

Idiosyncratic Risk in Emerging Markets

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Abstract

I examine the properties and portfolio management implications of value-weighted idiosyncratic volatility in 24 emerging markets. This paper provides evidence against the view that the rise of idiosyncratic risk is a global phenomenon. Specific and market risks jointly predict market returns, as there is a negative (positive) relation between idiosyncratic (market) risk and subsequent stock returns. Idiosyncratic volatility is the most important component of tracking error volatility, and it does not exhibit either an upward or a downward trend. Thus, investors do not have to increase, on average, the number of stocks they hold to keep the active risk constant.

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Keywords: Emerging markets, Idiosyncratic risk, Tracking error volatility.

JEL Codes: G10, G11, C13.

1. Introduction

Numerous studies report that idiosyncratic risk is the most important component of total volatility in developed markets and that asset-specific risk affects portfolio management decisions. Campbell, Lettau, Malkiel, and Xu (2001) provide evidence supporting the view that in the U.S., the percentage of total risk attributed to idiosyncratic risk is higher than that of the market, and they show that idiosyncratic risk exhibits a positive and statistically significant trend. The latter findings have clear portfolio management implications; to achieve a given level of risk, more stocks are required. Goyal and Santa-Clara (2003) demonstrate that average total volatility is positively related to subsequent market returns and hence conclude that idiosyncratic risk matters! However, not all the empirical studies agree with these findings.

This paper presents additional out-of-sample evidence on three controversial issues of idiosyncratic risk. Little research has been conducted on the properties of asset-specific risk in emerging markets though they are more volatile, characterized by substantial returns, and represent at least 7.5% of the total world's investable market capitalization¹. Specifically, the following questions are investigated:

- I. Does average idiosyncratic risk increase over time?
- II. Is the relation between average idiosyncratic risk and expected market returns positive, negative, or statistically insignificant?
- III. What are the implications of idiosyncratic risk for portfolio management?

¹ Morgan Stanley Capital International (MSCI) estimates that the investable value of emerging markets is close to \$1.9 trillion or 7.5% of the total world market capitalization, whereas the total market capitalization is close to \$4.4 trillion without the free-float adjustment.

Campbell, Lettau, Malkiel, and Xu (2001) report that only firm-specific risk exhibits a significant upward trend during the 1962-1997 period, while market and industry volatilities show no significant trend. The findings rekindle² interest on asset-specific risk and many authors try to investigate whether the rise of idiosyncratic risk is a global phenomenon. Yet, the recent evidence casts doubt on the findings of Campbell, Lettau, Malkiel, and Xu (2001). Guo and Savickas (2008) use G7 country data and provide evidence that the value-weighted idiosyncratic volatility increased during the late 1990s and reversed to the pre-1990s level afterward. Brandt, Brav, Graham, and Kumar (2008) extend the sample of Campbell, Lettau, Malkiel, and Xu (2001) by including ten more years of data and show that the trend coefficient is lower and statistically insignificant. They attribute their findings to an episodic phenomenon that occurred during the 1990s that is related to speculative trading driven by retail investors. Bekaert, Hodrick, and Zhang (2008) use firm-level data from 23 developed markets covering the period from 1980 to 2005, and they reject the hypothesis of a permanent increase in asset-specific risk, arguing that a structural break occurs around 1997-2000.

The evidence on the relation between idiosyncratic risk and future stock returns is conflicting and confusing. Malkiel and Xu (2006) show that if investors do not hold the market portfolio, which is the most common case, the non-systematic risk is positively related to stock returns. In line with their work, Goyal and Santa-Clara (2003) demonstrate that the average total volatility is positively related to the subsequent monthly market returns. However, other empirical studies fail to confirm the positive relation between future stock returns and asset-specific risk. The results of Wei and Zhang (2005) as well as Bali, Cakici, Yan, and Zhang (2005) cast doubt on the evidence provided by Goyal and Santa-Clara (2003), as they show that the relation between asset-specific risk and future stock market

² Lintner (1965) and Douglas (1969) suggest that idiosyncratic risk explains the cross-sectional average of stock returns, whereas Tinic and West (1986) and Lehman (1990) reaffirm the significance of idiosyncratic risk.

returns is sample-specific.³ Guo and Savickas (2006) find that value-weighted idiosyncratic risk and market volatility predict excess quarterly stock market returns. They show that idiosyncratic risk is negatively related to subsequent quarterly stock market returns, while market volatility is positively related. Guo and Savickas (2008) use G7 countries' data and show a significant relation for the U.S. and the U.K. but an insignificant one for the other markets. However, given the integration of stock markets, U.S. idiosyncratic (market) volatility forecasts negatively (positively) international stock market returns.

Idiosyncratic risk affects portfolio management decisions. Holding everything else equal, an increase in the idiosyncratic risk lowers the correlation between stock returns. Campbell, Lettau, Malkiel, and Xu (2001) show that 20 stocks were needed before 1985 to reduce the excess standard deviation to 10%, but it was only possible to reach this level of risk with a portfolio of 50 stocks during the 1990s. Kearney and Poti (2008) reach a similar conclusion, reporting that 166 (35) European stocks were needed in 2003 (1974) to reduce idiosyncratic risk. Xu (2003) examines the diversification benefits in China and argues that in the recent years, more stocks were needed to achieve a given level of risk.

The recent literature on idiosyncratic risk focuses on three main issues: (i) whether the risk exhibits a significant positive trend; (ii) whether the risk predicts future stock market returns; and (iii) the implications of an idiosyncratic risk trend for portfolio management decisions. The goal of this paper is to use data from emerging markets to investigate the three issues in other samples and provide further evidence that adds to the existing conflicting results.

This study provides evidence against the view that the rise of idiosyncratic risk is a global phenomenon. A high volatility regime is observed during the 1997–2000 period followed by

³ Angelidis and Tessaromatis (2009) estimate a regime-switching model and show that the future market returns are positively related to idiosyncratic risk only during low volatility periods that mainly coincide with the sample that Goyal and Santa-Clara (2003) used.

a low volatility regime, implying that the increase cannot be attributed to a long-run trend. Furthermore, idiosyncratic risk forecasts market returns only in conjunction with the stock market risk as the coefficient of idiosyncratic risk turns out to be negative and statistically significant, while market risk is positively related to subsequent stock market returns. Therefore, asset-specific risk could be a proxy for systematic risk omitted from the Capital Asset Pricing Model (CAPM). Finally, investors do not need to alter the number of stocks included in a portfolio to keep the active risk constant. For most of the markets, the average correlations, idiosyncratic and market volatilities exhibit no trend over the sample period.

.2. Idiosyncratic risk

Daily idiosyncratic return is calculated as the residual of the following regression:

$$r_i = \alpha + \beta_i r_m + \varepsilon_i, \quad (1)$$

where r_i is the stock return, r_m is the value-weighted market return and ε_i is the firm-specific return^{4,5}. Idiosyncratic (IV) and market (MV) risk in month t equals $\sqrt{n_t} \sqrt{\text{Var}(\varepsilon_{t,i})}$ and

$\sqrt{n_t} \sqrt{\text{Var}(r_{t,m})}$. The monthly value-weighted asset-specific risk is calculated as:

$$IV_t = \sum_{i=1}^N w_{i,t} \sqrt{n_t} \sqrt{\text{Var}(\varepsilon_{t,i})}, \quad (2)$$

where $w_{i,t}$ is the market capitalization weight of stock i in month $t - 1$ and n_t is the number of days in month t .

3. Data set and summary statistics

⁴ The risk-free rate is ignored because the effect on the stock returns is minimal at a daily horizon.

⁵ The Fama and French (1993) model was not used to construct the idiosyncratic risk because both Guo and Savickas (2008) and Bali, Cakici, Yan, and Zhang (2005) argue that the results they obtain by using either the CAPM or the three-factor model are very similar.

The data set is obtained from Datastream and covers all the listed stocks from December 31, 1994 to May 31, 2007 for countries that are covered by the Morgan Stanley Capital International (MSCI)⁶ database of emerging markets as of June 2006. Specifically, the MSCI Emerging Markets Index consists of the following 25 emerging markets: 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. However, Jordan is excluded from the sample, as the stock data are available only after 2000.

All the foreign companies and investment trusts are excluded from the data set.⁷ For each market, the total market Datastream Global Index (Totmk item of Datastream) is used as the national market portfolio.⁸ In Datastream, some stocks are extremely volatile. Thus, the following filters are imposed to account for potential errors⁹:

1. If the daily absolute return of a stock is greater than 50%, then the return is set as missing to mitigate the effect of extreme stock returns.
2. If the return index¹⁰ is below three in a day, then the return is set as missing.
3. All stocks with less than five observations during a month are excluded from the analysis.

⁶ The MSCI Emerging Markets Index is a free-float-adjusted market capitalization index that is designed to measure the equity market performance in the emerging markets.

⁷ The first number in the following parentheses shows the number of stocks per country covered by Datastream in 1994, and the second shows the number of stocks in 2007: Argentina (71, 65), Brazil (216, 303), Chile (172, 173), China (215, 1295), Colombia (25, 36), Czech Republic (46, 18), Egypt (5, 102), Hungary (24, 25), India (645, 867), Indonesia (198, 320), Israel (64, 97), Korea (608, 912), Malaysia (470, 1021), Mexico (111, 118), Morocco (37, 65), Pakistan (90, 124), Peru (72, 60), Philippines (148, 205), Poland (26, 140), Russia (15, 289), South Africa (418, 326), Taiwan (290, 1222), Thailand (360, 501), and Turkey (144, 218).

