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A Comparison of the Level of Economic Integration of Hong Kong between the Mainland China and the USA

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Abstract

This study examines the level of economic integration of Hong Kong with the Mainland China and the USA in terms of selected economic indicators. The economic indicators being tested are real GDP growth rate, inflation rate, money market interest rate and money supplied growth rate. Bivariate models are set up in order to investigate if there are co-integration relationship and Granger causality between the regions. This results show that Hong Konghas higher economic integration level with the Mainland China than that of the USA. The study provides evidence for economic policy formulation and evaluation of the appropriateness of adopting US dollar as the anchor currency of Hong Kong dollar.

Keywords: Economic Integration, Economic Indicators, Co-integration Analysis, Granger Causality, Anchor Currency
JEL Classification: F150 F360 F440 F450

1. Introduction

The sovereignty of Hong Kong Special Administrative Region has been handed over to the People's Republic of China for almost 20 years. Throughout this period, the economic activities between Hong Kong and the Mainland are getting more closely related, both in the real economic sector and financial sector. The Mainland China is replacing the USA as Hong Kong's biggest trading partner. The aim of this paper is to investigate the closeness of the economic relationship between Hong Kong, the Mainland China and the USA.

This research can provide empirical analysis to the formulation of Hong Kong's economic policy, especially on monetary policy. Hong Kong adopts the Linked Exchange Rate System, which pegs the Hong Kong Dollar (HKD) to the US Dollar (USD). The monetary policy in Hong Kong is passive and follows that of the USA. While the economic structure of a country determines its monetary policy, the hard peg exchange rate system to the USD may not be an effective monetary policy for stabilizing the economy. Revealing their economic relationship by empirical data analysis can provide concrete support for further policy considerations.

Four fundamental economic indicators are selected, namely real GDP growth rate, inflation rate, 3-month market interest rate and money supplied growth rate. These indicators typically cover the general economic conditions and market movements. To reveal the economic relationship between counties, data from Hong Kong, the Mainland China and the USA are paired up and tested by co-integration analysis. The data are further put into VAR model for determining Granger Casuality.

2. Previous Research

A number of previous researches on exchange rate by using cointegration analysis are listed out in table13. In particular, Liang (1999), Ferre and Hall (2002), Ding (2003), Cheung, Tam and You (2008) performed cointegration test on the long-term relationship of the real exchange rate between Hong Kong, the Mainland and USA. As reviewed in Chapter 2, no long-term cointegration relationship has been found between Hong Kong and the Mainland. On the other hand, relationship has been found between Hong Kong and USA. In this research, the author would like to check on the co-integration for the selected economic indicators. In the long run, real effective exchange rate will finally revert to its equilibrium. If economic structure is changed, the economic fundamental indicators will also be changed, leading to the real effective exchange rate to the new equilibrium.

Nieh and Yau (2004), Ahn, He, Rangkakulnuwat et al. (2010), Simon and Sons (2011) used cointegration analysis on the real exchange rate and other economic fundamentals for some other Asian countries.

Ding (2003) has done an in-depth research on the sustainability of the Linked Exchange Rate System. Johansen's tests were conducted to test the co-integration between exchange rate and inflation in the country pairs: Hong Kong-USA and Hong Kong-the Mainland. He found that co-integration existed in both situations. In particular, the strength of co-integration was stronger in Hong Kong-USA pair. The result was not surprising because Hong Kong was pegged with USD with free capital flow between these two areas and it was only 6 years after the sovereignty hand over. He further revealed that adding asset price adjustment in the model would reflect the de jure effect of the Linked Exchange Rate System. A more meaningful finding from his study was the co-integration existence in Hong Kong-the Mainland pair. Although capital and exchange rate were controlled in the Mainland, large amount of capital and asset was flowing between Hong Kong and the Mainland in private market.

The interrelationship between HKD, USD and RMB may have changed as time went by. It is worth discovering whether there are changes between the correlations of these currencies.

Hu and Zhang (2009) have done a similar analysis. They tested the co-integration existence between RMB/HKD and RMB/USD. They found that co-integration was significant between this exchange rate pair. They carried out a Granger Causality test on the data and found out that RMB/USD had more influence on RMB/HKD. They suggested that the weight of influence could be stronger when the trade and financial cooperation became more inseparable.

