Industry Effects, Contagion and Equity Market Comovement: Implications for International Diversification

Lichuan Xia

A Thesis Submitted for the Degree of Doctor of Philosophy

CASS BUSINESS SCHOOL

Department of Banking and Finance

October 2005

TABLE OF CONTENTS

LIST OF TABLES

LIST OF ILLUSTRATIONS

ACKNOWLEDGEMENT

I would like to express my greatest thanks to my supervisor Professor Kate Phylaktis for the encouragement, guidance and strict supervision to complete this thesis. Her inspiring suggestions and accurate comments helped me in realisation of a valuable and rewarding research work. I would also like to thank my wife for her full support during my study for the Ph.D.

DECLARATION OF COPYRIGHT

ABSTRACT

The thesis examines the increasing market co-movement and its implications for international portfolio diversification. The main purpose is to investigate the relative importance of country/industry effects and contagion in global equity markets. The overall analysis shows that the country versus industry effects in equity returns are changing over time and vary across regions. In particular, the divergence is more prevalent between developed and emerging markets. When examining the potential sources driving the country/industry effects, the study finds that the dynamics of those effects are related to the ongoing business globalization and financial market integration. Specifically a rise in a firm's international sales increases its global effects and decreases its country effects and a firm with ADR counterpart tends to have higher global and industry effects compared to a non-ADR firm. The study also indicates that the recent increase of industry effects is not only confined to TMT sectors but is an industry-wide phenomenon, thus suggesting that IT bubbles are not responsible for such increase. With the increasing importance of industry effects and the rising cross-border industry/sector co-movement, the thesis further studies the sector level integration and contagion in equity markets. The results show that sector level integration varies across regions and contagion exists at sector level. Particularly nearly half the sectors in Europe, Asia and Latin America were affected via the global shocks during the Mexican crisis, but only several sectors in Asia were contagious during the Asian crisis. The evidence provided in this thesis has important implications for international diversification.

ABBREVITIONS

ADR	American Depository Receipts
APT	Arbitrage Pricing Theory
ASEAN	Association of South-East Asian Nations
CAPM	Capital Asset Pricing Model
DJGI	Dow Jones Global Indexes
EM	Expectation Maximization
EMU	European Monetary Union
ERM	Exchange Rate Mechanism
EU	European Union
FDI	Foreign Direct Investment
FT	Financial Times
G-7	Group of Seven
GARCH	Generalised Autoregressive Conditional Heteroscedasticity
GDR	Global Depository Receipts
GICS	General Industry Classification Standard
IT	Information Technology
LTCM	Long-Term Capital Management
MAD	Mean Absolute Deviation
MSCI	Morgan Stanley Capital International
NAFTA	North America Free Trade Agreement
OECD	Organisation for Economic Co-operation and Development
OLS	Ordinary Least Squares
PPP	Purchasing Power Parity
TMT	Technology, Media and Telecommunications
UK	United Kingdom
UNCTAD	United Nations Conference on Trade and Development
US	United States
WLS	Weighted Least Squares

CHAPTER ONE

INTRODUCTION

1.1 Background to the study

Researchers have shown a long time interest in studying the equity market co-movement, which plays a central role in the international portfolio diversification. One of the most pronounced empirical regularities in international equity markets has been the low degree of correlations of returns across national equity markets. Even for many developed and economically linked countries, their equity markets tend to move to a large extent independently of one another in terms of returns and volatility. The low degree of co-movement between markets represents the key to the gains from international diversification. Because markets are not perfectly correlated, only a fraction of national systematic risk elements is systematic in a world context. Thus investing across different markets has the potential of diversifying away part of the national systematic risks which are non-diversifiable within the domestic markets. Earlier papers by Grubel (1968), Levy and Sarnat (1970) and Solnik (1974) have documented the low correlations between market returns and confirmed the benefits of international diversification.

The low degree of market co-movement could be due to several reasons. One reason is the local fiscal and monetary polices, differences in institutional and legal regimes which induce large country-specific variation in returns. The other reason is the different industrial structures across markets. Because industries are imperfectly correlated, equity markets with different industry composition will also be imperfectly correlated. So part of the benefits of international diversification may come from industrial diversification. Empirical evidence shows, however, that the country-specific components of return variation are large enough to dominate the industry effects (see, e.g. Lessard, 1974, 1976; Grinold, et al, 1989; Heston and Rouwenhorst, 1994, 1995; and Griffin and Karolyi, 1998). Therefore an important implication for the international diversification strategy is that diversification across countries is a more efficient tool than diversification across industries in reducing a portfolio's risks.

However, the low correlations across markets have broken down in recent years. For example, Brooks and Del Negro (2004) indicate that the correlation coefficient of US equity market returns with equity returns in other developed markets has risen from a relatively stable level of 0.4 from the mid-1980s through the mid-1990s to close to 0.9 more recently. The increase of market co-movement is also highlighted in other studies (e.g. Longin and Solnik, 1995; Rangvid, 2001; and Goetzmann et al, 2005).

The increasing market co-movement could be the direct consequence of economic globalization and capital market integration. On the economic side, the reduction or removal of trade barriers has facilitated the cross-border direct investment and the global capital flows increased explosively during the 1980s and 1990s[1]. At the same time, worldwide business has forged through an increasing process of globalization in the last two decades. Firms have sought to consolidate and rationalize business activities globally through the expansion of existing affiliates as well as a wave of mergers and acquisitions[2].

On the financial markets side, the reduction in the cost of information, the improvement in trading systems technology, the development of new financial instruments and relaxation of certain legal restrictions have stimulated global capital movement and strengthened the worldwide linkages amongst the financial markets.

[1] For example, according to the United Nations Conference on Trade and Development (UNCTAD), the FDI inflow was US$ 59 billions in 1982, but increased to US$ 203 billions in 1990 and further up to US$ 735 billions in 2001.

[2] UNCTAD statistics show that cross-border mergers & acquisitions amounted to US$ 151 billions in 1991 and US$ 601 billions in 2001. The figures for the sales of foreign affiliates were US$ 5,479 billions in 1990 and US$ 18,517 billions in 2001.

Notably the establishment of the European Monetary Union (EMU) and adoption of a single currency have increased the harmonization of economic policies and the regional financial integration. On the other hand, the cross-listings such as ADRs (American Depository Receipts) and GDRs (Global Depository Receipts) have enriched the tools and scopes to diversify risks and improve returns for international investors[3]. ADRs are found to have overcome many of the regulatory restrictions, cost and information problems that inhibit international investment and thus allowed some indirect market integration (e.g. Errunza, Hogan and Hung, 1999; Foerster and Karolyi, 1999; Errunza and Miller, 2000; and Bekaert, Harvey and Lumsdaine, 2002).

The trend toward economic and financial globalization may have dramatically changed the investment landscape for the international diversification. On the one hand, firms of all sizes are now under increasing competition on a global basis, thus reducing the relative importance of domestic country factors. Simultaneously the evolution of the global value chain linking a firm's manufacturing, distribution and delivery infrastructure with a variety of firms across countries and regions is enhancing the power of global industry effects. On the other hand, the increasing market integration means that the equity returns are more closely linked to the global factors and less so with national specific factors, such that the significance of country effects will be diminished and the importance of global industry effects increased, ceteris paribus. Inevitably countries are now performing more in line with one another, while different industries are becoming relatively less correlated. So the international diversification strategy is now confronted with a new challenge: is the traditional cross-country diversification still valid?

[3] According to the Bank of New York, worldwide ADRs in the US market were 285 prior to the year 1992. By the year of 2001, they rose to 1726. See the bank's ADR website: http://www.adrbny.com

The same issue is mirrored among practitioners as well. Traditionally portfolio managers allocate funds in a top-down fashion: first making a decision across countries and/or geographical regions and then selecting securities within the countries and/or the regions. These practices reflect the view that conforms to the traditional cross-country diversification strategy. However, this view is reversed in recent years, at least among the European managers. According to Galati and Tsatsaronis (2001), in 1997, 20% of managers for European equities believed in the superiority of portfolio allocation strategies based on industrial sectors, while 50% of managers thought that country factors were dominant. However, in 2001 about 75% of managers thought that investment strategies based on industries are superior to country strategies while only 10% still believed in the dominance of country effects. Bolliger (2001) documents that most banks and brokers have decided to reorganize their research departments according to sectors rather than countries. Some banks even began to launch cross-market industry or sector funds. All these point to the practitioners' belief that the industry factors in recent years are becoming more important than the country factors in equity markets. However, whether their belief is right is still subject to further empirical investigation.

The increasing equity market co-movement could also be due to the financial contagion. In the last decade or so, financial markets were hit by a series of crises: the 1992 ERM attacks, the 1994 Mexican peso collapse, the 1997 Asian crisis, the 1998 Russian collapse, the 1998 LTCM crisis, the 1999 Brazilian devaluation and the 2000 technological crisis. One feature during these crises is that markets tend to co-move more closely with one another than during tranquil times, and this excessive co-movement is often known as contagion effect. The close linkages between markets make it possible that external shocks are transmitted across different markets.

Especially during the crisis periods, shocks from one market are propagated to the markets which have no real or financial linkages with the market in crisis and to the markets which are in different geographic locations. So the diversification is quite different in volatile times from the one in tranquil times. Particularly during crises when the diversification is most needed, the markets may fail to offer the opportunity. Given the prevalence of contagion across markets, one new challenge for the international diversification is: can the benefits of diversification be still achieved during the financial crises?

Therefore, an examination of the subjects on the relative importance of country versus industry effects and on the contagion effects versus market co-movement is essential for the international diversification given the new challenges raised above. In fact, many researchers have already studied these subjects, but the results are inconclusive. There are still many questions which have not been answered, such as: have the industry effects increased in firm level returns? Do the roles of industry and country effects change over time and vary across regions? Are the dynamics of country versus industry effects a long-term feature which is embedded in the process of business globalization and market integration or just a temporary one due to reasons such as IT bubbles? Are the sources driving the country/industry structure in developed markets the same as the ones driving the country/industry structure in emerging markets? Are the sector returns more integrated at the global level or at the regional level? Does the contagion effect exist at the sector level? And finally do the sectors provide a channel in transmitting global or regional shocks? The current research is designed to answer the above questions with the aim to add new empirical contents to the literature and provide new implications for international diversification.

1.2 Objectives of the thesis

One of the main objectives of the thesis is to employ a new comprehensive database - The Dow Jones Global Indexes (DJGI) which are based on 34 countries and 51 industry group categories - to re-examine the relative importance of country and industry effects in the international equity returns. The focus of analysis is on the market level evidence, which is aimed at explaining the behaviour of the aggregate indexes by asking, for example, how much of the return of German index is due to a country factor that affects all German equities and how much is due to the industrial composition of the German market.

In relation to the above, the thesis intends to examine the evolution of country versus industry effects over time and test whether the roles of those effects have changed in different times. Moreover, the country and industry effects are further broken down to study the heterogeneity of market behaviour across regions and across industries, particularly with regard to the issue of whether the country effects are different across Europe, Asia, North America and Latin America in view of their differences in economic activities and financial integration, and to the issue of whether the industry effects vary between traded goods industries and non-traded goods industries in view of their different characteristics of international trade and exchange rate exposure.

Another main objective of the thesis is to examine the firms' level country versus industry effects and the sources driving those factor effects. Firm level analysis asks the question of, for example, how much of the movement of Honda equity return is due to the fact that Honda is in the automobile industry and how much is due to the fact that Honda is a Japanese firm. Since developing countries are less observed in the literature, the analysis of this thesis places a particular focus on the evidence in emerging markets. Specifically, the thesis intends to document the different behaviour of the country versus industry effects in firm level returns between developed and emerging markets.

The thesis also intends to provide an answer to the question of what forces drive the dynamics of country versus industry effects. By examining the cross-sectional differences in the factor effects across firms using information on their characteristics such as the extent of their international sales, cross-listings as ADRs and TMT affiliations, the thesis explores whether the dynamics are related to the business globalization and financial market integration, or due to IT bubbles, and with regard to the emerging markets, whether the sources that impact the dynamics of country/industry effects in developed market returns are the same as the sources that affect the structures of country/industry effects in emerging market returns.

The final objective of the thesis is to analyse the equity market integration and the contagion from a sectoral perspective. Equity markets have become increasingly integrated, yet the market level integration does not preclude sector level segmentation, or vice versa. Even if a market is integrated with world markets, some of its sectors may still be segmented. Similarly, some of sectors may be integrated even though a market is segmented from the rest of world. Given the strong regional economic and financial interdependence as shown in EMU, the integration analysis of the thesis focuses on whether the sectors are integrated at the global level or at the regional level.

The last decade witnessed a series of financial crises and during the crises markets tend to co-move more closely together. Such strong comovement across markets is often referred to as contagion. Study on the contagion is usually conducted at the market level. However, the market level analysis may mask the contagion effect due to the different industrial structures represented in market indexes. On the other hand, cross-country correlations among equivalent sectors have increased due to the increasing market co-movement and sectors have become more subject to the external shocks. So the contagion analysis of the thesis is conducted at the sector level in order to explore whether sectors contain contagion and whether global or regional shocks are transmitted amongst the equivalent sectors across different markets.

1.3 Contributions to the literature

One fundamental issue in the international diversification is whether the diversification should be arranged across countries or across industries. The relevant empirical studies focus on finding which factor effects – the country or industry effects – are more important in explaining the variation of equity returns. Traditionally the country effects are found to dominate the industry effects (Lessard, 1974, 1976; Grinold, et al, 1989; Heston and Rouwenhorst, 1994, 1995; and Griffin and Karolyi, 1998). So the diversification across countries is more favourable than diversification across industries. However more recent papers by Baca et al (2000), Cavaglia, Brightman and Aked (2000), L'Her et al (2002), Brooks and Del Negro (2004), Flavin (2004) show that the industry effects have levelled or even surpassed the country effects in recent years, suggesting that international diversification across industries may now provide greater risk reductions than the traditional diversification across countries.

The contradicting results in the literature may reflect the fact that the dynamics of the country versus industry effects are changing over time. Though the country effects have traditionally dominated the industry effects, recent economic and financial developments might have caused that dominance to shift. With the increasing economic and financial globalization in the last decade, particularly in recent years, the country boundaries would be blurred and the country effects diminished. At the same time, the industry effects, which are more pertinent to the global business cycles, would become more important.

On the other hand, the formation of large economic and trading blocks such as EU (European Union), NAFTA (North American Free Trade Agreement) and ASEAN (Association of South-East Asian Nations), has accelerated the regional integration in economic activities. Notably, in Europe the establishment of the European Monetary Union (EMU) and the increasing harmonization of government policies stand in contrast to the other regions. The regional integration and the varying degree of regional economic concentration may suggest that the dynamics of country vs. industry effects vary across different regions.

Most studies in the literature focus on advanced markets. Little attention has been paid to the study on dynamics of country versus industry effects in emerging markets[4]. Returns of emerging markets have vastly different characteristics from those of developed markets (e.g. Bekaert, 1995; Harvey, 1995; and Bekaert and Harvey, 1995, 1997, 2000). Emerging market returns usually have higher sample returns, low correlations with developed market returns and amongst emerging markets, more predictable returns, and higher volatility. Given those facts, one would expect the behaviour of country versus industry effects in emerging markets to be different from those in developed markets.

---

[4] One of the papers is by Serra (2000), who finds that emerging markets' returns are mainly driven by country factors, and the industry factors play little role in the cross-market correlations.

Therefore, one major contribution of the thesis to the literature is an analysis of the changing roles of country versus industry effects over time and the heterogeneous behaviour of those factor effects across regions as well as between emerging markets and developed markets. The analysis is conducted both at the market level and at the firm level. The market level analysis examines the behaviour of aggregate indexes and their different industrial structures, while firm level analysis compares the effects between firms' headquarter locations and their industry affiliations. The majority of papers studying the country versus industry effects focus on the market level evidence, yet the firm level evidence is limited (e.g. Brooks and Del Negro, 2003). Firm level analysis is equally important to the international diversification.

While the literature concentrates on finding the relative importance of country versus industry effects, one important question to ask is what factors drive the dynamics of those factor effects. To the present, only two relevant papers by Cavaglia, Cho and Singer (2001) and Brooks and Del Negro (2003) have turned to this issue and examined the connection of the dynamics of country and industry effects in firm level returns with the firms' international activities (proxy by firms' accounting data such as foreign sale ratios). However, the literature has not examined whether the sources that impact the dynamics of country/industry effects in developed market returns are the same as the sources that affect the structures of country/industry effects in emerging market returns.

So another major contribution of the thesis to the literature is the examination of the different behaviour of emerging markets relative to developed markets by comparing the dynamics of their global, country and industry effects at the firm level and the sources driving these factor effects by exploring the cross-sectional differences in the factor effects across firms using information on their characteristics. Firms' foreign sale ratios are used as a proxy for the business globalisation, the ADR listings are used as a proxy for the financial market integration[5]. In fact, the role of firms' ADR listings on the country/industry effects in cross-sectional analysis at the firm level has not yet been explored in the literature. Firms' TMT affiliation information is also employed in the cross sectional analysis to investigate whether the TMT sectors have an impact on the dynamics of country and industry effects and in particular, whether the increase of industry effects is due to IT bubbles. Brooks and Del Negro (2004) claim that the recent increase of industry effects is only confined to TMT sectors and such increase is due to IT bubbles. The thesis represents the first work on examining the impact of TMT sectors on the country/industry effects in a cross-sectional analysis.

There is a long tradition investigating the international equity market co-movement and integration. As the importance of industry factors has been found increasing recently, part of the research interest has been shifted to examining the integration process at the industry level. If the markets are integrated, the effect should show up at industry level. On the other hand, market integration does not preclude industry segment, in a sense that some industries are still segmented even though the market integration is found. So it might be the case that a specific group of industries drives the movement towards greater international interdependence of equity returns.

[5] ADR's role in the financial market integration is documented in many papers. See, for example, the references introduced in Section 1.1 of this chapter and Section 4.1 of Chapter 4.

The issue of industry level integration has been dealt with in Carrieri et al (2004), Berben and Jansen (2005) and Kaltenhauser (2002, 2003), which focus on either euro zone or large, mature markets. Carrieri et al (2004) focus on industries in the G-7 countries and find that global industry risk is priced for industries that produce internationally traded as well as non-traded goods and that the time variation in the prices of global industry risks has recently increased. Berben and Jansen (2005) find that in the period 1980-2000 the conditional correlations between Germany, UK and the US have doubled and no specific sector played a dominant role in the process of integration. Kaltenhauser (2002) studies the 10 industry sectors within the euro area, the US and UK and provides evidence that sector-specific effects have gained in importance. In another paper, Kaltenhauser (2003) reports that the process towards higher integration has been primarily a phenomenon of equity markets in the euro area and the US, and this higher integration is especially pronounced for sectors compared to the aggregate markets.

Against this background, a third major contribution of the thesis to the literature is the broader coverage of markets in examination of the sector level integration. The analysis focuses on the sector returns in 29 smaller markets in Europe, Asia and Latin America. From an asset pricing perspective, the paper explores whether the sectors are priced globally or regionally, thus indicating whether the integration is stronger at the global level or at the regional level.

The market co-movement is asymmetric in a sense that markets tend to move more closely together in volatile times, especially during the financial crises. In the last decade or so, financial markets were affected by a series of crises: the 1992 ERM attacks, the 1994 Mexican peso collapse, the 1997 East Asian crisis, the 1998 Russian collapse, the 1998 LTCM crisis, the 1999 Brazilian devaluation and the 2000 technological crisis. One common observation during those crises is the closer market co-movement than during tranquil times. Such strong co-movement is usually beyond the explanation of real and financial linkages and often referred to as contagion. Though a precise definition has not been agreed upon, contagion, in general, is referred to the spread of market shocks – mostly on the downside – from one country to another, a process observed through co-movement in equity prices.[6]

Study on the equity market contagion is voluminous but the results are mixed. For example, King and Wadhwani (1990) test for cross-market correlations between the US, UK and Japan during the 1987 US market crash and finds the correlations increased significantly after the US crash. Calvo and Reinhart (1996) focus on the emerging markets and find that the correlations in equity prices and Brandy bonds between Asian and Latin American emerging markets increased significantly during the 1994 Mexican peso crisis. Baig and Goldfajn (1999) test for contagion in equity indices, currency prices, interest rates and sovereign spreads in emerging markets during the 1997-1998 Asian crisis and document a surge of cross-market correlations during the crisis for many of the countries. Bekaert, Harvey and Ng (2003) and Dungey et al (2003) indicate that the contagion existed in Asian countries during the Asian crisis.

On the other hand, Forbes and Rigobon (2001, 2002) show that examining the unadjusted correlation is biased due to the presence of heteroskedasticity between samples. After correcting this bias, they do not find any contagion during the 1997 Asian crisis, the 1994 Mexican peso collapse, and the 1987 US equity market crash. Instead, there exists a high level of market co-movement during these crises periods,

[6] This general definition is from Dornbusch et al (2001) and Karolyi (2003)

which reflects a continuation of strong cross-market linkages present globally. Their conclusion is "there is no contagion, only interdependence".

The literature on the contagion effect focuses on the market evidence and examines whether contagion exists across markets. However, studying the contagion at the market level may mask the contagion effect due to the different industrial composition contained in the market returns. Contagion may be sustained in a group of specific sectors while other sectors may be not or less affected by the external unexpected shocks. On the other hand, the breakdown of national barriers and the rising importance of industry factors have strengthened the linkage between equivalent sectors across different markets. The increasing co-movement between global sectors may provide a channel in propagating idiosyncratic shocks and spillovers.

So the final major contribution of the thesis to the literature is the study on contagion at the sector level, an issue which is equally important but has not yet been examined in the literature. The research presents a study on contagion from a unique perspective for it incorporates the empirical findings of other papers and provides new implications for international diversification.

1.4 Structure of the thesis

The thesis consists of six chapters. Chapter 3, 4 and 5 are the three papers that represent the main body of this doctoral dissertation. Chapter 2 presents a comprehensive explanation to the econometric methodologies applied in the three papers. The chapter is divided into three sections. After a brief introduction in section one, section two details the factor decomposition approach with constrained betas which is employed in the first paper included in Chapter 3, and the factor decomposition with unconstrained betas which is used in the second paper in Chapter 4. The last section is devoted to the two-factor international asset pricing model applied to the empirical analysis of the third paper in Chapter 5.

The main empirical body of the thesis starts in the third chapter. The paper in Chapter 3 examines the relative importance of country versus industry effects in the global equity returns to document the changing roles of those factor effects and their divergent behaviour across different regions. The factor decomposition with constrained betas methodology allows separating the various factors and disentangling the "pure" global, country and industry factor returns which are orthogonal to one another. By calculating the variance of those pure factor returns in different sub-periods and across different regions (Europe, Asia, North America and Latin America), the paper explores whether the country and industry effects change over time and whether those factor effects vary across regions. An MAD (mean absolute deviation) approach is also used to confirm the above findings. Finally the paper looks at the different behaviour between traded goods and non-traded goods industries in view of their differences in international trade, exchange rate and global risk exposures.

Chapter 4 reports a study that uses firm level returns and accounting data to examine the different behaviour of global, country and industry effects between developed and emerging markets. Further, the work attempts to investigate the sources driving the dynamics of those factor effects in both developed and emerging markets.

In view of the problems involved in the factor decomposition with constrained betas, the imposed constraints are relaxed to allow the betas to differentiate across individual firms and the factor decomposition with unconstrained betas methodology is applied into the analysis. A two-step iterative approach suggested by Marsh and Pfleiderer (1997) and Cavaglia, Cho and Singer (2001) is conducted to obtain the loadings of unconstrained betas of global, country and industry factors, which are used to compare how much a firm's total variance is due to the respective global, country and industry effects.

In examination of the sources driving the dynamics of those factor effects, cross-sectional analysis across all firms is conducted to see whether the structure of factor effects is systematically connected with the business globalization (proxied by the firms' foreign sale ratios) and capital market integration (proxied by ADRs), and whether the structure is different between developed markets and emerging markets. The effect of a firm's TMT affiliation on the structure is also tested. The result should be useful in answering the question of whether the increase of industry effects is related to the IT bubbles at the turn of the century.

The paper in Chapter 5 studies the sector level integration and contagion in 29 smaller markets in Europe, Asia and Latin America. The two-factor (global and regional) international asset pricing model framework of Bekaert, Harvey and Ng (2003) is employed. Essentially, the framework decomposes the correlations of sector returns into two components: the part the asset pricing model explains (the expected returns) and the part the model does not explain (the residuals). The explained part controls for the economic fundamentals and provides insights on sector level integration through the movements in the conditional betas. The unexplained part allows examining the correlation of model residuals. Any significant correlation found in the residuals is beyond what our model can account for and therefore suggests evidence of contagion.

In this doctoral thesis, we perform the proposed empirical analysis by using the weekly data starting from the year of 1990 up to the year of 2004. The choice of weekly data is based on the following consideration: due to the non-synchronous trading hours across markets, the use of higher frequency returns may induce bias in examining the country and industry effects. Since international markets trade at different times, examining the industry effects with one-day returns on a calendar-day basis may lead to incorrect inferences about the degree of co-movement in returns (Griffin and Karolyi, 1998). On the other hand, had we used monthly data, much of the information contained in the data would have been lost. The same argument applies to the contagion analysis.

The reasons for choosing the sample period starting from the year of 1990 are: firstly, our market coverage includes both developed and developing countries. The data for most of the developing countries are only available around this time. For example, the price information for emerging markets included in the Dow Jones Global Indexes (DJGI) used in the first paper was collected and compiled from the year of 1990. Secondly, the increase of industry effects is a recent phenomenon and a sample period starting from 1990 is able to pick up the change of the factor effect dynamics. And thirdly, with regard to the contagion analysis, a series of financial and currency crises occurred in the last decade or so and the contagion effect was frequently observed during this period of time.

Finally, Chapter 6 summarizes and concludes this thesis. The chapter also includes a discussion of the new implications for international diversification as well as suggestions for future research.

The three papers have been submitted for publication to international academic journals. The first paper is forthcoming in the European Journal of Finance and the second paper in the Journal of International Money and Finance. The papers have been presented at various conferences, such as FMA (Financial Management Association) European conference 2004 in Zurich, the MMF (Money, Macro and Finance) conference 2005 in London, the 3rd INFINITI conference 2005 in Dublin, the EMG (Emerging Markets Group) conference 2004 and 2005 in London, PhD Research Day 2003 and various workshops at Cass Business School.

CHAPTER TWO

A REVIEW OF THE APPLIED METHODOLOGIES

2.1 Introduction

The correct modelling and identification of characteristics of equity returns is essential for the empirical analysis. This thesis employs different methodologies in studying the various characteristics of returns in the international equity markets. While the dummy variable model of Heston and Rouwenhorst (1994) is used to investigate the country and industry effects at the market level (Chapter 3), the two-step iterative approach developed in Cavaglia, Cho and Singer (2001) and Marsh and Pfleiderer (1997) is employed to the analysis of country and industry effects at the firm level (Chapter 4). In fact, the two methodologies are inter-related, with the former one characterized as factor decomposition with constrained betas and the latter one as factor decomposition with unconstrained betas. On the other hand, a two-factor international asset pricing model of Bekaert, Harvey and Ng (2003) is applied to test the various integration hypotheses and the contagion effect at sector level (Chapter 5). This chapter is devoted to provide a detailed and coordinated introduction to the models and methodologies used in later chapters and to demonstrate why those models and methodologies are chosen and how they meet our research purposes.

2.2 Modelling the country/industry effects

2.2.1 Factor decomposition: constrained betas

A simple way to determine the relative importance of country versus industry effects is to analyze the correlations of country and industry indices over time. However, because indices contain both country and industry effects, we do not know if a change in the correlations between two indices is due to the country element or to the industry element of the index returns. Given the above, the studies in this area have focused on isolating the "pure" country and industry factors so that each factor does not contain any bias from the other. A workhorse model is by Heston and Rouwenhorst (1994), which has been generally adopted in the literature since then.

The starting point of modelling the pure country and industry factors is the factor decomposition approach, which decomposes the equity returns into global, country, industry and firm-specific factors. Denoting R_{nt} the return on equity n in country c and industry i in period t, where n goes from 1 to N and t goes from 1 to T, we have

$$R_{nt} = \beta_n^G f_t^g + \beta_n^C f_t^c + \beta_n^I f_t^i + e_{nt}, \tag{2.1}$$

where f_t^g is the return on the global factor, f_t^c and f_t^i are the returns on the country factor c and industry factor i, respectively, and e_{nt} represents the idiosyncratic shock to the return on equity n, all in period t. β_n^G, β_n^C and β_n^I represent loadings on the global, country and industry factors respectively.

However, not just one country and one industry is examined in the model. In fact, the sample of countries and industry classifications included in the analysis vary in different papers. Suppose country c goes from 1 to C ($c = 1,...,C$) and industry i goes from 1 to I ($i = 1,...,I$), the above model stacks up in the following form:

$$R_{nt} = \beta_n^G f_t^g + \sum_{c=1}^{C} \beta_{nc}^C f_t^c + \sum_{i=1}^{I} \beta_{ni}^I f_t^i + e_{nt} \tag{2.2}$$

The methodology used in Heston and Rouwenhorst (1994) is characterized as imposing the following restrictions in examining model (2.2):

$$\beta_n^G = 1$$

$$\beta_{nc}^C = \begin{cases} 1, & \text{if } n \text{ belongs to country } c \\ 0, & \text{otherwise} \end{cases}$$

$$\beta_{ni}^I = \begin{cases} 1, & \text{if } n \text{ belongs to industry } i \\ 0, & \text{otherwise,} \end{cases} \tag{2.3}$$

With constrained betas in (2.3), the factor model (2.2) is exactly the dummy variable model of Heston and Rouwenhorst (1994). For simplicity and comparison, we transform the model into the dummy variable form (at each time t):

$$R_n = \alpha + \sum_{i=1}^{I} \beta_i I_{ni} + \sum_{c=1}^{C} \gamma_c C_{nc} + e_n \tag{2.4}$$

where α is the constant which can be treated as the global factor. β and γ are the respective pure industry and country factor component of return. I and C denote the dummy variables that equal 1 if the return is from that particular industry or country and zero otherwise.

Model (2.4) represents a cross-sectional analysis at a particular point of time, t. However, it is not possible to estimate (2.4) because of perfect multicollinearity between the regressors. Each return observation belongs to both a country and an industry and the country dummies as well as the industry dummies add up to the unit vector. One way to solve this problem is to choose an arbitrary country and industry as a benchmark, and then compare the performances of country/ industry effects against this benchmark. However, the results might be awkward to interpret and difficult to understand. Suits (1984) and Kennedy (1986) provide a way out for dummy variable regression which makes the estimation more useful and easier to interpret. Following their approach, Heston and Rouwenhorst (1994) apply the following restrictions[7]:

$$\sum_{j=1}^{I} w_j \beta_j = 0 \tag{2.5a}$$

$$\sum_{k=1}^{C} v_k \gamma_k = 0 \tag{2.5b}$$

where w_j and v_k are the value weighs of industry j (j =1,..., I) and country k (k =1,...,C) in the European value-weighted market, and $\sum_j w_j = \sum_k v_k = 1$. By setting the market-cap-weighted average of both the country and industry coefficients to be zero, the constant, α , then represents the return of cap-weighted European market index (their samples include only the European countries) and all the pure country and industry returns are measured relative to this benchmark. Those pure factor returns are diversified portfolios in the sense that they have the same (value-weighted) geographical and industrial distribution as the European value-weighted index.

A weighted least square (weighed by market cap) estimation of model (2.4) subject to restrictions of (2.5) for each point of time, t, yields a time series of coefficients of the intercept ($\hat{\alpha}$), the country and industry factor returns ($\hat{\beta}$ and $\hat{\gamma}$). Those time series of coefficients enable us to compare and analyze the relative

[7] They also set the simple average of coefficients to be zero and compare the country and industry pure return performances against the European equally weighted index. The paper in this thesis applies only the market cap weighted average in estimation, so only their weighted average demonstration is reported.

importance of global (or regional), country and industry effects in equity market returns.

2.2.2 *Factor decomposition: unconstrained betas*

However, constraining the factor betas of model (2.2) as in Heston and Rouwenhorst (1994) may result in an unnecessary loss of information. For example, if two firms are identical in every aspect except that one has higher leverage than the other, then the two must have different sensitivities to the country and industry factors. It is also hardly convincing to assume that firms like Nokia, which accounts for about 60% of the total market capitalization of Finland, has the same loadings as other smaller firms in the country on the country and industry factor returns. In the case of industry factor, the restriction implies that all equities in the financial services industry have the same loadings to that factor no matter whether a firm is a diversified financial services provider or a small bank, which is likely to be violated in the data. In addition, it runs counter to much of the empirical finance literature on the CAPM or the APT, where the key difference across companies is in their betas. Further, Harvey, Solnik, and Zhou (1994) demonstrate that differences in risk loadings are important in accounting for the cross-sectional variation in industry and country equity returns.

In view of the above, some papers (e.g. Brooks and Del Negro, 2003; Cavaglia, Cho and Singer, 2001; and Marsh and Pfleiderer, 1997) have examined the factor effects by employing the factor decomposition with unconstrained betas. In this case, betas in model (2.2) are allowed to vary across firms when they are not zero:

β_n^G = unconstrained

$$\beta_{nc}^{C} = \begin{cases} \text{unconstrained, if } n \text{ belongs to country } c \\ 0, \text{ otherwise} \end{cases}$$

$$\beta_{ni}^{I} = \begin{cases} \text{unconstrained, if } n \text{ belongs to industry } i \\ 0, \text{ otherwise,} \end{cases} \tag{2.6}$$

In estimating the model (2.2) under the conditions of (2.6), two approaches have been initiated in the literature. Marsh and Pfleiderer (1997) propose a two-step iterative approach: in the first step, the values for the factor loadings are initially assumed as either unity or zero, and a cross-sectional regression yielding the pure global, country and industry factor returns is estimated at each time point. In the second step, the time series of the pure factor returns are standardized (unity variance) and used in ordinary least squares (OLS) estimates of Model (2.2) to obtain the new factor loadings (unconstrained betas) for each firm. This iteration procedure is repeated until convergence is obtained. This approach is also employed in Cavaglia, Cho and Singer (2001).

On the other hand, Brooks and Del Negro (2003) uses the Lehmann and Modest (1985) EM algorithm to obtain the maximum likelihood estimates of model (2.2) under the assumptions of both the factors and idiosyncratic shocks are normally distributed. The EM algorithm follows the same intuition as Marsh and Pfleiderer's iterative procedure, but delivers the maximum likelihood estimates.

However, as Brooks and Del Negro (2003) point out, the maximum likelihood method can only be applied to balanced panel data. Estimation based on this method might lose much essential information as many firms will be excluded from the model due to their lack of full data coverage. So studying the firm level country/industry effects in this thesis follows the methodology in the spirit of the iterative approach of Marsh and Pfleiderer (1997) as much of our sample data are unbalanced.

2.3 Modelling market integration and contagion effect

2.3.1 Two-factor international asset pricing model

Papers studying the equity market contagion are voluminous. Contagion can be defined as the excess correlation over and above what one would expect from economic fundamentals[8]. However, the literature has shown no agreement on the definitions of the fundamentals, the potential country-specific nature of the fundamentals, and the mechanism that links the fundamentals to asset correlation. On the other hand, the traditional correlation analysis of contagion (as in King and Wadhwani, 1990; Bertero and Mayer, 1990; and Baig and Goldfajn, 1999) may be biased as the correlation coefficients is an increasing function of the variance of the underlying asset return (Forbes and Rigobon, 2001, 2002).

Bekaert, Harvey and Ng (2003) have developed a two-factor asset pricing model to study the equity market contagion. The model takes a stand on the definitions of the fundamentals from an asset pricing perspective and contagion is defined simply by the correlation of the model residuals. The novelty of the model is that it not only avoids the problem with the bias correction for correlations that Forbes and Rigobon (2001, 2002) propose (i.e. the bias correction does not work in the presence of common shocks), but also has the maximum flexibility in testing various market integration hypotheses. The two-factor model of Bekaert, Harvey and Ng (2003) is used in this thesis to study the equity market integration and contagion at sector level.

The international version of the conditional CAPM of Sharp (1964) and Lintner (1965) under the assumption of purchasing power parity (PPP) generally

[8] Various definitions of contagion are employed in the literature. See details on the World Bank's website: http://www1.worldbank.org/economicpolicy/managing%20volatility/contagion/

focuses on one source of risk or on the effect of a single international market (often the US or world market). Some papers extend the traditional one-factor model to two-factor setting by adding the currency risk (e.g. Ferson and Harvey, 1993; Dumas and Solnik, 1995). Bekaert, Harvey and Ng (2003)'s two factor model includes one global source of risk from the US and one regional source of risk from a particular region. It also allows for local factors to be priced. The model has the following form:

$$R_{i,t} = \delta_i Z_{i,t-1} + \beta_{i,t-1}^{us} \mu_{us,t-1} + \beta_{i,t-1}^{reg} \mu_{reg,t-1} + \beta_{i,t-1}^{us} e_{us,t} + \beta_{i,t-1}^{reg} e_{reg,t} + e_{i,t}, \tag{2.7a}$$

$$e_{i,t} \mid \Omega_{t-1} \sim N(0, \sigma_{i,t}^2), \tag{2.7b}$$

$$\sigma_{i,t}^2 = a_i + b_i \sigma_{i,t-1}^2 + c_i e_{i,t-1}^2 + d_i \eta_{i,t-1}^2, \tag{2.7c}$$

where $R_{i,t}$ is the excess return of national index of country i in US dollars. $\mu_{us,t-1}$ and $\mu_{reg,t-1}$ are the conditional expected excess returns on the US and a regional market, respectively, based on information available at time *t-1*; and $e_{us,t}$ and $e_{reg,t}$ are the respective residuals of the US and regional market excess returns. $e_{i,t}$ is the idiosyncratic shock of any market i, and Ω_{t-1} includes all the information available at time *t-1*. The variance of the idiosyncratic return shock of market i follows a GARCH process as specified in (2.7c) with asymmetric effects in conditional variance. $\eta_{i,t}$ is the negative return shock of market i, i.e. $\eta_{i,t} = \min\{0, e_{i,t}\}$. The vector $Z_{i,t-1}$ contains a set of local economic fundamentals which help estimate the expected return of market i.

In model (2.7), the parameter $\beta^{us}_{i,j,t-1}$ measures the sensitivities of market i to the US news factors, which derive from two components: the conditional expected returns ($\mu_{us,t-1}$) and the residuals ($e_{us,t}$). An analogy applies to the parameter of $\beta^{reg}_{i,j,t-1}$, which measures the sensitivities of market i to the regional news factors. The conditional betas $\beta^{us}_{i,j,t-1}$ and $\beta^{reg}_{i,j,t-1}$ are the cornerstone of testing the market integration, where the integration can be global or regional.

In examining the model, Bekaert, Harvey and Ng (2003) show that market returns, together with the US and regional market returns, can be treated as a joint multivariate likelihood function. This joint function is estimated in three stages. In the first stage, the model for the US market is estimated, and then based on the US estimates, the regional market model is examined. In the final stage, a univariate model in (2.7) is estimated market by market, conditioning on the US and the regional market estimates.

2.3.2 Time-varying conditional betas

It is now well known that the betas are time-varying. To address this time variation, three common approaches have been adopted in the literature. One approach is to model the time-varying coefficients through instrumental variables. For example, in model (2.7) Bekaert, Harvey and Ng (2003) allow the coefficients of betas to be influenced by the trade pattern since Chen and Zhang (1997) find that the cross-market correlations of equity returns are related to external trade among countries. However, relating the time-varying betas to specific variables may be problematic in a sense they only account for part of the time variation due to the omission of other variables which might have an important impact on the process.

The second approach uses the GARCH processes to capture the time-varying betas (e.g. Conrad, Gultekin and Kaul, 1991; Bekaert and Wu, 2000). In GARCH models, betas are time-varying but the variations in the betas are strictly driven by past innovations in returns. So many papers use a third approach: the rolling estimation method to document the time variation of betas. This method is used in the market integration analysis. For example, Fratzscher (2002) develops a trivariate GARCH model to examine the size of spillovers from European and US equity markets to 16 individual countries in OECD as an indication of the degree of market integration. The paper applies the rolling estimation to capture the time variation of spillover coefficients. The author takes a 12-month regression window to obtain the estimated coefficients and then move this 12-month window forward by one month at a time. The technique is also employed in other integration papers such as Kaltenhauser (2002, 2003).

In studying the time-varying integration at sector level, this thesis follows Fratzscher (2002)'s rolling estimation technique to allow the conditional beta coefficients to change over time. Although the method has some shortcomings, it can provide a good first proxy of the volatility of the parameters of the system (Fratzscher, 2002).

2.3.3 Contagion analysis

As said earlier, Bekaert, Harvey and Ng (2003)'s two-factor asset pricing model can test the market contagion, where the contagion is defined by the correlation of the model residuals. Two types of contagion are established: an overall contagion over the entire sample period and an additional contagion during a particular crisis period. The test involves the following time-series cross-section regression model:

$$\hat{e}_{i,t} = w_i + v_{i,t}\hat{e}_{g,t} + u_{i,t} \tag{2.8a}$$

$$v_{i,t} = v_0 + v_1 D_{i,t} \tag{2.8b}$$

where $\hat{e}_{i,t}$ and $\hat{e}_{g,t}$ are the estimated idiosyncratic return shocks of market i and country-group g respectively. This country-group can be the US market or the regional market. $D_{i,t}$ is a dummy variable that represents a particular crisis period such as during the Mexican crisis in 1994-1995 and the Asian crisis in 1997-1998. The tests of model (2.8) can determine whether there is an overall contagion ($v_0 = v_1 = 0$) and whether there is additional contagion during a particular crisis period ($v_1 = 0$). This time-series cross-section regression model is employed in this thesis to test if contagion exists at the sector level in equity markets.

CHAPTER THREE

THE CHANGING ROLES OF INDUSTRY AND COUNTRY EFFECTS IN THE GLOBAL EQUITY MARKETS

3.1 Introduction

Diversifying a financial portfolio by adding international investment improves the portfolio's risk-return characteristics. This international diversification benefit, first identified in Grubel (1968), is now well documented by academics and experienced by investors. International diversification benefits stem from the fact that equity markets are not perfectly integrated due to country specific factors, such as local monetary and fiscal policies, and differences in institutional and legal regimes. These country factors may act as a wedge to separate equity markets from full integration and induce large country specific variation in returns. On the other hand, however, the diversification benefits might be due to the differences in the national industrial compositions. For example, investing in Switzerland means a disproportionate bet on banking industry and diversification into Australia places a large bet on basic resources. As Roll (1992) argues, industry factors are important in explaining cross-sectional differences in volatility, as well as the correlation structure of country index returns. The relative importance of country factors versus industry factors in the equity return process defines the diversification strategies for financial portfolio management. If country factors are more important, diversification across countries is a more effective tool in reducing the portfolio risks. Conversely, if industry factors are more important, diversification across industries has more merits in achieving the risk reductions.

Whether the national return variation is driven by country effects or industry effects has long been a challenge to academics. Early studies including Lessard (1974) and Solnik (1974) have documented the influence of industry effects on country index returns. Both papers conclude that country effects dominate industry effects. The dominance of country effects over industry effects has also been identified in most of the recent studies. For example, Heston and Rouwenhorst (1994) analyse 12 European countries (MSCI Indexes) on 829 stocks and 7 broad industries from 1978-1992 and find that the industrial structure explains less than 1% of the variance of equally-weighted country index returns and the low correlation between country indexes is almost completely due to country-specific sources of return variation. The small industry effects imply that country diversification remains more effective than industrial diversification.

Using data from Dow Jones Global Indexes which include 25 worldwide countries and 66 well-defined industries during the period of 1992-1995, Griffin and Karolyi (1998) report that the industrial composition of country indexes can only explain 4% of the variation in the average country index, and the country effects dominate the industry effects for the time period examined. Similar results are also found in Grinold et al. (1989), Beckers, Grinold and Stefek (1992), Drummen and Zimmermann (1992), Heston and Rouwenhorst (1995), Beckers, Connor and Curds (1996) and Rouwenhorst (1999).

Yet the more recent papers by Baca et al. (2000) and Cavaglia, Brightman and Aked (2000) contrast themselves by showing that the industry effects are as equally important as, or even more important than, the country effects. Baca et al. use data from Datastream Global indexes and study 10 sectors in the 7 largest countries from 1979-1999. They find a significant shift in the relative importance of national and economic influences in the equity returns of the world's largest equity markets. In these markets, the impact of the industrial sector effects is now roughly equal to that of the country effects. By studying 36 industries in 21 developed countries in MSCI indexes from 1986 to 1999, Cavaglia, Brightman and Aked provide evidence showing that the industry effects have been growing in relative importance and may now dominate the country effects. They also reveal that over the past five years, diversification across global industries has provided greater risk reduction than diversification by countries. The same findings are also found in L'Her et al (2002), Brooks and Del Negro (2004) and Flavin (2004).

Studies in the literature have shown no consensus on the number of countries and industries which are included into their estimation. For example, some authors use broader industry sectors rather than the partitioned industry groups. There are also many researchers who test their results by employing data of a certain region such as Europe. An analysis of returns consisting of fewer countries and smaller number of industry groups, analogous to examining portfolio returns less diversified across countries and industries, may reduce the power of the tests and induce bias in the estimation. In this paper, we employ a new comprehensive database, The Dow Jones Global Indexes (DJGI), which are based on 34 countries and 51 industry group categories, to re-examine the relative importance of country and industry effects in the international equity returns. Our analysis focuses on the following issues:

First, we examine the evolution of country and industry effects over time, which might explain the contrasting findings in the literature relevant to the relative importance of country and industry effects. Though the country effects have traditionally dominated the industry effects, recent economic developments might have caused that dominance to shift. With the increasing financial market integration and business globalization in recent years, the country boundaries would be blurred and the country effects diminished. At the same time, the industry effects, which are more pertinent to the global business cycles, would become more important. By using the most recent data from DJGI, we explore whether the dynamics of country and industry effects have been changing over time. In fact, our findings nest the earlier studies and provide an explanation for their contrasting results.

