

CREDIT RISK MANAGEMENT IN GREATER CHINA

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ABSTRACT. In this paper we focus on market-wide credit protection. More exactly, we look at the newly introduced *iTraxx Greater China* credit default swap (CDS) index, and assess to what degree this index can be used to protect against market-wide credit risk in the Greater China area. While the *iTraxx Greater China* CDS index is found to be significantly correlated with both the value and volatility of an equally weighted stock portfolio of the names in the CDS index itself, it is found to move more or less independently from some of the most widely used stock indexes in the Greater China region. Not surprisingly, considering the geographical distribution of the constituents in the *iTraxx Greater China* index, the major stock indexes covering mainland China are found to be particularly uncorrelated with the CDS index. Based on well known theoretical arguments as well as extensive empirical evidence in the literature, we argue that this makes it difficult to manage credit risk in mainland China using the *iTraxx Greater China* CDS index. At least until more mainland China names have been included in the CDS index.

Keywords: *iTraxx*; Greater China; credit default swap index; stock market

JEL classification codes: G33; C20

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Credit Risk Management in Greater China

In this paper we focus on market-wide credit protection. More exactly, we look at the newly introduced *iTraxx Greater China* credit default swap (CDS) index, and assess to what degree this index can be used to protect against market-wide credit risk in the Greater China area. While the *iTraxx Greater China* CDS index is found to be significantly correlated with both the value and volatility of an equally weighted stock portfolio of the names in the CDS index itself, it is found to move more or less independently from some of the most widely used stock indexes in the Greater China region. Not surprisingly, considering the geographical distribution of the constituents in the *iTraxx Greater China* index, the major stock indexes covering mainland China are found to be particularly uncorrelated with the CDS index. Based on well known theoretical arguments as well as extensive empirical evidence in the literature, we argue that this makes it difficult to manage credit risk in mainland China using the *iTraxx Greater China* CDS index. At least until more mainland China names have been included in the CDS index.

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1. INTRODUCTION

Credit derivatives transfer the credit risk of an underlying asset from one counter party to another without actually involving the underlying asset in any way. Credit derivatives are therefore useful tools for managing credit risk, and the market has grown tremendously over the last couple of years; in 2004 notional amounts for credit derivatives amounted to USD4.5 trillion compared to less than USD1 trillion three years earlier (BIS (2004)). Moreover, the size of today's global exposure to credit risk indicates an enormous potential for the credit derivatives market in the years to come.

The value of any credit derivative is determined by the (risk-neutral) probability of the underlying firm (the firm that issued the underlying asset in the credit derivative contract) being exposed to a credit event (bankruptcy, restructuring, delayed debt payments, etc.) at some point in the future. This probability, in turn, is often determined using information from the financial markets and for listed firms one typically turns to the stock market. The traditional model used to estimate the risk-neutral default probability of a firm based on information from the stock market is the Merton (1974) model.¹ This model uses the debt to equity ratio, stock market value and stock return volatility of the firm as inputs (the higher the debt to equity ratio, the lower the stock market value and the higher the stock return volatility, the likelier default is) and the Merton (1974) model as well as its many successors have proved successful in predicting defaults as well as deteriorations/improvements in the credit quality of a firm². Furthermore, regardless of whether the Merton (1974) model holds or not, several empirical studies confirm the general signalling ability of the stock market when it comes to credit worthiness; Campbell and Taksler (2003), for instance, finds a significant link between stock return volatilities and corporate bond yield spreads, and Curry, Elmer and Fissel (2001) finds stock prices and stock return volatilities to predict rating changes of banks at least a year before actual downgrades.

In this paper we look at the largest of the various credit derivatives markets, the credit default swap (CDS) market. More exactly, we look at a tradable index of single-name credit default swaps,

¹We should keep in mind that risk-neutral default probabilities are different from real-world default probabilities. However, the risk-neutral default probabilities can be treated as upper bounds for the real-world default probabilities and the two can be expected to behave similarly in reaction to news. For a discussion on the relationship between the two types of default probabilities we refer to Delianedis and Geske (1998) and Zhang (2005).

