Emmanuel Anoruo, Habtu Braha, and Yusuf Ahmad (2002). "Purchasing Power Parity: Evidence from Developing Countries", *International Advances in Economic Research*, 8(2): 85-96.

Engel, Charles (1993). "Real Exchange Rates and Relative Prices: An Empirical Investigation", *Journal of Monetary Economics*, August: 35-50.

Engel, Charles and Rogers, John (1996). "How wide is the border", *American Economic Review*, 86: 1112-1125.

Engel, Charles and Rogers, John (1999). "Violating the Law of One Price: Should We Make A Federal Case Out of It?" *NBER working paper series*, no. 7242.

Engel, Charles (2000). "Long-Run PPP May not Hold After All", *Journal of International Economics*, No. 5646 NBER discussion paper.

Feenstra, Robert, Joseph Gagnon and Knetter, Michael (1993). "Market Share and Exchange Rate Pass-Through in World-Automobile Trade"; *NBER Working paper series*, no. 4399.

Frankel, Jeffrey (1986). "International Capital Mobility and Crowding-out in the U.S. Economy: Imperfect Integration of Financial Markets or Goods Markets?" in *How open is the U.S. economy*? pp33-67.

Frenkel, Jacob (1978). "Purchasing Power Parity: Doctrinal Perspectives and Evidence from the 1920s", *Journal of International Economics*,

8(4): 169-191.

Frenkel, Jacob (1978). “Purchasing Power Parity: Doctrinal Perspective and Evidence from the 1920s,” *Journal of Internal Economics*, 8(2): 169-91

Frankel, Jeffrey and Rose, Andrew (1995). “A Panel Project on Purchasing Power Parity: Mean Reversion Within and Between Countries”, *NBER working paper series*, no. 5006.

Frankel, Jeffrey, Stein, Ernesto and Wei, Shang-jin (1995). “Trading Blocs and the Americas: the Natural, the Unnatural and the Super-natural”, *Journal of Development Economics*, 47(1): 61-96.

Frankel, Jeffrey A. and Rose, Andrew (1996). “A Panel Project on Purchasing Power Parity: Mean Reversion Within and Between Countries”, *Journal of International Economics*, 40: 209-224.

Froot, Kenneth and Klemperer, Paul (1989). “Exchange Rate Pass-Through When Market Share Matters”, *American Economic Review*, September: 637-654.

Froot, Kenneth, Kim, Michael and Rogoff, Kenneth (1995). “The Law of One Price”, *NBER working paper series*, no. 5132.

Gagnon, J.E. and Knetter, M (1995). “Markup Adjustment and Exchange Rate Fluctuations: Evidence from Panel Data on Automobile Exports”, *Journal of International Money and Finance*, 14(2): 289-310.

Gailliot, Henry “Purchasing Power Parity as an Explanation of Long Term Changes in Exchange rates” J. Money, Credit, Banking, Aug. 1970, 2(3), 348-57

Ghosh, Atish and Wolf, Holger (1994). “Pricing in International Markets: Lessons From the ECONOMIST”, *NBER working paper series*, no. 4806.

Giovannini, Alberto (1988). “Exchange rates and traded goods prices,” *Journal of International Economics*, 24(1/2): 45-68.

Glen, Jack(1992). “Real Exchange Rates in the Short, Medium, and Long Run”, *Journal of International Economics*, 33: 147-66.

Goldberg, Pinelopi and Verboven, Frank (2001). “Market Integration and Convergence to the Law of One Price: Evidence From the European Car Market”, *NBER working paper series*, no.8402.

Ha, Jiming and Fan, Kelvin (2002) “Price Convergence between Hong Kong and the Mainland”, Hong Kong Monetary Authority, discussion paper.

Hakkio, Craig (1984). “A Re-examination of Purchasing power parity,” *Journal of International Economics*, 17(3/4): 265-77.

Huizinga, John (1987). “An Empirical Investigation of the Long-run Behavior of Real Exchange rates,” *Carnegie-Rochester Conf. Ser. Public Policy*, 27: 149-215.

Im, K.S., Pesaran, M.H. and Shin, Y. (1999). “testing for Unit Roots in Heterogeneous Panels”, *Oxford Bulletin of Economics and Statistics*, Special Issue.

Jothansen, D.R. (1990). “Cointegration Error Correction, and Purchasing Power Parity Between Canada and the Unite States”, *Canadian Journal of Economics*, 23: 839-55.

Jothansen, S. (1988). “Statistical Analysis of Cointegrating Vectors”, *Jouranl of Economic Dynamics and Control*, 12: 231-54.

Kasa, Kenneth (1992). “Adjustment Costs and Pricing-to-Market: Theory and Evidence”; *Journal of International Economics*, February: 1-27.

