The European Journal of Management and Public Policy

VOLUME 1 • No.1 (2002)
ISSN 1726-6475

EUROPEAN CENTER FOR PEACE AND DEVELOPMENT
UNIVERSITY FOR PEACE ESTABLISHED BY THE UNITED NATIONS

The European Journal *of* Management *and* Public Policy

VOLUME 1 • No.1 (2002)
ISSN 1726-6475

Contents

published by:

ECPD

EUROPEAN CENTER FOR PEACE AND DEVELOPMENT
OF THE UNIVERSITY FOR PEACE ESTABLISHED BY THE UNITED NATIONS

European Journal of Management and Public Policy
Academic Journal and Professional Forum on Interface between Business and Society

Published by the European Center for Peace and Development of the University for Peace established by the United Nations

For the Publisher: **Prof. dr Negoslav P. Ostojić**, ECPD Executive Director

ISSN 1726-6475

Editor	ŽELJKO ŠEVIĆ, Ph.D. Professor of Accounting, Finance and Public Policy University of Greenwich London, England, UK E-mail: Z.Sevic@gre.ac.uk Permanent Visiting Professor in Business and Public Administration European Center for Peace and Development University for Peace established by the United Nations Belgrade
Editorial Assistant (Belgrade)	GORDANA HOFMANN, Ph.D. European Center for Peace and Development University for Peace established by the United Nations Belgrade, Serbia E-mail: ecpd@EUnet.rs
Editorial Assistant (London)	EDOUARD MAMBU MA KHENZU, Ph.D. University of Greenwich Business School London, England, UK E-Mail: me25@gre.ac.uk
Language editor (Paris)	JANE FINLAY (Paris)
Design	NATAŠA OSTOJIĆ-ILIĆ, M.A.
Editorial Office (BELGRADE)	EUROPEAN CENTRE FOR PEACE AND DEVELOPMENT UNIVERSITY FOR PEACE ESTABLISHED BY THE UNITED NATIONS Terazije 41, 11000 Belgrade, Serbia phone +381 11 3246 041...045 • fax +381 11 2651-344, 3240-673 e-mail: ecpd@eunet.rs, office@ecpd.org.rs • www.ecpd.org.rs

The European Center for Peace and Development (ECPD) is a regional, international and research organization. The ECPD represents a unique institution in Europe and has special significance to countries of South-Eastern Europe. The ECPD was established in 1985, with the main tasks and objectives "to organize and carry out postgraduate studies, research projects and dissemination of knowledge, which contribute to the promotion of peace, development and international cooperation". Following its mission defined in its Statute, the ECPD "…brings together the intellectual potentials from all parts of the world for the benefit of implementation of the programs of education and research project devoted to the fulfillment of the ECPD aims and objectives". Dr. Simonida Marjanovic, Ambasador Paul-Marc Henry (long serving UN Under-Secretary Genaral and President of the OECD Development Center) and Dr. Pierre Maries-Gallois served as president, while Professor Norman Scott CMG, Professor Shinichi Ichimura and Professor Takehiro Togo chaired the ECPD Council.

The Basic tasks and objectives of the ECPD have been incorporated into its program structure, which feature:

(A) Studies leading to postgraduate degrees and specialist training in Management, European Union, European Union Law and International Business Law, Diplomatic Studies, Banking and Finance, Sustainable development issues,

(B) Interdisciplinary research on sustainable development issues, regional development, multicultural, multi-confessional and inter-ethnic relations and international relations;

(C) Organizing international meetings, conferences, round tables, symposia, and workshops on topical issues from its programme;

(D) Publishing conference, proceedings, professional and scientific texts, research papers, case-studies, textbooks, etc.

The ECPD organizational structure is based on its Executive Staff, consisting of the Executive Director and the ECPD Secretariat as well as professors core and expert team. The ECPD Executive Director represents the ECPD in public, national and international organizations, coordinates the ECPD activities and manages the ECPD Secretariat.

In focusing its activities on education and research that foster sustainable development and the promotion of peace, the ECPD has a very well-developed educational network in various countries, a number of research units and an extensive publication program (with more than 200 books published).