²Two widely used commercial models built around the original Merton (1974) model are the *Moody's* *KMV* model and the *Credit-Grades* model.

namely the *Dow Jones iTraxx Greater China* CDS index. In 2004, *Dow Jones* and *International Index Company* created a liquid, transparent and tradable family of CDS indexes called *Dow Jones iTraxx* in the US, in Europe and in various Asian-Pacific markets (in the US, the indexes are called *Dow Jones CDX* indexes) that allows investors to buy or sell market-wide credit risk in one transaction, and since our focus is China we have chosen to look at the particular index covering this region.

With a focus on market-wide credit protection in Greater China, i.e. China together with Hong Kong and Taiwan, we look at the hedging performance of the *iTraxx Greater China* CDS index. Since the main determinant of the size of the CDS index spread is the (risk-neutral) probability that the underlying firms are exposed to credit events, and since both theory and empirical evidence tells us that this probability is linked to the stock market valuation as well as the stock return volatility of the underlying firms, we study the link between the stock market and the CDS market. To do so we create a stock portfolio consisting of the same names as the *iTraxx Greater China* index and calculate correlations between the value and volatility of this portfolio and the CDS index spread. In addition, we also investigate whether the value and volatility of various market-wide stock indexes in the Greater China region are correlated with the *iTraxx Greater China* CDS index. Essentially, in order for the *iTraxx Greater China* CDS index to successfully protect against the credit risk in the markets represented by these stock indexes, the CDS index spread (which is supposed to be an indicator of the general credit worthiness in the Greater China region) and the various stock indexes' values and volatilities (that according to the theoretical and empirical results referred to above also serve as signals of the general credit worthiness in the region) have to move together in ways predicted by theory.

Indeed, for the stock portfolio containing the exact same names as the CDS index we do find the expected relationship between the CDS index spread and the stock portfolio value and volatility. However, the usefulness of the *iTraxx Greater China* CDS index in serving as a hedge against a more dispersed credit risk exposure in the Greater China area strongly depends on the actual portfolio one tries to protect. Over the time period covered in this study, it would have been more or less pointless to use the *iTraxx Greater China* CDS index for protection against the credit risk in a diversified debt or equity portfolio of mainland China names, while, on the other hand, portfolios

containing mainly Hong Kong or Taiwan names most probably would have been successfully protected with the CDS index.

The results in this study can be compared to earlier studies (Byström (2005) and Byström (2006)) on the *iTraxx Europe* and the Japanese *iTraxx CJ* markets where a close relationship between stock portfolio values and volatilities and corresponding *iTraxx* index spreads is found in various industrial sectors. Furthermore, both in Europe and in Japan a distinct lead-lag relationship is found between the stock market and the CDS market (the stock market leads the CDS market). While these results are very similar to those in the current study on Greater China there is one point where the Chinese CDS market is very different, though, and that is in its almost total lack of autocorrelation. While, interestingly, both the European and the Japanese CDS index returns demonstrate significant autocorrelation, there is no evidence of this in the *iTraxx Greater China* CDS index.

Except for the studies above, earlier literature on the relationship between CDS markets and stock markets has exclusively studied individual CDS contracts. Longstaff, Mithal and Neis (2003), for instance, looks at the US CDS market but do not find the significant lead-lag relationship between the stock market and the CDS market that was found in the studies referred to above. Norden and Weber (2004), however, studies individual credit default swaps in Europe, US and Asia, and finds CDS spread changes to be negatively correlated with stock returns just like us. Furthermore, Norden and Weber (2004) also finds stock returns to lead CDS spread changes. Blanco, Brennan and Marsh (2005) investigates the determinants of CDS spreads and finds that stock returns, both in US and in Europe, have an impact on CDS spreads. Finally, Blanco, Brennan and Marsh (2005) is one of the first papers that investigates stock volatilities in this context and similar to us these authors demonstrate a significant positive link between stock volatilities and CDS spreads.

In section two of this paper we discuss credit default swaps and the *iTraxx* credit default swap index market. Section three presents the data and section four presents the empirical results. Section five concludes the paper.

2. THE *iTraxx* MARKET AND THE *iTraxx Greater China* CDS INDEX

A credit default swap can be seen as an insurance contract that protects the buyer against losses from certain credit events involving an underlying firm. The buyer of the credit default swap pays the seller a periodic fee, the CDS spread, and typically delivers the debt owed by the firm to the seller in return for a sum equal to the notional amount in case a credit event strikes the underlying firm. A credit default swap index, in turn, is a portfolio of individual credit default swaps just like a stock index is a portfolio of individual stocks. Consequently, while a single-name CDS protects or exposes the investor to a particular firm's credit risk, a CDS index provides the investor with market-wide credit risk protection or exposure.

