CAN EMERGING MARKETS OFFER DIVERSIFICATION BENEFITS TO CANADIAN INVESTORS DURING CREDIT CRISIS?

by

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ABSTRACT

This paper examines whether emerging markets offer benefits to a Canadian portfolio when it is needed most during a credit crisis. The study considers the relationship of the monthly data of ten emerging market indices (EM) and its weighted index with Toronto Stock Exchange Composite Index (TSX) through out 1998 to August 2007. We add S&P500 and MSCI EAFE to represent a diversified developed market portfolio. While the findings indicate most individual emerging market and its weighted index do not add values to a Canadian portfolio when credit risk is tight, China stands out differently. China adds significant diversification benefits to the developed market portfolio when credit risk is tight. When examining the subprime credit crunch in summer 2007, the results are consistent with the sample period, that is, Canadian investors benefit from diversifying in China during credit crisis.

Keywords: Emerging Markets, Ted Spread, Credit Risk, Diversifications

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GLOSSARY

KOSPI	Korea Composite Stock Price Index
MSCI EAFE Index	The Morgan Stanley Capital International (MSCI) EAFE Index is a market capitalization index comprises of 21 MSCI country indices. It represents the developed markets in Europe, Australaisa and Far East (EAFE). It is a benchmark to measure the performance of developed markets outside North American.
MSCI Emerging Markets Index	The Morgan Stanley Capital International Emergent Markets Index is a well recognized market capitalization index that measures equity market performance in the global emerging markets. It consists of 25 emerging market country indices: Argentina, Brazil, Chile, China, Colombia, Czech Republic, Egypt, Hungary, India, Indonesia, Israel, Jordan Korea, Malaysia, Mexico, Morocco, Pakistan, Peru, Philippines, Poland, Russia, South Africa, Taiwan, Thailand and Turkey.
Purchasing Power Parity (PPP)	It is developed by Gustav Cassel in 1920 based on the law of one price. In an efficient market, there is only one price for the identical goods. The PPP utilized exchange rate to equalize the purchasing power of different countries. In theory, after adjustment by exchange rate, the purchasing power of two currencies is the same for the same basket of goods. It is a more meaningful comparison of standards of living among countries rather than nominal GDP.
Ted Spread	Ted Spread stands for Treasury Eurodollar Spread. It is the price difference between three-month future contracts of U.S. Treasuries and Eurodollar as represented by the London Inter Bank Offered Rate (LIBOR) of the same expiration months. U.S. T-bills are considered risk free while Eurodollar future reflects the credit ratings of corporate borrowers. The spread are considered as an indicator of credit risk. When it diverges, it indicates credit risk is increasing.

Subprime Subprime refers to the credit status of a borrower. Typically the borrower has deficient credit history or adverse financial situations that do not qualify to secure a loan at market interest rates. A subprime loan is exposed to high default or foreclosure risk. A higher interest rate is charged to compensate for the additional risk. In this paper, subprime refers to the financial contagion created by the U.S. subprime mortgage crisis in 2007. When interest rate increased, many subprime borrowers with flexible rate mortgages were unable to meet their payments, at the same time property values declined. Lenders, banks and financial institutions were unable to recoup losses which led to a restriction on the availability of credit in the world financial markets.

1: INTRODUCTION

There have been four U.S. centred financial crises since 1987. More recently there were three major financial shocks during the past decade. The credit crises occurred in Asian between 1997 and 1998; the Russian debt default in 1998 and the U. S. subprime crisis in this summer caused TSX to drop by 13%, 25% and 12% respectively. Evidence suggests financial crisis is cyclical and reoccurs. At the same time, emerging market capitalization has experienced rapid growth. Between 1985 and 1995 emerging financial markets increased ten-fold whereas the developed markets increased by only three-fold (Ahmed, Gangopadhyay, Nanda 2001). When the stock markets were hard hit by a credit crunch in August 2007, emerging countries had a record US$4.5 trillion in international reserves. In addition, the fastest growing funds are in emerging economies that have benefited greatly from the global boom. Can emerging markets offer some support to investors to offset domestic stock market risk? One argument is that stock market correlations are high when market volatility is high, especially during market downturns such as the international stock market crash in 1987. If this in fact is true, then the value of diversification is reduced during bear markets in which investors are exposed to losses.

During financial crisis, liquidity is often withdrawn from the market and credit risk becomes tight. It exerts a restriction on the availability of credits in the financial markets. Often, financial crisis and tight credit risk move in tandem. When credit contraction persists and liquidity dries up, investors and funds hit with margin calls and

withdrawal requests, investors may be forced to sell their best holdings to meet liquidity needs. Borrowers may be forced to default and file for bankruptcy. Generally, it results in a downturn in the stock market. This summer's credit crunch was a direct result of the U.S. subprime nightmare. It caused the S&P 500 & TSX to decline by 9.4% and 12 % respectively in July and August. Similar drops occurred in virtually every market in the world hitting the emerging markets much harder, dropping them by an average 14.4% with Brazil and Korea being hardest hit. Banks, other financial institutions and lenders were unable to recoup their losses from thousands of subprime mortgage foreclosures and led to a restriction on the availability of credit in the world financial markets. Several financial companies were shut down or filed for bankruptcy. This led to a further collapse of stock prices in August, 2007. The financial contagion has been associated with a severe credit crunch in the greater financial markets, and worldwide stock market melt down. Financial companies wrote off billions of subprime mortgage loans, several hedge funds became worthless, and some mortgage lenders went bankrupt. The impact spilled over to the equity market causing increased volatility. A large daily drop is not uncommon. For example the KOSPI dropped about 7% in a day. This is consistent with the view that price volatility tends to be higher during liquidity shortage (Holmstrom, Tirole 2000).

This paper examines whether emerging markets offer diversification benefits to Canadian investors when stock markets experience downward pressure from credit risk crisis. We study the local indices of ten emerging markets which represent 80% of the GDP adjusted by the Purchasing Power Parity of MSCI Emerging Markets Index. The sample period covers January 1998 to August 2007. It uses the Ted Spread, a well

recognized indicator of credit risk to separate stock markets to subperiods by high and low credit risk. Credit risk is defined in two contexts. One is the binary classification used by Conover, Jensen, Johnson 2002. When Ted Spread changes reverse direction to diverge, the subperiod is considered as high credit risk period; when the spread changes turn around to reduce the spread, the subperiod is considered as low credit risk period. The second approach compares Ted Spread to the average spread of the sample period. When the spread is above or below the average, it reflects high and low credit risk environment respectively. The paper employs mean variance approach to examine the mean returns, standard deviation, correlation of coefficient and correlation of individual emerging country and the weighted index relative to TSX. We compare the statistical results among the entire period, high and low risk periods of both approaches to identify if any individual emerging market or its weighted index improves the performance of a Canadian portfolio. The paper extends the study to the recent subprime credit crisis in this summer; examining similar statistics and the resemblance to the ten year sample period. Finally, the findings are tied together to form a combinations of efficient frontiers using the mean-variance efficient framework. The asset mix includes S&P 500, TSX, MSCI EAFE, the emerging markets weighted index and China to optimize asset allocation for a Canadian portfolio.

2: LITERATURE SURVEY

A large volume of literature exists on international diversification. The rationale for international portfolio diversification is that it expands the opportunities for gains from portfolio diversification beyond those that are available through domestic securities. Financial literature in the 1970s emphasized the benefits of international diversifications among developed countries (e.g. Grubel 1968, Levy, Sarnat, 1970 and Solnick 1977). This argument is based on stock markets that are less than perfectly correlated among countries, and investors gain from risk reduction. Studies had mixed results in the 90's and 2000's while Errunza (1999); DeSantis and Gerard (1997), Stulz (1999) and Statman, Scheid (2004) still supported international diversification offers values, Sinquefield (1996), and Rodriguez (2007) inferred that market risk premiums are the same throughout the developed markets. Some attributed the diminishing benefit to the integration of the financial markets of developed countries in the past thirty-five years as their stock market performance have became highly correlated (Campa & Fernandes 2005). Interest in diversification benefits has expanded to emerging markets in the past 20 years. Many studies demonstrate by empirical analysis that G7 stock portfolio earns significant benefits by diversifying into emerging stock markets (Lessard 1973, Errunza 1983, Bailey and Stulz 1990, Bailey and Lim 1992, Li 2003). Theoretically the lower correlation between emerging and developed markets leads to better risk diversification. Some studies reveal that the liberalization of capital markets has increased the correlation between the emerging markets index and developed markets, thus reducing the benefits

of pursuing indexing strategies in emerging markets. Country and stock selection strategies are imperative in order to add significant values to a portfolio (Fernandes 2003, Fernandes 2003, Antoniou, Olus, Paudyal 2006). Country selection attempts to identify countries that have low correlation with the world financial markets. For instance, China stock market was not much affected by 911 terrorist attacks and Asian crisis in 1997 compare to the world financial markets. Yao Yao (2002) explained the unusual performance of the China stock market by the inconvertibility of China's currency RMB and China's solid USD reserve.