printed in Belgrade by Graficom-uno

Editorial Policy

The *European Journal of Management and Public Policy* publishes original scholarly papers across the whole spectrum of disciplines encompassing Management and/or Public Policy (widely defined). The areas of interest include Accounting, Finance, Human Resource Management, Organisational Behaviour, Industrial Organisation, Marketing, Public Administration, Public Policy, Transformation and Transition Studies, etc. but this list is by no means exhaustive. The Journal aims to be eclectic and pluralistic and, consequently, multidisciplinary work and work endorsing different (even conflicting) schools of thought is welcome. The Journal desires to be an influential policy forum and therefore the submissions must be primarily policy oriented and capable of influencing the policy processes at both the micro and macro levels. However, good quality theoretical papers, which may also be considered for publication, should clearly demonstrate the potential for replication and further extension by the professionals and policy-oriented scholars. Each paper submitted for publication will be judged, based on its own merit and international standards of excellence. The editors and referees will pay particular attention to the originality of the topic, the quality of the methodological approach, the paper's relevance for future developments of and within the discipline and the overall quality of exposition. Although the Journal promotes high quality, original empirical and theoretical work, high quality review articles are also welcome, especially if they demonstrate excellence to the extent that they may influence the directions of further research on the particular topic or in the focus area. All published papers must be accessible to both academics and practitioners, who should be able to understand papers published without being experts on the particular topic or area of research. All papers submitted will be judged in the first place by the Editor. If the paper is initially judged to be suitable for publication in the Journal, the Editor will send the paper to *at least* two anonymous referees. The referees can recommend a paper for publication without revision, publication with minor revisions, publications with major revisions and to reject publication of a submitted paper. In all cases where they recommend some changes to be made, the referees must provide a detailed report listing all the changes that are recommended. Based on the referee reports, the Editor will decide on the status of the submitted paper. The decision of the Editor is final and cannot be disputed.

The Journal aims to publish contributions of the highest quality possible that can be of interest to the wider international professional public. However, the research topics should preferably reflect research interests and traditions of Europe, notwithstanding the comparison of different approaches existing in other parts of the world.

The prospective authors may contact the Editor and respective Regional Associate Editor (if appointed) with questions regarding the suitability of the paper for publication in the Journal. However, the final decision can only be made on the submitted full paper. The editors can assess submissions that are incomplete, using their discretion, but their comments are not binding regarding any decision on a later submitted full paper. The editors will not provide detailed comments on papers prior to formal submission to the Journal. The Editor reserves the right to return manuscripts to the authors without the full refereeing process if, in his professional and academic judgement, the paper is not of a quality acceptable to the Journal, or for any other reason. However, the Editor or his nominee will provide a prospective author with reasons for such a decision, especially if the paper falls outside the editorial policy or the authors seriously disregarded the Notes to the Contributors, published on the back cover of the Journal.

The Journal is committed to best publishing practices and emphasises that the full referee procedure will be completed within 16 weeks from the date of submission to the Journal. The Editor will personally confirm receipt of the submission in writing and keep authors informed on the progress of their submission. Every effort will be made by the Editorial Board to inform the author of the decision within the committed 16 weeks from the date of submission. No submission fee is currently being charged.

Editorial Board

EDITORIAL BOARD

Togo Takehiro, President of the Board
Blaise Allaz, Haute Ecole de Commerce, France
David Amborski, Ryerson University, Canada
Jürgen G. Backhaus, Erfurt University, FR Germany
Frantz Butynets, Zhytomyr Technical State University, Ukraine
Anto Bajo, Institute of Public Finance, Croatia
Roberta Benini, NOMISMA, Italy
Peter Boorsma, University of Twente, the Netherlands
Jonatan Bradley, University of the West England, UK
Philip Bryson, Bingham Young University, US
Prodromos Chadzoglou, University of Xanti, Greece
Mark Chandler, Stockholm School of Economics in Riga, Latvia
Boris Cizelj, director SBRA, Brussels, Belgium
Enrico Colombatto, University of Turin, Italy
Patrick Dawson, University of Aberdeen, Scotland
Jayesh Dahya, Baruch College, US
Tran Dat, National Economics University, Vietnam
Mieczysław Dobija, Krakow University of Economics, Poland
Michael Drew, Queensland University of Technology, Australia
Eva Eberhartinger, Vienna University of Economics and Business Administration, Austria
Peter Gabor, LGI Development, Hungary
Tihomir Jovanovski, University of Skopje, Macedonia
G. Roland Kaye, Open University, UK
David M. Kemme, University of Memphis, US
Chandrasekhar Krishnamurti, Nanyang Technological University, Singapore
Yoji Koyama, Niigata University, Japan
Herbert Kotzab, Copenhagen Business School, Denmark
Kenneth Kriz, University of Nebraska – Omaha, US
John R. Lampe, University of Maryland, US
Mervyn K. Lewis, University of South Australia, Australia
Jonathan R. Macey, Cornel University, US
Susan Martin, Bowling Green State University, US
Robert W. McGee, Barry University, US
Jeffrey B. Miller, University of Delaware, US
Lucia Miree, University of New England, US
Lawrence E. Mitchell, George Washington University, US
Philip O'Hara, Edith Cowan University, Australia
Nickolay Nenovsky, Bulgarian National Bank, Bulgaria
Negoslav Ostojić, ECPD Executive Director, SCG
Barry Pettman, Hull, England
Godfrey Pirotta, University of Malta, Malta
Christopher D. Rogers, University of Dundee, Scotland
Joshua Ronen, New York University, US
Alexander Russell, Glasgow Caledonian University, Scotland
Mark Saunders, Oxford Brookes University, England
Davor Savin, University of Maribor, Slovenia
Norman Scott, CMG, Geneva Institute of International Studies, Switzerland
Ron Singleton, Western Washington University, US
Hideaki Shiroyama, University of Tokyo, Japan
Jan Smolarski, University of Stockholm, Sweden
Vladimir Stipetić, Croatian Academy of Science, Croatia
Shyam Sunder, Yale University, US
Hideaki Tanaka, Ministry of Finance, Japan
Metka Tekavčič, University of Ljubljana, Slovenia
Jean Tesche, US Treasury, US
Richard Thorpe, University of Leeds, England
Roland Tuninga, Maastricht School of Management, the Netherlands
Tony Verheijen, The World Bank, US
Guglielmo M. Volpe, London Metropolitan University, England
Markéta Vylítová, RILSA, the Czech Republic
Bruce Webber, London Business School, England
Thomas Whalen, Georgia State University, US

