OPTIMAL PORTFOLIO ALLOCATIONS FOR GLOBAL BANK STOCKS 1992-2001

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Abstract

In this paper we examine the optimal composition of global portfolios of bank stocks, expressed in US dollar terms, over the period January 1992 to June 2001.We estimate optimal global bank stock portfolios using two covariance optimisation algorithms – the Markowitz expected return/variance algorithm (MPT), and the Elton, Gruber and Padberg average correlation algorithm (EGP) – and compare the composition and performance of these portfolios with a portfolio comprising equally-weighted bank stocks. Our study also includes measures of skewness and kurtosis, and risk adjusted return measures based on variance, semi-variance and portfolio betas. The purpose of our study is twofold. First, we wish to examine whether the covariance optimisation approaches produce significantly different portfolio allocations over the period of the study. Second, we wish to determine if two significant events for the global banking sector – the implementation of global risk-based capital adequacy standards in 1992 and the Asian banking crisis of 1997 – may have had any influence on the optimal allocation of global bank stocks in an investment portfolio. To achieve this we construct the optimal bank portfolios, using both optimisation algorithms, for the period 1992-1996 and 1997-2001. We include bank stock returns for 26 countries in the study. We find that the MPT and EGP optimisation algorithms do produce different portfolio allocations during both periods of the study. If return is measured against variance, the MPT algorithm produces the best performing portfolio. However if return is measured against semi-variance, the results are mixed. We also find that bank portfolios performed better on a risk-adjusted basis in the period leading up to the Asian crisis of 1997. Our most interesting finding is that if the highest risk bank stocks are removed from the portfolio, the terminal wealth of the portfolio falls by around half in each period. This suggests that higher-risk bank stocks are needed to achieve sufficient diversification to 'protect' the return for a global portfolio of bank stocks.

1. Introduction

In this paper we examine the optimal composition of global portfolios of bank stocks, expressed in US dollar terms, over the period January 1992 to June 2001.We estimate optimal global bank stock portfolios using two covariance optimisation algorithms – the Markowitz expected return/variance algorithm (MPT), and the Elton, Gruber and Padberg average correlation algorithm (EGP) – and compare the composition and performance of these portfolios with a portfolio comprising equally-weighted bank stocks. Our study also includes measures of skewness and kurtosis, and risk adjusted return measures based on variance, semi-variance and portfolio betas.

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adequacy standards in 1992 and the Asian banking crisis of 1997 – may have had any influence on the optimal allocation of global bank stocks in an investment portfolio. To achieve this we construct the optimal bank portfolios, using both optimisation algorithms, for the period 1992-1996 and 1997-2001. We include bank stock returns for 26 countries in the study.

The rest of this paper is structured as follows. In the next section we provide a background to the study and outline the study methodology. This is followed by discussion of the results. The final section concludes.

2. Background and Methodology

The period 1992-1996 represents one of significant interest in the global banking system. During this period banks worldwide were implementing risk-based capital adequacy guidelines, following the deliberations of the Basel Committee of the Bank for International Settlements on a risk-based capital standard. The outcome of these deliberations was the Basel Accord of 1988. The basis of the Accord of 1988 was that a consistent standard be applied for determining minimum capital requirements across internationally active banks. These capital requirements were structured to make regulatory capital sensitive to differences in risk profiles across banks, with banks holding riskier assets required to hold a higher level of capital. From the perspective of investors in portfolios of bank stocks, this period could be viewed as one in which banks were increasing their capital bases in proportion to credit risks in both on-balance sheet assets and off-balance sheet activities. All else equal, this means this period is one in which we could expect lower volatility in bank stock returns as undercapitalised banks increased their capital or reduced their asset risks in order to comply with the capital adequacy standard.

Juxtaposed against this is the apparent build-up in credit risks in the banking books in the Asian countries, which manifested in the so-called Asian financial crisis of 1997. The large loan losses on the books of Asian banks in 1997 has led some observers to conclude that bank capital standards were ineffective in controlling risk-taking by banks in the region. That is, despite banks in the region conforming to minimum capital requirements under the Basel Accord, banks appear to have been undercapitalised relative to the credit risks in their books. In a previous study, Weston and Ford (2002) examined data for the period 1992-97 to assess the potential of risk-based capital requirements on bank risk-taking in the region, as measured by volatility in bank returns. They find an improvement in the risk/return profile of banks in Australia, Canada and the United States, but deterioration in the risk/return profile of Asian banks. The latter result is perhaps not surprising given the eventual collapse of banks in the region in 1997. This lends support to the hypothesis that the Basel capital adequacy requirements did not necessarily discourage riskier lending by banks in some countries. In the Asian banking context, we concluded that a key source of problems lay in loan loss provisioning policies, bank accounting standards and loan classifications standards in the region.