More recent research investigates diversification strategies in specific economic or market conditions, such as US monetary policy and market downturn. Studies have mixed results in turbulent market, especially in market downturn (Campbell, Forbes, Koedijk, Kofman 2006). Often, it is associated with higher correlations among international markets and reduced diversification benefits (Butler, Joaquin 2001). Sarkar, Patel 1998 confirms "that correlations between U.S. and other emerging markets tend to be higher in times of market decline". Their study reveals strong evidence of contagion within region and relates all market crises in their sample periods 1970 to 1997 to a financial crisis. The contagion effect during stock market crisis affects both developed and developing markets. Developed markets tend to have smaller price decline and recover faster than emerging markets. Data further confirms portfolio benefits decrease during market crisis, in particular during emerging market crisis (Sarkar, Patel 1998 Patev, Kanaryan 2003). These findings bring up the question if emerging markets a poor diversification option during market crisis when it is needed most?

Many studies report US monetary policy affects the performance of US and emerging equity markets (Jensen & Johnson 1995, Conover, Jensen & Johnson 2002) especially those with large proportions of their trade with the U.S. Johnson, Buetow and Jensen (1999) also reveal that international equity fund indices have higher returns during periods of U.S. monetary expansion than restrictive periods. Conover, Jensen and Johnson (2002) confirmed similar observations. However, China is not included in the the above studies. The contagion effect on China has yet to be tested. Especially when Yao Yao (2002) suggests "the Dow Jones Industrial Index and The NASDAQ Composite often reflect the world economics but fail in the case of China market" it is worth to extend the study adding China in the emerging market mix.

Credit risk is a well recognize factor that has a close relationship with economic conditions. Demchuk and Gibson (2004) suggest credit spreads are lower during economic expansions and higher during recessions. Their study shows past performance of the stock index and the correlation between firm's assets and index return has a significant impact on credit spread. Similarly, Forte, Pena (2007) demonstrate that stocks lead credit risk more times than the opposite. Credit risk appears to be a desirable factor to replace monetary policy to evaluate the efficiency of diversification benefits.

3: METHODS

3.1 Emerging Market Index

This study follows the Conover, Jensen and Johnson 2002 (CJJ) mean variance approach and conducts the analysis from the perspective of a Canadian investor. We select the top ten emerging markets based on their PPP GDP in 2006. Their total PPP GDP represents over 80% of the MSCI emerging markets index and 34.48% of the world. CJJ uses 20 countries but these countries in total represent only 21.85% of the world PPP GDP in 2006. Although this paper uses less than half of CJJ's number of countries, we believe our emerging market composite index truly represents the values of the current global emerging markets. The total emerging market GDP in our sample is 1.5 times higher than CJJ's in 2006's values. We use the returns of the country local stock market index, converting it to Canadian currency to construct a weighted emerging market index. The weight based on the average annual GDP in our sample period of 1998 to August 2007. Table I provides the average weights of each country. China comprises almost 30% of the total weight. Brazil, India, Mexico and South Korea make up another 45%. Although Argentina, Indonesia, Russia, Taiwan and Turkey represent half of the top ten countries, they make up only 25% of the weighted GDP. The weight is concentrated in the top 5 countries which represent 75% of the total GDP.

3.2 Mean Variance Framework

The mean variance framework developed by Markowitz (1952) is employed in this paper. The basic assumption is to optimize expected return for a given level of variance (or standard deviation) or vice versa, to minimize variance (or standard deviation) given the expected return. End of the month data of the indices have been collected from January 1998 to August, 2007, yielding a total of 116 observations per index. With the liberalization of the emerging markets, we believe the past decade is a better indicator of the current investment environment. We include the same sample period for S&P 500 and MSCI EAFE to represent global developed markets. Returns on the indices are measured in Canadian dollars, based on month end exchange rate. Microsoft Excel is used to calculate the mean, variance, standard deviation, covariance, correlation of coefficient, correlation with TSX, and T-test.

3.3 Credit Risk

Two approaches are used to define credit risk environment. Both are based on the Ted Spread, a widely accepted indicator of credit risk and the liquidity of capital market. When the Ted Spread increases, default risk is considered to be increasing, and investors will prefer safe investments. Generally it signifies lower liquidity which translates to higher corporate borrowing rate and an adverse effect on equity returns. A rising Ted spread is an indicator of a market downturn as liquidity is withdrawn. Conversely, when the spread decreases, the risk of default is considered to be decreasing. Liquidity eases off and there is a free flow of capital for investments.

3.3.1 Binary Classification Approach

Similar to CJJ, we use the binary classification which was introduced by Jensen and Johnson (1995). We classify credit risk environment as high when Ted spread reverses direction to increase the spread, low when the spread turns around its direction to decrease. When Ted spread changes remain in the same direction, an increasing spread represents high credit risk environment persists while a decreasing spread stands for low credit risk condition continues. We follow CJJ's approach and eliminate the first month when Ted spread change in direction to remove the transition month that falls between two different periods, in this case, the high and low credit risk periods. There are 36 months considered as low and 20 months as high credit risk periods.

3.3.2 Absolute Mean Approach

We take 0.4, the absolute mean of the Ted Spread in our sample period as the benchmark. When Ted spread is higher than the average, the month is considered as high credit risk (or higher than average credit risk); spread that is lower than the average as low credit risk environment (or lower than average credit risk). There are 73 months below the average, and 43 months above it.

Within each approach, we calculate the mean, standard deviation, correlation of coefficient, the correlation between returns with respect to TSX, and use t-test to verify if the results are statistically significant.

3.4 2007 Subprime

We calculate the same statistical measures that are used for the above subperiods. The daily data for the month of August, 2007 is used to represent the market turbulence during this credit crisis. The purpose is to compare the result of a recent market downturn with this paper's findings.

3.5 Efficient Frontier

This research employs the MATLAB frontcon function, utilizing the mean variance approach to optimize returns for a Canadian portfolio. The portfolio maintains a buy and hold strategy. We input the mean and covariance to generate different combinations of efficient frontiers with constraint to short selling. The assets include S&P 500, TSX, MSCI EAFE, Emerging Markets Weighted Index and China. It uses three month Canadian T-bills in the same sample period as the risk free asset for the tangency line.

4: RESULTS

4.1 Entire Sample Period

Table II provides statistical results for the entire period. The returns of all emerging markets, except Taiwan and Argentina, are higher than TSX by 1.5 to 4.4 times. The return of the emerging markets weighted index is almost twice that of TSX. Evidence generally suggests that emerging markets offer additional returns to a Canadian portfolio. The standard deviation of each emerging market is 1.6 to 3.4 times higher than TSX while the standard deviation of the emerging markets index is only 1.2 times higher than TSX's. The volatility of emerging markets is reduced substantially when combined together. While the standard deviation suggests emerging markets have a higher volatility than TSX, the coefficient of variation (standard deviation divided by the mean) is a more meaningful comparison using relative risk. Six of the emerging markets have marginally lower coefficients of variation than TSX. These emerging markets, namely China, India, Indonesia, Mexico, South Korea and Turkey, offer additional returns to a Canadian investor for the same level of risk. Similar to the standard deviation, the coefficient of variation is reduced substantially once it is combined to the weighted index. This indicates risk is diversified away when the emerging markets are combined. The correlation with TSX is a mixed bag. Brazil, Mexico and the weighted index exhibit a correlation almost the same as the correlation between S&P500 and TSX. Contrary to the view that developed markets are more integrated and higher correlated, Brazil and Mexico resembles the correlation of a developed market with TSX during the sample

period. The rest of the emerging markets have an average correlation with TSX between 0.30 and 0.40 except China which stands out with a substantially lower correlation at 0.08. Of all the emerging markets, China, India, Indonesia, South Korea and Turkey offer higher returns, lower coefficient of variation and correlation with TSX below 0.5. They appear to be a favourable individual addition to a Canadian portfolio from the perspective of both added returns and risk reduction.