Knetter, Michael (1989). “Price Discrimination by U.S. and German Exports,” *American Economic Review*, 79(1): 198-210.

Krugman, Paul (1978). “Purchasing Power Parity and Exchange Rates: Another Look at the Evidence”, *Journal of International Economics*, 8(3): 397-407

Krugman, Paul (1986). “Pricing to Market When the Exchange Rate Changes”; *NBER working paper series.*

Levin, A. and Lin, C (1992). “Unit Root Tests in Panel Data: Asymptotic and Finite-Sample Properties”, unpublished manuscript, University of California, San Diego Discussion Paper 92-23.

Lothian, James, and Taylor, Mark (1996). “Real Exchange Rate Behavior: The Recent Float from the Perspective of the Past Two Centuries”, *Journal of Political Economy*, 104(3): 488-509.

McCallum, John (1995). “National Borders Matter: Regional Trade Patterns in North America”, *American Economic Review*, 85(3): 615-623.

McCloskey, D, and Zecher, J.R. (1984). “The Success of Purchasing Power Parity: Historical Evidence and its Implications for Macroeconomics”, In *A Retrospective on the Classical Gold Standard*, 1880-1913, edited by M.D.Bordo and A.J.Schwartz. Chicago: University of Chicago Press.

Meese, Richard and Rogoff, Kenneth (1988). “Was it real? The Exchange Rate Interest Differential Relation over the Modern Floating-Rate Period,” *Journal of Finance*, 43(4): 933-48.

O’Connell, Paul G.J. (1998). “Overvaluation of Purchasing Power Parity”, *Journal of International Economics*, 44: 1-19.

O’Connell, Paul G.J. and Shangjin-Wei (2002) “The bigger they are, the harder they fall: Retail Price Differences Across U.S. Cities,” *Journal of International Economics*, 56:21-53

Parsley, David and Wei, Shang-jin (1996). “Convergence to the law of one price without trade barriers or currency fluctuations”, *Quarterly Journel of Economics*, 111: 1211-1236.

Quah, Danny (1994). “Expliting Cross-Section Variation for Unit Root Inference in Dynamic Data”, *Economics Letters*, 44: 9-19.

Ramirez, Miguel D. and Khan, Shahryar (1999). “A Cointegration Analysis of Purchasing Power Parity: 1973-96”, *International Advances in Economic Research*, 5(3): 369-385.

Rogers, John and Jenkins (1995). “Haircuts or Hysteresis? Sources of Movements in Real Exchange Rate,” *Journal of International Economics*, 38(3/4): 339-60.

Roll, Richard (1979).“Violations of Purchasing Power Parity and Their Implications for Efficient International Commodity Markets,” *International finance and trade,*133-76

Rose, Andrew K. (2000). “ One Money, One Market: Estimating the Effect of Common Currencies on Trade” *Economic Policy: A European Forum*, 30: 7-33

Rose, Andrew K and Wincoop, Eric van (2001). “ National Money as a Barrier to International Trade: The Real Case for Currecy Union”, *American Economic Review, Papers and Proceedings*, 91(2): 386-390.

Sanyal, Kalyan K. and Jones, Ronald W. (1982). “The Theory of Trade in Middle Products.” *American Economic Review*, 72(1): 16-31.

Sheshinski, Eytan and Weiss, Yoram (1977). “Inflation and Costs of Price Adjustment”, *Review of Economic Studies*, 44: 281-303.

Sheshinski, Eytan and Weiss, Yoram (1983). “Optimal Pricing Policy Under Stochastic Inflation”, *Review of Economic Studies*, 51: 513-529.

Taylor, Alan (2000). “A Century of Purchasing Power Parity”, *NBER working paper series*, no. 8012.

Taylor, Alan (2001). “Potential Pitfalls for the Purchasing-Power-Parity Puzzle? Sampling and Specification Biases in Mean-Reversion Tests of the Law of One Price,” *Econometrica*, 69(2): 473-498.

Taylor, Mark, David Peel and Lucio Sarno (2001) “Nonlinear Mean-Reversion in Real Exchange Rates: Toward a Solution to the Purchasing Power Parity Puzzles,” *International Economic Review*, 42(4):1015-1042

Wei, Shang-jin and Parsley, David (1995). “Purchasing Power Dis-Parity during the Floating Rate Period: Exchange Rate Volatility, Trade Barriers, and Other Culprits”, *NBER working paper series*, no. 5032.

Wu, Yangru (1994). “Are Real Exchange Rates Non-Stationary?” Chinese University of Hong Kong: working paper.

Young, Alwyn (2000), “The Razor’s Edge: Distortions and Incremental Reform in the People’s Republic of China,”