

Copyright is owned by the Author of the thesis. Permission is given for a copy to be downloaded by an individual for the purpose of research and private study only. The thesis may not be reproduced elsewhere without the permission of the Author.

AN EMPIRICAL ANALYSIS OF THE
TRANSMISSION OF MARKET MOVEMENTS:
LINKAGES BETWEEN EQUITY MARKETS IN
THE ASIA PACIFIC REGION

A thesis presented in partial fulfilment of the requirements for the degree
of Master of Business Studies in Finance at Massey University

ARIE DEKKER
1998

Abstract

This study provides an empirical analysis of the transmission of market movements to examine the linkages between markets, and the efficiency with which innovations between markets are transmitted in the Asia Pacific region. Vector autoregression (VAR) analysis has been carried out on daily data for the period, January 1, 1987 to May 29, 1998, for ten markets in the Asia Pacific region: Australia, Hong Kong, Japan, Malaysia, New Zealand, the Philippines, Singapore, Taiwan, Thailand and the United States. This is the first study, that the author is aware of, to consider the generalised approach to forecast error variance decomposition and impulse response analysis in favour of the traditional orthogonalised approach for studying the linkages between equity markets. The generalised approach is invariant to the order of the variables in the VAR model. Forecast error variance decomposition and impulse response analysis has been used to study the nature of the linkages between markets in the region, and the efficiency with which innovations are transmitted between the markets in the region. The Asia Pacific region is characterised by a number of markets with strong linkages. The dominant influence of the U.S. market in the region is also apparent from the results. The impulse response functions are consistent with the notion of informationally efficient equity markets in the Asia Pacific region. The analysis has been carried out on exchange rate adjusted data as well as local currency data so that the effect of exchange rate risk can be taken into account.

Acknowledgments

This thesis could not have been completed in the form it has taken, without the guidance of two important people, to whom I owe a great debt of gratitude.

I would like to thank my supervisor, Dr. Martin Young from the Department of Finance, Banking and Property at Massey University for the freedom he allowed me in developing the topic, for the thoughtful consideration with which he answered all of my questions, and for keeping me focused and on track throughout the year. My gratitude to Martin extends beyond the supervision of this thesis. Over the past three years at Massey University, I have looked upon Martin as my mentor, and I would like to record my appreciation for the direction he has given me in my studies, and for his support and encouragement.

I would also like to thank my advisor, Dr. Kunal Sen from the Department of Applied and International Economics at Massey University for his contribution. Kunal provided me with much needed guidance in the time series techniques used to conduct the empirical testing in this thesis. I am very grateful to him for his ideas, comments, time and patience. There is no doubt that this thesis has benefited greatly from Kunal's involvement.

Table Of Contents

Abstract	ii
Acknowledgments	iii
Table of Contents	iv
List of Tables	vii
List of Figures	ix
Introduction	1
Part One: Literature Review	7
Chapter 1: International Portfolio Diversification - A Review Of The Early Literature	8
1.1 Comovement Between World Equity Markets	8
1.2 Inter-temporal Stability In The Comovement Between World Equity Markets	14
1.3 Lead-lag Relationships Between World Equity Markets	20
1.4 Conclusions	21
Chapter 2: Volatility And Comovement In World Equity Markets	23
2.1 The October 1987 Stock Market Crash	23
2.2 Returns, Volatility And The Transmission Of Price Changes Between World Equity Markets	28
2.3 Conclusions	37
Chapter 3: Linkages Between World Equity Markets	39
3.1 Integration Of World Equity Markets	40
3.2 Examining The Linkages Between World Equity Markets – A Vector Autoregression Approach	42
3.3 Using Cointegration Analysis To Examine The Linkages Between World Equity Markets	51

3.4 Conclusions	55
Part Two: Data & Methodology	57
Chapter 4: Data Description	58
4.1 Raw Data	58
4.2 Market Opening And Closing Times	63
4.3 Emerging And Developed Markets	64
4.4 Data Transformation	65
Chapter 5: Testing For Stationarity And Cointegration	67
5.1 Testing For The Presence Of A Unit Root	67
5.2 Johansen Multivariate Cointegration Methodology	74
Chapter 6: Vector Autoregression Methodology	78
6.1 Unrestricted Vector Autoregression Methodology	78
6.2 The Order of Integration, Cointegration And VARs	89
Part Three: Results & Analysis	92
Chapter 7: Exploratory Data Analysis	93
7.1 Summary Statistics	93
7.2 Comovement Of Asia Pacific Equity Markets	97
7.3 Volatility And Worldwide Stock Market Crashes	101
7.4 Conclusions	107
Chapter 8: Results And Analysis – Stationarity And Cointegration	109
8.1 Unit Root Test Results	109
8.2 Multivariate Cointegration Results	115
8.3 Conclusions	119
Chapter 9: Results And Analysis – Vector Autoregressions	121
9.1 Vector Autoregression Model Specifications	121
9.2 Estimated System Covariance Matrix Of Errors	122
9.3 Forecast Error Variance Decomposition	125
9.4 Impulse Response Analysis	133