4.2 High and Low Credit Risk

Table III exhibits statistical results based on the binary classification. Clearly, this approach indicates that returns in a high credit risk environment are substantially lower than a low credit risk period for all countries and composite indices except China. Contrary to traditional beliefs that the stock market is under distress when liquidity and credit risk is high, China's return improves from 0.73% to 5.17% (7 times). Half of the emerging markets and all three developed market indices have higher standard deviations when credit risk is high. Table IV demonstrates almost all countries and composite indices exhibit higher correlation with TSX when credit risk is high, except China and India. China's correlation with TSX is 0.04 when credit risk is high. It is four times lower than the correlation in low credit risk periods. This indicates China offers substantial diversification to a Canadian portfolio when liquidity is tight. These results are statistically significant. Correlation between India and TSX reduces from 0.41 to 0.31 (25% reduction) when credit risk reverses its direction to diverge.

Table V presents the statistical summary using the absolute mean of the Ted spread as a benchmark. The results are mixed. Four of the emerging markets and all four composite indices have higher returns than TSX in high credit risk environment.

China's return increases from 0.63% to 2.79% (4.4 times) from low to high credit risk, a substantial increase that is statistically significant. South Korea and Turkey also demonstrate statistically significant higher returns when credit risk is high. Table IV shows Brazil, China, India, Taiwan, S&P500 and MSCI EAFE have lower correlation with TSX in high credit risk periods. China is the only index that exhibits a negative correlation -0.06 with TSX. It is consistent with the observation of the binary classification approach that China offers the best diversification to TSX during financial crisis.

4.3 2007 Subprime

Table VI presents the statistical summary during the subprime crisis in August, 2007. All emerging stock markets were experiencing downward pressure and registered negative returns lower than TSX, except for China, the only country that registered a gain. Consistent with the observations in this paper's ten year sample period, China's correlation with TSX is the lowest among all emerging markets and the weighted index. In fact, the negative correlation suggests diversification benefits during the subprime financial crisis in August.

4.4 Efficient Frontiers

This paper analyzes optimal investment mix for Canadian investors in a mean variance framework and its efficiency in different credit risk periods. The benefits of three portfolios were assessed. The 1st portfolio comprises three developed market indices S&P 500, TSX and MSCI EAFE representing US, Canada, and developed markets in Europe, Australaisa and Far East. The 2nd portfolio is the same three

developed market indices plus the emerging markets weighted index. The 3rd portfolio again consists of the three indices in the 1st portfolio plus the China market index.

4.4.1 Entire Sample Period

Figure 1 examines the efficient frontiers during the entire sample period. Both four asset frontiers on the left dominate the three asset portfolio. The portfolios shift their weight from developed market indices to emerging economies as the frontiers extend to the right. Portfolio 2 and 3 offer a more favourable return and risk at the corresponding risk level or return of portfolio 1. By adding emerging economies, investors can expand the investment horizon to risk level or returns that the developed market frontier does not offer. Portfolio 2 expands the investment horizon of the developed market frontier from 4.58% to 5.74% risk level; and 0.73% to 1.14% returns while portfolio 3 further expands the risk level to 7.87% and returns to 1.43% for investors who are willing to take more risks. For risk adverse investors, portfolio 3 expands the risk level from 3.96% of the developed market portfolio to 3.74%, with corresponding returns from 0.43% to 0.59%. Overall, the frontiers suggest investors can gain significant diversification benefits by adding the EM or China index in their asset mix.

Interesting to note, the frontier of portfolio 2 and 3 dominate at different risk levels. They intersect at risk level 4.85% and monthly return 1.1% where portfolio 2 holds 41.09% TSX, 27.26% EAFE and 31.65% of EM index without holding S&P. At the same time portfolio 3 holds 47.14% of TSX and 52.86% of the China index, without holding S&P and EAFE. The frontier consists of portfolio 2 dominating above the intersection while portfolio 3 dominates below. The determining factor appears to be the

relative weight between the emerging markets index and the China index. The portfolio that holds more weights of emerging economies dominates. By adding portfolio 2 to their investment mix, investors whose risk level is above the intersection will be able to obtain higher returns than portfolio 3 at the same level of risk. The tangency line touches the frontier of portfolio 2 where investors can optimize investment returns at 1.41% when risk level is 5.74%. The optimal portfolio consists of 100% of emerging markets index with no exposure to S&P, TSX and EAFE. The frontier of the four asset portfolio including China dominates below the intersection when the weight of China overtakes the emerging markets index. At the low risk level 3.96%, portfolio 3 holds 2.26%, 57.24% 13.36% and 27.14% in S&P, TSX, EAFE and China respectively comparing to portfolio 2 that holds 25.33%, 30.67%, 44% and 0% (no exposure to the emerging markets index). At the same time portfolio 3 generates 0.85% return which is significantly higher than the 0.43% of portfolio 2. When portfolio 3 continues to shift its weight to hold larger amounts of the China index as its risk increases, the weight of the developed market indices diminishes and so is the shift to increase the China index due to the constraint of no short selling. Alternatively portfolio 2 starts with relatively lower weight of EM, as risk increases its weight in emerging markets catches up, hits the intersection and overtakes the weight of China, portfolio 2 starts to dominate. At any level of risk, emerging countries play a critical role in an optimal portfolio.

4.4.2 High and Low Credit Risk

Figure 2 to 4 report subperiods based on using the binary classification.

Figure 2 assesses the efficiency of diversification in high and low credit risk subperiods. The three frontiers in the low credit risk periods on the left dominate their

high credit risk counter parts. This suggests investors can achieve higher returns at the same level of standard deviation when credit risk is low. Alternatively, the frontiers in high credit risk subperiods are inferior to their low credit risk counter parts. This appears to be consistent with the general belief that financial turmoil and tight liquidity adversely affects stock markets.

Figure 3 presents the frontiers in high credit risk periods. Clearly, the four asset frontier consists of the China index dominates all other frontiers at any level of returns and risk. It indicates investors can improve their return and risk by adding China in their portfolio during credit crisis. It is worth noting that portfolio 1 performs poorly with negative returns. By considering the emerging markets index, the portfolio starts to generate positive returns above 6.06% risk level. In fact, risk free T-Bill at 0.46% monthly returns offers better returns than any asset mix of portfolio 1 and 2.

The most striking benefit comes from considering China. Different from the frontiers for portfolio 1 and 2, the frontier for portfolio 3 offers positive returns to investors during credit crisis. The frontier offers risk level over 7.48% to 11.83% and returns above 0.25% to 5.17% that are not available from other portfolios. The portfolio optimizes when investing 100% in China where the tangency line touches the frontier. Although investors are able to expand their investment mix to reduce their risk below 4.45% to 4.36%, the return of the risk free asset is higher than the portfolio returns as risk reduces to 4.43%. The frontier suggests China adds value to investors whose risk tolerance is above 4.43% risk level, otherwise investors will prefer to hold the risk free asset.

Figure 4 considers the investment portfolios in low credit risk periods. The frontier for portfolio 1 comprises developed country indices is the inferior of the three. Portfolio 2 and 3 intersect at 3.77% risk level and 0.92% returns where it splits the optimal investment strategies above and below the intersection. Investors who are willing to take risks above the intersection will diversify their asset mix by holding portfolio 2. It extends the investment horizon above portfolio 3's maximum risk level 4.47% to 5.1%; expanding returns from 1.21% to 2.1%. The tangency portfolio optimizes investment returns at 1.21% when the portfolio holds 100% of EM index. The frontier of portfolio 3 dominates below the intersection. It allows risk adverse investors the opportunity to invest below 3.73% risk level to 3.47% which is not available in portfolio 2. Investors can also gain higher returns at the existing level of risk.

Figure 5 to 7 report subperiods based on the absolute mean of the Ted spread.

