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A Study on Exchange Rate Exposure of Chinese Banks

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Abstract

For banks to adjust to the changing financial environment, it is essential to understand how the foreign exchange market impacts them. The purpose of this master thesis is to evaluate the effect of exchange rates movement on fourteen listed Chinese banks' equity returns, by using the Arbitrage Pricing Theory Model. In particular, this paper analyses the three foreign currencies holding the largest trading position with China, namely the Euro, US Dollar, and Japanese Yen. This empirical study finds that Chinese banks are on average most sensitive to RMB exchange-rate movements with regards to Japanese yen. It is also found that foreign exchange exposure has some relation to bank size, with foreign exchange risk being most prominent for medium size banks, than for larger banks. This study tests the foreign exchange rate risk faced by Hong Kong banks, and finds that Hong Kong banks display a much larger exposure than Chinese banks face. In all, this study determines that foreign exchange rates do have an effect on the Chinese banking sector.

Keywords: Chinese banks, Bank of China, exchange rate exposure, foreign exchange risk, exchange rate, RMB, APT.

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Table of Contents

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1 Introduction

The banking sector plays an integral part in the economic life of a nation. The health of the economy is closely related to the soundness of its banking system. Although banks create no new wealth, their borrowing, lending and related activities facilitate the process of production, distribution, exchange and consumption of wealth. Therefore, measuring banks' sources of risk has long been a core interest of risk management professionals, academics and central banks. Among the sources of risk examined in the past, we find exchange rate risk to be one of the most prominent.

Banking institutions today are faced with increased exposure to changes in exchange rates. They experience both direct and indirect exposure. Direct effects to the cash flows of banks, recognized by Martin and Mauer (2001), include foreign currency-denominated asset and liability structures, off-balance sheet exposures, and non-asset based services. Banks can also be indirectly affected by customers, competitors and fund suppliers which have been negatively exposed to exchange rate changes.

Numerous studies have been performed in this field. However, most of these have focused on US Banks (Chamberlain et al. (1997), Martin and Mauer (2001) Choi and Elyasiani (1997), and Choi et al. (1992)), Japanese Banks (Chamberlain et al. (1997)), Australian Banks (Chi et al. (2007)), South African Banks (De Wet, W.A (2004)), Canadian Banks (Atindéhou and Gueyie (2001)), as well as large financial institutions (Martin (1999)). These studies have all included more developed banking institutions. We direct our study to a more recent and upcoming banking sector, namely China. Previous studies regarding the exchange rate exposure faced by Chinese banks has been limited, due to a restricted amount of data available. In addition, as the RMB[1] was pegged to the USD until July 21, 2005, their exchange rate remained fixed and thus China experienced very little foreign exchange rate exposure.

Since China's entry to the World Trade Organization (WTO) in 2001, many sectors have been exposed to foreign competition. Following China's membership to the WTO, international trade has escalated, as China was now seen as part of the fair trade system.

1 During the course of this paper, we will use Renminbi (RMB) and Yuan interchangeably, where Yuan is the base unit for RMB. RMB is the abbreviation of Renminbi. In this thesis, we will use RMB instead of Renminbi.

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However, this has substantially increased China's dependence on foreign exchange movements (Prime (2002)), as a large portion of loans issued by the Chinese Banks are in connection to export-import activities. Wong et al. (2008) note that China is not well equipped with instruments to hedge their foreign exchange risk. This coupled with the increase in internationalization since the WTO agreement in 2001, may suggest that foreign exchange exposure of Chinese banks have become increasingly significant.

1.1 Background

1.1.1 The Chinese Banking Sector

China's banking system lies predominantly in the hands of the Chinese government. The main financial institutions are state-owned commercial, or managed by structures directly controlled by the government. China's banking system can be viewed in a pyramid-like structure. At the head of the pyramid lies People's Bank of China (PBOC). PBOC was established in 1948 and is currently the central bank of the People's Republic of China. It is supported by the China Banking Regulatory Commission (CBRC). The CBRC was officially established in April 2003, to act as the supervisory role for the PBOC. Thus the PBOC focuses only on monetary policy issues. The CBRC plays an integral part in the stability of the Chinese banking sector. It oversees regulation and supervision over all banking institutions and their business activities in the People's Republic of China. The CBRC promote the safety and soundness of the Chinese banking industry, and to stabilize and enhance public confidence in the banking system. They focus on fair competition within the banking industry, thus allowing it to maintain its competitiveness.

The Chinese banking system is fundamentally represented by the State-owned commercial Banks, divided into Commercial Banks and State Policy Banks. The "Big Four" make up the four major Commercial Banks. These four state-owned commercial banks include; the Agricultural Bank of China, Bank of China, China Construction Banks and the Industrial and Commercial Bank of China. The "Big Four" was formed in 1980 when Deng Xiaoping began to modernize PBOC in the hope of encouraging greater economic reform (Geretto, Pauluzzo (2001). Agricultural Bank of China offers financial support mainly to rural areas in the form of agricultural activities. Bank of China is mainly focused on foreign exchange transactions and trade finance. China Construction Banks is mainly active with long-term credit

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applications, used specifically for longer-term projects, such as infrastructure and urban housing development projects. Industrial and Commercial Bank of China is the largest bank in China, in terms of total assets, employees and customers. Its main priorities lie within the commercial and industrial sector. These four major commercial banks intermediated around 52% of the total financial flows in 2006 (Geretto and Pauluzzo, 2008). Except Agricultural Bank of China, the other three are all dual listed in both Shanghai stock exchange and Hong Kong stock exchange. Agricultural Bank of China has not listed in any stock exchange until now.

Other important players in the Chinese banking system include joint-stock commercial banks and city commercial Banks. Joint-stock commercial banks are owned by the state, local authorities and other investors. These banks are approved to handle any banking activities, as well as foreign currency transactions. There exist 13 joint-stock commercial banks, of which half engage in partnerships with foreign investors. These commercial banks hold approximately 16% of the market share. In contrast, City Banks work only within urban centers. Their market share is around 5%. These joint-stock commercial banks and city banks are locally listed either on the Shanghai stock exchange or Shenzhen stock exchange in China.

1.1.2 Chinese Foreign Exchange Policies

For most of its early history, the RMB was pegged to the U.S. dollar at 2.46 yuan per USD. During the 1980's, China's economy gradually emerged. The RMB was devaluated at this time, as to reflect its true market price and to boost the exports in China. Since 1980, the RMB/USD declined from 1.50 yuan, to 8.62 yuan in 1994. As China's current account balance grew stronger by the end of 1990, the Chinese government agreed to maintain a peg of 8.27 yuan per USD. The peg lasted from 1997 to 2005. On July 21, 2005, the peg was lifted as the Chinese currency was believed to be undervalued. The RMB appreciated instantaneously to 8.11 per USD. Today, the RMB is under a managed floating exchange rate system, which is based on market supply and demand with reference to basket of foreign currencies. The daily trading price of the USD against the RMB in the inter-bank foreign exchange market would be allowed to float within a narrow band of 0.3% around the central parity published by the People's Bank of China (PBC). On May 19, 2007, this band was

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extended to 0.5%. The PRC has stated that the basket is dominated by the USD, Euro, Japanese yen and South Korean won, with a smaller proportion made up of the British pound, Thai baht, Russian ruble, Australian dollar, Canadian dollar and Singapore dollar.

1.2 Purpose

Our study will estimate the sensitivity of Chinese banks' stock returns to individual exchange rates and examine the overall effect of exchange rate movements on Chinese banks' stock returns.

We estimate the sensitivity of Chinese banks´ stock returns to individual exchange rates by running multiple regressions. The coefficient of foreign exchange is the expected sensitivity. A positive coefficient illustrates that movements in an exchange rate, has a positive effect on Chinese banks' equity returns, and vice versa. The overall statistical effect of exchange rate exposures to the banks' equity returns is calculated by their contribution to variance of model. In other words, we measure how much changes in exchange rates contribute to the variance of the APT model.

1.3 Limitations of the Study

The method used in this study, APT, is sufficient in examining the overall exchange rate exposure of each bank in our study. However, some limitations beyond APT exist, namely the use of the Cash Flow Method (discussed in the latter part of this paper). This method allows one to find the independent causes related to a bank's equity return, using line items from both the income statement and balance sheet. Of the fourteen listed Chinese banks in our study, we found only one bank (Bank of China) to have published an updated financial statement for 2008, in English. This prevented us from finding the true foreign asset and foreign liability accounts, for the thirteen remaining banks. While APT allows us to accurately calculate the overall exchange rate exposure faced by each individual bank, we are not able to quantify the exact causes of the behavior each bank experiences. Without these values, it is impossible to accurately quantify the direct and indirect effects of foreign exchange rate exposure.

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1.4 Thesis Outline

We have structured the latter part of this paper as follows:

Chapter Two will cover previous literature on past studies implemented on the exchange rate exposure faced by banks. Chapter Three, will be based on the theories behind our study- namely the sources and estimates of foreign exchange rate exposure. In Chapter Four, the methodologies are discussed in detail. Chapter Five follows with the descriptive statistics and regression analysis. An analysis and discussion of results are performed in Chapter Six. The final conclusion is made in Chapter Seven, with managerial implications and some suggestions for further studies included in Chapter Seven.

2 Literature Review

Previous literature on the behavior of banks' stock returns has been explained primarily by a two-factor model, using the market index and interest rate index as factors. Kwan (1993) and Brewer et al. (1993) are among the researchers who have quantified this relationship. Increased globalization over the past years, coupled with greater integration among world economies, advocate that market and interest factors may not be sufficient in explaining the risks banks face today. International competition, multinational firms' growth financing, and more integrated capital markets are among the sources of an increasing number of international activities now present in commercial banks. As a result, banks today are faced with increased international risks, such as exchange rate risk.