⁸ According to Datastream, the total market indexes do not include all companies in a market; rather, they are based on their market value and the most important are chosen. For the markets of Egypt and Morocco, the national market indexes are constructed from raw data, as Datastream does not calculate the total market indexes.

⁹ Ang, Hodrick, Xing, and Zhang (2009) remove 5% of the stocks with the smallest capitalization to address the outlier effect. As a robustness check, this filter was also applied. The average correlation of the idiosyncratic measures between the two filtering procedures was close to 0.98. The results are quite similar to those reported and are available from the author.

¹⁰ The return index is a Datastream variable that is used to calculate the total return of a stock. A return index less than 3 indicates that the security lost 97% of its value over its life.

3.1 Descriptive statistics and correlation analysis

Table 1 presents the descriptive statistics for the monthly value-weighted idiosyncratic and market risk. The average annualized asset-specific risk equals 30.72%, ranging from 18.94% for Morocco to 46.34% for Indonesia, and is almost double that of the U.S. On average, the market risk equals 22.13%, ranging from 9.35% (Morocco) to 40.84% (Turkey). Brooks (2007) examines the volatility of 26 emerging markets and observes the highest standard deviation for Turkey and the lowest for Morocco.

The average first order autoregressive coefficient equals 0.60. It ranges from 0.16 to 0.89, decays slowly, and is lower than that of the U.S. and the U.K. markets. Angelidis and Tessaromatis (2008a) report that the first autoregressive coefficient is close to 0.8 for the U.K. market, in line with the evidence provided for the U.S. market by Campbell, Lettau, Malkiel, and Xu (2001); Goyal and Santa-Clara (2003); and Bali, Cakici, and Levy (2008). The autocorrelation structure of idiosyncratic risk indicates that the volatility shocks do not last as long as those in the more developed markets.

The average percentage of the total risk attributed to idiosyncratic risk, defined as $\frac{\sqrt{n_t \text{Var}(\varepsilon_{t,i})}}{\sqrt{n_t \text{Var}(\varepsilon_{t,i}) + n_t \text{Var}(r_{m,t})}}$, equals 55%, and it is not the dominant component of the total risk. In more developed markets, the percentage of total risk attributed to asset-specific risk is much higher. In the U.S., it is close to 76% (Campbell, Lettau, Malkiel, and Xu, 2001) while in the U.K., depending on the weighting scheme, it ranges from 75% to 97% (Angelidis and Tessaromatis, 2008a). Furthermore, in ten European markets, it ranges from 61% to 80% (Angelidis and Tessaromatis, 2008b), while Kearny and Poti (2008) also provide evidence in favor of the view that the average asset-specific risk is more important than the market risk for European stocks.

There are indications in favor of the view that the percentage of total risk attributed to asset-specific risk is higher in markets with more efficient trading mechanisms. Morck, Yeung, and Yu (2000) show that asset-specific risk is higher in the high-income economies in the mid-1990s and, in our case, in the more developed markets. They attribute the finding to stronger investor protection laws. Li, Morck, Yang, and Bernard (2004) show that idiosyncratic risk is the larger component of total variance in countries with more efficient and open financial systems. This finding is in line with Beny (2000), who argues that greater asset-specific risk is observed in markets with more developed financial systems. The presented findings are in accordance with Bris, Goetzmann, and Zhu (2002), who note that short sale restrictions, an investment constraint mainly applied in emerging markets, lower idiosyncratic variability.

In most cases, idiosyncratic volatilities do not move in tandem, as the correlation coefficient ranges from -0.28 to 0.81, with an average value close to 0.27. Hence, there are no indications of a contemporaneous correlation between the markets. However, a different picture emerges if asset-specific risk is examined across geographical areas. On one hand, the European (Czech Republic, Hungary, Poland, and Turkey) and Asian (China, India, Indonesia, Korea, Malaysia, Pakistan, Philippines, Taiwan, and Thailand) idiosyncratic volatilities are more correlated, as the average correlation is greater than 0.40 but lower than the 0.70 that Angelidis and Tassaromatis (2008b) report for ten developed European markets and that Bekaert, Hodrick, and Zhang (2008) calculate for the G7 countries. On the other hand, the South American (Argentina, Brazil, Chile, Colombia, Mexico, and Peru) and the African markets (Egypt, Israel, Morocco, and South Africa) are less correlated. See Table 2 for detailed results.

3.2 Trend analysis

Campbell, Lettau, Malkiel, and Xu (2001) show that firm-specific risk increases while both market and industry volatilities do not exhibit a significant trend. They speculate that the increase in idiosyncratic volatility is attributed to two factors: (i) firms are listed separately due to the tendency to break up conglomerates and hence their idiosyncratic risk is not eliminated, and (ii) firms issue stock too early in their life cycle, before establishing their long-run profitability, a corporate action that increases idiosyncratic risk. This evidence triggers the academic community to uncover the underlying factors that determine the behavior of aggregate volatility. Bennett and Sias (2005) argue that the changes in the relative importance of the riskier industries, smaller firms, and in within-industry concentration explain the increase in the asset-specific risk between 1962 and 1999 and the subsequent decrease. Brown and Kapadia (2007) point out that the increase in the idiosyncratic risk is due to the increase in the number of risky firms that listed over the last 40 years.

However, recent findings provide evidence that the upward trend in idiosyncratic risk attenuates substantially after 2001 and challenge the view that idiosyncratic risk is higher than it was in the 1960s. Brandt, Brav, Graham, and Kumar (2008) show that idiosyncratic risk fell sharply in the past few years, a pattern that is also observed during the late 1920s and early 1930s. Brandt, Brav, Graham, and Kumar conclude that the recent increase is related to speculative trading driven by retail investors. Bekaert, Hodrick, and Zhang (2008) demonstrate that there is no upward trend in the 23 developed countries. For most of the markets, two structural breaks occur recently: at the end of 1997/1998 (peak of idiosyncratic risk) and 2001/2002 (start of the decline of idiosyncratic risk). Bekaert, Hodrick, and Zhang estimate a regime-switching model to accommodate the structural breaks and show that idiosyncratic risk experiences several short durations of high-variance episodes that explain the temporary increase in the firm-specific risk that Campbell, Lettau, Malkiel, and Xu

(2001) report. Guo and Savickas (2008) also find that the value-weighted asset-specific risk did not increase over the past three decades in the G7 countries, while Hamao, Mei, and Xu (2003) demonstrate that idiosyncratic volatility fell during the 1986-1999 period in Japan due to an increase in the homogeneity of earnings.

Table 3 presents a 90% confidence interval of Vogelsang's (1998) test statistic for the monthly idiosyncratic risk (Panel A) and the market risk (Panel B). The coefficient of the trend is negative and statistically significant in six (Czech Republic, Hungary, Mexico, Poland, Russia, and Turkey) out of 24 markets, while a statistically significant increase is only observed in Morocco. Li, Morck, Yang, and Bernard (2004), in line with the findings of Morck, Yeung, and Yu (2000), Campbell, Lettau, Malkiel, and Xu (2001), and Kearney and Poti (2008), show a significant rise in idiosyncratic risk in the majority of the emerging markets in the 1990s. The contradictory results possibly reflect the different sample period, data frequency, or equally weighted scheme used to construct the systematic and unsystematic component of total volatility.

Market risk is stable over the period examined, decreasing in only a few markets (Brazil, Chile, China, Peru, Poland, and Russia). Campbell, Lettau, Malkiel, and Xu (2001) report that stock market volatility did not increase, whereas Kearney and Poti (2008) find a significant rise. See Section 5 for a discussion about the importance of these findings.

To summarize, the rise of idiosyncratic risk is not a global phenomenon, as there are indications that asset-specific risk is not significantly higher than it was in the beginning of the 1990s and there are periods of high volatility followed by periods of low volatility. Following the work of Bekaert, Hodrick, and Zhang (2008) who suggest the use of a stationary, mean-reverting process with shifts to model the high-variance regime of asset-specific risk, I estimate Hamilton's (1989) regime-switching model to accommodate the

short-duration high variance episodes. Figure 1 shows the smoothed probability, based on Kim's (1994) algorithm, in the high mean category (high idiosyncratic risk).¹¹ During the 1997–2000 period, idiosyncratic volatility switches to the high variance regime in most of the markets. However, high-risk periods are not observed in most of the markets after 2000. Hence, the evidence reinforces the view of Bekaert, Hodrick, and Zhang (2008), who state that the increase is due to particular sample periods, and that the time trend has reversed in recent years.

4. Investigating the forecasting ability of idiosyncratic risk

The CAPM states that stock prices are set in such a way that expected returns are only determined by systematic risk measured by beta. Specific risks are diversified¹² by holding a portfolio of stocks and hence are unrewarded. However, investors do not always hold diversified portfolios. Blume and Friend (1975) and Barber and Odean (2000) report that individual investors hold portfolios with an average of 3.4 to 4.3 stocks. Benartzi and Thaler (2001) analyze the portfolio selection decisions in the retirement accounts and show that if investors divide their wealth equally, as they commonly do, they pick a wrong point in the efficient frontier. Goetzmann and Kumar (2004) show that more than 25% of the 62,000 household investors examined hold only one stock. Thus, based on the work of Malkiel and Xu (2006), it can be stated that idiosyncratic risk is a factor that could positively affect stock returns. Merton (1987) supports the view, demonstrating that high idiosyncratic stocks earn more than low idiosyncratic stocks because investors cannot create portfolios that contain only systematic risk.

¹¹ Due to space limitations, the estimated parameters of the regime-switching model are not reported in detail, but they are available. The regime-switching model algorithm does not converge for three markets (Egypt, Mexico, and Turkey).