Figure 5 demonstrates portfolio 1 continues to be the inferior portfolio in all subperiods. Different from the binary classification approach, the set of frontiers for high credit risk dominates the low credit risk frontiers. It implies returns are higher at a given level of risk when credit risk is tight. This is inconsistent with traditional beliefs that relaxed credit risk periods generally favours better investment returns. The division of high and low credit risk measured by absolute mean may have bias. There are two thoughts of the reason of the bias. First, when a sample period has experienced a prolonged low credit risk, the average spread will be low. Even a slight deviation from the average spread will classify the period as high credit risk. When credit spreads experience more volatility in a similar sample period, the average spread will be relatively higher. The same spread categorized as period of high credit risk could be

defined as period of low credit risk. Please refer to appendix A for a numeric example. Spread volatility can affect the division of the subperiods and the way to sort data differently. Second, the confusion may be explained by spreads above the mean may not represent credit risk is high. Credit risk could be relaxing after a tight cycle and slowly reverting to the mean. Stock market performance would recover instead of worsen. In this situation, the spread above average mean does not associate with stock market downturn, rather recovery. The absolute mean approach may smooth out results of the sample period with the possibility of producing confusing outcomes.

Figure 6 clearly confirms the findings suggested in the binary classification approach that during high credit risk periods, investors gain substantial diversification benefits from considering the China index. The tangency portfolio lies on portfolio 3's frontier at 4.74% standard deviation and 1.91% returns. Different from the binary classification approach, all portfolios produce positive returns above the risk free asset.

Figure 7 evaluates the portfolio performance in the low credit risk subperiods. The risk free T-bill outperforms portfolio 2 and 3 below risk level 3.83% and 3.7% respectively. This contradicts assumptions that low credit risk offers liquidity to investors and corporations, a favourable investment environment that markets tend to reward investors. Portfolio 2 intersects with portfolio 3 at 3.91% risk level and 0.59% returns where each frontier dominates above and below the intersection. Similar to all situations when two frontiers dominate at different level of risk, portfolio 2 dominates above the intersection while portfolio 3 dominates below.

5: CONCLUSIONS

The data from the period between 1998 and 2007 supports the idea that Canadian investors can benefit from diversifying in emerging markets. Investors can gain higher returns at a given level of risk and also the opportunities to expand investment horizon at risk levels that are not available from the developed market portfolio.

When we consider subperiods where credit risk is high, consistent with the general assumption that market correlations are high, our results present reduced diversification benefits from all emerging markets except China. Both the binary classification and absolute mean approaches suggest China as the optimal diversification asset. Investors who are willing to take higher risk can expand their investment horizon significantly by 58.16% in risk level and 19.68% in returns by adding China in their asset mix when credit risk is high. The findings are statistically significant.

In the subperiods when credit risk is low, the frontier of portfolio 2 and 3 intersect and each frontier dominates at a different level of risk. Both the binary classification and absolute mean approaches report portfolio 2 dominates above the intersection while portfolio 3 dominates below. It suggests risky investors to consider the emerging markets index as they maximize their investment returns, and risk adverse investors add China in their asset mix. The tangency portfolio lies on the frontier of portfolio 2 in both approaches.

Using the absolute mean approach, frontiers of high credit risk periods prevail rather than those in low credit risk periods. Risk free T-bill outperforms portfolio 2 and 3

below risk level 3.83% and 3.7% respectively. These results are not consistent with the consensus that low credit risk generally favours stock markets for investors. It appears the method may not always match credit spread above the mean with a financial crisis.

When the recent subprime credit crunch in this summer was examined, the results are consistent with our findings in the ten year sample period. All indices dropped along with TSX except China. China had a positive monthly return 1.1% and a negative correlation with TSX that could offer diversification benefits to a Canadian portfolio.

This paper is a preliminary study of the relationship between emerging markets and TSX when credit risk is high and liquidity is withdrawn. It covers only ten years of data, a relatively short period in traditional research. While it captures a more current and relevant investment condition of the emerging markets as they liberalize, it may not reflect a full economic cycle of the developed markets. As globalization speeds up, in particular after China joined the World Trade Organization a few years ago, the pace of emerging markets integrates with the world capital market will affect future diversification benefits.

APPENDICES

Appendix A

Example: sorting subperiods based on the absolute mean approach:

Scenario 1

Credit spreads in 10 subperiods:
0.6, 0.8, 0.9, 0.5, 0.5, 0.4, 0.6, 0.4, 0.4, 0.4; absolute mean is 0.55.
Credit spreads 0.6, 0.8, and 0.9 indicate credit risk is high
Credit spreads 0.5 and 0.4 indicate credit risk is low

Scenario 2

Credit spreads in 10 subperiods:
0.5, 0.6, 0.4, 0.4, 0.4, 0.4, 0.4, 0.4, 0.4, 0.6; absolute mean is 0.45.
Credit spreads 0.5 and 0.6 indicate credit risk is high
Credit spread 0.4 implies credit risk is low

Conclusions: When credit spread equals to 0.5, the period could be sorted under high or low credit risk depending on the volatility of the spread. Subsequently, the subperiod and its corresponding market performance may be a mismatch and the data becomes irrelevant.

Appendix B Tables

Table I GDP-Weighted Emerging Index 1998-2007

Country	Weighted Average GDP
Argentina	4.10%
Brazil	12.90%
China	28.90%
India	10.40%
Indonesia	3.80%
Mexico	11.40%
Russia	8.10%
S Korea	10.50%
Taiwan	5.80%
Turkey	4.40%
Total	100.00%

Note: These weights are averages of annual weights used in the 10 years of the sample.
Source: International Monetary Foundation (IMF)

Table II Summary Statistics for Monthly Stock Returns Jan 1998 – Aug 2007

	Return	Variance	Standard Deviation of Return	Coefficient of Variation	Correlation with TSX
Argentina	0.63%	1.78%	13.35%	21.22	0.40
Brazil	1.30%	1.15%	10.74%	8.29	0.71
China	1.33%	0.62%	7.88%	5.93	0.08
India	1.21%	0.53%	7.29%	6.04	0.39
Indonesia	1.77%	1.23%	11.09%	6.27	0.36
Mexico	1.30%	0.59%	7.68%	5.91	0.69
Russia	2.22%	2.10%	14.50%	6.52	0.52
S Korea	2.01%	1.03%	10.17%	5.07	0.45
Taiwan	0.12%	0.64%	8.02%	68.49	0.41
Turkey	3.20%	2.51%	15.86%	4.96	0.40
S&P	0.20%	0.19%	4.33%	22.08	0.69
TSX	0.73%	0.21%	4.62%	6.37	1.00
MSCI	0.36%	0.18%	4.19%	11.75	0.70
Weighted Emerging	1.41%	0.33%	5.77%	4.10	0.70

Note: Returns are arithmetic mean Canadian dollar returns for the whole sample period.

Table III Statistical Summary - Binary Classification Approach Jan 1998- Aug 2007

	Whole Period		Low Credit Risk		High Credit Risk		Difference (Low minus High Risk)		T-Test			
	Return	Standard Deviation	Return	Standard Deviation	Return	Standard Deviation	Return	Standard Deviation	T Stat	P 0.1	P 0.05	P 0.01
Argentina	0.63%	13.35%	1.65%	13.12%	-2.99%	10.78%	4.64%	2.35%	1.58	1.325	1.725	2.528
Brazil	1.30%	10.74%	1.90%	10.92%	-3.33%	13.41%	5.23%	-2.49%	2.14	1.325	1.725	2.528
China	1.33%	7.88%	0.73%	6.71%	5.17%	11.84%	-4.44%	-5.13%	-2.96	1.325	1.725	2.528
India	1.21%	7.29%	1.98%	7.01%	0.55%	6.47%	1.43%	0.54%	0.91	1.325	1.725	2.528
Indonesia	1.77%	11.09%	4.16%	11.16%	-2.36%	8.62%	6.52%	2.54%	2.61	1.325	1.725	2.528
Mexico	1.30%	7.68%	1.74%	7.03%	-0.70%	10.30%	2.45%	-3.26%	1.55	1.325	1.725	2.528
Russia	2.22%	14.50%	6.25%	14.78%	-4.01%	16.68%	10.26%	-1.90%	3.11	1.325	1.725	2.528
S Korea	2.01%	10.17%	3.39%	11.21%	-0.46%	7.42%	3.85%	3.79%	1.53	1.325	1.725	2.528
Taiwan	0.12%	8.02%	1.38%	8.41%	-3.30%	6.07%	4.68%	2.34%	2.49	1.325	1.725	2.528
Turkey	3.20%	15.86%	5.56%	18.31%	1.09%	14.97%	4.48%	3.34%	1.09	1.325	1.725	2.528
S&P	0.20%	4.33%	0.01%	4.10%	-0.49%	4.86%	0.49%	-0.76%	0.54	1.325	1.725	2.528
TSX	0.73%	4.62%	1.21%	4.50%	-0.39%	5.55%	1.60%	-1.05%	1.59	1.325	1.725	2.528
MSCI	0.36%	4.19%	-0.10%	4.30%	-0.38%	4.68%	0.28%	-0.39%	0.29	1.325	1.725	2.528
Weighted Emerging	1.41%	5.77%	2.10%	5.08%	0.25%	7.46%	1.85%	-2.37%	1.63	1.325	1.725	2.528

Difference in mean returns significant in a one-tailed t-test at the 10 percent level.