One of the objectives of this paper is to assess whether these events may have had any influence on the optimal allocation of global bank stocks in an investment portfolio. To achieve this we construct the optimal bank portfolios, using stock returns for the banking sectors of 26 countries for the period 1992-1996 and 1997-2001. With respect to the first period, we hypothesise that banks from the Asian region would be included in the optimal portfolio because these banks would have shown high returns as accounting standards and loan classifications standards allowed them to effectively circumvented capital controls and increase the proportion of higher risk/higher return business on their books without commensurate increases in capital. Importantly, we expect that investors in Asian bank stocks during this period would have been attracted to these returns, ignorant of the fact that these banks were becoming increasingly undercapitalised relative to credit risk. In the second period of the study, we expect that few, if any, Asian banks would be included in the optimal portfolio following the high volatility in bank returns arising from bank collapses and loan write-downs in the region.

A second objective of the study is to assess if the use of alternative portfolio models provides significantly different results with respect to optimal bank portfolios. Specifically, we use two portfolio optimisation models: the Markowitz Modern Portfolio Theory (MPT) covariance model and the Elton, Gruber, Padberg (EGP) reward-to-variability model. For purposes of comparison, we also construct an equally weighted portfolio.

Nawrocki (2000) outlines a number of statistical problems with the use of traditional portfolio optimisers that perform asset allocation and portfolio allocation functions. First, securities with extreme values for returns and variances will be overweighted or underweighted in the portfolio – securities with large returns and low variances will be overweighted while securities with low returns and high variances will be underweighted. Under this scenario the likelihood of making estimation errors is high. Second, small changes in inputs such as mean returns can cause large changes in optimal asset weightings. As investors changes their estimates for risk and return over time, optimal weights become excessively unstable. Third, estimation errors in traditional portfolio optimisers prevent the determination of a single set of estimated returns and variances. This means that alternative solutions that are non-optimal may be returned. Elton, Gruber and Padberg (1976) developed a successful portfolio heuristic by using a single average correlation coefficient. They demonstrate that this approach will provide stable portfolio allocations and more diversification than a standard optimiser. Our study uses both an EGP optimisation algorithm and a MPT mean/variance optimisation algorithm to estimate the optimal portfolio allocations of bank stocks for the two periods under consideration.

The 26 countries whose bank stocks are included in the study are listed in Table 1.

Table 1: Countries Included in the Study

Australia	Italy	Singapore
Belgium	Japan	South Africa
Canada	Luxemburg	Spain
Chile	Malaysia	Switzerland
Denmark	Mexico	Thailand
Germany	Netherlands	Taiwan
Greece	Norway	United Kingdom
Hong Kong	Philippines	United States
India	Portugal	

3. Results

Our results are presented in Tables 2 and 3. Table 2 summarises our results of the 1992-1996 period. Earlier we discussed our expectation of lower volatility in bank stock returns in light on the capital charge for risky assets being implemented by banks during this period. While the ECP portfolio yields higher returns than the MPT portfolio, a lower level of risk does not compensate these returns. The equally weighted portfolio demonstrates fat tails and low returns to both variance and semi-variance, compared to the optimal portfolios constructed. The returns to beta for the optimal portfolios are significantly higher than for the equally weighted portfolio. The ECP portfolio and the equally weighted portfolio demonstrate significant positive skewness at two standard deviations, which offers an attractive protection against downside risk.

Interestingly and as expected, bank stocks from two Asian countries are included in the optimal ECP portfolio for this period. These countries are Hong Kong and Malaysia. This lends some support to our hypothesis that investors in bank stocks in the Asian region were 'comforted' by the introduction of risk-based capital standards to banks in the

region, and that these investors did not anticipate that higher returns from banks in the region were being achieved with higher risk loan categories. Weston and Ford (2002) discuss how despite the introduction of risk-based capital standards, riskier assets were not being appropriately measured due to accounting standards, provisioning policies and loan classifications in the region.

Table 2: Optimal Portfolios: 1/1992 – 12/1996

	MPT portfolio	EGP portfolio	Equal weight
Annualised return (%)	28.3497	29.0775	20.3336
Monthly return (%)	2.1017	2.1498	1.5544
Terminal wealth	3.6321	3.6779	2.4845
Standard deviation of returns (%)	2.3459	2.7810	3.7431
Semi-deviation of returns (%)	0.6524	0.9688	1.7233
Skewness	0.3073	0.3699	0.7038
Kurtosis	3.2248	3.7706	5.1103
Beta	0.2192	0.2966	0.3386
Probability (return < 0%) (%)	18.5200	0.2197	
Return/variance (%)	**0.7908**	**0.6844**	**0.3485**
Return/semi-variance (%)	2.8435	1.9645	0.7589
Return/beta (%)	8.4628	6.4175	3.8523
Portfolio utility	2.0467	2.0725	1.4143
Portfolio composition	Belgium 6%	Belgium 18%	
	Chile 2%	Hong Kong 5%	
	Luxemburg 21%	Malaysia 3%	
	Netherlands 14%	Luxemburg 19%	
	Philippines 18%	Netherlands 19%	
	South Africa 8%	Philippines 11%	
	US 31%	UK 10%	
		US 15%	