In 2004, the two CDS indexes *iBoxx* and *Trac-x* were merged to become *iTraxx* in Europe and Asia and *CDX* in the US. In April, the *CDX* index family was introduced, and in June, the *iTraxx Europe* index family was introduced by *Dow Jones* and the newly created *International Index Company*. Finally, in July similar indexes were also introduced in the Japanese market, the Australian market and the non-Japanese Asian market (*iTraxx CJ*, *iTraxx Australia*, *iTraxx Asia ex-Japan*). All these indexes are further divided into sub-indexes covering certain regions or sectors, and the index we are looking at, *iTraxx Asia ex-Japan*, is divided into three regional sub-indexes covering Korea, Greater China and the rest of Asia (*iTraxx Korea*, *iTraxx Greater China*, *iTraxx Rest of Asia*). The particular index that we investigate in this study, the *iTraxx Greater China* index, consists of eighteen (as of August 2006) equally weighted names from China, Hong Kong and Taiwan selected by a market maker poll based on the previous twelve months' CDS trading volume (IIC (2005)). Investment grade as well as non-investment grade names are included in the index and the composition of the index is reviewed and adjusted according to a new market maker poll every six months (March and September).³ Upon roll, the CDS contracts in the index have maturities of 5 1/4 years.

All the *iTraxx* indexes are based on the most liquid CDS contracts in the sector or market they cover. This has led to a world-wide extended family of liquid *iTraxx* CDS indexes that makes it easy for investors to exploit beliefs regarding counter party credit risk, and hedgers as

³From July 2004 to September 2005 (Series 1,2 and 3) the index contained only nine names, in September 2005 (Series 4) nine new names were included at the same time as one was removed making it seventeen names in total, and in March 2006 (Series 5) three new names were included and two were removed.

well as arbitrageurs and speculators can use the indexes for a wide range of different trading and risk management purposes. Furthermore, the standardized *iTraxx* indexes also serve as liquid benchmarks of credit portfolios from which one can develop new structured products. They have for instance opened up for second generation credit derivatives such as standardized synthetic CDOs, CDS index futures and CDS index options.

3. DATA

We use daily 5-year maturity CDS spreads (the mid-points between quoted bid and ask spreads at the end of the trading day) for the *iTraxx Greater China* index over the time period July 26, 2004 - August 7, 2006. The data was provided by the *International Index Company* and compared to earlier studies on credit default swaps, where single-name CDS data of varying quality typically has been relied upon, the aggregated data in this study is of very high quality in the sense that all spread quotes are true market quotes, that all quotes are directly comparable to each other and that the quotes consistently are sampled on a daily basis. When Series 4 of the index is replaced by Series 5 in March 2006 there is a sudden jump in CDS index spread due to the change in index composition. This jump (equal to +28.5%) would contaminate the results in the paper and has therefore been removed. The jumps around the other Series changes were significantly smaller and have not been removed.

As mentioned above, the *iTraxx Greater China* index is based on nine, seventeen or eighteen individual names (depending on the time period) and in order to study the link between the CDS market and the stock market, for the purpose of evaluating the hedging performance of the CDS index, we construct stock portfolios containing the exact same names as the CDS index.⁴ The names are listed in Table 1 and since the *iTraxx Greater China* CDS index is equally weighted in the underlying CDS contracts the "*iTraxx Greater China*" stock portfolio is also constructed as an equally weighted portfolio.^{5,6}

⁴The stock market data was downloaded from the *EcoWin* database. Of the twenty-one names, no stock market information was available for three of the companies (Bank of China, China Development Bank and Export-Import Bank of China) and for the two sovereigns (People's Republic of China and Hong Kong SAR).

⁵The first day in the sample we construct an equally weighted stock index and thereafter we do no re-balancing of our index portfolio.

⁶The three currencies, the Taiwan Dollar, the Chinese Yuan and the Hong Kong Dollar, were very stable against each other over the time period. Nonetheless, we have chosen to convert all stock prices to Hong Kong Dollars.