¹² Pontiff (2006) shows that asset-specific risk is important because the optimal weight of an asset is a function of “risk aversion, the alpha of the position and the position’s idiosyncratic risk.” Thus, it is unaffected by the other equity positions.

The existing evidence on the relation between idiosyncratic volatility and future stock returns in the U.S. market is conflicting and confusing. Bali, Cakici, Yan, and Zhang (2005) and Wei and Zhang (2005), who challenge the evidence of Goyal and Santa-Clara (2003) that the average idiosyncratic risk is positively related to future returns, argue that there is no time series¹³ relation between asset-specific risk and subsequent stock returns. Guo and Savickas (2003, 2006, and 2008) and Kearney and Poti (2008) show that asset-specific risk is negatively related to future stock returns.

The inter-temporal relation between subsequent market returns and asset-specific risk is investigated by estimating the following regression:

$$r_{t+1} = \alpha + \beta IV_t + \gamma MV_t + \varepsilon_{t+1} \quad (3)$$

where r_{t+1} is the log market monthly return at month $t + 1$. Since that a panel data set often yields more efficient estimators, I estimate a pooled regression model using the Seemingly Unrelated Regression (SUR) method:

$$r_{t+1,j} = \alpha + \beta IV_{t,j} + \gamma MV_{t,j} + \varepsilon_{t+1,j}, j = 1, 2, \dots, 24. \quad (4)$$

Panel A of Table 4 presents the regressions of the monthly market returns on lagged idiosyncratic and market volatilities. In most of the cases, asset-specific (market) risk is negatively (positively) related but statistically insignificant to subsequent market returns. This evidence is in line with Bali, Cakici, Yan, and Zhang (2005) and Wei and Zhang (2005),

¹³ Ang, Hodrick, Xing, and Zhang (2006 and 2009) report a negative cross-sectional relation between idiosyncratic risk and returns. Fu (2009) challenges these findings as he demonstrates that idiosyncratic volatilities are time-varying and uncovers a positive relation between idiosyncratic risk (constructed using EGARCH models) and expected stock returns. He argues that the return reversal of small and high idiosyncratic risk stocks offers an explanation of Ang, Hodrick, Xing, and Zhang (2006) findings. To present preliminary evidence on the cross-sectional relation, I form five portfolios on past idiosyncratic risk for all equity markets. On average, the low idiosyncratic risk portfolio outperforms the stocks with the highest asset-specific risk by 0.58% per month, lower than the 0.89% reported by Ang, Hodrick, Xing, and Zhang (2009), who examine the difference in average returns between the extreme idiosyncratic portfolios across 23 developed countries. However, the difference is higher than the 0.39% calculated by Ang, Hodrick, Xing, and Zhang (2009) when they exclude the U.S. market. Due to space limitations, the results are not reported in detail, but they are available from the author.

who argue that asset-specific risk is unrelated to future market returns. The negative coefficient on idiosyncratic risk supports the results presented by Guo and Savickas (2003, 2006, and 2008), who report that the return of high idiosyncratic portfolios is lower than that of low idiosyncratic portfolios. The coefficient on market volatility is consistent with CAPM, as it predicts a positive risk-return relation.

However, a different picture emerges when pooling the data.¹⁴ The coefficient of idiosyncratic volatility is negative and statistically significant, whereas the market risk is positively related to the subsequent market returns. This observation is in line with Guo and Savickas (2003, 2006 and 2008) and Kearney and Poti (2008); however, it contradicts the argument made by Malkiel and Xu (2006) who state that idiosyncratic risk is expected to be positively related to stock returns due to the non-diversification hypothesis.

Guo and Savickas (2006 and 2008) use quarterly data and demonstrate that for most of the G7 countries, idiosyncratic risk in conjunction with market volatility forecasts stock market returns. Therefore, they interpret idiosyncratic risk as a proxy for systematic risk omitted from the CAPM. This is also the case in emerging markets, as idiosyncratic and market risk predict stock market returns only in conjunction with one another. When the variables are used alone, the coefficients are not statistically different from zero. The *t*-statistic for idiosyncratic risk is equal to -1.3769 and 0.1303 for market volatility.

Guo and Savickas (2006 and 2008) find stronger evidence using quarterly data, as opposed to the monthly data, because the realized volatility is more precisely measured (Ghysels, Santa-Clara, and Valkanov, 2005). Panel B of Table 4 presents the pooled regression of the quarterly market returns on lagged idiosyncratic and market volatility. Both variables are related to subsequent stock returns with the same signs as they are in the

¹⁴ To examine the stability of the relation and account for the questions that have been raised by Bali, Cakici, Yan, and Zhang (2005) and Wei and Zhang (2005), equation 4 is re-estimated for the period from 1994:12 to 1999:12. The results for the shorter sample are qualitatively similar to those reported and are available.

monthly data set and explain 1.13% of the stock market variation. The asset-specific risk predicts the stock market returns without the inclusion of market risk. The t -statistic equals -1.8787 though the forecasting power increases when both variables are included in the regression.

However, why are the stock returns negatively affected by idiosyncratic risk and positively affected by market volatility? The positive risk-return relation is predicted by the CAPM and is also uncovered in the emerging markets. Yet, the coefficient of market risk is statistically significant only when specific-risk is included in the regression. Therefore, idiosyncratic risk may be a proxy for systematic risk omitted from the CAPM.

Several alternative hypotheses have been proposed to explain the negative relation between asset-specific risk and future stock returns. Kearney and Poti (2008) show that idiosyncratic and market risk jointly predict the future stock market returns and attribute their findings to the fact that these risks jointly proxy for the average correlation and hence they account for a component of systematic risk. Furthermore, Guo and Savickas (2003) demonstrate that the value-weighted average stock market volatility is negatively related to the subsequent one-quarter-ahead stock market returns only in conjunction with the stock market volatility. However, the negative relation turns out to be insignificant when they include the consumption-wealth ratio developed by Lettau and Ludvigson (2001). Thus, they provide evidence supporting the limited stock market participation model developed by Guo (2004) who argues that the equity premium has two components: a risk premium as in CAPM and an illiquidity premium. Continuing their work, Guo and Savickas (2006) suggest that asset-specific risk predicts the stock market returns, as it could be a measure of a risk factor omitted from CAPM (e.g., liquidity risk). They compare idiosyncratic risk with the consumption-wealth ratio, and they suggest that both variables model similar components of stock market variability. The negative sign of idiosyncratic risk in the predictive equation can

be attributed to the fact that asset-specific risk measures the conditional variance of liquidity risk that might be negatively related to market risk (Guo, 2004). Additionally, Guo and Savickas (2008) work on the hypothesis that the value premium is a risk factor omitted from CAPM (Fama and French, 1996) and compare the idiosyncratic risk with the variance of the value premium. They show that the value-weighted idiosyncratic risk is highly correlated (0.88) with the variance of the value premium and have similar predictive properties. Specifically, they demonstrate that the volatility of the value premium is negatively and statistically significant related to future stock market returns only when market volatility is included in the forecasting equations, as it is in the case of idiosyncratic risk. However, the forecasting ability of the volatility of the value premium vanishes when idiosyncratic risk is included. Finally, they demonstrate that asset-specific risk is negatively related to future stock market returns due to the negative relation between idiosyncratic risk and the aggregate book-to-market ratio, which is positively related to stock market returns.

To summarize, the evidence suggests that idiosyncratic risk is a proxy for volatility of a risk factor omitted from CAPM and could be either related to the volatility of the value premium or liquidity or both.

5. Portfolio implications

Asset-specific risk is not only the most significant component of total volatility, but it is also related to tracking error risk, a variable that measures the performance of portfolio managers. Tracking error volatility is the standard deviation of the difference between the portfolio and the benchmark return. Under the assumption that all betas, β , are equal to 1, the tracking error and the asset-specific risk are equal, because if $\beta = 1$, idiosyncratic risk

$\sqrt{\text{Var}(\varepsilon_{t,i})}$ equals the tracking error volatility $\sqrt{\text{Var}(r_i - r_m)}$. Therefore, understanding the

properties of idiosyncratic risk can be quite rewarding to fund managers. To illustrate the relation between asset-specific risk, market risk, correlation among stocks, and tracking error volatility, assume that an investor creates an equally weighted portfolio p , all securities have a common variance, σ^2 , and all security pairs have a common correlation coefficient, ρ . Thus, the tracking error variance (σ_{TE}^2) can be written as:

$$\sigma_{TE}^2 = \sigma^2 - \sigma_p^2 = \sigma^2 - \left(\frac{1}{n} \sigma^2 + \frac{n-1}{n} \rho \sigma^2 \right) = \sigma^2 \left(1 - \left(\frac{1}{n} + \frac{n-1}{n} \rho \right) \right), \quad (5)$$

where σ_p^2 is the variance of an equally weighted portfolio and n is the number of stocks held in the portfolio. Equation (5) implies that the tracking error depends on the total variance of the stocks, the number of stocks in the portfolio, and the average correlation between the security returns. As n ¹⁵ increases, the portfolio becomes more diversified, and the tracking error becomes $\sigma^2 - \sigma^2 \rho$. If the chosen securities are perfectly positively correlated with the benchmark index ($\rho = 1$), the variance of the tracking portfolio equals 0 (a perfect track), whereas equation (5) equals σ^2 if $\rho = 0$. In the extreme case that the fund manager selects negatively correlated stocks ($\rho = -1$), the variance of the tracking portfolio becomes $2\sigma^2$.