Most of the researchers applied cointegration analysis on the real effective interest rate between Hong Kong and other Asian countries. In this way, PPP was assumed. However, due to foreign exchange control of the Mainland, the real effective interest might not follow PPP. The effect on real effective exchange rate might have been absorbed by the transaction cost of RMB. On the other hand, cointegration of real effective exchange rate is not the necessary condition for determining forming OCA. Instead, the fundamental economic indicators are more important evidence to judge the appropriateness of forming currency union.

3. Hypothesis

3.1 Hypothesis of this Research

To investigate whether the economic cycle of two economies are in-phase, four economic fundamental indicators are selected, namely real GDP growth, inflation rate, 3-months interbank interest rate and money supply. Thus, this research composes of four hypotheses. Each hypothesis is sub-divided into different country pairs, i.e. Hong Kong-Mainland China and Hong Kong-USA. The hypotheses are set as below.

H1a: The real GDP growth rate of Hong Kong is in-phase with the Mainland China.

H1b: The real GDP growth rate of Hong Kong is in-phase with the USA.

H2a: The inflation rate of Hong Kong is in-phase with the Mainland China.

H2b: The inflation rate of Hong Kong is in-phase with the USA.

H3a: The market interest rate of Hong Kong is in-phase with the Mainland China.
H3b: The market interest rate of Hong Kong is in-phase with the USA.
H4a: The money supply of Hong Kong is in-phase with the Mainland China
H4b: The money supply of Hong Kong is in-phase with the USA

4. Research Methods

4.1 Co-integration Analysis and Granger Causality Test

The rapid development on the Mainland's economy leads to the change in Hong Kong's economic structure. If this is the case, empirical data will reflect the facts. This empirical study is to test whether Hong Kong's economic fundamentals converges with the Mainland or the USA. In other words, the author would like to find out the level of economic integration of Hong Kong with the Mainland and USA. Cointegration analysis is an appropriate method to fulfill the above purpose.

Cointegration analysis covers two major functions in econometric methods (Rao, 2007). Firstly, it serves as a method for theorist to get empirical evidence. Secondly, it can be acted as theoretical prediction. Cointegration anslysis is fit for the purpose of this research. It is because from the theoretical point of view, this research requires a model for economic integration. The concept of cointegration matches the theoretical requirement.

Further to the cointegration analysis, this research will explore the causal relation between the economic indicators of each country. Granger Causality Test is applied to the research. Although Granger Causality only shows narrow definition of causality of variables, it helps to explore how the economic indicators in each country affects the other countries. It supplements the information found from the cointegration analysis.

There are two approaches for testing co-integration, namely Engle and Granger Method (1987) and Johansen's Method (1998, and Johansen and Juselius, 1990). Due to the fact that Johansen's method estimates a vector autoregressive model, Granger Causality Test can be used to get information on how each variable is affected by each other (Brailsford, Penm& Terrell, 2006). Johansen's method is applied in this study.

The nature of this research is to compare the appropriateness of using USD or RMB as the anchor currency for Hong Kong. As referenced from Ding (2003), Nieh and Yau (2004), two-region setting on the cointegration model is employed. The two regions setting are Hong Kong-Mainland and Hong Kong-USA. Cointegration analysis and Granger Causality test on each economic indicator will be applied two times: one for Hong Kong-Mainland China and the other for Hong Kong-USA.

4.2 Data Collection

The data of the selected economic indicators for Hong Kong and USA are exported from Reuters DataStream. For data of the Mainland China, unless specified in the below paragraphs, data are collected from the official website of the government. For measuring economic growth, real GDP is adopted. To investigate long-term economic growth, quarterly data is appropriate. Since quarterly real GDP growth of the Mainland China is not published officially, researchers are required to make transformation from quarterly nominal GDP data. The author adopted the transformation approach from the Renmin University of the Mainland. Data started from 1988-first quarter till 2014-second quarter.

For inflation rate, monthly data of all the three countries are collected. Year on year monthly inflation rate is adopted. Data range starts from February 1988 to November 2014.

For interest rate, 3-month daily interbank offer rate is used because it is the market interest rate. It can capture the short-term market movement and at the same time filter out momentary fluctuation. It is sensitive to capture the money market signal. Long-term interest rates are not adopted because Hong Kong's current exchange rate system requires the long-term interest rate to follow the US.