In addition to the "*iTraxx Greater China*" stock index we also collect daily quotes of several other stock indexes covering the Greater China area. See Table 2 for a list of the indexes. One index covers the entire area (*FTSE Greater China*), one covers the Taiwanese market (*Taiex Weighted*), one covers the Hong Kong market (*Hang Seng*), and the remaining six indexes (*Dow Jones CBN 600*, *FTSE Xinhua 200*, *Shanghai A*, *Shanghai B*, *Shenzhen A* and *Shenzhen B*) cover various segments of the mainland China market. Not only does a direct investment in any of these stock indexes give a market-wide credit risk exposure, but, indirectly, the signals (value and volatility) sent out by the stock indexes are also indicators of the credit risk in corresponding market-wide bond or loan portfolios (see Merton (1974)). The question we try to answer in this paper is whether the *iTraxx Greater China* CDS index can be used to protect the investor against this credit risk.

Finally, we estimate return volatilities for the various stock indexes and for robustness reasons we estimate sample volatilities using five different historical window sizes (1 month, 2 months, 3 months, 6 months and 1 year).

4. USING THE *iTraxx Greater China* INDEX TO MANAGE CREDIT RISK IN GREATER CHINA

In this section we set out to study the *iTraxx Greater China* CDS index and its relationship with various stock indexes covering the Greater China area. We expect to find a large CDS index spread when the stock index values are low and the stock index volatilities are high and vice versa. The link is supposed to be strongest for the stock index containing the actual stocks in the CDS index (the hypothetical "*iTraxx Greater China*" stock index) and we start out with investigating the CDS index' relationship with this particular stock index. A second important question, however, is whether the protective ability of the CDS index can be extended to the Greater China market as a whole and to answer this question we turn to the links between the CDS index and some widely used indexes covering this market.

In Table 3 we present some statistics on the *iTraxx Greater China* CDS spread. The spread is given in basis points and in Figure 1 we see how it varies over time. From the beginning of the sample, July 2004, to the beginning of 2006 the *iTraxx Greater China* spread is tightening from around 50 basis points to around 30 basis points. In March 2006, however, with the issue of

Series 5, the spread starts to increase again and returns to 40-50 basis points towards the end of the sample.⁷

In addition to the dynamics of the spread itself we also present some results for the spread change dynamics in Table 3. When we compare the *iTraxx Greater China* index spread change distribution with the corresponding "*iTraxx Greater China*" stock index return distribution we find the CDS market to be much more volatile than the stock market. Similar to the situation in the European and Japanese *iTraxx* markets (see Byström (2005) and Byström (2006)) the Chinese *iTraxx* index is about two to three times as volatile as the corresponding stock index (the sample standard deviations are equal to 35% and 14% on an annual basis, respectively). Turning to the two markets' reactions to extremely bad/good news, we find the largest daily positive/negative CDS spread changes to be around +/- 11% while the largest negative/positive stock returns are found to be much smaller at around -/+ 3%. Evidently, extreme movements are both more common and more extreme in the CDS market than in the stock market and the assumption of normally distributed CDS spread changes is strongly rejected. Further evidence of this is given by the CDS index' high kurtosis. Again, these results are quite similar to those found in Byström (2005) and Byström (2006) for the European and Japanese *iTraxx* Europe markets. One point where the Chinese CDS market stands out, however, is in its lack of autocorrelation. While both the European and the Japanese CDS indexes demonstrate significant autocorrelation there is no evidence of this in the *iTraxx Greater China* CDS index (see the non-significant Ljung-Box statistics in Table 3).

The main purpose of this paper is to study the link between the *iTraxx Greater China* CDS index and various market-wide Greater China stock indexes, and in Table 4 we present correlations between the CDS index spreads and the various stock index values and their volatilities. From theory (Merton (1974) etc.) we expect the credit spreads to be negatively related to the stock prices and positively related to the volatilities. Correlations for the changes in CDS spreads and stock values, including cross-serial (lead-lag) correlations, are also presented and we expect to find non-zero cross-serial correlations only if one of the markets leads the other.

⁷As mentioned above, the jump in March 2006 is due to the change in average creditworthiness among the index constituents when the index composition is adjusted, and it should not be interpreted as a sudden deterioration of corporate China's overall creditworthiness.

