SUBMISSION TO THE BASEL COMMITTEE ON BANKING SUPERVISION:CP3 AND THE DEVELOPING WORLD

Professor Stephany Griffith-Jones and Stephen Spratt,
Institute of Development Studies, and
Miguel Segoviano,
LSE[1]

Institute of Development Studies
University of Sussex
Brighton BN1 9RE
Email: s.griffith-jones@ids.ac.uk

July 2003

I - Introduction

The proposals for Basle 2 contained in the third consultative package contain a number of important positive features, particularly in the standardised approach.

From the perspective of developing countries, positive features of Basle 2 refer, for example, to the removal of the OECD/non-OECD distinction and the reduction of the excessive incentive towards short-term lending to lower rated borrowers.

More broadly, the aim of attempting to more accurately align regulatory capital with the risks that international banks face is a highly desirable one.

However, a number of major concerns exist about the proposed IRB approach within Basle 2, and its negative impact on developing economies:-

1.   It would significantly overestimate the risk of international bank lending to developing countries, primarily because it would not appropriately reflect the clear benefits of international diversification which such lending has in terms of reducing risk.[2]

A further reason why at present the IRB approach would inappropriately discourage international bank lending to developing countries is because even large international banks lack the data on developing countries required for IRB modelling.

The combination of these factors is likely to cause an excessive increase in regulatory capital requirements on international lending to developing economies, creating a risk that bank lending to developing economies could be sharply reduced and a significant part of remaining lending could see its cost increased. This is contrary to the stated objective of G-10 governments to encourage private flows to developing countries, and use them as an engine for stimulating and funding growth. This is particularly

---

[2] For a more detailed empirical analysis, see below and "Basel II and Developing Countries; Diversification and Portfolio Effects" S Griffith-Jones, S Spratt and M Segoviano www.ids.ac.uk/intfinance/ - for briefer versions see "Basel II and Emerging Markets: The case for incorporating the benefits of international diversification" S Griffith-Jones, S Spratt and M Segoviano, in Central Banking and for a summary see S Griffith-Jones "A capital idea that will hurt poorer countries" Financial Times, May 13, 2003.

the case at present as all capital flows to developing countries – and especially bank lending – have fallen sharply in the past six years, posing a constraint on growth.

2.   It would accentuate the pro-cyclicality of bank lending, which is damaging for all economies, but particularly so for fragile developing ones, which are more vulnerable to strong cyclical fluctuations of bank lending, both nationally and internationally.

Both these severe problems have been somewhat reduced by modifications to the Basle 2 proposals, especially by the flattening of the IRB curve in November 2001; however, they have certainly not been fully addressed.

In what follows, we first elaborate on the nature of the problems and then propose specific measures that could be fairly easily incorporated into Basle 2 to address them.

II – Key issues for Developing and Emerging Economies

1.   <u>The clear benefits of international diversification are not reflected in current proposals</u>

It has long been argued that one of the major benefits of investing in developing and emerging economies is their relatively low correlation with mature markets. We have undertaken detailed empirical research that demonstrates that this is clearly the case.[3] Consequently, clear benefits – at the portfolio level – would accrue to banks with well-diversified international portfolios. That is, a bank with a loan portfolio that is distributed widely across a range of relatively uncorrelated markets, is less likely to face simultaneous problems in all of those markets, than a bank with loans concentrated in a smaller number of relatively correlated markets. Therefore, in order to accurately align regulatory capital with the actual risks a bank might face, the Accord should take account of this portfolio level effect: the capital requirements for a bank with a well diversified international loan portfolio

---

[3] *Griffith-Jones, S., Segoviano, M.A. and Spratt. S.(2002)* Basel II and Developing Countries: Diversification and Portfolio Effects @ *http://www.ids.ac.uk/intfinance/*

should reflect the lower total risk than for a more concentrated portfolio. At present the proposals contain no such considerations, suggesting that, in this area at least, capital requirements will not accurately reflect risk.

We have tested the argument of differential correlations between developed and developing markets, first with specific regard to international bank lending and profitability and, secondly, in a more general macroeconomic sense (see Table 1 below). <u>All of our results offer strong support for the validity of this position, and all are statistically significant.</u> The fact that the tests performed - using a variety of variables, over a range of time periods - all provide robust and unequivocal evidence in support of the diversification hypothesis, represents a compelling case.

Table 1.