Difference in mean returns significant in a one-tailed t-test at the 5 percent level.

Difference in mean returns significant in a one-tailed t-test at the 1 percent level.

Table IV Correlations with TSX

Correlation with TSX	Argentina	Brazil	China	India	Indonesia	Mexico	Russia	S Korea	Taiwan	Turkey	S&P	TSX	MSCI	Weighted Emerging
Whole Period	0.40	0.71	0.08	0.39	0.36	0.69	0.52	0.45	0.41	0.40	0.69	1.00	0.70	0.70
Binary Approach - High Credit Risk	0.61	0.82	0.04	0.31	0.48	0.85	0.65	0.53	0.54	0.64	0.76	1.00	0.69	0.73
Binary Approach - Low Credit Risk	0.31	0.62	0.16	0.41	0.08	0.47	0.38	0.26	0.24	0.28	0.65	1.00	0.62	0.62
Average Mean - High Credit Risk	0.54	0.69	-0.06	0.21	0.43	0.78	0.63	0.40	0.35	0.54	0.68	1.00	0.67	0.71
Average Mean - Low Credit Risk	0.34	0.71	0.19	0.56	0.25	0.58	0.39	0.53	0.46	0.22	0.70	1.00	0.72	0.67

Table V Statistical Summary - Ted Spread Mean Return Benchmark Jan 1998 - Aug 2007

	Whole Period		Low Credit Risk		High Credit Risk		Difference (Low minus High Risk)		T-Test			
	Return	Standard Deviation	Return	Standard Deviation	Return	Standard Deviation	Return	Standard Deviation	T Stat	P 0.1	P 0.05	P 0.01
Argentina	0.63%	13.35%	1.31%	14.53%	-0.52%	11.13%	1.83%	3.40%	1.07	1.294	1.667	1.994
Brazil	1.30%	10.74%	1.16%	9.66%	1.52%	12.47%	-0.36%	-2.80%	-0.31	1.294	1.667	1.994
China	1.33%	7.88%	0.63%	7.41%	2.79%	8.53%	-2.16%	-1.12%	-2.50	1.294	1.667	1.994
India	1.21%	7.29%	1.43%	6.80%	0.82%	8.11%	0.62%	-1.32%	0.78	1.294	1.667	1.994
Indonesia	1.77%	11.09%	1.82%	7.66%	1.68%	15.37%	0.15%	-7.71%	0.16	1.294	1.667	1.994
Mexico	1.30%	7.68%	1.51%	6.45%	0.94%	9.47%	0.58%	-3.02%	0.76	1.294	1.667	1.994
Russia	2.22%	14.50%	3.50%	9.02%	0.06%	20.70%	3.43%	-11.68%	3.25	1.294	1.667	1.994
S Korea	2.01%	10.17%	0.49%	7.54%	4.57%	13.23%	-4.08%	-5.70%	-4.62	1.294	1.667	1.994
Taiwan	0.12%	8.02%	0.42%	7.81%	-0.39%	8.44%	0.81%	-0.64%	0.89	1.294	1.667	1.994
Turkey	3.20%	15.86%	2.29%	12.84%	4.74%	20.05%	-2.45%	-7.21%	-1.63	1.294	1.667	1.994
S&P	0.20%	4.33%	-0.28%	4.17%	1.01%	4.52%	-1.30%	-0.35%	-2.66	1.294	1.667	1.994
TSX	0.73%	4.62%	0.58%	4.08%	0.97%	5.47%	-0.38%	-1.40%	-0.80	1.294	1.667	1.994
MSCI	0.36%	4.19%	0.07%	4.17%	0.84%	4.21%	-0.78%	-0.04%	-1.59	1.294	1.667	1.994
Weighted Emerging	1.41%	5.77%	1.19%	5.10%	1.77%	6.81%	-0.57%	-1.71%	-0.96	1.294	1.667	1.994

Difference in mean returns significant in a one-tailed t-test at the 10 percent level.

Difference in mean returns significant in a one-tailed t-test at the 5 percent level.

Difference in mean returns significant in a one-tailed t-test at the 1 percent level.

Table VI. Summary Statistics* for Daily Stock Returns, Aug 1 to 31, 2007 (subprime period)

Index	Return (%)	Standard Deviation of Return	Correlation with Canada
Argentina	-0.35%	2.53%	0.7938
Brazil	-0.39%	3.23%	0.6219
China	1.01%	2.01%	-0.3675
India	-0.12%	2.29%	0.3637
Indonesia	-0.39%	3.52%	0.5478
Mexico	-0.11%	2.01%	0.8438
Russia	-0.20%	1.62%	0.4018
South Korea	-0.25%	3.22%	0.2553
Taiwan	-0.18%	2.48%	0.2045
Canada	-0.06%	1.34%	1

