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Diversification and Its Malcontents

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Abstract- **Instability of the global financial system is causing reevaluation of some of the most revered financial theories. In particular, the concept of diversification, a staple of financial risk education and a foundation of risk management under Modern Portfolio Theory, has to be reassessed in light of financial market realities. Article highlights the central flaw of the 'fallacy of diversification', and follows it to its ultimate effect on financial markets and the real economy via the risk taking actions of the participants of the financial markets. Various adjustments to the standard risk forecasting and optimization tools are proposed based on the latest research. These adjustments allow investors to avoid being blindsided by the phenomenon of 'rising correlations' through explicitly accounting for the dynamics of the extreme market state.**

Keywords: **Diversification; Financial instability; MPT**
JEL Codes: **G001, G12, G15**

1. The Many Faces of Diversification

It has been almost half a century since the first tenets of Modern Portfolio Theory were introduced by Harry Markowitz. After its formalization, the theory gradually became widely accepted by the academicians and practitioners alike. It is taught in classrooms worldwide and its use in the construction of portfolios nearly parallels the use of Newtonian physics in the construction of automobiles. It is little wonder; after all, it has all of the necessary attributes to capture the mind: it is mathematically elegant, logical, congenial to common sense, and relatively easy to implement in practice. The work of Markowitz was extended into the realm of risk forecasting by Barr Rosenberg. In his significantly titled 'Prediction of systemic and specific risk in common stocks' paper, Rosenberg (1973) started with these momentous words: "Ex Ante predictions of the riskiness of common stocks – or, in more general terms, predictions of probability of returns can be based on fundamental (accounting) data for the firm and also on the previous history of stock prices." The discussion of questions that this little paragraph appears to have so impressively and easily settled could have filled volumes, and the empirical results appeared solid enough for widespread acceptance. Why were the results so good, given what we now know about the performance of the CAPM based risk models? We believe that the key reason for acceptance of Rosenberg's paradigm and its MPT foundations, was the particular sample that he used for testing, the years from 1954 to 1970. This happened to be one of the most tranquil periods in the history of stocks, the standard deviation of the daily returns of S&P 500 over this period was meager - around .66% (annualized volatility of 10.46%), while the same daily standard deviation since that time (1970-2010) was much higher at 1.08% (annualized volatility of 17.1%). The standard deviation of S&P 500 from 1928 to 1954 was even higher at 1.47% (annualized volatility of 23.2%). Another and perhaps a more illuminating way of looking at this issue is to count the number of days when S&P 500 was down more than 3.5 %[1]. For the sixteen year period between 1954 and 1970 the number of days with a return below 3.5% was only 3 (!). For the

[1] This cutoff is close to three times the long run daily standard deviation (1928-2010) of 1.169%, so it provides a good metric to qualify extreme events.

prior sixteen years, namely between 1938 and 1954, the number of such days was 24, eight times higher. Meanwhile, the last sixteen years between 1994 and 2010 have produced 35 such days. Rosenberg was not the only one who developed his ideas during a period of stable economic growth and absence of major systemic risks. As Peter Bernstein (2007), himself an ardent proponent of efficient markets, notes, all of the key pillars of Modern Portfolio Theory were put in place between 1951 and 1973. Surely, in such a calm environment as 1950's and 1960's the financial markets may appear continuous and recent historical returns are really all you need to forecast risk. Thus, much of the groundwork of the MPT risk modeling was laid during the period of unusually low risks and this fact has to be kept in mind by anyone wanting to understand the roots of the problem. Of course, its numerous assumptions such as lack of friction in the market and Gaussian distribution were sometimes questioned as unrealistic – with good evidence.

However, the center of the MPT, namely the concept of diversification, remained largely unscathed. The diversification is the central concept of the MPT due to the following factors:

- An assumption of the joint Gaussian distribution for all assets in the market place
- An assumption that risk is defined as the volatility of return

A consequence of these two assumptions is that in a portfolio with more than a handful of assets, the correlation between the assets is likely to be a key factor in determining the portfolio's risk level. In other words, diversification can transform the combination of high risk assets into a low risk portfolio if correlations are low enough. In addition, Barr Rosenberg's statement about accounting data and past history of the returns being enough to forecast volatility has suggested to practitioners an elegant way to model these correlations and construct portfolios in a seemingly rigorous and objective manner. In essence, it led to the introduction of a new strong assumption, which is much more consequential than the beleaguered bell curve:

- Future volatility and correlations are a function of statistical estimates of volatility and correlations calculated over some recent period[2].