Previous studies in this field have focused mainly on more developed banking institutions, including those in the US, Japan, Australia, South Africa and Canada. Several of these authors have analyzed the relationship between the stock return of banks to changes in exchange rates in their respective countries. For example, Chamberlain et al. (1997) examine the exchange rate sensitivities of US bank holding companies and of Japanese banks, using both daily and monthly data. They find that the stock returns of approximately one-third of thirty large US bank holding companies appear to be sensitive to exchange rate changes. In contrast, they find relatively few Japanese banks to be sensitive to exchange rate changes.

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Martin and Mauer (2001) use a cash flow-based framework to examine the exchange rate exposure of 105 individual US banks over the period 1988-1998. Their study focuses on the exposure faced by domestic banks compared to international banks as well as a comparison based on their relative sizes. Finally, they examine the effect of long-term compared to short-term exposures. Their analyses show that 72% of internationally orientated and 88% of domestically orientated banks in their sample, face considerable exposure to at least one of five currency pairs. Lastly, they find that longer-term exposures are more prevalent than short-term exposures in this sample, thus confirming their belief that longer-term exposures are harder to identify, measure and hedge.

De Wet, W.A (2004) use an augmented market model to determine whether South Africa's four major commercial banks are exposed to exchange rate changes. Their model reveals that all four major banks face substantial foreign exchange risk.

Atindéhou and Gueyie's (2001) study involves determining whether Canadian banks' stock returns react differently to changes (both positive and negative) in the exchange rate by using sensitivity analysis. They use a three-factor pricing model of banks' stock returns, with market, interest rate, and exchange rate indices as factors over the period 1988-1995. Their results show that Canadian banks' stock returns are influenced by movements in the exchange rate, especially to the USD. They examine further that investors react more to a re-evaluation of their portfolio after losses, than to an appreciation after successive gains.

Chi et al. (2007) are among the very few researchers in this field who have indicated that there does not exist any significant relationship between the stock returns of their sample banks to foreign exchange rate movements. Their study explores the relationship of four major Australian banks, which have significant operations outside of Australia, with five regional banks in Australia which do not participate in any foreign business. They use the Capital Market Method to quantify this relationship over the period 1997-2007.

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3 Theoretical Framework

3.1 Sources of Foreign Exchange Rate Exposure

Foreign exchange rate fluctuations affects banks both directly and indirectly. In this section, we will discuss some of these sources, stemming from 'direct and indirect determinants'.

3.1.1 Direct Determinants

The most easily recognized and managed is the direct effect banks face from foreign denominated payment streams in both the asset and liability accounts. Bank of China, reported in their 2007 annual report, that direct determinants contribute the most to their exchange rate risk. Banks are directly exposed to foreign exchange rate changes by their foreign currency-denominated asset and liability structures, as a depreciation in a foreign currency will decrease the overall value of a line of assets denominated in the foreign currency. For example, Bank of China may own a USD denominated bond, where payments have to be issued in USD. Say, the RMB appreciates against the USD. This would decrease the RMB value of this asset. If Bank of China has no offsetting USD-denominated obligations, the value of their portfolio in RMB will increase or decrease depending on the exchange rate movement. Banks' balance sheet can also be affected by movements in exchange rates. For example, say the RMB appreciates, RMB denominated borrowings will decrease. In contrast, the foreign denominated currency borrowing will increase. This in turn leads to more RMB denominated assets and less foreign currency denominated assets, therefore the asset structure of the bank will change.

There is a positive relation between movements in the exchange rate and a bank's equity return through this direct effect. For instance, if the RMB appreciates against the USD, which means the USD/RMB exchange rate will go down or equivalently, the movement of exchange rate is negative, the foreign currency denominated net assets (foreign assets - foreign liabilities) will shrink. Therefore, the change of a banks' equity return is negative as well.

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3.1.2 Indirect Determinants

Chinese Banks are not only affected directly, but also indirectly by customers, competitors and fund suppliers which have been negatively exposed to exchange rate changes. These indirect sources are not as easily noticeable, and even more difficult to manage. However, they are still just as important as the direct sources mentioned above.

Domestic banks are generally characterized by having no foreign currency involvement. However, domestic banks could be affected through this indirect exposure. Wentz (1979) and Jorian (1990), are among the researches who have conceptually acknowledged that foreign exchange exposure is evident in domestic banks. Choi (1986) and Hodder (1982), have presented these findings theoretically. Martin and Mauer (2001) note that domestic banks can have significant exchange rate exposure due to their lack of awareness of the importance of currency exposure, and their lack of preparation to manage and measure these exposures.
Although these banks may not hold foreign denominated assets or liabilities, they are still exposed to the foreign exchange exposure their domestic banking operations face.

For example, say Bank of China issues a loan to a Chinese exporter. An appreciation of the RMB, may make it more difficult for the Chinese exporter to compete with foreign firms. If the appreciation hinders the profitability of the Chinese exporter, it also reduces the probability of a timely loan repayment, and correspondingly the profitability of Bank of China. In essence, any time the foreign exchange rate is connected with international competition, to the issuance of loans, or to other sides of banking conditions, it will affect even banks without foreign assets or liabilities.

Foreign exchange risk stems from several sources, not just from its holding of foreign exchange. The vulnerability of the bank as a whole, can also be made between foreign exchange risk and other market risks, such as interest rate risk. Interest rates and exchange rates often move together. In other words, a bank's interest rate positions often indirectly influences its overall foreign exchange exposure. According to Sandra Chamberlain (1997), the foreign exchange rate sensitivity of a bank with no interest rate position typically will differ from that of a bank with no interest rate exposure, even if the two banks have the same actual holding of assets denominated in a foreign currency.

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There exist both positive and negative relationships between movements in exchange rates and banks' equity return, through these indirect effects. For instance, if the RMB appreciates against the USD, exporters will experience greater pressure. This might lead to an exporter defaulting, and thus the bank's equity return will be harmed as well. In this case, exchange rate movements have a negative effect on banks' equity return. However, at the same time, when RMB appreciates, importers may benefit, and thus the banks' equity return will gain. In this aspect, an exchange rate movement has a positive effect on banks' equity return.

3.2 Estimation of Foreign Exchange Rate Exposure

Previous studies on the effect of exchange rate exposure to banks have used two methods until now, namely the Free Cash Flow Approach and the Capital Market Approach. The studies using the Free Cash Flow Approach, such as Choi et al.(1992), Anna et al. (2001), and Martin and Mauer (2003), try to explore the relationship between banks' operating incomes (before adjustments for depreciation and exchange rate gains and losses) disclosed in their financial statements and selected bilateral exchange rates against domestic currency.

Compared to this method, the Capital Market Approach uses the market value of the banks, instead of their book values. Theoretically, these two methods are similar as long as the equity values of banks are largely reflected by their discounted expected future cash flows. However, since data on banks' incomes are generally less available than banks' equity data, due to lower frequency of banks' financial result announcements, it is hard to apply the Cash Flow Approach for studying Chinese banks that have a short financial history. Therefore, we will use the Capital Market Approach by applying the Asset Pricing Theory to quantify the exchange rate affect of Chinese banks.

Arbitrage Pricing Theory (APT) is a general capital asset pricing model, which has become a powerful method of stock valuation. APT holds that the expected return of a financial asset can be modeled as a linear function of various macroeconomic factors or theoretical market indices, where sensitivity to changes in each factor is represented by a factor-specific beta coefficient. The model-derived rate of return will then be used to price the asset correctly - the asset price should equal the expected end of period price discounted at the rate implied by model. If the price diverges, arbitrage should bring it back into line. If APT holds, then a risky asset can be described as satisfying the following relation:

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$$E(r_j) = r_f + b_{j1}RP_1 + b_{j2}RP_2 + \cdots + b_{jn}RP_n$$
$$r_j = E(r_j) + b_{j1}F_1 + b_{j2}F_2 + \cdots + b_{jn}F_n + \epsilon_j$$

Where, $E(r_j)$ is the risky asset's expected return, RP_k is the risk premium of the factor, r_f is the risk-free rate, F_k *i*s the macroeconomic factor, b_{jk} is the sensitivity of the asset to factor k, also called factor loading, and ϵ_j is the risky asset's idiosyncratic random shock with a mean of zero. That is, the uncertain return of an asset j is a linear combination of n factors and a noise term. Additionally, every factor is also considered to be a random variable with a mean of zero. Be aware that there are some assumptions and requirements, which need to be fulfilled for the implementation of the model. There must be perfect competition in the market, and the total number of factors may never surpass the total number of assets (in order to avoid the problem of matrix singularity).

The APT differs from the CAPM in that it is less restrictive in its assumptions. It allows for an explanatory (as opposed to statistical) model of asset returns. It assumes that each investor will hold a unique portfolio with its own particular array of betas, as opposed to the identical "market portfolio". In some ways, the CAPM can be considered a "special case" of the APT in that the security market line represents a single-factor model of the asset price, where beta is exposed to changes in the value of the market.

4 Methodology

4.1 Sample

We conduct research on fourteen listed Chinese banks. These banks are divided among three state-owned commercial banks, eight joint-stock commercial banks and three city banks. The three state-owned banks include: Industrial and Commercial Bank of China (GSYH), China Construction Bank (JSYH), and Bank of China (ZGYH). The eight joint-stock commercial banks include; Bank of Communications (JTYH), China Merchants Bank (ZSYH), China CITIC Bank (ZXYH), Shanghai Pudong Development Bank (PDYH), China Minsheng Bank (MSYH), Industrial Bank (XYYH), Huaxia Bank (HXYH), and Shenzhen Development (SZYH). Lastly, the three city banks include; Bank of Beijing (BJYH), Bank of Nanjing (NJYH), and Bank of Ningbo (NBYH).