We start by looking at the "*iTraxx Greater China*" stock index, i.e. the index containing the same names as the *iTraxx Greater China* index, and we find a negative correlation of -0.17 between the CDS index spread and the stock index value in the uppermost part of Table 4. The negative sign is in accordance with theory and the correlation is statistically significant. Turning to the stock index volatility, we find the expected positive relationship for all the volatility estimates; the correlations are all highly significant and they range from 0.38 to 0.77. For a visual inspection of the relationship between the two markets, Figure 2 shows the *iTraxx Greater China* CDS spread and the corresponding "*iTraxx Greater China*" stock index normalized to start at one. The pattern in Figure 2 confirms the correlation results in Table 4 and demonstrates the negative relationship that exists between the *iTraxx Greater China* CDS index and the corresponding stock portfolio. Even more striking, the positive correlation between the CDS spread and the (6-Month) stock index volatility is clearly evident in Figure 2 where the spread tightens and widens in tandem with the stock market volatility. In Figure 2, the CDS index is plotted together with a hypothetical CDS index without the jump in March 2006. While hypothetical, the movements of this index further strengthens the link between the CDS index spread and the underlying stock portfolio's volatility.⁸

When we turn to day to day changes in the right hand part of Table 4 we find the correlation between the CDS spread changes and the corresponding stock index returns to be -0.14 . The negative sign is in accordance with theory and the correlation is significant at the 1% level. Somewhat surprisingly, though, when we continue to one-day lagged stock returns we find them to be (at least) as strongly negatively correlated (-0.19) with current CDS spread changes as current stock returns. The lead-lag relationship disappears when we reverse the lead-lag direction, which supports the hypothesis that information flows *from* the stock market *to* the CDS market and not vice versa. To summarize, this far, the results for the *iTraxx Greater China* CDS index are very much in accordance with theoretical predictions and they are very similar to earlier results found for the *iTraxx* CDS indexes in Europe and Japan.

⁸When we study Figure 2 we have to keep in mind the well known lag in the stock volatility that follows from using a historical estimation window.

Our final task is to investigate whether the *iTraxx Greater China* CDS index can be used to hedge, to a satisfactory degree, against the market-wide credit risk in typical diversified investment portfolios in the Greater China region. To answer this question we start by looking at the co-movements of the "*iTraxx Greater China*" stock index, i.e. the portfolio of stocks in the *iTraxx Greater China* CDS index, and the various region-wide stock indexes listed in Table 2. The correlations range from a negative correlation of -0.20 (with *Dow Jones CBN 600*) to a positive correlation of 0.96 (with *FTSE Greater China*) for the levels, and from a correlation of 0.08 (again with *Dow Jones CBN 600*) to a correlation of 0.84 (again with *FTSE Greater China*) for the changes. The wide range of correlations is somewhat disappointing from a hedgers point of view but at the same time it is not very surprising considering the heavy overweight of Hong Kong and Taiwan stocks in the *iTraxx Greater China* CDS index as well as the very different performance of the various stock markets in the region over the studied time period. The latter means that the correlations between the day-to-day changes are the most interesting since they are less dependent on the overall relative performance of the different stock markets. All these correlations between day-to-day changes are indeed positive ($0.08 - 0.84$), which is good news, but at the same time the correlations for the mainland China based indexes are all fairly small ($0.08 - 0.13$).

We now leave the *stock market – stock market* (price - price) correlations and turn to the correlations we set out to compute from the beginning, namely the *stock market – CDS market* (price/volatility - spread) correlations. We therefore repeat all the correlation computations done earlier for the tailor-made "*iTraxx Greater China*" stock index but now for the nine widely used stock indexes in the Greater China area. The results are presented in Table 4 and the main message is that there is no clear-cut answer to whether the CDS index can be used to hedge market-wide credit risk in the Greater China area or not. The protective performance depends crucially on which part of the region you invest in; for investors that mainly invest in the Hong Kong or Taiwan regions there seems to be a point in trying to hedge the credit risk in their diversified debt or equity portfolios using the *iTraxx Greater China* CDS index, but for those investing mostly in mainland China there seems to be no point, whatsoever, to try to cover the credit risk in their portfolios using the CDS index.