Second, we study the heterogeneity of country and industry effects across regions. The formation of large economic and trading blocks such as EU, NAFTA and ASEAN, has accelerated the regional integration in economic activities. Notably, in Europe the establishment of the European Monetary Union (EMU) and the increasing harmonization of government policies stand in contrast to the other regions. The regional integration and the varying degree of regional economic concentration may suggest that the dynamics of country vs. industry effects vary across different regions, and therefore analyses based on one region as in many earlier studies might be misleading.

Third, we explore whether the recent increase of industry effects is due to IT bubbles. Brooks and Del Negro (2004) find that the rise of industry effects is only confined to the TMT (Technology, Media and Telecommunications) sectors, and it has been caused by IT bubbles and is thus a temporary phenomenon. We address this issue in our estimation by investigating whether the increase of industry effects is an industry-wide phenomenon or just prominent in TMT sectors.

Finally, we examine whether there are any differences between traded goods and non-traded goods industries, as suggested by Griffin and Karolyi (1998).

The paper is organized as follows: Section 3.2 discusses the data and methodology, and Section 3.3 presents the descriptive statistics and our major results. Section 3.4 tests the robustness of our results by excluding the TMT sectors, which could have been responsible for the increase of the industry effects in recent years. The last section summarizes our results and discusses the implications for portfolio diversification.

3.2 Data and Methodology

3.2.1 Dow Jones Global Indexes Data

The Dow Jones Global Indexes database has a comprehensive coverage both across industries and across countries. Its coverage represents 95% of free float market cap at the country level and comprises large cap, mid-cap and small-cap equities. Up to present, the indexes include 51 well partitioned industry groups and 34 worldwide countries, 11 of which belong to emerging markets.[9] In a sense, the indexes are well diversified both across countries and across industries, and the estimation based on such dataset will be less biased and reflect more accurately the universal global industry effects.

The data used in this paper are the weekly industry-level total return series. We use US dollar-denominated, Wednesday to Wednesday total return indexes spanning the period from Jan 8, 1992 to Dec 26, 2001, with a total of over 1030 observations at a point in time. There are altogether 50 industry groups and 34 countries covered in our analysis.[10]

Table 3.1 presents the coverage of indexes both across countries and across industries (as of date Dec 26, 2001). The number of companies included in the global indexes is 4801, with US represented by the highest number, 1650, and Venezuela by the lowest, 5. Panel A reveals the number of industries present in each country. The US is represented in 50 industries and Austria and Venezuela are represented in fewer

---

[9] The emerging markets in our sample were: Brazil, Chile, Mexico, Venezuela, South Korea, Taiwan, Philippines, South Africa, Malaysia, Indonesia and Thailand.

[10] The industry data are downloaded from Dow Jones website, http://www.djindexes.com. Dow Jones indexes classify the industries into 51 industry groups. In our sample, one industry group, the technology services, is not available during the time period examined.

than 10 industries. Panel B shows the number of countries covered in each industry group. Only 9 out of the total 50 industries have coverage in fewer than 10 countries.

3.2.2 Methodology

We apply in our analysis the dummy variable regression framework of Heston and Rouwenhorst (1994) and Griffin and Karolyi (1998). The return of an equity can be decomposed into four components: a common factor, an industry effect, a country effect and a firm-specific disturbance. The model has the following form:

$$R_{ijkt} = \alpha_t + \beta_{jt} + \gamma_{kt} + e_{it} \tag{3.1}$$

where R_{ijkt} is the return of an equity i that belongs to industry j and country k in period t. α_t is a common factor, β_{jt} is the pure industry effect for industry j, γ_{kt} the pure country effect for country k , and e_{it} is a firm-specific disturbance, which is assumed to have a zero mean and finite variance for returns in all countries and industries, and uncorrelated across equities. Model (3.1) allows separate influences of industry and country effects, but rules out any interaction between these effects. Our data include 50 industry categories distributed over 34 countries, so for each period t, we re-write model (3.1) as:

$$R_i = \alpha + \sum_{j=1}^{50} \beta_j I_{ij} + \sum_{k=1}^{34} \gamma_k C_{ik} + e_i \tag{3.2}$$

Like in Griffin and Karolyi (1998), we use industry indexes to measure returns instead of individual equities. So R_i is the return on each industry index i. I_{ij} is an industry dummy variable that is to equal one if the index i belongs to industry j and zero otherwise, and C_{ik} is a country dummy variable that is equal to one if the index i is from country k and zero otherwise.

There is a perfect multicollinearity problem in the estimation of equation (3.2) since each return belongs to both one country and one industry. One way to solve the problem is to choose an industry and a country as benchmarks. However, to avoid the interpretation problem of an arbitrary benchmark, we apply the following constraints to equation (3.2) as other studies have done:

$$\sum_{j=1}^{50} w_j \beta_j = 0 \tag{3.3a}$$

$$\sum_{k=1}^{34} v_k \gamma_k = 0 \tag{3.3b}$$

where w_j and v_k denote the value weights of respective industry j and country k in the world market portfolio.

Based on equation (3.2) under restrictions of (3.3a) and (3.3b), we run cross-sectional regression by the Weighted Least Squares (WLS) estimate. We weigh each equation by the market cap at the beginning of the week. The estimated intercept, $\hat{\alpha}$, then, can signify the world value-weighted market. The coefficients $\hat{\beta}_j$ can be interpreted as the "pure" industry effect relative to the value-weighted world market portfolio, and $\hat{\gamma}_k$ as the "pure" country effect relative to the value-weighted world market portfolio.

Note that the regressions above produce the industry and country effects for one particular week. By running a cross-sectional regression for every week, we obtain a time series of $\hat{\alpha}$, $\hat{\beta}_j$ and $\hat{\gamma}_k$. Based on those estimated $\hat{\alpha}$, $\hat{\beta}_j$ and $\hat{\gamma}_k$, we apply two methods to gauge the relative importance of country and industry effects. The first one is to compute and compare the variances of country versus industry effects in the value-weighted country and industry index returns. The estimation procedure shown above allows us to decompose the value-weighted index return of country *k*, R_k, into a component common to all the countries, $\hat{\alpha}$, the value-weighted average of the industry effects (i.e. cumulative industry effects) based on the unique industrial composition of that country's index, and a pure country specific effect, $\hat{\gamma}_k$, as follows:

$$R_k = \hat{\alpha} + \sum_{j=1}^{50} x_{k,j} \hat{\beta}_j I_{k,j} + \hat{\gamma}_k \tag{3.4}$$

where $x_{k,j}$ denotes the proportion of the total market cap of country *k* included in industry group *j*. Equation (3.4) states that the return in, say, Hong Kong, may differ from the world market portfolio because the industrial composition of Hong Kong market is different from the industrial composition of the world market portfolio, and because the returns of Hong Kong equities are different from returns on equities in the same industry in other countries. Similarly, the return index of an industry *j*, R_j, can be decomposed into a component common to all the industries, $\hat{\alpha}$, the value-weighted average of the country effects (i.e. cumulative country effects) based on the unique industry index, and a pure industry effect $\hat{\beta}_j$:

$$R_j = \hat{\alpha} + \sum_{k=1}^{34} \phi_{k,j} \hat{\gamma}_k C_{k,j} + \hat{\beta}_j \tag{3.5}$$

where $\phi_{k,j}$ represents the proportion of the market cap of the industry j index composed of country k's equities.

The second method of comparing the relative importance of country and industry effects is the use of mean absolute deviation (MAD). Formally, the industry or country MADs are defined as the absolute value of estimated industry or country effect in time t multiplied by the corresponding market cap at that time. So, country and industry MAD can be written as:

$$MAD_{Ct} = \sum_{k=1}^{34} v_{kt} \left| \gamma_{kt} \right| \tag{3.6a}$$

$$MAD_{It} = \sum_{j=1}^{50} w_{jt} \left| \beta_{jt} \right| \tag{3.6b}$$

MAD was employed in Rouwenhorst (1999) and Cavaglia, Brightman and Aked (2000). It can be thought of as the cap-weighted returns of "perfect foresight" strategies that are exclusively based on either country or industry tilts. The country MAD can be interpreted as the capitalisation weighted average tracking error for returns on industry-neutral country portfolios. The industry MAD has an analogous interpretation.

3.3 Empirical Results

3.3.1 Descriptive statistics

Table 3.2 summarizes the means and standard deviations of the average raw returns across 50 industries and 34 countries during the full time period and the three sub-periods. All returns are measured in US dollars and expressed as percent per week. The country returns at the top panel display quite a large difference not only across countries but also over time. During the entire sample period, the highest average return went to the US. The worst players were Greece, Indonesia, Philippines, Thailand and Taiwan, which experienced negative returns. In terms of the standard deviation, Korea, Indonesia, Malaysia and Venezuela were the most volatile countries. In general, emerging markets exhibited higher volatility than advanced markets did. Closer examination of the sub-periods shows that in the first sub-period equity returns were much higher (and more volatile) in emerging markets than in the advanced markets. In the second sub-period, which covered the Asian crisis, emerging markets performed as expected much worse than advanced markets (i.e. lower returns and higher volatility). During the third sub-period, all countries with very few exemptions experienced negative returns and high volatility. In fact, 27 out of the 34 countries had negative returns in the last period.

The bottom panel in Table 3.2 shows that industry performance was generally more uniform than country performance. On average, industries had a higher return and lower standard deviation than did countries. The average return and standard deviation for industries for the full period were 0.107% and 1.885% respectively. The corresponding figures for countries were 0.093% and 2.653%. The negative returns were present for most of the industries during the third sub-period. In fact, out of the total 50 industries, 41 had minus returns during this period. The standard deviations for industries during the three sub-periods were all smaller than those for countries. But the result also shows that the level of the industry volatility was increasing at a very fast speed from the first to the third sub-period, which is an indication that industries might have become increasingly important in recent years.

3.3.2 The global country and industry effects

We first look at the estimated results for our full sample period in Table 3.3. Panel A of Table 3.3 shows the comparison of pure country effects with the cumulative sum of industry effects for the country index returns based on equation (3.4), whereas Panel B compares the pure industry effects with the sum of country effects for the industry index returns based on equation (3.5). In Panel A, one quick conclusion to be drawn is that there are considerable differences across countries in the variances of country index components. The US had the smallest country effect variance (1.112%-squared), followed by UK (2.448%), Netherlands (3.065%) and France (3.614%). On the other hand, Brazil had the highest country effect variance (50.393%), followed by Indonesia (49.14%) and Venezuela (39.816%). Generally, developed countries had smaller country effects than developing countries. The level of country effect variance for all the developed countries was less than 10% (except for Finland, which was 26.766%), whereas the variance level for emerging market economies was over 10%, with the highest being more than 40 times that of US. Thus, emerging markets, compared to advanced markets, tend to exhibit large country effects and are more segmented from the rest of the world. On average, the pure country effects in our sample were 15.181%, whereas the average cumulative industry effects were only 0.791%.

In Panel B, the semiconductors industry had the largest variance of pure industry effect at 21.906%-squared. Other industries like advertising, biotechnology, communication technology, consumer services, investment services and tobaccos were also among the highest (around 10-15%). Overall, the average pure industry effects across all industries were 5.952%. On the other hand, the corresponding cumulative country effects stood at 0.554%.

Clearly the country effects were dominant over the cumulative industry effects in the country index returns as shown in Panel A. Likewise, the industry effects dominated the sum of country effects in the industry index returns as shown in Panel B. However, if comparing the average pure country versus industry effects, one can find that the former had a variance of 15.181%, while the latter had a variance of only 5.952%. The two effects had a ratio of 2.55:1. This result indicates that the country effects during our whole sample period were a more important determinant of variation in international returns than the industry effects.

The results derived from our full sample period may not reveal recent developments in the light of EMU, the Asian crisis and increasing mergers and acquisitions, which may have had an impact on the roles of country and industry effects in the global financial markets. In order to study the evolving process of those effects over time, we divide our sample into three sub-periods: the first sub-period is from Jan 1992 to Mar 1995. This is the time period studied by Griffin and Karolyi (1998). The second sub-period ranges from April 1995 to November 1999, and this sample period was examined by Cavaglia, Brightman and Aked (2000), who have found that industry effects were becoming increasingly more important. The third sub-period covers from Dec 1999 to Dec 2001, which includes the boom and bust of IT bubbles.

Our sub-period results are also shown in Table 3.3. Several points are noteworthy: first, Brazil had a very high country effect variance (92.66%) in the first sub-period and Indonesia a most volatile time (with variance of 81.843%) in the second sub-period. This comes as no surprise as Brazil was badly hit during Latin America financial and currency crisis in the early nineties and Indonesia had a political turmoil in the late nineties. Second, in Finland, both country and cumulative industry effects went up abruptly in the third sub-period, the time when the global technology bubbles prevailed. It should be pointed out that Finland's market heavily concentrates on the technology sector, which accounted for over 60% of its total market cap during the time examined.

In the first sub-period, the average pure country effects were 13.593%, against a value of 2.842% for the average pure industry effects. The two effects had a ratio of 4.78:1. Griffin and Karolyi (1998) report a ratio of 3.32:1 for the same time period. The higher ratio in our estimation is expected as our sample includes 7 more emerging markets than theirs. Yet the ratio kept decreasing in the second and third sub-periods: 3.17:1 in the second and only 1.29:1 in the third period. Closer examination reveals that the decrease of the ratio was entirely due to the increase of industry effects. In fact, the country effects were increasing across the three sub-periods: from 13.593% in the first up to 17.075% in the third sub-period. On the other hand, the corresponding industry effects went up from 2.842% to 13.152%. Obviously the industry effects were catching up with the country effects at a very fast pace. One thing to bear in mind is that the increase of country effects over time was not a reflection of the decrease of global market integration; rather, it was caused by some particular reasons in specific regions such as the financial crisis in Asia Pacific, as illustrated in the following sub-section.

During the third period, over one fifth of the industries had an industry effect higher than the average country effects. Such industries include not only technology and telecommunications industry groups, such as biotechnology, semiconductors, communications technology, software, but also other industries, such as consumer services, tobaccos, entertainment, household products and advertising.

Overall, our analysis demonstrates that the country effects still dominated the industry effects for the whole sample period. However, even though the country effects kept increasing over time, the industry effects were catching up at a faster speed, especially in the most recent years. In fact, in some of the industries as noted above which cover not only TMT sectors but also other non-TMT sectors, the industry effects had already outperformed the country effects.

3.3.3 The geographical breakdown of country effects

The global country effects analyzed above do not account for the geographical differences. As a matter of fact, the country effects in different regions may vary because of the regional substantial variations in how economic and financial integration have progressed. Our geographical breakdown of country effects can nest our study with other papers which focus on the European countries such as Heston and Rouwenhorst (1994, 1995) and Rouwenhorst (1999). In addition, it allows us to explore whether the evolution of country and industry effects in each region is consistent with the differences across regions in economic and financial integration.

We divide our sample of countries into 4 regions: Europe (16 countries), Asia Pacific (11), North America (2) and Latin America (4). For each region, we average the pure country effects and cumulative industry effects of the countries within that region to obtain the regional country effects and regional cumulative industry effects. We also divide our sample of countries into developed and emerging markets to detect any differences between the two markets. The results are presented in Table 3.4.

Panel A of Table 3.4 reports the country and cumulative industry effects across regions. During the entire sample period, Latin America exhibited the highest country effects (with a variance of 31.263%), followed by Asia Pacific with a variance of 21.251%. This is as expected since all the four countries included in Latin America belong to emerging markets, and there are 7 developing countries included in Asia Pacific. By contrast, the country effects for Europe and North America (including only the US and Canada) were much smaller (8.842% and 3.067% respectively).

The sub-period results show that compared to the first sub-period, the country effects for all the regions except Asia Pacific decreased in the second period. In the third sub-period, the country effects decreased in both Asia Pacific and Latin America, but increased in Europe and North America. Recall that the global country effects shown in sub-section 3.3.2 went up during the second and third sub-periods. By breaking down those country effects across regions, we find that the increase of global country effects during the second period was entirely due to the surge of country effects in Asia Pacific countries, which might be a consequence of the Asian crisis during that time period. On the other hand, the increase of global country effects during the third period was due to the climbing-up of country effects in Europe and North America.

Comparing the country effects in each region with the global industry effects, one can see that the country effects in North America were lower than the global industry effects for not only the full sample period, but for the three sub-periods as well. In Europe, the country effects were higher than the industry effects in the first and second periods, but for the third period, the two effects nearly levelled each other (13.783% of country effects vs. 13.152% of industry effects, a ratio of 1.05). There were no surprising results for the Asia Pacific and Latin America regions: the country effects had still dominated the industry effects not only for the full sample period but also for the sub-sample periods.

All in all, during the entire period of 1992-2001, the country effects had dominated the industry effects in all the regions except North America. The country effects for Latin America and Asia Pacific were much higher than those for Europe and North America. The ratios of country/industry effects were 5.25:1, 3.57:1 and 1.49:1 respectively for Latin America, Asia Pacific and Europe. Yet judging from sub-periods, the ratios for all the three regions were continuing to decrease (except for Asia Pacific in the second sub-period when the Asian crisis occurred). The ratios in the last sub-period were down to 1.44:1, 1.8:1 and 1.05:1 respectively for the above three regions. Especially in Europe, the industry effects almost levelled the country effects. The decreasing ratios across all the regions imply a tendency that not only in Europe, but globally, equity markets have become increasingly integrated. The only difference across regions is that the industry effects in Europe were catching up with the country effects at a faster rate.

Panel B of Table 3.4 shows the comparison of country and cumulative industry effects between developed and emerging markets. It confirms our geographical breakdown analysis that the emerging markets tend to have larger country effects. It also indicates that during the third sub-period, the industry effects began to dominate the country effects in developed markets. Generally, the result suggests that it was only in recent years that the industry effects had become more important than the country effects in the developed world, as those developed markets had lower country effects and might be more globally integrated not only relative to the emerging markets but also over time.

3.3.4 The global and regional country vs. industry effects: MAD estimation

We conduct MAD estimation in our analysis to investigate the changing roles over time as well as the regional differences between the country and industry effects. Figure 3.1-3.7 plot the 52-week moving averages of industry and country MADs for the globe, the 4 regions and the developed vs. emerging markets. Notice that the regional country and industry MADs are calculated in the same way as the global country and industry MADs except that the weight is the proportion of country or industry value in the regional portfolio. A similar procedure is applied to the calculation of MADs for developed and emerging markets.

Figure 3.1 shows that in the global markets, the country effects varied less compared to the industry effects during the whole sample period. Before the year 1998, the country effects dominated the industry effects. Since then, however, they had been outperformed by the industry effects so that the return opportunities from industry tilts had dominated those from country tilts.

Figures 3.2-3.5 are the MAD plots for the regions of Europe, Asia Pacific, Latin America and North America. Several common features are noteworthy: First, in the early stage of our sample period, the country effects dominated the industry effects in all regions, including North America. Second, the industry effects for all the regions showed an upward trend, although the increase was not identical across regions. Third, as in the global markets, the industry effects in all the regions increased sharply and then turned downwards during the last several years, which may be related to the boom and bust of IT bubbles. Nevertheless, such increase was not completely contributable to the IT bubbles as the level of industry effects at the end of our sample was still historically high, and even higher than the country effects in some regions.

In Europe, the industry effects surpassed the country effects within the year 1999 and the margin of the difference since then was wide relative to the scenarios in other regions. This finding supports the notion that the start of EMU as well as the introduction of single euro currency have accelerated the economic integration in the region and brought it to stand in contrast to the other regions. The dominance of industry effects over country effects took place earlier in North America, back in 1995. Yet the gap was very small and in the recent period, both country and industry effects went up abruptly and industry effects lost its dominance for a short time in 2000. Again this may be related to the burst of the technology bubbles. For Asia Pacific, the country effects hit the highest during 1997-1999, the Asian crisis period. After the crisis, the two effects were moving closer and the gap between the two had become narrower. In Latin America, there were two spikes present on the line of the country effects. The first one, which was also the highest, was related to the Latin America financial crisis during the early 1990s and the second happened at the time of the Asian crisis. Clearly the Asian crisis had a great impact on the region. Although the country effects dominated the industry effects in the region for the whole period, the gap was getting smaller and the importance of industry effects was increasing as well in recent years.

Figure 3.6 shows that for the developed countries, the industry effects increased very fast while the country effects were relatively constant. The former had dominated the latter with a great margin since 1998. On the other hand, Figure 3.7 reveals that in the developing countries, although the industry effects were all the way dominated by the country effects, their importance was increasing over time and the gap between the two effects was narrowing in recent years.

To sum it up, our MADs estimation indicates that the world had witnessed a major shift in the sources of importance in the return variation: industry effects began to dominate the country effects in recent years. The increasing importance of industry effects worldwide seems to coincide with the increasing process of business and financial globalization. Yet the situation varies across regions: while the industry effects became more important in Europe and North America in recent years, they were still dominated by the country effects in the regions of Asia Pacific and Latin America. In terms of the developed versus emerging markets, the former had shown the industry effect dominance and the latter the country effect dominance. It is clear that emerging markets had larger country effects and were less integrated with the rest of the world.

3.3.5 Traded vs. non-traded goods industries

Griffin and Karolyi (1998) point out that traded and non-traded goods industries might behave differently in terms of the variance of the pure industry effects. Traded goods industries are denoted with a "T" in parenthesis in Table 3.3. In fact, Table 3.3 shows that most of the traded goods industries exhibited greater industry effects than non-traded goods industries. We separate the industries into traded and non-traded goods industries to investigate whether there are significant differences between the two categories.

Table 3.5 indicates that compared to non-traded goods industries, the traded goods industries did have among the highest industry effects. The traded goods industries had a pure industry effect variance of 7.169% and non-traded goods industries had a variance of 5.43%. On the other hand, the sum of country effects for the traded goods industries was lower than that for the non-traded goods industries:

0.529% vs. 0.565%. Those results held true not only for the whole sample period, but also for the three sub-periods. F statistics strongly rejects the null that either the variance of pure industry effects or the cumulative sum of the country effects was equal between the two categories.

Therefore, during our whole sample period, as well as for the three sub-periods, traded goods industries had larger industry effects and smaller cumulative country effects than the non-traded goods industries. Such a significant difference between the two industry categories may have a theoretical explanation. For firms in traded goods industries, their profitability, cash flows and asset values are more sensitive to the external factors such as the international input and output price fluctuations and change of exchange rates, rather than domestic factors. So the sources of variation in global industry factors can be more important for equity prices of traded goods firms. Those traded goods firms as a whole tend to exhibit a higher co-variation. As a result, industry factors can explain a relatively larger proportion of the total variation in the index returns of traded goods industries.

3.4 Robustness Test

Our estimation shows that the industry effects were catching up and gaining in importance in the most recent years, although they were still dominated by the country effects during our whole sample period. The increasing importance of industry effects were closely related to the ongoing capital market integration worldwide. However, some papers, such as Brooks and Del Negro (2004), have argued that the recent increase of industry effects is confined to a narrow set of industry sectors—Technology, Media and Telecommunication (TMT)[11], while for the

[11] Those industries also include biotechnology industry.

rest of the industries, the industry effects are still dominated by the country effects. They further conclude in their paper that the recent rise of industry effect is not an indication of global market integration, rather it is a temporary phenomenon associated with the equity market technology bubble in the late 1990s.

To address the above issue and also to investigate the robustness of our analysis, we re-examine the country vs. industry effects by excluding the TMT sectors in our sample. The results for the detailed variance computation and the MAD estimation are listed in the appendices (Appendix 3A, 3B and 3C). We report in the paper the main findings.

At the global level, the average variances of the pure country effects and industry effects were 15.716% and 5.098 % respectively during the full sample period. The two effects had a ratio of 3.082:1, higher than the ratio of 2.55:1 in the prior estimation, which included TMT sectors. For the sub-periods, the ratio of the two effects dropped from 5.798:1 in the first period to 4.175:1 in the second period and further down to 1.291:1 in the third period (For comparison, the ratios for the three sub-periods in the prior estimation were 3.32:1, 3.17:1 and 1.29:1 respectively).

Looking at the results by regions, we find that the industry effects surpassed the country effects in North America during the full sample period. As far as sub-periods are concerned, in Europe the industry effects (11.419%) slightly outperformed the country effects (11.197%) in the third sub-period. This is a more favourable result compared to our prior estimation (the corresponding figures were 13.152% and 13.783%). While the industry effects were still dominated by the country effects in emerging markets in the third sub-period, they began to outperform the country effects in the developed markets.

Clearly, all those findings support our prior estimation. Our MAD estimations without TMT sectors further indicate that the industry effects in the late 1990s had surpassed the country effects at the global level and for the developed countries. In terms of regions, while the industry effects had been still dominated by the country effects in Asia Pacific and Latin America, the situation for Europe and North America had changed: the industry effects had become more important than the country effects in recent years.

Overall, our results were robust to the estimation which excludes TMT sectors. In other words, the recent growth of industry effects was not confined to a narrow set of TMT sectors. Rather, it was an industry-wide phenomenon which was embedded in the ongoing financial and business globalization process.

3.5 Conclusion

Previous literature has shown a mixed empirical result over the importance of country and industry effects in the international equity returns. In this paper, we employ a new comprehensive database, the Dow Jones Global indexes, to re-examine the issue with a focus on those effects' changing roles over time and their geographical divergence. Our sample covers 50 well partitioned industries and 34 worldwide countries for the time period of Jan 1992 – Dec 2001. Our results indicate that the earlier findings of the dominance of country effects over industry effects in papers such as Griffin and Karolyi (1998) and Heston and Rouwenhorst (1994) were due to their use of a sample period that only covered the 1980's and early 1990's. As we have shown, however, the importance of the two effects was changing over time and the industry effects were catching up with the country effects in recent years. In fact in some industries like semiconductors, technology, consumer services, household products, tobacco and entertainments, the industry effects had already outperformed the country effects.

Our results have also shown that the shift between the two effects varied across geographical regions. While the industry effects became more important in Europe and North America in recent years, they were still dominated by the country effects in Asia Pacific and Latin America. The results were in contrast to those found in some earlier studies on Europe, such as Rouwenhorst (1999) who employed the regional data for the period 1993-98. Our estimation of industry effects is based on a large number of countries and industries, which may be a more appropriate representation of the world portfolio.

We tested the robustness of our results by excluding TMT, which might have been the reason for the rising importance of the industry effects in recent years. Our results show that the increasing industry effects were not only bounded to the TMT sectors, but an industry-wide phenomenon which may be related to the globalization activities.

We also confirm the previous findings by Griffin and Karolyi (1998) of the different pattern within the traded and non-traded goods industries. Traded-goods industries, such as semiconductors, auto manufacturers, software and energy, tend to have higher industry effects than do the non-traded goods industries. The difference between the two types of industry is statistically significant for the entirely sample period as well as all the three sub-periods.

Our findings have several implications for international portfolio diversification strategies. First, while global portfolios focusing on diversification across countries still has merits, diversification across industries cannot nevertheless be neglected. For industries with higher industry effects such as semiconductors, consumer services, etc, it is more favourable to choose equities across those industries to diversify than to choose equities across countries. Second, diversifying portfolios across countries or industries also depends on the regions the assets are allocated. In Asia Pacific or Latin America, where most emerging markets are located, the traditional diversification across countries is still preferable. However, in Europe and North America, where the markets are more integrated, such traditional diversification will miss out the benefits of industrial diversification. Third, knowing the different characteristics of traded and non-traded goods industries is also important in the international diversification. Investing abroad in a manner that tilts toward traded goods industries should take into account the industrial composition of the portfolios. Otherwise the diversification potential would be impaired.

Tables

Table 3.1 Industry and country composition of Dow Jones Global Indexes
(as the data of Dec 31, 2001)

Panel A shows the number of industries in each country (with the number of companies covered in parentheses). Panel B shows the number of countries with representation in each industry. Traded-goods industries have a "T" to the right of their name in Panel B

Panel A

Country	*No. of Industries*	*country*	*No. of Industries*	*country*	*No. of Industries*
Australia(148)	38	Indonesia(28)	17	Singapore(91)	28
Austria(7)	6	Ireland(19)	13	South Africa(95)	31
Belgium(29)	18	Italy(82)	44	Spain(47)	23
Brazil(90)	20	Japan(695)	48	Sweden(63)	25
Canada(202)	42	Korea(113)	36	Switzerland(77)	29
Chile(38)	17	Malaysia(131)	30	Taiwan(237)	32
Denmark(23)	15	Mexico(34)	15	Thailand(35)	19
Finland(29)	19	Netherlands(57)	25	UK(321)	48
France(107)	41	New Zealand(16)	15	US(1650)	50
Germany(105)	43	Norway(20)	13	Venezuela(5)	2
Greece(45)	25	Philippines(18)	11		
HongKong(132)	36	Portugal(12)	10		

Panel B

Industry	*No. of countries*	*Industry*	*No. of countries*	*Industry*	*No. of countries*
Banks	30	forest prodts.(T)	20	textile/apparel(T)	14
fxdline communi.	29	publishing	20	auto part/equip (T)	13
leisure gds/serv.	27	broadcasting	19	container/packaging	12
food (T)	26	real estate	19	gas utilities	12
mining/metals (T)	25	airline	18	tobacco (T)	12
indust.services	25	chemical (T)	18	auto manufact (T)	10
buldg material	24	elect.utilities	18	consumer service	10
divers. Industrial	24	invest.services	18	aerospace	8
Retailers	24	pharmaceutical (T)	17	biotechnology	8
energy(T)	23	food produ.(T)	17	cosmetics (T)	8
communi. Tech	22	home construc.	17	health providers	8
Insurance	22	software(T)	17	household prodts.	8
indust.transport	22	semiconductors (T)	15	indust. Equip	8
Beverage	21	tech prodts (T)	15	advertising	7
divers.financial	21	elect.compo.(T)	14	water utilities	7
heavy constructn	20	adv.industry equip.	14	entertainment	5
wireless communi.	20	medical prodts	14		

Table 3.2 Summary statistics
(weekly data 1992-2001)

All the returns are measured in US dollar, expressed in percent per week. Standard deviation is also expressed in percent

Panel A	***By country***							
	Whole period		Sub 1		Sub 2		Sub 3	
	01/92- 12/01		**01/92-03/95**		**04/95-11/ 99**		**12/99-12/01**	
Country	*mean*	*std.dev*	*mean*	*std.dev*	*mean*	*std.dev*	*mean*	*std. dev*
Austria	-0.027	1.675	0.036	1.439	-0.033	1.762	-0.110	1.818
Australia	0.167	1.876	0.114	1.705	0.334	1.859	-0.125	2.129
Belgium	0.089	1.608	0.162	1.182	0.205	1.552	-0.282	2.163
Brazil	0.250	3.867	0.487	4.147	0.217	3.833	-0.042	3.487
Canada	0.162	1.881	0.070	1.466	0.250	1.885	0.109	2.384
Switzerland	0.128	1.920	0.197	1.347	0.253	1.716	-0.255	2.850
Chile	0.158	2.546	0.442	2.624	0.021	2.539	0.024	2.423
Germany	0.070	1.918	0.129	1.382	0.179	1.534	-0.263	3.051
Denmark	0.076	1.701	-0.042	1.747	0.100	1.248	0.203	2.378
Spain	0.071	1.852	-0.010	1.930	0.211	1.559	-0.116	2.277
Finland	0.116	1.656	0.149	1.113	0.184	1.571	-0.087	2.384
France	0.194	2.122	0.190	1.622	0.330	1.975	-0.105	2.947
UK	0.182	2.023	0.195	2.215	0.295	1.648	-0.089	2.428
Greece	-0.061	2.427	0.001	0.744	0.170	1.484	-0.670	4.693
HongKong	0.149	2.842	0.248	2.300	0.211	3.159	-0.139	2.858
Indonesia	-0.013	5.631	0.220	1.665	0.078	7.621	-0.575	4.191
Ireland	0.138	1.655	0.129	1.282	0.179	1.590	0.059	2.225
Italy	0.139	2.701	-0.009	2.980	0.319	2.457	-0.034	2.767
Japan	0.010	2.998	0.126	3.164	0.126	2.910	-0.429	2.911
Korea	0.113	4.729	0.360	2.544	0.067	5.843	-0.167	4.560
Mexico	0.082	3.809	-0.199	3.827	0.349	4.105	-0.079	3.001
Malaysia	0.090	4.079	0.407	2.248	-0.057	5.282	-0.071	3.063
Netherlands	0.159	1.837	0.191	1.350	0.255	1.777	-0.104	2.498
Norway	0.086	2.380	0.117	1.712	0.160	2.143	-0.128	3.513
New Zealand	0.114	1.752	0.272	1.392	0.041	1.757	0.034	2.185
Philippines	-0.018	3.339	0.425	1.979	-0.174	3.886	-0.353	3.637
Portugal	0.083	2.041	0.110	1.066	0.259	2.254	-0.348	2.573
Sweden	0.146	1.948	0.128	1.917	0.254	1.790	-0.065	2.302
Singapore	0.097	2.804	0.290	1.741	0.120	3.421	-0.253	2.586
Thailand	-0.085	3.720	0.305	2.311	-0.345	4.712	-0.104	2.845
Taiwan	-0.023	3.272	0.234	2.785	-0.058	2.931	-0.342	4.474
US	0.269	2.036	0.216	1.512	0.408	1.997	0.037	2.713
Venezuela	0.018	4.771	-0.233	4.271	0.088	5.528	0.249	3.539

South Africa	0.049	2.783	0.260	1.681	0.052	3.150	-0.285	3.229
Average	*0.093*	*2.653*	*0.168*	*2.011*	*0.148*	*2.779*	*-0.144*	*2.914*
Median	*0.093*	*2.251*	*0.176*	*1.726*	*0.179*	*2.070*	*-0.108*	*2.806*

Panel B ***By industry***

	Whole period		Sub 1		Sub 2		Sub 3	
	01/92- 12/01		**01/92-03/95**		**04/95-11/ 99**		**12/99-12/01**	
Industry	*mean*	*std. dev*	*mean*	*std.dev*	*mean*	*std.dev*	*mean*	*std. dev*
Advertising	0.114	2.385	0.052	1.312	0.414	1.887	-0.460	4.018
Airline	0.015	1.975	0.117	1.128	0.126	1.917	-0.392	2.886
Aerospace	0.067	1.821	0.106	1.515	0.145	2.031	-0.164	1.750
auto part/equip (T)	0.021	2.165	0.151	1.347	0.096	2.630	-0.345	2.010
auto manufact (T)	0.154	2.410	0.147	1.495	0.278	2.886	-0.111	2.384
buldg material	0.109	1.814	0.251	1.344	0.089	2.114	-0.066	1.716
Banks	0.231	2.052	0.320	1.470	0.317	2.404	-0.098	1.949
Broadcasting	0.090	2.281	0.169	1.062	0.259	1.563	-0.408	4.177
biotechnology	0.093	2.310	-0.029	1.343	0.266	1.726	-0.103	4.007
Beverage	0.135	1.637	0.221	1.235	0.092	1.919	0.096	1.498
chemical (T)	0.097	1.682	0.259	1.449	0.091	1.843	-0.138	1.625
communi. Tech	0.145	2.422	0.221	1.301	0.297	2.083	-0.313	3.945
heavy constructn	-0.023	1.944	0.147	1.269	-0.023	2.258	-0.286	2.033
cosmetics (T)	0.193	1.462	0.140	1.248	0.197	1.548	0.267	1.578
consumer service	0.080	2.121	0.249	0.983	0.169	1.964	-0.377	3.349
container/packaging	-0.008	1.228	0.028	0.946	0.019	1.295	-0.125	1.446
wireless communi.	0.092	2.052	0.152	0.732	0.252	1.361	-0.361	3.872
pharmaceutical (T)	0.210	1.557	0.176	1.097	0.309	1.798	0.040	1.580
elect.utilities	0.166	1.482	0.306	1.528	0.165	1.512	-0.048	1.319
elect.compo.(T)	0.156	2.006	0.234	1.293	0.190	1.877	-0.040	2.968
energy(T)	0.191	1.789	0.266	1.371	0.230	2.027	-0.012	1.793
leisure gds/serv.	0.058	1.771	0.160	0.719	0.066	1.730	-0.117	2.743
food produ.(T)	0.174	1.388	0.158	1.015	0.296	1.505	-0.075	1.580
divers.financial	0.147	2.038	0.242	1.443	0.194	2.384	-0.104	1.983
food (T)	0.089	1.659	0.146	1.380	0.129	1.869	-0.086	1.555
forest prodts.(T)	0.091	1.687	0.243	1.338	0.017	1.938	0.020	1.563
fxdline communi.	0.152	2.388	0.229	1.085	0.363	2.197	-0.438	3.781
gas utilities	0.193	1.417	0.241	1.308	0.224	1.496	0.052	1.403
health providers	0.163	1.740	0.379	1.693	0.106	1.483	-0.042	2.252
home construc.	-0.037	1.864	0.043	1.310	-0.079	2.189	-0.066	1.814
household prodts.	0.008	1.376	0.128	1.049	-0.051	1.675	-0.045	1.041
divers. Industrial	0.060	1.790	0.150	1.222	0.117	1.886	-0.207	2.242
indust. Equip	0.083	1.504	0.165	1.305	0.135	1.632	-0.160	1.479
Insurance	0.138	1.766	0.132	1.247	0.238	1.921	-0.078	2.058
adv.industry equip.	0.017	1.927	0.210	0.939	0.121	1.438	-0.515	3.389
mining/metals (T)	0.098	2.022	0.311	1.502	0.061	2.264	-0.148	2.130

entertainment	0.072	2.187	0.196	1.043	0.170	1.784	-0.339	3.736
medical prodts	0.110	1.377	0.039	0.833	0.172	1.190	0.083	2.202
Publishing	0.105	1.780	0.208	1.005	0.221	1.395	-0.312	3.015
real estate	-0.011	1.606	0.031	1.270	0.005	1.891	-0.112	1.369
Retailers	0.122	1.778	0.183	1.171	0.215	1.970	-0.181	2.064
invest.services	0.132	2.224	0.225	1.328	0.211	2.485	-0.189	2.659
semiconductors (T)	0.264	3.148	0.218	0.844	0.394	2.467	0.044	5.727
software(T)	0.099	2.571	0.191	1.155	0.336	1.629	-0.570	4.813
indust.services	0.084	1.737	0.137	1.190	0.221	1.655	-0.305	2.442
textile/apparel(T)	0.014	1.533	0.169	1.165	-0.061	1.666	-0.057	1.708
tech prodts (T)	0.195	2.650	0.225	1.297	0.391	2.668	-0.288	3.857
tobacco (T)	0.200	1.504	0.114	1.129	0.297	1.591	0.116	1.783
indust.transport	0.035	1.483	0.109	1.159	0.043	1.590	-0.099	1.673
water utilities	0.165	1.731	0.047	1.165	0.287	1.859	0.076	2.122
Average	*0.107*	*1.885*	*0.174*	*1.216*	*0.176*	*1.882*	*-0.152*	*2.442*
Median	*0.102*	*1.790*	*0.169*	*1.248*	*0.181*	*1.873*	*-0.111*	*2.061*

Table 3.3 Variances of country and industry effects
(34 countries and 50 industries)
(Variance: %-squared)

Panel A shows the comparison of pure country effect with the cumulative industry effects for the country index returns based on equation (3.4), whereas Panel B compares the pure industry effect with the cumulative country effects for the industry index returns based on equation (3.5)

Panel A

	Whole period		Sub 1		Sub 2		Sub 3	
	01/92- 12/01		**01/92-03/95**		**04/95-11/ 99**		**12/99-12/01**	
Country	*pure ctry effect*	*cum. Ind. effects*	*pure ctry effect*	*cum. Ind. effects*	*pure ctry effect*	*cum. Ind. effects*	*pure ctry effect*	*cum. Ind. effects*
Austria	6.803	0.800	5.678	0.210	6.218	0.473	9.941	2.363
Australia	5.067	0.426	5.638	0.120	4.307	0.276	5.962	1.203
Belgium	4.424	0.697	2.829	0.202	4.241	0.391	7.271	2.115
Brazil	50.393	1.007	92.660	0.365	33.760	0.865	22.797	2.333
Canada	5.021	0.252	3.231	0.094	2.876	0.155	12.618	0.707
Switzerland	5.643	1.184	4.658	0.423	6.291	0.566	5.552	3.718
Chile	12.058	1.131	15.897	0.413	11.185	1.005	7.900	2.509
Germany	4.603	0.177	4.034	0.095	3.263	0.118	8.565	0.950
Denmark	6.597	0.310	6.975	0.166	5.504	0.134	8.442	0.397
Spain	7.021	0.560	7.117	0.222	5.650	0.435	9.864	1.337
Finland	26.766	5.041	14.910	0.646	20.255	0.795	60.039	21.319
France	3.614	0.177	2.998	0.033	3.095	0.102	5.787	0.566
UK	2.448	0.298	2.475	0.043	2.607	0.118	2.084	1.097
Greece	20.814	0.773	21.550	0.911	18.987	0.518	23.405	1.143
HongKong	11.450	0.493	11.235	0.301	10.694	0.384	13.616	1.032
Indonesia	49.140	1.231	12.881	0.164	81.843	0.879	32.311	3.614
Ireland	11.305	1.104	8.450	0.414	10.905	0.570	16.794	3.331
Italy	9.693	0.371	14.649	0.188	7.370	0.279	7.285	0.867
Japan	8.468	0.128	5.995	0.043	9.800	0.104	9.303	0.309
Korea	31.659	0.755	16.686	0.137	37.977	0.364	41.080	2.598
Mexico	22.784	0.756	27.587	0.247	20.242	0.413	20.856	2.321
Malaysia	24.459	0.429	13.263	0.097	35.928	0.314	15.981	1.157
Netherlands	3.065	0.517	2.354	0.284	3.227	0.317	3.758	1.308
Norway	8.738	0.583	6.515	0.176	7.465	0.525	15.151	1.315
New Zealand	10.829	1.033	7.167	0.492	9.166	0.990	20.170	1.976
Philippines	24.179	0.846	20.932	0.347	24.772	0.525	27.844	2.340
Portugal	9.177	0.879	11.217	0.951	7.230	0.380	10.545	1.900
Sweden	10.758	0.821	7.215	0.145	6.420	0.291	26.045	3.011
Singapore	11.441	0.285	7.051	0.159	12.869	0.170	15.005	0.740
Thailand	30.004	0.398	20.973	0.221	37.916	0.275	25.648	0.954

Taiwan	27.063	1.683	21.074	0.119	19.295	0.771	54.026	6.170
US	1.112	0.062	1.437	0.024	1.010	0.048	0.848	0.152
Venezuela	39.816	1.041	45.353	0.239	43.074	0.732	23.969	2.983
South Africa	9.738	0.636	9.470	0.231	9.836	0.408	10.102	1.713
Mean	*15.181*	*0.791*	*13.593*	*0.262*	*15.449*	*0.432*	*17.075*	*2.398*
Median	*10.248*	*0.666*	*7.833*	*0.206*	*9.483*	*0.387*	*13.117*	*1.525*

Panel B

	Whole period		Sub 1		Sub 2		Sub 3	
	01/92- 12/01		**01/92-03/95**		**04/95-11/ 99**		**12/99-12/01**	
Industry	*pure ind. effect*	*cum. ctry effects*	*pure ind. effect*	*cum. ctry effects*	*pure ind. effect*	*cum. ctry effects*	*pure ind. effect*	*cum. ctry effects*
advertising	12.387	0.358	6.713	0.531	11.645	0.314	22.816	0.190
airline	8.153	0.206	3.270	0.187	7.630	0.126	17.007	0.416
aerospace	4.926	0.547	2.199	0.807	5.080	0.424	8.593	0.423
auto part/equip (T)	3.626	1.242	1.393	1.051	4.203	1.478	5.743	1.019
auto manufact (T)	4.894	1.132	2.389	0.473	4.220	1.113	10.347	2.190
buldg material	2.246	0.368	1.277	0.244	1.664	0.363	4.888	0.577
banks	2.894	0.348	2.168	0.693	1.816	0.178	6.454	0.198
broadcasting	4.429	0.496	2.317	0.920	3.921	0.350	8.794	0.170
biotechnology	9.464	0.791	5.085	1.024	5.289	0.715	25.477	0.613
beverage	6.207	0.207	1.983	0.326	4.815	0.170	15.956	0.107
chemical (T)	3.170	0.120	0.841	0.044	2.142	0.090	9.014	0.301
communi. Tech	12.326	0.316	2.177	0.174	9.415	0.119	33.856	0.955
heavy constructn	4.036	1.492	4.325	1.459	3.402	1.314	4.834	1.950
cosmetics (T)	5.790	0.180	1.507	0.135	4.575	0.165	15.194	0.283
consumer service	12.964	0.280	3.526	0.349	13.507	0.243	26.280	0.258
container/packaging	3.833	0.134	1.154	0.133	3.813	0.096	7.950	0.220
wireless communi.	7.421	0.528	3.243	0.107	6.752	0.689	15.365	0.796
pharmaceutical (T)	5.684	0.200	3.153	0.223	3.552	0.203	14.361	0.157
elect.utilities	4.703	0.113	1.417	0.136	4.449	0.121	10.232	0.063
elect.compo.(T)	4.156	1.668	2.110	1.414	2.438	1.677	11.247	2.029
energy(T)	5.935	0.326	2.699	0.515	5.134	0.248	12.760	0.212
leisure gds/serv.	1.855	0.411	1.111	0.313	1.267	0.433	4.337	0.508
food produ.(T)	4.523	0.165	1.196	0.121	2.355	0.170	14.606	0.223
divers.financial	3.123	0.178	1.313	0.371	3.471	0.067	5.153	0.135
food (T)	3.614	0.162	1.098	0.119	2.145	0.154	10.699	0.246
forest prodts.(T)	6.525	0.345	3.214	0.169	6.675	0.184	11.257	0.981
fxdline communi.	4.432	0.436	2.343	0.829	3.110	0.264	10.543	0.222
gas utilities	5.533	0.305	1.421	0.177	3.437	0.287	16.686	0.539
health providers	9.058	0.650	8.189	0.953	6.108	0.558	16.098	0.392

home construc.	3.205	0.667	2.375	1.019	2.178	0.521	6.545	0.453
household prodts.	7.119	0.727	2.036	0.903	4.321	0.713	21.377	0.493
divers. Industrial	2.169	0.148	0.899	0.128	1.298	0.114	6.119	0.249
indust. Equip	2.726	1.314	2.259	1.814	2.567	0.988	3.800	1.276
insurance	2.486	0.304	0.917	0.381	1.139	0.243	7.897	0.323
adv.industry equip.	7.492	1.474	1.784	0.510	1.872	1.419	29.020	3.007
mining/metals (T)	3.942	0.458	1.645	0.354	3.300	0.411	8.765	0.732
entertainment	7.943	0.380	2.791	0.323	5.689	0.256	21.080	0.745
medical prodts	3.896	0.485	3.645	0.692	2.259	0.396	7.780	0.367
publishing	1.883	0.499	0.868	0.752	1.323	0.348	4.691	0.454
real estate	2.658	1.369	1.735	1.973	2.040	1.165	5.282	0.893
retailers	3.438	0.107	1.538	0.145	2.768	0.069	7.897	0.136
invest.services	11.221	0.870	8.358	1.674	12.039	0.550	14.013	0.345
semiconductors (T)	21.906	0.328	9.974	0.234	21.463	0.332	41.666	0.466
software(T)	12.270	0.562	7.493	0.740	9.341	0.524	26.271	0.373
indust.services	1.449	0.097	0.433	0.096	1.216	0.103	3.565	0.089
textile/apparel(T)	2.627	0.522	1.095	0.534	2.175	0.472	5.924	0.617
tech prodts (T)	8.387	0.264	3.152	0.167	8.636	0.270	15.932	0.402
tobacco (T)	14.106	0.428	9.162	0.929	13.388	0.207	22.874	0.157
indust.transport	2.150	1.080	1.066	0.707	1.693	1.245	4.612	1.291
water utilities	6.598	1.924	4.033	1.676	4.243	1.496	15.958	3.295
Mean	*5.952*	*0.554*	*2.842*	*0.595*	*4.860*	*0.483*	*13.152*	*0.651*
Median	*4.613*	*0.395*	*2.173*	*0.427*	*3.682*	*0.323*	*10.621*	*0.409*

Table 3.4 Geographical country effects vs. industry effects
(Variance: %-squared)

Panel A reports the geographical breakdown of country effects as a comparison to the global industry average. Panel B shows the average country effects between developed and emerging markets as opposed to the global industry averages. The country/industry effects and cumulative industry/country effects are based on equation (3.4) and (3.5).