Variable	Time-Period	Frequency	Developed/ Developed Mean Correlation Coefficient	Developed/ Developing Mean Correlation Coefficient	Test Statistic (H0:Mx=My) Critical Value of 0.05% one-tailed test in parentheses
Syndicated	1993-2002	Monthly	0.37	0.14	3.33 (3.29)
ROA	1988-2001	Annual	0.10	-0.08	4.40 (3.29)
ROC	1988-2001	Annual	0.14	-0.11	6.92 (3.29)
GDP	1985-2000	Six-monthly	0.44	0.02	9.08 (3.29)
GDP HP	1950-1998	Annual	0.35	0.02	9.41 (3.29)
STIR	1985-2000	Six-monthly	0.72	0.23	11.09 (3.29)
STIRR	1985-2000	Six-monthly	0.66	0.22	10.93 (3.29)
GBI-EMBI	1991-2002	Daily	0.78	0.53	5.45 (3.29)
GBI-EMBI	1991-1997	Daily	0.90	0.74	4.64 (3.29)
GBI-EMBI	1998-2002	Daily	0.42	0.09	5.87 (3.29)
IFCI-COMP	1990-2000	Daily	0.58	-0.15	7.83 (3.29)
IFCG-COMP	1990-2000	Daily	0.58	-0.17	8.06 (3.29)

The evidence presented above clearly supports our hypothesis that a bank's loan portfolio that is diversified internationally between developed *and* developing country borrowers would benefit in terms of lower overall portfolio risk relative to one that focused exclusively on lending to developed countries. In order to test this hypothesis in the specific context of a bank's loan portfolio, we undertook a simulation exercise to assess the potential unexpected loss resulting from a portfolio diversified within developed countries, and one diversified across developed and developing regions.

Table 2. Comparison of non-industrially diversified portfolios

1. Diversified developed/developing			2. Diversified developed			
Total Exposure = 117,625,333.00			Total Exposure = 117,625,333.00			
Percentile	Loss value	Unexpected loss (%)	Percentile	Loss value	Unexpected loss (%)	Percentage Difference
99.8	22,595,312	19.21	99.8	27,869,349	23.69	+23.34

As can be seen from table 2, the unexpected losses simulated for the portfolio focused on developed country borrowers are, on average, <u>almost twenty-three percent higher than for the portfolio diversified across developed and developing countries.</u>

An important issue, which has been raised in this regard, is the fact that correlations are not constant over time. The danger, of course, is that correlations within emerging markets increase dramatically in crises, as contagion spreads the crisis from one country or region to another. In this instance, it is possible that a portfolio diversified across a range of emerging and developing regions, might be hit simultaneously in all of the emerging market areas. However, while this may be the common perception of emerging market behaviour in crises, it only applies to a limited number of cases, which require specific preconditions to be in place; preconditions, which at the current time – and indeed at most times - do not apply. Kaminsky, Reinhart and Vegh (2002)[4] examine two hundred years of financial crises, in both developed and developing countries, for evidence of contagion. They conclude that 'fast and furious' contagion of the type described above, and often viewed as inherent in emerging markets, may occur, but only under certain circumstances. Of the major emerging market crises since 1980, the Mexican default of 1982, the Mexican devaluation of 1994, the devaluation of the Thai baht in 1997 and the Russian default of 1998, were all seen as instances where significant contagion did occur. However, with the exception of the Russian default – which affected all emerging and developing regions, as well as the developed world to a surprising extent (Davis, 1999)[5] - the resultant contagion was restricted to the same region. Consequently, a portfolio diversified across *all* emerging and developing regions would not have suffered simultaneous problems to the extent described above.

---

[4] Kaminsky, Reinhart and Vegh (2002) *Two Hundred Years of Contagion*. Forthcoming.
[5] Davis, E.P. (1999) Russia/LTCM and market liquidity risk", *The Financial Regulator*, 4/2

In order to assess the validity of this argument, we extended our analysis to check what would happen to diversification effects during crises times in three separate periods:

Table 3: Analysed crises periods	
Time Period	Crises Included
94-4 to 99-1	Mexican, Asian and Russian Crises
94-4 to 95-4	Mexican Crisis
97-3 to 98-4	Asian and Russian Crises

Our results are contained in Annex 1, and clearly demonstrate that for each of the analysed variables, the mean Correlation between "Developed" and "Developing" Countries is lower than the mean correlation between "Developed" and "Developed" countries:

Corr(DEVED/DEVING)<Corr(DEVED/DEVED)

This result holds for all periods and all variables. Given this evidence, we can conclude that the diversification benefits obtained through a well diversified portfolio of developed and emerging markets still hold in crises periods. As would be expected, the magnitude of the diversification benefits is lower in crisis periods than in non-crisis periods. However, these benefits remain positive in all instances, thus demonstrating that our argument in favour of diversification effects holds, and is robust even in crises periods.