The idea of diversification is an appealing one, and it overpowered all of the objections to various assumptions of the MPT. Even the obstacle of the apparent non-normality (fat tailness) of individual asset returns seemed to have mattered less because it was supposed that in the large portfolio lower correlations would inevitably bring down risk. Diversification was sometimes described as the "only free lunch." It permeated finance and was used in ever more complex assets turned out by the financial engineers.

To take only the two most prominent examples, consider Mortgage-Backed Securities (MBS) and Credit Default Swaps (CDS). Rating and pricing MBS heavily relied on the concept of geographical diversification, namely the idea that the geographical dispersion of the underlying mortgages within the pool would significantly reduce the risk of the MBS. Issuers of corporate CDS made use of the same concept across different companies and sectors. As a result, the mathematical models suggested that as long as they issue protection on multiple corporations, the risk of a large loss would be minimized because the observed correlations between them were low enough. This reasoning is similar to what the principals of the famed LTCM hedge fund used in estimating the risk of the multitude of their trades, which were varied by geography, asset class, and sector. The diversification concept suggested that their total investment was relatively safe, regardless of the riskiness of the individual trades. Note that this is not only limited to the CDS contracts that reference a basket of securities, but is relevant to all insurance-like contracts, because diversification suggested to the insurers (the firms issuing the individual CDS) that it is highly unlikely for a large portion of their issued CDS portfolio to require the payoff at the same time. For example, based on normal period correlations it would appear that issuing two CDS contracts issued Lehman Brothers and General Motors would be a relatively safe strategy, due to moderate normal period correlation between the two.

2 In that paradigm, the lookback window could be one, two, three or five years, depending on the desired horizon of the risk forecast. Exponential decay is also frequently used to overweight recent observations.

So firm is the grasp of MPT diversification on the public's mind that almost exactly ten years after the spectacular meltdown of LTCM, Donald Kohn the Vice Chairman of the Federal Reserve discussed the concept of "International Decoupling" at the International Research Forum on Monetary Policy. "International Decoupling" is an essentially MPT-inspired idea that gained great traction in the media and among analysts in the months leading up to the September 2008 crash. It suggested that international markets were shielded from possible housing related problems in the U.S. because world economies interacted with each other directly much more than in the past and interacted somewhat less with the U.S. economy. Subsequent events have exposed this idea as absolutely unrealistic when the markets are under stress, especially under the conditions of global mobility of capital. As we know, MPT concepts embedded in the issuance and valuations of CDS and MBS did not fare much better.

2. The World Is Not a Linear Place

Most persistent misconceptions usually have some limited basis in fact, but are stretched far beyond their realistic application. The basis on which the various flavors of the diversification fallacy are built is that during normal times there are some stable linear relationships between asset returns. These relationships stem from the arrangements within the economic system and can be characterized by the correlation coefficient. However, these stable relationships are overwhelmed in times of crises by factors like investor psychology, deleveraging, and others, which we will discuss in the next section. Since diversification is mostly used for risk management, the fact that it fails during extreme events makes it very nearly useless.

To vividly see the problem inherent in the MPT diversification, consider the following corollary of the portfolio risk formula above. Let's say we have two assets: an index A and an asset B. If we used the multivariate normal distribution as the MPT does, a basic result from statistics would tell us that the return of B conditional on us observing some return of index A would be:

$$E(B \mid A) = \frac{COVARIANCE(A, B)}{VARIANCE(A)} * RETURN(A) \quad (1)$$

Most will recognize the first part of the equation as the beta function of B with respect to the index A. For simplicity of presentation, let's also assume that:

$$CORRELATION(A, B) = 25$$

and

$$VARIANCE(A) = VARIANCE(B) = 1$$

Then we have:

$$E(B \mid A) = .25 * RETURN(A) \quad (2)$$

In other words, if index A goes down by 4%, we expect on average to lose about 1%. This is more of a trading range move and as such is not very interesting for the purposes of risk measurement. What if we asked a question that is much more relevant to the risk profile of the asset B: If index A loses 40%, what will asset B do?