A. Regional country effects vs. industry effects

	Europe		Asia		Latin America		North America		Global Industries	
	ctry effect	*cum.ind effects*	*ctry effect*	*cum.ind effects*	*ctry effect*	*cum.ind effects*	*ctry effect*	*cum.ind effects*	*ind. effect*	*cum.ctry effects*
Whole period	8.842	0.893	21.251	0.701	31.263	0.984	3.067	0.157	5.952	0.554
(01/92-12/01)										
Sub 1	7.727	0.319	12.991	0.200	45.375	0.316	2.334	0.059	2.842	0.595
(01/92-3/95)										
Sub 2	7.420	0.376	25.870	0.459	27.065	0.754	1.943	0.102	4.860	0.483
(04/95-11/99)										
Sub 3	13.783	2.921	23.722	2.008	18.880	2.536	6.733	0.430	13.152	0.651
(12/99-12/01)										

B. Country effects of developed and emerging markets vs. industry effects

	Developed		Emerging		Global Industries	
	ctry effect	*cum.ind effects*	*ctry effect*	*cum.ind effects*	*ind. effect*	*cum.ctry effects*
Whole period	8.472	0.736	29.21	0.890	5.952	0.554
(01/92-12/01)						
Sub 1	7.190	0.247	26.98	0.291	2.842	0.595
(01/92-3/95)						
Sub 2	7.367	0.346	32.35	0.589	4.860	0.483
(04/95-11/99)						
Sub 3	12.959	2.351	25.68	2.486	13.152	0.651
(12/99-12/01)						

Table 3.5 Estimation of industry effects for traded and non-traded goods industries

"Mean(median)" is calculated by taking the average (median) of the cumulative country effects, pure industry effects across all industries separately for traded and non-traded goods industries. "Average variance" is estimated by pooling the time series of all cumulative country or pure industry effects across the industries in that subset and estimating the variance separately for non-traded and traded goods industries. The F-statistics is computed for the ratio of the variances across groups separately for the cumulative sum of country effects and pure industry effects and tests for the equality of variances between non-traded and traded goods industries

		Mean(median)		**Average variance**		**F-statistics**
		Non-traded goods	*Traded goods*	*Non-traded goods*	*Traded goods*	*(p-value)*
Whole period	*pure ind. effect*	5.430 (4.429)	7.169 (5.684)	5.428	7.174	0.76 (.000)
(01/92-12/01)	*cum ctry effects*	0.565 (0.411)	0.529 (0.345)	0.567	0.532	1.07 (.000)
Sub 1	*pure ind. effect*	2.602 (2.168)	2.935 (2.168)	2.599	3.411	0.76 (.000)
(01/92-3/95)	*cum ctry effects*	0.647 (0.510)	0.474 (0.354)	0.644	0.472	1.36 (.000)
Sub 2	*pure ind. effect*	4.268 (3.437)	4.623 (3.437)	4.297	6.271	0.69 (.000)
(04/95-11/99)	*cum ctry effects*	0.475 (0.348)	0.503 (0.270)	0.479	0.506	1.98 (.000)
Sub 3	*pure ind. effect*	12.333 (8.794)	12.909 (11.26)	12.298	14.976	0.82 (.000)
(12/99-12/01)	*cum ctry effects*	0.640 (0.416)	0.676 (0.402)	0.642	0.682	0.94 (.000)

Figures

MADs estimation (Figure 3.1-3.7)

Figure 3.1 Cap-weighted MADs for the globe, 1992-2001
(52-week moving average)

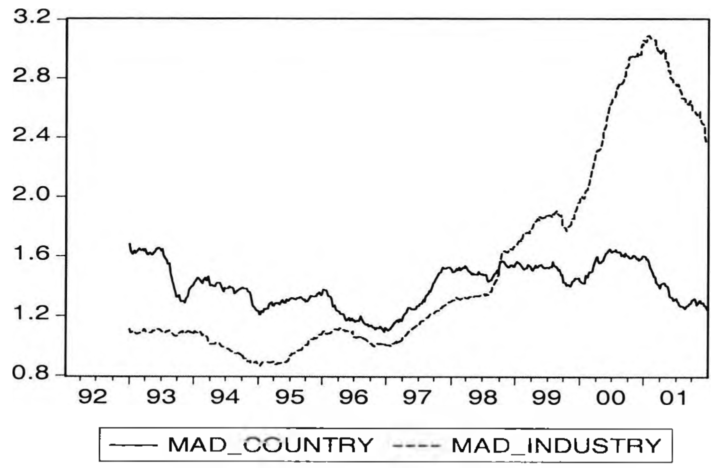


Figure 3.2 Cap-weighted MADs for Europe, 1992-2001
(52-week moving average)

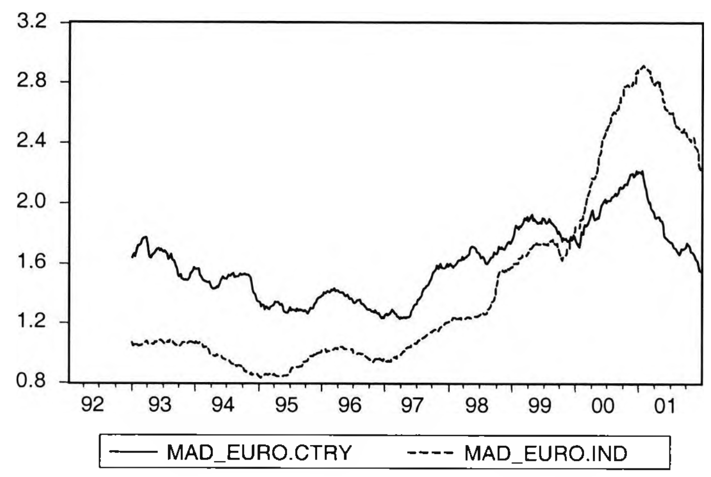


Figure 3.3 Cap-weighted MADs for Asia Pacific, 1992-2001

(52-week moving average)

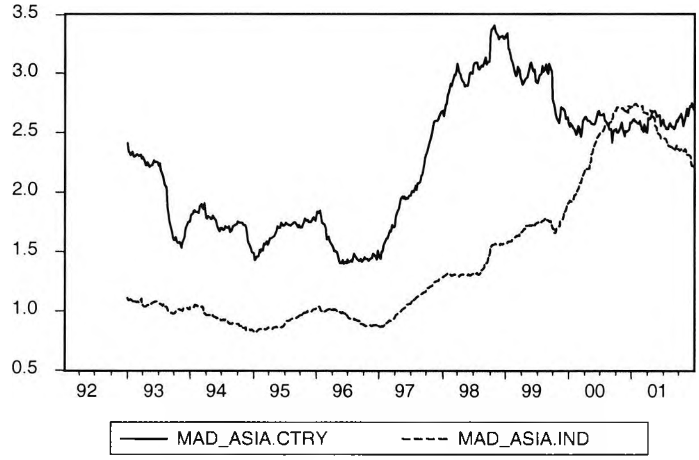


Figure 3.4 Cap-weighted MADs for Latin America, 1992-2001

(52-week moving average)

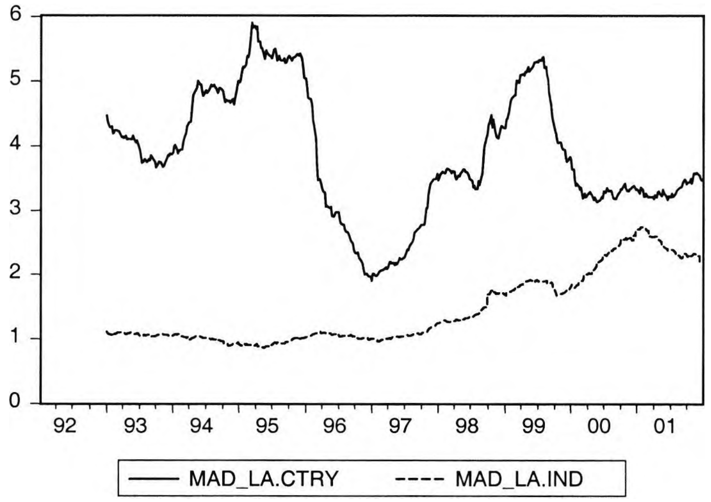


Figure 3.5 Cap-weighted MADs for North America, 1992-2001

(52-week moving average)

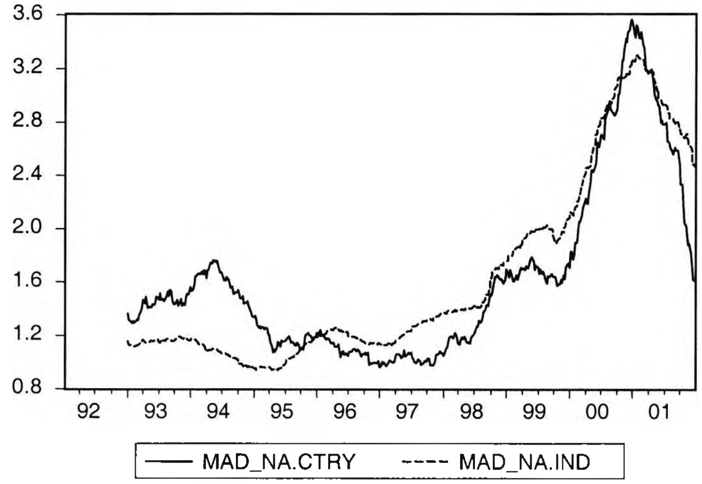


Figure 3.6 Cap-weighted MADs for developed markets, 1992-2001

(52-week moving average)

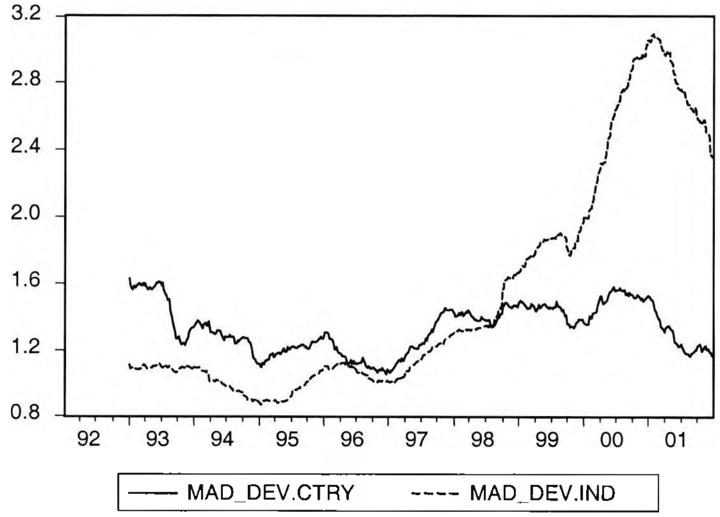
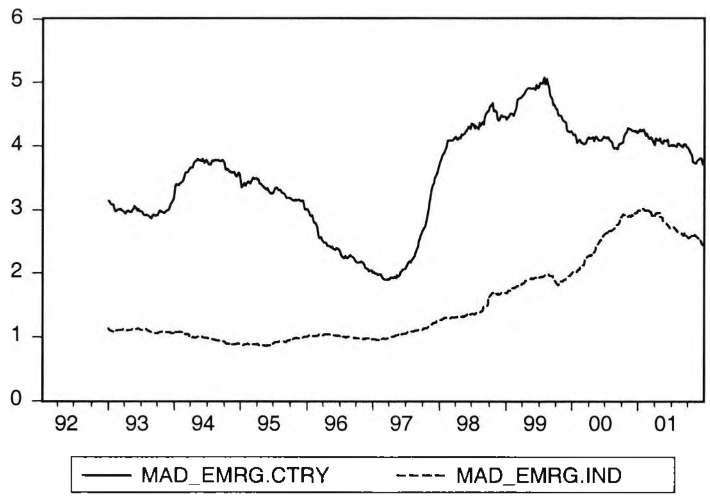


Figure 3.7 Cap-weighted MADs for emerging markets, 1992-2001

(52-week moving average)



Appendices:

Appendix 3A Variances of country and industry effects without TMT

(34 countries and 39 industries)

(Variance: %-squared)

Panel A shows the comparison of pure country effect with the cumulative industry effects for the country index returns whereas Panel B compares the pure industry effect with the cumulative country effects for the industry index returns

Panel A

	Whole period		Sub 1		Sub 2		Sub 3	
	01/92- 12/01		**01/92-03/95**		**04/95-11/ 99**		**12/99-12/01**	
Country	pure ctry effect	cum. Ind. effects	pure ctry effect	cum. Ind. effects	pure ctry effect	cum. Ind. effects	pure ctry effect	cum. Ind. effects
Austria	6.727	0.769	5.635	0.234	6.194	0.410	9.678	2.385
Australia	5.886	0.421	5.934	0.166	4.729	0.256	8.489	1.183
Belgium	4.382	0.612	2.839	0.230	4.203	0.292	7.157	1.928
Brazil	53.070	0.363	97.650	0.174	38.351	0.335	17.472	0.718
Canada	3.065	0.293	3.345	0.128	2.507	0.219	3.859	0.714
Switzerland	5.603	0.990	4.664	0.446	6.287	0.592	5.375	2.721
Chile	12.426	0.765	16.272	0.319	11.279	0.710	8.866	1.582
Germany	4.630	0.386	4.059	0.141	3.528	0.218	8.046	1.145
Denmark	6.530	0.279	6.947	0.171	5.458	0.163	8.235	0.711
Spain	6.958	0.432	7.114	0.222	5.591	0.300	9.705	1.057
Finland	21.481	2.628	14.934	0.734	20.391	0.994	33.959	9.190
France	2.993	0.205	3.058	0.042	2.964	0.099	3.006	0.699
UK	2.490	0.279	2.507	0.065	2.647	0.132	2.152	0.941
Greece	22.488	0.841	21.475	0.880	21.629	0.493	25.203	1.574
HongKong	12.448	0.472	13.907	0.288	12.280	0.371	10.679	0.985
Indonesia	58.807	0.931	12.896	0.207	99.254	0.744	39.141	2.410
Ireland	12.069	1.058	8.434	0.449	10.654	0.650	21.042	2.924
Italy	9.836	0.386	14.427	0.172	7.292	0.248	8.448	1.032
Japan	8.477	0.475	6.013	0.097	10.039	0.210	8.766	1.660
Korea	31.296	0.255	17.199	0.159	39.468	0.161	35.267	0.616
Mexico	26.900	0.367	38.200	0.165	22.825	0.239	18.899	0.972
Malaysia	24.673	0.399	13.171	0.127	36.630	0.200	15.505	1.254
Netherlands	3.148	0.569	2.411	0.329	3.321	0.349	3.880	1.440
Norway	9.105	0.708	6.657	0.236	7.573	0.531	16.455	1.839
New Zealand	11.246	0.542	8.972	0.401	12.252	0.480	12.549	0.895
Philippines	26.476	0.535	23.655	0.239	26.774	0.394	30.124	1.307
Portugal	9.090	0.632	11.200	0.897	8.249	0.288	7.790	1.001
Sweden	6.441	0.272	7.247	0.165	4.785	0.178	9.018	0.653
Singapore	15.564	0.425	7.551	0.182	20.077	0.208	18.000	1.293
Thailand	30.336	0.421	20.993	0.265	39.183	0.325	24.454	0.881

Taiwan	20.063	0.319	21.573	0.156	16.187	0.225	26.457	0.787
US	1.153	0.217	1.463	0.068	1.062	0.116	0.887	0.676
Venezuela	48.713	0.526	54.633	0.267	51.989	0.391	32.492	1.215
South Africa	9.760	0.779	9.509	0.312	9.814	0.442	10.201	2.246
Mean	*15.716*	*0.575*	*14.604*	*0.269*	*16.925*	*0.352*	*14.743*	*1.548*
Median	*9.798*	*0.452*	*8.703*	*0.215*	*9.926*	*0.296*	*9.953*	*1.164*

Panel B

	Whole period		Sub 1		Sub 2		Sub 3	
	01/92- 12/01		**01/92-03/95**		**04/95-11/ 99**		**12/99-12/01**	
Industry	*pure ind. effect*	*cum. ctry effects*	*pure ind. effect*	*cum. ctry effects*	*pure ind. effect*	*cum. ctry effects*	*pure ind. effect*	*cum. ctry effects*
airline	8.419	0.220	3.387	0.212	7.823	0.131	17.684	0.433
aerospace	4.699	0.534	2.312	0.816	4.982	0.430	7.684	0.330
auto part/eqp (T)	4.145	1.250	1.582	1.054	4.310	1.515	7.772	0.966
auto manufact (T)	5.220	1.224	2.649	0.479	4.332	1.195	11.279	2.423
buldg material	2.244	0.408	1.446	0.273	1.431	0.384	5.237	0.671
banks	2.755	0.360	2.063	0.692	1.835	0.187	5.937	0.242
beverage	5.419	0.212	1.969	0.329	4.723	0.176	12.409	0.112
chemical (T)	3.035	0.126	0.926	0.045	1.997	0.102	8.631	0.296
heavy constructn	4.133	1.418	4.404	1.476	3.145	1.409	5.817	1.353
cosmetics (T)	4.978	0.154	1.490	0.143	4.392	0.157	11.762	0.165
consumer service	16.083	0.302	3.627	0.357	15.256	0.263	36.987	0.310
container/packaging	3.862	0.121	1.216	0.138	3.916	0.075	7.842	0.201
pharmaceutical (T)	5.076	0.206	3.180	0.231	3.680	0.216	11.089	0.148
elect.utilities	3.717	0.113	1.436	0.142	3.850	0.121	6.930	0.051
elect.compo.(T)	6.015	1.626	2.295	1.415	2.906	1.691	18.815	1.795
energy(T)	5.544	0.329	2.788	0.518	5.014	0.251	11.077	0.210
leisure gds/serv.	3.090	0.400	1.280	0.323	1.610	0.440	9.264	0.426
food produ.(T)	3.540	0.166	1.231	0.125	2.173	0.173	10.193	0.217
divers.financial	3.464	0.174	1.342	0.372	3.585	0.068	6.516	0.107
food (T)	2.840	0.161	1.161	0.118	1.854	0.155	7.644	0.240
forest prodts.(T)	6.836	0.258	3.244	0.167	6.971	0.180	12.119	0.573
gas utilities	4.869	0.288	1.395	0.178	2.979	0.301	14.548	0.425
health providers	8.247	0.665	8.503	0.971	6.279	0.581	11.618	0.381
home construc.	3.482	0.646	2.511	1.023	2.214	0.511	7.728	0.367
household prodts.	6.340	0.756	2.050	0.920	4.148	0.751	17.985	0.519
divers. Industrial	2.621	0.163	0.952	0.131	1.577	0.119	7.572	0.305
indust. Equip	3.407	1.309	2.532	1.817	2.711	1.005	6.372	1.203
insurance	2.149	0.294	0.914	0.381	1.164	0.242	6.292	0.277
adv.industry equip.	10.701	1.616	1.839	0.540	2.207	1.440	43.523	3.601
mining/metals (T)	3.841	0.464	1.774	0.369	2.954	0.449	8.983	0.651

medical prodts	3.750	0.497	3.648	0.706	2.504	0.416	6.650	0.358
real estate	2.342	1.551	1.597	2.427	2.013	1.346	4.130	0.658
retailers	3.929	0.106	1.685	0.146	3.166	0.073	9.147	0.117
invest.services	13.436	0.851	8.391	1.675	13.105	0.556	22.191	0.239
indust.services	2.494	0.094	0.579	0.097	1.635	0.105	7.395	0.065
textile/apparel(T)	2.758	0.517	1.230	0.533	2.185	0.478	6.405	0.577
tobacco (T)	13.132	0.436	9.255	0.932	13.035	0.218	19.100	0.162
indust.transport	2.183	1.066	1.199	0.709	1.611	1.276	4.876	1.154
water utilities	4.041	1.567	3.159	1.680	2.849	1.435	8.148	1.711
Mean	*5.098*	*0.581*	*2.519*	*0.632*	*4.054*	*0.529*	*11.419*	*0.616*
Median	*3.929*	*0.400*	*1.839*	*0.381*	*2.979*	*0.301*	*8.631*	*0.358*

Appendix 3B Geographical country effects vs. industry effects (estimation without TMT)

Refer to the explanation in Table 3.4. The country/industry effects are estimated by excluding the industries of TMT

A. Regional country effects vs. industry effects

	Europe		Asia		Latin Am.		North Am.		Globe industries	
	ctry	cum.ind	ctry	cum.ind	ctry	cum.ind	ctry	cum.ind	ind.	cum.ctry
whole period	8.373	0.690	22.297	0.472	35.277	0.505	2.109	0.255	5.098	0.581
(1/92-12/01)										
sub 1	7.726	0.338	13.806	0.208	51.689	0.231	2.404	0.098	2.519	0.632
(1/92-3/95)										
sub 2	7.548	0.371	28.807	0.325	31.111	0.419	1.785	0.167	4.054	0.529
(4/95-11/99)										
sub 3	11.197	1.952	20.857	1.206	19.432	1.122	2.373	0.695	11.419	0.616
(12/99-12/01)										

B. Country effects for developed vs. emerging markets

	Developed		Emerging						Globe industries	
	ctry	cum.ind	ctry	cum.ind					ind.	cum.ctry
whole period	8.340	0.604	31.138	0.515					5.098	0.581
(1/92-12/01)										
sub 1	7.426	0.293	29.614	0.217					2.519	0.632
(1/92-3/95)										
sub 2	7.987	0.339	35.614	0.379					4.054	0.529
(4/95-11/99)										
sub 3	10.538	1.680	23.534	1.272					11.419	0.616
(12/99-12/01)										

Appendix 3C MAD estimation without TMT (Figures 3C1-3C7)

Figure 3C1 Cap-weighted MADS for the world, 1992-2001
(estimation excluding TMT, 52-weeking moving average)

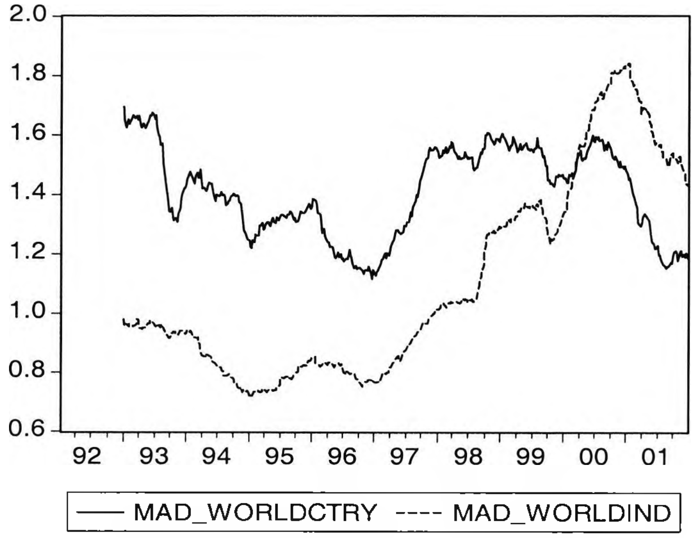


Figure 3C2 Cap-weighted MADS for Europe, 1992-2001
(estimation excluding TMT, 52-weeking moving average)

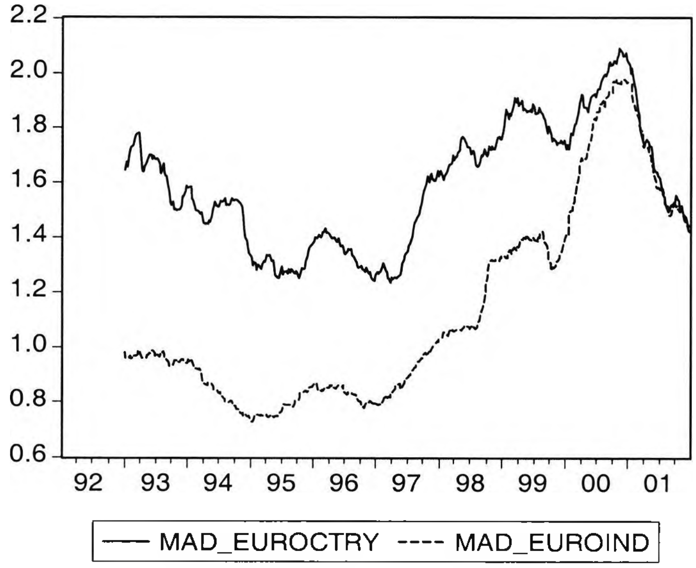


Figure 3C3 Cap-weighted MADS for Asia Pacific, 1992-2001
(estimation excluding TMT, 52-weeking moving average)

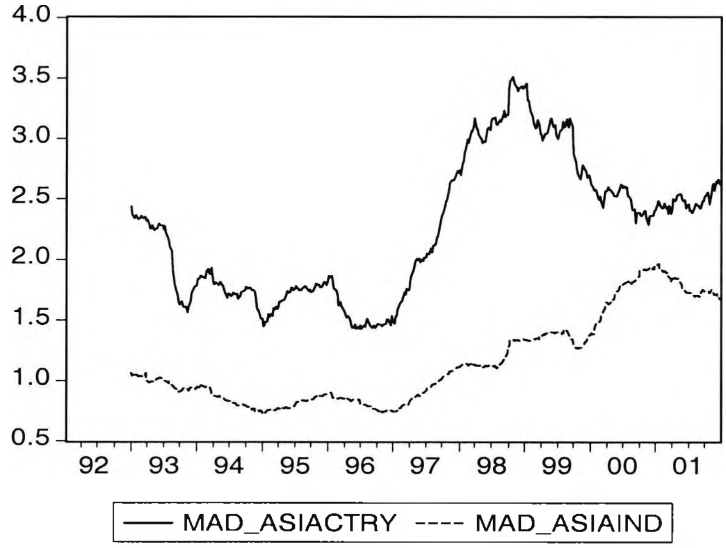


Figure 3C4 Cap-weighted MADS for Latin America, 1992-2001
(estimation excluding TMT, 52-weeking moving average)

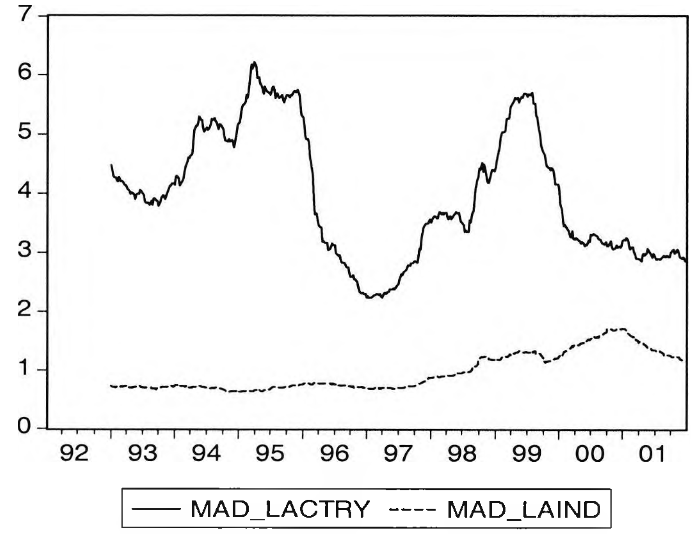


Figure 3C5 Cap-weighted MADS for North America, 1992-2001
(estimation excluding TMT, 52-weeking moving average)

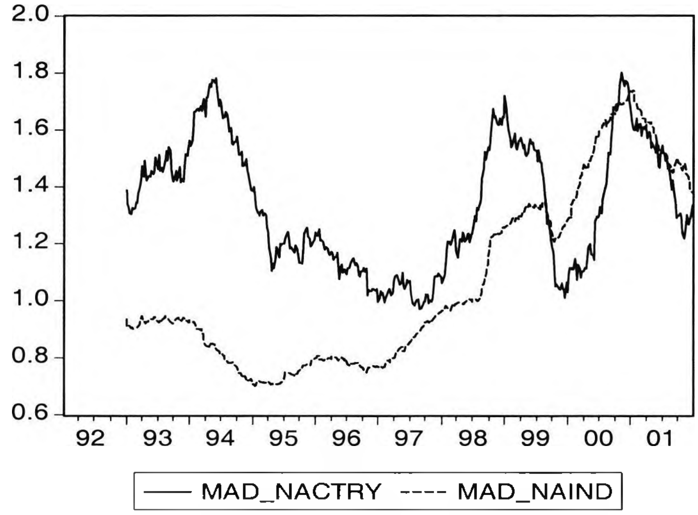


Figure 3C6 Cap-weighted MADS for developed countries, 1992-2001
(estimation excluding TMT, 52-weeking moving average)

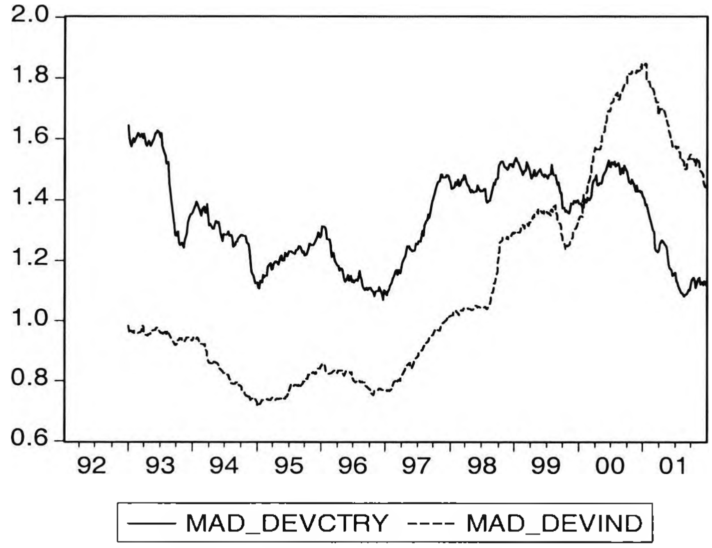
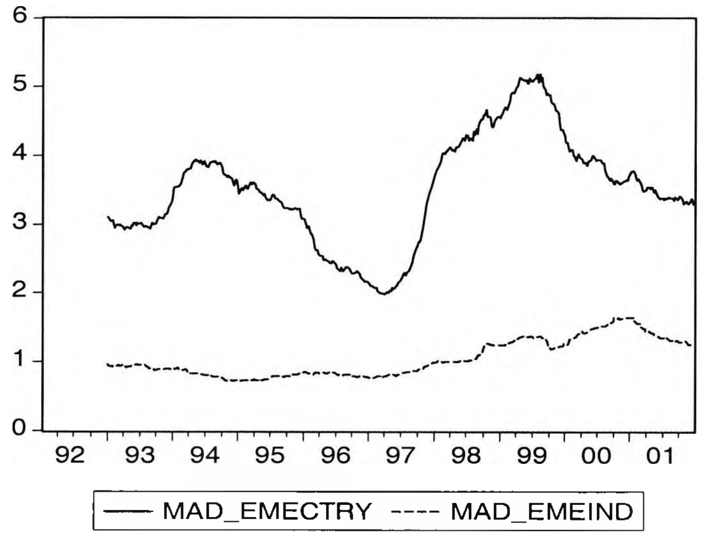


Figure 3C7 Cap-weighted MADS for emerging countries, 1992-2001
(estimation excluding TMT, 52-weeking moving average)



CHAPTER FOUR

SOURCES OF FIRMS' INDUSTRY AND COUNTRY EFFECTS IN EMERGING MARKETS

4.1 Introduction

A recently revived topic in the international finance literature is the study on the relative importance of country versus industry effects in explaining the global equity market movements. Traditionally, the country effects have dominated the industry effects (see, for example, Lessard, 1974; Solnik, 1974; Heston and Rouwenhorst, 1994, 1995; and Griffin and Karolyi, 1998). However, more recently Baca et al (2000), Cavaglia, Brightman and Aked (2000), L'Her et al (2002) and Flavin (2004) have shown that the industry effects have levelled or even surpassed the country effects in recent years, suggesting that international diversification across industries may now provide greater risk reductions than the traditional diversification across countries[12].

The change in the relative importance of country and industry effects in recent years raises the following question: what are the driving forces of this change? Is such shift embedded in the ongoing process of business globalization and financial market integration, or is it due to some temporary reasons such as IT bubbles at the turn of the century? During the last decade, the worldwide businesses have forged through an increasing process of globalization. Firms have sought to consolidate and rationalize business activities globally through the expansion of existing affiliates as well as through a wave of mergers and acquisitions[13]. As a result, firms have become more diversified across countries in their revenues and operations so that country-specific economic shocks should now affect domestic equity markets less than before. On the other hand, the worldwide financial markets have been increasingly integrated with each other during the last decade. Empirical evidence shows that market co-

[12] A detailed literature review can be found in Chapter 3 of this thesis.

[13] For example, as quoted in Cavaglia, Cho and Singer (2001), cross-border mergers and acquisitions rose from an average of $40 billion per year over the 1989-1993 period to an average of $400 billion per year over the 1994-2000 period.

movements are currently higher.[14] These developments would have blurred the national borders, diminished the country effects, and increased the global and industry effects, ceteris paribus.

Indeed, papers by Cavaglia, Cho and Singer (2001) and Brooks and Del Negro (2003) have documented evidence on the connection of the dynamics of country and industry effects in firm level returns with the firms' international activities, which is employed as a proxy for business globalization. Cavaglia, Cho and Singer (2001) develop a risk model, which decomposes the security returns into components of global, domestic and regional industrial sector factors and regress the loadings on those factors, obtained via a two-stage methodology similar to the iterative approach of Marsh and Pfleiderer (1997), on the firms' foreign sale ratios. Using weekly excess return data of FT World Index constituents in 22 developed countries from 1990 to 1999 they find that while the non-domestic factors (the global and regional industrial sector factors) are positively associated with the firms' foreign sales, the domestic factors are negatively associated with the firms' foreign sales. However, only the coefficients on the regional industrial sector factors are statistically significant.

Brooks and Del Negro (2003) on the other hand estimate a factor model that decomposes the equity returns into global, country and industry specific factors using the maximum likelihood procedure to estimate the factor betas and their links to firms' global operations proxied by firms' foreign sale ratios, international income ratios, international assets ratios, and whether firms belong to traded or non-traded goods industries. Using monthly data of 1,239 companies in 20 markets (of which only two are developing markets) from January 1985 to February 2002, they find that

[14] See, for example, Freimann (1998) and Goetzmann et al (2005).

the global factors are positively and the country factors negatively related to those global proxies. However, contrary to Cavaglia, Cho and Singer (2001), they do not find any statistically significant link between the industry factors and the extent to which firms operate internationally.

The studies mentioned above focus on advanced markets. Little is known about the sources driving the structure of country/industry effects in emerging markets. It has been shown that returns of emerging markets have vastly different characteristics from those of developed markets (e.g. Bekaert, 1995; Harvey, 1995; and Bekaert and Harvey, 1995, 1997, 2000). Bekaert and Harvey (1997) point out at least four distinguishing features of emerging market returns: higher sample returns, low correlations with developed market returns and amongst emerging markets, more predictable returns, and higher volatility. Given those facts, one would expect the dynamics of country versus industry effects in emerging markets to be different from those in developed markets. Indeed, using Dow Jones Global Indexes data over the period of 1992-2001, the paper in Chapter 3 of this thesis shows that the industry effects are still dominated by the country effects in emerging market returns.[15] However, the literature has not examined whether the sources that impact the dynamics of country/industry effects in developed market returns are the same as the sources that affect the structures of country/industry effects in emerging market returns.

The purpose of the current paper and the main contribution to the literature is to examine the reasons for the different behaviour of Emerging Markets relative to developed markets by comparing the dynamics of their global, country and industry effects at the firm level. Our analysis examines the sources driving these factor

[15] Serra (2000) also finds that emerging markets' returns are mainly driven by country factors, and the industry factors play little role in the cross-market correlations.

effects by exploring the cross-sectional differences in the factor effects across firms using information on their characteristics. In particular, we examine the impact of firms' foreign sale ratios used as a proxy for the firms' business globalisation and the role of firms' ADR listings used as a proxy for financial market integration. The role of firms' ADR listings has not yet been explored in the literature on the country/industry effects in cross-sectional analysis at the firm level. ADRs and other forms of cross-border listings overcome many of the regulatory restrictions, cost and information problems that inhibit international investment and thus allow some indirect market integration[16]. In fact, various papers have documented that ADR listings in aggregate foster greater integration of international capital markets (see e.g. Errunza, Hogan and Hung, 1999; Foerster and Karolyi, 1999; Errunza and Miller, 2000; Hargis, 2002; Bekaert, Harvey and Lumsdaine, 2002; Karolyi, 2003; and Fernandes, 2005)[17]. For example, Karolyi (2003) indicates that the increasing number of new ADRs, their market cap and trading volume in emerging markets, are positively associated with the pace of international capital flows and market integration. Therefore, if ADR listings facilitate the acceleration of market integration, one would expect domestic factors to matter less and global factors including industry ones to matter more for ADR firms.

Finally, we examine whether a firm's TMT - Technology, Media and Telecommunication - affiliation has an impact on the dynamics of the global, country and industry effects and in particular, whether the increase of industry effects is due to IT bubbles. Brooks and Del Negro (2004) claim that the recent increase of industry effects is only confined to TMT sectors and such increase is due to IT bubbles.

---

[16] According to the Bank of New York, worldwide ADRs in the US market were 285 prior to the year 1992. By the year of 2001, they rose to 1726. See the bank's ADR website: http://www.adrbny.com

[17] For a good survey on the literature of ADRs, see Karolyi (1998, 2004)

The following sections are structured as follows: Section 4.2 introduces our model and estimation procedures. Section 4.3 provides details of our data. Section 4.4 presents our analysis and key empirical results, while Section 4.5 points out the implications of our findings for international diversification. The final section concludes our paper.

4.2 Modelling and methodology

4.2.1 Firm level global, country and industry effects

The majority of papers which examine the industry and country effects concentrate on explaining the behaviour of the aggregate market indexes (Heston and Rouwenhorst, 1994; Griffin and Karolyi, 1998). In this paper, we focus on the firm level evidence. We ask how much of the movement of Honda equity return is due to the fact that Honda is in the automobile industry and how much is due to the fact that Honda is a Japanese firm. Exploring the firm level evidence not only provides new empirical contents to the study of the importance of country versus industry effects, but also has the advantage of allowing us to employ individual firm's accounting data to examine the cross sectional links between firms' country and industry effects and the extent to which firms operate globally.

Our starting point is the standard factor model which decomposes returns into global, country, industry and firm-specific factors. Denoting R_{nt} the return on equity n in country c and industry i in period t, where n goes from 1 to N and t goes from 1 to T, we have

$$R_{nt} = \beta_n^G f_t^g + \beta_n^C f_t^c + \beta_n^I f_t^i + e_{nt} , \tag{4.1}$$

where f_t^g is the return on the global factor, f_t^c and f_t^i are the returns on the country factor c and industry factor i, respectively, and e_{nt} represents the idiosyncratic shock to the return on equity n, all in period t. β_n^G, β_n^C and β_n^I represent loadings on the global, country and industry factors respectively.

In estimation of model (4.1), most papers such as Heston and Rouwenhorst (1994), Griffin and Karolyi (1998) and many others, have imposed restrictions that β_n^G =1 and β_n^C =1 if equity n belongs to country c and 0 otherwise, and β_n^I =1 if equity n belongs to industry i and 0 otherwise. Implicitly, their estimation is the fixed effects model in econometric terms. However, constraining the factor loadings as above, as argued in Marsh and Pfleiderer (1997), may result in an unnecessary loss of information. For example, if two firms are identical in every aspect except that one has higher leverage than the other, then the two must have different sensitivities to the country and industry factors. It is also hardly convincing to assume that firms like Nokia, which accounts for about 60% of the total market capitalization of Finland, has the same loadings as other smaller firms in the country on the country and industry factor returns. In addition, Harvey, Solnik, and Zhou (1994) demonstrate that differences in risk loadings are important in accounting for the cross-sectional variation in industry and country equity returns.

In view of this, we relax the constraints that all β s are unity in our estimation. In econometric terms, we move from a fixed effects model to a random effects one. There are two papers which have applied this random effects model into their analysis. Brooks and Del Negro (2003) which uses the Lehmann and Modest (1985) EM algorithm to obtain the maximum likelihood estimates of the factor loadings in model (4.1); and Cavaglia, Cho and Singer (2001), which employs an iterative estimation approach suggested by Marsh and Pfleiderer (1997). However, the maximum likelihood method can only be applied to balanced panel data. Estimation based on this method might lose much essential information as many firms will be excluded from the model due to their lack of full data coverage. Since we have unbalanced panel data we follow the methodology in the spirit of the iterative approach of Marsh and Pfleiderer (1997).

In particular, a two-step approach is adopted: the first step is to obtain the pure global, country and industry factor returns which are, by construction, orthogonal with each other. The estimation is similar to the fixed effects model of Heston and Rouwenhorst (1994) and Griffin and Karolyi (1998)[18]. Namely, the values for the factor loadings are initially assumed as either unity or zero, and a cross-sectional regression yielding the pure global, country and industry factor returns is estimated at each time point. In the second step, the time series of the pure factor returns are standardized (unity variance) and used in ordinary least squares (OLS) estimates of model (4.1) to obtain the new factor loadings (unconstrained betas) for each firm. The unconstrained betas indicate the sensitivities of a firm's returns to the respective pure global, country and industry factors. Our estimation of betas are expected to be little biased by the interactions among the factor returns for they are extracted from the pure global, country and industry factor returns, which are orthogonal by construction.[19]

---

[18] The detailed estimation procedure is outlined in Heston and Rouwenhorst (1994) and Griffin and Karolyi (1998). As there are 37 countries and 24 industries in the sample, our model is in the following form:

$$R_{nt} = \beta_n^G f_t^g + \sum_{c=1}^{37} \beta_{nc}^C f_t^c + \sum_{i=1}^{24} \beta_{ni}^I f_t^i + \varepsilon_{nt} \qquad (4.2)$$

[19] The country and industry factor returns are orthogonal ex ante by construction, but they may be interacting with each other ex post. However, we find that the average ex post correlations among them to be very small.

Having obtained the unconstrained betas of global, industry and country factors for each firm, we can decompose the firm's total variance into the sum of the variances attributed to those factors and the idiosyncratic components:

$$Var(R_{nt}) = (\hat{\beta}_n^G)^2 + (\hat{\beta}_n^C)^2 + (\hat{\beta}_n^I)^2 + \sigma_n^2 \qquad (4.3)$$

where $Var(R_{nt})$ represents the variance of returns on Equity n, $\hat{\beta}_n^G$, $\hat{\beta}_n^C$ and $\hat{\beta}_n^I$ are the unconstrained betas on the returns of pure global factor, country factor c and industry factor i respectively, and σ_n^2 is the squared residuals. The variance decomposition in model (4.3) enables us to gauge the relative importance of those factors by determining how much of a firm's total variance can be explained by the respective global, country, industry and firm-specific factors.

4.2.2 Cross-sectional analysis

The ultimate purpose of this paper is to explore whether the relative importance of firms' factor effects (global, country and industry) and the driving forces behind those effects are different across firms in emerging markets compared to those in developed markets. We first run a cross-sectional regression of each factor effect on emerging market dummy variable to document the differences between emerging and developed markets:

$$P_n = \alpha_0 + \alpha_1 EM + \eta_n \qquad (4.4)$$

where P_n represents a firm's respective global, country or industry effects. Each effect is calculated as the proportion of a firm's total variance accounted for by the respective factor betas obtained from model (4.3). EM is the dummy variable, which takes the value of 1 if the firm belongs to an emerging country and 0 otherwise. α_0 is the intercept and η_n the error term.

We then proceed to investigate the robustness of the above differences by controlling for some of the firms' specific characteristic variables. Those variables include the firms' foreign sale ratios, ADR listing status and TMT sector affiliations. So the models are in the following form:

$$P_n = \alpha_0 + \alpha_1 EM + \alpha_2 FR + \alpha_3 ADR + \alpha_4 TMT + \eta_n \qquad (4.5)$$

where *FR* denotes the variable of the firms' foreign sale ratios. *ADR* is the dummy variable which equals 1 if the firm is listed as ADR and 0 otherwise. *TMT* is also the dummy variable with a value of 1 for the firm which belongs to TMT sector and 0 otherwise.