Table 3: Optimal Portfolios: 1/1997 – 6/2001

	MPT portfolio	EGP portfolio	Equal weight
Annualised return (%)	23.6418	24.3626	13.4852
Monthly return (%)	1.7842	1.8335	1.0598
Terminal wealth	3.1353	3.2306	3.2911
Standard deviation of returns (%)	5.8050	6.0991	4.6050
Semi-deviation of returns (%)	3.5293	3.6341	2.9533
Skewness	-0.7239	-0.5430	-0.3761
Kurtosis	5.1813	5.2263	6.1734
Beta	0.6754	0.6892	0.6714
Probability (return < 0%) (%)	37.9300	38.1900	
Return/variance (%)	**0.2649**	**0.2602**	**0.1759**
Return/semi-variance (%)	0.4357	0.4367	0.2753
Return/beta (%)	2.2767	2.3024	1.2061
Portfolio utility	1.4472	1.4615	0.8477
Portfolio composition	Denmark 56%	Denmark 64%	
	Greece 10%	Greece 7%	
	Ireland 8%	Italy 15%	
	Italy 16%	Mexico 14%	
	Mexico 10%		

When the countries were ranked by standard deviation, eight of the twenty-six were found to have high standard deviations (greater than 9%). We investigated whether eliminating these banking sector stocks had an influence on the performance of the optimal portfolio. While taking out these stocks did not make a significant difference to the results, doing this is not preferred because the result is a less-diversified portfolio.

Table 2 summarises our results for the second period of the study, which incorporates the Asian financial crisis, subsequent recovery and banking system restructures in the region. The optimal portfolios under both MPT and EGP approaches are significantly changed when compared to the first period of the study. As expected, Asian banking sector stocks drop out of the optimal portfolios. However, more surprising is that banking stocks in the United States and the United Kingdom also drop out of the optimal portfolios. While the lower performing banking stocks from the Asian region drop out, the period is still characterised, somewhat counter-intuitively, by higher risk stocks that are not being compensated for by higher returns. That is, risk-adjusted returns have dropped significantly during the second period of the study.

Despite the crisis in the Asian region and expected lower-risk taking on the part of banks in the restructuring and recovery period, the terminal wealth is higher for the equally weighted portfolio that includes all of the Asian countries listed in Table 1. This suggests that a genuinely diversified portfolio is achieved when using all countries in the construction of the portfolio. Thus despite a convergence of bank capital adequacy standards for risk taking, there appears still to be a considerable amount of low or negative correlations among bank stock returns. Further, the removal of highest risk stocks in the first period from the portfolio constructed in the second period results in a significant decline in investment terminal wealth and returns to variance and semi-variance do not improve. This is an important result. It suggests that high risk-banking sector stocks are required to maintain stable returns to a global banking stock portfolio. The shift in portfolio focus between the two periods in the study appears to confirm that global investors in banking stocks require a full range of countries in their portfolios to maintain reasonable returns over time. In fact, the equally weighted portfolio performs so well in the second period that a realistic portfolio strategy for the full period 1992-2001, which includes the Asian financial crisis, might well have been holding an equally weighted portfolio.

4. Conclusions

We have investigated the optimal composition of global US dollar-based portfolios of bank stocks during the period January 1992 to June 2001 using both the MPT and EGP approaches to portfolio optimisation. The period was divided into the post-Basel pre-Asian crisis years of 1992 to 1996 and the Asian crisis and recovery period from 1997 to June 2001.

Our conclusions make three distinct contributions. First, we find that the ECP and average correlation portfolios yield higher returns than the MPT portfolios, but these are not compensated for on the risk side. Second, we find that for the first period of the study, investors in Asian bank stocks achieved higher returns unaware of the substantial credit risks building in the books of Asian books. This is despite the introduction of risk-adjusted capital adequacy standards for banks, because it is apparent that accounting practices and provisioning policies in the region were misaligned with the new capital standard. Fundamentally, banks in the region were able to engage in regulatory arbitrage. Third, we find that for the entire period 1992-2001, a genuinely diversified portfolio of global bank stocks should not have eliminated higher-risk stocks because these stocks are required to achieve stable returns. Indeed, the terminal wealth on an equally weighted portfolio outperforms the portfolios on which higher-risk banks stocks are eliminated.

Our last finding is important because it suggests that investors in banking sector stocks should not panic at the sign of a crisis, but rather, be aware that a truly diversified bank sector portfolio representing all of the 26 countries listed in Table 1 will achieve reasonable and stable returns regardless of the cycle.

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