2. Potentially large increased cost of international bank lending to developing countries

The sharp increase in regulatory capital requirements for international loans to developing countries (which inappropriately does not reflect the benefits of international diversification), is very likely to significantly increase the costs of such loans. The extent of the increase cannot be precisely estimated ex-ante. However, the increase in capital requirements for lower rated borrowers will be very large. Thus, for example, according to the Basle Committee estimates, for B-corporate borrowers, capital requirements would increase from current 8% to 20.8%, an increase of 260%. Lower rated borrowers and

unrated Sovereigns would have a substantially larger figure. In contrast, a loan to a borrower rated AA – would require only 1.18% to be set aside as regulatory capital, a sharp reduction in relation to the current 8%.

It is unlikely that this sharp increase in regulatory capital requirements for lower rated borrowers will be fully reflected in the increased cost, both because capital requirements may not be fully binding and because banks may be able to book marketable bonds in their trading books for some developing countries, which would not affect capital requirements.

However, the fact that the increase in capital requirements is so large for lower rated borrowers implies the risk that an unintended consequence of the new Accord could be very large cost increases for them, even though these would not reach the 2000 basis point maximum potential increase for the lowest rated borrowers by <u>Weder and Wedow (2002)</u>[6], based on the Basle Committee estimates.

A recent study[7] from a leading international risk management consultancy has also estimated the likely impact on the capital requirements facing domestic banks in developing countries. The study concludes that:

> *If emerging markets implement the new regulation as it currently stands, we estimate that the Standardised Approach could lead to 20-25% increases in regulatory capital. The more risk-sensitive IRB approaches could produce increases of up to 70-80% for some banks; and even higher changes could be possible in both theory and practice.* (p.29)

Clearly regulatory requirements will not be fully binding in practice, with the result that the increase in costs will be lower than these maximum figures. However, it is equally improbable that these large shifts in the pattern of regulatory capital will have only a very small impact on the pricing of loans. The most often used, but in our view imprecise, argument to support this position is that banks price loans off their own calculation of economic capital,

---

[6] Weder B., and Wedow M. (2002) *Will Basel II affect international capital flows to emerging markets*?, OECD Development Centre. Technical Paper No. 199.

[7] Garside, T., and Pederson, C. (2003) *The New Rules of the Game: Implications of the New Basel Capital Accord for the European Banking Industries.* Mercer Oliver Wyman.

rather than regulatory capital. However, this argument presupposes that the use of economic risk capital is uniform across all major banks that are actively engaged with emerging and developing country borrowers. A recent study by PriceWaterhouse Coopers[8], surveyed a cross-section of the most sophisticated European banks. They concluded that, far from being uniform, economic capital is only fully integrated into the business practice of less than half of those surveyed. This suggests strongly that, for at least the more than 50% of European banks that have not fully developed the system, pricing cannot be being based on calculations of economic capital. We would therefore expect regulatory capital to have a significant impact on the pricing of loans for these banks, thereby creating a significant impact on average across the system.

The study cited by the leading international risk management consultancy, Mercer Oliver Wyman, concludes that the new Accord will produce:

> *An increase in credit spreads for higher risk segments such as mid-market*
> *lending, SMEs, low-rated sovereigns, and specialised lending.*

3.   Reduction of Quantity of Loans

Strong forces resulting from the implementation of the new Accord will encourage a reduction in the quantity of lending to poorer countries. These forces relate to the changed incentives that will face banks. Clearly, banks will wish to minimise the regulatory capital they are required to hold. If this were not so, there would be little point in the Basel Committee intentionally endowing the Advanced IRB approach with lower capital requirements than the other possible approaches as an 'incentive' for banks to move towards its adoption. That is, if, as is often suggested, banks are indifferent to changing regulatory capital requirements when making their lending decisions, then the lower capital requirements under the Advanced IRB approach would *not* provide an incentive towards its adoption. This 'incentive' can only work in practice if banks seek to minimise the regulatory capital they hold. If this is the case, then the reduction in regulatory capital for higher rated borrowers and the increase for lower rated borrowers, must provide a strong incentive over the medium to long-term for banks to refocus their loan portfolios away from

---

[8] Presented at the CBC Banking and Financial Services Symposium, London, June 25, 2003.

lower rated borrowers towards higher rated borrowers – that is, to increase the proportion of developed country borrowers and decrease the proportion of developing country borrowers in the portfolio.