Panel C of Table 3 presents the Vogelsang (1998) 90% confidence interval for the average monthly correlation coefficient¹⁶. In most of the markets, the average bivariate correlation does not decrease, a finding that contradicts the evidence presented by Campbell, Lettau, Malkiel, and Xu (2001), who report a downward trend in the average stock

¹⁵ The classical study of Evans and Archer (1968) and many textbooks state that maximum diversification can be achieved by holding portfolios with 15 or 20 stocks. However, Domian, Louton, and Racine (2007) analyze the diversification problem and argue that more than 100 stocks are needed to minimize the possibility of achieving a return smaller than that of the Treasury bonds. Bennett and Sias (2008) point out that even portfolios containing 200 stocks bear significant idiosyncratic risk.

¹⁶ The average correlation coefficient was calculated using daily data.

correlation. However, it is in line with the evidence presented by Kearney and Poti (2008), who demonstrate that the trend coefficient of average correlation in Europe is not statistically significant. The average correlation declined in four markets (Israel, Mexico, Poland, and Taiwan) and increased in Morocco and Pakistan.

Figure 2 depicts the time series of the monthly average correlation coefficient between all pairs of stocks traded in each of the 24 emerging markets. The average correlation is close to 10%, which is smaller than the 20% reported by Kearney and Poti (2008).¹⁷ However, the correlations are higher in a few markets. In China, for example, the average correlation is greater than 0.5 during 1994-1997 and 2001, but it started to decline over the past six years. This conclusion is also reached by Xu (2003), who claims that the pairwise monthly correlation in China exhibits a decreasing trend.

To examine the effects of asset-specific risk, market risk, and average correlation on relative risk, I create equally weighted portfolios by selecting randomly without replacement 10, 20, and 30 stocks.¹⁸ The volatility of the tracking portfolios remain constant in most of the markets, since the components of tracking errors (idiosyncratic risk, market volatility, and average correlation) did not exhibit a trend (see Table 3). Hence, portfolio managers do not have to increase the number of stocks to keep the active risk constant. The detailed results are presented in Table 5.

According to equation (5), tracking error volatility depends positively on total volatility and negatively on correlation. To verify the relation, I regress the monthly tracking error volatility based on the three equally weighted portfolios against idiosyncratic, market risk and average correlation using the SUR method:

¹⁷ Campbell, Lettau, Malkiel, and Xu (2001) report that during 1960-1997, the correlations decline from 0.12 to between 0.02-0.04.

¹⁸ If during the examined period (1994-2007) the number of stocks in a market is less than 10, 20 or 30, then their corresponding portfolios are not created.

$$\sigma_{TE,t,j} = \alpha_j + \beta IV_{t,j} + \gamma MV_{t,j} + \delta \rho_{t,j} + \varepsilon_{t,j}, j = 1, 2, \dots, 24. \quad (6)$$

Irrespective of the number of stocks included in the portfolios, all the coefficients are statistically significant, showing the importance of the three factors in explaining tracking error volatility. Both idiosyncratic and market risk have a positive effect on tracking error volatility while the average correlation is negatively related. The tracking error decreases when total volatility decreases, and the average correlation between stock returns increases.

The cross-sectional R^2 of the decomposition in equation (6) is slightly higher than 75%, suggesting that the underlying assumptions (all betas, β , equal to one, and all securities have a common standard deviation, σ , and correlation coefficient, ρ) are quite accurate and can be used to analyze tracking variability. The regression suggests that idiosyncratic risk influences tracking error volatility, accounting for over 81% of the fitted cross-sectional variance.¹⁹ About 10% is attributed to market risk, while 9% is due to average correlation. The detailed results are presented in Table 6.

6. Conclusions

The purpose of this article is to investigate the behavior, forecasting ability, and portfolio management implications of idiosyncratic volatility in emerging markets. The comparison of asset-specific risk of emerging markets with that of the more developed markets is quite useful for investors. The analysis confirms the view that the percent of total volatility that is attributed to asset-specific risk is lower in the emerging markets than that of the developed markets, as the developed markets are more efficient. Furthermore, for most of the markets, neither component of total volatility (idiosyncratic risk or market risk) nor the average correlation between stock returns exhibits evidence of a trend. Thus, there are indications that

¹⁹ The percentage of fitted variance attributed to idiosyncratic risk is defined as: $\frac{\beta^2 \text{Var}(IV)}{\beta^2 \text{Var}(IV) + \gamma^2 \text{Var}(MV) + \delta^2 \text{Var}(\rho)}$

the increase in asset-specific risk and the decrease in the average stock correlation reported in other markets are sample- and period-specific.

Idiosyncratic risk forecasts market returns only in conjunction with stock market risk. When the data are pooled across the 24 markets, the coefficient of idiosyncratic risk is negative and statistically significant. Therefore, the evidence presented adds to the conflicting results reported using data from more developed markets and support the view that asset-specific risk is a proxy for systematic risk omitted from the CAPM.

Idiosyncratic risk is closely related to active risk management. Indeed, under some conditions, asset-specific and tracking returns are equal. Tracking error volatility is closely related to idiosyncratic risk, market risk, and the correlation between the returns of the stocks that the manager has chosen and the returns of the benchmark index. For most of the markets, neither component of the tracking error volatility exhibits an upward or downward trend. Thus, investors do not have to increase, on average, the number of stocks they are holding to keep the active risk constant. Asset-specific risk is the dominant component of tracking error volatility, explaining more than 81% of the fitted cross-sectional variance.

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Table 1. Descriptive statistics

Panel A. Idiosyncratic risk												
	Argentina	Brazil	Chile	China	Colombia	Czech Republic	Egypt	Hungary	India	Indonesia	Israel	Korea
Mean	0.0834	0.1035	0.0610	0.0902	0.0747	0.0700	0.0761	0.0712	0.1024	0.1338	0.0686	0.1175
Median	0.0748	0.0950	0.0576	0.0858	0.0697	0.0706	0.0757	0.0663	0.0948	0.1162	0.0672	0.1034
Maximum	0.2158	0.2779	0.1186	0.1763	0.1696	0.1303	0.2815	0.1616	0.2334	0.3296	0.1033	0.2426
Minimum	0.0440	0.0033	0.0345	0.0378	0.0314	0.0243	0.0004	0.0392	0.0642	0.0711	0.0478	0.0668
Standard deviation	0.0296	0.0452	0.0164	0.0301	0.0260	0.0207	0.0319	0.0193	0.0287	0.0540	0.0109	0.0397
Skewness	1.5678	1.1313	1.3953	0.7758	1.0274	0.1943	1.4648	1.7311	1.4955	1.4075	0.5721	1.1206
Kurtosis	6.0376	6.2727	5.1255	3.0454	4.2200	3.2253	14.2550	7.5670	6.1430	4.3670	3.2641	3.4949
Jarque-Bera	118.0000	98.0000	76.0000	15.0000	35.0000	1.0000	823.0000	204.0000	117.0000	61.0000	9.0000	33.0000
Observations	149.0000	149.0000	149.0000	149.0000	149.0000	149.0000	146.0000	149.0000	149.0000	149.0000	149.0000	149.0000
AR1	0.6670	0.3940	0.5340	0.7140	0.3900	0.5530	0.3960	0.4460	0.5650	0.8330	0.3580	0.8540
AR6	0.4450	0.0800	0.4040	0.2210	0.1790	0.3670	0.198	0.1360	0.3770	0.5830	0.0850	0.6880
AR12	0.1660	0.0510	0.2440	0.2680	0.1190	0.2520	-0.0700	0.1660	0.2860	0.4150	0.1290	0.5510
	Malaysia	Mexico	Morocco	Pakistan	Peru	Philippines	Poland	Russia	South Africa	Taiwan	Thailand	Turkey
Mean	0.0861	0.0788	0.0547	0.0853	0.0782	0.0988	0.0884	0.1134	0.0847	0.0873	0.1033	0.1176
Median	0.0785	0.0724	0.0532	0.0796	0.0749	0.0919	0.0839	0.0921	0.0766	0.0833	0.0941	0.1163
Maximum	0.2128	0.2215	0.1021	0.2030	0.1562	0.1844	0.1640	0.5043	0.2190	0.1589	0.2253	0.2139
Minimum	0.0524	0.0434	0.0235	0.0472	0.0364	0.0617	0.0526	0.0414	0.0415	0.0398	0.0534	0.0605
Standard deviation	0.0302	0.0265	0.0174	0.0248	0.0220	0.0243	0.0235	0.0693	0.0267	0.0207	0.0382	0.0339
Skewness	1.9457	1.9555	0.5074	1.5198	1.1341	1.2057	0.8219	2.7111	1.6194	0.5152	1.1462	0.4909
Kurtosis	7.3659	8.7836	3.0318	6.3330	4.8128	4.3553	3.2093	12.5059	7.2994	3.0586	3.7906	2.6229
Jarque-Bera	212.0000	303.0000	6.0000	126.0000	52.0000	48.0000	17.0000	744.0000	180.0000	7.0000	37.0000	7.0000
Observations	149.0000	149.0000	149.0000	149.0000	149.0000	149.0000	146.0000	149.0000	149.0000	149.0000	149.0000	149.0000
AR1	0.7890	0.5150	0.4000	0.5540	0.1640	0.6930	0.6730	0.6790	0.8440	0.7100	0.8910	0.7550
AR6	0.5470	0.3060	-0.0530	0.0830	-0.0510	0.4170	0.4260	0.2240	0.5430	0.4190	0.7050	0.5290
AR12	0.3970	0.2810	-0.0240	0.1490	-0.0250	0.4340	0.4260	0.2110	0.3470	0.3040	0.4380	0.5960