Note: All data in CAD currency

Appendix C Figures

Figure 1. Efficient Frontier - Entire Sample Period, January 1998 - August 2007

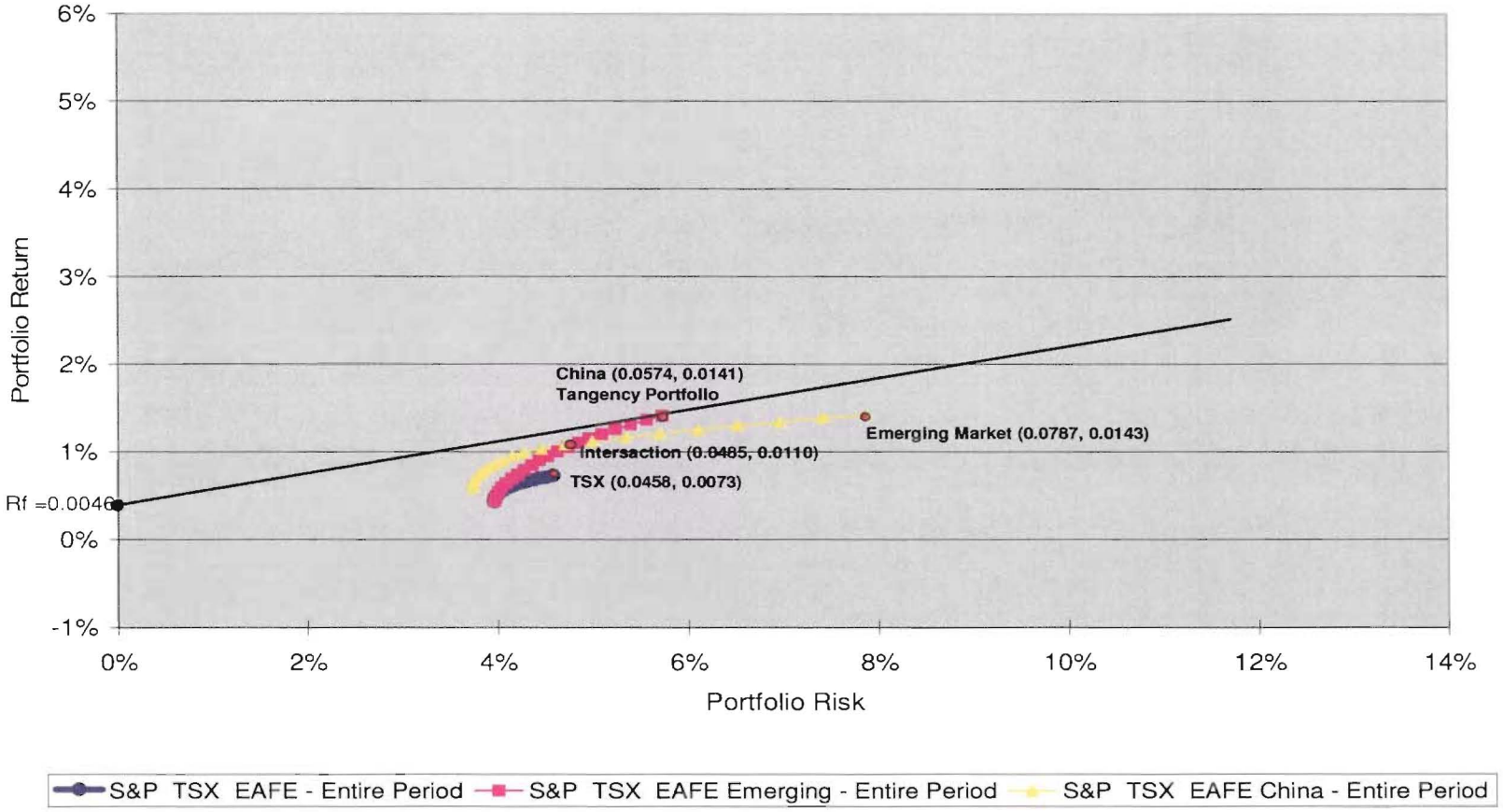


Figure 2. Efficient Frontier - Binary Classification

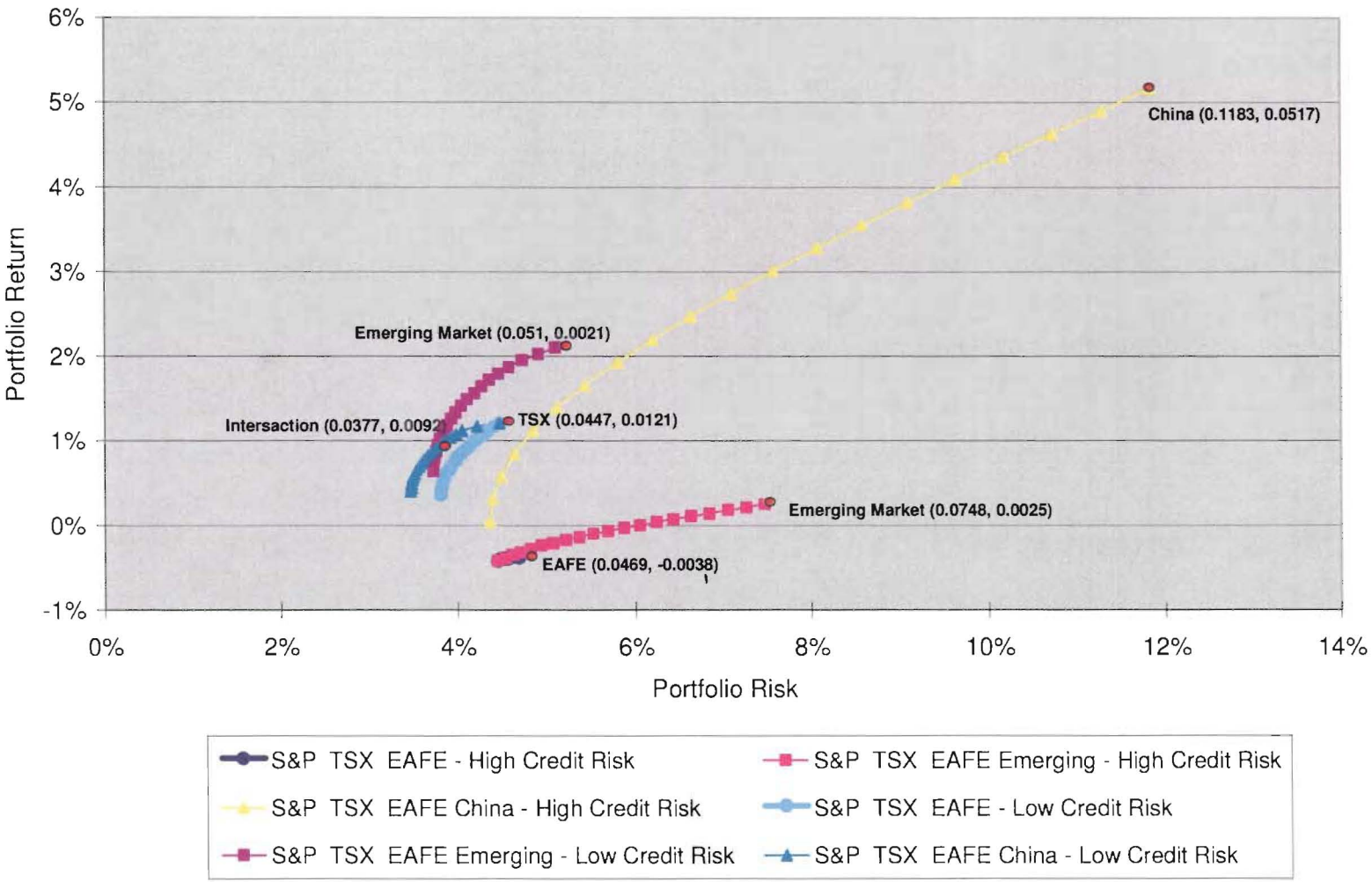


Figure 3. Efficient Frontier - High Credit Risk Period (Binary Classification)

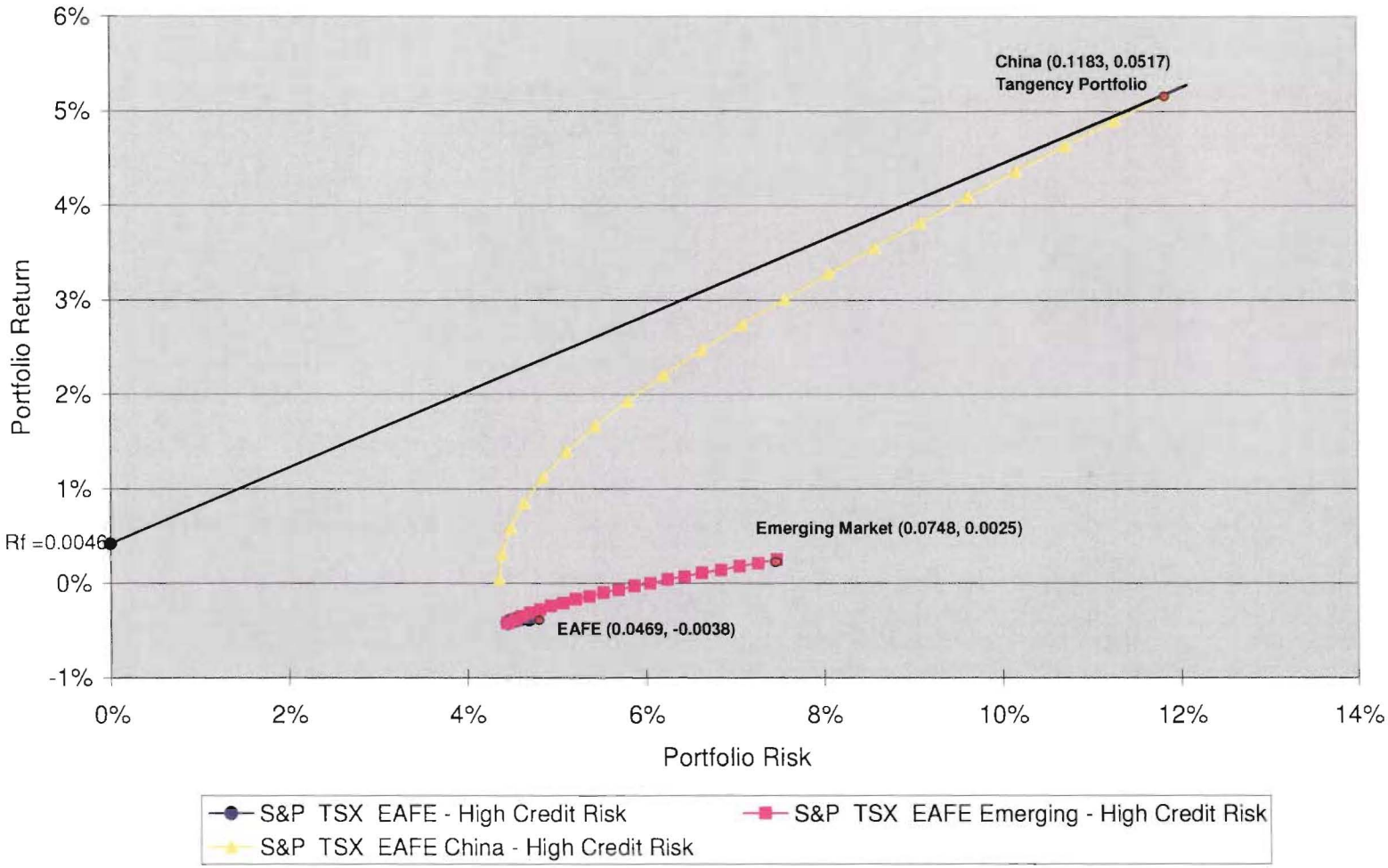


Figure 4. Efficient Frontier - Low Credit Risk Period (Binary Classification)