4.3 Data

The individual firm constituents of MSCI global index at the end of year 2002 define our data sample. There are altogether 2,179 firms from 23 developed markets and 27 emerging markets, covering the period from Jan 1990 – Dec 2002. Firms with fewer than 3 years of data and countries with fewer than 5 firms are excluded in order to minimize any estimation bias. After the data screening, there are a total of 1,893 firms included in our analysis representing 37 countries out of which 14 are emerging markets. The firms' weekly price and market cap data in US dollars are extracted from Datastream. Each firm's industry affiliation is based on the GICS (General Industry Classification Standard) provided by MSCI. We focus on the broad classification which includes 24 industry groups.

It should be pointed out that our data may be deficient subject to survivorship bias as we examine only those firms which are included in the MSCI global index at the end of our sample period. This means that only firms surviving through the full sample period are covered. However, this problem may be partly offset by the fact that not only some large firms but also many small firms are omitted from our sample. Nevertheless our sample covers roughly 85% percent of the total market capitalization in all the countries included in the analysis. Because the data comprises the largest and most actively traded firms in both developed and emerging markets, it can be reasonably deemed as quite representative from the point view of global investors.

Table 4.1 presents the coverage of firms both across countries and industries. Generally, firms are not evenly distributed. Panel A shows that smaller countries have fewer representations, with Argentina and Austria having only 9 firms. On the other hand, large countries are better represented. There are 380 firms in the US and 309 firms in Japan. In Panel B, while Capital Goods and Material industries include nearly 200 firms, industries like Food and Staple Retail, and Household and Personal Products, are composed of only 31 and 19 firms respectively.

The information of firms' foreign sale ratios and ADR listings are also required in our analysis. Firms' annual foreign sale ratios (foreign sales over total sales) are collected from Thompsons Financial, Bloomberg and the individual firm's websites. Out of the total sample examined, there are 1,262 firms which have reported their foreign sale ratios and these are available for the last five years (1998-2002). The simple five-year average is used in our analysis. We check however the robustness of our results with different alternatives. Firm's ADR information is taken from the website of Bank of New York. The total number of ADR firms in our sample is 532. As the listing years are different across firms, we choose 1996 as the cut off point to differentiate ADR from non ADR firms. Once again we check the robustness of our results by anchoring on different cutting points.

4.4 Empirical results

This section reports our major results. It is divided into two sub-sections. Sub-section 4.4.1 presents the analysis for our full sample period, whereas Sub-section 4.4.2 reports the result for the sub-periods which show the changes of the factor effects over time. In each sub-section, we focus first on the variance decomposition of firms' global, country and industry factor effects to gauge and compare their relative importance, and then move on to the cross-sectional analysis to explore the differences between emerging and developed markets, and the quantitative links between firms' factor effects and the firms' characteristic variables.

4.4.1 Full sample period

4.4.1.1 Variance decomposition

In our analysis we are primarily concerned with the issue of how much of a firm's total variance is explained by the respective global, country and industry factors. So we decompose the firm's total variance based on model (4.3) into proportions accounted for by each of these factors to gauge their respective importance.

Figure 4.1 reports the value weighted averages of the global, country and industry effects across all the firms in our full sample period. On average, the global effects explain 15.69% of firms' total variance, which is the highest out of the three factor effects. This suggests that during our 1992-2002 sample period, the global effects have played a more important role than the country effects in explaining the variation of international equity returns. This could reflect the increasing integration of the global capital markets in the last decade. A similar finding is also reported in other papers. For example, L'Her et al (2002) in their modelling of the global, country and industry effects find the global effects, explicitly identified as size, book-to-market and price momentum, to have increased during their sample period 1992-2000 and to be currently more significant than the country and industry effects.

As far as the country versus industry effects are concerned, the former have a value of 12.86% and the latter 11.54%. Clearly the country effects have dominated the industry effects in our sample period. Yet the gap between the two is very small. The two effects have a ratio of 1.11:1, indicating that the industry effects are almost levelling the country effects. In short, the higher level of global effects and the catching-up industry effects point favourably to our intuition that the ever increasing globalization and market integration have systematic impacts on the dynamics of those factor effects.

On the whole, the three factor effects explain 40.09% of firms' total variance with the rest being attributed to firm specific factors, indicating that firm's specific shocks are the most important determinants of the international equity movements. Similar results are found in L'Her et al (2002), where firm specific effects are over 70%. The dominance of firm specific effects confirms the relevance of investing in a portfolio rather than in a single equity, given that the equity specific component can be significantly reduced by forming a portfolio of non-perfectly correlated securities. In related paper, Campbell et al (2001) decompose the firms' returns into market, industry and firm specific components to study the volatility at the market, industry and firm levels, and find that the firm level volatility is the most important component of the firm's total volatility.

Figure 4.1 also reports the average variance decomposition across firms in both emerging and developed markets. For firms in developed markets, the global, country and industry effects are 16.94%, 12.27% and 14.71% respectively. The global effects are the highest and the industry effects surpass the country effects, confirming the results of other recent studies in the literature, which have concentrated on developed markets. The situation is, however, reversed for firms in emerging markets: the country effects (27.06%) dominate both the global effects (7.65%) and the industry effects (3.49%). As a result, the country effects are the most important determinant of the equity return variation in emerging markets. In the next sub-section we test whether these differences in factor effects between emerging and developed markets are statistically significant.

4.4.1.2 Cross-sectional analysis

We report the cross sectional regression result of each factor effect against the emerging markets dummy variable in Panel A of Table 4.2. The negative signs on the global and industry effects as well as the positive sign on the country effects suggest that firms in emerging markets have lower global and industry effects and higher country effects than in developed markets. Those differences in factor effects between the two markets are significant not only statistically, but also economically. The mean difference between the two markets is -6.8 for the global effects, 6.0 for the country effects and -3.7 for the industry effects. In other words, if the global, country and industry effects for the developed markets are 12%, 8.8% and 4.9% respectively, the corresponding figures for the emerging markets will be 5.2%, 14.8% and 1.2%.[20]

The significance of the above differences between the two markets does not change even after controlling for some of the firms' characteristic variables: foreign sale ratios, ADR listings and TMT sector affiliations (see Panel B of Table 4.2). Emerging markets have lower global and industry effects and higher country effects than developed markets.

As far as the controlling variables are concerned, the coefficients of foreign sale ratios have a positive sign on the global effects and a negative sign on the country effects and both are statistically significant. Those signs are as expected and confirm our prior hypotheses: an increase in the extent to which firms operate globally raises their global effects and reduces their country effects. Specifically, a 10% increase in the level of firm's foreign sales over its total sales can induce an increase of global effects by 0.17% on the one hand, and a decrease of country effects by 0.71% on the other hand. However, the coefficient on the industry effects is insignificant, although it has the expected positive sign. This finding is consistent with what has been found in Brooks and Del Negro (2003), although we applied in this paper a different methodology.

The variable of ADR has a significant relationship with each of the three factor effects. Both the global and industry effects have the right signs and conform to our prior hypotheses: firms listed as ADRs increase their global and industry effects. However, the country effects have an unexpected positive sign, which means that firms listed as ADRs exhibit higher country effects than non-ADR firms. One

[20] In fact, the values of those factor effects for the developed markets are the intercepts in the regressions based on equation (4.4).

possible reason could be that ADR firms in many countries are often large companies which account for a substantial proportion of domestic market indexes, and their returns tend to be more correlated to the domestic market returns compared to those of non-ADR firms[21].

Turning now to the TMT variable we find it to be positively related to the global effects given the global nature of the so-called "new economy", but the coefficient is statistically insignificant. The variable has a statistically significant positive link with the country effects, which means that firms in TMT sectors have higher country effects than non-TMT sectors. On the other hand, it has a negative but insignificant link with the industry effects and thus provides no support for the proposition that the increase in industry effects is only confined to TMT sectors (see Brooks and Del Negro, 2004).

In summary, our cross-sectional regression estimation reveals that there are significant differences between emerging markets and developed markets. Emerging markets have higher country effects and lower global and industry effects than developed markets, and those differences are robust after controlling for some of the firms' characteristics such as firms' foreign sale ratios, ADR listings and TMT sector affiliations. The latter characteristics paint a picture of what drives the factor effects of firms.

4.4.1.3 Robustness checks

As it was pointed out previously our controlling variables such as foreign sale ratios and ADRs may be subject to measurement errors. So we have checked the

[21] Similar findings are also reported in Choi and Kim (2000) and Patro (2000). For example, Patro (2000) studies the return behaviour and pricing of ADRs and shows that ADR firms have a significant exposure to the home-market risk even after controlling for the global market risk.

robustness of our results against alternative specifications. For the variable of foreign sales ratios, we replace the 5-year simple average by the latest 3-year average, the latest single annual figures, and the average of annual percentage increases. No major changes are found and our results generally hold. As for the ADR, we have tried different cutting points from the single year of 1995 through to 1999, and the results are once again qualitatively the same.[22]

4.4.2 Sub sample period analysis

Our analysis up to now spans the whole period 1990 to 2002. Studies have found, however, that the industry and country effects have been changing and it is not until recently that industry effects have caught up with or even surpassed the country effects in importance in the international equity markets. In this sub-section, we conduct our analysis for different sub-periods to investigate whether the full sample results are still valid.

We divide our sample into 4 sub-periods of roughly the same length, Jan 1990-Dec 1993, Jan 1994 to Dec 1996, Jan 1997 to Dec 1999 and Jan 2000 to Dec 2001. For each sub-period, we re-calculate the firms' factor effects for the period and regress each of them cross-sectionally on emerging market dummy variable as well as other controlling variables. In the case where the data of those controlling variables such as foreign sale ratios are not available for a particular sub-period, we use the next sub-period information instead.

4.4.2.1 Variance decomposition

[22] Detailed results are shown in the appendix (Appendix 4A).

The average variance decomposition across all the firms is shown in Figure 4.2. Several points can be made: first, the full sample period result that the global effects are higher than the country effects holds for most of the sub-periods (except for the second one). Second, none of the three factor effects exhibit any upward or downward trend, but a cyclical pattern. Third, in terms of the relative importance of country versus industry effects, the former still dominates the latter in all the sub-periods; however, the two effects are drawing closer. The ratio of country over industry effects drops from 2.31:1 in the first period down to 1.19:1 in the last period. Finally, all the sub-periods show that less than half of firms' total variance is explained by the above three factor effects, and the rest is due to firms' specific factors.

The variance decomposition for both emerging and developed markets is also reported in Figure 4.2. In emerging markets, the country effects dominate the other two effects across all the sub-periods, consistent with what has been found in our full sample analysis. However, the ratio of country to industry effects drops significantly in the last sub-period. A similar downward trend of the ratio is generally also observed in developed markets.

4.4.2.2 Cross-sectional analysis

The results of the cross sectional regressions for the sub-periods are shown in Table 4.3. In Panel A, the coefficients of the emerging market dummy variable have the same signs in all the sub-periods as in the full sample analysis: negative on global and industry effects and positive on country effects. In other words, the global and industry effects are lower while the country effects are higher in emerging markets relative to developed markets. As Panel B shows those differences between the two market groups are still prominent even after controlling for other variables, such as foreign sale ratios, ADR and TMT, which might have significant impacts on the dynamics of firms' factor effects.

The results for the control variables of foreign sale ratios and ADR remain the same in all the sub-periods and are consistent with those of the full sample period. A firm raising its international sales tends to increase its exposure to the global shocks and decrease its exposure to domestic shocks. Similarly ADR listing increases a firm's global and industry effects, yet it raises the firm's country effects as well.

The results for the variable of TMT are volatile across the different sub-periods. As a result of the boom and burst of IT bubbles which occurred during the last two sub-periods, one would expect the industry effects for TMT sectors to be higher. Our estimation shows however that during the last two periods, the coefficients on the industry effects are negative (the one in the last period is significant), meaning that the industry effects are lower for firms in TMT sectors than for those in non-TMT sectors. This suggests that the recent increase of industry effects identified in the literature is not only confined to TMT sectors. In fact, it is more prominent in the non-TMT sectors.

4.5 Implications for International Portfolio Diversification

Our findings in this paper have important implications for international diversification. First, our firm level evidence shows that the country effects, compared to the industry effects, are still more important in explaining the variation of firm level equity returns. Therefore, asset allocation strategy should be based on the country-oriented approach and diversification across countries is still superior to diversification across industries in portfolio management. Particularly, diversification across emerging markets would be more efficient as we find that emerging markets, compared to mature markets, tend to have higher country effects and lower global and industry effects. However, diversification across industries cannot be neglected in the future for we find the industry effects in firm returns to be increasing and country effects to be decreasing in recent years.

Second, in composing portfolios and selecting individual equities, consideration should be given to the firms' various characteristics, such as their level of global business and ADR listing status. We find in this paper that a firm's level of foreign sales is negatively related to the firm's country effects. In other words, an increase in a firm's global operations decreases its exposure to shocks from the domestic market. As more international firms tend to have lower country effects than other firms, it would be advantageous for the country-oriented diversification to choose and include less international firms that have lower levels of foreign sales. On the other hand, our analysis indicates that ADR listing increases a firm's exposure to domestic risks, thus confirming the diversification benefits of ADR investment found in studies such as Choi and Kim (2000) and Patro (2000). However, ADR listing also increases a firm's global and industry effects at the same time. So an efficient way would be to choose firms that are cross-listed as ADRs, less international in business reach, and primarily from emerging markets.

4.6 Conclusions

In this paper we investigate the sources and the dynamics of global, country and industry effects in firm level returns between emerging and mature markets. Previous literature has concentrated on developed markets.

In the first stage of our analysis, we measure the global, country and industry effects in firm level returns by applying a factor model in the spirit of Cavaglia, Cho and Singer (2001) and Marsh and Pfleiderer (1997) to a sample data of 1,893 firms representing 37 countries within 24 industry categories from Jan 1990 to Dec 2002. We note first the differences in factor effects between emerging and developed markets. We subsequently test whether these differences in factor effects are statistically significant by regressing each of these factor effects cross-sectionally on a dummy, which differentiates emerging from developed markets. We check the robustness of our results by controlling for other firm characteristics, such as a firm's extent of business globalization using the firm's foreign sale ratios as a proxy, a firm's degree of financial integration using whether the firm has ADRs or not, and finally, whether a firm belongs to TMT sector. We repeat the exercise by dividing the sample into sub-periods to study the dynamics and sources of the various factor effects over time.

Our paper brings out the differences between emerging and developed markets. Comparing to developed markets, emerging markets have higher country effects and lower global and industry effects. Those differences are significant not only statistically but also economically and can explain why it has been found that the global and industry effects surpass the country effects in developed markets whereas the country effects still dominate the global and industry effects in emerging markets when using market level return data. The significance of such differences is robust to controlling for variables which might have significant impacts on firms' factor effects, and to different sub-sample periods.

In this paper we have also shown that even though the dynamics of firms' global, country and industry effects are different between emerging and developed markets, they are systematically linked to the firms' foreign sale ratios and ADR listings. On the one hand, a rise in a firm's foreign sale ratios increases the firm's global effects and decreases the country effects, and such relations are statistically and economically significant. However, no significant links are found between foreign sale ratios and industry effects, which is consistent with Brooks and Del Negro (2003). On the other hand, ADR listings are positively related to the firms' global and industry effects. This is consistent with our prior expectations. However, what is inconsistent with our expectations is that ADR listing increases, rather than decreases, a firm's country effects. A tentative explanation would be that ADR firms in many countries are large companies accounting for a substantial proportion of domestic market indexes, and their returns are usually more closely correlated to the domestic market returns compared to those of non-ADR firms. All the above results are robust across the four sub-periods.

Third, the link between the firms' factor effects and the TMT sectors is volatile and unstable over time: the signs of the coefficients switch across different time-periods. This volatile and unstable relationship minimizes the possibility that the increase of industry effects is the direct result of IT bubbles. Especially during the last two sub-periods when the IT bubbles were rampant and burst, we find that the relationship between TMT sectors and the industry effects is negative, suggesting that the increase of industry effects in recent years is not confined to TMT sectors, but is an industry-wide phenomenon, and thus not due to IT bubbles. This firm level evidence confirms the findings in Chapter 3 of this thesis, where the study focuses on the market level evidence and concludes that the increase of industry effects is not the consequence of IT bubbles.

Our findings have important implications for the international diversification. First, at the asset allocation level, diversification across countries, especially across emerging economies, is more efficient than diversification across industries. However, diversification across industries should not be neglected in the future as the industry effects are becoming more important over time. Second, at the individual equity selection level, consideration should be taken into account on the firms' various characteristics such as their level of international business and ADR listing status. An efficient way to diversity would be to choose firms that are cross-listed as ADRs, less international in business operations, and primarily from emerging markets.

Tables

Table 4.1 Firm distribution across countries and industries

A. by country

Country	No of firms	Country	No of firms
Argentina*	9	Ireland	11
Austria	9	Italy	39
Australia	61	Japan	309
Belgium	16	Korea*	74
Brazil*	36	Mexico*	17
Canada	70	Malaysia*	62
Switzerland	33	Netherlands	24
Chile*	20	Norway	17
China*	36	New Zealand	10
Germany	44	Philippines*	15
Denmark	21	Portugal	10
Spain	27	Sweden	32
Finland	18	Singapore	33
France	52	Thailand*	26
UK	123	Taiwan*	83
Greece	21	US	380
HK	26	Israel*	26
Indonesia*	14	South Africa*	36
India*	53		
		Total	1893

(Note: * denotes emerging markets)

B. by industry (GICS industry group)

Industry	No of firms	Industry	No of firms
Energy	65	Household & Personal Products	19
Materials	195	Health Care Equipment & Services	48
Capital Goods	198	Pharmaceuticals & Biotechnology	63
Commercial Services & Supplies	49	Banks	130
Transportation	78	Diversified Financials	86
Auto & Components	52	Insurance	54
Consumer Durables & Apparels	74	Real Estate	60
Hotels, Restaurants & Leisure	45	Software & Services	73
Media	77	Tech Hardware & Equipment	111
Retailing	84	Semiconductors & Equipment	41
Food & Staples Retail	31	Telecomm Services	66
Food, Beverage & Tobacco	104	Utilities	90
		Total	1893

Table 4.2 Globalization vs. emerging markets: full sample

	Dependent variables		
	Global effects	Country effects	Industry effects
A. On emerging markets variable			
EM	-0.068 **(-20.02)**	0.060 **(9.72)**	-0.037 **(-9.79)**
$\overline{R}^2$ (%)	17.43	4.71	4.78
B. Adding controlling variables:			
EM	-0.049 **(-14.18)**	0.029 **(4.64)**	-0.014 **(-3.64)**
FR	0.017 **(3.46)**	-0.071 **(-8.05)**	0.004 (1.10)
ADR	0.028 **(7.70)**	0.059 **(8.79)**	0.015 **(3.66)**
TMT	0.004 (1.27)	0.030 **(4.76)**	-0.002 (-0.52)
$\overline{R}^2$ (%)	28.53	15.76	20.51

1. The global, country and industry effects are the proportions of firms' total variance explained by the respective global, country and industry betas based on model (4.3)

2. Panel A shows the cross sectional regression results of each of the firm's factor effects (global, country and industry effects) on the emerging market dummy variable (EM) which takes the value of 1 if the firm belongs to the emerging markets and 0 otherwise.

3. Panel B shows the above links after controlling for the firm's characteristic variables: FR, ADR and TMT. FR is the firm's foreign sale ratios. ADR is the dummy variable which equals 1 if the firm is listed as ADR and 0 otherwise. TMT is also the dummy variable which is equal to 1 if the firms belong to TMT sectors and 0 otherwise.

4. *t* statistics are shown in parentheses. The figures highlighted represent the significance at 5% level or less.

5. Each of the regressions includes a constant term and regressions in Panel B include a US dummy variable which equals 1 if the firms belong to US and 0 otherwise.

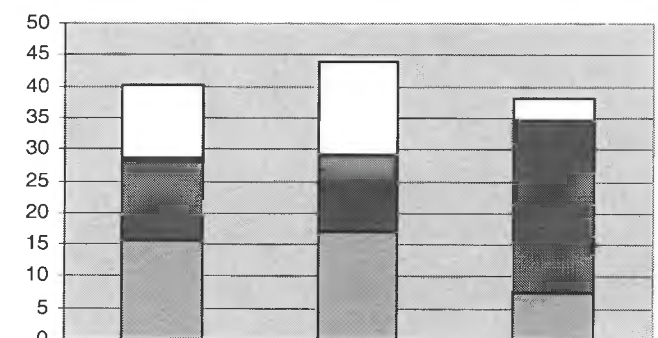
Table 4.3 Globalization vs. emerging markets: sub-periods

	Subperiod1 (90.1- 93.12)			*Subperiod2 (94.1- 96.12)*			*Subperiod3 (97.1-99.12)*			*Subperiod4 (00.1- 02.12)*		
	Dependent Variable			Dependent Variable			Dependent Variable			Dependent Variable		
	global	country	industry	global	country	industry	global	country	industry	global	global	country
A. On emerging market variable												
EM	-0.094	0.098	-0.022	-0.051	0.010	-0.029	-0.054	0.017	-0.039	-0.045	0.080	-0.028
	(-17.04)	**(10.60)**	**(-5.00)**	**(-14.11)**	**(12.11)**	**(-6.75)**	**(-11.56)**	**(24.79)**	**(-9.19)**	**(-13.00)**	**(11.43)**	**(-9.36)**
R^2 (%)	17.47	7.03	1.61	10.53	7.94	2.58	6.60	24.60	4.25	8.16	6.41	4.38
***B. Adding controlling variables*:**												
EM	-0.079	0.077	-0.10	-0.043	0.064	-0.011	-0.029	0.014	-0.019	-0.026	0.058	-0.014
	(-13.30)	**(8.03)**	**(-2.22)**	**(-11.06)**	**(7.40)**	**(-2.34)**	**(-6.15)**	**(19.31)**	**(-4.27)**	**(-7.13)**	**(7.81)**	**(-4.64)**
FR	0.024	-0.026	0.001	0.011	-0.067	0.012	0.025	-0.056	0.006	0.032	-0.065	-0.003
	(2.96)	**(-2.00)**	(0.23)	**(2.04)**	**(-5.55)**	(1.86)	**(3.70)**	**(-5.44)**	(0.96)	**(6.48)**	**(-6.26)**	(-0.78)
ADR	0.030	0.071	0.005	0.022	0.097	0.010	0.015	0.048	0.010	0.016	0.042	0.016
	(4.43)	**(6.47)**	**(3.02)**	**(5.37)**	**(10.59)**	**(2.00)**	**(3.19)**	**(6.68)**	**(2.37)**	**(4.65)**	**(6.03)**	**(5.39)**
TMT	-0.027	-0.025	0.001	-0.009	-0.005	0.015	0.014	0.020	-0.007	0.005	0.045	-0.010
	(-4.35)	**(-2.51)**	(0.03)	**(-2.36)**	(-0.57)	**(3.25)**	**(2.81)**	**(2.75)**	(-1.67)	(1.40)	**(5.95)**	**(-3.04)**
R^2 (%)	19.83	15.74	5.59	14.67	11.57	12.72	16.91	31.69	14.49	18.20	11.74	16.64

Please refer to the explanation in Table 4.2. For each sub-period, we re-calculate the firms' factor effects for the period and regress each of them cross-sectionally on emerging market dummy variable as well as other controlling variables. In the case where the data of those controlling variables such as foreign sale ratios are not available for a particular sub-period, we use the next sub-period information instead. The figures in parentheses are the t statistics and those in bold terms represent the significance at the 5% level or less.

Figures

Figure 4.1 Variance decomposition for all firms, developed vs. emerging markets: full sample



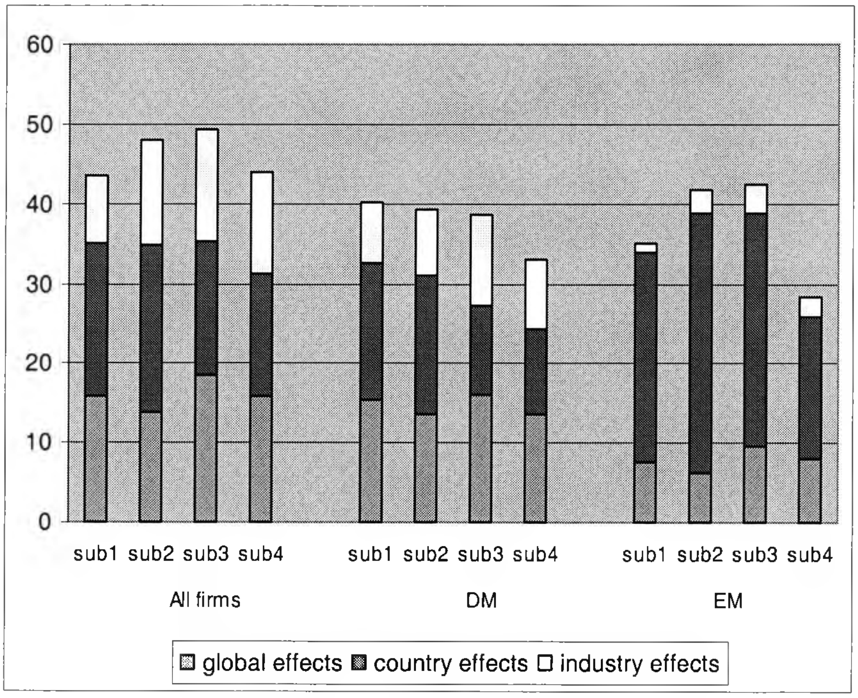
	All firms	DM	EM
Industry effects	11.54	14.71	3.49
Country effects	12.86	12.27	27.06
Global effects	15.69	16.94	7.65

Note: 1. The graph and the table show the proportions (%) of total variance in firm level returns accounted for by the respective global, country and industry factors. Those proportions are the value weighted averages across all firms, developed markets or emerging markets and are measured via Equation (4.1) and Equation (4.3).

2. The time period examined is from Jan 1990 to Dec 2001.

3. DM denotes developed markets whereas EM represents emerging markets.

Figure 4.2 Variance decomposition for all firms, developed versus emerging markets: sub-periods



Note: 1. The graph and the table show the proportions (%) of total variance in firm level returns explained by the respective global, country and industry factors across four different sub-periods. Those proportions are the value weighted averages across all firms, developed markets and emerging markets and are measured via Equation (4.1) and Equation (4.3).

2. The four sub-periods are Jan 1990- Dec 1993, Jan 1994-Dec 1996, Jan 1997-Dec 1999 and Jan 2000- Dec 2001.

3. DM denotes developed markets whereas EM represents emerging markets.

Appendix

Appendix 4A Robust Tests for Controlling Variables

		Dependent variables		
		Global effects	*Country effects*	*Industry effects*
Panel A Alternative foreign sale ratios (FR)				
(1)	FR(1)	0.008 (1.25)	-0.074 **(-6.91)**	0.020 **(2.69)**
	EM	-0.052 **(-10.26)**	0.045 **(5.33)**	-0.011 (-1.91)
	ADR	0.024 **(5.36)**	0.066 **(8.79)**	0.016 **(3.09)**
	TMT	-0.0003 (-0.64)	0.021 **(2.86)**	-0.006 (-1.28)
	R2 (%)	24.79	18.32	19.94
(2)	FR(2)	0.004 (0.628)	-0.066 **(-6.30)**	0.021 **(2.62)**
	EM	-0.052 **(-9.42)**	0.043 **(5.03)**	-0.011 (-1.79)
	ADR	0.024 **(4.94)**	0.067 **(8.83)**	0.017 **(3.05)**
	TMT	-0.003 (-0.71)	0.015 **(2.15)**	-0.006 (-1.19)
	R2 (%)	23.85	18.63	19.61
(3)	FR(3)	0.184 (1.82)	-0.226 (-1.21)	0.061 (0.56)
	EM	-0.052 **(-15.61)**	0.043 **(6.99)**	-0.016 **(-4.45)**
	ADR	0.028 **(7.30)**	0.057 **(8.13)**	0.014 **(3.61)**
	TMT	0.005 (1.56)	0.028 **(4.33)**	-0.001 (-0.31)
	R2 (%)	27.96	13.39	20.40
Panel B Alternative ADR variables (ADR)				
(1)	ADR(1)	0.027 **(6.73)**	0.061 **(8.41)**	0.014 **(3.28)**
	EM	-0.048 **(-13.99)**	0.031 **(4.81)**	-0.013 **(-3.57)**
	FR	0.018 **(3.74)**	-0.069 **(-7.81)**	0.013 **(2.49)**
	TMT	0.005 (1.46)	0.032 **(5.02)**	-0.002 (-0.41)
	R2 (%)	28.21	15.71	20.62
(2)	ADR(2)	0.027 **(7.00)**	0.063 **(8.98)**	0.014 **(3.38)**
	EM	-0.049 **(-14.14)**	0.029 **(4.68)**	-0.013 **(-3.64)**
	FR	0.018 **(3.65)**	-0.07 **(-7.94)**	0.013 **(2.45)**

	TMT	0.004 (1.37)	0.031 **(4.93)**	-0.001 (-0.46)
	R2 (%)	28.34	16.14	20.64
(3)	ADR(3)	0.025 **(7.07)**	0.054 **(8.29)**	0.013 **(3.45)**
	EM	-0.048 **(-14.03)**	0.031 **(4.76)**	-0.013 **(-3.58)**
	FR	0.017 **(3.67)**	-0.069 **(-7.83)**	0.012 **(2.45)**
	TMT	0.004 (1.05)	0.028 **(4.51)**	-0.002 (-0.62)
	R2 (%)	28.38	15.62	20.66
(4)	ADR(4)	0.025 **(7.33)**	0.053 **(8.42)**	0.015 **(4.05)**
	EM	-0.049 **(-14.19)**	0.029 **(4.61)**	-0.014 **(-3.64)**
	FR	0.017 **(3.53)**	-0.071 **(-7.97)**	0.012 **(2.33)**
	TMT	0.003 (0.97)	0.028 **(4.42)**	-0.002 (-0.66)
	R2 (%)	28.52	15.72	20.85

Note: The table reports the robust estimation of cross sectional analysis in Table 4.2 by using the alternative measures of controlling variables. For the variable of foreign sale ratios shown in Panel A, (1), (2) and (3) represent the latest three-year average, the latest single year ratio and the average of annual percentage increase respectively. For the variable of ADR shown in Panel B, (1)-(4) denote respectively the cutting point by the year of 1995, 1997, 1998 and 1999. *t* statistics are shown in parentheses. The figures highlighted represent the significance at 5% level or less.

CHAPTER FIVE

EQUITY MARKET COMOVEMENT AND CONTAGION: A SECTORAL PERSPECTIVE

5.1 Introduction

Researchers have shown a long time interest in the study of financial market comovement. Various studies have found that market comovement is currently higher.[23] This increased comovement can be attributed to the increasing market integration in relation to the close economic and financial links. However, market integration may not fully explain this comovement, and contagion may, in part, contribute to the process. In the last decade or so, financial markets were hit by a series of crises: the 1992 ERM attacks, the 1994 Mexican peso collapse, the 1997 East Asian crisis, the 1998 Russian collapse, the 1998 LTCM crisis, the 1999 Brazilian devaluation and the 2000 technological crisis. A striking feature during those crises is that markets tend to move more closely together than in the tranquil times. Such strong comovement is frequently referred to as contagion. Evaluating if contagion occurs and understanding its origin is important for policy makers and fund managers aiming to diversify risks. If contagion prevails in times of crises, the benefits of international diversification would be hampered when they are mostly needed.

Many papers have studied the contagion effect on the equity markets (e.g. King and Wadhwani, 1990; Forbes and Rigobon, 2001, 2002; and Bekaert, Harvey and Ng, 2003). All of them focus on the empirical evidence at the market level and examine whether contagion exists across markets. The question they try to answer is whether idiosyncratic shocks from one particular market or group of markets are transmitted to the other markets during financial crises. In this paper, we take a different perspective and explore the equity market contagion at the disaggregated sector level, an issue which has not yet been examined in the literature. The question

[23] See, e.g. Freimann (1998) and Goetzmann et al (2005)

we endeavour to answer is whether unexpected shocks from a particular market, or group of markets, are propagated to the sectors in other countries.

Studying the contagion effect at sector level is important for several reasons. First, studying the contagion at the market level may mask the heterogeneous performances of various sectors. Sector contagion can be asymmetric, in the sense that some sectors are more severely affected by external shocks than the other sectors within a market. Forbes (2001) shows that trade linkage is an important determinant of a country's vulnerability to crises that originate from elsewhere in the world. If this is so, sectors with extensive international trade (e.g. traded goods sectors) would tend to be more prone to external shocks than sectors with less international trade (e.g. non-traded goods sectors). Some sectors (e.g. Banking) may even constitute a major channel in transmitting the shocks across markets during crises (see e.g. Tai, 2004; and Kaminsky and Reinhart, 1999). From the point view of portfolio management, the sector heterogeneity of contagion implies that there are sectors which can still provide a channel for achieving the benefits of international diversification during crises despite the prevailing contagion at the market level. Second, there is evidence showing that in recent years the global industry factors are becoming more important than the country specific factors in driving the variation of international equity returns (e.g. Baca et al, 2000; Cavaglia, Brightman and Aked, 2000; and chapter 3 and 4 of this thesis).[24] Industries have overcome the cross-border restrictions and become increasingly correlated worldwide, which increases the likelihood of industries' role in propagating the global shocks and providing a channel for transmitting the contagion effect. Third, the industrial composition varies across global markets. Large, mature markets (e.g. US and UK) comprise of more diversified industries

[24] A detailed literature review can be found in chapter 3 of this thesis.

whereas small, less mature markets (e.g. Switzerland) are usually concentrated on a few industries. It is thus interesting to know whether markets with similar industrial structures will co-move more closely with each other and be more prone to contagion during crises compared to the markets with different industrial structures.

The importance of industry/sector analysis is also highlighted in other studies. Campbell et al (2001) decompose the firms' returns into market, industry and firm specific components to study the volatility at the market, industry and firm levels. They have found that all the three volatility measures increase substantially in economic downturns and tend to lead recessions. The volatility measures, particularly the industry-level volatility, help to forecast economic activity and reduce the significance of other commonly used forecasting variables such as market returns and lagged GDP growth rate. Griffin and Stulz (2001) examine the importance of exchange rate movement and industry competition for equity returns and find that common shocks to industries across countries are more important than competition shocks due to changes in exchange rates. Moskowitz and Grinblatt (1999) and Rouwenhorst (1998) show that industry momentum strategies are profitable and suggest the existence of time-varying industry risk premium.

The literature on contagion has shown no consensus on the exact definition of contagion. In this paper, we define contagion as excess correlation – that is, correlation over and above what one would expect from economic fundamentals.[25] Our paper takes an asset pricing perspective and contagion is defined by the correlation of the model residuals. Our asset pricing model follows the methodology of Bekaert, Harvey and Ng (2003) and examines two sources of risk: one from the US equity market (proxy for the world market) and the other from the regional market.

[25] The detailed definitions of contagion are shown on the World Bank's website: http://www1.worldbank.org/economicpolicy/managing%20volatility/contagion

This structure nests a world asset pricing model (CAPM) with the US equity return as the benchmark and a regional CAPM with a regional portfolio as the benchmark. We test the asset pricing specifications by adding local factors. Essentially test of integration or segmentation constitutes a critical step in our analysis. If a sector is globally integrated for most of the sample period but suddenly experiences a strong integration at the regional level during a regional crisis, our test will reject the null hypothesis of no contagion. Conversely, if the sector is initially integrated at the regional level, an increase of regional integration during the regional crisis may not indicate a contagion; rather it is simply a consequence of increased interdependence.

Therefore, our main contribution to the literature is the examination of contagion effect at the sector level. As it has been argued above sector level contagion is an important issue, but it has not yet been examined. We focus on the sectors of small equity markets across three regions: Europe, Asia and Latin America. At the same time, our model tests whether the sectors are more integrated at the global or regional level, thus nesting the empirical work on equity market integration at the industry level, a subject covered in papers such as Carrieri et al (2004), Berben and Jansen (2005) and Kaltenhauser (2002, 2003). However, the novelty of our analysis in this area is our focus on the sector returns in 29 smaller markets in Europe, Asia and Latin America, whereas the previous papers mainly concentrate on sectors in the euro zone or a few major markets such as the US, UK, Japan, or G-7 countries. This constitutes our paper's second major contribution to the literature.

The remaining of our paper is organized as follows: after reviewing the relevant literature in Section 5.2, we describe our estimation and modelling framework in Section 5.3. While Section 5.4 presents the data and the empirical results, the final section summarizes and concludes this paper.

5.2 Related Literature

As mentioned above, our paper draws from two strands of literature: equity market contagion and equity market integration.

5.2.1 Equity market contagion

The primary focus of our paper is to examine the contagion effect at sector level in equity markets and test whether contagion exists in sectors during the periods of financial crises such as the Mexican crisis in 1994 and the Asian crisis in 1997. The previous literature focuses on the cross-market evidence. The early studies make use of correlation analysis. The central idea is to assess whether the correlation coefficient between two equity markets changes across tranquil and volatile periods. If the correlation increases significantly, it suggests that the transmission between the two markets amplifies after the shock and thus contagion occurs. Papers following this methodology examine the contagion immediately after the US equity market crash of 1987. The seminal reference is King and Wadhwani (1990), which uses hourly equity market data for the period September 1987 to November 1987 and finds that cross-market correlations between the US, UK and Japan increased significantly after the US crash.

Bertero and Mayer (1990) extend this analysis to a sample of 23 industrialized and developing countries and find also that the correlation coefficients increased appreciably following the equity market crash in the US. Lee and Kim (1993) find further evidence of contagion when applying the same approach to twelve major markets: the average weekly cross-market correlations went from 0.23 before the 1987 crash up to 0.39 afterwards. Calvo and Reinhart (1996) focus on emerging markets and find that the correlations in equity prices and Brady bonds between Asian and Latin American emerging markets increased significantly during the 1994 Mexican peso crisis. Baig and Goldfajn (1999) present the most thorough analysis using this framework and test for contagion in equity indices, currency prices, interest rates and sovereign spreads in emerging markets during the 1997-1998 Asian crisis. They document a surge of cross-market correlations during the crisis for many of the countries.

However, later studies have recognized that focusing on correlations can be misleading. For example, Forbes and Rigobon (2001, 2002) show that looking at unadjusted correlation coefficients is not appropriate, as the calculated correlation coefficient is an increasing function of the variance of the underlying asset return, so that when coefficients between a tranquil period and a crisis period are compared, the coefficient in the crisis period is biased upwards as volatility rises substantially. After correcting for this bias, they find no contagion during the 1997 Asian crisis, the 1994 Mexican peso collapse, and the 1987 US equity market crash. Instead, a high level of market co-movement is found during these crises periods, which reflects a continuation of strong cross-market linkages present globally. Their conclusion is "there is no contagion, only interdependence". On the other hand, a contrary argument is developed in Corsetti et al. (2002), who suggest that the results of Forbes and Rigobon (2001, 2002) are highly dependent on their specification of idiosyncratic shocks. When these shocks are accounted for, contagion was present during the Asian crisis.

Bekaert, Harvey and Ng (2003) avoid the above correlation analysis and develop a two-factor (global and regional) asset pricing model to examine the equity market contagion in the regions of Europe, South-East Asia and Latin America during both the Mexican and Asian crises in the 1990s. By defining contagion as correlation among the model residuals after controlling for the local and foreign shocks, the authors show that there is no evidence of additional contagion caused by the Mexican crisis. However, economically meaningful increases in the residual correlation have been found, especially in Asia, during the Asian crisis, a result confirmed by Dungey et al. (2003) and others who have studied the contagion on Asian equity markets.

5.2.2 Industry level integration

Equity market integration has been extensively studied, while integration at the industry level has been of recent interest (see e.g. Carrieri et al, 2004; Berben and Jansen, 2005; and Kaltenhauser, 2002, 2003). Our paper is closely related to this literature and examines whether sectors are integrated at the global or regional level. However, our focus is on the evidence in smaller countries in Europe, Asia and Latin America, whereas the above papers concentrate on the euro zone or in large, developed countries such as the US, UK and Japan or the G-7 countries.

Carrieri et al (2004) apply a conditional asset pricing framework to a sample of 458 weekly returns from 18 industries across the G-7 countries during the periods of 1991-1999, and find that global industry risk is priced for some industries and that the time variation in the prices of global industry risks has recently increased. Their evidence further shows that market level integration does not preclude industry level segmentation. Even if a market is integrated with world markets, some of its industries may still be segmented. Similarly, some of industries may be integrated even though a market is segmented from the rest of the world.

Berben and Jansen (2005) develop a novel bivariate GARCH model with smoothly time-varying correlation to test for an increase in co-movements between equity returns at the market and industry level. They find that in the period 1980-2000 conditional correlations among Germany, UK and the US equity markets have doubled and this correlation behaviour is broadly reflected at the industry level as well.

Kaltenhauser (2002) estimates the time-varying spillover effects from European and US return innovations to 10 industry sectors within the euro area, the US and UK for the period 1988-2002. Over time sectors have become more heterogeneous, and the response to aggregate shocks has increasingly varied across sectors. This provides evidence that sector-specific effects have gained in importance. They also indicate that information technology and non-cyclical services, which are most affected by the aggregate European and US shocks, are the most integrated sectors worldwide. On the other hand, basic industries, non-cyclical consumer goods, resources, and utilities are less affected by aggregate shocks.

In another paper, Kaltenhauser (2003) distinguishes between three types of linkages (cross-country linkages, cross-sector linkages within a given country, and the linkages among equivalent sectors across countries) and explores the spillover effects between equity returns of ten sectors in the euro area, the US and Japan during the periods of 1986-2002. The results indicate that the price innovations in European equities, stemming from both aggregate and sector returns, have doubled or tripled their impacts on other equity markets. At the same time, the response to aggregate shocks in the countries examined has increasingly varied across sectors. Overall, the equity markets in the euro area and the US have become more integrated with each other during the late 1990s, and this higher integration is especially pronounced for sectors compared to the aggregate markets.

5.3 Framework of Analysis

5.3.1 The models

We examine the sector returns using the two-factor asset pricing model developed in Bekaert, Harvey and Ng (2003), where the two factors are defined as the US market (proxy for the global source of risk) and a particular regional market (proxy for the regional source of risk). We also allow for local factors to be priced. Our model has the following specification:

$$r_{i,j,t} = \delta_{i,j} X_{i,j,t-1} + \beta^{us}_{i,j,t-1} \mu_{us,t-1} + \beta^{reg}_{i,j,t-1} \mu_{reg,t-1} + \beta^{us}_{i,j,t-1} e_{us,t} + \beta^{reg}_{i,j,t-1} e_{reg,t} + e_{i,j,t}, \tag{5.1}$$

$$e_{i,j,t} \mid \Omega_{t-1} \sim N(0, \sigma^2_{i,j,t}), \tag{5.2}$$

$$\sigma^2_{i,j,t} = a_{i,j} + b_{i,j} \sigma^2_{i,j,t-1} + c_{i,j} e^2_{i,j,t-1} + d_{i,j} \eta^2_{i,j,t-1}, \tag{5.3}$$

where $r_{i,j,t}$ is the weekly excess return of sector i in country j. $\mu_{us,t-1}$ and $\mu_{reg,t-1}$ are the conditional expected excess returns on the US and a regional market, respectively, based on information available at time *t-1*; and $e_{us,t}$ and $e_{reg,t}$ are the respective residuals of the US and regional market excess returns. All the excess returns are calculated in excess of the weekly US one-month Treasury-bill rate and expressed in US dollars. $e_{i,j,t}$ is the idiosyncratic shock of sector i in country j, and Ω_{t-1} includes all the information available at time *t-1*. The variance of the idiosyncratic return shock of sector i follows a GARCH process as specified in (5.3) with asymmetric effects in conditional variance. $\eta_{i,j,t}$ is the negative return shock of sector i in country j, i.e. $\eta_{i,j,t} = \min\{0, e_{i,j,t}\}$. The vector $X_{i,j,t-1}$ contains a set of local economic fundamentals which help estimate the expected return of sector i. In our analysis, the fundamentals are proxied by a constant, the dividend yield of sector i and the market dividend yield of country j which sector i belongs to.

The parameter $\beta^{us}_{i,j,t-1}$ measures the sensitivities of sector i to the US news factors, which derives from two components: the conditional expected returns ($\mu_{us,t-1}$) and the residuals ($e_{us,t}$). An analogy applies to the parameter $\beta^{reg}_{i,j,t-1}$, which measures the sensitivities of sector i to the regional news factors. Those conditional betas $\beta^{us}_{i,j,t-1}$ and $\beta^{reg}_{i,j,t-1}$ are the cornerstone of our tests of integration and contagion. We begin with an examination of model (5.1)-(5.3) assuming the betas to be constant in order to obtain the benchmark case, and then allow those betas to change over time in order to capture their time-varying nature. The time-varying parameters of $\beta^{us}_{i,j,t-1}$ and $\beta^{reg}_{i,j,t-1}$ are obtained through a one-year window rolling estimation. Specifically, we take a 12-month regression window, starting from the beginning of our data sample and moving this 12-month window forward by one month at a time. We use this method to study the time-varying integration of our sectors.[26]

The US and regional market models are the special cases of (5.1)-(5.3). For the US market, $r_{i,j,t} = r_{us,t}$, $\beta^{us}_{us,t-1} = \beta^{reg}_{us,t-1} = 0$, and $X_{i,j,t-1} = X_{us,t-1}$ where the latter comprises a set of world information variables, including a constant, the world market dividend yield, the spread between the 90-day Eurodollar rate and the 3-month Treasury-bill yield, the difference between the US 10-year Treasury bond yield and the 3-month bill yield, the change in the 90-day Treasury bill yield, and the US

[26] See, e.g. Fratzscher (2002) and Kaltenhauser (2002, 2003) for a similar approach to time-varying integration.

money supply (M3). These variables are often used in the literature to capture the movement of international equity market returns. For the regional market model, $r_{i,j,t} = r_{reg,t}$, $\beta^{reg}_{reg,t-1} = 0$ and $X_{i,j,t-1} = X_{reg,t-1}$, which includes a constant and the regional market dividend yield.