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In the section 4.2, we will distinguish between dual-listed and locally listed banks. In our sample, six of the banks (ZGYH, JSYH, GSYH, JTYH, ZSYH, and ZXYH) are dual-listed in both China and Hong Kong, while the remaining banks (PDYH, HXYH, MSYH, XYYH, SZYH, NJYH, NBYH and BJYH) are locally listed.

4.2 Methodological Approach

We apply the APT model differently for dual-listed banks and locally listed banks. For the dual-listed banks, the excess return of A-Shares[2] of the bank is affected by both the excess returns of the Chinese market portfolio, and the excess returns of the Hong Kong market portfolio. The reason is that the two markets are integrated into the whole world market and the equity belongs to the same bank. For example, when people in the Hong Kong market have high expectation for a bank, they will in return buy more stock of this bank. This leads to an increase of the stock price in the Hong Kong market. When the investors in the Chinese market see the growth of this bank, they will start to buy more in the Chinese market as well. Therefore, we include both Chinese and Hong Kong excess market returns for A-shares and H-shares, for the dual-listed banks. In order to distinguish returns from the Chinese market and the Hong Kong market, we use dummy variables to capture the difference in coefficients of the market premium variables when two set of stock returns (data taken from Chinese market and Hong Kong market) are used. The model will be as follows:

Model 1:

$$R_{n,t} - RF_t = \alpha_n + \beta_n{}^{CH}(R_{CH,t} - RF_{CH,t}) + \beta_n{}^{HK}(R_{HK,t} - RF_{HK,t}) + \beta_n{}^{CH,A}(R_{CH,t} - RF_{CH,t})Dum_A +$$
$$+ \beta_n{}^{HK,A}(R_{HK,t} - RF_{HK,t})Dum_A + \sum_{k=1}^{4} \beta_k{}^{X} X_n + \varepsilon_{n,t}$$

[2] A-Shares on the Shanghai and Shenzhen stock exchanges refers to those that are traded in Renminbi, the currency in mainland China. Some shares on the two mainland Chinese stock exchanges, known as B-Shares, are traded in foreign currencies.
B-shares on the Shanghai and Shenzhen stock exchanges refer to those that are traded in foreign currencies. Those that are traded on the two mainland Chinese stock exchanges in Renminbi, the currency in mainland China, are called A-shares. The face values of B-shares are set in Renminbi. In Shanghai B-shares are traded in US dollar, whereas in Shenzhen they are traded in Hong Kong dollar.
H-shares refers to the shares of companies incorporated in mainland China that are traded on the Hong Kong Stock Exchange. Many companies float their shares simultaneously on the Hong Kong market and one of the two mainland Chinese stock exchanges. Huge price discrepancies between the H-share and the A-share counterparts of the same company are not uncommon. A-shares generally trade at a premium to H-shares, as the People's Republic of China's government restricts mainland Chinese people from investing abroad, and foreigners from investing in the A-share markets in mainland China.

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Where, $R_{n,t}$ is the return of the n[th] bank stock share at time t. $RF_{CH,t}$ and $RF_{HK,t}$ are the risk free rates for the Chinese market and the Hong Kong market respectively. $R_{CH,t} - RF_{CH,t}$ is the Chinese market premium while $R_{HK,t} - RF_{HK,t}$ is the Hong Kong market premium. Dum_A is a dummy variable, which equals zero for A-shares, and equals one for H-shares. X_n is the return from exchange rate of the n[th] currency to Chinese Yuan.

β_n^{CH} and β_n^{HK} are the market sensitivities (coefficients) of the excess returns of the Chinese bank's A-shares to the Chinese market premium and to the Hong Kong market premium respectively. $\beta_n^{CH} + \beta_n^{CH}$ and $\beta_n^{HK} + \beta_n^{HK}$ are the market sensitivities of the excess returns of a Chinese bank's H-shares to the Chinese market premium and to the Hong Kong market premium respectively. By using dummy variables, we have four market sensitivities of the Chinese market premium to Chinese equity, the Hong Kong market premium to Chinese equity, the Chinese market premium to Hong Kong equity, and the Hong Kong market premium to Hong Kong equity, in a single APT model. β_k^X is the sensitivity of the k^{th} return of exchange rate to the return of banks' excess equity return.

The contribution of each factor k (exchange rate return), to the total variance of the dependent variable, y_t(banks' excess equity return), is:

$$c_k = \beta_k \sum_{j=1}^{K} \beta_j \sigma_{kj}$$

Where β_j is the coefficient of the factor k in the regression contribution of factor j in the regression. $\sigma_{kj}$is the covariance between factor k and factor j. By dividing $c_k$with the total variance of y_t, we can compute the part of the total variance that is explained by each factor. The sum of these partial contributions is:

$$C_s = \sum_{k=1}^{K} \frac{c_k}{\text{var}(y_t)}$$

In our study, we are interested in the individual, as well as the overall exchange rate effect to the banks' equity returns; therefore, we will calculate the contribution of each exchange rate c_k and the overall contribution of exchange rates, denoted as C_s.

For the locally-listed banks, the APT model includes only the market premium where the bank is listed, as well as the exchange rate variables:

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Model 2:

$$R_{n,t} - RF_t = \alpha_n + \beta_n{}^{CH}(R_{CH,t} - RF_{CH,t}) + \sum_{n=1}^{4} \beta_n{}^{X} X_n + \varepsilon_{n,t}$$

Every variable is defined the same as for the model for dual-listed banks. All the variables and calculations are similar and consistent with the first model for dual-listed banks.

We estimate a third model, to measure the exchange rate risk for Hong Kong local banks. Again, we conduct research on six[3] listed Hong Kong banks, using a third model similar to the second model, with the Hong Kong market premium, Hong Kong risk free rate of interest and the exchange rate between the Hong Kong Dollar and the four sample currencies as above. Hong Kong plays a key role in the financial economy of the Asian market. We therefore find it beneficial for comparison reasons to the Chinese banking sector. We will discuss the results further in section 6.

Model 3:

$$R_{n,t} - RF_t = \alpha_n + \beta_n{}^{HK}(R_{HK,t} - RF_{HK,t}) + \sum_{n=1}^{4} \beta_n{}^{X} X_n + \varepsilon_{n,t}$$

The weekly return of the market portfolio is approximated by using the Hang Seng Index. To calculate the weekly return of Hong Kong's risk free interest rate, we use the yield of Hong Kong's 9 month exchange fund bill. The data is found in DataStream. The weekly Hong Kong Dollar exchange rate to Euro, US dollar, and Japanese yen is also found in DataStream

4.3 Data

The data is collected over the period of 22 July 2005[4] to April 2009 from Yahoo Finance. However, some banks have shorter historical data periods. We decided to use weekly data instead of daily data for this study, as daily data presented some pitfalls. Firstly, the Chinese market is unable to respond to exchange rate changes immediately. Therefore, a close relationship between daily exchange rates and daily returns does not exist. If we use lag

[3] These include Heng Sheng Bank, Bank of East China, Wing Hang Bank, Fubon Bank, Chong Hing Bank and Dahsing Bank.

[4] On 21 July 2005, China changed its exchange rate policy. In order to eliminate the big change on this day, we start our research from 22 July 2005.

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variables, as Wong et al. (2008) did, we need to run multiple regressions in order to determine the best lag period. However, this lag period found by the regression, may be different from the true lag period in reality. We thus find that although daily data may be more accurate, the complexity of it does not bode well with our research topic. Secondly, the daily dataset may contain some outliers, which could arise from either sudden changes in market sentiments or some special events of the banks (such as sharp rises in dividend payments). Including these outliers in the sample, may lead to biased results, as the estimations could be unduly affected by them.

The weekly return of the market portfolio is approximated by using the Shanghai Stock Exchange A-share Index (for banks listed in Shanghai stock Exchange), Shenzhen Stock Exchange A-share Index (for banks listed in Shenzhen Stock Exchange) and Hang Seng Index (for banks listed in Hong Kong). We use the yield of China's 10 year benchmark bond to calculate the weekly return of China's risk free interest rate since we are unable to find the benchmark bond with a shorter time period. To calculate the weekly return of Hong Kong's risk free interest rate, we use the yield of Hong Kong's 9 month exchange fund bill. The data is found in DataStream. The weekly RMB exchange rate to the Euro, US dollar and Japanese yen5 is also found in DataStream.

5 Data Analysis

5.1 Descriptive Statistics

Table I reports some descriptive statistics on the individual variables used in our study. Over the period we research, the average weekly stock returns vary from -1.02 percent for NBYH (Ningbo Bank) to 0.44 percent for JTYHHK (H-Share of Bank of Communication). The average weekly return is positive for ASI (A-Share Index) and also positive for HSI (Hang Seng Index). Both ASI and HIS have higher average return than both risk free return on average. This is consistent to the concept of conpensation for risk. The average weekly change of exchange rate is zero for CHJPY (Chinese Yuan relative to Japanese Yen), and negative for the other three exchange rates we research. Market index volatility, as measured

[5] From WTO annual report of 2008, we know that United States, European Union and Japan are the biggest trade partners of China. Their trading shares are 27%, 25% and 10% respectively. All the other counties have far below 10% share of trade.

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by the standard deviation of its returns, is lower than the volatility of banks' stock returns. As can be seen, the exchange rates show the lowest volatility in comparison to the other variables.