Because of the assumed linearity of the relationships, formula (2) would give us an answer of 10%, simply the scaled version of what we observed with a 4% move in the index. Now is that realistic? Absolutely not; we know from experience that in the extreme environments such diversification effects disappear, hence the ubiquitous "rise in correlations." This effect is shown in many studies, for examples see Campbell et al. (2002), Folmpers and de Rijke (2008), and others. In reality, we are much more likely to see asset A produce a 30% or even 40% loss after becoming closely correlated with the index in the event of such a drastic move in the markets. As Rick Bookstaber (2007) put it:

"Investors are not as dumbfounded when volatility skyrockets as when correlations go awry. This may be because investors depend on correlations to control their risk and to allow them to extend further out in their investment exposures. And nothing hurts more than to think that you are well hedged and then to discover you are not hedged at all."

It is important to understand that the term "rise in correlations" can be misleading. We do not observe correlations; all we are really saying is that our model (MPT) breaks down in extreme environments, i.e., it doesn't perform exactly when the risk manager needs it most. Whether we like it or not, the world is not a linear place; double the quantity of something and the results are not what you except. This axiom goes for many things like food, drink, medicine, and even wealth. Likewise, an environment created by the major market reversal is likely to be a fundamentally different one from the normal times.

3. Hyman Minsky and the Financial Instability Hypothesis

We believe that the work of an American economist sheds light on a crucial reason for the disappearance of the diversification benefits in times of stress, even when such stress appears to be localized in the financial system as was the case with housing related CDOs. In his key working paper on the subject, Minksy (1992) states:

> "In contrast with the Orthodox Quantity Theory of Money, the Financial Instability Hypothesis takes banking seriously as a profit-seeking activity. . . . Like all entrepreneurs in a capitalist economy, bankers are aware that innovation ensures profits. Thus bankers (using the term generically for intermediaries in finance), whether they be brokers or dealers, are merchants of debt who strive to innovate in the assets they acquire and the liabilities they market".

As a result, fundamental relationships in the real economy and financial markets change with the change in the behavior of the participants and particularly with the change in financial intermediaries' behavior. For example, after a period of prosperity, an increase in the risk-taking activities takes place and rising leverage builds setting up the potential for a violent downturn. Some interruption will expose the unsustainability of leverage levels leading to a credit contraction and a potential collapse in the asset values. Specifically, Minsky identifies three types of participants:

- Hedge financing units: "those that can fulfill all of their contractual payment obligations by their cash flows," i.e., they do not use debt
- Speculative finance units: units that will pay the interest out of their cash flows, but not the principal
- Ponzi units: those that roll over both principal and interest

Ponzi units depend completely on the continued rise in the asset values to sustain their activities. When a rise in the asset values stops, the liquidation that is forced on the Ponzi players will spill over to the sounder hedge and speculative entities, and the credit contraction is likely to result. The most important insight of the FIH for our purposes can be summarized by Minsky's words as follows:

> It can be shown that if hedge financing dominates, then the economy may well be an equilibrium seeking and sustaining system. In contrast, the greater the weight of speculative and Ponzi finance, the greater the likelihood that the economy is a deviation amplifying system. Over periods of prolonged prosperity, the economy transits from financial relations that make for a stable system to financial relations that make for an unstable system.

In the liquidation environment, capital will flee all the risky assets regardless of the correlations that were observed during the normal times. It can be argued that this insight now seems trivial. However, if in fact it was trivial, MPT would not still be used today for risk management, at least not without serious modifications.

4. The Effects of Diversification on Diversification

In the post-Enlightenment era, every science strove to imitate physics and other natural sciences with their extensive uses of mathematical apparatus and attempted discovery of permanent laws. This "physics envy" caused many to miss the crucial difference between natural and social sciences. Social sciences deal with human beings who have free will and may change their response to external events and forces, unlike, say, a stone that will always fall with the same acceleration. Going even further, human behavior can be affected by the social science discoveries that purport to describe the laws of that very behavior. In a curious turn, the widespread use of diversification actually made the markets less stable and further diminished what diversification benefits were there. This happened because diversification promised a reduction in risk with each additional asset up to a certain point. This reduction in risk was promised even if the company being added was riskier than the existing portfolio, as long as its correlation with that portfolio was low enough. The effect of this idea was to expand the number of assets in the average portfolio, since a "free lunch" could not be left on the table uneaten.

Expanding the number of assets caused a corresponding diminution in the investors' knowledge of the businesses or real assets backing the investment vehicles. There is a great difference between an investor who invests in some emerging market or lesser known sector, because he is convinced of its great prospects and the one who invests because he is looking for "some diversification". This difference becomes very apparent during a major market reversal. When many investors do not have a detailed knowledge of their investments, they are much more likely to unload them at the first sign of panic, thus exacerbating the panic and reinforcing the vicious loop of liquidation. In this manner, diversification greatly contributes to the overall opacity in times of crises and, as a result, contributes to the indiscriminate selling of all assets.