For banks that see their overall regulatory capital increase, there will be three possibilities. First, if they have a sufficient capital buffer, they may be able to absorb the increase. Second, if they are unable to do this, they will have to raise additional capital. However, this second option may not be feasible in certain situations. If it were not possible or desirable to raise additional capital, a third option would have to be considered. For Mercer Oliver Wyman (2003):

> *The most obvious is to reduce risk-weighted assets by rebalancing business portfolios and exiting high-risk markets.* (p.23)

It has been suggested that even if the cost of bank lending to developing countries were to increase and/or the quantity of such lending fall, the countries concerned would be able to access other sources of finance, from the international capital markets, for example. However, the fact that countries without a sovereign rating, as well as those with very low ratings, are also those without access to the international capital markets strongly undermines this point.

4.   The Growing 'Data Divide'

An important issue, that has received relatively little attention, relates to the increasingly sophisticated and quantified approach to credit risk, and the reliance of this process on accurate data of sufficient historical length. It is likely that the process of reforming the Basel Capital Accord will accelerate this process. Indeed, a number of commentators have argued that this acceleration is already well under way, as banks seek to upgrade their internal systems so as to be eligible for the IRB approaches.

Under the Foundation IRB framework a bank is required to provide its own estimates of probability of default (PD), with supervisory authorities providing estimates of loss given default (LGD), exposure at default (EAD), and maturity (M). Under the Advanced IRB approach, banks are required to

provide estimates of all of these inputs, subject to meeting minimum standards. However, in order for a bank's estimate of PD to be acceptable as an input:

> *The length of the underlying historical observation period used must be at least five years for at least one source.[9]*

For estimates of LGD:

> *Estimates of LGD must be based on a minimum data observation period that should ideally cover at least one complete economic cycle but must in any case be no shorter than a period of seven years for at least one source.[10]*

The most sophisticated internationally active banks that have well-developed systems of this sort, the historical data that underlies their estimates is derived from developed markets. As major banks have told us, the availability of these underlying data inputs in developing countries is far lower than in the developed markets.

In order for the system to be robust – and therefore acceptable to supervisory authorities – it is clear that a given PD in, say, the UK, must be directly comparable with the same PD in any developing country. In order for this to be possible with any degree of accuracy, historical data on the default experience of the various PD bands would need to be gathered in each market. However, this is far from being the case at present .

Consequently, given the fact that a bank wishing to use a statistical default model must:

> *Satisfy its supervisor that a model or procedure has good predictive power and that regulatory capital requirements will not be distorted by its use. The variables that are input into the model must form a reasonable set of predictors.[11]*

There will clearly be an incentive to reduce those inputs which exhibit greater uncertainty. Again, therefore, banks will be faced with an incentive to focus

---

[9] CP3, paragraph 425.
[10] CP3, paragraph 434.
[11] CP3, paragraph 379.

their activities on developed markets - markets for which such data is readily available.

Whilst this can be seen as a further force that is likely to reduce the quantity of loans to developing countries, these deficiencies in data can also be expected to adversely impact upon the cost of borrowing in such countries. CP3 contains a number of pieces of advice for banks faced with data problems of the sort discussed above.

The following is typical of this advice:

> *In general, estimates of PDs, LGDs and EADs are likely to involve unpredictable errors. In order to avoid over-optimism, a bank must add to its estimates a margin of conservatism that is related to the likely range of errors. Where methods and data is less satisfactory and the likely range of errors is larger, the margin of conservatism must be larger.[12]*

Thus a bank operating rules under an IRB approach faces two options, in relation to lending to developing countries; 1) withdraw from lending, which would reduce supply of loans or 2) adopt a conservative approach to assigning borrowers to PD bands, which would increase cost, as banks will "assume the worst" about those borrowers' creditworthiness. Furthermore, while these factors are likely to reduce the current quantity of lending and/or increase its cost, they will also negatively affect the potential for future lending. Banks that are not currently engaged in lending to developing countries, and choose to adopt the IRB framework, will be effectively precluded from entering these markets in the future by the data limitations we have described.