The skewness of banks´ return and indexes are neither consistently positive nor negative. They are located around zero, which present that there is no significant non-zero skewness. Except ZGYH and MSYH, kurtosis of other banks is around three, which means that the return distributions are close to normal distribution. Especially, the kurtosis of ASI and HIS are 2 and 2.8 which are very near to the kurtosis of normal distribution.

Table I: Descriptive statistics of data in regression

Returns	Mean	Standard Deviation	Sample Variance	Kurtosis	Skewness	Minimum	Maximum
ZGYH	0.0000	0.0531	0.0028	7.5615	1.2165	-0.1628	0.3043
ZGYHHK	-0.0007	0.0477	0.0023	1.7973	0.1237	-0.1719	0.1495
JSYH	-0.0088	0.0580	0.0034	0.6374	0.3773	-0.1416	0.1713
JSYHHK	0.0042	0.0599	0.0036	2.8256	-0.1177	-0.2457	0.2417
GSYHHK	0.0022	0.0504	0.0025	4.9089	-0.0567	-0.2309	0.2676
GSYH	0.0021	0.0597	0.0036	2.8130	0.7928	-0.1446	0.2680
JTYH	0.0042	0.0599	0.0036	2.8256	-0.1177	-0.2457	0.2417
JTYHHK	0.0044	0.0580	0.0034	3.3907	-0.5539	-0.2801	0.1627
PDYH	0.0029	0.0638	0.0041	1.7936	-0.1784	-0.2390	0.2256
HXYH	0.0018	0.0650	0.0042	3.3258	-0.2055	-0.3106	0.2707
MSYH	-0.0025	0.0643	0.0041	9.6466	-1.6341	-0.4304	0.2353
ZSYH	0.0014	0.0606	0.0037	5.2419	-0.7597	-0.3589	0.2521
ZSYHHK	0.0030	0.0755	0.0057	1.4283	-0.3949	-0.2716	0.2206
XYYH	0.0000	0.0871	0.0076	-0.1026	-0.1526	-0.2155	0.2090
ZXYH	-0.0082	0.0547	0.0030	1.1960	-0.3221	-0.1742	0.1342
ZXYHHK	-0.0071	0.0684	0.0047	3.4089	-0.2416	-0.2466	0.2352
SZYH	0.0015	0.0693	0.0048	3.5460	-0.4125	-0.3594	0.2133
NJYH	-0.0045	0.0621	0.0039	1.1460	0.2976	-0.1791	0.2087
NBYH	-0.0102	0.0689	0.0047	0.5451	0.0997	-0.1971	0.1665
BJYH	-0.0080	0.0640	0.0041	0.3068	0.0859	-0.1488	0.1988
ASI	0.0011	0.0366	0.0013	2.0336	0.0155	-0.1492	0.1393
HIS	0.0014	0.0365	0.0013	2.8121	-0.4621	-0.1992	0.1392
CHJPY	0.0000	0.0148	0.0002	3.8746	0.7002	-0.0642	0.0945
CHUSD	-0.0004	0.0015	0.0000	5.4250	-5.1904	-0.0204	0.0060
CHEU	-0.0004	0.0144	0.0002	4.1992	-0.5912	-0.0693	0.0569
RFch	0.0008	0.0001	0.0000	-0.6698	-0.0254	0.0006	0.0010
RFhk	0.0006	0.0002	0.0000	-0.7915	-0.8711	0.0001	0.0009

Note: Mean is Significant at 5% significant level for all the data.

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As we can see from Table II and III, most of correlations have absolute values much smaller than 0.5 except the correlations between dummy variables and market excess return variables, therefore the equity returns for both dual-listed banks and locally-listed banks do not have multicollinarity problem and heteroskedasity.

Table II: Correlation metrics of independent variables for dual-listed banks

	RPCH	RPHK	RPCHDM	RPHKDM	CHJPY	CHUSD	CHEU
RPCH	1	-0.05528	0.717172	-0.0373	0.049394	0.1445	-0.04502
RPHK	-0.05528	1	-0.03645	0.709737	-0.1069	-0.03686	0.129785
RPCHDM	0.717172	-0.03645	1	-0.05225	0.028737	0.111574	-0.03591
RPHKDM	-0.0373	0.709737	-0.05225	1	-0.07807	-0.02168	0.088931
CHJPY	0.049394	-0.1069	0.028737	-0.07807	1	0.047453	-0.13111
CHUSD	0.1445	-0.03686	0.111574	-0.02168	0.047453	1	-0.33881
CHEU	-0.04502	0.129785	-0.03591	0.088931	-0.13111	-0.33881	1

Table III: Correlation metrics of independent variables for locally-listed banks

	RPCH	RPHK	CHJPY	CHUSD	CHEU
RPCH	1	-0.05528	0.118386	-0.04082	0.034041
RPHK	-0.05528	1	-0.01238	0.131208	-0.06016
CHJPY	0.118386	-0.01238	1	0.047453	-0.13111
CHUSD	-0.04082	0.131208	0.047453	1	-0.33881
CHEU	0.034041	-0.06016	-0.13111	-0.33881	1

5.2 Regression Analysis

We begin by analyzing the value of R^2 and the adjusted R^2 to determine whether the regression line fits the data well or not. From Table IV, we can see that the regressions have a R^2 ranging from 0.119793 for PDYH to 0.662308for JTYH.

On average, the adjusted R^2 is 0.5038[6], which means that the market premium and the exchange rate, is able to explain around half of the banks´ excess equity return. The model we research covers only from the aspect of the market premium and macroeconomic factors. There are some other important factors that can affect bank ´s stock price. For example, a company´s intrinsic value is a very important factor of stock price. As Brooks (2005) noted, the intrinsic value is based on the company´s ability to generate cash flow in the future. The stock price of a firm will rise if the cash flow of this firm increases. Some other factors such

[6] It is the average of R^2 in table IV.

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as political and psychological reasons can also affect stock prices. In all, the regression line fits the data very well since macroeconomic and market factors contribute only to a part of the stock price in reality.

We use time-series data which is often faced with an autocorrelation problem. Durbin-Watson (DW) is a test for first order autocorrelation. When DW equals two, there is no autocorrelation in the residuals. Between the upper critical value (d_U) and lower critical value (d_L), there is no evidence of autocorrelation. According to the Table for Lower and Upper 1% critical values for DW statistic, we know that d_U and d_L are around 1.65 and 1.45 respectively. Therefore, the region where no autocorrelation exist ranges from 1.65 to 2.35. Table IV shows that all the fourteen Chinese banks in our sample, lie in this region. Therefore, there is no autocorrelation in our sample.

Table IV: Results for R^2, adjusted R^2 and Durbin-Watson test

	ZGYH	JSYH	GSYH	JTYH	ZSYH	ZXYH	PDYH
R^2	0.621053	0.651807	0.448884	0. 662308	0.477055	0. 471604	0. 119793
Adjusted R^2	0.6111646	0.642135	0.438624	0. 655988	0.466217	0. 462047	0. 105986
DW Statistic	1.957647	1.896730	2.213483	1. 853807	2.11996	2.115952	2. 336878
	HXYH	**MSYH**	**XYYH**	**SZYH**	**NJYH**	**NBYH**	**BJYH**
R^2	0.319989	0. 201262	0. 507142	0. 130396	0. 526744	0. 494587	0. 607307
Adjusted R^2	0.306603	0. 188733	0. 488186	0. 116755	0. 503936	0. 470229	0. 586080
DW Statistic	2.165976	2. 190750	2. 088775	2. 299732	1. 873416	2. 042417	1. 785108

6 Analysis and Discussion of Results

Table V, Table VI and Table VII, illustrate the results from Model 1, Model 2 and Model 3 mentioned in section 4.2. We will discuss the three findings below. The first finding will cover the relationship between the equity return of each bank and the independent variables. Our second finding will talk about the relationship between the overall foreign exchange exposure and bank size. Lastly, our third finding will relate to the exposure faced by Hong Kong banks, in comparison to Chinese mainland banks.

Table V: Regression results for dual-listed banks

Explanatory Variables	ZGYH	JSYH	GSYH	JTYH	ZSYH	ZXYH
Intercept	-0.002815 (0.1894)	0.001516 (0.55020)	-0.000931 (0.6893)	0. 002600 (0. 1862)	-0. 000662 (0. 8152)	-0.00344 (0.3143)

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($R_{CH,t}$-$RF_{CH,t}$)	0.822774 (0.0000)	0.832335 (0.0000)	0.832355 (0.0000)	0. 020127 (0.0000)	0. 895895 (0.0000)	0.830415 (0.0000)
($R_{HK,t}$-$RF_{HK,t}$)	-0.097038 (0.1159)	-0.0029999 (0.9698)	-0.108039 (0.1861)	1. 217366 (0. 7135)	-0.158231 (0.0853)	-0. 154914 (0. 0933)
($R_{CH,t}$-$RF_{CH,t}$)Dum_A	-0.686414 (0.0000)	-0.837056 (0.0000)	-0.736216 (0.0000)	0. 035018 (0. 6449)	-0.844932 (0.0000)	-0. 845756 (0.0000)
($R_{HK,t}$-$RF_{HK,t}$) Dum_A	0.961153 (0.0000)	1.228956 (0.0000)	1.026243 (0.0000)	0. 054457 (0. 5547)	1.515739 (0.0000)	1. 512605 (0.0000)
CHUSD	-0.704160 (0.4578)	-0.750459 (0.5082)	-0.782833 (0.8096)	-1.227796 (0. 1525)	4.545423 (0.2167)	-2.232747 (0. 1237)
CHJPY	0.025142 (0.8011)	0.118830 (0.3020)	-0.229423 (0.0595)	0. 148915 (0. 1435)	-0.195146 (0.1979)	-0. 257047 (0. 0847)
CHEU	-0.231048 (0.0668)	-0.142829 (0.3152)	0.109755 (0.4538)	0. 058650 (0. 6382)	0.094530 (0.6060)	0. 011989 (0. 9467)
R square	0.621053	0.651807	0.448884	0. 662308	0.477055	0. 471604
Adjusted R square	0.6111646	0.642135	0.438624	0. 655988	0.466217	0. 462047
DW stastic	1.957647	1.896730	2.213483	1. 853807	2.11996	2.115952
Cs	0.001674	-0.000025	0.00747	0.003074	0.007655	0.013288

Notes:

(1) ($R_{CH,t}$-$RF_{CH,t}$) is the Chinese market premium, ($R_{HK,t}$-$RF_{HK,t}$) is the Hong Kong market premium

(2) CHUSD, CHJPY and CHEU are exchange rates of Chinese RMB to USD, JPY and EURO respectively.