5. Non-Linear Assets and Diversification

There is one issue that we only slightly touched on, but that warrants further elaboration. As we mentioned, diversification assumptions play a major role in the issuance and pricing of such complex assets as MBS and CDS securities. Recent problems with MBS are widely known, but it is useful to consider what did not go wrong in the credit crunch of 2008 with CDS. Firms were able to issue CDS contracts with the aggregate notional amount close to $50 trillion. This astounding size of the market could not have been achieved had it not been for the assumptions of diversification, namely that recent historical correlations gave a good idea of the probability of multiple bankruptcies occurring at the same time, even during a downturn. It could be easily argued that we did not see a string of major bankruptcies following the Lehman collapse only because of the unprecedented support extended by the Federal Government to the private sector.

Had the bailout not happened, we would have seen what could be called "a meeting of two nonlinearities." The first one is the nonlinearity that we discussed in section called "The World Is Not a Linear Place", which manifests itself as a "rise in correlations" in times of crises. The second one comes into play when an instrument's payoff is a nonlinear function of the payoff of an underlying security, as is the case with options and CDS contracts. This second nonlinearity means that at some point the payoff can increase dramatically, even if an underlying asset moves only modestly. The two nonlinearities could meet when correlations rise and a large number of nonlinear payoffs kicks in, thus creating an enormous demand for liquidity.

Consider an extreme case: let's say a third of CDS contractual default payments had to be made in Fall 2008. On top of the credit crunch already in place this could have created a need for over $10 trillion of capital flows. Even accounting for such netting of the flows that would be available, this demand for liquidity in an already stressed market could have proven disastrous. Thankfully, this did not occur, but it does not mean that we can disregard this threat for the future. The CDS market is only one of many examples of the fundamental misunderstanding of risk that is caused by the current application of the MPT diversification concepts.

6. Solutions

Everything that we have said above indicates that the use of diversification concepts must be reconsidered by the financial industry. But does that mean MPT must be completely thrown out? We do not think so. The first reason for that is the absence of a full fledged alternative that could replace MPT easily in many of the processes currently in place in the industry. The second and the more important reason is that MPT can be adjusted to correct for its shortcomings. The situation is analogous to that experienced by traders with the Black-Scholes formula. In short, Black-Scholes omits some important characteristics of the behavior of the financial asset returns. As a result, the parameter called Implied Volatility differs for different options on the same underlying, which at first seems nonsensical because volatility is the property of the underlying security not of the individual option. However, this difference is based on adjustment by traders that reflects their experience with the behavior of deep out-of-the-money puts and in-the-money calls and allows them to retain Black-Scholes as an easy-to-implement and a well known formula for communication purposes. Sometimes Implied Volatility is referred to as the "wrong number to put into a wrong formula to get the correct price".

How could we use this insight to force MPT to reflect the reality of risk? The obvious parallel is to make the correlation coefficient reflect the relationships between securities that exist in the market downturns. Risk should reflect what goes on the tails and it is obvious from many experiences that correlations are always different in the tail. In short, all risk statistics and not just some selected stress tests must include data gathered from the periods of liquidation. This can be achieved by narrowing the dataset to only extreme periods and keeping the trading range period data (i.e., "normal times") out of the model altogether to avoid the contamination of results. The definition of an extreme period could be any observation that is outside the three standard deviation band or any similar reasonable definition. There are many possible variations of this approach to risk estimation.

For a practical and vivid demonstration of the benefits of such an approach, let us again consider the international decoupling story that we mentioned in section I. Exhibit 1 shows two sets of correlations both calculated on 8/31/2008, prior to the onset of the major selloff. The Normal row contains correlations of the S&P 500 with various emerging markets calculated using one year of data prior to 8/31/2008. The Extreme row contains the same correlations, but calculated only using the 25 most extreme days during the 8/31/2007 to 8/31/2008 period.

As row 2 of Exhibit 1 indicates, a simple historical trailing correlation calculated on 8/31/2008 seemed to support the existence of international decoupling. However, the Extreme correlation in row 1 of the same exhibit, which is based only on the inclusion of the most extreme 10% of the sample provides ample evidence that the correlations were unlikely to stay low if a serious downturn were to occur. This, as we discussed, will cause investors to find that the diversification benefits that they expect dwindle exactly when they need them the most. Both of the correlation sets were calculated without looking ahead to the subsequent events of Fall 2008, so any investor could have reasonably disputed the possibility of the much touted decoupling without the benefit of knowledge of subsequent events.