Three of the indexes, i.e. the market-wide *FTSE Greater China* index, the Hong Kong based *Hang Seng* index and the Taiwan based *Taiex Weighted* index, are as correlated with the CDS index as the "*iTraxx Greater China*" stock index (see Table 4). Consequently, an investor with a portfolio of names similar to that behind any of these three indexes would be able to buy credit risk protection in the *iTraxx Greater China* CDS index market. At least partially. That is the good news. The bad news, however, is that none of the mainland China based stock indexes is related to the *iTraxx* CDS index in the expected way. Theory predicts the stock volatility of a firm to be positively related to the firm's credit risk but in Table 4 we find only some of the stock index volatility estimates to be positively correlated with the CDS index spread. Furthermore, the correlations between the stock market values and the CDS index spread (both the levels and the changes) are clearly inconsistent with theory and do not indicate any hedging possibilities. These results indicate that investors in mainland China have to turn somewhere else than to the *iTraxx Greater China* index for credit risk protection. Unfortunately, there are no real alternatives at this stage of development of the Chinese financial sector.

Compared to the links that were found between the *iTraxx* CDS market and the general stock market in Japan (see Byström (2006)) the results in the Greater China CDS market are not very encouraging. At the current state of development of the *iTraxx Greater China* CDS index, investors holding diversified debt or equity portfolios in mainland China do not seem to be able to use the CDS index for credit risk protection. Only investors in Hong Kong and Taiwan seem to be able to shred (some) credit risk using the *iTraxx* market.⁹ Having said that, however, one must add that this situation is most likely to improve in the years to come and there is no reason to believe that the CDS index will not eventually become a much broader and much more representative index that truly merits the name *iTraxx Greater China*. It is also possible that the index could split up into regional sub-indexes covering the different parts of the Greater China region.

⁹When the entire study was redone using, approximately, the first half of the sample all the results were qualitatively unchanged. The results are available from the author upon request.

5. CONCLUSIONS

We have studied the newly established *iTraxx Greater China* credit default swap index and whether this index can be used to protect against market-wide credit risk in the Greater China region. We cover the first two years of the index (July 26, 2004 - August 7, 2006) and start by presenting some descriptive index statistics, of which the main finding is that the *iTraxx Greater China* CDS index spread change distribution is much more volatile and much more leptokurtic than the corresponding stock index return distribution.

Even more important than the rather extreme spread change distribution is the link between the CDS market and the stock market, and, referring to basic credit risk theory, we try to quantify this link in order to tell whether an investor in the Greater China area can use the CDS index for credit risk protection or not. The first major result is that the *iTraxx Greater China* CDS index is significantly negatively correlated with the value and significantly positively correlated with the volatility of an equally weighted stock portfolio of the names in the CDS index itself. This is in line with theoretical predictions. The CDS index is not, however, found to be correlated in the same fashion with some of the most widely used stock indexes in the Greater China region. The stock indexes covering mainland China are found to move in a particularly unrelated fashion with the CDS index and based on well known theoretical arguments backed up by extensive empirical evidence in the literature we argue that this makes it difficult to manage credit risk in mainland China using the *iTraxx Greater China* CDS index. At least until more mainland China names are included in the CDS index. The Hong Kong and Taiwan based stock indexes, on the other hand, move more in tandem with the CDS index and the credit risk of widely dispersed debt or equity portfolios in these markets might be possible to manage using the *iTraxx Greater China* CDS index.

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Figure 1 The spread of the *iTraxx Greater China* CDS index (in basis points) over the time period July 26, 2004 - August 7, 2006.

Figure 2 The *iTraxx Greater China* CDS index spread (with and without the March 2006 jump), the corresponding "*iTraxx Greater China*" stock index, and the "*iTraxx Greater China*" stock index return 6-Month volatility (all normalized to start at one) over the time period July 26, 2004 - August 7, 2006.

TABLE 1. The names in the *iTraxx Greater China* CDS index. All the names have equal weighting in the index. * indicates names lacking in the constructed "*iTraxx Greater China*" stock index.