Apart from examining the beta parameters, we also calculate the variance ratios for each sector i. As shown in (5.1), the return of sector i is composed of expected (i.e., the expected excess return) and unexpected parts: the expected excess return of sector i, $\mu_{i,j,t}$, is a linear function of some local information variables as well as the expected excess return on the US and regional markets,

$$\mu_{i,j,t} = E[r_{i,j,t} \mid \Omega_{t-1}] = \delta_{i,j} X_{i,j,t-1} + \beta^{us}_{i,j,t-1}\mu_{us,t-1} + \beta^{reg}_{i,j,t-1}\mu_{reg,t-1} \tag{5.4}$$

Similarly, the unexpected part of the sector return ($\varepsilon_{i,j,t}$) is driven not only by its own idiosyncratic shocks, but also by the shocks from the US and regional markets,

$$\varepsilon_{i,j,t} = \beta^{us}_{i,j,t-1} e_{us,t} + \beta^{reg}_{i,j,t-1} e_{reg,t} + e_{i,j,t} \tag{5.5}$$

To complete the model, we assume that the idiosyncratic shocks from the US, region and the sector i are orthogonal with each other, and therefore the conditional variance of sector i is in the following form:

$$h_{i,j,t} = E[\varepsilon^2_{i,j,t} \mid \Omega_{t-1}] = (\beta^{us}_{i,j,t-1})^2 \sigma^2_{us,t} + (\beta^{reg}_{i,j,t-1})^2 \sigma^2_{reg,t} + \sigma^2_{i,j,t} \tag{5.6}$$

Equation (5.6) allows us to derive two variance ratios to explore how much of the local sector return variance is explained by the respective US and regional factors ($VR^{us}_{i,j,t}$ and $VR^{reg}_{i,j,t}$):

$$VR^{us}_{i,j,t} = \frac{(\beta^{us}_{i,j,t-1})^2 \sigma^2_{us,t}}{h_{i,j,t}} \tag{5.7}$$

$$VR^{reg}_{i,j,t} = \frac{(\beta^{reg}_{i,j,t-1})^2 \sigma^2_{reg,t}}{h_{i,j,t}} . \tag{5.8}$$

5.3.2 Tests of integration and contagion at sector level

In examination of the two-factor model of (5.1)-(5.3), we assume first that the conditional betas are time-invariant to obtain a benchmark case, and then relax this assumption and allow the betas to change over time. The model (5.1)-(5.3) with time-invariant betas can test several integration hypotheses. On the one hand, if the model holds, that is, if the two foreign risk factors are sufficient in explaining the expected returns of sectors within a particular country, the local instruments should have no explanatory power on those sector returns, and thus $\delta_{i,j} = 0$. We interpret this test as a test of integration, where the integration can be either global or regional. On the other hand, the model nests the one-factor CAPM model as a special case. If $\beta^{reg}_{i,j,t-1} = 0$ together with $\delta_{i,j} = 0$, the model reduces to the traditional CAPM with the US being the benchmark market and sector i priced with the US market. In this case, the model implies that sector i is fully integrated with the world market. Similarly, if $\beta^{us}_{i,j,t-1} = 0$ together with $\delta_{i,j} = 0$, the model becomes one-factor model with the region being the benchmark market. We interpret this as a full integration of sector i at the regional level.

The model (5.1)-(5.3) with time-variant betas is examined via the rolling estimation method with one-year regression window. We use this method to study the time-varying integration at sector level. After the time-variant betas have been accounted for, we employ the model residuals to examine the sector level contagion effect. Contagion is measured by the correlation of the model's idiosyncratic shocks. Any significant correlations amongst those shocks would indicate that sector residuals are correlated beyond what is captured in our model, suggesting evidence of contagion.

For each sector i, three correlations are considered: with the global shocks from the US market, with the regional shocks from a geographic region, and with intra-sector shocks from the equivalent sectors in other countries within a region. Our model is in the following form:

$$\hat{e}_{i,j,t} = \nu_{i,j} + \phi_{i,j,t}\hat{e}_{g,t} + \xi_{i,j,t} \tag{5.9}$$

$$\phi_{i,j,t} = m + n D_{i,t} \tag{5.10}$$

where $\hat{e}_{i,j,t}$, $\hat{e}_{g,t}$ are the estimated idiosyncratic return shocks of sector i and a country-group respectively after the time-varying betas have been accounted for. Three country-groups are employed: the return shocks from the US, $\hat{e}_{g,t} = \hat{e}_{us,t}$, the return shocks from a geographic region, $\hat{e}_{g,t} = \hat{e}_{reg,t}$, and the intra-sector shocks (i.e. the sum of equivalent sector shocks within a particular region excluding that sector in country j to be considered), $\hat{e}_{g,t} = \sum_{\substack{k \neq j \\ k \subset G}} \hat{e}_{i,k,t}$, where G denotes a particular region country k belongs to.

The regression of model (5.9) across time yields the time-varying coefficient, $\phi_{i,j,t}$, for each sector i. The time-varying coefficients $\phi_{i,j,t}$ of equivalent sectors are pooled into cross-sectional time-series data and examined separately in model (5.10) for each of the three regions: Europe, Asia and Latin America[27]. $D_{t,t}$ is a dummy variable that represents two sample periods: the Mexican crisis period from November 1994 to December 1995 and the Asian crisis period from April 1997 to October 1998. In estimation of the above regression, we establish a baseline level of contagion by examining the shock correlations over the full sample period, i.e. whether the coefficients of m and n are zero (overall contagion for the whole sample period), and test for additional contagion during crisis periods by examining the significant increase of shock correlations during a particular crisis period, i.e. whether n is significantly different from zero (contribution of a particular crisis period to contagion).

5.3.3 Model estimation and specification test

Sector returns, together with the US and regional market returns, can be treated as a joint multivariate likelihood function. We estimate this joint function in three stages. In the first stage, the model for the US market is estimated, and then based on the US estimates, we examine the regional market model. In the final stage,

[27] The estimation of model (5.10) for each region corrects for the serial correlation and group-wise heteroskedasticity.

a univariate model in (5.1)-(5.3) is estimated sector by sector, conditioning on the US and the regional market estimates.[28]

By using the generalized method of moments, we conduct a series of specification tests on the estimated standardized idiosyncratic shocks, $\hat{z}_{i,j,t} = \hat{e}_{i,j,t} / \hat{\sigma}_{i,j,t}$ for sector i (including the US and regional markets). Under the null hypothesis that the model is correctly specified,

$$E[\hat{z}_{i,j,t}] = 0, \tag{5.11a}$$

$$E[\hat{z}_{i,j,t}\hat{z}_{i,j,t-s}] = 0, \text{ for } s = 1,...,\tau, \tag{5.11b}$$

$$E[\hat{z}^2_{i,j,t} - 1] = 0, \tag{5.11c}$$

$$E[(\hat{z}^2_{i,j,t} - 1)(\hat{z}^2_{i,j,t-s} - 1)] = 0, \text{ for } s = 1,...,\tau, \tag{5.11d}$$

$$E[\hat{z}^3_{i,j,t}] = 0, \tag{5.11e}$$

$$E[\hat{z}^4_{i,j,t} - 3] = 0 \tag{5.11f}$$

Equation (5.11b) and (5.11d) are a sequence of the correct specification for the conditional mean and variance, and we test these two conditions by Ljung-Box Q-statistics. The unconditional moments in the other four constraints are jointly tested by a χ^2 statistics with four degrees of freedom.

5.4 Empirical Results

5.4.1 Data

[28] This methodology has also been employed in, for example, Bekaert and Harvey (1997).

The empirical analysis is conducted on the sector returns for a set of 29 countries that are grouped into three geographical regions – Europe, Asia and Latin America. All the sector indices as well as the US and regional market indices are compiled by and extracted from Datastream International. We follow the broad distinction of ten economic sectors according to the Financial Times Actuaries, which Datastream uses: Basic Industries, Cyclical Consumer Goods, Cyclical Services, Financials, General Industries, Information Technology, Non-cyclical Consumer Goods, Non-cyclical Services, Resources, and Utilities (see Appendix 5A and 5B for a more detailed description of sector classifications and a list of our sample countries).

Our Wednesday-to-Wednesday sample covers the period from 3 January 1990 to 30 June 2004 for most countries and a somewhat shorter time period for a few countries where some of the time series started later. All weekly returns are calculated in excess of the weekly US one-month Treasury-bill rate and expressed in US dollars. The other data, including dividend yields, 90-day Eurodollar rate, 3-month Treasury-bill yield, US 10-year Treasury bond yield and the US money supply (M3) are also downloaded from Datastream.

5.4.2 US and regional models

Table 5.1 details the US and regional market estimation. For the US market (first row in the table), asymmetric GARCH model is selected as the hypothesis of no asymmetry in the conditional variances is strongly rejected. All three specification tests fail to reject the US model specification. The Wald test on the information variables indicates that the explanatory power of those variables is significant.

The rest of Table 5.1 presents the regional market estimation. Like the US market, both Asia and Latin America exhibit asymmetric volatility. However, we find little evidence of asymmetry in the region of Europe. The three specification tests fail to provide evidence against our model specification for all three regions. The local instruments have significant explanatory power in Asia, but not in Latin America or Europe.

The conditional betas with respect to the US market are significant for all three regions, with Europe being the highest (0.593), followed by Latin America (0.576) and Asia (0.431). In terms of variance ratios, more than 30% of the conditional return variance in Europe can be attributed to the US shocks, whereas the ratios are 15.68% and 12.25% for Latin America and Asia respectively.

5.4.3 Sector level integration

In this sub-section, we estimate GARCH model (5.1)-(5.3) for sectors with constant coefficients, i.e. with coefficients that are assumed to be time-invariant. Our framework tests the sector level integration and nests at least two distinct models: an asset pricing model with a single US factor and an asset pricing model with a single regional factor. Detailed sector-by-sector tests are shown in appendix (Appendix 5B). Here we summarize the main results.

In total, the numbers of sector returns to be tested are 130 in Europe, 76 in Asia and 61 in Latin America. We first test whether the lagged local information enters the mean equation (test of $\delta_{i,j} = 0$). If the asset pricing model is properly specified, those local instruments should not enter the model. This test can be thought of as a test of whether the conditional alpha (or pricing error) is zero and, under the null hypothesis of the regional or world CAPM, as a test of market integration. In Europe, 34 out of total 130 sector returns represented in 14 countries reject the hypothesis that local information is unrelated to the pricing errors. In Asia, 24 out of a total of 76 sector returns presented in 8 countries show the significant explanatory power of the local information, whereas in Latin America the local information is important for explaining the pricing errors in 21 sector returns out of a total of 61 presented in 7 countries.

Tests of whether betas are significantly different from zero indicate that the beta with respect to the US ($\beta^{us}_{i,j,t-1}$) is significant in 111 sector returns in Europe, 68 in Asia and 42 in Latin America. The number of sector returns with significant beta with respect to the regional factor ($\beta^{reg}_{i,j,t-1}$) are 122, 73 and 55 respectively for Europe, Asia and Latin America.

We also test restrictions on two sets of parameters. If $\beta^{reg}_{i,j,t-1} = 0$ and $\delta_{i,j} = 0$, the model reduces to the traditional world CAPM with the US being the benchmark. This model is rejected at the 5% level for 116 sector returns in Europe, 74 in Asia and 48 in Latin America. If $\beta^{us}_{i,j,t-1} = 0$ and $\delta_{i,j} = 0$, the model becomes one-factor model with the region being the benchmark. This model is rejected at the 5% level for 127 sector returns in Europe, 75 in Asia and 55 in Latin America.

Generally, our Wald tests reveal that most sectors in the three regions are priced at both regional and global level, with local information having little explanatory power in the return process. However, one single factor CAPM (special case of our two factor model) is usually rejected, indicating that it is not a good description of the data by itself. Nevertheless, the covariance with one factor benchmark is a significant determinant of expected returns for most sectors.

The conditional betas and variance ratios are our primary focus on the sector level integration analysis. Table 5.2 reports the average betas and variance ratios with respect to the US and regional markets across the sectors in Europe, Asia and Latin

America[29]. In Europe, out of the 10 sectors examined, Information Technology has the highest average betas (0.7105 on the US vs. 0.6368 on the region), whereas Utilities has the lowest betas (0.1255 vs. 0.3635). This is consistent with our prior expectation as Information Technology sector is considered more international in nature while Utilities sector is more subject to local country-specific factors. Generally, sectors have a greater beta on the regional market relative to on the US market, suggesting that the European sectors are more responsive to the shocks from their own regional market than to shocks from the US market and thus more integrated at the regional level. The only exception is Information Technology sector, which responds more strongly to the US market innovations as shown by a higher beta with respect to the US than with respect to the region. Not surprisingly, the variance ratios follow the same pattern, and the fraction of the return shock variance explained by the region is larger than that by the US (except for Information Technology).

In Asia, like in Europe, the sector with the highest betas is Information Technology (0.694 on the US vs. 0.5659 on the region) and the sector with lowest betas is Utilities (0.2055 vs. 0.2352). However, for most sectors, the betas with respect to the US market are larger than the betas with respect to the regional market, suggesting the dominance of the US market in the region. The pattern of the US market dominance is about the same in terms of the variance ratios.

In Latin America, Non-cyclical Services sector tops the rest with the highest betas (0.5834 on the US vs. 0.6885 on the region) and the smallest betas go to the sector of Cyclical Consumer Goods (0.1397 vs. 0.2667). Nevertheless, the sectors in the region display a pattern closer to what we see for the region of Europe, with the

[29] There are only 9 sectors in Latin America and the Information Technology is unclassified in the dataset.

betas on the regional market higher than those on the US market. Clearly, the regional integration, relative to the global one, is stronger in Latin America. A similar result can be made from the comparison of the variance ratios.

Summarizing the above, we find that the performance of sectors does vary across regions: while sectors are dominated by the regional market and thus more strongly integrated at the regional level in Europe and Latin America, they are more influenced by the US market and thus more integrated at the global level in Asia. One point to notice is the distinct deviation of Information Technology sector, which is more responsive to the global shocks and this global nature is ubiquitous across different regions.

Our finding of regional dominance in Europe is consistent with the market integration analysis in Fratzscher (2002), where it is shown that the European regional market has gained considerably in importance in world financial markets and has taken over from the US as the dominant market in Europe. Similarly, Hardouvelis et al. (2005) have also found that expected returns became increasingly determined by EU-wide market risk and less by local risk implying stock market integration across the Eurozone countries. This regional dominance can to a large part be attributed to the drive toward EMU and in particular, the elimination of exchange rate volatility and uncertainty in the process of monetary unification after the introduction of the euro.

The dominance by the regional market in Latin America is also reported in other papers. For example, Heaney et al (2002) find that the equity markets in Latin America are becoming regionally integrated at a faster rate than globally, reflecting the growing co-operation between Latin American countries since liberalization in the early 1990s. The stronger connection to the US market in Asia is documented in papers such as, Masih and Masih (1997), Siklos and Ng (2001), and Bekaert, Harvey and Ng (2003) in their investigation of market interdependence in Asian countries.

5.4.4 Time-varying integration

To capture the time-varying nature of sector level integration, we relax the assumption of constant betas and allow them to change over time. Our GARCH model (5.1)-(5.3) are re-examined via a one-year window rolling estimation to obtain those time-variant betas. Figure 5.1 details the inter-temporal movement of sector average betas in Europe, Asia and Latin America. Indeed those betas vary substantially, with several peaks and troughs along the time horizon, but distinct features across regions can be observed. For sectors in Europe, the regional betas dominated the US ones for most of the sample period (except for the Information Technology, which mainly had a higher beta with respect to the US than the one with respect to the region). However, we see some periodic shifts from the regional beta dominance to the US beta dominance and the occurrence of those shifts coincide with the crisis periods such as the Mexican crisis in 1994-1995, the Asian crisis in 1997-1998 and Technology bubbles in 2000-2001, a phenomenon which may suggest possible contagion effects sustained at sector level.

The sector betas in Asia present a different scenario. Compared to other regions, the beta dominance in Asia was more unstable and fluctuated from time to time. The US betas went to the lowest and even negative in 1992-1994, implying that sector movement in Asia during this time period was in opposite direction with the US market and solely positively correlated with the regional market. However, immediately after this period, the US betas rose abruptly and began to dominate the regional betas in 1994-1996, indicating the increasingly strong impact of US market in the Asian countries. Another period of high US betas was in 1997-1999, which happened to be the Asian crisis period. But the regional betas during this period were even higher and dominated the US betas. Phylaktis and Ravazzolo (2002) find a similar result when examining real and financial links for the Asian countries during the period 1980-1998. In their study they analysed the covariances of excess returns on national stock markets and used the comovement of innovations in future expected stock returns as an indicator of financial integration and the comovement of dividend news between two countries as an indicator of economic integration.

In Latin America, the movement of betas was least volatile out of the three regions. All the sectors display a stronger regional level integration for most of the sample period. There were periodic switches of beta dominance over time and those switches were also related to the financial crisis periods.

In general, sector betas in the three regions had a great deal of variation and the beta dominance was unstable over time. We find that the changes of beta dominance from one to the other usually occurred during crisis periods, a possible indication of contagion effects sustained at the sector level.

5.4.5 Sector level Contagion

As explained before, our framework decomposes the correlations of sector returns into two components: the part the asset pricing model explains and the part the model does not explain. The explained part provides potential insights about sector level integration through the movements in the conditional betas. The unexplained part allows us to examine the correlations of model residuals, which we define as the contagion effects at the sector level.

We examine model (5.9)-(5.10) to detect the overall contagion for the whole sample as well as the additional contagion during particular crisis periods, where two crises are considered: the Mexican crisis during 1994-1995 and the Asian crisis during 1997-1998 (see Table 5.3). Panel A in Table 5.3 reports the estimation for the Mexican crisis. Looking first at the overall contagion through the joint test of $m = n = 0$, we reject the null of no contagion against all the country-group benchmarks at the 5% level for the majority of sectors in the three regions. However, the channels and magnitude of contagion vary across regions. On the one hand, in Europe and Asia the overall contagion comes from all three channels, each of which is significant: the global shocks, regional shocks and the shocks of regional equivalent sectors. In Latin America it is mainly transmitted via the global and regional shocks channels but the link with the regional equivalent sector shocks is not as widely spread as that in Europe or Asia. On the other hand, comparing the m coefficients against the three benchmarks within each region, we find that sectors in Europe and Latin America had the greatest correlation with the regional residuals whereas in Asia the correlation with the sum of equivalent sector residuals was the greatest. In other words, the highest magnitude of contagion is driven by regional shocks for sectors in Europe and Latin America, but by the equivalent sector shocks for sectors in Asia.

The n coefficient measures the additional correlation during the Mexican crisis. 5 sectors in Europe and Asia and 4 in Latin America displayed a positive significant coefficient with respect to the US residuals. Clearly the Mexican crisis did cause contagion and nearly half of the sectors in the three regions were affected. This contagion was mainly driven by the global shocks (shocks from the US market).

Panel B of Table 5.3 presents the results for the Asian crisis. 5 (4) sectors in Asia had a positive significant n coefficient with respect to the US (regional), whereas the number of significant n coefficients in Europe and Latin America was negligible. This finding indicates that the Asian crisis worsened contagion for most sectors in Asia but had no effect elsewhere. However, the finding also points out that even though contagion was prevalent at the market level, there are still some sectors which were immune from the contagion effect during the crisis. The overall contagion test confirms the result in Panel A of the cross-regional differences in terms of the channels and magnitude of contagion.

Overall, our analysis reveals that sector residuals are correlated beyond what is captured in our model, suggesting evidence of contagion. On the one hand, an overall contagion at sector level over our entire sample period is found but it varies across regions. In terms of possible channels, contagion across the three regions is transmitted via global and regional shocks. But in Europe and Asia, an additional channel is identified, which is the shocks from equivalent sectors within the region. This confirms our prior expectation that contagion occurs at the sector level and sectors provide channels in propagating unexpected shocks. In terms of the magnitude of contagion, in Europe and Latin America the most severe contagion comes from the regional shocks whereas in Asia it is mainly driven by the shocks from equivalent sectors within the region. On the other hand, in studying whether contagion worsened during particular crisis periods, our paper shows that nearly half sectors in the three regions were affected during the Mexican crisis and the contagion was mainly transmitted via the global shocks. However, during the Asian crisis, no additional contagion is found in Europe or Latin America, but we do find that the crisis worsened the contagion for most sectors in Asia transmitted via the global and regional shocks channels.

5.5 Conclusions

The last decade or so witnessed a series of financial crises and one common observation during those crises is that financial markets tend to co-move more closely than during the tranquil times. Such strong comovement across markets is often referred to as contagion. At the same time, there is evidence showing the increasing importance of industry factors in driving the global equity returns. Industries or sectors overcome the cross-border restrictions and become more closely correlated and such increasing correlation across industries/sectors in different countries may lend themselves to the possible impact from the external shocks and contagion effects may sustain at the industry/sector level. The purpose of this paper is to examine the sector level contagion across the regions of Europe, Asia and Latin America, an issue not yet studied in the literature. A by-product of our analysis is the investigation of industry/sector level integration on equity markets, which has been studied at the limited coverage of the Euro zone, the US, UK and G-7 countries.

The literature has shown no agreement on the exact definition of contagion and in this paper we define contagion as excess correlation – i.e. correlation over and above what one expects from economic fundamentals. As no consensus is agreed upon what the fundamentals are, our paper follows the two-factor international asset pricing model framework of Bekaert, Harvey and Ng (2003) to study the sector level integration and contagion. Essentially, our framework decomposes the correlations of sector returns into two components: the part the asset pricing model explains and the part the model does not explain. The time-varying nature of integration is captured through the estimation of the asset-pricing model over a 12-month rolling window. The explained part controls for the economic fundamentals and provides insights on sector level integration through the movements in the conditional betas. The unexplained part allows us to examine the correlation of model residuals. Any significant correlation found in the residuals is beyond what our model can account for and therefore suggests evidence of contagion. Such an approach to contagion, however, depends on model specification and care has been taken to correctly specify it.

Our analysis focuses on the 10 broad sectors in 29 smaller markets in Europe, Asia and Latin America during the period of Jan 1990 – June 2004. The main results are summarized as follows: first, the sector level integration displays a distinct pattern across regions: sectors in Europe and Latin America have higher betas with respect to the regional market than with respect to the US market, suggesting the stronger integration at the regional level. Conversely, sectors in Asia are more responsive to the US market than to the regional market and thus more integrated at the global level. Our findings of regional differences are also confirmed in other papers studying the international equity market comovments. The heterogeneous performance of sectors across regions indicates that those sectors are less globally correlated than we have expected and still subject to the regional effects. However, one exception is Information Technology, which is more globally integrated regardless of its geographic location.

Second, the pattern of sector integration changes over time, especially during the crisis periods. Across the three regions, we find many sectors showing a sudden change from regional beta dominance to the US beta dominance or vise versa during crisis times. This beta shift points to the fact that contagion is possibly sustained at the sector level.

Third, we find that the sector residuals are economically and statistically significantly correlated with the US market residuals and regional market residuals as well as with the sum of equivalent sector residuals and such correlations are beyond what our asset pricing model accounts for, indicating evidence of contagion. An overall contagion over our entire sample period is found for the majority of sectors in Europe, Asia and Latin America. However the transmitting channels and the magnitude of contagion vary across regions. On the one hand, while contagion in Europe and Asia is transmitted via the global and regional shocks as well as the equivalent sector shocks, it is mainly connected to the global and regional shocks in Latin America and the equivalent sector shocks plays little role in contagion propagation. On the other hand, the most severe impact of contagion derives from the channel of regional shocks in Europe and Latin America, whereas in Asia it comes from the channel of equivalent sector shocks.

Finally, in examining whether the Mexican and Asian crises provide additional contagion effects, we find that nearly half sectors in the three regions were affected via the global shocks during the Mexican crisis. During the Asian crisis no additional contagion is found in Europe or Latin America, but a worsened contagion transmitted via the global and regional shocks is found for most sectors in Asia.

Our findings have important implications for portfolio managers aiming to diversify risks. On the one hand, industries/sectors are found to have crossed the national boundaries and become integrated to the rest of the world. This means that domestic risk factors now matter less and non-domestic factors matter more so that diversification across countries may be losing the merit and diversification across industries is preferable. However, the divergence of integration across regions points to the fact that industries/sectors are not as globally correlated as we expect and regional effects still play a role. Therefore selecting portfolios across regions rather than within regions would be more efficient. On the other hand, international investors and portfolio managers are concerned with diversification in volatile times, especially during the crisis periods when it is most needed. Our evidence shows that some sectors are plagued with contagion during crises, so investors and portfolio managers should avoid choosing individual securities from those contagious sectors. However, our evidence also shows that there are sectors which are immune from the external shocks or contagion during the financial crises. Those sectors can provide a tool to diversify risks during the crisis periods and the benefits of diversification can still be achieved.

Tables

Table 5.1 US and regional market return model

The following GARCH model is examined:

$$r_{i,t} = \delta_i X_{i,t-1} + \beta^{us}_{i,t-1}\mu_{us,t-1} + \beta^{us}_{i,t-1}e_{us,t} + e_{i,t}$$
$$e_{i,t} \mid \Omega_{t-1} \sim N(0,\sigma^2_{i,t})$$
$$\sigma^2_{i,t} = a_i + b_i\sigma^2_{i,t-1} + c_i e^2_{i,t-1} + d_i\eta^2_{i,t-1}$$
$$\eta^2_{i,t-1} = \min\{0, e_{i,t}\}$$

where $r_{i,t}$ is the excess return and $X_{i,t-1}$ represents local information variables available at time t-1. $\mu_{us,t-1}$ and $e_{us,t}$ are the conditional expected excess return and residual of the US market. For the US market (i = us), $\beta^{us}_{i,t-1}$ is zero, and $X_{i,t-1}$ represents a set of US or world information variables, which includes a constant, the world market dividend yield, the spread between the 90-day Eurodollar rate and the 3-month T-bill yield, the difference between the US 10-year Treasury bond yield and the 3-month Treasury bill yield, the change in the 90-day Treasury bill yield, and the US money supply (M3). All the information variables are lagged by one period. For the regional market ($i = reg$), $X_{i,t-1}$ represents a set of regional variables, which includes a constant and the regional market dividend yield.

To test for model specification, Q(20) and $Q^2(20)$ are the 20th order Ljung Box statistics for the autocovariances of the scaled residuals (5.11b) and the autocovariances of the squared scaled residuals (10d); the moments are based on joint test of four moments (5.11a,c, e, f). The Wald test is the test of the significance of the local information in the mean, i.e. $\delta_i = 0$. The *p* value is shown in brackets and * represents significance at 5% level or less.

Note: Latin Am. – *Latin America.*

Market	Model	Specification test			Wald test	$\hat{\beta}^{us}_{i,t-1}$	$\hat{V}\hat{R}^{us}_{i,t-1}$ (%)
		Q(20)	$Q^2(20)$	Moments	$\delta_i = 0$		
US	Asymmetric	20.250 [0.442]	16.067 [0.712]	6.412 [0.170]	**34.757*** [0.000]	-	-
Europe	Symmetric	18.598 [0.233]	16.037 [0.714]	0.797 [0.939]	0.896 [0.826]	**0.593***	31.79
Asia	Asymmetric	21.268 [0.381]	17.748 [0.604]	0.326 [0.988]	**15.646*** [0.001]	**0.431***	12.25
Latin Am.	Asymmetric	33.789 [0.289]	12.647 [0.892]	0.186 [0.996]	3.844 [0.146]	**0.576***	15.68

Table 5.2 GARCH summary for sector level integration

The following asymmetric GARCH model is examined:

$$r_{i,j,t} = \delta_{i,j} X_{i,j,t-1} + \beta^{us}_{i,j,t-1}\mu_{us,t-1} + \beta^{reg}_{i,j,t-1}\mu_{reg,t-1} + \beta^{us}_{i,j,t-1}e_{us,t} + \beta^{reg}_{i,j,t-1}e_{reg,t} + e_{i,j,t}$$
$$e_{i,j,t} \mid \Omega_{t-1} \sim N(0, \sigma^2_{i,j,t})$$
$$\sigma^2_{i,j,t} = a_{i,j} + b_{i,j}\sigma^2_{i,j,t-1} + c_{i,j}e^2_{i,j,t-1} + d_{i,j}\eta^2_{i,j,t-1}$$
$$\eta_{i,j,t} = \min\{0, e_{i,j,t}\}$$

where $r_{i,j,t}$ is the excess return, $\mu_{us,t-1}$ and $e_{us,t}$ ($\mu_{reg,t-1}$ and $e_{reg,t}$) are the conditional expected excess return and residual on the US (regional) market. $e_{i,j,t}$ is the idiosyncratic shock of any sector i in country j, and $X_{i,j,t-1}$ represents local information variables available at time t-1.
The table reports the sample average of beta parameters ($\hat{\beta}^{us}_{i,j}$ and $\hat{\beta}^{reg}_{i,j}$) and variance ratios accounted for by the US and region ($V\hat{R}^{us}_{i,j}$ and $V\hat{R}^{reg}_{i,j}$) for sector i across all countries within the region . Standard deviations are given in parentheses.

Note: *Std dev. – standard deviation, Latin Am. – Latin America, BASIC – basic industries, CYCGD – cyclical consumer goods, CYSER – cyclical services, GENIN – general industries, ITECH – information technology, NCYCG – non-cyclical consumer goods, NCYSR – non-cyclical services, RESOR – resources, TOTLF – financials, and UTILS – utilities.*

Sector	$\hat{\beta}^{us}_{i,j}$		$\hat{\beta}^{reg}_{i,j}$		$V\hat{R}^{us}_{i,j}$ (%)		$V\hat{R}^{reg}_{i,j}$ (%)	
	Mean	*(Std dev.)*	*Mean*	*(Std dev.)*	*Mean*	*(Std dev.)*	*Mean*	*(Std dev.)*
Europe								
BASIC	0.3299	(0.148)	0.4858	(0.075)	5.9794	(4.745)	9.0025	(5.059)
CYCGD	0.3569	(0.199)	0.4479	(0.212)	3.6816	(4.397)	3.5554	(2.192)
CYSER	0.3922	(0.177)	0.5107	(0.127)	6.9211	(5.738)	9.1897	(5.629)
GENIN	0.4019	(0.295)	0.5286	(0.114)	8.0265	(8.238)	8.4258	(4.975)
ITECH	0.7105	(0.364)	0.6368	(0.207)	7.2742	(7.147)	4.4303	(2.766)
NCYCG	0.2694	(0.117)	0.4392	(0.072)	3.9709	(3.779)	6.8267	(3.594)
NCYSR	0.3967	(0.229)	0.4886	(0.260)	5.5331	(4.667)	6.5537	(4.280)
RESOR	0.1841	(0.198)	0.4119	(0.158)	2.5906	(3.544)	4.1710	(3.536)
TOTLF	0.4395	(0.222)	0.5543	(0.096)	8.6642	(7.371)	10.8427	(5.628)
UTILS	0.1255	(0.192)	0.3635	(0.114)	1.5847	(2.173)	4.9105	(4.124)

Asia								
BASIC	0.3359	(0.123)	0.3196	(0.099)	2.1120	(1.277)	2.4681	(1.759)
CYCGD	0.3912	(0.138)	0.2731	(0.215)	2.6236	(2.444)	2.2119	(1.840)
CYSER	0.3722	(0.139)	0.3374	(0.069)	4.4800	(4.460)	3.6968	(2.158)
GENIN	0.4735	(0.203)	0.3413	(0.081)	5.5982	(5.212)	3.6256	(3.198)
ITECH	0.6940	(0.289)	0.5659	(0.338)	5.2074	(3.119)	4.5234	(2.604)
NCYCG	0.2786	(0.087)	0.2622	(0.065)	2.0027	(1.796)	2.2676	(1.751)
NCYSR	0.3888	(0.196)	0.3251	(0.058)	3.2120	(3.061)	2.7145	(1.197)
RESOR	0.2966	(0.148)	0.3289	(0.078)	1.3433	(1.077)	1.6345	(0.765)
TOTLF	0.4426	(0.142)	0.3345	(0.063)	4.7466	(4.539)	3.1358	(2.046)
UTILS	0.2055	(0.081)	0.2352	(0.098)	0.7535	(0.394)	1.4007	(0.918)
Latin Am.								
BASIC	0.3409	(0.199)	0.4528	(0.260)	3.9528	(3.939)	12.1821	(13.353)
CYCGD	0.1397	(0.126)	0.2667	(0.238)	0.5203	(0.613)	2.6004	(2.919)
CYSER	0.2185	(0.284)	0.3972	(0.346)	2.9667	(4.160)	7.8290	(8.813)
GENIN	0.2657	(0.335)	0.4344	(0.297)	3.0495	(3.683)	8.2466	(9.224)
ITECH	-		-		-		-	
NCYCG	0.3086	(0.182)	0.4365	(0.236)	3.1929	(2.883)	10.5641	(10.009)
NCYSR	0.5834	(0.350)	0.6885	(0.384)	6.9520	(7.799)	15.3412	(16.930)
RESOR	0.2552	(0.312)	0.4008	(0.360)	2.8214	(2.746)	9.2245	(13.216)
TOTLF	0.3185	(0.233)	0.4676	(0.290)	3.2746	(2.890)	10.8926	(10.141)
UTILS	0.2980	(0.221)	0.4095	(0.416)	2.4305	(2.620)	9.5409	(14.915)

Table 5.3 Cross-sectional analysis of sector residuals

The following models are estimated:

$$\hat{e}_{i,j,t} = v_{i,j} + \phi_{i,j,t}\hat{e}_{g,t} + \xi_{i,j,t}$$

$$\phi_{i,j,t} = m + nD_{i,t}$$

where $\hat{e}_{i,j,t}$, $\hat{e}_{g,t}$ are the estimated idiosyncratic return shocks of sector i and a country-group respectively in examination of model (5.1)-(5.3) with time-variant betas. Three country-groups are considered: the return shocks from the US, $\hat{e}_{g,t} = \hat{e}_{us,t}$, the return shocks from a geographic region, $\hat{e}_{g,t} = \hat{e}_{reg,t}$, and the return shocks from the sum of residuals of sector i in a region excluding the country to be considered, $\hat{e}_{g,t} = \sum_{\substack{k \neq j \\ k \subset G}} \hat{e}_{k,t}$, where G denotes a particular region country k belongs to. The former equation involves the time series regression and $\phi_{i,j,t}$ is the time-varying coefficient of each sector i. The time-varying coefficients $\phi_{i,j,t}$ of equivalent sectors in each region (Europe, Asia and Latin America) are pooled together and the latter equation involves the panel data regression. The estimation corrects for individual serial correlations by adding cross-sectional AR(1) term in equation and group-wise heteroskedasticity by employing seemingly unrelated regression (SUR) method. $D_{i,t}$ is a dummy variable that represents two sample periods: the Mexican crisis period from November 1994 to December 1995, the Asian crisis period from April 1997 to October 1998. The parameter estimates of m and n are reported, with standard errors in parenthesis, while p-values are given in brackets. * represents significance at 5% level or less.

Wald t – Wald test, Latin Am. – Latin America, BASIC – basic industries, CYCGD – cyclical consumer goods, CYSER – cyclical services, GENIN – general industries, ITECH – information technology, NCYCG – non-cyclical consumer goods, NCYSR – non-cyclical services, RESOR – resources, TOTLF – financials, and UTILS – utilities.

Sector	US residuals $e_{us,t}$			Regional residuals $e_{reg,t}$			Sum of residuals $\sum_{\substack{k \neq j \\ k \subset G}} e_{kt}$		
	m	n	Wald t m=n=0	m	n	Wald t m=n=0	m	n	Wald t m=n=0
Panel A: Mexican crisis dummy									
EUROPE									
BASIC	**0.11***	0.018	**127.68***	**0.203***	-0.01	**148.17***	**0.033***	-0.003	**114.54***
	(0.01)	(0.028)	[0.000]	(0.017)	(0.038)	[0.000]	(0.003)	(0.004)	[0.000]
CYCGD	**0.111***	**0.174***	**100.01***	**0.179***	-0.039	**89.07***	**0.025***	0.008	**56.49***
	(0.013)	(0.045)	[0.000]	(0.019)	(0.048)	[0.000]	(0.003)	(0.005)	[0.000]
CYSER	**0.129***	0.058	**134.99***	**0.224***	0.076	**168.14***	**0.029***	-0.000	**161.26***
	(0.012)	(0.031)	[0.000]	(0.018)	(0.042)	[0.000]	(0.002)	(0.003)	[0.000]
GENIN	**0.099***	0.048	**103.53***	**0.188***	-0.009	**111.68***	**0.034***	0.001	**198.39***
	(0.011)	(0.029)	[0.000]	(0.018)	(0.04)	[0.000]	(0.002)	(0.003)	[0.000]
ITECH	**0.181***	**0.242***	**120.67***	**0.295***	0.049	**130.78***	**0.035***	0.004	**36.1***
	(0.021)	(0.056)	[0.000]	(0.027)	(0.064)	[0.000]	(0.006)	(0.005)	[0.000]
NCYCG	**0.086***	**0.054***	**91.04***	**0.2***	**0.086***	**139.33***	**0.037***	0.004	**166.06***
	(0.01)	(0.026)	[0.000]	(0.018)	(0.038)	[0.000]	(0.003)	(0.003)	[0.000]
NCYSR	**0.098***	0.06	**66.52***	**0.389***	-0.024	**163.88***	**0.051***	-0.002	**94.93***
	(0.013)	(0.034)	[0.000]	(0.031)	(0.058)	[0.000]	(0.005)	(0.005)	[0.000]

RESOR	**0.099***	**0.145***	**82.38***	**0.132***	**0.146***	**54.34***	**0.03***	0.005	**29.13***
	(0.014)	(0.038)	[0.000]	(0.02)	(0.054)	[0.000]	(0.006)	(0.006)	[0.000]
TOTLF	**0.071***	0.052	**47.07***	**0.208***	0.066	**120.58***	**0.047***	0.001	**189.75***
	(0.012)	(0.029)	[0.000]	(0.02)	(0.044)	[0.000]	(0.003)	(0.003)	[0.000]
UTILS	**0.079***	**0.107***	**75.54***	**0.178***	0.074	**96.25***	**0.036***	0.001	**78.94***
	(0.011)	(0.032)	[0.000]	(0.019)	(0.043)	[0.000]	(0.004)	(0.004)	[0.000]
ASIA									
BASIC	**0.051***	0.097	**9.112***	**0.08***	0.02	**25.99***	**0.075***	0.012	**90.35***
	(0.024)	(0.06)	[0.011]	(0.017)	(0.045)	[0.000]	(0.008)	(0.007)	[0.000]
CYCGD	**0.048***	**0.139***	**12.103***	**0.073***	0.006	**12.16***	**0.075***	**0.031***	**96.82***
	(0.023)	(0.061)	[0.002]	(0.022)	(0.057)	[0.002]	(0.008)	(0.01)	[0.000]
CYSER	**0.032***	0.08	**9.476***	**0.063***	0.05	**29.49***	**0.063***	0.008	**94.79***
	(0.016)	(0.045)	[0.009]	(0.013)	(0.036)	[0.000]	(0.007)	(0.007)	[0.000]
GENIN	0.026	**0.105***	**9.55***	**0.085***	-0.095	**21.84***	**0.086***	0.009	**166.47***
	(0.017)	(0.046)	[0.008]	(0.019)	(0.046)	[0.000]	(0.007)	(0.008)	[0.000]
ITECH	-0.003	**0.394***	**25.63***	**0.062***	-0.043	**6.189***	**0.085***	**0.048***	**42.86***
	(0.019)	(0.079)	[0.000]	(0.025)	(0.079)	[0.045]	(0.014)	(0.02)	[0.000]
NCYCG	0.016	**0.152***	**21.1***	0.022	0.05	**6.923***	**0.05***	**0.044***	**95.96***
	(0.012)	(0.038)	[0.000]	(0.013)	(0.033)	[0.031]	(0.006)	(0.009)	[0.000]
NCYSR	0.012	**0.133***	**12.43***	**0.038***	-0.008	**9.321***	**0.064***	0.003	**41.25***
	(0.015)	(0.043)	[0.002]	(0.013)	(0.038)	[0.009]	(0.01)	(0.01)	[0.000]
RESOR	**0.059***	0.009	5.505	0.037	0.037	4.184	**0.042***	-0.002	**34.11***
	(0.026)	(0.068)	[0.064]	(0.022)	(0.052)	[0.123]	(0.007)	(0.011)	[0.000]
TOTLF	0.019	0.018	1.699	**0.054***	-0.008	**10.27***	**0.063***	0.007	**96.29***
	(0.017)	(0.046)	[0.427]	(0.017)	(0.046)	[0.006]	(0.006)	(0.006)	[0.000]
UTILS	**0.027***	0.135	3.617	0.034	-0.124	3.809	**0.04***	0.043	**8.63***
	(0.03)	(0.09)	[0.164]	(0.028)	(0.071)	[0.149]	(0.019)	(0.024)	[0.013]
LATIN AM.									
BASIC	0.026	**0.212***	**35.05***	**0.127***	0.006	**14.51***	**0.012***	**0.024***	**11.35***
	(0.016)	(0.041)	[0.000]	(0.017)	(0.034)	[0.000]	(0.006)	(0.009)	[0.000]
CYCGD	0.027	-0.097	1.649	0.008	-0.011	0.017	0.002	0.001	0.132
	(0.023)	(0.057)	[0.199]	(0.014)	(0.025)	[0.897]	(0.008)	(0.007)	[0.716]
CYSER	**0.045***	**0.109***	**18.95***	**0.163***	-0.003	**8.94***	-0.021	0.017	0.019
	(0.011)	(0.037)	[0.000]	(0.024)	(0.054)	[0.003]	(0.014)	(0.027)	[0.891]
GENIN	**0.092***	0.108	**11.22***	0.088*	0.046	**10.31***	0.003	0.009	1.057
	(0.023)	(0.061)	[0.0001]	(0.016)	(0.043)	[0.001]	(0.007)	(0.011)	[0.304]
ITECH	-	-	-	-	-	-	-	-	-
NCYCG	**0.042***	0.021	**4.08***	**0.129***	-0.000	**16.48***	0.024	0.023	**5.647***
	(0.011)	(0.032)	[0.043]	(0.012)	(0.033)	[0.000]	(0.013)	(0.016)	[0.017]
NCYSR	**0.069***	0.002	1.411	**0.074***	-0.015	0.834	0.015	-0.022	0.085
	(0.022)	(0.061)	[0.235]	(0.029)	(0.063)	[0.361]	(0.014)	(0.024)	[0.771]
RESOR	0.015	0.07	3.09	**0.091***	0.007	**6.634***	0.012	-0.003	0.36
	(0.018)	(0.049)	[0.079]	(0.017)	(0.038)	[0.01]	(0.009)	(0.014)	[0.548]
TOTLF	**0.03***	**0.079***	**7.842***	**0.047***	0.031	**6.482***	**0.021***	0.005	**8.087***
	(0.015)	(0.04)	[0.005]	(0.012)	(0.031)	[0.011]	(0.004)	(0.009)	[0.004]
UTILS	**0.039***	**0.128***	**11.69***	**0.051***	-0.000	1.479	0.018	0.065	**4.457***
	(0.016)	(0.049)	[0.000]	(0.014)	(0.041)	[0.224]	(0.014)	(0.039)	[0.035]
Panel B: Asia crisis dummy									
EUROPE									
BASIC	**0.112***	-0.009	**17.98***	**0.199***	0.031	**150.93***	**0.033***	-0.000	**112.54***
	(0.01)	(0.025)	[0.000]	(0.017)	(0.036)	[0.000]	(0.003)	(0.003)	[0.000]
CYCGD	**0.112***	0.047	**30.86***	**0.167***	0.067	**95.96***	**0.025***	0.004	**54.35***
	(0.014)	(0.03)	[0.000]	(0.019)	(0.041)	[0.000]	(0.004)	(0.004)	[0.000]
CYSER	**0.129***	0.039	**36.9***	**0.227***	0.009	**160.03***	**0.03***	0.000	**160.88***
	(0.012)	(0.029)	[0.000]	(0.019)	(0.039)	[0.000]	(0.002)	(0.003)	[0.000]
GENIN	**0.107***	-0.042	**6.478***	**0.185***	0.048	**111.05***	**0.034***	0.002	**203.02***
	(0.011)	(0.026)	[0.011]	(0.019)	(0.039)	[0.000]	(0.002)	(0.003)	[0.000]
ITECH	**0.211***	-0.013	**14.68***	**0.296***	0.064	**129.63***	**0.035***	0.003	**36.96***
	(0.021)	(0.053)	[0.000]	(0.027)	(0.06)	[0.000]	(0.006)	(0.005)	[0.000]
NCYCG	**0.094***	-0.024	**8.886***	**0.205***	**0.086***	**149.44***	**0.037***	-0.002	**166.94***
	(0.01)	(0.024)	[0.003]	(0.018)	(0.036)	[0.000]	(0.003)	(0.003)	[0.000]
NCYSR	**0.102***	0.029	**15.08***	**0.387***	-0.01	**162.12***	**0.051***	0.004	**99.73***
	(0.014)	(0.035)	[0.000]	(0.031)	(0.054)	[0.000]	(0.005)	(0.005)	[0.000]
RESOR	**0.111***	-0.019	**7.381***	**0.133***	-0.032	**42.59***	**0.031***	0.001	**29.14***
	(0.015)	(0.034)	[0.007]	(0.02)	(0.048)	[0.000]	(0.006)	(0.006)	[0.000]
TOTLF	**0.075***	0.001	**8.336***	**0.206***	0.05	**119.16***	**0.047***	0.000	**188.58***

	(0.012)	(0.027)	[0.004]	(0.02)	(0.041)	[0.000]	(0.003)	(0.003)	[0.000]
UTILS	**0.086***	-0.033	3.589	**0.184***	0.016	**89.43***	**0.037***	-0.007	**85.07***
	(0.011)	(0.029)	[0.058]	(0.02)	(0.04)	[0.000]	(0.004)	(0.004)	[0.000]
ASIA									
BASIC	0.032	**0.209***	**24.21***	**0.072***	0.064	**27.52***	**0.076***	-0.003	**84.32***
	(0.022)	(0.052)	[0.000]	(0.017)	(0.041)	[0.000]	(0.008)	(0.007)	[0.000]
CYCGD	0.035	**0.154***	**14.89***	**0.063***	0.094	**15.88***	**0.071***	-0.003	**49.52***
	(0.022)	(0.054)	[0.000]	(0.022)	(0.052)	[0.000]	(0.01)	(0.01)	[0.000]
CYSER	0.025	**0.08***	**8.997***	**0.059***	**0.07***	**30.02***	**0.066***	-0.01	**86.84***
	(0.016)	(0.04)	[0.011]	(0.014)	(0.034)	[0.000]	(0.007)	(0.007)	[0.000]
GENIN	0.025	0.044	4.321	**0.073***	0.068	**23.89***	**0.086***	0.006	**158.18***
	(0.017)	(0.043)	[0.115]	(0.018)	(0.043)	[0.000]	(0.007)	(0.008)	[0.000]
ITECH	0.009	0.068	2.715	**0.051***	0.08	**8.133***	**0.09***	-0.001	**41.85***
	(0.021)	(0.051)	[0.257]	(0.025)	(0.059)	[0.017]	(0.014)	(0.011)	[0.000]
NCYCG	**0.035***	-0.1	**11.48***	0.023	0.037	**6.125***	**0.051***	0.005	**48.22***
	(0.013)	(0.036)	[0.003]	(0.013)	(0.031)	[0.047]	(0.008)	(0.009)	[0.000]
NCYSR	0.025	-0.019	2.684	**0.029***	**0.098***	**18.87***	**0.065***	0.001	**40.9***
	(0.015)	(0.041)	[0.261]	(0.012)	(0.034)	[0.000]	(0.01)	(0.01)	[0.000]
RESOR	0.042	**0.159***	**13.94***	0.019	**0.163***	**16.53***	**0.04***	0.013	**38.33***
	(0.025)	(0.059)	[0.000]	(0.02)	(0.046)	[0.000]	(0.007)	(0.01)	[0.000]
TOTLF	0.013	**0.087***	**6.206***	**0.047***	0.052	**11.97***	**0.065***	-0.014	**94.01***
	(0.017)	(0.043)	[0.044]	(0.017)	(0.042)	[0.003]	(0.007)	(0.006)	[0.000]
UTILS	0.039	-0.041	1.745	-0.004	**0.214***	**16.1***	**0.045***	0.006	**5.98***
	(0.03)	(0.064)	[0.418]	(0.026)	(0.055)	[0.000]	(0.019)	(0.022)	[0.05]
LATIN AM.									
	0.03	0.046	5.804	**0.126***	0.011	**60.51***	**0.014***	0.009	5.867
BASIC	(0.018)	(0.042)	[0.055]	(0.017)	(0.033)	[0.000]	(0.007)	(0.01)	[0.053]
	0.007	0.044	1.083	-0.007	**0.051***	4.137	0.006	-0.008	1.106
CYCGD	(0.024)	(0.054)	[0.582]	(0.014)	(0.026)	[0.126]	(0.008)	(0.008)	[0.575]
	0.053*	0.01	**19.597***	**0.174***	-0.041	**54.49***	-0.024	0.043	4.926
CYSER	(0.013)	(0.036)	[0.000]	(0.024)	(0.052)	[0.000]	(0.014)	(0.026)	[0.085]
	0.097*	0.057	**22.49***	**0.094***	-0.024	**33.51***	0.002	0.005	0.334
GENIN	(0.024)	(0.056)	[0.000]	(0.016)	(0.039)	[0.000]	(0.008)	(0.011)	[0.846]
	-	-	-	-	-	-	-	-	-
ITECH									
	0.041*	0.023	**18.37***	**0.124***	0.028	**130.61***	0.022	0.018	4.867
NCYCG	(0.011)	(0.028)	[0.000]	(0.012)	(0.03)	[0.000]	(0.013)	(0.016)	[0.088]
	0.066*	0.028	**11.06***	0.058	0.061	**6.673***	0.01	0.02	1.743
NCYSR	(0.022)	(0.055)	[0.004]	(0.028)	(0.057)	[0.036]	(0.014)	(0.021)	[0.418]
	0.013	0.034	1.601	**0.092***	0.002	**29.66***	0.011	0.006	1.838
RESOR	(0.018)	(0.044)	[0.449]	(0.018)	(0.035)	[0.000]	(0.009)	(0.014)	[0.399]
	0.035*	0.01	5.789	**0.045***	0.039	**19.19***	**0.023***	-0.014	**27.67***
TOTLF	(0.016)	(0.037)	[0.055]	(0.013)	(0.029)	[0.000]	(0.004)	(0.009)	[0.000]
	0.034*	**0.074***	**11.52***	**0.051***	-0.005	**12.79***	0.019	0.014	4.023
UTILS	(0.017)	(0.037)	[0.003]	(0.015)	(0.034)	[0.002]	(0.014)	(0.013)	[0.134]

Figures

Figure 5.1 Summary of time-varying sector level integration: GARCH 12-month rolling estimates

The model description is identical to that in Table 5.2. The result is the 12-month regression window rolling estimation moved month by month. The coefficients of $\hat{\beta}_i^{us}$ and $\hat{\beta}_i^{reg}$ are the averages across all the countries within a region examined.