The decoupling and the suspect diversification benefits vanish even without considering the events of Fall 2008. Therefore, it is not surprising that no presently used risk model is known to have warned about one of the biggest disasters in the history of finance. All present day models use either equal weighted (EW) or time decay weighted (DTW) methods. The equal weighted estimator of (co)variance [3] is derived directly from statistics where an unbiased estimator of (co)variance is equal to:

$$^{EW}\sigma^2{}_{j,k} = \frac{1}{n-1} * \sum_{i=1}^{n} \left[r_{j,i} * r_{k,i} \right] \tag{3}$$

Where:

$r_{j,i}$ - return of asset j or k at time i

n - number of observations

The VaR[4] is then calculated as:

$$VaR = k * \sigma_{j,k} \tag{4}$$

Where:

k - scaling based on the confidence level of VaR

The DTW (co)variance estimate could be written as:

$$^{TDW}\sigma^2{}_{j,k} = (1-\lambda) * \sum_{i=1}^{n} \left[\frac{\lambda^{i-1} * r_{j,i} * r_{k,i}}{\sum_{l=1}^{n} (1-\lambda) * \lambda^{l-1}} \right] = \frac{1}{\sum_{l=1}^{n} \lambda^{l-1}} * \sum_{i=1}^{n} \left[\lambda^{i-1} * r_{j,i} * r_{k,i} \right] \tag{5}$$

λ - exponential decay factor

l, i - indicators of time

$r_{j,i}$ - return of asset j or k at time i

[3] For a normal distribution which are we are using, the risk and variance are assumed to be synonymous.

[4] Fat Tail VaR would be calculated differently. However, the difficulties in estimating fat tail copula, i.e. the set of interrelationships between assets or factors, hardly allow for such an exercise. This is because the number of parameters required for estimation with multivariate fat tail distributions increases a great deal faster than the data available to estimate those parameters, resulting in a severe dimensionality problem for the estimates.

Since they are focused on the latest data, without any regard for whether it comes from a normal or extreme state, they get caught at the worst possible time, when risk premiums are at their lowest point and start turning around.

For an extremely illuminating discussion of the problems with downside correlations, see “The Myth of Diversification” by Chua et al. (2009). In that article, which is based on extensive and rigorous empirical tests, authors state the following: “Correlations, as typically measured over the full sample of returns, often belie an asset’s diversification properties in market environments when diversification is most needed.” This problem is not an accidental feature of one or two crises, but rather a permanent property of the financial economy in panic mode.

6.1 Solution for Risk Forecasting

The problem of overestimation of diversification benefits can be corrected by specifically accounting for dynamics of extreme periods in calculation of correlation model inputs. In Satchkov (2010), an alternative to the time decay weighted methods is proposed, where historical data is weighted based on the boom-bust dynamics of the financial economy. Proper incorporation of risk taking behavior into risk estimates allows to turn metrics like Value-at-Risk into an ‘early warning’ signal of instability, because it will show when high endogenous risk leads to a higher likelihood of a crash. This is achieved, because the weight of the extreme periods is increased when two conditions are present:

- **a.** Risk is mispriced for a period of time
- **b.** The trend of worsening risk mispricing stops and shows signs of reversal

Unlike neo-classical economics and Modern Portfolio Theory, the proposed approach views financial economy as a system that generates endogenous risk, see Danielsson and Shin (2003). The endogenous risk does not come from some Black Swan ‘completely unforeseen’ constellation of accidents, but instead is a systematic pattern that repeats itself in boom-bust cycles in many different markets. The article suggests that the center of the risk forecasting activity should be analysis of the risk taking actions of the participants of the economy. Condition (a) will measure the degree to which risk taking actions have deviated from historically median levels. This condition measures actions that set the stage for the reversal and the ultimate financial crash. The second condition looks for the turning point, where investors begin to reassess their behavior and ultimately revert to normal levels. These two conditions together indicate that the crash in nearly inevitable and is only a matter of time. As Danielsson and Shin (2003) explain, “One of the implications of a highly leveraged market going into reversal is that a moderate fall in asset value is highly unlikely. Either the asset does not fall in value at all, or the value falls by a large amount”.