July 2004 - September 2005 (Series 1,2,3)	Hutchinson Whampoa Ltd PCCW-HKT Telephone Ltd People's Republic of China*	Hongkong Land Company Ltd Swire Pacific Ltd Cathay Financial Holding Co Ltd	MTR Corp Ltd Bank of China* Fubon Financial Holding Co Ltd
September 2005 - March 2006 (Series 4)	Hutchinson Whampoa Ltd PCCW-HKT Telephone Ltd People's Republic of China* China Mobile Ltd Export-Import Bank of China* Jardine Strategic Holdings Ltd	Hongkong Land Company Ltd Swire Pacific Ltd Cathay Financial Holding Co Ltd Citic Pacific Ltd Hong Kong SAR* Wan Hai Lines Ltd	MTR Corp Ltd Bank of China* The Wharf (Holdings) Ltd CNOOC Ltd Hysan Development Company Ltd
March 2006 - August 2006 (Series 5)	Hutchinson Whampoa Ltd PCCW-HKT Telephone Ltd People's Republic of China* China Mobile Ltd Export-Import Bank of China* China Development Bank*	Hongkong Land Company Ltd Swire Pacific Ltd Cathay Financial Holding Co Ltd Citic Pacific Ltd Hong Kong SAR* Panva Gas Holdings Ltd	MTR Corp Ltd Bank of China* The Wharf (Holdings) Ltd CNOOC Ltd Hysan Development Company Ltd United Microelectronics Corp.

TABLE 2. The Greater China stock indexes included in the study.

Index	Constituents	Currency
<i>FTSE Greater China</i>	Mainland China (A, B, H, Red Chip), Hong Kong, Taiwan	USD
<i>Dow Jones CBN 600</i>	Mainland China (the 600 largest A-share companies)	CNY
<i>FTSE Xinhua 200</i>	Mainland China (the 200 largest A-share companies)	HKD
<i>Hang Seng</i>	Hong Kong (the 33 largest companies)	HKD
<i>Taiex Weighted</i>	Taiwan (all listed companies)	TWD
<i>Shanghai A</i>	Mainland China (all listed A-share companies on Shanghai SE)	CNY
<i>Shanghai B</i>	Mainland China (all listed B-share companies on Shanghai SE)	USD
<i>Shenzhen A</i>	Mainland China (all listed A-share companies on Shenzhen SE)	CNY
<i>Shenzhen B</i>	Mainland China (all listed B-share companies on Shenzhen SE)	CNY

TABLE 3. Descriptive statistics for *iTraxx Greater China* CDS index spreads (levels and changes) and "*iTraxx Greater China*" stock indexes (levels and changes) over the time period July 26, 2004 to August 7, 2006. Skew indicates skewness, Kurt indicates excess kurtosis and $Q(L)$ are Ljung-Box tests for autocorrelation up to lag L .

		daily CDS spreads (bp)	daily stock index levels (normalized)
LEVELS	Mean	35.42	1.24
	Stdev	6.69	0.11
	Min	24.95	0.99
	Max	52.00	1.50
		daily CDS spread changes (%)	daily stock returns (%)
CHANGES	Mean	-0.070	0.065
	Stdev	2.23	0.86
	Min	-10.99	-3.31
	Max	11.22	2.77
	Skew	0.31	-0.34
	Kurt	5.93	0.92
	Q(6)	6.50	4.46
	Q(12)	9.05	8.17
Q(24)	17.52	12.60	

TABLE 4. Correlations between *iTraxx Greater China* CDS index spreads (levels and changes), stock indexes (levels and changes) and stock index return volatilities over the time period July 26, 2004 to August 7, 2006. 1%, 5% and 10% significance levels are indicated by ***, ** and *, respectively.