Table 1 (continued). Panel B. Market risk

	Argentina	Brazil	Chile	China	Colombia	Czech Republic	Egypt	Hungary	India	Indonesia	Israel	Korea
Mean	0.0714	0.0840	0.0316	0.0742	0.0440	0.0535	0.0523	0.0691	0.0641	0.0711	0.0540	0.0815
Median	0.0614	0.0588	0.0273	0.0625	0.0385	0.0509	0.0459	0.0573	0.0573	0.0576	0.0494	0.0705
Maximum	0.2867	0.4905	0.1219	0.3744	0.2550	0.1435	0.1675	0.2456	0.1918	0.2376	0.1648	0.2401
Minimum	0.0233	0.0124	0.0104	0.0252	0.0076	0.0132	0.0008	0.0223	0.0269	0.0189	0.0180	0.0249
Standard Deviation	0.0414	0.0721	0.0145	0.0431	0.0285	0.0238	0.0295	0.0381	0.0290	0.0418	0.0212	0.0411
Skewness	2.5604	3.0850	2.2264	2.9659	3.4754	0.8266	0.7701	2.1388	1.4729	1.6134	1.8760	1.0472
Kurtosis	11.8095	14.0292	12.3985	18.2548	23.2403	3.7592	3.8598	8.4993	5.6669	5.4730	8.7749	3.7985
Jarque-Bera	645.0000	992.0000	671.0000	1663.0000	2843.0000	21.0000	19.0000	301.0000	98.0000	103.0000	294.0000	31.0000
Observations	149.0000	149.0000	149.0000	149.0000	149.0000	149.0000	146.0000	149.0000	149.0000	149.0000	149.0000	149.0000
AR1	0.5030	0.4290	0.2970	0.2890	0.3820	0.5020	0.3540	0.5220	0.3310	0.6570	0.2760	0.7630
AR6	0.0610	0.0380	0.1180	0.0670	0.1040	0.2810	0.2310	0.0920	0.1730	0.2930	0.1260	0.5220
AR12	-0.0100	0.1810	0.0550	0.0300	0.0730	0.1940	-0.0360	0.2010	0.0120	0.2390	0.1650	0.4030

	Malaysia	Mexico	Morocco	Pakistan	Peru	Philippines	Poland	Russia	South Africa	Taiwan	Thailand	Turkey
Mean	0.0545	0.0592	0.027	0.0777	0.0434	0.0554	0.0703	0.0979	0.0443	0.0650	0.0704	0.1179
Median	0.0411	0.0517	0.0215	0.0730	0.0367	0.0482	0.0634	0.0788	0.0398	0.0587	0.0621	0.1087
Maximum	0.3719	0.1789	0.1225	0.2847	0.1614	0.1920	0.1971	0.3021	0.1589	0.1700	0.2000	0.3825
Minimum	0.0090	0.0228	0.0052	0.0255	0.0123	0.0147	0.0215	0.0262	0.0136	0.0226	0.0241	0.0449
Standard Deviation	0.0459	0.0270	0.019	0.0389	0.0258	0.0284	0.0332	0.0555	0.0219	0.0264	0.0354	0.0554
Skewness	3.3537	1.2815	2.0574	1.7784	2.1283	1.8190	1.6059	1.1033	2.1564	0.9967	1.4176	1.5615
Kurtosis	19.4996	5.2618	8.5524	8.2600	8.5746	7.3854	6.3424	3.7991	9.8355	4.2267	5.0966	6.7114
Jarque-Bera	1969.0000	73.0000	297.0000	250.0000	305.0000	202.0000	133.0000	34.0000	406.0000	34.0000	77.0000	146.0000
Observations	149.0000	149.0000	149.0000	149.0000	149.0000	149.0000	149.0000	149.0000	149.0000	149.0000	149.0000	149.0000
AR1	0.6160	0.5230	0.3600	0.4220	0.2610	0.3520	0.5130	0.5210	0.4170	0.5270	0.5720	0.5200
AR6	0.3550	0.2120	0.1510	-0.0540	0.0720	0.1290	0.3070	0.2320	0.0740	0.2300	0.5010	0.1280
AR12	0.3220	0.1980	0.1380	0.0920	0.1480	0.0410	0.3060	0.2770	0.0980	0.1500	0.3620	0.2850

This table presents descriptive statistics of volatility measures. In Panels A and B, the descriptive statistics of monthly idiosyncratic and market volatilities are presented. AR1, AR6, and AR12 are the autoregressive coefficients of order 1, 6, and 12, respectively. The sample period is from 12/31/1994 to 05/31/2007.

Table 2. Correlation matrix

	Argentina	Brazil	Czech Republic	Chile	China	Colombia	Egypt	Hungary	India	Indonesia	Israel	Korea	Malaysia	Morocco	Mexico	Pakistan	Peru	Philippines	Poland	Russia	South Africa	Taiwan	Thailand	Turkey
Argentina	1.00																							
Brazil	0.28	1.00																						
Czech Republic	0.24	0.32	1.00																					
Chile	0.23	0.51	0.47	1.00																				
China	-0.27	-0.06	0.00	-0.02	1.00																			
Colombia	0.18	0.30	0.23	0.45	-0.03	1.00																		
Egypt	0.09	-0.09	-0.05	-0.02	0.05	0.10	1.00																	
Hungary	0.22	0.28	0.35	0.31	-0.06	0.30	0.06	1.00																
India	0.20	0.24	0.27	0.32	0.11	0.21	0.15	0.19	1.00															
Indonesia	0.17	0.58	0.40	0.57	0.02	0.41	0.12	0.10	0.45	1.00														
Israel	0.20	0.23	0.33	0.30	0.13	0.26	0.28	0.41	0.34	0.26	1.00													
Korea	0.16	0.42	0.38	0.50	0.08	0.39	0.28	0.15	0.57	0.78	0.32	1.00												
Malaysia	0.01	0.54	0.41	0.46	0.16	0.33	-0.02	0.29	0.25	0.71	0.23	0.61	1.00											
Morocco	0.11	-0.13	-0.13	-0.07	0.06	0.02	0.14	-0.13	0.05	-0.15	-0.01	-0.13	-0.23	1.00										
Mexico	0.15	0.53	0.41	0.54	0.08	0.27	-0.20	0.46	0.38	0.29	0.28	0.33	0.42	-0.14	1.00									
Pakistan	0.13	0.40	0.38	0.39	0.01	0.33	0.08	0.15	0.37	0.53	0.21	0.45	0.32	-0.16	0.37	1.00								
Peru	-0.01	0.11	-0.03	0.05	0.13	0.08	0.04	0.09	-0.04	-0.07	0.14	-0.09	0.09	0.15	0.20	-0.09	1.00							
Philippines	0.13	0.50	0.45	0.57	0.17	0.40	0.07	0.25	0.27	0.73	0.36	0.64	0.75	-0.13	0.42	0.35	0.10	1.00						
Poland	0.04	0.39	0.44	0.44	0.31	0.24	-0.18	0.47	0.22	0.31	0.35	0.34	0.54	-0.16	0.63	0.42	0.16	0.52	1.00					
Russia	0.05	0.61	0.46	0.58	0.19	0.31	-0.13	0.47	0.18	0.54	0.28	0.42	0.64	-0.17	0.52	0.36	0.10	0.66	0.62	1.00				
South Africa	0.40	0.59	0.48	0.58	-0.13	0.40	0.09	0.36	0.37	0.70	0.35	0.66	0.58	-0.04	0.44	0.41	0.00	0.65	0.44	0.66	1.00			
Taiwan	0.42	0.23	0.33	0.26	-0.06	0.20	0.27	0.13	0.45	0.43	0.33	0.53	0.32	0.07	0.26	0.15	0.08	0.34	0.12	0.14	0.47	1.00		
Thailand	0.09	0.47	0.47	0.57	0.03	0.36	0.15	0.14	0.36	0.81	0.27	0.74	0.75	-0.18	0.36	0.48	0.05	0.73	0.46	0.59	0.65	0.42	1.00	
Turkey	-0.06	0.30	0.47	0.39	0.16	0.19	-0.13	0.47	0.31	0.33	0.28	0.44	0.50	-0.28	0.56	0.30	0.02	0.45	0.61	0.49	0.37	0.21	0.37	1.00

This table reports the bivariate correlation between the monthly idiosyncratic risk measures of the 24 emerging markets over the 1994:12 to 2007:05 period.