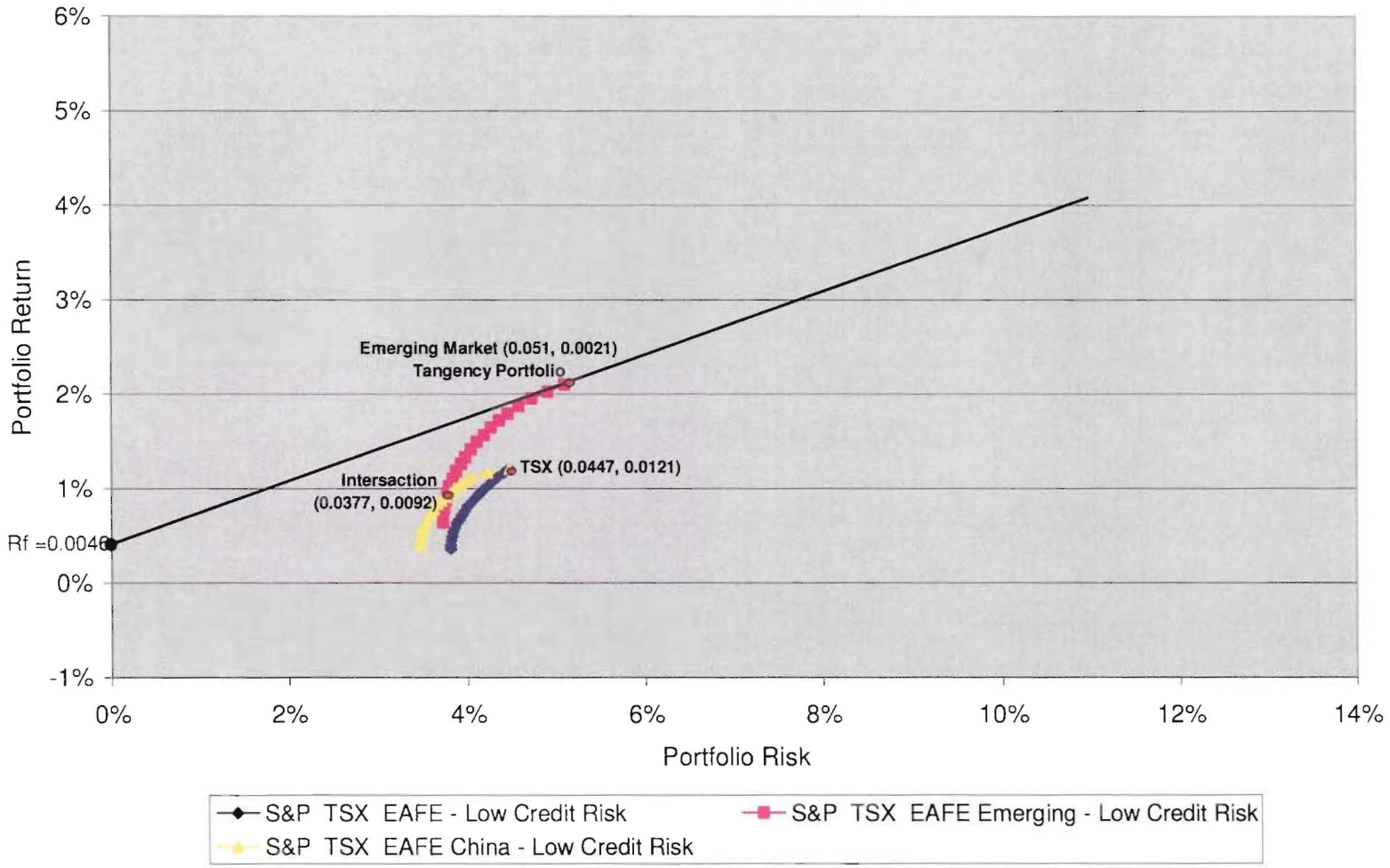


Figure 5. Efficient Frontier - Absolute Mean Approach

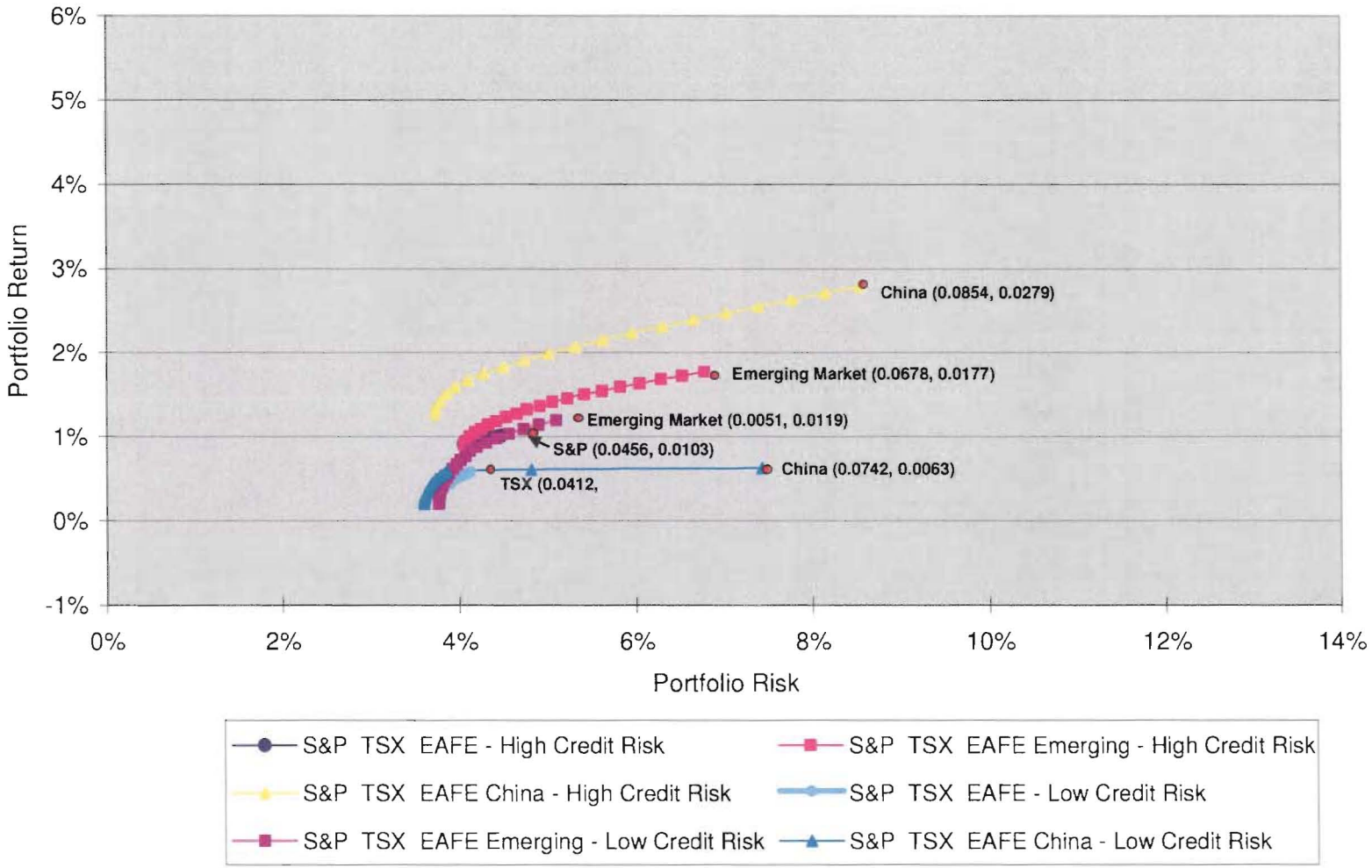


Figure 6. Efficient Frontier - High Credit Risk Period (Absolute Mean Approach)