Choosing 3-month interbank interest rate can reduce the long-term effect such that the interest rate truly reflects the market. Due to its ever-changing nature, daily frequency is used for testing. The People's Bank of the Mainland announced the SHIBOR since 2006, therefore the data collected starts from 2006.

For M2 supply, quarterly data are collected from 2005 because of the reformation of the Mainland's exchange rate system forms a natural structural break.

Table 1: Data Frequency and Period

Data	Hong Kong - the Mainland	Hong Kong – USA
Real GDP growth rate	Quarterly (1989-2012)	Quarterly (1989-2013)
Inflation rate	Monthly (2005-2014)	Monthly (2005-2014)
M2 Supply	Quarterly (2005-2014)	Quarterly (2005-2014)
Interest rate (3 months interbank offer rate)	Daily (2006-2014)	Daily (2006-2014)

Source: All data are downloaded from Thomson Reuters DataStream exceptthat the Mainland's unemployment rate is downloaded from Wind Terminal

Real GDP growth rate						
Hong Kong-Mainland China						
Hypothesized No. of CE	**Trace Statistic**	**95% Critical Value**	**Probability**	**Max-Eigen Statistic**	**95% Critical Value**	**Probability**
None	21.59284	15.49471	0.0053***	21.58369	14.2646	0.0029***
At most 1	0.009154	3.841466	0.9234	0.009154	3.841466	0.9234
Hong Kong-USA						
None	6.067232	15.49471	0.6876	4.589727	14.2646	0.7925
At most 1	1.477504	3.841466	0.2242	1.477504	3.841466	0.2242
Inflation rate						
Hong Kong-Mainland China						
None	21.50098	20.26184	0.0336**	16.77442	15.8921	0.0363**
At most 1	4.72656	9.164546	0.3147	4.72656	9.164546	0.3147
Hong Kong-USA						
None	18.20457	20.26184	0.0936*	14.24855	15.8921	0.089*
At most 1	3.956019	9.164546	0.4187	3.956019	9.164546	0.4187
M2 Supply						
Hong Kong-Mainland China						
None	24.31817	20.26184	0.0131**	21.73861	15.8921	0.0054***
At most 1	2.579559	9.164546	0.6618	2.579559	9.164546	0.6618
Hong Kong-USA						
None	9.440022	15.49471	0.3262	8.326793	14.2646	0.3465
At most 1	1.11323	3.841466	0.2914	1.11323	3.841466	0.2914
3-Months Interbank Offer rate						
Hong Kong-Mainland China						
None	10.62053	20.26184	0.579	8.693533	15.8921	0.4674
At most 1	1.926998	9.164546	0.7922	1.926998	9.164546	0.7922
Hong Kong-USA						
None	29.17305	20.26184	0.0023*	22.94822	15.8921	0.0033*
At most 1	6.224828	9.164546	0.1741	6.224828	9.164546	0.1741

5. Empirical Results

5.1 Unit Root Test for Stationarity

Stationarityshould be firstly tested so that the structural form of the model can be obtained. Stationary at the same level of indifferencing of the time series is the required condition for cointegration analysis. Augmented Dickey-Fuller unit root test is applied to test the stationarity of the data. The following table summarizes the stationarity level of each variable.

Table 2: Stationary Level of all Variables

Data	Hong Kong	the Mainland	USA
Log real GDP	I(2)	I(2)	I(2)
Inflation rate	I(1)	I(1)	I(1)
Log M2 Supply	I(1)	I(1)	I(1)
Interest rate (3 months interbank offer rate)	I(1)	I(1)	I(1)

From the above unit root test, all variables except log real GDP are stationary at I(1). For log real GDP, it is stationary at I(2). It is therefore the growth rate of log real GDP is adopted in the co-integration test. Other variables can be used directly without differencing for Johansen's test for cointegration, Granger Causality.