(3) Figures in parentheses are P-values.

(4) CHUSD, CHJPY and CHEU are foreign exchange of Chinese RMB to US Dollar, Hong Kong Dollar, Japanese Yen and Euro.

(5) The C_s shows the overall effect of movements in exchange rates, to banks´ equity return.

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Table VI: Regression results for locally-listed banks

Explanatory Variables	**PDYH**	**HXYH**	**MSYH**	**XYYH**	**SZYH**	**NJYH**	**NBYH**	**BJYH**
Intercept	0. 002447 (0. 5751)	-0. 003083 (0. 4129)	-0. 005191 (0. 2459)	-0. 003996 (0. 5633)	0. 000321 (0. 9461)	0. 000102 (0. 9851)	-0. 004670 (0. 4537)	-0. 001869 (0. 7322)
($R_{CH,t}$-$RF_{CH,t}$)	0. 544827 (0.0000)	0. 893512 (0.0000)	0. 771619 (0.0000)	1. 161744 (0.0000)	0. 601662 (0.0000)	0. 806187 (0.0000)	0. 869393 (0.0000)	0. 902471 (0.0000)
CHUSD	1.395099 (0. 5728)	-3.690700 (0. 0844)	-1.515868 (0. 5495)	-4.528599 (0. 1188)	0.017907 (0.9947)	0.437842 (0. 8424)	0.577993 (0. 8188)	-2.198454 (0. 3052)
CHJPY	0. 087589 (0. 7264)	-0. 265430 (0. 2194)	0. 123253 (0. 6307)	0. 095817 (0. 7487)	0. 502101 (0. 0663)	0. 031065 (0. 8850)	-0.046357 (0. 8506)	-0. 231460 (0. 2650)
CHEU	0. 256918 (0. 3781)	-0. 217553 (0. 3867)	-0. 270967 (0. 3640)	0. 229551 (0. 5299)	0. 059514 (0. 8511)	0. 025380 (0. 9232)	0. 169532 (0. 5746)	-0. 032559 (0. 8968)
R square	0. 119793	0.319989	0. 201262	0. 507142	0. 130396	0. 526744	0. 494587	0. 607307
Adjusted R square	0. 105986	0.306603	0. 188733	0. 488186	0. 116755	0. 503936	0. 470229	0. 586080
DW stastic	2. 336878	2.165976	2. 190750	2. 088775	2. 299732	1. 873416	2. 042417	1. 785108
Cs	0.00449835	0.006544	0.003122	0.00379720	0.012955	0.002733	0.001708	-0.0026912

Notes:

(1) ($R_{CH,t}$-$RF_{CH,t}$) is the Chinese market premium, ($R_{HK,t}$-$RF_{HK,t}$) is the Hong Kong market premium

(2) CHUSD, CHJPY and CHEU are exchange rates of Chinese RMB to USD, JPY and EURO respectively.

(3) Figures in parentheses are P-values.

(4) CHUSD, CHJPY and CHEU are foreign exchange of Chinese RMB to US Dollar, Hong Kong Dollar, Japanese Yen and Euro.

(5) The C_s shows the overall effect of movements in exchange rates to banks´ equity return.

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Finding One:

As shown, there exists some relationship between the equity return of each bank and the independent variables.

We find that dual-listed banks have some correlation to both the Chinese market premium and the Hong Kong market premium, with a much larger correlation to the Chinese market premium. All of the banks are significantly related to the Chinese market premium, at a 99% confidence level, while only three banks are significantly related to the Hong Kong market premium at a confidence level above 90%. The direction of affect from the Chinese market premium and the Hong Kong market premium is different. As shown in Table V, the equity return of the dual-listed banks, are on average, positively related to the Chinese market premium, but negatively related to the Hong Kong market premium. For instance, Bank of China (ZGYH), has a positive (0.822774) relationship with the Chinese market premium at a 99% confidence level. In contrast, it is negatively (-0.097038) related to the Hong Kong market premium, at a confidence level around 88%.

The observed relationship between banks' equity return and the sample exchange rates is inconsistent. Among the state-owned commercial banks, Bank of China is negatively (-0.231048) related to the Euro, while Industrial and Commercial Bank of China is negatively (-0.229423) related to the Japanese Yen. China Construction Bank is not significant to any particular exchange rate. Among the joint-stock commercial banks, Bank of Communications(JTYH),China Merchant Bank(ZSYH), Pudong Development Banks (PDYH), Mingsheng Bank(MSYH) and Industrial Bank(XYYH) does not show any relationship with any foreign exchange rate in the sample; China CITIC Bank(ZXYH)is negatively (-0.257047) related to the Japanese Yen, CITIC Industrial Bank if negatively (-0.284) related to the JPY, Huaxia Bank(HXYH) is negatively(-3.690700) related to US dollar, Shenzheng Bank(SZYH) is positively(0.502101) related to Japanese Yen. Among the city banks, neither Nanjing Bank, Ningbo Bank nor Beijing Bank, show any significant relationship towards the exchange rate in the sample. [7]

[7] The results from the data are based on a 90% confidence level.

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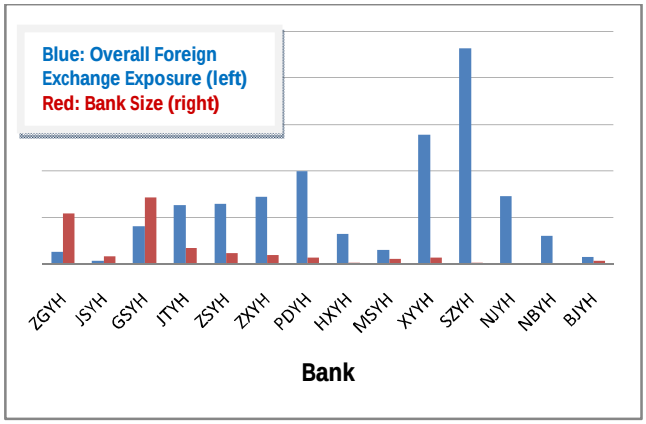
Generally speaking, we find that two out of three state-owned banks, three out of eight joint-stock commercial banks and non city banks are expose to the foreign exchange rate in the sample. Also, different banks expose to different foreign exchange rates. However, we realize that three out of the five banks, which is significantly exposed to foreign exchange, expose to Japanese Yen. This is different from our expectation from Bank of China's annual report of 2008. It states the total assets denominated in foreign currencies.[8]The total asset in RMB is 4,535,407[9] yuan, in USD it is 1,321,111 yuan, in EURO it is 638,014 yuan, and in JPY it is 200,128 yuan. Due to the large quantity of USD denominated assets, movements in US dollar should affect Bank of China's overall equity return more than movements in Japanese yen and Euro.

Finding Two:

Empirical evidence suggests that the overall foreign exchange exposure is significantly related to the bank size. The bank size is measured by the product of each banks number of shares outstanding, and their respective stock price. [10]

Figure I: Foreign exchange exposure relative to bank size



Bank	Bank Size	Overall Exposure
ZGYH	109	0.002656
JSYH	17	0.000794
GSYH	144	0.008081
JTYH	35	0.012804
ZSYH	25	0.013039
ZXYH	20	0.014451
PDYH	14	0.020000
HXYH	4	0.006604
MSYH	12	0.003122
XYYH	14	0.027879
SZYH	4	0.046378
NJYH	3	0.014631
NBYH	3	0.006085
BJYH	8	0.001539

Figure I illustrate the magnitude of the overall exchange rate exposure faced by each bank. There is no linear relationship that exists between the bank size and the magnitude of the foreign exchange exposure. There does however exist some relationship between certain groups. For example, we see that state-owned commercial banks which include the two

[8] Bank of China, Annual Report 2008, page 326.
[9] All numbers for assets is in million.
[10] The stock price was reported on May 18, 2009. This date was chosen as it was the most recent date in our study; it does not hold any special significance.

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largest banks have an average magnitude of 0.00304. The equivalent value for the group of joint-stock commercial banks is 0.006867, and for the group of city banks it is 0.000583. Thus, we find that the group with smallest banks (city banks), have the smallest magnitude of foreign exchange rate exposure. However, the group with the medium banks (joint-commercial banks), does have the largest magnitude of foreign exchange rate exposure.