9.5 Conclusions	145
Chapter 10: Conclusions	151
References	157

List Of Tables

1.1 Cophenetic correlations of observed structures in contiguous time periods	16
2.1 Stock price index percentage changes in major markets: Calendar year 1987 and October 1987	24
3.1 Accounting national stock market innovations	45
4.1 Asia Pacific stock market indices data	59
4.2 Asia Pacific exchange rate data	61
4.3 Market opening and closing times	63
7.1 First four moments of the return distributions of Asia Pacific markets	94
7.2 Measures of volatility for Asia Pacific markets – local currency and U.S. dollars	96
7.3 Asia Pacific stock market correlation matrices – local currency and U.S. dollars	98
7.4 Dependency indices of Asia Pacific stock markets – local currency and U.S. dollars	100
7.5 Stock market returns in October 1987 and October 1997	101
7.6 Correlation matrix of weekly return data for Asia Pacific stock markets	103
7.7 Standard deviation for weekly return data for Asia Pacific stock markets	104
7.8 Standard deviation for daily return data for Asia Pacific stock markets around the October 1987 stock market crash	105
7.9 Standard deviation for daily return data for Asia Pacific stock markets around the October 1997 stock market correction	106
8.1 Unit root tests of daily stock index data – local currency, 01/01/87 – 29/05/98	111
8.2 Unit root tests of daily stock index data – expressed in U.S. dollars, 01/01/87 – 29/05/98	113
8.3 Johansen tests for cointegration among ten Asia Pacific markets using daily stock index data – local currency, 01/01/87 – 29/05/98	116
8.4 Johansen tests for cointegration among nine Asia Pacific markets using daily stock index data – expressed in U.S. dollars, 01/01/87 – 29/05/98	117
9.1 Estimated system covariance matrix of errors – local currency and U.S. dollars, 01/01/87 – 29/05/98	123

9.2	Orthogonalised decomposition of forecast error variances for daily market returns for ten Asia Pacific markets – local currency, 01/01/87 – 29/05/98	126
9.3	Generalised decomposition of forecast error variances for daily market returns for ten Asia Pacific markets – local currency, 01/01/87 – 29/05/98	127
9.4	Generalised decomposition of forecast error variances for daily market returns for nine Asia Pacific markets – local currency, 01/01/87 – 29/05/98	132
9.5	Impulse responses to a one standard error shock in the U.S. market using daily data for ten Asia Pacific markets – local currency, 01/01/87 – 29/05/98	137

List Of Figures

4.1 Stock index levels (LN) for Asia Pacific markets – local currency and U.S. dollars, 01/01/87 – 29/05/98	62
4.2 Lognormal probability density function	65
9.1 Time paths of generalised impulse responses to a one standard error shock in the U.S. market – local currency, 01/01/87 – 29/05/98	135
9.2 Time paths of generalised impulse responses to a one standard error shock in the Australian market – local currency, 01/01/87 – 29/05/98	140
9.3 Time paths of generalised impulse responses to a one standard error shock in the New Zealand market – local currency, 01/01/87 – 29/05/98	141
9.4 Time paths of generalised impulse responses to a one standard error shock in the Singapore market – local currency, 01/01/87 – 29/05/98	142
9.5 Time paths of generalised impulse responses to a one standard error shock in the Malaysian market – local currency, 01/01/87 – 29/05/98	143
9.6 Time paths of generalised impulse responses to a one standard error shock in the Hong Kong market – local currency, 01/01/87 – 29/05/98	144
9.7 Time paths of orthogonalised impulse responses to a one standard error shock in the Hong Kong market – local currency, 01/01/87 – 29/05/98	149
9.8 Time paths of generalised impulse responses to a one standard error shock in the Hong Kong market – local currency, 01/01/87 – 29/05/98	150