	LEVELS	CHANGES
<i>"iTraxx Greater China" stock index</i>		
CDS index vs. stock index	-0.17***	-0.14***
CDS index vs. lagged stock index		-0.19***
lagged CDS index vs. stock index		0.03
CDS index vs. 1 Month stock index volatility	0.42***	
CDS index vs. 2 Month stock index volatility	0.60***	
CDS index vs. 3 Month stock index volatility	0.72***	
CDS index vs. 6 Month stock index volatility	0.77***	
CDS index vs. 1 Year stock index volatility	0.38***	
<i>FTSE Greater China stock index</i>		
CDS index vs. stock index	-0.10***	-0.13***
CDS index vs. lagged stock index		-0.24***
lagged CDS index vs. stock index		0.01
CDS index vs. 1 Month stock index volatility	0.63***	
CDS index vs. 2 Month stock index volatility	0.73***	
CDS index vs. 3 Month stock index volatility	0.80***	
CDS index vs. 6 Month stock index volatility	0.77***	
CDS index vs. 1 Year stock index volatility	0.33***	
<i>Dow Jones CBN 600 stock index</i>		
CDS index vs. stock index	0.70***	0.00
CDS index vs. lagged stock index		-0.03
lagged CDS index vs. stock index		-0.06*
CDS index vs. 1 Month stock index volatility	0.34***	
CDS index vs. 2 Month stock index volatility	0.37***	
CDS index vs. 3 Month stock index volatility	0.31**	
CDS index vs. 6 Month stock index volatility	-0.07**	
CDS index vs. 1 Year stock index volatility	-0.62***	
<i>FTSE Xinhua 200 stock index</i>		
CDS index vs. stock index	0.69***	-0.03
CDS index vs. lagged stock index		-0.01
lagged CDS index vs. stock index		-0.03
CDS index vs. 1 Month stock index volatility	0.39***	
CDS index vs. 2 Month stock index volatility	0.41***	
CDS index vs. 3 Month stock index volatility	0.36**	
CDS index vs. 6 Month stock index volatility	0.02	
CDS index vs. 1 Year stock index volatility	-0.57***	
<i>Hang Seng stock index</i>		
CDS index vs. stock index	-0.07*	-0.17***
CDS index vs. lagged stock index		-0.08**
lagged CDS index vs. stock index		-0.02
CDS index vs. 1 Month stock index volatility	0.40***	
CDS index vs. 2 Month stock index volatility	0.52***	
CDS index vs. 3 Month stock index volatility	0.65***	
CDS index vs. 6 Month stock index volatility	0.80***	
CDS index vs. 1 Year stock index volatility	0.51***	

Table 4 continues on the next page.

Table 4. Cont.

	LEVELS	CHANGES
<i>Taixi Weighted stock index</i>		
CDS index vs. stock index	-0.06*	-0.10***
CDS index vs. lagged stock index		-0.22***
lagged CDS index vs. stock index		-0.01
CDS index vs. 1 Month stock index volatility	0.55***	
CDS index vs. 2 Month stock index volatility	0.69***	
CDS index vs. 3 Month stock index volatility	0.74***	
CDS index vs. 6 Month stock index volatility	0.72***	
CDS index vs. 1 Year stock index volatility	0.27***	
<i>Shanghai A stock index</i>		
CDS index vs. stock index	0.70***	-0.03
CDS index vs. lagged stock index		-0.02
lagged CDS index vs. stock index		-0.06*
CDS index vs. 1 Month stock index volatility	0.34***	
CDS index vs. 2 Month stock index volatility	0.37***	
CDS index vs. 3 Month stock index volatility	0.31***	
CDS index vs. 6 Month stock index volatility	-0.11***	
CDS index vs. 1 Year stock index volatility	-0.60***	
<i>Shanghai B stock index</i>		
CDS index vs. stock index	0.63***	0.03
CDS index vs. lagged stock index		0.02
lagged CDS index vs. stock index		-0.02
CDS index vs. 1 Month stock index volatility	-0.18***	
CDS index vs. 2 Month stock index volatility	-0.15***	
CDS index vs. 3 Month stock index volatility	-0.11***	
CDS index vs. 6 Month stock index volatility	-0.06*	
CDS index vs. 1 Year stock index volatility	-0.08**	
<i>Shenzhen A stock index</i>		
CDS index vs. stock index	0.71***	0.04
CDS index vs. lagged stock index		-0.03
lagged CDS index vs. stock index		-0.04
CDS index vs. 1 Month stock index volatility	0.31***	
CDS index vs. 2 Month stock index volatility	0.30***	
CDS index vs. 3 Month stock index volatility	0.22***	
CDS index vs. 6 Month stock index volatility	-0.23***	
CDS index vs. 1 Year stock index volatility	-0.72***	
<i>Shenzhen B stock index</i>		
CDS index vs. stock index	-0.41***	-0.01
CDS index vs. lagged stock index		-0.02
lagged CDS index vs. stock index		-0.06*
CDS index vs. 1 Month stock index volatility	0.08**	
CDS index vs. 2 Month stock index volatility	0.12***	
CDS index vs. 3 Month stock index volatility	0.20***	
CDS index vs. 6 Month stock index volatility	0.15***	
CDS index vs. 1 Year stock index volatility	-0.10***	