B_us – $\hat{\beta}_i^{us}$, *B_reg* – $\hat{\beta}_i^{reg}$, *BASIC – basic industries, CYCGD – cyclical consumer goods, CYSER – cyclical services, GENIN – general industries, ITECH – information technology, NCYCG – non-cyclical consumer goods, NCYSR – non-cyclical services, RESOR – resources, TOTLF – financials, and UTILS – utilities*

A. Europe

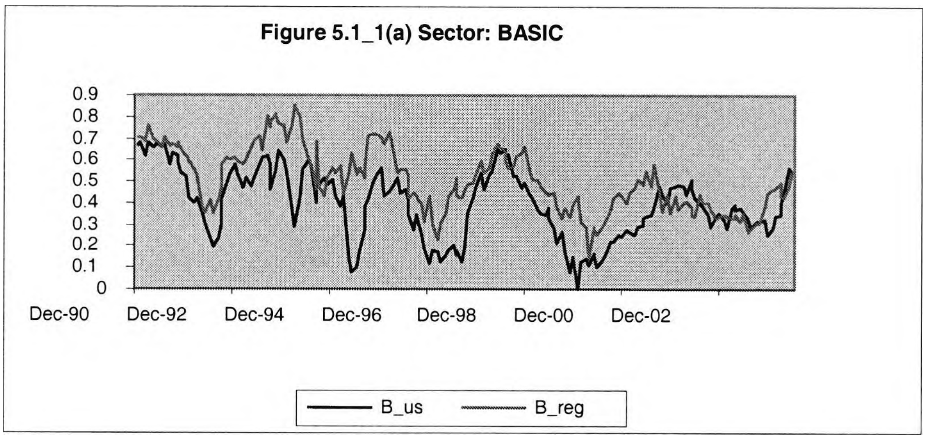


Figure 5.1_1(b) Sector: CYCGD

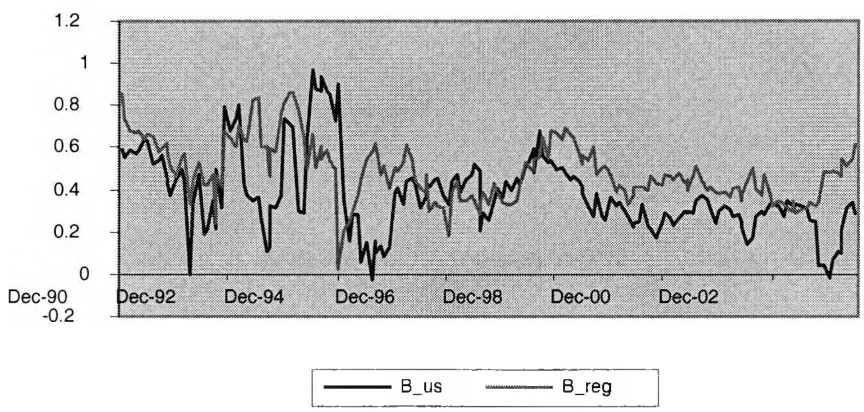


Figure 5.1_1(c) Sector: CYSER

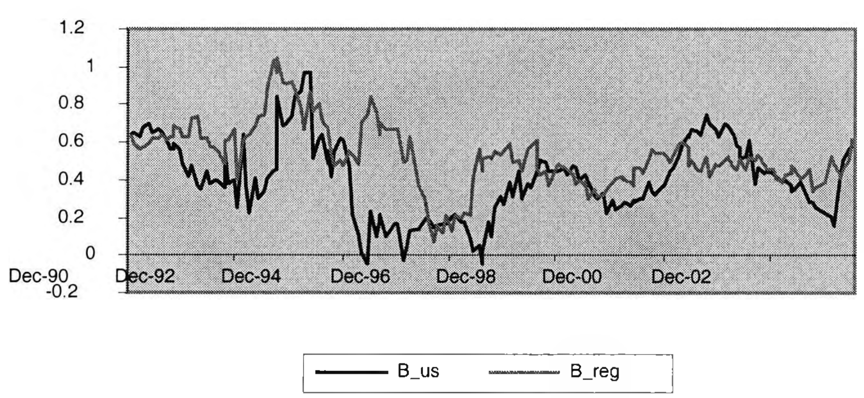


Figure 5.1_1(d) Sector: GENIN

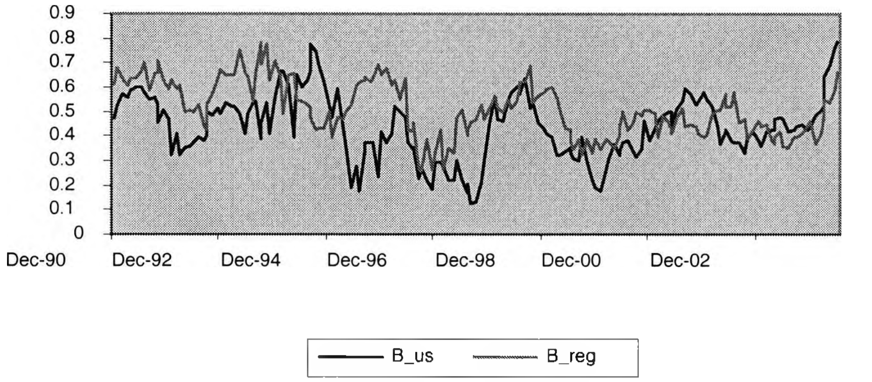


Figure 5.1_1(e) Sector: ITECH

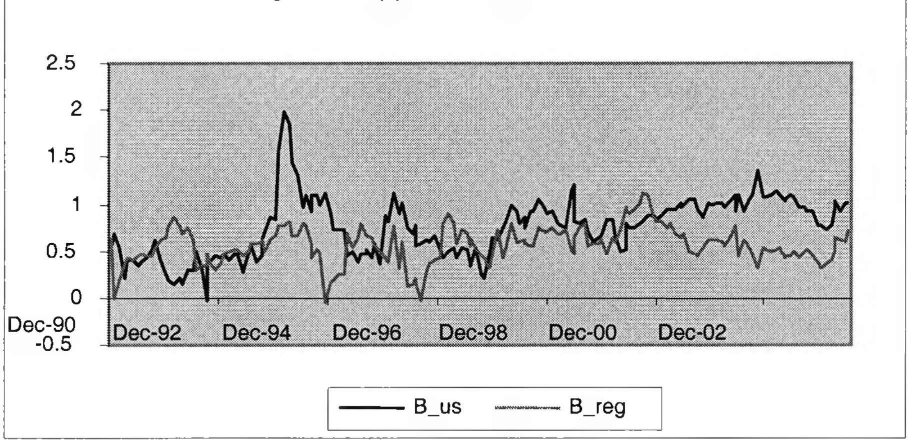


Figure 5.1_1(f) Sector: NCYCG

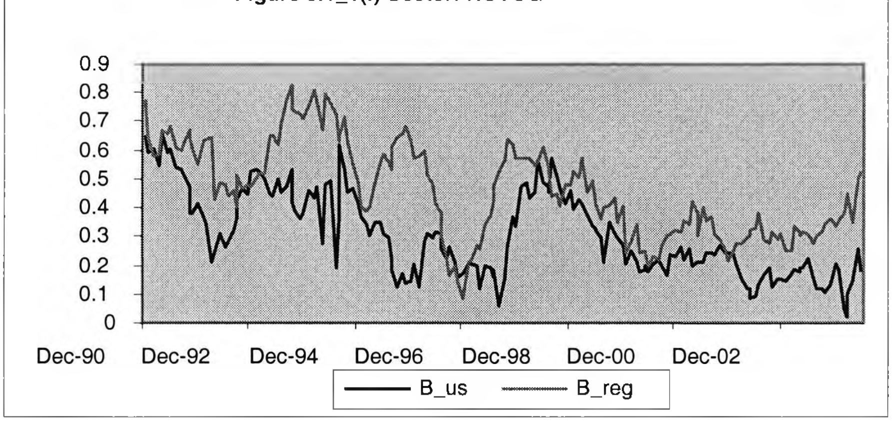


Figure 5.1_1(g) Sector: NCYSR

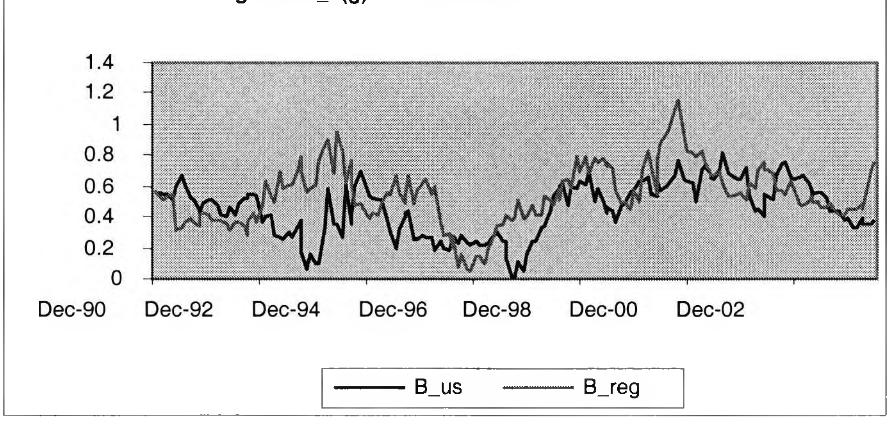


Figure 5.1_1(h) Sector: RESOR

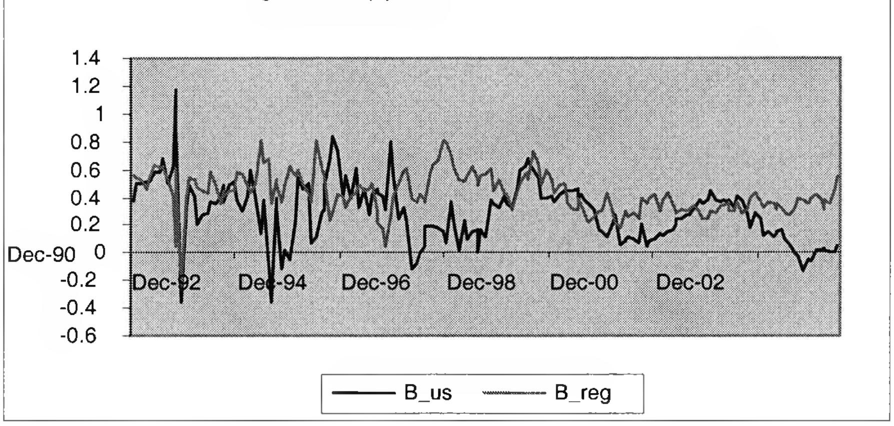


Figure 5.1_1(i) Sector: TOTLF

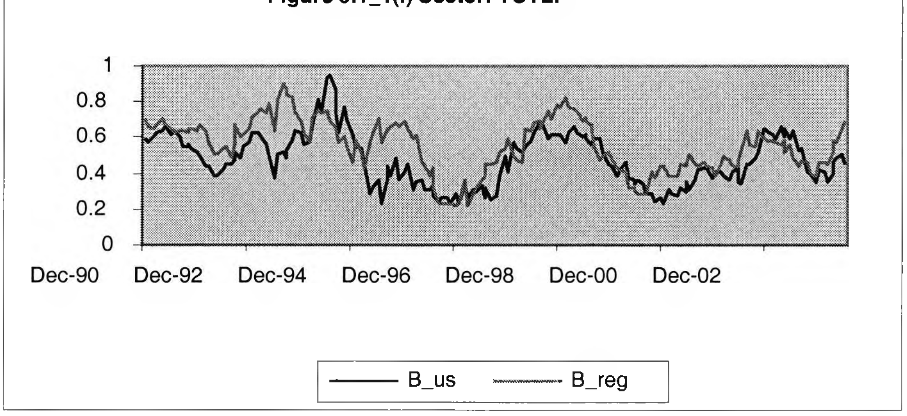
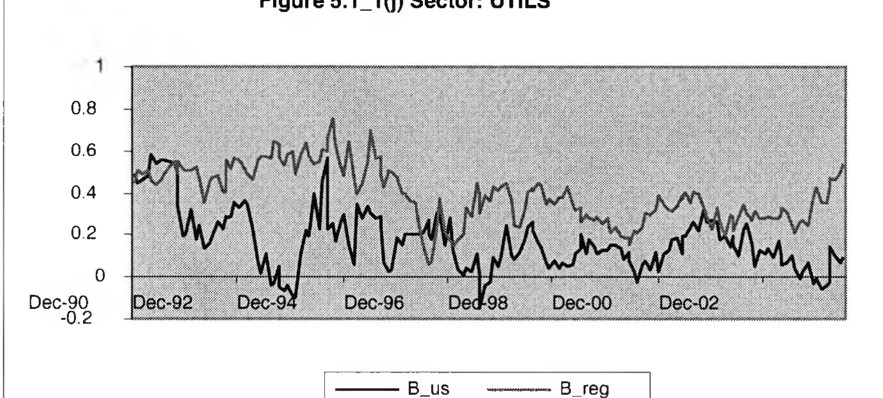


Figure 5.1_1(j) Sector: UTILS



B. Asia

Figure 5.1_2(a) Sector: BASIC

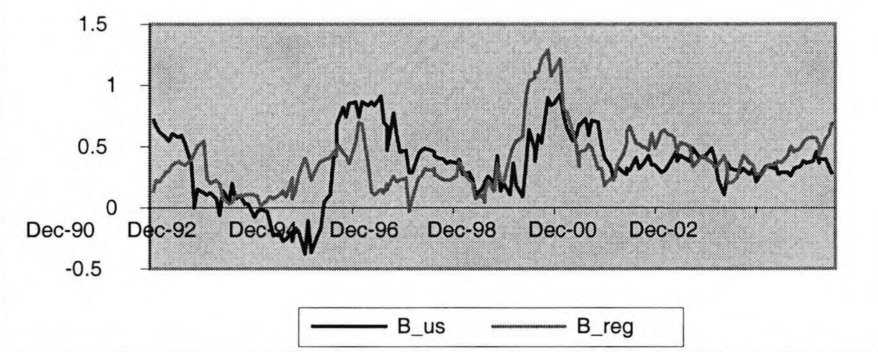


Figure 5.1_2(b) Sector: CYCGD

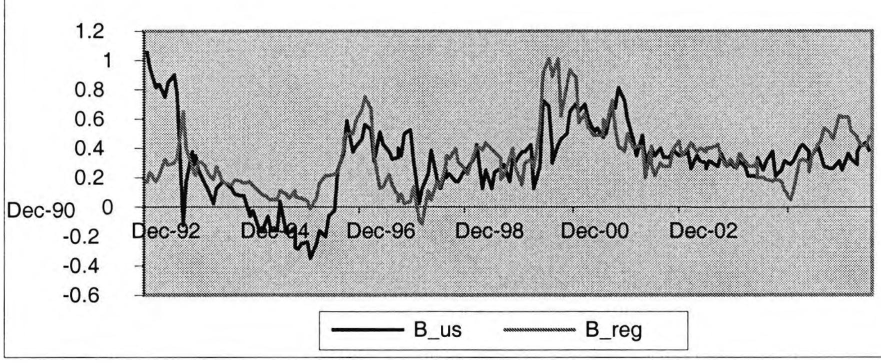


Figure 5.1_2(c) Sector: CYSER

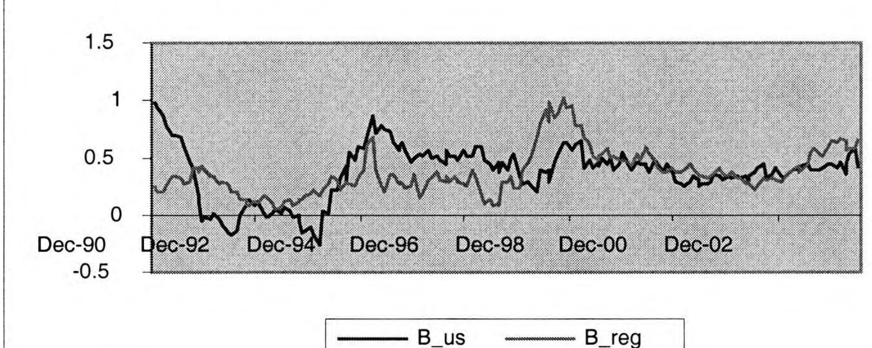


Figure 5.1_2(d) Sector: GENIN

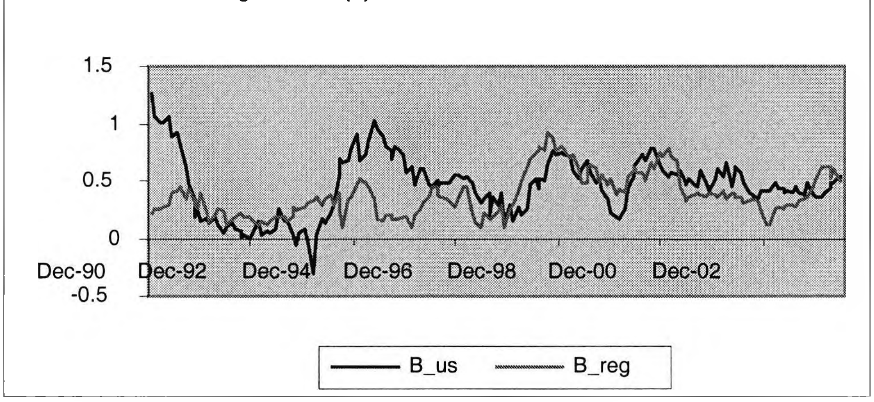


Figure 5.1_2(e) Sector: ITECH

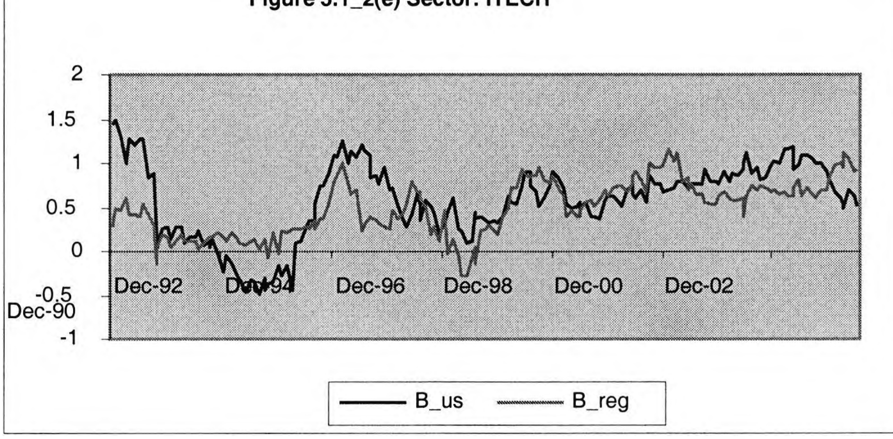


Figure 5.1_2(f) Sector: NCYCG

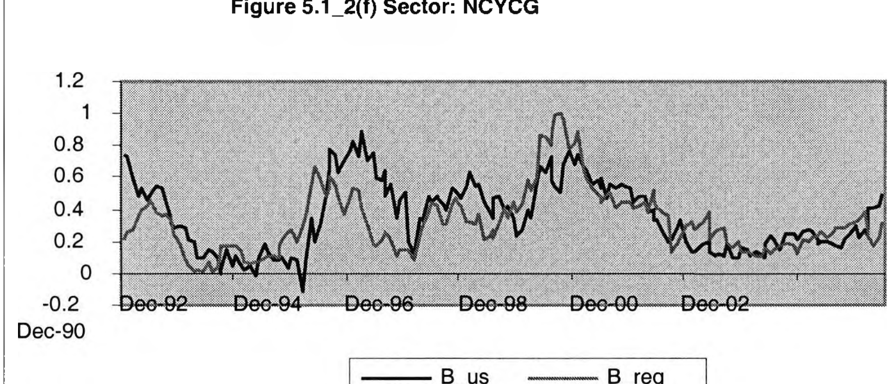


Figure 5.1_2(g) Sector: NCYSR

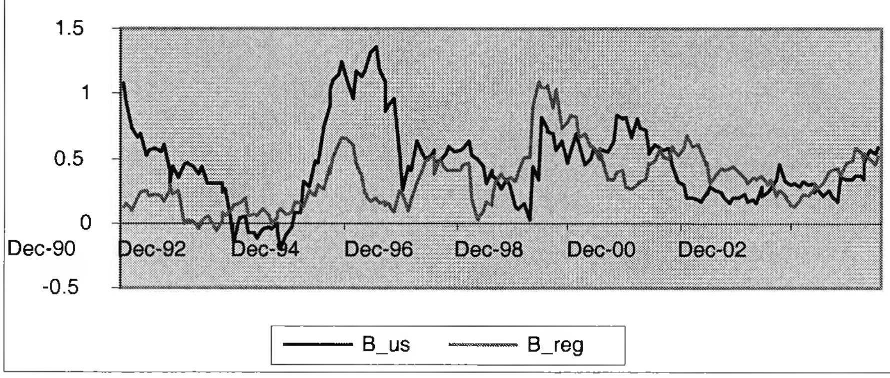


Figure 5.1_2(h) Sector: RESOR

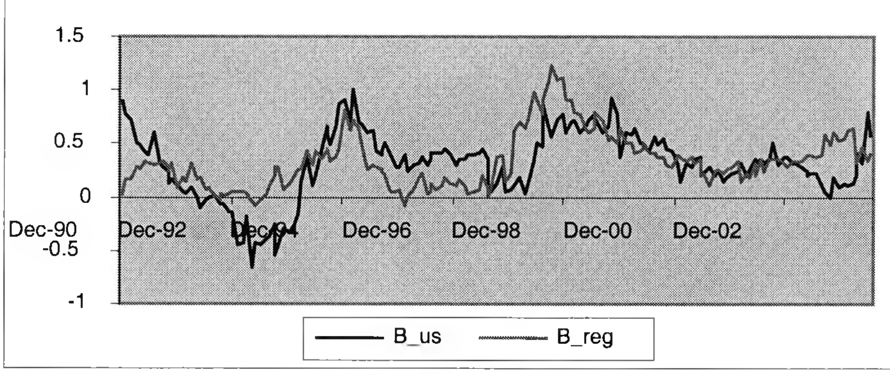


Figure 5.1_2(i) Sector: TOTLF

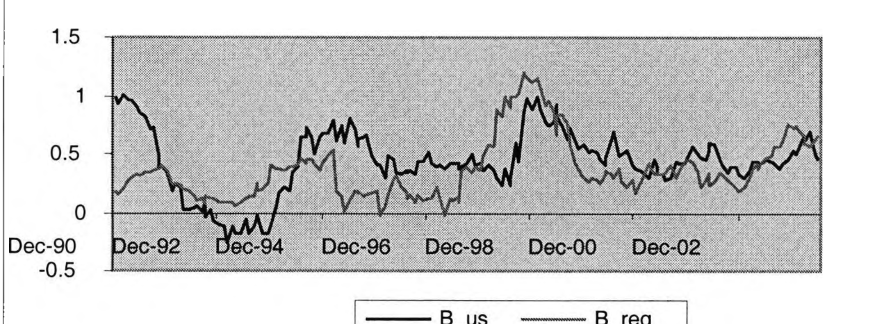
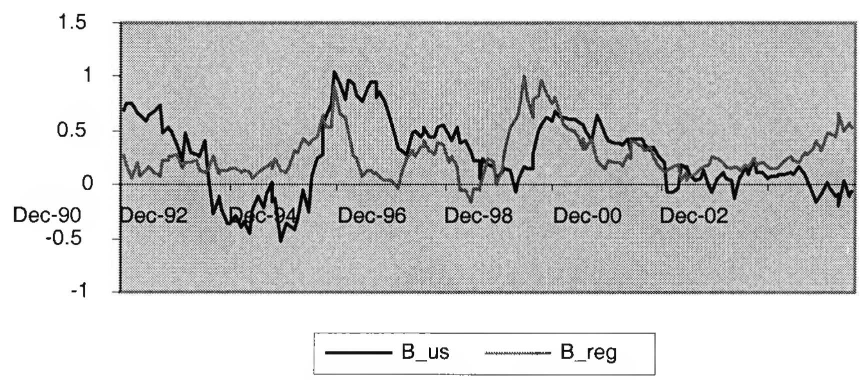


Figure 5.1_2(j) Sector: UTILS



C. Latin America

Figure 5.1_3(a) Sector: BASIC

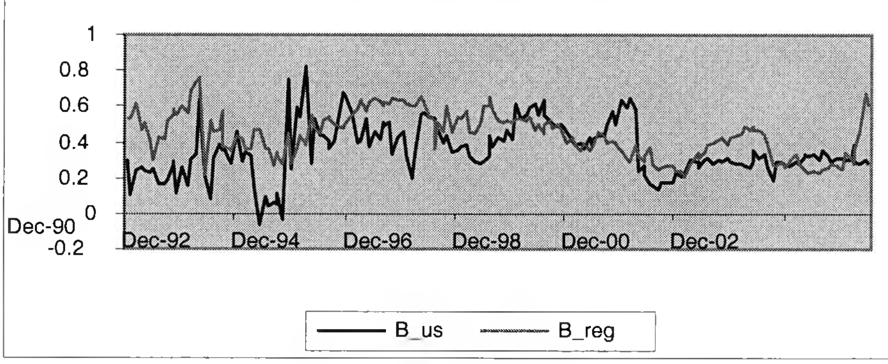


Figure 5.1_3(b) Sector: CYCGD

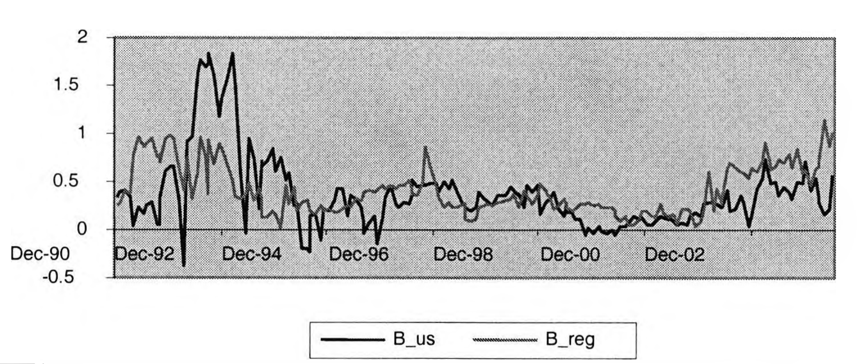


Figure 5.1_3(c) Sector: CYSER

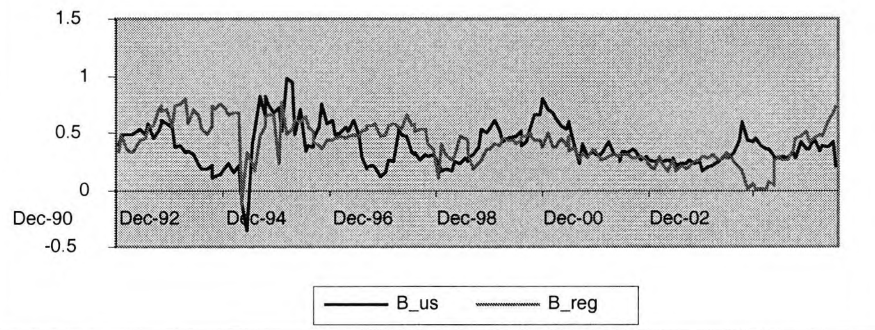


Figure 5.1_3(d) Sector: GENIN

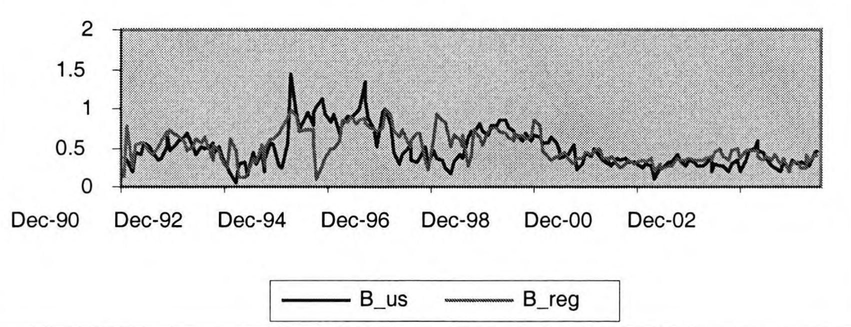
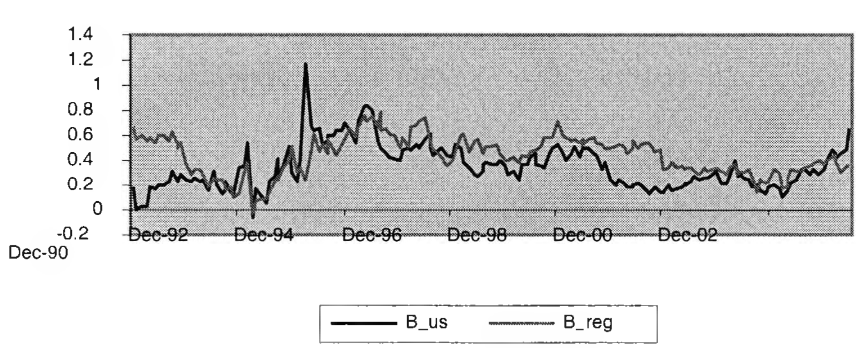


Figure 5.1_3(e) Sector: NCYCG



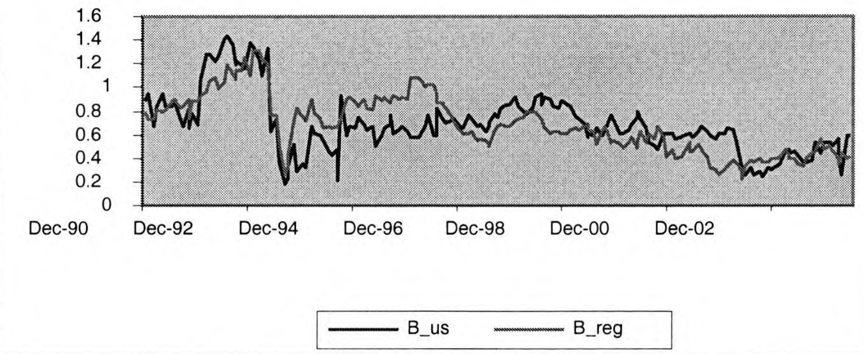


Figure 5.1_3(f) Sector: NCYSR

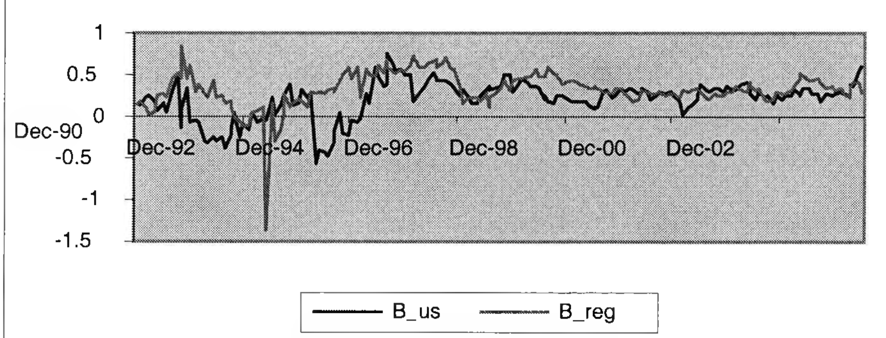


Figure 5.1_3(g) Sector: RESOR

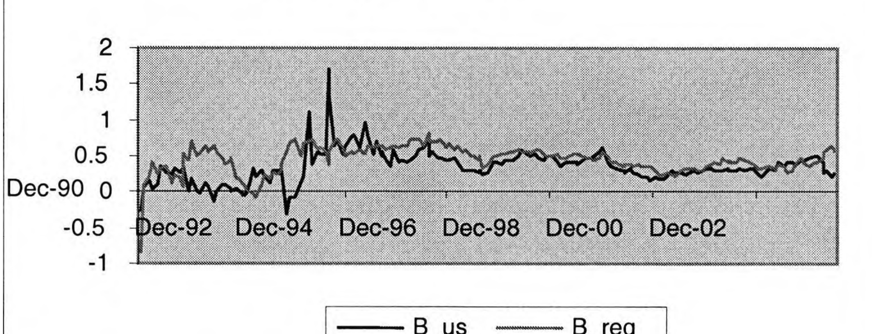
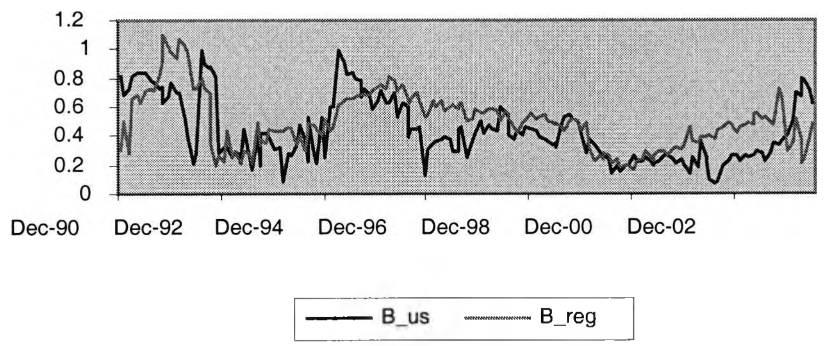


Figure 5.1_3(h) Sector: TOTLF

Figure 5.1_3(i) Sector: UTILS



Appendices:

Appendix 5A FTSE actuaries (sector and industry classification)

Sector	Industries Included
Basic Industries	Chemicals Construction & Building Materials Forestry & Paper Steel & Other Metals Chemicals, Construction & Building Materials, Forestry & Paper Steel & Other Metals
Cyclical Consumer Goods	Automobiles & Parts Household Goods & Textiles
Cyclical Services	General Retailers Leisure Entertainment & Hotels Media & Photography Support Services Transport
General Industries	Aerospace & Defence Electronic & Electrical Equipment Engineering & Machinery
Information Technology	Information Technology Hardware Software & Computer Services
Non-cyclical Consumer Goods	Beverages Food Producers & Processors Health Personal Care & Household Products Pharmaceuticals & Biotechnology Tobacco
Non-cyclical Services	Food & Drug Retailers Telecommunication Services
Resources	Mining Oil & Gas
Financials	Banks Insurance Life Assurance Investment Companies Real Estate Speciality & Other Finance
Utilities	Electricity Gas Distribution Water

Appendix 5B Sample countries included in the analysis

Region	Countries Included
Europe	Belgium, Denmark, Spain, Finland, Greece, Ireland, Luxemburg, Netherlands, Norway, Austria, Portugal, Sweden, Switzerland, Turkey
Asia	Hong Kong, Malaysia, Korea, Indonesia, Singapore, Thailand, Taiwan, Philippines
Latin America	Argentine, Brazil, Columbia, Chile, Mexico, Peru, Venezuela

Appendix 5C Sector by sector estimation results

The following model is examined for each sector in each country:

$$r_{i,j,t} = \delta_{i,j} X_{i,j,t-1} + \beta^{us}_{i,j,t-1}\mu_{us,t-1} + \beta^{reg}_{i,j,t-1}\mu_{reg,t-1} + \beta^{us}_{i,j,t-1}e_{us,t} + \beta^{reg}_{i,j,t-1}e_{reg,t} + e_{i,j,t},$$

$$e_{i,j,t} \mid \Omega_{t-1} \sim N(0, \sigma^2_{i,j,t}),$$

$$\sigma^2_{i,j,t} = a_{i,j} + b_{i,j}\sigma^2_{i,j,t-1} + c_{i,j}e^2_{i,j,t-1} + d_{i,j}\eta^2_{i,j,t-1}$$
$$\eta_{i,j,t} = \min\{0, e_{i,j,t}\}$$

where $r_{i,j,t}$ is the excess return, $\mu_{us,t-1}$ and $e_{us,t}$ ($\mu_{reg,t-1}$ and $e_{reg,t}$) are the conditional expected excess return and residual on the US (regional) market. $e_{i,j,t}$ is the idiosyncratic shock of any sector i in country j, and $X_{i,j,t-1}$ represents local information variables available at time t-1.

The table reports the results of model specification test as well as the beta and variance ratio estimates for each sector in each country. To test for model specification, Q(20) and $Q^2(20)$ are the 20th order Ljung Box statistics for the autocovariances of the scaled residuals (10b) and the autocovariances of the squared scaled residuals (10d); the moments are based on joint test of four moments (10a,c, e, f). Three Wald tests are conducted: (1) is the test of the significance of the local information in the mean, i.e. $\delta_{i,j} = 0$. (2) is the test of CAPM with the US as benchmark, i.e. $\beta^{reg}_{i,j,t-1} = 0$ and $\delta_{i,j} = 0$. (3) is the test of CAPM with the regional market as the benchmark, i.e. $\beta^{us}_{i,j,t-1} = 0$ and $\delta_{i,j} = 0$. The *p* value is shown in brackets and t statistics is included in parenthesis. The figure highlighted represents significance at 5% level or less.