Table 3. Trend analysis

	Panel A. Idiosyncratic risk			Panel B. Market risk			Panel C. Pair wise correlation		
	\widehat{V}_{min}	PS-statistic	\widehat{V}_{max}	\widehat{V}_{min}	PS-statistic	\widehat{V}_{max}	\widehat{V}_{min}	PS-statistic	\widehat{V}_{max}
Argentina	-0.076	0.017	0.109	-0.053	-0.025	0.003	-0.141	-0.069	0.002
Brazil	-0.070	-0.023	0.025	-0.115	-0.057	0.000	-0.009	0.010	0.029
Chile	-0.040	-0.015	0.010	-0.022	-0.011	0.000	-0.052	-0.021	0.009
China	-0.087	-0.025	0.036	-0.083	-0.045	-0.007	-0.333	-0.101	0.131
Colombia	-0.042	-0.007	0.028	-0.018	0.007	0.032	-0.019	0.070	0.159
Czech Republic	-0.039	-0.023	-0.007	-0.019	0.025	0.069	-0.044	0.011	0.065
Egypt	-0.024	0.024	0.072	-0.005	0.021	0.048	-0.010	0.062	0.134
Hungary	-0.027	-0.017	-0.008	-0.075	-0.025	0.024	-0.207	-0.059	0.089
India	-0.078	-0.012	0.055	-0.038	-0.002	0.034	-0.003	0.063	0.130
Indonesia	-0.543	-0.018	0.508	-0.127	-0.008	0.110	-0.048	0.012	0.071
Israel	-0.014	-0.004	0.006	-0.029	-0.011	0.007	-0.123	-0.072	-0.020
Korea	-0.596	-0.020	0.556	-0.218	-0.007	0.203	-0.161	-0.070	0.020
Malaysia	-0.125	-0.037	0.050	-0.134	-0.043	0.048	-0.362	-0.166	0.031
Morocco	0.003	0.010	0.018	0.001	0.013	0.026	0.002	0.037	0.073
Mexico	-0.056	-0.040	-0.024	-0.061	-0.025	0.011	-0.111	-0.061	-0.010
Pakistan	-0.041	-0.016	0.009	-0.054	-0.023	0.007	0.009	0.047	0.085
Peru	-0.017	-0.006	0.004	-0.046	-0.030	-0.013	-0.124	-0.050	0.023
Philippines	-0.091	-0.024	0.044	-0.046	-0.008	0.029	-0.053	-0.025	0.003
Poland	-0.063	-0.042	-0.022	-0.078	-0.043	-0.007	-0.471	-0.253	-0.035
Russia	-0.152	-0.082	-0.013	-0.120	-0.062	-0.004	-0.050	-0.021	0.008
South Africa	-0.153	-0.009	0.135	-0.025	0.005	0.035	-0.054	-0.016	0.022
Taiwan	-0.094	0.004	0.102	-0.053	-0.005	0.044	-0.205	-0.127	-0.049
Thailand	-0.749	-0.026	0.697	-0.122	-0.027	0.068	-0.025	0.014	0.053
Turkey	-0.088	-0.066	-0.045	-0.131	-0.028	0.076	-0.165	-0.015	0.136

This table presents the monthly idiosyncratic (Panel A), monthly market risk (Panel B), and the average monthly correlation (Panel C) between stock returns. The 90% confidence interval of Vogelsang (1998) test statistic is based on the model: $V_t = \mu + \gamma t + \vartheta V_{t-1} + u_t$, $u_t = \alpha u_{t-1} + d(L)e_t$, where V_t is the corresponding risk measure.

\widehat{V}_{min} (\widehat{V}_{max}) denotes the lower (higher) bound of the 90% confidence interval. The sample period is from 12/31/1994 to 05/31/2007.

Table 4. The Forecasting ability of idiosyncratic risk

Panel A. Monthly Data				
	Constant	Idiosyncratic risk	Market volatility	Adjusted R ²
Argentina	0.0751	0.0385	-0.0125	
<i>t</i> -statistic	0.8586	0.9689	-0.6718	-0.0040
Brazil	-0.0253	-0.0201	0.0025	
<i>t</i> -statistic	-0.8435	-3.8149	0.2833	0.0125
Czech Republic	-0.0486	-0.0100	-0.0114	
<i>t</i> -statistic	-0.9971	-0.6286	-1.1909	-0.0042
Chile	-0.0009	-0.0059	0.0020	
<i>t</i> -statistic	-0.0197	-0.2388	0.1673	-0.0133
China	0.1236	0.0274	0.0157	
<i>t</i> -statistic	2.3632	1.1021	0.9731	0.0162
Colombia	-0.0574	-0.0377	0.0095	
<i>t</i> -statistic	-1.6715	-1.4347	0.5329	0.0041
Egypt	-0.0001	0.0064	-0.0089	
<i>t</i> -statistic	-0.0162	0.3828	-0.5464	-0.0112
Hungary	0.0247	-0.0119	0.0135	
<i>t</i> -statistic	0.2995	-0.3326	0.8041	-0.0105
India	-0.0713	-0.0524	0.0135	
<i>t</i> -statistic	-1.2200	-1.4213	0.6311	0.0029
Indonesia	-0.0041	-0.0498	0.0321	
<i>t</i> -statistic	-0.0879	-1.0645	1.0348	-0.0030
Israel	0.0084	-0.0227	0.0188	
<i>t</i> -statistic	0.1077	-0.5022	0.9145	-0.0052
Korea	-0.0007	-0.0536	0.0415	
<i>t</i> -statistic	-0.0115	-1.2513	1.4855	-0.0005
Malaysia	-0.0872	-0.0762	0.0315	
<i>t</i> -statistic	1.0490	-1.5954	1.6788	0.0008
Morocco	0.0272	0.0004	0.0036	
<i>t</i> -statistic	0.9655	0.0203	0.2640	-0.0109
Mexico	-0.0468	-0.0309	0.0056	
<i>t</i> -statistic	-0.8901	-0.9632	0.2545	-0.0023
Pakistan	-0.0570	-0.0457	0.0170	
<i>t</i> -statistic	-0.9103	-1.1902	0.6704	-0.0076

Peru	0.0055	-0.0124	0.0075	
<i>t</i> -statistic	0.1158	-0.5236	0.4828	-0.0111

Table 4. Continued

	Constant	Idiosyncratic Risk	Market Volatility	Adjusted R ²
Philippines	-0.0044	-0.0340	0.0236	
<i>t</i> -statistic	-0.0458	-0.7704	1.4552	-0.0034
Poland	-0.0006	-0.0031	-0.0024	
<i>t</i> -statistic	-0.0065	-0.0479	-0.0730	-0.0133
Russia	-0.1447	-0.0790	0.0058	
<i>t</i> -statistic	-1.6433	-1.5498	0.1701	0.0433
South Africa	-0.0080	-0.0228	0.0108	
<i>t</i> -statistic	-0.1646	-0.8538	0.8534	-0.0073
Taiwan	-0.1150	-0.0415	-0.0057	
<i>t</i> -statistic	-1.6421	-1.2115	-0.3285	0.0076
Thailand	-0.0463	0.0370	-0.0485	
<i>t</i> -statistic	-0.6430	0.7176	-1.3782	0.0032
Turkey	0.1012	0.0645	-0.0340	
<i>t</i> -statistic	1.4732	1.4314	-1.1311	-0.0039
Pooled	-0.0066	-0.0076	-	
<i>t</i> -statistic	-0.0076	-1.3769	-	0.0009
Pooled	0.0139	-	0.0005	
<i>t</i> -statistic	1.0848	-	0.1303	-0.0002
Pooled	-0.0039	-0.0159	0.0079	
<i>t</i> -statistic	-0.2467	-2.7894	2.0370	0.0022
Panel B. Quarterly data				
Pooled	-0.0419	-0.0403	-	
<i>t</i> -statistic	-0.8975	-1.8787	-	0.0077
Pooled	0.0288	-	-0.0026	
<i>t</i> -statistic	0.6898	-	-0.1739	-0.0008
Pooled	-0.0286	-0.0649	0.0263	
<i>t</i> -statistic	-0.5695	-3.2667	1.8600	0.0113

Panel A (B) presents the regression of the monthly (quarterly) market return on lagged idiosyncratic (IV) and market (MV) volatilities. The predictive equation is defined as: $r_{t+1} = \alpha + \beta IV_t + \gamma MV_t + \varepsilon_{t+1}$, where r_{t+1} is the log monthly return of the market at month $t + 1$. IV_t (MV_t) is the monthly value-weighted idiosyncratic (market) risk defined in equations (1) and (2). The first row gives the coefficients of the regression, while the second row for each regression gives the Newey-West (1987) adjusted *t*-statistics. The last column reports the adjusted R². In the pooled case, the following equation is estimated: $r_{t+1,j} = \alpha + \beta IV_{t,j} + \gamma MV_{t,j} + \varepsilon_{t+1,j}$ using the Seemingly Unrelated

Regression method. $j = 1, 2, \dots, 24$ is a vector that contains the data of the 24 emerging markets over the 1994:12 to 2007:05 period.

Table 5. Trend analysis of tracking error volatility

	Panel A. 10 stocks portfolio			Panel B. 20 stocks portfolio			Panel C. 30 stocks portfolio		
	$\widehat{\gamma}_{min}$	PS-statistic	$\widehat{\gamma}_{max}$	$\widehat{\gamma}_{min}$	PS-statistic	$\widehat{\gamma}_{max}$	$\widehat{\gamma}_{min}$	PS-statistic	$\widehat{\gamma}_{max}$
Argentina	-0.018	-0.001	0.016	-0.015	-0.001	0.013	-0.012	-0.001	0.009
Brazil	-0.021	-0.006	0.009	-0.017	-0.004	0.008	-0.014	-0.004	0.006
Czech Republic	-0.006	0.001	0.007	-	-	-	-	-	-
Chile	-0.005	-0.001	0.004	-0.004	-0.001	0.002	-0.003	-0.001	0.002
China	-0.028	-0.011	0.005	-0.020	-0.008	0.004	-0.017	-0.007	0.004
Colombia	-0.007	-0.001	0.004	-0.005	-0.001	0.003	-	-	-
Egypt	-	-	-	-	-	-	-	-	-
Hungary	-0.017	-0.005	0.006	-0.012	-0.003	0.005	-	-	-
India	-0.035	-0.005	0.024	-0.030	-0.005	0.021	-0.028	-0.004	0.020
Indonesia	-0.229	0.005	0.239	-0.167	0.004	0.175	-0.147	0.004	0.154
Israel	-0.009	0.000	0.008	-0.007	0.000	0.007	-0.005	0.000	0.006
Korea	-0.229	-0.001	0.223	-0.219	0.000	0.220	-0.192	0.001	0.193
Malaysia	-0.029	-0.004	0.020	-0.020	-0.002	0.015	-0.015	-0.001	0.013
Morocco	0.004	0.007	0.010	0.003	0.005	0.008	0.003	0.005	0.007
Mexico	-0.017	-0.007	0.004	-0.014	-0.005	0.004	-0.012	-0.004	0.003
Pakistan	-0.032	-0.013	0.006	-0.025	-0.010	0.006	-0.021	-0.008	0.006
Peru	-0.019	-0.010	-0.001	-0.015	-0.007	-0.001	-0.012	-0.006	-0.001
Philippines	-0.025	0.004	0.032	-0.018	0.002	0.023	-0.015	0.002	0.019
Poland	-0.007	0.000	0.007	-0.005	0.001	0.008	-	-	-
Russia	-0.047	-0.023	0.002	-	-	-	-	-	-
South Africa	-0.073	0.008	0.090	-0.051	0.005	0.062	-0.035	0.005	0.044
Taiwan	-0.043	0.003	0.050	-0.024	0.003	0.030	-0.023	0.003	0.029
Thailand	-0.268	-0.008	0.253	-0.237	-0.007	0.224	-0.197	-0.006	0.185
Turkey	-0.029	-0.015	-0.002	-0.021	-0.011	-0.001	-0.017	-0.009	-0.001