This can once again be partially explained by the structure of the three groups of banks mentioned above. The first group, This is consistent with Martin and Mauer (2001) who found in their study that smaller banks are predominantly more affected by exchange rate changes than larger banks. This result can be partially explained by the structure of the larger commercial banks. Larger banks have branches abroad, take part in joint-ventures with foreign parties and have subsidiaries in foreign countries. For example, as we know from Bank of China's 2007 annual report, it has branches in 26 countries, including: Singapore, Japan, South and North Korea, UK, France, US, Canada, Zambia. In all, Bank of China covers Asia-Pacific Area, Europe, America and Africa. These banks cover an array of services, both to domestic and foreign clients. They engage in many partnerships with foreign investors, thus they face multiple foreign denominated currency transactions on a regular basis. The multiple activities larger banks take part in; allow them the ability to hedge their foreign exchange rate risk by offsetting incoming and outgoing payment streams, denominated in the same currency.

Furthermore, larger banks typically have the knowledge and practice to effectively diversify their foreign exchange rate risk better than smaller banks can, as they are constantly dealing with these internationally linked operations. They are also equipped with the resources to utilize derivative markets, such as forward foreign exchange contracts, cross-currency rate swaps, future contracts and currency options. These well-designed financial instruments help banks to respond to changes in exchange rates and thereby hedge their risk.

In general, state-owned commercial banks, is able to diversify their foreign exchange exposure better than the other two groups, due to their multiple international operations. Joint-commercial banks are also active in the foreign exchange market, but their participation is much smaller than the big state-owned banks. They are thus less experienced in managing foreign exchange risk, and therefore experience a greater magnitude of it. City banks operate primarily in urban areas, and are thus the least active in the foreign exchange market and international financial market. Therefore, although their hedging techniques may be the least

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advanced, their relative magnitude of foreign exchange exposure is smallest due to the unexposed to international financial market.

Finding Three:

Since 1997, Hong Kong became one part of China. Today, they play a core role in the financial market in Asia. Therefore we also try to measure the exchange rate risk for local Hong Kong banks. We conduct research on six[11] listed Hong Kong banks, using a third model similar to the second model, with the Hong Kong market premium, Hong Kong risk free rate of interest and the exchange rate between the Hong Kong Dollar and the three sample currencies as above. This model is explained in section 4.2

The regression results are listed in Table VII.

Table VII: Regression results for Hong Kong locally-listed banks

Explanatory Variables	HSYH	DYYH	YXYH	FBYH	CXYH	DXYH
Intercept	-0. 000382 (0. 8159)	-0. 001148 (0. 5939)	-0. 000851 (0. 7777)	-0. 000377 (0. 9251)	-0. 000711 (0. 7172)	-0. 002871 (0. 3376)
($R_{CH,t}$-$RF_{CH,t}$)	0. 726449 (0.0000)	0. 874242 (0.0000)	0. 867029 (0.0000)	0. 756502 (0.0000)	0. 664068 (0.0000)	0. 834403 (0.0000)
HKUSD	-1.867078 (0. 4823)	-0.462511 (0. 8945)	0.675941 (0. 8899)	8.552761 (0. 1702)	0.518904 (0.8703)	3. 461779 (0. 4686)
HKJPY	-0. 394015 (0. 0010)	-0. 192611 (0. 2149)	-0. 052776 (0. 8079)	-0. 221834 (0. 4143)	-0. 252085 (0. 0754)	0. 084262 (0. 6927)
HKEU	0. 357308 (0. 0032)	0. 408341 (0. 0102)	0. 254767 (0. 2495)	0. 420127 (0. 1419)	0. 140492 (0. 3291)	-0.006613 (0. 9759)
R square	0. 500420	0. 452951	0. 287761	0. 224433	0. 358381	0. 280907
Adjusted R square	0. 492584	0. 444370	0. 276589	0. 209226	0. 348316	0. 269167
DW stastic	2. 313418	2. 112273	2. 300234	2. 281513	1. 793003	1. 814875
C_s	0.037402	0.023554	0.008093	0.028517	0.012332	0.004906

Notes:

(1) ($R_{HK,t}$-$RF_{HK,t}$) is the Hong Kong market premium

(2) HKCH, HKUSD, HKJPY and HKEU are exchange rates of Hong Kong Dollar to RMB, USD, JPY and EURO respectively.

(3) Figures in parentheses are P-values.

(4) HKCH, HKUSD, HKJPY and HKEU are foreign exchange of Hong Kong Dollar to Chinese RMB, US Dollar, Japanese Yen and Euro.

(5) The C_s shows the overall effect of movements in exchange rates to banks´ equity return.

[11] These include Heng Sheng Bank, Bank of East China, Wing Hang Bank, Fubon Bank, Chong Hing Bank and Dahsing Bank.

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The results indicate that the average degree of exchange rate exposure of Hong Kong local banks is 0.019143. This is higher than 0.00304 for Chinese state-owned commercial banks and 0.006867 for Chinese joint-stock commercial banks, and also much higher than 0.000583 for Chinese city banks. This means that Hong Kong local banks are in general, more exposed to US Dollar, Japanese Yen and the EURO, compare to the three groups of banks in mainland China.

There is no certain reason why Hong Kong banks have higher exchange rate exposure than Chinese banks. It is, however, possible that the Hong Kong banks are involved in more international business than Chinese banks.

Hong Kong banks are also involved in more risky business than Chinese banks. Chinese banks usually deal with traditional borrowing and lending transactions, while Hong Kong banks have some business that deals with complicated financial derivatives, as well as owning many investment companies which are rather risky.

7 Conclusion

In this paper, we examine the exchange rate exposure of fourteen listed Chinese banks, using weekly data. Using the Arbitrage Pricing Theory Model (APT) we are able to calculate the sensitivity of Chinese banks' stock returns to changes in exchange rates. The volatility method allows us to find the overall exchange rate exposure of each bank.

First, we find that Chinese banks' equity returns are exposed to movements in foreign exchange rates. And different banks expose to different foreign exchange rate. Japanese yen is a key foreign exchange risk for some banks.

Second, we find that Chinese banks' foreign exchange exposure has some relation to its respective bank size. The smallest banks which are comprised of city banks, have the smallest exposure. The biggest banks which are comprised of state-owned banks, have the medium exposure. We do however find that, the medium size banks, comprised of joint-commercial banks, have the largest foreign exchange exposure, since they are exposed to foreign exchange operations more than smaller banks are, but do not manage the foreign exchange risk as efficient as the larger banks can.

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Lastly, we find that Hong Kong banks have higher foreign exchange exposure than any group of Chinese mainland banks. This maybe because of Hong Kong banks are more involved in international financial business and the business is more risky compare to Chinese mainland banks.

7.1 Managerial Implications

Our study demonstrates that Chinese banks are exposed to foreign exchange risk. We find that on average, Chinese banks' stock returns are more sensitive to the Japanese yen, than they are to the USD and the Euro.

For banks' international management strategy, it follows those Chinese banks who think US dollar is the one which have highest exposure should pay more attention to Japanese yen. Although China pegged RMB with mainly US dollar, Japanese yen is actually a crucial risk at present for Chinese banks.

Medium size banks should use more hedging instruments since they have the highest foreign exchange exposure. It will cause these banks a large loss if exchange rates fluctuate a lot in later years, without appropriate hedging instruments to combat these movements. China is becoming a more dominant player in the world every day, and thus they are open to greater exposures. This means that even the smallest banks will experience increased foreign exchange rate exposure. Therefore, it is urgent and necessary, for all the banks to pay close attention to hedging instruments, and take control of this risk.

7.2 Suggestions for Further Studies

In order to take our research one step further, one will need accurate financial statements to perform the Cash Flow method, mentioned in section 3.2. Since updated annual reports are not published in English, and readily available, we suggest that further researchers of this study, contact representatives from their chosen sample of Chinese banks. We suggest that one requests these banks' respective annual reports. This way, one will be able to quantify the exact direct and indirect effects.

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Appendix I

Bank list

Chinese mainland banks		Hong kong local banks
Chinese state-owned banks (Shorten names)	Chinese joint-stock commercial banks(shorten names)	Hong Kong banks(shorten names)
Bank of China (ZGYH)	*Bank of Communications (JTYH)*	*Heng Sheng Bank (HSYH)*
China Construction Bank (JSYH)	*China Merchants Bank (ZSYH)*	*Bank of East China(DYYH)*
Industrial and Commercial Bank of China (GSYH),	*China CITIC Bank (ZXYH)*	*Wing lung Bank(YLYH)*
	Pudong Development Bank (PDYH)	*Wing Hang Bank(YXYH)*
	China Minsheng Bank (MYYH)	*Fubon Bank(FBYH)*
	Industrial Bank(XYYH)	*ChongHing Bank(CXYH)*
	Huaxia Bank (HXYH)	*Dahsing Bank(DXYH)*
	Shenzhen Development (SZYH)	

Appendix II

One example(ZGYH) to calculate Cs

var(y)	Regression Coefficient(βk)		Variance-Covariance Metrix								$\sum_{i=1}^{n}\beta_i\sigma_{ik}$	Ck	Cs
0.0025	RPCH	0.8224	0.0026	-0.0001	0.0013	-0.0001	0.0000	0.0000	0.0000	0.0000	0.0012	0.0010	0.0027
	RPHK	-0.0968	0.0001	0.0018	-0.0001	0.0009	0.0000	0.0000	-0.0001	0.0001	0.0006	-0.0001	
	RPCHDM	-0.6865	0.0013	-0.0001	0.0013	-0.0001	0.0000	0.0000	0.0000	0.0000	0.0001	-0.0001	
	RPHKDM	0.9613	-0.0001	0.0009	-0.0001	0.0009	0.0000	0.0000	0.0000	0.0000	0.0008	0.0007	
	CHUSD	-2.5010	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
	CHHKD	1.7629	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
	CHJPY	0.0066	0.0000	-0.0001	0.0000	0.0000	0.0000	0.0000	0.0003	0.0000	0.0000	0.0000	
	CHEU	-0.2555	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0002	0.0000	0.0000	