Table 3: Result of the Co-integration test of the economic indicators

There is evidence on the cointegration of log real GDP between Hong Kong and the Mainland, but not Hong Kong and USA. It can be explained by the fact that the Mainland is Hong Kong's biggest trading partner. Export contributes 25% of Hong Kong's nominal GDP. Demand from the Mainland for Hong Kong's export dominates Hong Kong's economic growth. The fast economic development of the Mainland has stimulated the demand for export in Hong Kong. In the past years, theeconomic activities in Hong Kong have been more inclined to the Mainland China. The economic development of Hong Kong and the Mainland are mutual attractive. The Mainland provides abundant of resources, e.g. land and labour, which is scarce in Hong Kong. On the other hand, Hong Kong provides technical know-how and skills for high quality product development. With the support of the governments, policies for encouraging the cooperation between the two places are implemented. Hong Kong is given preferential status as the Mainland's special trading partner. It provides evidence on the integration of real GDP between Hong Kong and the Mainland. They are moving forward and sharing the same goal.

On the other hand, the real GDP growth rates are different between Hong Kong and the USA. In the period after 2008, the economy of the USA was in recession. Over that period, Hong Kong was having positive economic growth. As stated in the previous paragraph, Hong Kong has become closer with the Mainland. While the Mainland's real GDP growth is greater than the USA, its effect transferred to Hong Kong through private investment, export consumption and capital transfer.

This result is for the economic integration between Hong Kong and the Mainland also sensible because Hong Kong is a small open economy. Most of the basic food and daily consumables are imported from the Mainland. Hong Kong automatically imports inflation from the Mainland because trading with the Mainland contributes 25% of Hong Kong GDP.

There is cointegration of inflation rate between Hong Kong and USA. It is interesting that the level of significance is higher for HK-Mainland pair. The major reason for this phenomenon is that Hong Kong has a different business cycle with USA. In fixed exchange rate context, internal price movement corrects external imbalance. Therefore, the fixed exchange rate system brings out price fluctuation.

For M2 Supply, cointegration is found in both Hong Kong-the Mainland and Hong Kong-USA settings. Hong Kong has no active monetary policy. Its money supply must be come from foreign capital injection from other countries. The result shows that the money supply from USA are synchronized with Hong Kong's M2 supply. The more money supplied in USA, the more flows to Hong Kong. The exceptionally high foreign reserves level is the evidence of the money flowing into Hong Kong.

For the Mainland's M2 Supply, its mechanism is not as clear as Hong Kong. Besides, the M2 supplied in the Mainland may not be diverted into Hong Kong due to exchange control. The cointegration of M2 supply between Hong Kong and the Mainland may not have much explanatory power.

For cointegration of market interest rate, the results match with expectation. The interest rate of Hong Kong cointegrates with USA but not the Mainland. In order to sustain the Linked Exchange Rate System in Hong Kong, the interest rate of Hong Kong must follow USA.

On the other hand, the interest rate adjustment mechanism is not totally market oriented. Therefore no cointegration is found in Hong Kong-the Mainland setting.

Table 4: Results of the Granger Causality Tests

Null Hypothesis:	F-Statistic	Prob.
GDP growth rate		
HK does not Granger Cause CH	1.98895	0.0913*
CH does not Granger Cause HK	12.6821	1.00E-08***
USA does not Granger Cause HK	2.90035	0.0176**
HK does not Granger Cause USA	1.31437	0.2645
Inflation rate		
HK does not Granger Cause CH	3.40393	0.0116**
CH does not Granger Cause HK	3.72254	0.0071***
USA does not Granger Cause HK	1.38544	0.244
HK does not Granger Cause USA	4.41413	0.0024***
M2 Supply		
HK does not Granger Cause CH	0.34997	0.8435
CH does not Granger Cause HK	0.96019	0.4326
US does not Granger Cause HK	1.82223	0.1665
HK does not Granger Cause US	1.90374	0.1538
3-months Interbank offer rate		
HK does not Granger Cause CH	0.57531	0.7765
CH does not Granger Cause HK	1.03861	0.4019
USA does not Granger Cause HK	36.7184	1.00E-54***
HK does not Granger Cause USA	27.2046	8.00E-47***

It is also significant that the Mainland's and USA's log real GDP both Granger cause Hong Kong (Table 4). Theoretically speaking, the nature of Granger Causality reflects the correlation between the lagged terms of X and the current term of Y. It shows that the economy of USA and the Mainland will affect Hong Kong at a later stage.