This table presents the monthly tracking error volatility of portfolios containing ten (Panel A), 20 (Panel B), and 30 (Panel C) stocks. The 90% confidence interval of Vogelsang's (1998) test statistic is based on the model: $V_t = \mu + \gamma t + \vartheta V_{t-1} + u_t$, $u_t = \alpha u_{t-1} + d(L)e_t$ where V_t is the corresponding measure. $\widehat{\gamma}_{min}$ ($\widehat{\gamma}_{max}$) denotes the lower (higher) bound of the 90% confidence interval. The sample period is from 12/31/1994 to 05/31/2007.

Table 6. Explaining tracking error volatility				
	Idiosyncratic risk	Market risk	Correlation	R ²
Equally weighted portfolio containing 10 stocks				
Coefficient	0.2100	0.0807	-0.0062	0.7506
<i>t</i> -statistic	27.9863	11.7451	-3.3019	
Equally weighted portfolio containing 20 stocks				
Coefficient	0.1685	0.0619	-0.0092	0.7609
<i>t</i> -statistic	27.4260	11.4151	-6.5597	
Equally weighted portfolio containing 30 stocks				
Coefficient	0.1454	0.0495	-0.0078	0.7840
<i>t</i> -statistic	26.5058	10.4590	-6.3010	

This table presents the regression of the monthly tracking error volatility, $\sigma_{TE,t}$, against idiosyncratic, market risk and average correlation using the SUR method: $\sigma_{TE,t,j} = \alpha_j + \beta IV_{t,j} + \gamma MV_{t,j} + \delta \rho_{t,j} + \epsilon_{t,j}, j = 1, 2, \dots, 24$. $j = 1, 2, \dots, 24$ is a vector that contains the data of the 24 emerging markets over the 1994:12 to 2007:05 period. The first row gives the coefficients of the regression, while the second row for each regression gives the *t*-statistics. The last column reports the adjusted R².

Figure 1. Graphical analysis and the states of idiosyncratic risk

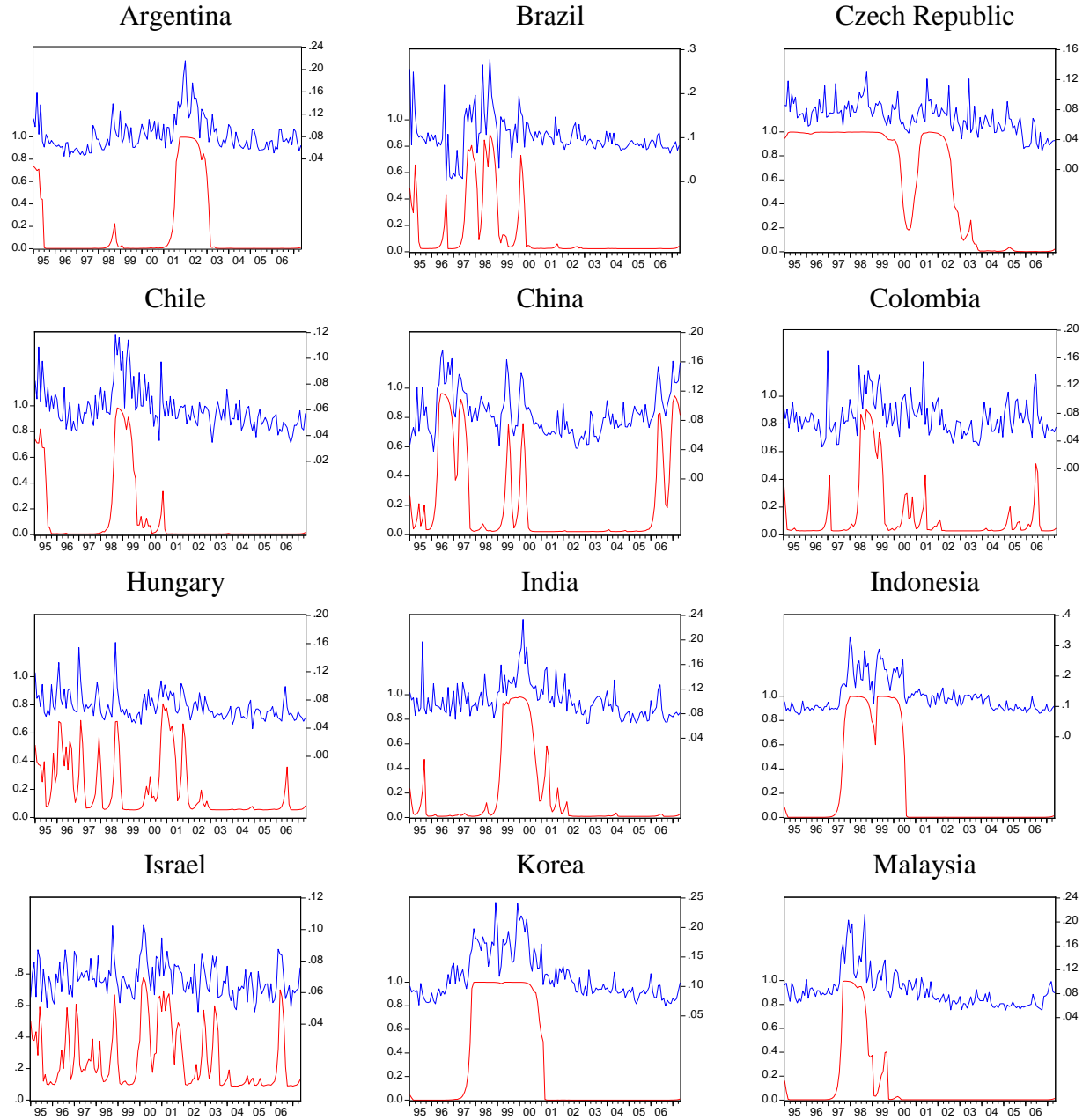
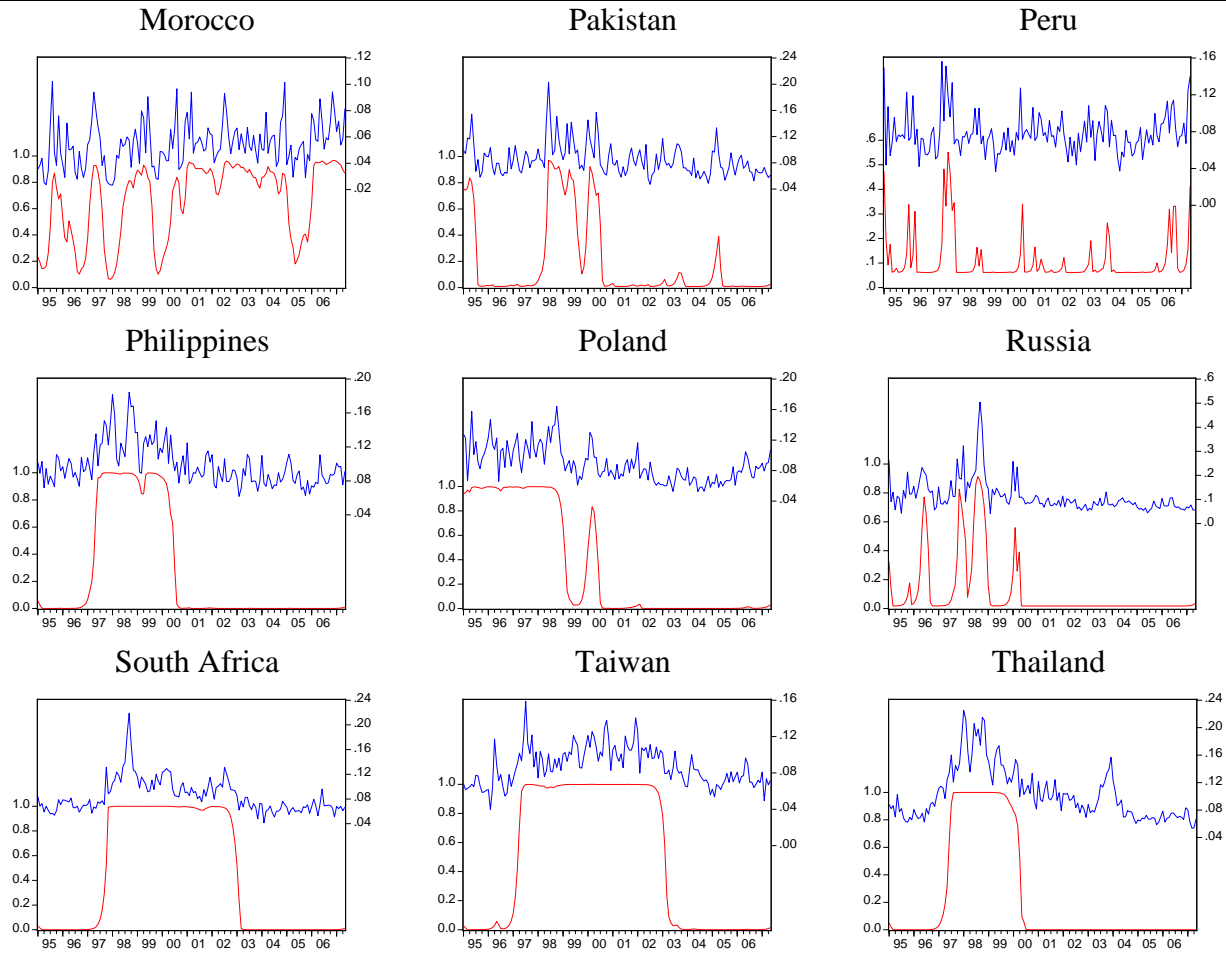