III – Our specific proposals

1. <u>International diversification benefits should be explicitly incorporated in the IRB approach</u>

The proposed Basle 2 does not explicitly take account of clear international diversification benefits of lending to developing countries, despite these being

---

[12] CP3, paragraph 413.

widely recognised and confirmed by our research described above. We feel that unless the proposal is amended, capital requirements will – in this respect – not accurately reflect risk, and will unfairly and inappropriately penalise developing countries.

It therefore seems important that in its final revision of the proposed Accord, the Basel Committee incorporate the benefits of international diversification.

There is a clear precedent. The Basel Committee, in its previous modifications, has already started to take account of variable asset correlation for lending to corporates, as related to probability of default and as regards size of firm. Following the publication of the Basle Committee's proposal in January 2001, there was widespread concern – especially in Germany, but more recently, in the US – that the increase in capital requirements would sharply reduce bank lending to SMEs. After intensive lobbying, particularly by the German authorities, and based on empirical research (Lopez, 2002)[13], the Basle Committee lowered capital requirements for lending to SMEs under the IRB approach.

Indeed, the Basle Committee has stated:

in recognition of the different risks associated with SME borrowers, under the IRB approach for corporate credits, banks will be permitted to separately distinguish loans to SME borrowers (defined as those with less than Euro 50 mn in annual sales) from those to larger firms. Under the proposed treatment, exposures to SMEs will be able to receive a lower capital requirement than exposures to larger firms. The reduction in the required amount of capital will be as high as twenty percent, depending on the size of the borrower, and should result in an average reduction of approximately ten percent across the entire set of SME borrowers in the IRB framework for corporate loans.[14]

---

[13] J.A. Lopez (2002) The Empirical Relationship between Average Asset Correlation, Firm Probability of Default and Asset Size. Presented at BIS Workshop "Basel II: An Economic Assessment" - May 2002.
[14] *Basel Committee reaches agreement on New Capital Accord issues.*
http://www.bis.org/press/p020710.htm

Thus, in the case of SME and corporate lending, the Basel Committee has recognised the impact that differential asset correlation can have on portfolio level risk. Our empirical results strongly suggest that a similar modification is justified with respect to internationally diversified lending, especially when one considers the fact that our evidence is as least as strong as that used to support the modification with respect to SMEs.

We recognise the fact that SME lending has "special characteristics", which justified the modification. However, our argument is precisely that lending to developing and emerging economies also has similar characteristics. Lopez (2002) argues that large firms are more susceptible to systemic risk than are SMEs: the higher weight given to idiosyncratic factors in the latter thus justifies the modification. However, if one defines 'systemic risk' in a global sense as associated with global business cycles, then the fact that developing and emerging economies are less correlated with industrialised business cycles – as our results clearly show – demonstrates that these economies are also less susceptible to systemic risk. Consequently, if a modification was justified with respect to SME lending, it is difficult to see why one is not justified in the case of developing and emerging economies.

The results of our simulation show that the unexpected losses for the portfolio focused on developed country borrowers are, on average, almost twenty-three percent higher than for the portfolio diversified across developed and developing countries.

As a specific proposal in this area, we would suggest an adjusting factor be incorporated into the Accord. This would be applied at the portfolio level, and could function in a tapered fashion. Our empirical results suggest that a fully diversified bank would qualify for a reduction of approximately 20% of required capital. This reduction would then decline as the level of diversification fell, reaching zero for an undiversified bank. Such a modification would be relatively straightforward to introduce, would not add to the complexity of the Accord, but would ensure a more accurate measurement of risk. Alternatively, the modification could be integrated into Pillar 1 of the Accord through the development of a separate developing country curve. This would be similar to

the modification produced for SMEs and would be calibrated so as to produce a similarly tapered reduction in capital as in the adjusting factor described above.

As well as reducing the required capital for loans to borrowers in developing countries, in the context of an internationally diversified portfolio, such an adjusting factor or separate curve would also provide an incentive for banks to maintain or increase their level of international diversification, in response to an accurate measurement of risk.

2. Overcoming the Data Divide by allowing long transition under standardised approach

The Basel Committee itself has recognised the problem of differential data quality in different jurisdictions. Although it is stated that:

Once a bank adopts the IRB approach for part of its holdings, it is expected to extend it across the entire banking group.

This is subsequently qualified:

Once on IRB, data limitations may mean that banks can meet the standards for the use of own estimates for LGD and EAD for some but not all of their asset classes/business units at the same time.[15]

As a result, the Basel Committee concedes that:

Supervisors may allow banks to adopt a phased roll-out of the IRB approach across the banking group.