Appendix III

Regression Results

Dependent Variable: ZGYH-RF
Method: Least Squares
Date: 06/06/09 Time: 13:28
Sample: 1 290
Included observations: 290

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Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.002815	0.002140	-1.315572	0.1894
RPCH	0.822774	0.052278	15.73831	0.0000
RPHK	-0.097038	0.061531	-1.577043	0.1159
RPCHDM	-0.686414	0.072436	-9.476127	0.0000
RPHKDM	0.961153	0.086128	11.15963	0.0000
CHUSD	-0.704160	0.947109	-0.743483	0.4578
CHJPY	0.025142	0.099690	0.252202	0.8011
CHEU	-0.231048	0.125582	-1.839814	0.0668

R-squared	0.621053	Mean dependent var	-0.000981
Adjusted R-squared	0.611646	S.D. dependent var	0.050246
S.E. of regression	0.031313	Akaike info criterion	-4.062395
Sum squared resid	0.276495	Schwarz criterion	-3.961157
Log likelihood	597.0473	F-statistic	66.02382
Durbin-Watson stat	1.957647	Prob(F-statistic)	0.000000

Dependent Variable: JSYH-RF
Method: Least Squares
Date: 06/06/09 Time: 13:31
Sample: 1 260
Included observations: 260

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.001516	0.002534	0.598270	0.5502
RPCH	0.855390	0.072381	11.81786	0.0000
RPHK	-0.002999	0.079116	-0.037904	0.9698
RPCHDM	-0.837056	0.091667	-9.131455	0.0000
RPHKDM	1.228956	0.103649	11.85688	0.0000
CHUSD	-0.750459	1.132621	-0.662586	0.5082
CHJPY	0.118830	0.114885	1.034336	0.3020
CHEU	-0.142829	0.141922	-1.006396	0.3152

R-squared	0.651807	Mean dependent var	-0.000267
Adjusted R-squared	0.642135	S.D. dependent var	0.059544
S.E. of regression	0.035620	Akaike info criterion	-3.801529
Sum squared resid	0.319735	Schwarz criterion	-3.691970
Log likelihood	502.1988	F-statistic	67.39085
Durbin-Watson stat	1.896730	Prob(F-statistic)	0.000000

Dependent Variable: GSYH-RF
Method: Least Squares
Date: 06/06/09 Time: 13:32
Sample (adjusted): 1 384
Included observations: 384 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.

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C	-0.000931	0.002327	-0.400130	0.6893
RPCH	0.832335	0.069499	11.97621	0.0000
RPHK	-0.108039	0.081563	-1.324603	0.1861
RPCHDM	-0.736216	0.091771	-8.022352	0.0000
RPHKDM	1.026043	0.110123	9.317283	0.0000
CHUSD	-0.782833	1.186658	-0.659696	0.5099
CHJPY	-0.229423	0.121397	-1.889856	0.0595
CHEU	0.109755	0.146357	0.749909	0.4538

R-squared	0.448884	Mean dependent var	0.000516
Adjusted R-squared	0.438624	S.D. dependent var	0.055028
S.E. of regression	0.041230	Akaike info criterion	-3.518710
Sum squared resid	0.639153	Schwarz criterion	-3.436405
Log likelihood	683.5924	F-statistic	43.75028
Durbin-Watson stat	2.213483	Prob(F-statistic)	0.000000

Dependent Variable: JTYH-RF
Method: Least Squares
Date: 06/06/09 Time: 13:33
Sample: 1 382
Included observations: 382

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.002600	0.001963	1.324260	0.1862
RPCH	0.020127	0.054768	0.367502	0.0000
RPHK	1.217366	0.065881	18.47831	0.7135
RPCHDM	0.035018	0.075918	0.461265	0.6449
RPHKDM	0.054457	0.092106	0.591239	0.5547
CHUSD	-1.227796	0.856471	-1.433552	0.1525
CHJPY	0.148915	0.101583	1.465950	0.1435
CHEU	0.058650	0.124616	0.470646	0.6382

R-squared	0.662308	Mean dependent var	0.003703
Adjusted R-squared	0.655988	S.D. dependent var	0.058854
S.E. of regression	0.034519	Akaike info criterion	-3.873874
Sum squared resid	0.445653	Schwarz criterion	-3.791248
Log likelihood	747.9100	F-statistic	104.7884
Durbin-Watson stat	1.853807	Prob(F-statistic)	0.000000

Dependent Variable: ZSYH-RF
Method: Least Squares
Date: 06/06/09 Time: 13:39
Sample: 1 395
Included observations: 395

Variable	Coefficient	Std. Error	t-Statistic	Prob.

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C	-0.000662	0.002831	-0.233936	0.8152
RPCH	0.895895	0.074427	12.03726	0.0000
RPHK	-0.154914	0.092073	-1.682513	0.0933
RPCHDM	-0.845756	0.112529	-7.515926	0.0000
RPHKDM	1.512605	0.134985	11.20569	0.0000
CHUSD	-2.232747	1.447284	-1.542715	0.1237
CHJPY	-0.257047	0.148707	-1.728544	0.0847
CHEU	0.011989	0.179157	0.066917	0.9467

R-squared	0.471604	Mean dependent var	0.001317
Adjusted R-squared	0.462047	S.D. dependent var	0.069083
S.E. of regression	0.050669	Akaike info criterion	-3.106945
Sum squared resid	0.993578	Schwarz criterion	-3.026360
Log likelihood	621.6217	F-statistic	49.34363
Durbin-Watson stat	2.115952	Prob(F-statistic)	0.000000

Dependent Variable: ZXYH-RF
Method: Least Squares
Date: 06/06/09 Time: 13:40
Sample: 1 203
Included observations: 203

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.003833	0.003369	-1.137570	0.2567
RPCH	0.829739	0.077641	10.68685	0.0000
RPHK	-0.106710	0.084092	-1.268962	0.2060
RPCHDM	-0.918517	0.108008	-8.504130	0.0000
RPHKDM	1.045687	0.117823	8.875065	0.0000
CHUSD	0.942863	1.378039	0.684206	0.4947
CHJPY	-0.307855	0.141426	-2.176799	0.0307
CHEU	-0.015760	0.174553	-0.090287	0.9282

R-squared	0.568653	Mean dependent var	-0.008236
Adjusted R-squared	0.553169	S.D. dependent var	0.061978
S.E. of regression	0.041429	Akaike info criterion	-3.491052
Sum squared resid	0.334693	Schwarz criterion	-3.360482
Log likelihood	362.3417	F-statistic	36.72461
Durbin-Watson stat	1.982879	Prob(F-statistic)	0.000000

Dependent Variable: PDYH-RFCH
Method: Least Squares
Date: 06/06/09 Time: 13:41
Sample (adjusted): 1 260
Included observations: 260 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.

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C	0.002447	0.004359	0.561253	0.5751
ASI-RFCH	0.544827	0.095368	5.712887	0.0000
CHUSD	1.395099	2.470490	0.564706	0.5728
CHEU	0.256918	0.291006	0.882862	0.3781
CHJPY	0.087589	0.250080	0.350244	0.7264

R-squared	0.119793	Mean dependent var	0.002111
Adjusted R-squared	0.105986	S.D. dependent var	0.068589
S.E. of regression	0.064853	Akaike info criterion	-2.614354
Sum squared resid	1.072497	Schwarz criterion	-2.545879
Log likelihood	344.8660	F-statistic	8.676148
Durbin-Watson stat	2.336878	Prob(F-statistic)	0.000001

Dependent Variable: HXYH-RFCH
Method: Least Squares
Date: 06/06/09 Time: 13:42
Sample (adjusted): 1 260
Included observations: 260 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.003083	0.003759	-0.820205	0.4129
ASI-RFCH	0.893512	0.082224	10.86683	0.0000
CHUSD	-3.690700	2.129987	-1.732733	0.0844
CHEU	-0.217553	0.250897	-0.867102	0.3867
CHJPY	-0.265430	0.215612	-1.231054	0.2194

R-squared	0.319933	Mean dependent var	0.000677
Adjusted R-squared	0.309265	S.D. dependent var	0.067277
S.E. of regression	0.055914	Akaike info criterion	-2.910955
Sum squared resid	0.797230	Schwarz criterion	-2.842480
Log likelihood	383.4241	F-statistic	29.99073
Durbin-Watson stat	2.163217	Prob(F-statistic)	0.000000

Dependent Variable: MSYH-RFCH
Method: Least Squares
Date: 06/06/09 Time: 13:43
Sample (adjusted): 1 260
Included observations: 260 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.005191	0.004463	-1.162958	0.2459
ASI-RFCH	0.771619	0.097640	7.902691	0.0000
CHUSD	-1.515868	2.529343	-0.599313	0.5495
CHEU	-0.270967	0.297938	-0.909475	0.3640
CHJPY	0.123253	0.256038	0.481387	0.6307

R-squared	0.201262	Mean dependent var	-0.003109
Adjusted R-squared	0.188733	S.D. dependent var	0.073717

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S.E. of regression	0.066398	Akaike info criterion	-2.567268
Sum squared resid	1.124204	Schwarz criterion	-2.498793
Log likelihood	338.7448	F-statistic	16.06340
Durbin-Watson stat	2.190750	Prob(F-statistic)	0.000000