Figure 1. Continued



This figure plots the monthly idiosyncratic risk and the smoothed probability based on Kim's (1994) algorithm of state 1 (high risk environment) conditioned on all information in the sample. The regime switching model is described as: $IV_t = \mu_1 + e_{t0}$, $e_{t0} \sim i.i.d. N(0, \sigma^2)$ where IV_t is the idiosyncratic risk in month t . The process is a first-order Markov which is described by latent variable $S_t = 1, 2$. The transition matrix Π is characterized by constant probabilities (p, q) : $\Pi = \begin{bmatrix} Pr(S_t = 1/S_{t-1} = 1) & Pr(S_t = 2/S_{t-1} = 1) \\ Pr(S_t = 1/S_{t-1} = 2) & Pr(S_t = 2/S_{t-1} = 2) \end{bmatrix} = \begin{bmatrix} p & p \\ 1 - q & q \end{bmatrix}$. The sample period runs from 1994:12 to 2007:05.

Figure 2. Bivariate correlations

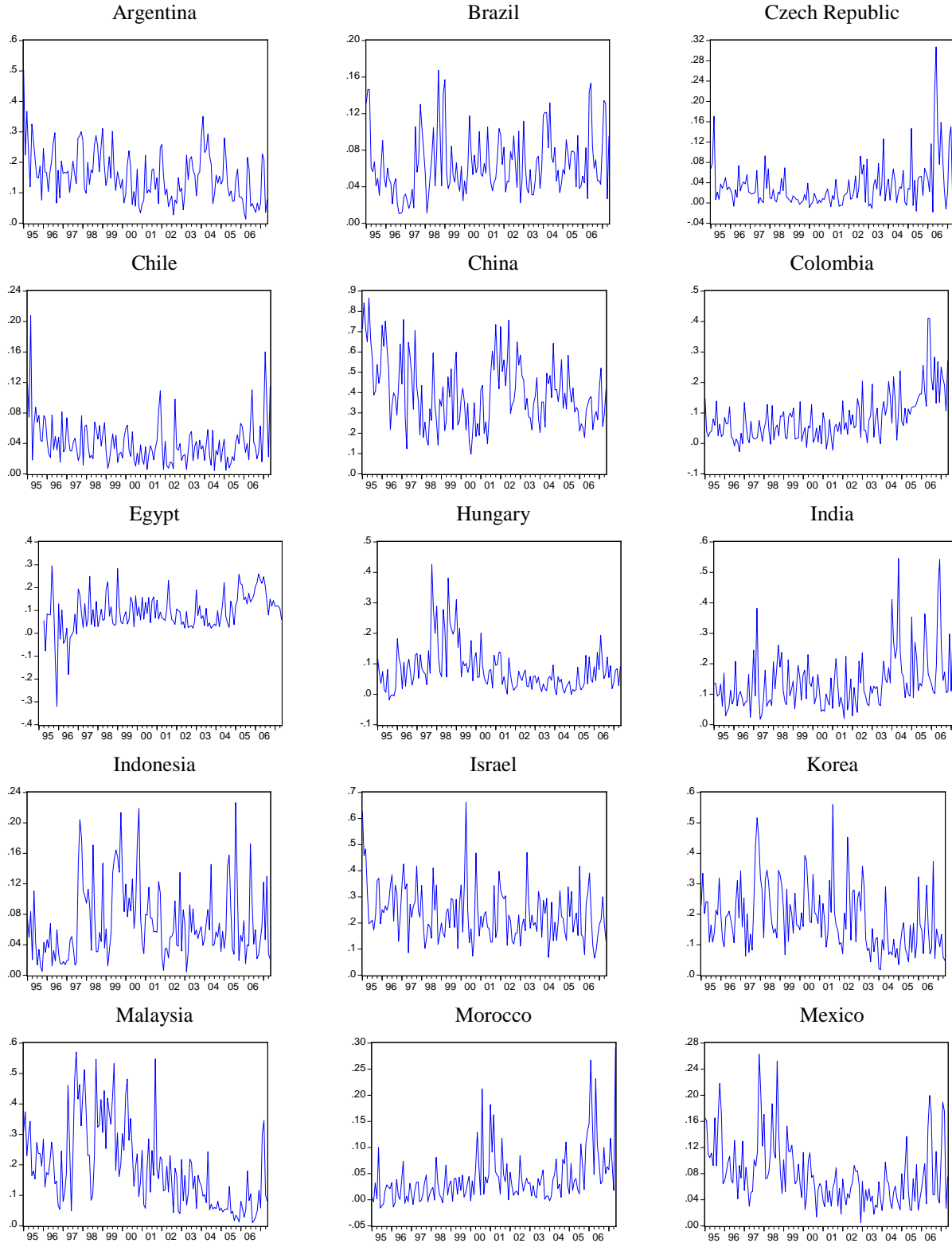
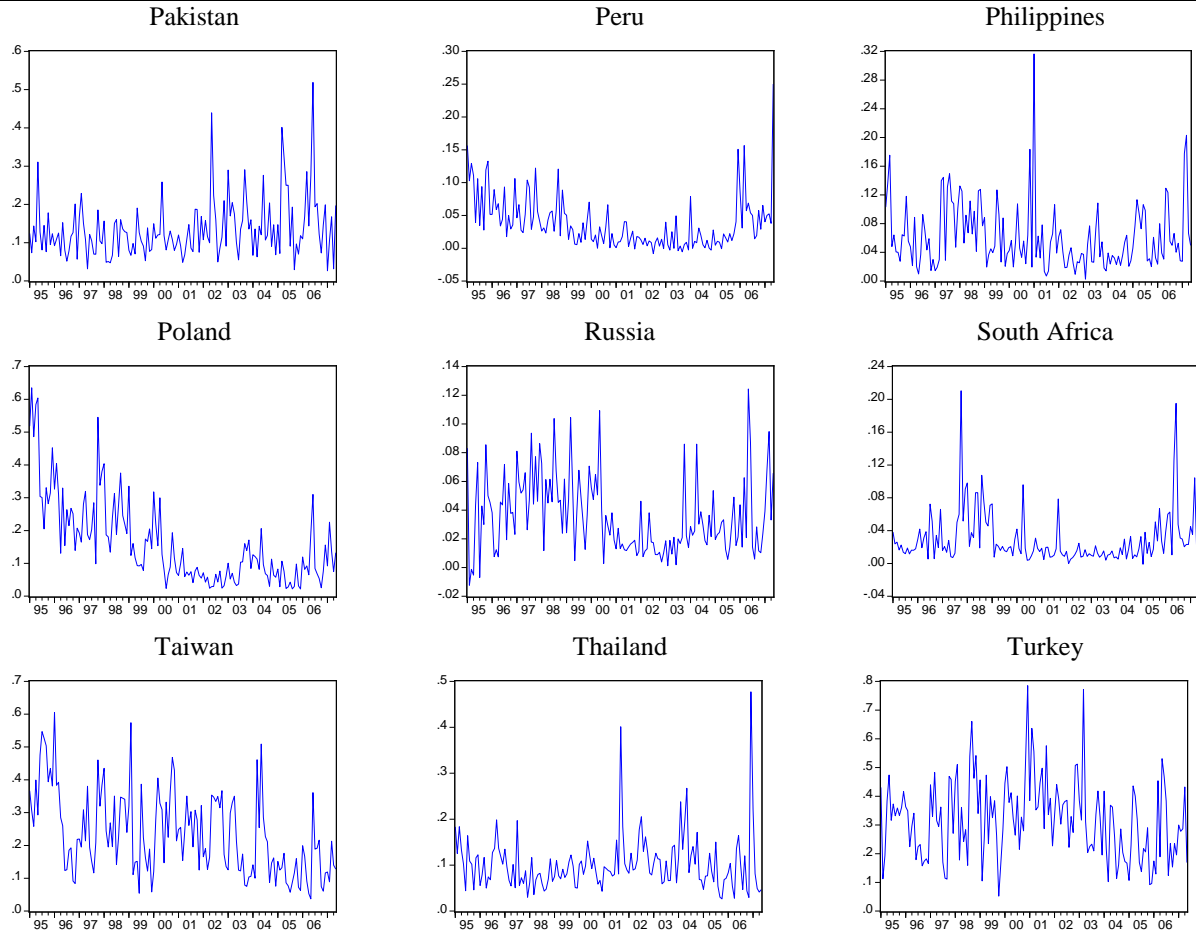


Figure 2. Continued



This figure plots the monthly average correlation between all pair of stocks traded in each emerging market. The sample period runs from 1994:12 to 2007:05.