---

[15] CP3, paragraph 225.

However, this phased roll-out must be of a limited duration:

A bank must produce an implementation plan, specifying to what extent and when it intends to roll-our IRB approaches across significant asset classes and business units over time. The plan should be exacting, but realistic, and must be agreed with the supervisor.[16]

It is essential, if the negative impacts linked to data described above are to be avoided, that banks are given the time to accumulate data of sufficient quality and duration in different markets. That is, an internationally active bank should be free to employ the standardised approach in their lending to those developing countries where the data limitations are such to make adoption of the IRB approaches impractical. Furthermore, there should be no arbitrary limit set on the length of this period. Rather, the IRB approaches should not be adopted in lending to developing countries until it can be proved that the underlying data that are inputs into the framework are of sufficient quality and comprehensiveness.

This transition period could also provide the space for more sophisticated full credit risk models to be developed, which could then make effective use of the better data available from developing countries. These models would, among other aspects, explicitly incorporate the benefits of international diversification.

These modifications, if implemented, would encourage a narrowing of the 'data divide' described above. In contrast, the proposals as they stand are more likely to encourage a widening and deepening of this divide; an outcome that would be to the benefit of nobody.

3. Dealing with pro-cyclicality

The adoption of a considerably flatter risk-weighted curve and encouragement, in Pillar 2, of banks to take a more forward looking view of their activities may help diminish the potential impact of Basle 2 on increased pro-cyclicality of bank lending, as may encouragement by regulators to carry out stress tests. However, it is unclear that these measures will be sufficient. It therefore would be highly desirable to introduce mandatory counter-cyclical measures, such as forward

---

[16] CP3, paragraph 227.

looking provisions before – or at the same time – as Basle 2 is implemented; a complementary measure would be to make stress-testing mandatory, with the parameters specified jointly by regulatory authorities and the banks themselves.

<u>Conclusion</u>

We would be happy to collaborate with the Basle Committee in developing these proposals, if this was considered helpful.

Annex 1.

Correlations in Three Crisis Periods: Developed/Developed & Developed/Developing

Table 4: Syndicated loan spreads under crises periods

Row	SYNDICATED	Total Time Series	94-4 to 99-1	94-4 to 95-4	97-3 to 98-4
1	Mean Correlation (Deved/Deving)	0.141	0.129	0.087	0.229
2	Mean CorrelationDeved/Deved	0.375	0.135	0.143	0.479
3	Ratio Mean Correlations	0.375	0.954	0.609	0.477
4	Ratio Volatilities	1.739	2.771	4.300	2.514

Table 5: Global Bond Index-Emerging Market Bond Index under crises periods

Row	GBI-EMBI+	Total Time Series	94-4 to 99-1	94-4 to 95-4
1	Mean Correlation (Deved/Deving)	0.532	0.397	0.698
2	Mean CorrelationDeved/Deved	0.783	0.571	0.823
3	Ratio Mean Correlations	0.679	0.694	0.849
4	Ratio Volatilities	1.656	2.400	1.716

Table 6: GDP under crises periods

Row	GDP-HP	Total Time Series	94-4 to 99-1
1	Mean Correlation (Deved/Deving)	0.020	0.114
2	Mean Correlation (Deved/Deved)	0.351	0.409
3	Ratio Mean Correlations	0.056	0.279
4	Ratio Volatilities	1.696	2.256

Tables 4 to 6 demonstrate that for each of the analysed variables, the mean Correlation between "Developed" and "Developing" Countries is lower than the mean correlation between "Developed" and "Developed" countries:

Corr(DEVED/DEVING)<Corr(DEVED/DEVED)

It is interesting to see from these results that, as would be expected in crises periods, developing countries become relatively riskier in comparison to developed countries. This is illustrated in row 4, which measures the ratio of volatilities given by the Standard deviation of the developing countries divided by the standard deviation of the developed countries. We observe that this ratio increases in crises periods.

Ratio: Std(DEVING)/Std(DEVED)

Finally, we observe that the ratio given by the mean correlation of "Developed" and "Developing" divided by the mean correlation of "Developed" and "Developed" countries:

Ratio: Corr(DEVED/DEVING)/Corr(DEVED/DEVING)

Increases in crises periods. This implies that diversification benefits are in fact aminorated in crises periods, however, they still remain. This is observed by the fact that the ratio never reaches a value of 1 or greater than 1.