Note: *std dev. – standard deviation, asy.- asymmetric, sym.- symmetric, BASIC – basic industries, CYCGD – cyclical consumer goods, CYSER – cyclical services, GENIN – general industries, ITECH – information technology, NCYCG – non-cyclical consumer goods, NCYSR – non-cyclical services, RESOR – resources, TOTLF – financials, and UTILS – utilities.*

Sector	*Mod-el.*	*Specification Tests*			*Wald test*			*Betas*		*Variance ratios*	
		Q(20)	Q2(20)	Moments	(1)	(2)	(3)	$\beta^{us}_{i,j,t-1}$	$\beta^{reg}_{i,j,t-1}$	$VR^{us}_{i,j,t}$	$VR^{reg}_{i,j,t}$
A. Europe											
Austria											
BASIC	Asy.	21.74 [0.355]	26.87 [0.139]	2.78 [0.596]	**22.97** [0.000]	**54.92** [0.000]	**197.57** [0.000]	**0.192** (5.53)	**0.447** (13.35)	2.006	8.753
CYCGD	Asy.	**294.9** [0.000]	18.25 [0.447]	2.57 [0.633]	**14396** [0.000]	**14520** [0.000]	**16292** [0.000]	3E-03 (0.00)	5E-03 (0.00)	0.000	0.000
CYSER	Asy.	14.76	17.75	2.92	**8.31**	**32.98**	**125.08**	**0.238**	**0.579**	1.892	8.781

		[0.79]	[0.604]	[0.571]	[0.04]	[0.000]	[0.000]	(5.33)	(10.93)		
GENIN	Sym.	18.97	10.39	0.34	**24.37**	**58.79**	**173.21**	**0.219**	**0.48**	2.375	8.905
		[0.524]	[0.961]	[0.987]	[0.000]	[0.000]	[0.000]	(5.18)	(11.84)		
ITECH	Asy.	9.47	9.25	9.41	4.59	4.717	**42.77**	5E-03	**0.287**	0.000	1.412
		[0.977]	[0.055]	[0.052]	[0.205]	[0.318]	[0.000]	(0.01)	(6.191)		
NCYCG	Sym.	16.03	**49.6**	1.15	2.74	**10.29**	**90.69**	**0.129**	**0.406**	0.696	5.29
		[0.715]	[0.000]	[0.886]	[0.432]	[0.036]	[0.000]	(2.75)	(9.33)		
NCYSR	Asy.	**47.69**	23.64	6.34	**2829**	**2855**	**3680**	-0.002	**-0.001**	0.000	0.000
		[0.000]	[0.272]	[0.175]	[0.000]	[0.000]	[0.000]	(-1.69)	(-2.1)		
RESOR	Asy.	18.11	22.07	0.136	1.71	**34.13**	**97.27**	**0.289**	**0.486**	2.484	5.726
		[0.712]	[0.337]	[0.998]	[0.635]	[0.000]	[0.000]	(5.64)	(9.65)		
TOTLF	Sym.	16.85	12.7	1.52	4.14	**23.12**	**227.62**	**0.154**	**0.471**	1.672	12.197
		[0.663]	[0.891]	[0.823]	[0.246]	[0.000]	[0.000]	(4.39)	(14.87)		
UTILS	Asy.	23.17	17.43	0.861	1.741	9.391	**86.61**	**0.121**	**0.417**	0.662	6.188
		[0.28]	[0.625]	[0.93]	[0.627]	[0.052]	[0.000]	(2.79)	(9.22)		
Belgium											
BASIC	Sym.	20.56	12.69	0.245	**11.48**	**139.22**	**352.91**	**0.335**	**0.543**	8.507	17.041
		[0.423]	[0.89]	[0.993]	[0.009]	[0.000]	[0.000]	(10.81)	(17.28)		
CYCGD	Sym.	18.38	20.84	0.685	2.48	**27.55**	**52.34**	**0.307**	**0.453**	2.859	4.748
		[0.563]	[0.407]	[0.953]	[0.479]	[0.000]	[0.000]	(4.97)	(6.84)		
CYSER	Sym.	17.08	16.33	0.71	0.33	**186.3**	**258.1**	**0.467**	**0.581**	12.603	14.927
		[0.648]	[0.696]	[0.949]	[0.954]	[0.000]	[0.000]	(13.57)	(16.04)		
GENIN	Sym.	15.79	14.35	0.62	1.81	**124.91**	**366.3**	**0.363**	**0.542**	9.546	16.238
		[0.106]	[0.812]	[0.96]	[0.613]	[0.000]	[0.000]	(11.04)	(18.89)		
ITECH	Asy.	30.22	7.72	1.4	**37.2**	**96.75**	**189.2**	**0.472**	**0.65**	2.939	4.263
		[0.066]	[0.996]	[0.843]	[0.000]	[0.000]	[0.000]	(6.56)	(10.56)		
NCYCG	Sym.	28.38	18.52	1.07	6.67	**117.4**	**190.4**	**0.383**	**0.545**	7.795	12.038
		[0.101]	[0.553]	[0.898]	[0.083]	[0.000]	[0.000]	(9.83)	(13.45)		
NCYSR	Sym.	19.26	20.21	0.339	2.16	**163.15**	**154.5**	**0.483**	**0.466**	10.508	7.47
		[0.505]	[0.445]	[0.987]	[0.539]	[0.000]	[0.000]	(12.32)	(12.34)		
TOTLF	Sym.	22.03	28.12	1.7	2.14	**223.2**	**436.8**	**0.408**	**0.587**	11.532	18.19
		[0.339]	[0.107]	[0.79]	[0.545]	[0.000]	[0.000]	(14.85)	(20.77)		
UTILS	Asy.	**52.73**	7.14	1.44	**37.2**	**96.75**	**189.2**	**0.472**	**0.65**	4.266	10.902
		[0.000]	[0.996]	[0.837]	[0.000]	[0.000]	[0.000]	(6.56)	(10.56)		
Denmark											
BASIC	Asy.	**38.61**	31.35	2.91	3.86	**16.71**	**149.9**	**0.111**	**0.366**	1.054	8.641
		[0.007]	[0.051]	[0.573]	[0.277]	[0.002]	[0.000]	(3.25)	(12.07)		
CYCGD	Asy.	22.03	26.38	8.34	**62.24**	**68.05**	**134.1**	**0.234**	**0.339**	1.547	2.47
		[0.339]	[0.154]	[0.079]	[0.000]	[0.000]	[0.000]	(4.32)	(7.83)		
CYSER	Asy.	21.99	17.02	0.26	3.57	**58.67**	**192.2**	**0.337**	**0.582**	5.154	11.734
		[0.341]	[0.652]	[0.992]	[0.311]	[0.000]	[0.000]	(7.11)	(13.74)		
GENIN	Sym.	28.66	19.59	2.14	3.37	**40.45**	**137.21**	**0.332**	**0.49**	3.77	6.415
		[0.095]	[0.484]	[0.709]	[0.338]	[0.000]	[0.000]	(6.28)	(11.22)		
ITECH	Sym.	8.07	15.52	1.21	5.00	**48.72**	**54.65**	**0.783**	**0.881**	6.023	5.825
		[0.991]	[0.746]	[0.876]	[0.172]	[0.000]	[0.000]	(6.79)	(6.84)		
NCYCG	Sym.	44.67	16.58	0.62	2.05	**72.18**	**184.5**	**0.313**	**0.45**	6.3	9.936
		[0.001]	[0.68]	[0.961]	[0.561]	[0.000]	[0.000]	(7.92)	(13.49)		
NCYSR	Sym.	**30.32**	19.75	0.58	0.56	**71.32**	**78.96**	**0.412**	**0.526**	4.345	5.42
		[0.065]	[0.474]	[0.965]	[0.906]	[0.000]	[0.000]	(7.83)	(8.74)		
TOTLF	Asy.	22.14	7.74	3.08	6.46	**74.51**	**244.9**	**0.331**	**0.495**	5.498	9.418
		[0.333]	[0.993]	[0.543]	[0.09]	[0.000]	[0.000]	(7.67)	(15.35)		
UTILS	Asy.	20.23	3.37	1.45	3.81	4.18	4.18	-0.142	0.169	0.282	0.308
		[0.444]	[0.999]	[0.836]	[0.282]	[0.382]	[0.382]	(-0.79)	(1.02)		
Finland											
BASIC	Sym.	24.62	**74.24**	9.01	0.66	**112.9**	**64.49**	**0.58**	**0.465**	9.569	4.7
		[0.216]	[0.000]	[0.061]	[0.882]	[0.000]	[0.000]	(10.58)	(7.96)		
CYCGD	Asy.	22.61	14.38	0.09	7.18	**37.16**	**25.88**	**0.273**	**0.319**	1.29	1.35
		[0.308]	[0.911]	[0.998]	[0.066]	[0.000]	[0.000]	(4.57)	(4.64)		
CYSER	Sym.	26.43	15.11	1.41	0.58	**43.71**	**98.37**	**0.254**	**0.379**	3.29	5.607
		[0.152]	[0.77]	[0.842]	[0.9]	[0.000]	[0.000]	(6.5)	(9.86)		
GENIN	Sym.	**40.92**	20.26	0.68	7.87	**109.6**	**117.7**	**0.402**	**0.435**	8.186	7.316
		[0.000]	[0.442]	[0.953]	[0.05]	[0.000]	[0.000]	(9.47)	(10.39)		
ITECH	Asy.	18.04	14.21	1.88	**28.05**	**194.3**	**89.86**	**1.164**	**0.611**	16.337	3.435
		[0.585]	[0.82]	[0.757]	[0.000]	[0.000]	[0.000]	(12.93)	(7.19)		
NCYCG	Asy.	**33.37**	21.89	0.61	0.84	**14.32**	**69.96**	**0.154**	**0.359**	1.202	4.995
		[0.031]	[0.346]	[0.962]	[0.84]	[0.006]	[0.000]	(3.56)	(8.26)		
NCYSR	Asy.	14.33	11.63	5.86	**8.23**	**43.01**	**71.01**	**0.418**	**0.473**	3.07	2.997
		[0.813]	[0.926]	[0.209]	[0.042]	[0.000]	[0.000]	(6.26)	(7.67)		
RESOR	Sym.	18.83	21.69	1.03	7.67	7.84	**22.53**	-0.033	**0.234**	0.049	1.805
		[0.533]	[0.358]	[0.906]	[0.053]	[0.098]	[0.000]	(-0.53)	(3.73)		
TOTLF	Sym.	22.02	18.29	0.08	5.46	**170.4**	**128.7**	**0.533**	**0.505**	5.077	3.485

		[0.34]	[0.569]	[0.999]	[0.141]	[0.000]	[0.000]	(12.89)	(11.06)		
UTILS	Asy.	16.72	7.86	1.54	5.28	**11.42**	**17.91**	-0.094	**0.226**	0.22	0.979
		[0.671]	[0.993]	[0.819]	[0.152]	[0.022]	[0.001]	(-1.55)	(3.23)		
Greece											
BASIC	Asy.	17.66	23.36	0.59	2.83	**30.29**	**114.9**	**0.304**	**0.573**	2.028	5.492
		[0.61]	[0.272]	[0.963]	[0.418]	[0.000]	[0.000]	(5.19)	(10.49)		
CYCGD	Asy.	**40.79**	**113.83**	3.65	**11.57**	**69.92**	**108.1**	**0.482**	**0.957**	1.016	3.064
		[0.000]	[0.000]	[0.455]	[0.009]	[0.000]	[0.000]	(6.9)	(10.22)		
CYSER	Sym.	10.93	27.26	2.92	5.43	**13.09**	**52.52**	**0.188**	**0.557**	0.611	4.119
		[0.948]	[0.128]	[0.571]	[0.142]	[0.01]	[0.000]	(2.47)	(6.77)		
GENIN	Sym.	28.2	18.1	0.48	1.21	**11.44**	**32.46**	**0.324**	**0.504**	0.802	1.482
		[0.105]	[0.581]	[0.975]	[0.752]	[0.022]	[0.000]	(3.13)	(5.45)		
ITECH	Sym.	14.33	5.63	5.1	2.97	**32.82**	**62.27**	**0.53**	**0.732**	3.233	4.713
		[0.813]	[0.999]	[0.277]	[0.395]	[0.000]	[0.000]	(5.62)	(7.67)		
NCYCG	Asy.	21.16	7.92	1.55	7.14	**19.69**	**80.74**	**0.178**	**0.456**	0.926	4.621
		[0.388]	[0.992]	[0.213]	[0.067]	[0.001]	[0.000]	(3.39)	(8.54)		
NCYSR	Asy.	29.03	27.36	0.53	1.02	**19.95**	**81.23**	**0.317**	**0.673**	2.639	9.504
		[0.087]	[0.126]	[0.971]	[0.796]	[0.001]	[0.000]	(4.25)	(8.74)		
RESOR	Sym.	12.44	14.74	5.14	2.48	**9.62**	**57.82**	**0.173**	**0.522**	0.646	4.471
		[0.9]	[0.791]	[0.273]	[0.478]	[0.047]	[0.000]	(2.37)	(7.54)		
TOTLF	Sym.	24.84	18.07	3.63	0.49	**33.98**	**122.2**	**0.382**	**0.658**	3.028	6.851
		[0.207]	[0.583]	[0.457]	[0.919]	[0.000]	[0.000]	(5.72)	(10.99)		
UTILS	Asy.	25.51	13.32	0.7	3.99	7.05	**33.78**	0.135	**0.514**	0.314	3.45
		[0.183]	[0.863]	[0.951]	[0.262]	[0.134]	[0.000]	(1.55)	(5.15)		
Luxemburg											
BASIC	Sym.	21.31	1.18	0.04	0.14	**12.56**	**29.16**	**0.227**	**0.45**	1.178	3.532
		[0.379]	[0.999]	[0.999]	[0.987]	[0.014]	[0.000]	(3.51)	(5.39)		
CYSER	Asy.	14.47	28.37	3.27	**16.65**	**24.33**	**77.03**	0.126	**0.493**	0.462	5.389
		[0.806]	[0.101]	[0.514]	[0.001]	[0.000]	[0.000]	(1.93)	(7.43)		
GENIN	Sym.	9.22	0.69	0.41	1.09	2.46	**38.96**	-0.063	**0.274**	0.294	4.273
		[0.98]	[1.0]	[0.981]	[0.779]	[0.652]	[0.000]	(-1.19)	(5.88)		
NCYCG	Sym.	17.96	26.03	0.21	7.68	**14.2**	**26.01**	**0.149**	**0.258**	0.582	1.323
		[0.59]	[0.165]	[0.995]	[0.053]	[0.007]	[0.000]	(2.12)	(3.81)		
RESOR	Asy.	18.89	13.12	9.07	4.71	4.77	**9.86**	-0.067	0.23	0.105	0.957
		[0.529]	[0.872]	[0.059]	[0.195]	[0.312]	[0.042]	(-0.66)	(1.99)		
TOTLF	Asy.	17.45	**48.36**	0.92	6.45	8.09	**149.6**	0.038	**0.353**	0.155	10.144
		[0.623]	[0.000]	[0.921]	[0.092]	[0.088]	[0.000]	(1.16)	(11.72)		
UTILS	Asy.	8.13	25.89	1.37	4.06	6.06	**65.65**	-0.057	**0.312**	0.188	4.296
		[0.991]	[0.169]	[0.848]	[0.255]	[0.195]	[0.000]	(-1.47)	(7.94)		
Netherlands											
BASIC	Asy.	22.03	**32.35**	0.39	1.12	**168.3**	**271.9**	**0.449**	**0.581**	10.979	14.037
		[0.34]	[0.04]	[0.983]	[0.773]	[0.000]	[0.000]	(12.84)	(16.39)		
CYCGD	Asy.	16.16	19.01	2.59	4.04	**64.14**	**103.3**	**0.285**	**0.337**	3.611	3.847
		[0.707]	[0.521]	[0.629]	[0.258]	[0.000]	[0.000]	(7.48)	(9.93)		
CYSER	Sym.	**33.03**	18.89	2.6	3.9	**459.9**	**674.4**	**0.491**	**0.649**	16.431	21.874
		[0.034]	[0.529]	[0.626]	[0.272]	[0.000]	[0.000]	(21.05)	(25.85)		
GENIN	Asy.	29.19	14.38	3.49	**9.68**	**327.9**	**176.3**	**1.028**	**0.735**	22.935	8.956
		[0.084]	[0.811]	[0.48]	[0.022]	[0.000]	[0.000]	(17.81)	(12.82)		
ITECH	Asy.	17.23	26.52	1.69	0.77	**327.6**	**188.5**	**1.01**	**0.865**	19.342	10.879
		[0.678]	[0.149]	[0.793]	[0.857]	[0.000]	[0.000]	(17.68)	(13.68)		
NCYCG	Sym.	27.79	12.9	1.18	2.58	**162.6**	**178.5**	**0.384**	**0.449**	10.279	10.7
		[0.114]	[0.882]	[0.881]	[0.461]	[0.000]	[0.000]	(12.24)	(13.21)		
NCYSR	Asy.	**45.58**	22.39	0.69	**11.09**	**176.8**	**277.5**	**0.547**	**0.677**	10.763	12.624
		[0.002]	[0.32]	[0.952]	[0.011]	[0.000]	[0.000]	(12.46)	(16.3)		
RESOR	Asy.	28.73	18.19	1.59	4.36	**107.9**	**103.5**	**0.375**	**0.342**	8.695	5.508
		[0.093]	[0.575]	[0.808]	[0.225]	[0.000]	[0.000]	(10.03)	(9.46)		
TOTLF	Sym.	29.89	14.09	0.46	1.38	**573.9**	**549.1**	**0.602**	**0.619**	21.061	17.041
		[0.072]	[0.826]	[0.977]	[0.711]	[0.000]	[0.000]	(23.81)	(23.21)		
Norway											
BASIC	Asy.	**33.53**	29.6	4.43	**19.21**	**123.03**	**115.02**	**0.433**	**0.428**	8.484	6.327
		[0.03]	[0.077]	[0.351]	[0.000]	[0.000]	[0.000]	(10.05)	(10.43)		
CYCGD	Sym.	29.39	17.82	2.34	2.25	**25.15**	**76.36**	**0.258**	**0.466**	2.854	7.078
		[0.08]	[0.599]	[0.668]	[0.521]	[0.000]	[0.000]	(4.55)	(8.69)		
CYSER	Asy.	23.44	21.5	4.74	4.02	**166.1**	**125.5**	**0.528**	**0.521**	9.346	6.937
		[0.268]	[0.368]	[0.315]	[0.259]	[0.000]	[0.000]	(12.63)	(10.85)		
GENIN	Sym.	19.98	19.72	0.81	4.71	**168.8**	**152.1**	**0.74**	**0.694**	13.473	9.036
		[0.459]	[0.495]	[0.368]	[0.195]	[0.000]	[0.000]	(12.8)	(12.12)		
ITECH	Asy.	11.55	11.62	1.93	**14.74**	**115.6**	**110.8**	**0.657**	**0.73**	6.505	6.122
		[0.931]	[0.928]	[0.748]	[0.002]	[0.000]	[0.000]	(8.91)	(10.17)		
NCYCG	Asy.	14.34	13.37	2.07	3.72	**46.68**	**65.89**	**0.409**	**0.471**	4.048	4.109
		[0.813]	[0.861]	[0.722]	[0.293]	[0.000]	[0.000]	(6.59)	(7.98)		

NCYSR	Asy.	15.03	25.82	4.55	4.42	**40.29**	**53.67**	**0.616**	**0.731**	4.224	4.54
		[0.775]	[0.172]	[0.337]	[0.219]	[0.000]	[0.000]	(6.16)	(7.13)		
RESOR	Asy.	12.53	16.93	0.11	1.07	**51.09**	**105.7**	**0.339**	**0.435**	4.704	5.921
		[0.897]	[0.658]	[0.998]	[0.784]	[0.000]	[0.000]	(7.03)	(10.19)		
TOTLF	Asy.	23.21	29.54	1.92	**28.78**	**92.52**	**182.7**	**0.333**	**0.492**	3.603	5.974
		[0.278]	[0.078]	[0.751]	[0.000]	[0.000]	[0.000]	(8.01)	(12.21)		
UTILS	Sym.	26.28	19.42	0.51	1.76	**52.23**	**39.08**	**0.378**	**0.374**	3.422	2.567
		[0.157]	[0.495]	[0.973]	[0.624]	[0.000]	[0.000]	(7.01)	(5.97)		
Portugal											
BASIC	Sym.	**32.36**	12.48	1.52	4.93	8.57	**107.4**	0.069	**0.389**	0.278	6.619
		[0.04]	[0.899]	[0.821]	[0.177]	[0.073]	[0.000]	(1.79)	(9.99)		
CYCGD	Asy.	20.89	8.79	0.092	**8.29**	**135.9**	**111.9**	**0.53**	**0.581**	5.352	4.498
		[0.404]	[0.985]	[0.762]	[0.04]	[0.000]	[0.000]	(10.43)	(9.57)		
CYSER	Asy.	16.75	7.53	0.34	1.54	**18.92**	**95.28**	**0.166**	**0.442**	0.983	5.354
		[0.669]	[0.995]	[0.986]	[0.674]	[0.001]	[0.000]	(3.96)	(9.15)		
GENIN	Asy.	28.21	13.13	1.93	5.85	8.11	**167.6**	0.049	**0.472**	0.142	9.764
		[0.105]	[0.872]	[0.748]	[0.119]	[0.087]	[0.000]	(1.22)	(12.77)		
ITECH	Asy.	24.85	**36.01**	4.5	6.34	**25.75**	**45.42**	**0.358**	**0.67**	1.184	3.172
		[0.207]	[0.015]	[0.342]	[0.096]	[0.000]	[0.000]	(3.91)	(6.61)		
NCYCG	Sym.	17.21	12.69	3.45	2.05	5.78	**85.19**	0.079	**0.412**	0.233	4.482
		[0.639]	[0.89]	[0.485]	[0.562]	[0.216]	[0.000]	(1.97)	(9.13)		
NCYSR	Asy.	25.19	15.68	0.19	4.28	**65.53**	**195.9**	**0.36**	**0.673**	4.436	1.825
		[0.194]	[0.736]	[0.996]	[0.232]	[0.000]	(0.000)	(7.76)	(13.84)		
TOTLF	Asy.	22.77	15.39	0.11	1.68	**15.04**	**261.5**	**0.138**	**0.509**	1.203	12.459
		[0.3]	[0.753]	[0.998]	[0.642]	[0.005]	[0.000]	(3.65)	(15.77)		
UTILS	Sym.	14.34	17.89	0.26	1.26	6.73	**43.96**	**0.116**	**0.374**	0.558	11.825
		[0.813]	[0.595]	[0.992]	[0.738]	[0.151]	[0.000]	(2.09)	(6.49)		
Sweden											
BASIC	Asy.	15.09	17.74	0.69	1.59	**207.4**	**187.1**	**0.521**	**0.502**	14.48	10.24
		[0.771]	[0.604]	[0.952]	[0.662]	[0.000]	[0.000]	(14.23)	(13.62)		
CYCGD	Asy.	**35.22**	**47.59**	0.29	0.77	**243.7**	**136.3**	**0.742**	**0.554**	14.573	6.199
		[0.019]	[0.000]	[0.991]	[0.857]	[0.000]	[0.000]	(15.16)	(11.29)		
CYSER	Sym.	**32.53**	14.67	0.61	7.65	**155.2**	**110.5**	**0.631**	**0.531**	11.919	6.468
		[0.038]	[0.795]	[0.962]	[0.053]	[0.000]	[0.000]	(11.67)	(9.93)		
GENIN	Sym.	21.19	17.88	0.45	0.96	**431.7**	**219.4**	**0.729**	**0.528**	23.143	9.25
		[0.386]	[0.596]	[0.978]	[0.809]	[0.000]	[0.000]	(20.28)	(14.66)		
ITECH	Asy.	28.98	16.66	0.43	0.55	**326.7**	**82.59**	**1.418**	**0.741**	20.994	4.376
		[0.088]	[0.675]	[0.979]	[0.906]	[0.000]	[0.000]	(17.67)	(8.86)		
NCYCG	Asy.	9.98	31.42	1.52	1.56	**33.43**	**91.75**	**0.287**	**0.446**	3.706	6.834
		[0.969]	[0.051]	[0.822]	[0.667]	[0.000]	[0.000]	(5.69)	(9.56)		
NCYSR	Sym.	29.52	26.65	0.68	2.67	**79.74**	**71.24**	**0.732**	**0.745**	8.398	6.641
		[0.078]	[0.145]	[0.953]	[0.443]	[0.000]	[0.000]	(8.78)	(8.09)		
RESOR	Sym.	18.14	14.39	1.33	**14.71**	**15.35**	**32.45**	-0.083	**0.679**	0.075	3.751
		[0.578]	[0.81]	[0.855]	[0.002]	[0.004]	[0.000]	(-0.35)	(3.33)		
TOTLF	Asy.	30.39	12.9	2.28	3.35	**299.1**	**213.0**	**0.771**	**0.649**	14.826	8.036
		[0.084]	[0.881]	[0.682]	[0.34]	[0.000]	[0.000]	(17.19)	(14.31)		
UTILS	Asy.	10.49	14.75	1.61	6.25	**11.48**	**92.97**	**0.114**	**0.386**	0.556	4.814
		[0.958]	[0.79]	[0.805]	[0.099]	[0.021]	[0.000]	(2.29)	(9.54)		
Switzerland											
BASIC	Asy.	**34.49**	18.87	0.17	6.01	**185.0**	**75.6**	**0.37**	**0.519**	10.788	16.225
		[0.023]	[0.53]	[0.996]	[0.111]	[0.000]	[0.000]	(13.5)	(16.2)		
CYCGD	Asy.	**37.63**	16.99	2.67	**8.06**	**154.0**	**138.5**	**0.633**	**0.535**	11.334	6.203
		[0.01]	[9.653]	[0.613]	[0.044]	[0.000]	[0.000]	(11.74)	(11.61)		
CYSER	Asy.	**32.83**	11.49	1.99	**9.06**	**165.3**	**219.2**	**0.502**	**0.588**	11.464	12.01
		[0.035]	[0.933]	[0.737]	[0.028]	[0.000]	[0.000]	(12.61)	(14.69)		
GENIN	Asy.	23.22	22.79	0.92	**9.81**	**249.4**	**344.7**	**0.521**	**0.619**	15.622	16.851
		[0.278]	[0.279]	[0.921]	[0.02]	[0.000]	[0.000]	(15.24)	(18.21)		
ITECH	Asy.	20.69	23.05	1.93	5.38	**134.6**	**204.7**	**0.64**	**0.68**	8.731	7.528
		[0.416]	[0.286]	[0.748]	[0.145]	[0.000]	[0.000]	(11.55)	(14.23)		
NCYCG	Sym.	24.93	17.62	0.17	5.41	**158.3**	**197.2**	**0.361**	**0.403**	11.661	11.076
		[0.204]	[0.612]	[0.996]	[0.144]	[0.000]	[0.000]	(12.06)	(13.81)		
NCYSR	Asy.	19.02	19.32	0.47	4.22	**24.96**	**110.9**	**0.219**	**0.436**	1.931	5.815
		[0.52]	[0.501]	[0.976]	[0.238]	[0.000]	[0.000]	(4.56)	(10.34)		
TOTLF	Asy.	17.22	13.05	0.09	**8.42**	**335.1**	**489.9**	**0.569**	**0.624**	17.523	16.113
		[0.639]	[0.875]	[0.957]	[0.037]	[0.000]	[0.000]	(18.02)	(21.99)		
UTILS	Asy.	27.96	21.74	0.05	2.97	**8.09**	**95.71**	**-0.076**	**0.314**	0.525	6.82
		[0.11]	[0.355]	[0.999]	[0.396]	[0.088]	[0.000]	(-2.24)	(9.52)		
Spain											
BASIC	Sym.	32.28	24.54	3.19	7.38	**97.15**	**248.5**	**0.361**	**0.6**	7.343	15.458
		[0.055]	[0.22]	[0.525]	[0.061]	[0.000]	[0.000]	(9.38)	(15.49)		
CYCGD	Asy.	26.43	16.79	4.33	5.48	**14.91**	**117.3**	**0.191**	**0.454**	0.76	3.298

		[0.152]	[0.666]	[0.362]	0.139]	[0.004]	[0.000]	(3.51)	(9.33)		
CYSER	Sym.	25.56	9.91	0.23	1.78	**160.8**	**365.6**	**0.493**	**0.58**	14.59	15.408
		[0.181]	[0.97]	[0.993]	[0.617]	[0.000]	[0.000]	(12.58)	(18.93)		
GENIN	Sym.	12.97	20.55	0.93	4.12	**95.96**	**254.5**	**0.432**	**0.578**	10.811	14.738
		[0.879]	[0.424]	[0.92]	[0.248]	[0.000]	[0.000]	(9.55)	(15.79)		
ITECH	Sym.	15.29	8.17	0.55	**26.24**	**221.2**	**82.88**	**0.82**	**0.653**	6.038	2.925
		[0.759]	[0.991]	[0.458]	[0.000]	[0.000]	[0.000]	(8.4)	(6.82)		
NCYCG	Asy.	26.27	20.86	0.08	3.12	**22.08**	**158.5**	**0.184**	**0.501**	1.841	10.342
		[0.157]	[0.405]	[0.999]	[0.372]	[0.000]	[0.000]	(4.52)	(12.5)		
NCYSR	Asy.	**31.8**	15.58	5.51	**9.77**	**225.8**	**215.3**	**0.685**	**0.694**	15.264	11.956
		[0.045]	[0.742]	[0.238]	[0.02]	[0.000]	[0.000]	(14.51)	(14.44)		
RESOR	Asy.	30.79	7.95	3.16	**8.64**	**121.5**	**251.8**	**0.432**	**0.585**	8.701	12.197
		[0.058]	[0.992]	[0.53]	[0.034]	[0.000]	[0.000]	(10.45)	(15.67)		
TOTLF	Asy.	19.54	20.03	0.79	3.35	**276.4**	**440.4**	**0.616**	**0.72**	19.459	290.28
		[0.487]	[0.456]	[0.938]	[0.34]	[0.000]	[0.000]	(16.42)	(20.97)		6
UTILS	Asy.	45.26	26.17	0.47	1.21	**76.03**	**254.3**	**0.343**	**0.551**	7.044	
		[0.001]	[0.16]	[0.975]	[0.749]	[0.000]	[0.000]	(8.44)	(15.53)		13.84
Ireland											
BASIC	Asy.	20.35	11.04	0.34	2.19	**82.02**	**175.9**	**0.408**	**0.524**	6.787	8.537
		[0.436]	[0.945]	[0.987]	[0.533]	[0.000]	[0.000]	(8.69)	(12.78)		
CYCGD	Asy.	15.3	20.95	2.55	5.58	**27.97**	**47.66**	**0.288**	**0.38**	1.632	2.159
		[0.759]	[0.4]	[0.634]	[0.133]	[0.000]	[0.000]	(4.45)	(6.35)		
CYSER	Asy.	17.71	12.86	0.13	**29.45**	**122.3**	**201.7**	**0.39**	**0.524**	7.267	10.02
		[0.606]	[0.883]	[0.998]	[0.000]	[0.000]	[0.000]	(9.93)	(12.84)		
GENIN	Asy.	15.01	13.61	1.03	**10.33**	**10.83**	**58.21**	0.065	**0.464**	0.091	3.457
		[0.775]	[0.85]	[0.905]	[0.015]	[0.028]	[0.000]	(0.84)	(6.87)		
ITECH	Sym.	15.33	11.26	0.11	0.59	**19.73**	**16.12**	**0.531**	**0.639**	2.651	2.931
		[0.757]	[0.939]	[0.998]	[0.896]	[0.000]	[0.002]	(4.13)	(3.9)		
NCYCG	Asy.	21.75	19.22	1.07	3.83	**70.42**	**157.9**	**0.364**	**0.529**	5.115	8.251
		[0.354]	[0.507]	[0.898]	[0.279]	[0.000]	[0.000]	(8.05)	(11.79)		
RESOR	Asy.	20.1	**41.44**	2.55	**38.46**	**40.77**	**44.66**	0.071	**0.253**	0.12	1.138
		[0.452]	[0.003]	[0.635]	[0.000]	[0.000]	[0.000]	(1.16)	(3.99)		
TOTLF	Sym.	29.18	**37.11**	0.05	4.85	**178.1**	**198.7**	**0.565**	**0.568**	13.528	10.434
		[0.084]	[0.011]	[0.999]	[0.182]	[0.000]	[0.000]	(13.09)	(13.79)		
Turkey											
BASIC	Asy.	**40.12**	19.69	0.49	**12.26**	**13.87**	**17.66**	0.254	**0.398**	0.23	0.432
		[0.005]	[0.477]	[0.974]	[0.006]	[0.007]	[0.001]	(1.43)	(2.24)		
CYCGD	Sym.	21.69	13.52	0.59	1.18	**13.04**	**12.95**	**0.415**	**0.445**	1.034	0.906
		[0.358]	[0.854]	[0.964]	[0.756]	[0.011]	[0.011]	(3.35)	(3.37)		
CYSER	Asy.	**33.77**	26.65	0.31	2.18	8.22	2.34	**0.68**	0.137	0.883	0.027
		[0.028]	[0.145]	[0.989]	[0.535]	[0.083]	[0.672]	(2.31)	(0.369)		
GENIN	Asy.	24.07	18.76	1.24	0.66	**16.09**	**18.74**	**0.482**	**0.574**	1.181	1.279
		[0.239]	[0.537]	[0.871]	[0.881]	[0.002]	[0.001]	(3.96)	(4.25)		
ITECH	Asy.	**44.61**	22.62	0.69	**140.1**	**145.9**	**140.8**	**0.854**	0.145	0.589	0.013
		[0.001]	[0.308]	[0.951]	[0.000]	[0.000]	[0.000]	(3.00)	(0.452)		
NCYCG	Sym.	17.62	14.88	0.49	0.85	**13.8**	**17.39**	**0.391**	**0.449**	1.208	1.217
		[0.612]	[0.783]	[0.974]	[0.837]	[0.007]	[0.001]	(3.55)	(4.10)		
NCYSR	Asy.	14.62	9.01	0.13	**15.12**	**32.27**	**16.67**	**0.368**	0.256	0.818	0.303
		[0.797]	[0.983]	[0.997]	[0.001]	[0.000]	[0.002]	(3.36)	(1.78)		
RESOR	Sym.	**37.3**	**34.3**	6.87	**102.1**	**109.2**	**104.5**	**0.344**	0.334	0.327	0.236
		[0.011]	[0.024]	[0.142]	[0.000]	[0.000]	[0.000]	(2.06)	(1.85)		
TOTLF	Sym.	13.36	25.23	0.91	0.81	**35.16**	**14.76**	**0.709**	**0.495**	3.133	1.169
		[0.861]	[0.193]	[0.924]	[0.848]	[0.000]	[0.005]	(5.85)	(3.71)		
UTILS	Sym.	18.16	10.15	0.18	1.19	**12.73**	4.63	**0.418**	0.261	0.981	0.293
		[0.577]	[0.965]	[0.995]	[0.754]	[0.012]	[0.326]	(3.33)	(1.85)		
B. Asia											
Hong Kong											
BASIC	Asy.	20.06	14.93	3.31	**8.96**	**35.92**	**27.76**	**0.36**	**0.22**	2.951	1.465
		[0.454]	[0.78]	[0.507]	[0.029]	[0.000]	[0.000]	(5.37)	(4.58)		
CYCGD	Sym.	22.96	19.71	0.41	4.99	**64.67**	**35.69**	**0.508**	**0.268**	6.929	2.56
		[0.291]	[0.476]	[0.981]	[0.172]	[0.000]	[0.000]	(7.07)	(5.08)		
CYSER	Sym.	21.9	16.74	0.39	1.38	**138.1**	**110.6**	**0.554**	**0.343**	13.303	6.79
		[0.346]	[0.669]	[0.983]	[0.707]	[0.000]	[0.000]	(11.72)	(10.49)		
GENIN	Sym.	18.04	18.71	0.018	5.73	**190.8**	**102.1**	**0.715**	**0.392**	16.048	6.421
		[0.585]	[0.54]	[0.999]	[0.125]	[0.000]	[0.000]	(13.68)	(10.0)		
ITECH	Sym.	**33.8**	14.07	2.11	7.43	**110.7**	**67.83**	**0.806**	**0.53**	6.544	3.761
		[0.027]	[0.827]	[0.715]	[0.059]	[0.000]	[0.000]	(9.99)	(7.71)		
NCYCG	Asy.	30.14	5.58	3.99	**9.84**	**41.49**	**26.22**	**0.418**	**0.227**	2.299	0.9
		[0.068]	[0.999]	[0.407]	[0.02]	[0.000]	[0.000]	(5.28)	(3.78)		
NCYSR	Asy.	**32.11**	14.65	1.31	7.54	**133.4**	**67.77**	**0.636**	**0.366**	9.95	4.384
		0.042]	[0.796]	[0.858]	[0.056]	[0.000]	[0.000]	(9.63)	(7.5)		

RESOR	Sym.	13.41	6.28	7.26	3.56	5.55	**33.66**	0.17	**0.474**	0.101	1.044
		[0.859]	[0.998]	[0.122]	[0.312]	[0.234]	[0.000]	(1.46)	(15.74)		
TOTLF	Sym.	16.4	20.81	0.11	**9.59**	**250.7**	**100.5**	**0.601**	**0.327**	14.218	5.6
		[0.691]	[0.406]	[0.998]	[0.022]	[0.000]	[0.000]	(15.16)	(9.76)		
UTILS	Asy.	21.16	14.69	7.17	11.72	**24.95**	**32.12**	**0.11**	**0.134**	0.785	1.569
		[0.388]	[0.794]	[0.126]	[0.008]	[0.000]	[0.000]	(3.32)	(5.08)		
Malaysia											
BASIC	Asy.	21.88	8.31	0.71	**14.13**	**107.7**	**64.61**	**0.393**	**0.284**	2.415	1.681
		[0.347]	[0.99]	[0.95]	[0.002]	[0.000]	[0.000]	(8.62)	(7.26)		
CYCGD	Asy.	24.65	9.21	5.22	0.09	**36.31**	**14.11**	**0.373**	**0.229**	2.059	1.038
		[0.215]	[0.98]	[0.264]	[0.992]	[0.000]	[0.006]	(5.82)	(3.75)		
CYSER	Sym.	18.19	16.85	0.95	**17.37**	**91.49**	**55.2**	**0.411**	**0.296**	4.018	2.762
		[0.574]	0.663]	[0.916]	[0.000]	[0.000]	[0.000]	(9.32)	(6.63)		
GENIN	Sym.	12.44	17.35	0.88	1.66	**75.36**	**47.87**	**0.374**	**0.297**	2.849	2.386
		[0.9]	[0.63]	[0.927]	[0.644]	[0.000]	[0.000]	(7.64)	(6.65)		
ITECH	Sym.	26.51	11.45	0.37	1.77	**56.84**	**50.15**	**0.695**	**0.715**	4.777	6.711
		[0.149]	[0.934]	[0.984]	[0.619]	[0.000]	[0.000]	(7.41)	(6.73)		
NCYCG	Sym.	15.79	9.19	1.76	4.84	**68.01**	**64.63**	**0.188**	**0.21**	1.371	2.287
		[0.729]	[0.981]	[0.779]	[0.183]	[0.000]	[0.000]	(7.08)	(7.34)		
NCYSR	Sym.	16.82	13.01	0.08	6.34	**19.96**	**30.19**	**0.255**	**0.245**	1.059	1.303
		[0.664]	[0.877]	[0.999]	[0.095]	[0.000]	[0.000]	(3.81)	(4.39)		
RESOR	Sym.	16.91	14.81	1.87	3.23	**44.46**	**53.97**	**0.269**	**0.263**	2.026	2.557
		[0.659]	[0.787]	[0.758]	[0.358]	[0.000]	[0.000]	(6.52)	(6.91)		
TOTLF	Sym.	18.76	6.35	0.54	4.35	**96.65**	**49.84**	**0.418**	**0.317**	2.876	2.2
		[0.537]	[0.998]	[0.968]	[0.225]	[0.000]	[0.000]	(9.01)	(6.78)		
UTILS	Asy.	17.45	29.23	0.36	2.23	**12.7**	**22.96**	**0.176**	**0.208**	0.56	1.041
		[0.623]	[0.083]	[0.985]	[0.524]	[0.012]	[0.000]	(3.49)	(3.99)		
Philippines											
BASIC	Asy.	12.94	20.07	1.23	**12.93**	**17.43**	**20.14**	0.141	**0.24**	0.126	0.485
		[0.88]	[0.454]	[0.871]	[0.004]	[0.001]	[0.000]	(1.2)	(2.61)		
CYCGD	Asy.	**36.68**	**42.95**	5.67	**178.1**	**178.1**	**199.1**	**0.326**	-0.183	0.067	0.028
		[0.01]	[0.001]	[0.224]	[0.000]	[0.000]	[0.000]	(2.05)	(-1.59)		
CYSER	Asy.	23.07	22.27	1.55	**38.02**	**52.6**	**91.51**	**0.27**	**0.413**	1.082	3.367
		[0.285]	[0.326]	[0.816]	[0.000]	[0.000]	[0.000]	(3.42)	(6.41)		
GENIN	Asy.	22.71	15.17	1.46	0.32	**15.56**	**32.09**	**0.326**	**0.351**	1.465	2.249
		[0.303]	[0.767]	[0.832]	[0.955]	[0.003]	[0.000]	(3.86)	(5.56)		
ITECH	Sym.	19.02	18.69	1.87	**10.07**	**13.17**	**10.87**	0.104	-0.03	0.148	0.017
		[0.52]	[0.542]	[0.758	[0.017]	[0.01]	[0.028]	(1.24)	(-0.38)		
NCYCG	Asy.	**35.33**	13.13	1.19	2.76	**10.74**	**20.21**	**0.163**	**0.172**	0.737	1.081
		[0.018]	[0.872]	[0.752]	[0.429]	[0.029]	[0.000]	(2.83)	(3.67)		
NCYSR	Asy.	24.14	19.99	0.64	1.38	**27.92**	**24.95**	**0.38**	**0.301**	3.304	2.533
		[0.238]	[0.458]	[0.957]	[0.709]	[0.000]	[0.000]	(5.15)	(4.91)		
RESOR	Asy.	14.52	6.18	1.1	4.68	**35.25**	**16.73**	**0.495**	**0.253**	1.961	0.681
		[0.803]	[0.999]	[0.893]	[0.196]	[0.000]	[0.002]	(5.51)	(3.38)		
TOTLF	Asy.	**39.59**	17.89	0.96	3.77	**37.55**	**36.11**	**0.314**	**0.258**	2.656	2.39
		[0.006]	[0.595]	[0.914]	[0.286]	[0.000]	[0.000]	(5.96)	(5.74)		
UTILS	Asy.	14.34	13.16	0.07	**23.58**	**35.44**	**35.33**	**0.319**	**0.259**	1.263	1.109
		[0.813]	[0.87]	[0.999]	[0.000]	[0.000]	[0.000]	(3.69)	(3.73)		
Thailand											
BASIC	Asy.	**45.24**	17.67	1.86	1.79	**38.56**	**31.14**	**0.403**	**0.352**	2.425	2.451
		[0.001]	[0.609]	[0.759]	[0.615]	[0.000]	[0.000]	(5.84)	(5.29)		
CYCGD	Asy.	**49.16**	15.03	0.94	**9.96**	**12.81**	**18.29**	0.204	**0.352**	0.35	1.386
		[0.000]	[0.775]	[0.917]	[0.018]	[0.012]	[0.001]	(1.48)	(3.35)		
CYSER	Asy.	19.08	**45.07**	0.61	**10.45**	**71.92**	**35.54**	**0.447**	**0.308**	3.764	2.373
		[0.517]	[0.001]	[0.961]	[0.015]	[0.000]	[0.000]	(6.98)	(4.87)		
GENIN	Sym.	8.96	16.06	0.27	4.12	**50.77**	**11.52**	**0.625**	**0.291**	4.341	1.249
		[0.983]	[0.712]	[0.991]	[0.248]	[0.000]	[0.021]	(6.07)	(2.68)		
ITECH	Asy.	**33.05**	24.32	1.27	6.25	**52.41**	**42.22**	**0.586**	**0.5**	2.915	2.821
		[0.033]	[0.228]	[0.865]	[0.099]	[0.000]	[0.000]	(6.22)	(5.23)		
NCYCG	Sym.	24.64	24.15	1.41	1.45	**18.98**	**29.31**	**0.249**	**0.27**	1.39	2.177
		[0.215]	[0.236]	[0.84]	[0.692]	[0.000]	[0.000]	(4.0)	(5.18)		
NCYSR	Asy.	29.36	**40.76**	0.46	**14.7**	**46.52**	**34.51**	**0.459**	**0.343**	2.565	1.804
		[0.081]	[0.004]	[0.976]	[0.002]	[0.000]	[0.000]	(5.05)	(4.03)		
RESOR	Asy.	23.94	13.85	2.21	**15.29**	**33.06**	**47.17**	**0.308**	**0.343**	1.233	2.026
		[0.245]	[0.838]	[0.695]	[0.001]	[0.000]	[0.000]	(3.22)	(4.6)		
TOTLF	Sym.	29.9	13.54	1.49	3.04	**70.28**	**35.31**	**0.616**	**0.412**	4.297	2.551
		[0.07]	[0.853]	[0.827]	[0.384]	[0.000]	[0.000]	(7.6)	(5.88)		
UTILS	Sym.	17.89	16.79	0.93	3.64	**15.59**	**18.01**	**0.176**	**0.255**	0.477	1.324
		[0.594]	[0.666]	[0.919]	[0.302]	[0.003]	[0.001]	(2.66)	(3.58)		
Indonesia											
BASIC	Asy.	19.4	11.67	0.56	**12.69**	**34.39**	**35.58**	**0.215**	**0.214**	0.565	0.747

		[0.496]	[0.927]	[0.966]	[0.005]	[0.000]	[0.000]	(4.04)	(4.14)		
CYCGD	Asy.	15.61	18.34	0.13	6.87	**27.79**	**24.97**	**0.296**	**0.21**	0.807	0.543
		[0.74]	[0.565]	[0.997]	[0.075]	[0.000]	[0.000]	(3.92)	(4.19)		
CYSER	Asy.	**32.84**	11.18	0.58	**10.25**	**18.17**	**84.96**	**0.153**	**0.248**	0.206	0.719
		[0.035]	[0.941]	[0.964]	[0.016]	[0.001]	[0.000]	(2.49)	(8.09)		
GENIN	Sym.	22.26	15.06	0.94	6.56	**13.97**	**24.01**	0.097	**0.187**	0.102	0.504
		[0.326]	[0.773]	[0.331]	[0.087]	[0.007]	[0.000]	(1.73)	(3.77)		
NCYCG	Asy.	23.17	18.22	1.24	6.37	**21.08**	**44.41**	**0.228**	**0.38**	0.545	2.011
		[0.28]	[0.573]	[0.87]	[0.094]	[0.000]	[0.000]	(3.46)	(6.37)		
NCYSR	Asy.	21.28	9.64	1.46	**10.8**	**54.09**	**39.22**	**0.369**	**0.44**	1.359	2.573
		[0.38]	[0.974]	[0.833]	[0.012]	[0.000]	[0.000]	(5.51)	(4.84)		
RESOR	Sym.	20.24	7.88	3.04	**8.16**	**10.01**	**21.72**	0.102	**0.354**	0.082	1.318
		[0.443]	[0.993]	[0.55]	[0.042]	[0.04]	[0.000]	(0.94)	(3.25)		
TOTLF	Asy.	28.88	12.15	1.68	**11.23**	**30.5**	**30.23**	**0.31**	**0.271**	0.748	0.76
		[0.09]	[0.911]	[0.792]	[0.01]	[0.000]	[0.000]	(3.05)	(3.57)		
Korea											
BASIC	Asy.	22.71	**31.6**	1.37	1.72	**35.63**	**56.01**	**0.45**	**0.371**	3.246	2.928
		[0.303]	[0.048]	[0.847]	[0.63]	[0.000]	[0.000]	(5.95)	(7.26)		
CYCGD	Asy.	20.07	22.23	3.13	4.81	**68.42**	**63.71**	**0.628**	**0.446**	5.28	3.527
		[0.453]	[0.328]	[0.536]	[0.185]	[0.000]	[0.000]	(7.77)	(7.59)		
CYSER	Asy.	18.88	26.46	2.44	7.31	**53.06**	**85.75**	**0.513**	**0.463**	3.554	3.851
		[0.529]	[0.151]	0.654]	[0.062]	[0.000]	[0.000]	(7.07)	(8.85)		
GENIN	Asy.	25.43	24.34	0.46	1.78	**64.4**	**60.12**	**0.653**	**0.433**	5.512	3.224
		[0.185]	[0.228]	[0.977]	[0.618]	[0.000]	[0.000]	(7.89)	(7.45)		
ITECH	Sym.	17.08	16.72	2.37	0.12	**39.57**	**58.64**	**0.986**	**1.115**	4.597	7.803
		[0.647]	[0.671]	[0.667]	[0.988]	[0.000]	[0.000]	(6.2)	(7.4)		
NCYCG	Asy.	23.04	16.09	2.25	2.21	**36.94**	**35.8**	**0.32**	**0.29**	1.87	2.047
		[0.287]	[0.711]	[0.688]	[0.529]	[0.000]	[0.000]	(5.63)	(5.67)		
NCYSR	Sym.	13.55	26.32	3.11	2.25	**64.06**	**23.71**	**0.649**	**0.311**	4.63	1.412
		[0.852]	[0.155]	[0.539]	[0.521]	[0.000]	[0.000]	(7.83)	(4.83)		
RESOR	Asy.	17.28	14.48	3.17	1.2	**39.49**	**22.78**	**0.485**	**0.265**	3.027	1.202
		[0.634]	[0.805]	[0.529]	[0.752]	[0.000]	[0.000]	(6.22)	(4.68)		
TOTLF	Sym.	27.46	11.79	3.89	3.03	**44.77**	**47.10**	**0.564**	**0.431**	3.444	2.675
		[0.123]	[0.923]	[0.42]	[0.386]	[0.000]	[0.000]	(6.57)	(6.7)		
UTILS	Asy.	31.18	8.44	2.04	1.71	**17.38**	**61.54**	**0.288**	**0.405**	1.164	3.061
		[0.067]	[0.988]	[0.728]	[0.635]	[0.001]	[0.000]	(4.01)	(7.64)		
Singapore											
BASIC	Sym.	26.23	12.23	1.45	4.16	**90.21**	**129.3**	**0.485**	**0.504**	3.689	5.284
		[0.158]	[0.908]	[0.834]	[0.243]	[0.000]	[0.000]	(9.21)	(10.48)		
CYCGD	Sym.	26.65	10.66	3.58	1.11	**46.59**	**83.73**	**0.482**	**0.538**	3.399	5.62
		[0.145]	[0.954]	[0.465]	[0.773]	[0.000]	[0.000]	(6.72)	(8.73)		
CYSER	Sym.	10.73	16.93	0.01	1.62	**135.5**	**123.8**	**0.39**	**0.301**	8.799	6.942
		[0.953]	[0.657]	[0.999]	[0.654]	[0.000]	[0.000]	(11.41)	(11.68)		
GENIN	Asy.	25.43	24.34	2.16	1.78	**64.4**	**60.12**	**0.486**	**0.42**	10.331	10.257
		[0.185]	[0.228]	[0.705]	[0.618]	[0.000]	[0.000]	(12.74)	(11.95)		
ITECH	Asy.	30.01	15.78	1.01	2.61	**74.67**	**49.09**	**0.874**	**0.582**	8.366	4.922
		[0.07]	[0.73]	[0.907]	[0.454]	[0.000]	[0.000]	(8.43)	(6.89)		
NCYCG	Asy.	18.84	30.47	0.8	5.16	**98.91**	**91.44**	**0.354**	**0.311**	6.22	6.393
		[0.532]	[0.063]	[0.938]	[0.16]	[0.000]	[0.000]	(9.48)	(9.12)		
NCYSR	Asy.	16.65	23.53	0.57	5.45	**44.61**	**52.77**	**0.303**	**0.306**	2.991	4.032
		[0.676]	[0.263]	[0.965]	[0.141]	[0.000]	[0.000]	(5.58)	(6.64)		
RESOR	Asy.	**57.75**	9.03	3.53	**200.4**	**240.4**	**260.9**	**0.247**	**0.35**	0.984	2.613
		[0.000]	[0.983]	[0.472]	[0.000]	[0.000]	[0.000]	(4.0)	(6.63)		
TOTLF	Sym.	28.23	19.96	0.49	2.5	**173.4**	**147.7**	**0.465**	**0.36**	8.657	6.918
		[0.104]	[0.46]	[0.974]	[0.474]	[0.000]	[0.000]	(13.07)	(12.05)		
UTILS	Sym.	14.54	29.19	8.89	1.49	2.12	7.19	0.165	0.15	0.271	0.3
		[0.802]	[0.084]	[0.063]	[0.683]	[0.711]	[0.125]	(1.08)	(1.83)		
Taiwan											
BASIC	Asy.	14.84	10.95	1.11	**11.25**	**23.33**	**76.68**	**0.24**	**0.372**	1.479	4.704
		[0.785]	[0.947]	[0.893]	[0.01]	[0.000]	[0.000]	(3.89)	(7.18)		
CYCGD	Sym.	23.08	20.29	1.61	1.3	**21.86**	**34.61**	**0.312**	**0.324**	2.098	2.933
		[0.285]	[0.439]	[0.807]	[0.728]	[0.000]	[0.000]	(4.31)	(5.64)		
CYSER	Asy.	27.38	20.41	0.84	**10.17**	**24.71**	**47.94**	**0.239**	**0.327**	1.113	2.77
		[0.125]	[0.432]	[0.931]	[0.017]	[0.000]	[0.000]	(3.94)	(5.85)		
GENIN	Sym.	20.22	16.67	1.24	**11.33**	**60.01**	**42.36**	**0.512**	**0.36**	4.139	2.714
		[0.444]	[0.674]	[0.87]	[0.01]	[0.000]	[0.000]	(6.57)	(5.85)		
ITECH	Sym.	15.86	15.45	0.7	5.46	**115.7**	**65.58**	**0.807**	**0.55**	9.105	5.628
		[0.725]	[0.75]	[0.95]	[0.14]	[0.000]	[0.000]	(10.5)	(6.72)		
NCYCG	Asy.	27.09	10.68	0.9	3.32	**18.91**	**18.08**	**0.31**	**0.238**	1.588	1.245
		[0.132]	[0.954]	[0.924]	[0.344]	[0.000]	[0.001]	(3.83)	(3.41)		
NCYSR	Asy.	28.8	14.16	0.09	**8.22**	**10.88**	**25.27**	0.059	**0.297**	0.109	3.675
		[0.092]	[0.822]	[0.999]	[0.041]	[0.027]	[0.000]	(0.67)	(3.77)		