6.2 Solution for Optimization

A similar thought process apparently led a group of authors to propose using non-parametric optimiziation to assure better estimate of downside correlation. This would create far more realistic inputs into the optimization process, than typically calculated EW or DTW correlations. For details, see Chua et al. (2010). Their solution is different from Satchkov (2010) in that it does not suggest any ‘early warning’ properties, but purely a better assessment of the diversification on the downside, while avoiding the counterproductive upside diversification.

6.3 Solution for Stress Testing

Novosyolov and Satchkov (2008) also attempted to solve this problem specifically applied to stress testing. They propose that correlations used for a particular stress test should be based on data points drawn from the periods which most resemble the period under study. This is a completely different solution path from the ones for VaR and for optimization presented above, yet it attacked the very same problem. This solution ensures that each stress test is calculated using the most realistic correlation set that would result in a given environment. For example, when shocking S&P 500 by -30%, this algorithm would overweight those periods when S&P 500 came closest to falling 30%. The correlation set would then reflect a realistic environment of a drastic fall in the S&P 500.

6.4 Implications for Hedging

The failure of normal period correlations to hold during crises can also be viewed as a major opportunity by the risk managers. One of the most important roles of the risk manager is to design hedging strategies to be implemented in certain circumstances. It is beyond the scope of this article to discuss what would prompt a firm to change their stance on risk; the reasons could vary from exposures reaching an uncomfortable level all the way to conviction that the market is in a last stage of the boom-bust cycle. Phenomenon of rising correlations presents a great opportunity to look for cheapest, long-dated insurance to reduce one's exposure. For example, a risk manager of a firm investing in Chinese equities or other emerging market may not have liquid markets to implement their hedging strategies. However, exhibit 1 would clearly suggest that the US equities are tied to Chinese equities far tighter than normal period correlation would imply (an extreme period correlation of .83 versus .51 in normal periods). This tighter correlation would allow a manager to reduce his exposure by using SPX derivatives, rather than trying to find protection in a specific market. To be sure, there is basis risk in such a trade, but the trade could be far less expensive in certain market environments and a risk-return tradeoff may well be to the firm's overall advantage.

Conclusions

We have outlined a number of major deficiencies in the traditional MPT paradigm, when it comes to real world applications. The market is not a slowly changing system, but rather is full of nonlinearities and discontinuities, which make correlations drawn from the tranquil samples useless for risk management. It is the delayed realization of this fact which has caused the Basel Committee on Banking Supervision to state in January of 09:

> "Most risk management models, including stress tests, use historical statistical relationships to assess risk. They assume that risk is driven by a known and constant statistical process, i.e., they assume that historical relationships constitute a good basis for forecasting the development of future risks. […]
>
> Given a long period of stability, backward-looking historical information indicated benign conditions so that these models did not pick up the possibility of severe shocks or the build up of vulnerabilities within the system. Historical statistical relationships, such as correlations, proved to be unreliable once actual events started to unfold. […] Extreme reactions (by definition) occur rarely and may carry little weight in models that rely on historical data."

As we have argued above, this misconception will continue to plague the financial system until the MPT diversification concept is significantly altered to focus on model calibration only in the extreme periods in history for the purpose of the estimation of risks. However tempting it might seem to increase the available sample by including trading range periods, if such practice is continued, it will doom risk management to irrelevance. We have outlined three different paths to solving this problem proposed by different researchers in three crucial risk management applications. All three look to achieve different aims and could be complementary in their results, but the problem that they are solving is exactly the one we identified in this work. It is important to note that modifications we describe from different sources all can enhance our knowledge of real risks by adjusting the inputs, rather than completely changing the whole theoretic framework. Therefore, they can be applied without the need to completely overhaul existing risk management models. The idea of 'decoupling', which seemed to have been buried in the debris of the 2008 Lehman collapse, is making a comeback in 2010. Risk managers must not only realize that such decoupling is a virtual impossibility under the conditions of global mobility of capital, they must also realize that this misconception can provide them with an advantage by making the prices of hedging instruments less than coherent.

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Exhibit 1: Correlations of S&P 500 with Emerging Markets as of 8/31/2008

	Brazil Bovespa	**China Shanghai SE**	**Hang Seng**	**India BSE**	**Russia RTS**
Extreme (25 most extreme days)	0.89	0.38	0.83	0.67	0.64
Normal (250 days)	0.66	0.16	0.51	0.39	0.36