The inflation rate of Hong Kong and the Mainland Granger causes each other. The result is not surprising. It is because Hong Kong imports the Mainland's inflation. On the other hand, Hong Kong is the second biggest trading partner of the Mainland. According to the data of Hong Kong trade statistics, the biggest re-export origin of Hong Kong to the Mainland is the Mainland itself. Therefore, their inflation rate Granger causes each other is sensible.

It is interesting to see that there is significance in the inflation of Hong Kong Granger causes USA. It suggests that the past value of Hong Kong's inflation rate is correlated with the current USA inflation rate. It is a result by coincidence because both countries are having positive inflation but the reason is different. Hong Kong is undergone inflation because the price of Hong Kong corrects mispricing of HKD. On the other hand, inflation of USA is due to economic growth and consumption confidence. It is also a coincidence for USA's inflation lags behind Hong Kong.

Because the interest rate between Hong Kong and the USA are highly synchronized, they Granger cause each other and with high F-Statistic. It is mainly due to the fixed exchange rate system between HKD and USD.

From the econometric analysis, Hong Kong's real GDP growth, inflation rate, unemployment rate and M2 supply are co-integrated with the Mainland. It provides significant information to suggest that the economy of Hong Kong and the Mainland is more converged.

On the other hand, due to the current linked exchange rate system, Hong Kong must follow the monetary policy in USA, so it is therefore not surprisingly to find Hong Kong's interest rate co-integrates with US's.

The following table summarizes the econometric analysis results:

Table 4: Summaries of Johansen's Co-integration Test and Granger Causality Test

Cointegration	Hong Kong - the Mainland	Hong Kong – USA
Log real GDP growth rate	Yes	No
Inflation rate	Yes (more significant)	Yes (less significant)
M2 Supply	Yes	Yes
Interest rate (3 months interbank offer rate)	No	Yes

Granger Causality	Hong Kong - the Mainland	Hong Kong – USA
Log real GDP growth rate	the Mainland Granger Cause Hong	No
Inflation rate	the Mainland Granger Cause Hong	No
M2 Supply	No	No
Interest rate (3 months interbank offer rate)	Hong Kong Granger Cause the Mainland	USA Granger Cause Hong Kong

Impulse Response	Hong Kong - the Mainland	Hong Kong – USA
Log real GDP growth rate	Greater Effect on Hong Kong	
Inflation rate	Greater Effect on Hong Kong	
M2 Supply	Negative effect on Hong Kong	Positive effect on Hong Kong
Interest rate (3 months interbank offer rate)		Greater Effect on Hong Kong

From the results, focus should be put on the effecttoHong Kong. It is because Hong Kong has no independent monetary policy. It cannot actively control the money supply by itself. All money supply in Hong Kong only depends on the inflow and outflow of foreign exchange. From the co-integration test result, Hong Kong's money supply is affected by both the Mainland and USA.. For example, the quantitative easing policy in USA increases the money supply in USA. The money further flows to Hong Kong, stimulating the money supply in Hong Kongat a proportion greater than that in USA.

For the effect of money supply in the Mainland, it will have negative effect on itself but positive effect on Hong Kong. It shows that if there is money supply in the Mainland, the liquidity will decrease locally. Money will flow to other region. Hong Kong is the biggest RMB offshore centre. It is the best place to absorb money from the Mainland. At certain level, it reflects the capital mobility between these two areas. Therefore, Hong Kong's money supply will also be boosted up by the money supply from the Mainland.

6. Conclusions

From this study, Hong Kong's real GDP growth is co-integrated with China but not USA, which is different from the similar researches done in early 2000s. It is mainly because the economic activities between Hong Kong and the Mainland have become more frequent.It is not difficult to find the policies in encouraging the bilateral trade between these two areas. Moreover, Hong Kong's inflation rate and unemployment rate are co-integrated with that of the Mainland China. Focus should be put on the fact that the GDP cycle of Hong Kong is following the Mainland China. However, due to the policy of fixed exchange rate system with the USD, the market interest rate is following the USA. This contradiction will lead to Hong Kong's economic cycle become more volatile. Besides, the effect of the fiscal policy in Hong Kong will be desalinated.

To adapt with the current situation, the exchange rate policy or even the monetary policy of Hong Kong should be adjusted. The policy makers should take into account the current economic integration between the two areas and implement a suitable policy for Hong Kong's monetary system. The aim is to adopt a better policy for smoothing the economic cycle of Hong Kong.

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