TOTLF	Sym.	16.66 [0.674]	4.38 [0.999]	3.91 [0.418]	3.81 [0.283]	**16.16** [0.002]	**32.91** [0.000]	**0.253** (3.64)	**0.299** (4.76)	1.076	1.992
C. Latin America											
Argentina											
BASIC	Asy.	24.01 [0.242]	8.58 [0.987]	0.86 [0.929]	**8.03** [0.045]	**74.69** [0.000]	**281.9** [0.000]	**0.551** (7.39)	**0.689** (15.29)	5.301	14.796
CYCGD	Asy.	15.28 [0.76]	8.71 [0.986]	4.38 [0.355]	7.13 [0.067]	**19.94** [0.000]	**136.8** [0.000]	**0.467** (4.14)	**0.612** (11.09)	1.476	4.512
CYSER	Asy.	**35.67** [0.017]	13.71 [0.845]	1.49 [0.826]	2.35 [0.501]	**17.91** [0.001]	**42.56** [0.000]	**0.296** (4.2)	**0.301** (6.29)	1.438	2.656
GENIN	Asy.	18.75 [0.538]	11.71 [0.926]	0.08 [0.775]	2.1 [0.551]	**58.96** [0.000]	**173.4** [0.000]	**0.449** (7.45)	**0.524** (13.02)	2.293	5.567
NCYCG	Asy.	22.12 [0.334]	11.34 [0.937]	3.66 [0.453]	3.42 [0.331]	**16.47** [0.002]	**154.1** [0.000]	**0.223** (3.73)	**0.462** (12.05)	1.35	10.344
NCYSR	Asy.	13.66 [0.847]	10.39 [0.96]	2.38 [0.665]	5.11 [0.163]	**123.4** [0.000]	**363.3** [0.000]	**0.836** (10.58)	**1.038** (18.8)	5.807	15.981
RESOR	Sym.	20.93 [0.401]	15.16 [0.767]	0.21 [0.995]	2.34 [0.503]	**148.9** [0.000]	**479.2** [0.000]	**0.5.9** (11.9)	**0.698** (21.11)	5.91	14.792
TOTLF	Asy.	17.38 [0.628]	12.05 [0.914]	3.71 [0.446]	6.05 [0.109]	**109.6** [0.000]	**268.5** [0.000]	**0.808** (10.01)	**0.911** (16.33)	7.82	17.73
UTILS	Sym.	17.86 [0.596]	15.8 [0.729]	0.2 [0.995]	**8.56** [0.035]	**49.44** [0.000]	**201.9** [0.000]	**0.425** (6.94)	**0.462** (13.62)	3.373	7.121
Brazil											
BASIC	Sym.	16.59 [0.679]	9.19 [0.981]	0.04 [0.999]	**9.17** [0.027]	**123.8** [0.000]	**788.6** [0.000]	**0.517** (10.99)	**0.826** (27.82)	7.901	35.91
CYCGD	Asy.	22.68 [0.305]	**34.8** [0.021]	1.76 [0.778]	**85.34** [0.000]	**86.56** [0.000]	**152.1** [0.000]	0.03 (0.24)	**0.426** (5.58)	0.01	3.571
CYSER	Sym.	11.0 [0.946]	3.52 [0.999]	0.21 [0.994]	1.49 [0.682]	3.23 [0.519]	**23.89** [0.000]	0.285 (1.04)	**1.019** (4.6)	0.648	14.81
GENIN	Asy.	14.42 [0.404]	24.47 [0.222]	0.22 [0.992]	4.03 [0.257]	**131.3** [0.000]	**534.8** [0.000]	**0.553** (10.75)	**0.857** (22.67)	5.272	22.661
NCYCG	Asy.	16.95 [0.656]	7.31 [0.996]	2.53 [0.639]	1.26 [0.737]	**80.56** [0.000]	**488.5** [0.000]	**0.576** (8.71)	**0.827** (20.9)	7.951	19.197
NCYSR	Asy.	18.31 [.566]	20.28 [0.44]	0.68 [0.952]	5.42 [0.143]	**219.1** [0.000]	**1018.6** [0.000]	**0.881** (14.48)	**1.191** (31.91)	12.681	41.398
RESOR	Sym.	26.16 [0.16]	12.59 [0.894]	0.05 [0.999]	5.62 [0.131]	**118.1** [0.000]	**839.1** [0.000]	**0.61** (10.48)	**0.1.049** (27.95)	7.043	37.213
TOTLF	Asy.	30.92 [0.056]	3.69 [0.999]	0.21 [0.994]	1.29 [0.729]	**121.2** [0.000]	**555.2** [0.000]	**0.449** (10.55)	**0.903** (23.17)	4.054	29.264
UTILS	Asy.	14.75 [0.79]	8.38 [0.989]	3.64 [0.455]	1.37 [0.710]	**89.4** [0.000]	**1168.6** [0.000]	**0.641** (9.41)	**1.297** (33.47)	5.794	42.27
Columbia											
BASIC	Asy.	**59.67** [0.000]	3.3 [0.999]	0.13 [0.997]	**10.24** [0.01]	**19.19** [0.000]	**30.58** [0.000]	**0.177** (3.24)	**0.177** (4.52)	1.302	2.303
CYCGD	Asy.	**35.68** [0.017]	14.04 [0.828]	0.77 [0.941]	4.31 [0.228]	5.11 [0.276]	**43.43** [0.000]	0.036 (0.9)	**-0.11** (-6.31)	0.032	0.539
CYSER	Sym.	17.16 [0.642]	5.41 [0.999]	2.76 [0.597]	**15.64** [0.001]	**16.49** [0.002]	**49.33** [0.000]	0.058 (1.01)	**0.317** (4.47)	0.077	0.753
GENIN	Sym.	14.35 [0.812]	8.68 [0.986]	0.86 [0.928]	**20.46** [0.000]	**29.58** [0.000]	**36.06** [0.000]	-0.178 (-1.83)	**0.331** (3.82)	0.189	1.165
NCYCG	Sym.	11.76 [0.924]	7.31 [0.996]	0.74 [0.945]	5.89 [0.116]	**11.05** [0.025]	**27.24** [0.000]	**0.178** (2.16)	**0.209** (4.52)	0.792	1.944
NCYSR	Asy.	29.98 [0.07]	2.49 [0.999]	0.44 [0.978]	4.76 [0.19]	5.37 [0.25]	8.07 [0.088]	-0.01 (-0.11)	0.093 (1.74)	0.003	0.503
RESOR	Asy.	15.38 [0.754]	6.4 [0.999]	0.69 [0.952]	2.24 [0.524]	4.47 [0.345]	2.31 [0.678]	-0.217 (-1.15)	0.023 (0.22)	0.644	0.013
TOTLF	Sym.	**45.62** [0.001]	26.61 [0.146]	0.89 [0.924]	**9.65** [0.021]	**14.86** [0.004]	**28.24** [0.000]	**0.129** (2.18)	**0.158** (4.56)	0.818	2.218
UTILS	Asy.	28.37 [0.101]	8.03 [0.992]	0.53 [0.969]	**148.7** [0.000]	**168.1** [0.000]	**246.4** [0.000]	0.083 (1.22)	0.033 (0.99)	0.204	0.058
Chile											
BASIC	Asy.	**50.38** [0.000]	30.62 [0.06]	0.34 [0.986]	4.99 [0.172]	**42.02** [0.000]	**136.9** [0.000]	**0.258** (5.93)	**0.325** (11.37)	1.866	5.263
CYCGD	Asy.	**47.86** [0.001]	20.47 [0.428]	0.24 [0.992]	6.9 [0.074]	**11.06** [0.025]	**10.81** [0.028]	0.076 (1.93)	**0.078** (2.3)	0.444	0.819
CYSER	Asy.	19.42 [0.494]	17.04 [0.65]	0.72 [0.948]	2.54 [0.466]	**79.82** [0.000]	**276.1** [0.000]	**0.489** (8.7)	**0.492** (16.24)	7.426	13.391
GENIN	Sym.	14.35 [0.812]	8.68 [0.986]	6.86 [0.143]	**20.46** [0.000]	**29.58** [0.000]	**36.06** [0.000]	**0.276** (6.6)	**0.347** (11.42)	2.964	8.329

NCYCG	Sym.	24.02	16.47	2.17	2.51	**77.36**	**149.8**	**0.38**	**0.376**	5.157	8.967
		[0.241]	[0.686]	[0.703]	[0.472]	[0.000]	[0.000]	(8.29)	(11.81)		
RESOR	Asy.	26.97	10.93	1.31	1.61	**13.79**	**15.87**	**0.167**	**0.122**	1.01	0.958
		[0.136]	[0.948]	[0.857]	[0.658]	[0.007]	[0.003]	(3.62)	(3.85)		
TOTLF	Sym.	**45.62**	26.61	1.65	**9.65**	**14.86**	**28.24**	**0.219**	**0.366**	1.577	7.91
		[0.001]	[0.146]	[0.799]	[0.021]	[0.004]	[0.000]	(6.67)	(22.52)		
UTILS	Sym.	15.77	20.51	0.22	6.67	**78.6**	**249.9**	**0.373**	**0.379**	6.102	11.258
		[0.73]	[0.426]	[0.993]	[0.083]	[0.000]	[0.000]	(8.28)	(15.31)		
Mexico											
BASIC	Asy.	17.39	23.18	2.05	1.45	**206.5**	**726.4**	**0.632**	**0.716**	10.4	23.861
		[0.627]	[0.28]	[0.725]	[0.691]	[0.000]	[0.000]	(13.69)	(26.28)		
CYCGD	Asy.	23.99	6.38	0.74	7.36	**28.14**	**128.3**	**0.357**	**0.593**	1.679	8.271
		[0.243]	[0.996]	[0.945]	[0.061]	[0.000]	[0.000]	(4.58)	(10.95)		
CYSER	Sym.	15.69	20.23	0.81	2.07	**169.2**	**469.8**	**0.591**	**0.652**	10.493	22.787
		[0.736]	[0.444]	[0.938]	[0.556]	[0.000]	[0.000]	(12.7)	(21.21)		
GENIN	Asy.	24.01	25.31	0.12	4.46	**138.5**	**536.4**	**0.715**	**0.737**	10.256	19.474
		[0.242]	[0.189]	[0.998]	[0.215]	[0.000]	[0.000]	(11.61)	(20.82)		
NCYCG	Asy.	24.95	**44.5**	4.7	7.15	**121.8**	**623.1**	**0.429**	**0.549**	3.796	11.119
		[0.203]	[0.001]	[0.319]	[0.067]	[0.000]	[0.000]	(10.01)	(23.03)		
NCYSR	Sym.	19.41	6.64	0.48	0.71	**431.1**	**1004.1**	**0.902**	**0.822**	19.815	29.388
		[0.495]	[0.998]	[0.975]	[0.87]	[0.000]	[0.000]	(20.5)	(31.07)		
RESOR	Asy.	21.27	17.32	1.31	**8.99**	**74.16**	**135.5**	**0.609**	**0.564**	5.09	7.795
		[0.381]	[0.632]	[0.859]	[0.029]	[0.000]	[0.000]	(8.0)	(11.43)		
TOTLF	Asy.	22.05	31.09	8.62	**15.91**	**135.9**	**489.8**	**0.613**	**0.638**	8.242	15.937
		[0.338]	[0.054]	[0.071]	[0.001]	[0.000]	[0.000]	(10.84)	(22.02)		
UTILS	Sym.	16.45	15.43	0.44	**8.54**	**38.17**	**255.3**	**0.107**	**0.206**	0.466	3.08
		[0.688]	[0.751]	[0.932]	[0.035]	[0.000]	[0.000]	(5.01)	(13.75)		
Peru											
BASIC	Asy.	22.58	8.52	1.87	7.4	**17.2**	**40.36**	**0.15**	**0.185**	0.817	2.221
		[0.309]	[0.988]	[0.758]	[0.06]	[0.001]	[0.000]	(2.95)	(5.6)		
CYCGD	Asy.	13.16	8.54	6.87	**318.3**	**318.5**	**399.7**	0.007	**0.052**	0.001	0.102
		[0.87]	[0.988]	[0.142]	[0.000]	[0.000]	[0.000]	(0.64)	(9.53)		
CYSER	Sym.	**40.95**	18.71	5.56	**458.9**	**496.3**	**572.2**	**0.06**	**0.512**	0.091	0.124
		[0.004]	[0.54]	[0.234]	[0.000]	[0.000]	[0.000]	(2.37)	(3.58)		
GENIN	Asy.	15.18	20.06	1.33	**1111.8**	**6382.2**	**1112.6**	**-0.173**	**-0.028**	0.184	0.009
		[0.056]	[0.454]	[0.855]	[0.000]	[0.000]	[0.000]	(-11.83)	(-2.4)		
NCYCG	Asy.	29.48	4.51	6.75	2.62	3.08	**13.43**	0.065	**0.197**	0.111	1.814
		[0.079]	[0.999]	[0.149]	[0.452]	[0.544]	[0.009]	(0.58)	(3.36)		
NCYSR	Asy.	15.84	0.905	2.33	**115.1**	**117.1**	**212.7**	**0.298**	**0.537**	0.554	3.209
		[0.726]	[0.999]	[0.673]	[0.000]	[0.000]	[0.000]	(3.45)	(11.31)		
RESOR	Asy.	17.11	17.24	0.36	**247.7**	**278.6**	**253.5**	0.043	**0.271**	0.051	3.712
		[0.646]	[0.637]	[0.985]	[0.000]	[0.000]	[0.000]	(0.66)	(6.42)		
TOTLF	Sym.	16.61	13.94	1.37	1.64	5.88	**50.33**	**0.088**	**0.197**	0.334	2.957
		[0.678]	[0.833]	[0.849]	[0.65]	[0.207]	[0.000]	(2.14)	(3.36)		
UTILS	Sym.	29.71	3.04	0.18	1.77	1.91	**12.52**	0.029	**0.169**	0.032	1.953
		[0.075]	[0.999]	[0.996]	[0.621]	[0.753]	[0.013]	(0.35)	(3.21)		
Venezuela											
BASIC	Sym.	17.94	10.5	0.21	6.25	6.44	**27.09**	0.101	**0.252**	0.082	0.922
		[0.591]	[0.958]	[0.994]	[0.099]	[0.168]	[0.000]	(1.06)	(3.74)		
CYCGD	Asy.	9.39	9.77	1.81	**8.21**	8.21	**11.06**	0.005	**0.216**	0.000	0.389
		[0.978]	[0.972]	[0.769]	[0.041]	[0.084]	[0.025]	(0.03)	(2.14)		
CYSER	Asy.	30.97	**36.35**	0.31	0.65	2.18	1.14	-0.249	0.128	0.593	0.282
		[0.056]	[0.014]	[0.989]	[0.884]	[0.701]	[0.887]	(-0.91)	(0.75)		
GENIN	Asy.	16.33	5.15	1.37	2.68	4.71	9.3	0.218	**0.271**	0.189	0.521
		[0.696]	[0.999]	[0.848]	[0.443]	[0.318]	[0.053]	(1.36)	(2.51)		
NCYSR	Asy.	16.76	13.17	0.66	**10.15**	**32.64**	**27.33**	**0.593**	**0.329**	2.851	1.568
		[0.668]	[0.87]	[0.955]	[0.017]	[0.000]	[0.000]	(4.09)	(3.7)		
RESOR	Asy.	22.22	18.68	2.27	2.38	6.69	6.15	-0.014	0.078	0.002	0.088
		[0.328]	[0.543]	[0.685]	[0.496]	[0.153]	[0.187]	(-0.12)	(1.25)		
TOTLF	Asy.	11.81	4.28	0.84	2.11	3.18	6.08	-0.076	0.099	0.077	0.232
		[0.922]	[0.999]	[0.932]	[0.55]	[0.527]	[0.192]	(-0.8)	(1.48)		
UTILS	Sym.	22.24	10.74	0.47	**9.21**	**25.01**	**23.39**	**0.427**	**0.32**	1.042	1.044
		[0.328]	[0.952]	[0.975]	[0.026	[0.000]	[0.000]	(3.07)	(3.38)		

CHAPTER SIX

SUMMARY AND CONCLUSIONS

6.1 Introduction

There is evidence showing that the correlations between equity markets have increased in recent years. One reason for such increase is attributed to the increasing business globalization and market integration, so that countries are now performing more in line with one another. Another reason is the financial contagion. The last decade or so witnessed a series of financial crises and one common observation during crises is that markets tend to move more closely together.

The increase of market co-movement may have changed the investment landscape for international portfolio diversification. On the one hand, with the business globalization and market integration, the significance of country effects in returns has diminished and the importance of global industry effects increased, ceteris paribus. As a result, the superiority of the traditional cross-country diversification over cross-industry diversification has been challenged. On the other hand, the contagion effects entails that diversification strategy in tranquil times is different from the one in volatile times. Particularly during crises when the diversification is most needed, the benefits of diversification may be hampered.

The main objective of this thesis is to study the dynamics of country/industry effects and contagion in global equity markets with the aim of adding new empirical contents to the literature and providing new implications for international diversification. Specifically, one of the purposes of this thesis is to examine the changing roles as well as the divergent performance across regions of the country versus industry effects in global equity markets. Another purpose is to document the different behaviour of those factor effects between emerging markets and developed markets and explore whether the sources driving the structure of the factor effects in emerging markets are the same as those driving the factor effects structure in developed markets. Furthermore, the thesis intends to investigate the market integration and contagion at sector level and answer the questions of whether sectors are integrated at the global level or at the regional level and whether sectors are affected by contagion during financial crises. These issues have been examined by using three different but inter-related approaches in Chapters 3, 4 and 5.

This conclusive chapter is structured as follows. Section 6.2 outlines the main conclusions for each of the chapter 3, 4 and 5 and a discussion of the overall results. Section 6.3 provides some new implications of the findings for international diversification. The last section suggests topics for future research.

6.2 Summary and conclusion

The first chapter of this thesis presented an introduction, which includes the thesis's motivation, objectives and major contributions to the literature, while the second chapter reviewed the techniques of estimation applied in the three papers, indicating the detailed estimation procedure and the interrelation between the applied models. The main empirical body of the thesis started in Chapter 3, which includes the work to examine the changing roles of the country and industry effects over time as well as the divergence of those factor effects across regions. The paper covers the time period of Jan 1992 – Dec 2001 and applies the dummy variable model of Heston and Rouwenhorst (1994) to a new comprehensive database, the Dow Jones Global indexes, which include 50 well partitioned industries and 34 worldwide countries. The analysis focuses on the market level evidence.

The empirical results indicate that the earlier findings of the dominance of country effects over industry effects in papers such as Griffin and Karolyi (1998) and Heston and Rouwenhorst (1994) were due to their use of a sample period that only covered the 1980's and early 1990's. As this paper has shown, however, the importance of the two effects was changing over time and the industry effects were catching up with the country effects in recent years, a conclusion consistent with that in other papers such as Baca et al. (2000) and Cavaglia, Brightman and Aked (2000). In fact in some industries like semiconductors, technology, consumer services, household products, tobacco and entertainments, the industry effects had already outperformed the country effects.

The paper also finds that the shift between the country versus industry effects varied across geographical regions. While the industry effects became more important in Europe and North America in recent years, they were still dominated by the country effects in Asia Pacific and Latin America. The findings are in contrast to those found in some earlier studies on Europe, such as Rouwenhorst (1999) who employed the regional data for the period 1993-98. The estimation of industry effects in this paper is based on a large number of countries and industries, which may be a more appropriate representation of the world portfolio.

The paper also tested the robustness of the results by excluding TMT, which might have been the reason for the rising importance of the industry effects in recent years. The result shows that the increasing industry effects were not only bounded to the TMT sectors, but were an industry-wide phenomenon, which may be related to the globalization activities.

Finally, the paper confirms the previous findings by Griffin and Karolyi (1998) of the different pattern between the traded and non-traded goods industries. Traded-goods industries, such as semiconductors, auto manufacturers, software and energy, tend to have higher industry effects than the non-traded goods industries. The difference between the two types of industry is statistically significant for the entirely sample period as well as for all the three sub-periods.

Given the changing roles of country versus industry effects over time and the divergent behaviour across regions, one important question to ask is what are the forces driving the dynamics of those factor effects? Especially for emerging markets, are the sources driving the dynamics the same as those driving the dynamics in developed markets? So the research proceeds with a second study, included in the fourth chapter, which examines the above issue by focusing on firm level evidence.

In the first stage of the analysis, the paper measured the global, country and industry effects in firm level returns by applying a factor model in the spirit of Cavaglia, Cho and Singer (2001) and Marsh and Pfleiderer (1997) to note the differences in factor effects between emerging and developed markets. In the second stage, the paper tested whether these differences in factor effects are statistically significant by regressing each of these factor effects cross-sectionally on a dummy, which differentiates emerging from developed markets. A robustness check of the results was conducted by controlling for other firm characteristics, such as a firm's extent of business globalization using the firm's foreign sale ratios as a proxy, a firm's degree of financial integration using whether the firm has ADRs or not, and finally, whether a firm belongs to TMT sector.

The paper brings out the differences between emerging and developed markets. Comparing to developed markets, emerging markets had higher country effects and lower global and industry effects. Those differences are significant not only statistically but also economically and can explain why it has been found that the global and industry effects surpass the country effects in developed markets whereas the country effects still dominate the global and industry effects in emerging markets when using market level analysis. The significance of such differences is robust to controlling for variables which might have significant impacts on firms' factor effects, and to different sub-sample periods.

The paper also shows that even though the dynamics of firms' global, country and industry effects are different between emerging and developed markets, they are systematically linked to the firms' foreign sale ratios and ADR listings. On the one hand, a rise in a firm's foreign sale ratios increased the firm's global effects and decreased the country effects, and such relations are statistically and economically significant. However, no significant links are found between foreign sale ratios and industry effects, a result consistent with Brooks and Del Negro (2003). On the other hand, ADR listing was positively related to the firms' global and industry effects. However, it increased, rather than decreased, a firm's country effects, which is against the notion of market integration. A tentative explanation of this is that ADR firms in many countries are large companies accounting for a substantial proportion of domestic market indexes, and their returns are usually more closely correlated to the domestic market returns compared to those of non-ADR firms. All the above results are robust across the four sub-periods.

Furthermore, the results show that the link between the firms' factor effects and the TMT sectors was volatile and unstable over time: the signs of the coefficients switch across different time-periods. This volatile and unstable relationship minimizes the possibility that the increase of industry effects is the direct result of IT bubbles. Especially during the last two sub-periods when the IT bubbles were rampant and burst, the paper finds that the relationship between TMT sectors and the industry effects was negative, suggesting that the increase of industry effects in recent years is not confined to TMT sectors, but is an industry-wide phenomenon, and thus not due to IT bubbles. The firm level evidence of this paper confirms the findings in Chapter 3 of this thesis, where the work focuses on the market level evidence and concludes that the increase of industry effects is not the consequence of IT bubbles.

The increasing importance of industry factors in equity returns implies that industries or sectors have surpassed the country borders and become globally linked. The strengthened intra-industry/sector linkages may suggest that the industry/sector returns are increasingly integrated to the world market; at the same time, the industry/sector returns may provide possible channels in transmitting contagion. So the third paper, included in Chapter 5, examined the market integration and contagion at sector level. The analysis follows the two-factor international asset pricing model framework of Bekaert, Harvey and Ng (2003) and focuses on the 10 broad sectors in 29 smaller markets in Europe, Asia and Latin America during the period of Jan 1990 – June 2004. The model allows testing whether sectors integration is stronger at the global or regional level by comparing the conditional betas with respect to the US market index against those with respect to the regional market index, and whether contagion exists at sector level by examining the correlations of model residuals.

The main findings of this paper are summarized as follows: first, sectors in Europe and Latin America had higher betas with respect to the regional market than with respect to the US market, suggesting the stronger integration at the regional level. Conversely, sectors in Asia were more responsive to the US market than to the regional market and thus more integrated at the global level. The finding of regional dominance in Europe conforms to the result of other studies such as Fratzscher (2002) which focuses on the financial market integration in Europe. The heterogeneous performance of sectors across regions indicates that those sectors are less globally correlated than we expect and still subject to the regional effects. However, one exception is Information Technology, which was more globally integrated regardless of its geographic location.

Second, the pattern of sector integration changes over time, especially during the crisis periods. Across the three regions, the paper finds many sectors showing a sudden change from regional beta dominance to the US beta dominance or vise versa during crisis times, suggesting the possibility of contagion effect at sector level.

Third, the results show that the sector residuals were economically and statistically significantly correlated with the US market residuals and regional market residuals as well as with the sum of equivalent sector residuals and such correlations were beyond what the asset pricing model accounted for, indicating evidence of contagion. An overall contagion over the entire sample period is found for the majority of sectors in Europe, Asia and Latin America. However the transmitting channels and the magnitude of contagion vary across regions. On the one hand, while contagion in Europe and Asia was transmitted via the global and regional shocks as well as the equivalent sector shocks, it was mainly connected to the global and regional shocks in Lain America and the equivalent sector shocks played little role in contagion propagation. On the other hand, the highest magnitude of contagion derived from the channel of regional shocks in Europe and Latin America, whereas the most severe impact of contagion came from the channel of equivalent sector shocks in Asia.

Finally, in examining whether the Mexican and Asian crises provide additional contagion effects, the paper finds that nearly half the sectors in the three regions were affected via the global shocks during the Mexican crisis. During the Asian crisis no additional contagion is found in Europe or Latin America, but a worsened contagion via the global and regional shocks is found for most sectors in Asia.

Concluding, the three different analyses composing this doctoral thesis underline that the increase of global industry effects relative to the country effects, a recent phenomenon in global equity markets, is systematically linked to the ongoing process of business and financial globalization. However, the performance of country versus industry effects varies across regions, and the divergence is particularly noteworthy between developed and emerging markets. On the hand, the majority of industries are less globally correlated than we expect due to the strong regional effects, and some industries within a region are composed of contagion during the financial crises.

6.3 Implications for international diversification

The empirical findings in this thesis have important implications for international portfolio managers aiming to diversify risks. As far as the asset allocation strategy is concerned, diversifying across countries still has merits in a global setting and the conventional top-down approach of allocating assets is still valid. However, as countries within a region tend to co-move more closely than ever before and the market integration is stronger at the regional level, choosing countries within a region is no longer favourable. So diversification across regions rather than diversification across countries should be preferred. Nonetheless the efficiency of cross-region diversification depends on the regions the assets are allocated. In Asia Pacific and Latin America, where country effects still dominate the industry effects, the regional diversification is effective. But in Europe and North America, where industry effects have levelled or even surpassed the country effects, the cross-region diversification will miss out the benefits of industrial diversification.

Another domain of asset allocation strategy is related to the emerging markets. Historically, emerging markets are less correlated to the rest of world and investing in emerging markets has substantial diversification benefits. However, during the last two decades, developing countries have gone through a series of financial liberalizations, thus allowing the domestic markets to be increasingly linked to the global markets. Though there is evidence showing that the correlation and beta to the world market have increased after the liberalizations (e.g. Bekaert and Harvey, 2000), diversifying a portfolio into emerging markets is still efficient, as the evidence in this thesis indicates that even in recent years emerging markets, compared to mature markets, tend to have higher country effects and lower industry effects.

The results in this thesis show that the industry effects relative to the country effects have been increasing in recent years. The increase of the industry effects is not due to the IT bubbles but a long-term feature embedded in the economic and financial globalization process. Therefore for portfolio management, diversification across industries cannot be neglected in the future. Especially for industries with higher industry effects such as semiconductors, consumer services, etc, it is more favourable to allocate the assets across industries rather than across countries or regions.

In composing portfolios and selecting individual equities, the firms' various characteristics, such as their level of global business and ADR listing status have to be taken into consideration. The thesis finds that a firm's level of international sales is negatively related to the firm's country effects. In other words, an increase in a firm's global operations decreases its exposure to shocks from the domestic market.

As more international firms tend to have lower country effects than other firms, it would be advantageous for the country or region-oriented diversification to choose and include less international firms that have lower levels of international sales. On the other hand, it is found in this thesis that ADR listing increases a firm's exposure to domestic risks, thus confirming the diversification benefits of ADR investment found in studies such as Choi and Kim (2000) and Patro (2000). However, ADR listing also increases a firm's global and industry effects at the same time. So an efficient way would be to choose firms that are cross-listed as ADRs, less international in business reach, and primarily from emerging markets.

Apart from the above, international investors and portfolio managers are also concerned with diversification in volatile times, especially during the crisis periods when the diversification is most needed. Sectors as well as the markets are prone to contagion during the crises, so it would be advantageous to avoid choosing assets in those contagious sectors or markets. Although contagion prevails at the market and the sector level during crises, however, the evidence in this thesis shows that there are some sectors immune from contagion or external shocks. Assets in those sectors can provide a tool to diversify risks during the crises and the benefits of diversification can still be achieved.

6.4 Further research

This doctoral dissertation has investigated whether the increasing equity market co-movement in recent years has changed the investment landscape for international portfolio diversification. Two sources driving the market co-movement have been examined: the economic and financial globalization and the contagion during the crises. Another source could be related to the so-called "home bias", a phenomenon having long challenged the modern portfolio theory. The existence of home bias in equity portfolios restricts the degree of market co-movement and integration.

One possible explanation of this phenomenon is that investors are better informed about domestic market conditions or they are more optimistic about the future performance of domestic markets (investor sentiment). However, the declining barriers to international investment and advances in information technology should have reduced the home bias so that country-specific investor sentiment now plays a smaller role in national equity markets than in the past. So further research can be focused on the home bias and investigate whether home bias has played a role in driving the dynamics of country and industry effects in equity returns.

Further research can also be extended to examine the currency effect in the dynamics of country/industry effects. The analysis in this thesis employed the US dollar denominated returns and left the currency effects embedded in the country returns. However, there is evidence showing that the exchange rate risk is a priced factor and can not be fully hedged. So instead of converting all returns into the US dollar denomination as in this thesis, future work can focus on examining the local currency returns and allowing exchange rate factor to be priced, or focus on examining return series in excess of local risk-free rate to separate the currency effect from the country returns.

BIBLIOGRAPHY

Baca, S., B. Garbe and R. Weiss, 2000, The rise of sector effects in major equity markets, *Financial Analysts Journal*, Sep/Oct, 56, 34-40.

Baig, T. and Goldfajn, I., 1999, Financial market contagion in the Asian crisis, *IMF Staff Papers* 46(2) 167-195

Beckers, S., G. Connor and R. Curds, 1996, National versus global influences on equity returns, *Financial Analysts Journal*, Mar/April, 52, 31-39

Beckers, S., R. Grinold, A. Rudd and D. Stefek, 1992, The relative importance of common factors across the European equity markets, *Journal of Banking and Finance*, 16, 75-95

Bekaert, G., 1995, Market integration and investment barriers in emerging equity markets, *The World Bank Economic Review*, 9(1), 75-108

Bekaert, G., C. R. Harvey, 1995, Time-varying world market integration, *Journal of Finance*, 50, 403-444

Bekaert, G., C. R. Harvey, 1997, Emerging equity market volatility, *Journal of Financial Economics*, 43, 29-78

Bekaert, G., C. R. Harvey, 2000, Foreign speculators and emerging equity markets, *Journal of Finance*, 55, 565-614

Bekaert, G., C. R. Harvey and R. L. Lumsdaine, 2002, Dating the integration of world equity markets, *Journal of Financial Economics*, 65(2), 203-247

Bekaert, G., Harvey, C.R., Ng, A., 2003, Market integration and contagion, NBER *Working Paper*, 9510; *Journal of Business*, forthcoming

Bekaert, G., and Wu, G., 2000, Asymmetric volatility and risk in equity markets, *Review of Financial Studies*, 13, 1-42

Berben, R.P. and W.J. Jansen, 2005, Co-movement in international equity markets: a sectoral view, *Journal of International Money & Finance*, 24 (5), 832-857

Bertero, E. and Mayer, C., 1990, Structure and performance: global interdependence of stock markets around the crash of October 1987, *European Economic Review*, 34, 1155-1180

Bolliger, G., 2001, The characteristics of individual analysts' forecasts in Europe, *International Centre FAME*, Geneva, Research Paper No 33.

Brooks, R. and M. Del Negro, 2003, Firm-level evidence on international stock market co-movement, International Monetary Fund, *IMF Working Paper*, 03/55; *Review of Finance*, forthcoming

Bibliography

Brooks, R. and M. Del Negro, 2004, The Rise in co-movement across national stock markets: market integration or IT Bubble? *Journal of Empirical Finance,* 11, 649-680

Calvo, S. and Reinhart, C., 1996, Capital flows to Latin America: is there evidence of contagion effects? in Calvo, G., Goldstein, M. and Hochreiter, E. (eds), *Private capital flows to emerging markets, institute for international economics*, Washington

Campbell, J.Y., Lettau, M., Malkiel, B. G., and Xu, Y., 2001, Have individual stocks become more volatile? An empirical exploration of idiosyncratic risk, *Journal of Finance*, 56, 1-43

Carrieri, F., Errunza, V., Sarkissian, S., 2004, Industry risk and market integration, *Management Science*, 50(2), 207-221

Cavaglia, S., C. Brightman and M. Aked, 2000, The Increasing importance of industry factors, *Financial Analysts Journal*, Sept/Oct, 56, 41-54

Cavaglia, S., D. Cho, and B. Singer, 2001, Risks of sector rotation strategies, *The Journal of Portfolio Management*, Summer, Vol. 27, 35-44

Chen, N., and Zhang, F., 1997, Correlations, trades and stock returns of the pacific rim markets, *Pacific Basin Finance Journal*, 5, 559-577

Choi, Y. K. and Kim, D., 2000, Determinants of American Depositary Receipts and their underlying stock returns: implications for international diversification, *International Review of Financial Analysis*, 9, 351-368

Conrad, J., Gultekin, M., and Kaul, G., 1991, Asymmetric predictability of conditional variances, *Review of Financial Studies*, 4, 597-622

Corsetti, G., Pericoli, M., Sbracia, M., 2002, Some contagion, some interdependence: more pitfalls in tests of financial contagion, *Mimeo*

Dornbusch, R., Park, Y. C. and Claessens, S., 2001, Contagion: how it spreads and how it can be stopped, in Claessens and Forbes (eds), *International Financial Contagion*, New York: Kluwer Academic Publishers

Drummen, M., and Zimmermann, H., (1992), The structure of European stock returns, *Financial Analysts Journal*, July/Aug 14-26

Dumas, B. and Solnik, B., 1995, The world price of foreign exchange risk, *Journal of Finance*, 50, 665-679

Dungey, M., Fry, R., Martin, V.L., 2003, Equity transmission mechanisms from Asia and Australia: interdependence or contagion? *Australian Journal of Management*, 28, 157-182

Errunza, V., K. Hogan and M. Hung, 1999, Can the gains from international diversification be achieved without trading abroad? *Journal of Finance*, 54(6), 2075-2107

Errunza, V., R. and D. P. Miller, 2000, Market segmentation and the cost Of capital in international equity markets, *Journal of Financial and Quantitative Analysis*, 35(4), 577-600

Fernandes, N., 2005, Market liberalization at the firm level: spillovers from ADRs and implications for local markets, *Universidade Catolica Portuguesa Working Paper*

Ferson, W. E. and Harvey, C. R., 1993, The risk and predictability of international equity returns, *Review of Financial Studies*, 6, 527-566

Flavin, T. J., 2004, The effect of the Euro on country versus industry portfolio diversification, *Journal of International Money and Finance*, 23, 1137-1158

Foerster, S. R. and G. A. Karolyi, 1999, The effects of market segmentation and investor recognition on asset prices: evidence from foreign stocks listing in the United States, *Journal of Finance*, 54, 981-1013

Forbes, K., 2001, Are trade linkages important determinants of country vulnerability to crises? *NBER Working Paper*, No. 8194, http://www.nber.org/papers/w8194

Forbes, K., and Rigobon, R., 2001, Measuring contagion: conceptual and empirical issues, in S. Claessens and K. Forbes (eds), *International Financial Contagion*, New York: Kluwer Academic Publishers

Forbes, K. and Rigobon, R., 2002, No contagion, only interdependence: measuring stock market co-movements, *Journal of Finance*, 57, 2223-62

Fratzscher, M., 2002, Financial market integration in Europe: on the effects of EMU on stock markets, *International Journal of Finance and Economics*, 7(3), 165-194

Freimann, E., 1998, Economic integration and country allocation in Europe, *Financial Analysts Journal*, 54, No 5, 32-41

Galati, G. and Tsatsaronis, K., 2001, The impact of the Euro on Europe's financial markets, Bank for International Settlements, Basel, *Working Paper* No. 100

Goetzmann, W., L. Li and G. Rouwenhorst, 2005, Long-term global market correlations, *Journal of Business*, 78(1), 1-38

Griffin, J. M. and G. A. Karolyi, 1998, Another look at the role of the industrial structure of markets for international diversification strategies, *Journal of Financial Economics*, 50, 351-373

Griffin, J.M. and Stulz, R.M., 2001, International competition and exchange rate shocks: a cross-country industry analysis of stock returns, *The Review of Financial Studies*, 14 (1), 215-241

Bibliography

Grinold, R., A. Rudd and D. Stefek, 1989, Global factors: fact or fiction? *Journal of Portfolio Management*, 16, 79-88

Grubel, H., 1968, International diversified portfolios: welfare gains and capital flows, *American Economic Review*, 58, 1299-1314

Hardouvelis, G.A., Malliaropoulos, D., and Priestley, R., 2005, "EMU and European stock market integration", *Journal of Business*, forthcoming.

Hargis, K., 2002, Forms of foreign investment liberalization and risk in emerging stock markets, *Journal of Financial Research*, 25(1), 19-38

Harvey, C., 1995, The risk exposure of emerging equity markets, *The World Bank Economic Review*, 9(1), 19-50

Harvey, C., B. Solnik and G. Zhou, 1994, What determines expected international asset returns, *NBER Working Paper W4660*

Heaney, R.A., Hooper, V. and Jagietis, M., 2002, Regional integration of stock markets in Latin America, *Journal of Economic Integration,* 17, 4, 745-760

Heston, S. L. and K. G. Rouwenhorst, 1994, Does industrial structure explain the benefits of international diversification? *Journal of Financial Economics*, 36, 3-27

Heston, S. L. and K. G. Rouwenhorst, 1995, Industry and country effects in international stock returns, *Journal of Portfolio Management*, 53-58

Kaltenhauser, B., 2002, Return and volatility spillovers to industry returns: does EMU play a role? *Working paper*, CFS (Centre for Financial Studies)

Kaltenhauser, B., 2003, Country and sector-specific spillover effects in the euro area, the United States and Japan, *Working Paper*, ECB (European Central Bank), No. 286

Kaminsky, G.L. and Reinhart, C.M., 1999, The two crises: the causes of banking and balance-of-payments problems, *American Economic Review*, 89, 473-500

Karolyi, G. A., 1998, Why do companies list shares abroad? a survey of the evidence and its managerial implications, *Financial Markets, Institutions and Instruments*, Blackwell Publishers, Oxford, 7, 1-60

Karolyi, G. A., 2003, The role of ADRs in the development and integration of emerging equity markets, *Working Paper*, Ohio State University

Karolyi, G. A., 2004, The world of cross-listings and cross-listings of the world: challenging conventional wisdom, *Working Paper*, Ohio State University

Kennedy, P., 1986, Interpreting dummy variables, *Review of Economics and Statistics*, 68, 174-175

King, M. and Wadhwani, S., 1990, Transmission of volatility between stock markets, *The Review of Financial Studies*, 3(1), 5-33

Lee, S.B. and Kim, K.J., 1993, does the October 1987 crash strengthen the co-movements among national stock markets? *Review of Financial Economics*, 3(1), 89-102

Lehmann, B. and D. M. Modest, 1985, The empirical foundations of arbitrage pricing theory I: the empirical tests, *NBER Working Paper* No. 1725

Lessard, D., 1974, World, national and industry factors in equity returns, *Journal of Finance*, 24, 379-391

Lessard, D., 1976, World, country and industry relationship in equity returns: implication for risk reduction through international diversification, *Financial Analysts Journal*, 32, 32-38

Levy, H. and Sarnat, M., 1970, International diversification of investment portfolios, *American Economic Review*, 60, 668-675

L'Her, J.F., O. Sy, and Y. Tnani, 2002, Country, industry and risk factor loadings in portfolio management, *Journal of Portfolio Management*, 28(4), 70-79

Lintner, J., 1965, The valuation of risk assets and selection of risky investments in stock portfolios and capital budgets, *Review of Economics and Statistics*, 46, 13-37

Longin, F. and Solnik, B., 1995, Is correlation in international equity returns constant: 1960-1990, *Journal of International Money and Finance*, 14, 3-26

Marsh, T. and P. Pfleiderer, 1997, The role of country and industry effects in explaining global stock returns, *Working Paper, U.C. Berkeley and Stanford University*

Masih, A. and Masih, R., 1997, A comparative analysis of the propagation of stock market fluctuations in alternative models of dynamic causal linkages, *Applied Financial Economics*, 7, 1, 59-74

Moskowitz, T. and Grinblatt, M., 1999, Do industries explain momentum? *Journal of Finance*, 54, 1249-1290

Patro, D. K., 2000, Return behaviour and pricing of American Depositary Receipts, *Journal of International Financial Markets, Institutions and Money*, 10-43-67

Phylaktis, K and Ravazzolo, F., 2002, Measuring financial and economic integration with equity prices in emerging markets, *Journal of International Money & Finance*, 21(6), 879-903

Rangvid, J., 2001, Increasing convergence among European stock markets? a recursive common stochastic trends analysis, *Economic Letters*, 71, 383-389

Roll, R., 1992, Industrial structure and the comparative behaviour of international stock market indices, *Journal of Finance*, 47, 3-42

Rouwenhorst, K.G., 1998, International momentum strategies, *Journal of Finance*, 53, 267-284

Rouwenhorst, K. G., 1999, European equity markets and the EMU, *Financial Analysts Journal*, May/June, 55, 57-64

Serra, Ana P., 2000, Country and industry effects in emerging markets' stocks", Emerging Markets Review, 1, 127-151.

Sharpe, W. F., 1964, Capital asset prices: a theory of market equilibrium under conditions of risk, *Journal of Finance*, 19, 425-442

Siklos, P. L. and Ng, P., 2001, Integration among Asia-Pacific and international stock markets: common stochastic trends and regime shifts, *Pacific Economic Review*, 89-110

Solnik, B., 1974, The international pricing of risk: an empirical investigation of the world capital market structure, *Journal of Finance*, 29, 365-378

Suits, D. B., 1984, Dummy variables: mechanics vs. interpretation, *Review of Economics and Statistics*, 66, 177-180

Tai, C., 2004, Can bank be a source of contagion during the 1997 Asian crisis? *Journal of Banking & Finance*, 28, 399-421