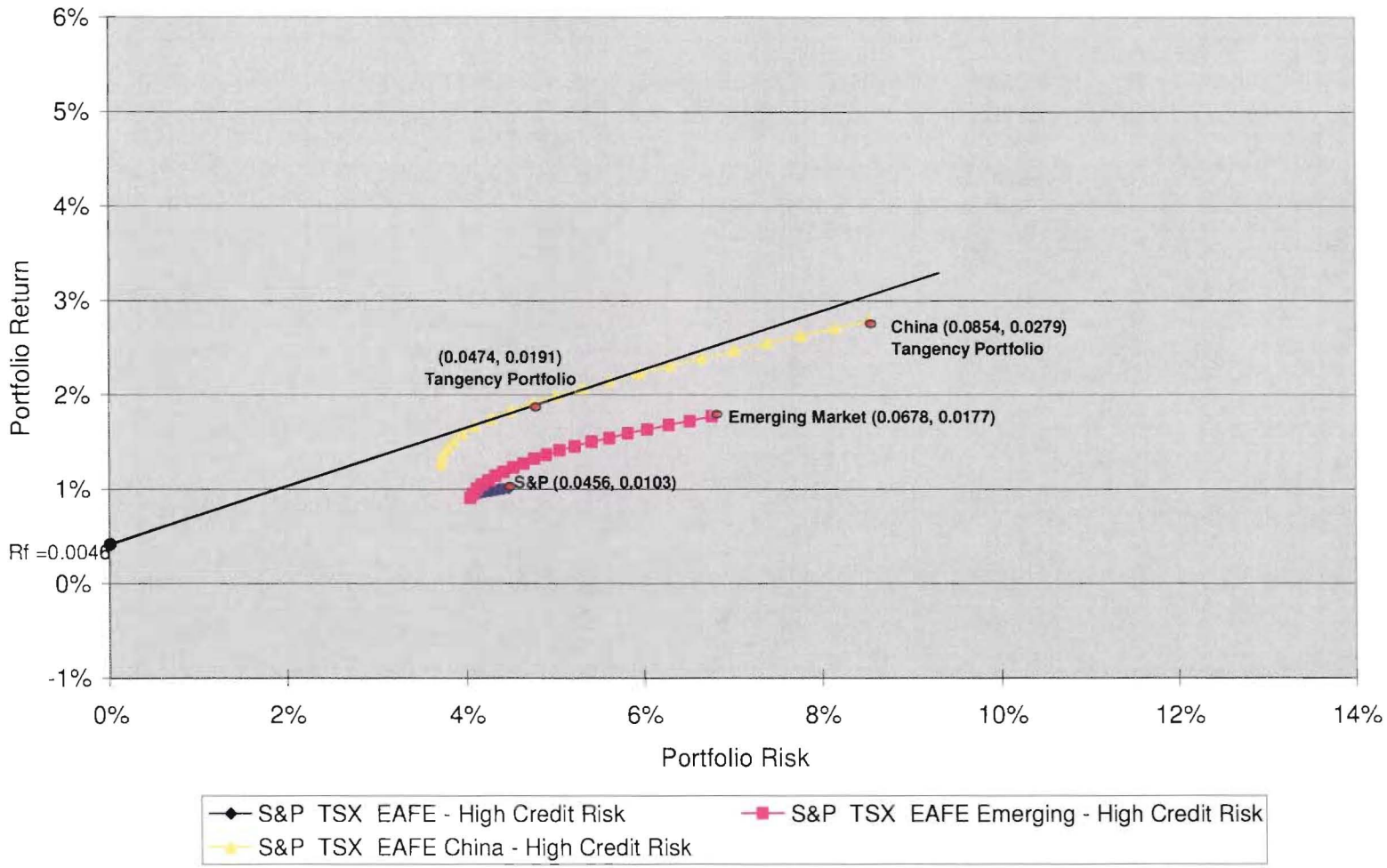
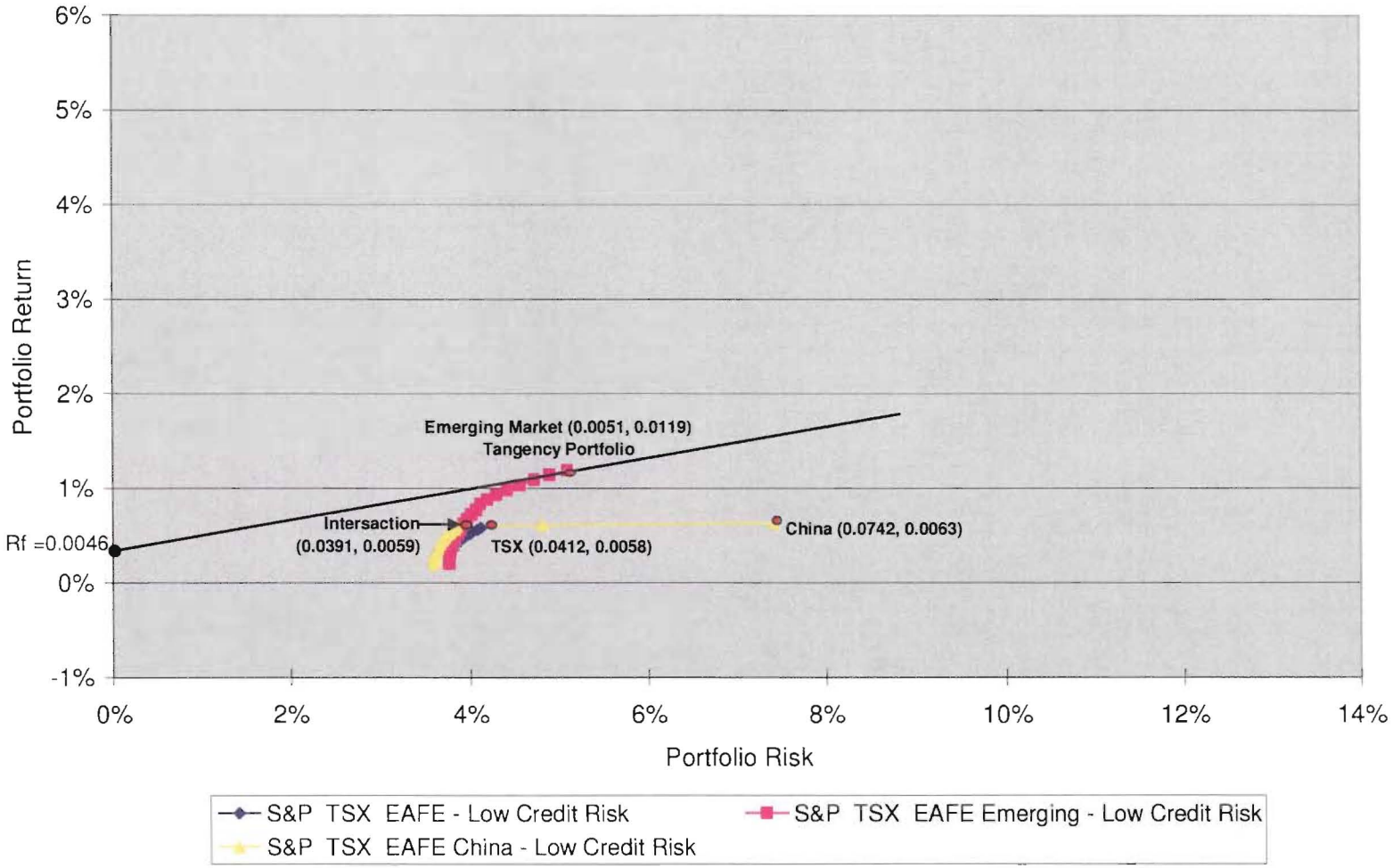


Figure 7. Efficient Frontier - Low Credit Risk Period (Absolute Mean Approach)



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Bloomberg, Argentina MERVAL Buenos Aires (MERVAL Index), Brazil IBOVESPA Sao Paulo (IBOV Index), Canada S&P TSX Composite, China SSE Composite Index (SHCOMP Index), India BSE SENSEX (SENSEX Index), Indonesia Composite Index (JCI Index), Mexico IPC (MEXBOL Index), Russia Trading System Stock Exchange (RTSI$ Equity), South Korea KOSPI Composite Index (KOSPI Index), Taiwan TSEC weighted index (TWSE Index), Turkey XU 100 Equity Index (XU100 Index), US S&P500 Index , MSCI EAFE Index Price (MXEA), monthly price (PX_LAST), Dec1997 to Aug2007

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