Dependent Variable: XYYH-RFCH
Method: Least Squares
Date: 06/06/09 Time: 13:44
Sample (adjusted): 1 109
Included observations: 109 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.003996	0.006891	-0.579797	0.5633
ASI-RFCH	1.161744	0.112489	10.32761	0.0000
CHUSD	-4.528599	2.879648	-1.572622	0.1188
CHEU	0.229551	0.364185	0.630315	0.5299
CHJPY	-0.095817	0.298320	-0.321187	0.7487

R-squared	0.507142	Mean dependent var	-0.000713
Adjusted R-squared	0.488186	S.D. dependent var	0.087101
S.E. of regression	0.062313	Akaike info criterion	-2.668515
Sum squared resid	0.403820	Schwarz criterion	-2.545059
Log likelihood	150.4341	F-statistic	26.75350
Durbin-Watson stat	2.088775	Prob(F-statistic)	0.000000

Dependent Variable: SZYH-RFCH
Method: Least Squares
Date: 06/06/09 Time: 13:45
Sample (adjusted): 1 260
Included observations: 260 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.000321	0.004746	0.067709	0.9461
ASI-RFCH	0.601662	0.103828	5.794812	0.0000
CHUSD	0.017907	2.689635	0.006658	0.9947
CHEU	0.059514	0.316819	0.187847	0.8511
CHJPY	0.502101	0.272264	1.844173	0.0663

R-squared	0.130396	Mean dependent var	0.000932
Adjusted R-squared	0.116755	S.D. dependent var	0.075127
S.E. of regression	0.070605	Akaike info criterion	-2.444376
Sum squared resid	1.271207	Schwarz criterion	-2.375901
Log likelihood	322.7689	F-statistic	9.559201
Durbin-Watson stat	2.299732	Prob(F-statistic)	0.000000

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Dependent Variable: NJYH-RFCH
Method: Least Squares
Date: 06/06/09 Time: 13:47
Sample (adjusted): 1 88
Included observations: 88 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.000102	0.005415	0.018784	0.9851
ASI-RFCH	0.806187	0.085837	9.392072	0.0000
CHUSD	0.437842	2.195553	0.199422	0.8424
CHEU	0.025380	0.262592	0.096653	0.9232
CHJPY	0.031065	0.214204	0.145026	0.8850

R-squared	0.526744	Mean dependent var	-0.005217
Adjusted R-squared	0.503936	S.D. dependent var	0.062138
S.E. of regression	0.043765	Akaike info criterion	-3.364844
Sum squared resid	0.158973	Schwarz criterion	-3.224086
Log likelihood	153.0531	F-statistic	23.09515
Durbin-Watson stat	1.873416	Prob(F-statistic)	0.000000

Dependent Variable: NBYH-RFCH
Method: Least Squares
Date: 06/06/09 Time: 13:47
Sample (adjusted): 1 88
Included observations: 88 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.004670	0.006203	-0.752848	0.4537
ASI-RFCH	0.869393	0.098334	8.841179	0.0000
CHUSD	0.577993	2.515219	0.229798	0.8188
CHEU	0.169532	0.300825	0.563557	0.5746
CHJPY	-0.046357	0.245392	-0.188910	0.8506

R-squared	0.494587	Mean dependent var	-0.010862
Adjusted R-squared	0.470229	S.D. dependent var	0.068883
S.E. of regression	0.050137	Akaike info criterion	-3.092992
Sum squared resid	0.208635	Schwarz criterion	-2.952235
Log likelihood	141.0917	F-statistic	20.30550
Durbin-Watson stat	2.042417	Prob(F-statistic)	0.000000

Dependent Variable: BJYH-RFCH
Method: Least Squares
Date: 06/06/09 Time: 13:48
Sample (adjusted): 1 79
Included observations: 79 after adjustments

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Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.001869	0.005443	-0.343439	0.7322
ASI-RFCH	0.902471	0.084499	10.68024	0.0000
CHUSD	-2.198454	2.129169	-1.032541	0.3052
CHEU	-0.032559	0.250205	-0.130131	0.8968
CHJPY	-0.231460	0.206058	-1.123276	0.2650

R-squared	0.607307	Mean dependent var	-0.008665
Adjusted R-squared	0.586080	S.D. dependent var	0.064000
S.E. of regression	0.041175	Akaike info criterion	-3.480750
Sum squared resid	0.125461	Schwarz criterion	-3.330785
Log likelihood	142.4896	F-statistic	28.61056
Durbin-Watson stat	1.785108	Prob(F-statistic)	0.000000

Dependent Variable: HSYH-RFHK
Method: Least Squares
Date: 06/06/09 Time: 13:49
Sample (adjusted): 1 260
Included observations: 260 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.000382	0.001638	-0.233031	0.8159
HSI-RFHK	0.726449	0.048482	14.98392	0.0000
HKUSD	-1.867078	2.653338	-0.703671	0.4823
HKJPY	-0.394015	0.118011	-3.338807	0.0010
HKEU	0.357308	0.120101	2.975063	0.0032

R-squared	0.500420	Mean dependent var	-0.000182
Adjusted R-squared	0.492584	S.D. dependent var	0.037016
S.E. of regression	0.026367	Akaike info criterion	-4.414339
Sum squared resid	0.177285	Schwarz criterion	-4.345865
Log likelihood	578.8641	F-statistic	63.85722
Durbin-Watson stat	2.313418	Prob(F-statistic)	0.000000

Dependent Variable: DYYH-RFHK
Method: Least Squares
Date: 06/06/09 Time: 13:50
Sample (adjusted): 1 260
Included observations: 260 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.001148	0.002151	-0.533806	0.5939
HSI-RFHK	0.874242	0.063649	13.73539	0.0000
HKUSD	-0.462511	3.483404	-0.132776	0.8945

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HKJPY	-0.192611	0.154929	-1.243220	0.2149
HKEU	0.408341	0.157673	2.589796	0.0102

R-squared	0.452951	Mean dependent var	-0.000763
Adjusted R-squared	0.444370	S.D. dependent var	0.046439
S.E. of regression	0.034616	Akaike info criterion	-3.869957
Sum squared resid	0.305559	Schwarz criterion	-3.801482
Log likelihood	508.0944	F-statistic	52.78443
Durbin-Watson stat	2.112273	Prob(F-statistic)	0.000000

Dependent Variable: YXYH-RFHK
Method: Least Squares
Date: 06/06/09 Time: 13:50
Sample (adjusted): 1 260
Included observations: 260 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.000851	0.003011	-0.282598	0.7777
HSI-RFHK	0.867029	0.089104	9.730489	0.0000
HKUSD	0.675941	4.876543	0.138611	0.8899
HKJPY	-0.052776	0.216890	-0.243329	0.8079
HKEU	0.254767	0.220732	1.154190	0.2495

R-squared	0.287761	Mean dependent var	-0.000479
Adjusted R-squared	0.276589	S.D. dependent var	0.056976
S.E. of regression	0.048460	Akaike info criterion	-3.197103
Sum squared resid	0.598840	Schwarz criterion	-3.128629
Log likelihood	420.6234	F-statistic	25.75653
Durbin-Watson stat	2.300234	Prob(F-statistic)	0.000000

Dependent Variable: FBYH-RFHK
Method: Least Squares
Date: 06/06/09 Time: 13:51
Sample (adjusted): 1 209
Included observations: 209 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.000377	0.004011	-0.094067	0.9251
HSI-RFHK	0.756502	0.110728	6.832085	0.0000
HKUSD	8.552761	6.213438	1.376494	0.1702
HKJPY	-0.221834	0.271199	-0.817975	0.4143
HKEU	0.420127	0.284932	1.474480	0.1419

R-squared	0.224433	Mean dependent var	-0.000515
Adjusted R-squared	0.209226	S.D. dependent var	0.065131
S.E. of regression	0.057918	Akaike info criterion	-2.835950
Sum squared resid	0.684313	Schwarz criterion	-2.755990

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Log likelihood	301.3568	F-statistic	14.75834
Durbin-Watson stat	2.281513	Prob(F-statistic)	0.000000

Dependent Variable: CXYH-RFHK
Method: Least Squares
Date: 06/06/09 Time: 13:51
Sample (adjusted): 1 260
Included observations: 260 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.000711	0.001960	-0.362573	0.7172
HSI-RFHK	0.664068	0.058003	11.44882	0.0000
HKUSD	0.518904	3.174426	0.163464	0.8703
HKJPY	-0.252085	0.141187	-1.785475	0.0754
HKEU	0.140492	0.143687	0.977764	0.3291

R-squared	0.358381	Mean dependent var	-0.000607
Adjusted R-squared	0.348316	S.D. dependent var	0.039077
S.E. of regression	0.031546	Akaike info criterion	-4.055723
Sum squared resid	0.253757	Schwarz criterion	-3.987248
Log likelihood	532.2440	F-statistic	35.60804
Durbin-Watson stat	1.793003	Prob(F-statistic)	0.000000

Dependent Variable: DXYH-RFHK
Method: Least Squares
Date: 06/06/09 Time: 13:52
Sample (adjusted): 1 250
Included observations: 250 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.002871	0.002988	-0.960861	0.3376
HSI-RFHK	0.834403	0.088497	9.428604	0.0000
HKUSD	3.461779	4.768576	0.725957	0.4686
HKJPY	0.084262	0.212970	0.395649	0.6927
HKEU	-0.006613	0.218448	-0.030271	0.9759

R-squared	0.280907	Mean dependent var	-0.002557
Adjusted R-squared	0.269167	S.D. dependent var	0.055177
S.E. of regression	0.047171	Akaike info criterion	-3.250297
Sum squared resid	0.545140	Schwarz criterion	-3.179868
Log likelihood	411.2871	F-statistic	23.92679
Durbin-Watson stat	1.814875	Prob(F-statistic)	0.000000