ŽELJKO ŠEVIĆ

Management and Public Policy: an Interface

1. Introduction

Management and Public Policy traditionally were two different, poles apart, ends of the spectrum. Management has traditionally been perceived as a process of steering (private) organisations by trained professionals, who are not necessarily the owners (see Fama and Jensen, 1983a; 1983b). In fact, the separation of management and ownership functions was to improve the overall efficiency, since professionals supposedly make less mistakes. Only relatively recently, (the 1970s) the term 'public management' was coined, in contrast to the more classical term 'public administration' which has been perceived as the implementation of law and regulations by government (state) bodies. In the 1990s, the term 'New Public Management' (NPM) was coined to describe the situation in which public sector bodies are 'advised' to introduce business-like processes and procedures (see: Hood, 1991; 1995). In contrast, Public Policy has always comprehended the activities (both doing and non-doing) carried out by the government. Therefore, there is a need to intertwine these two extremes, which lends to the question; do they really learn one from another?

In this paper we will try to present the public policy process and its analysis, focusing on different models and how they are applied in practice. This will be followed by the presentation of modern (business) management practices and experience, drawing a list of concepts that the public sector can draw upon when looking for innovative and more efficient instruments. Finally, we will try to paint a picture of why multidisciplinary research in management and public policy is not only useful, but also necessary, for understanding both (business) management and public policy in a competitive business and increasingly socially accountable, public policy domain. The paper claims that only multidisciplinary research, showing full appreciation for cross-fertilisation practices between public and private sectors, can respond to the expectations of a modern public policy arena; increasingly dominated by non-government organisations; informal and semi-organised pressure and interest groups, and individuals increasingly interested in current affairs and social issues in general.

2. Public Policy & Analysis

Public policy can be seen as anything and nothing done by the government of the day (the state bodies in the European continental model). Government, as a concentrated power within society, intervenes and maintains social stability, lessening the existing and preventing future serious conflicts. The remit of the public policy (or policies) is fairly wide, as this may take form the of organising something (civil service i.e. public administration, police, defence forces, etc.); regulating processes/behaviour (setting up the rules of conduct for professions, social groups, etc.); distributing benefits (social and taxation policies) and collecting public revenues on its sovereign territories, etc. Some of these can be single actions, whilst others can be taken concurrently. However, not every action taken by the government can be attributed as public. Only those functions taken directly in connection with discharging government functions (exercising social power), can be deemed to be public policy activities. If the government acquires an asset which is not necessary for performing its constitutional and statutory functions, this will not be regarded as a public action.

Public policy outcomes are the result of the process of political interaction. Formally, the same policy action can be taken by various forms of government. For example, the decision to introduce and enforce compulsory primary school education can be taken by both left-wing and right-wing governments (for fairly different reasons); by a democratically elected government; by one of a more autocratic nature, by a socially responsible and accountable government and by one which is corrupt and utterly disinterested in social well-being. Each of them can formally introduce the same change, but only after profound policy analysis will the results state whether the results are 'sustainable' (to use a very popular expression). Policy evaluation will tell us what the policy outcomes are and to what extent they are those publicly proclaimed by the government before the decision has seen the light of day. But again, the evaluation process will be conducted differently in different countries. In the case of a totalitarian state, the public will not be consulted and public interest will not be regarded as a high priority. The well-being of the state (or its leader) will be the supreme measure of policy success. As Karl Schmitt wrote in Nazi Germany, 'everything is to be succumbed to the leader and the duty of everyone is to follow the *Fürer*'. In the *Rechtstaat* concept, the ultimate goal of public policy is to ensure the rule of law and to adhere to positive legislation and regulation. *Dura lex, sed lex*, that is bad law, but law (which in any case has to be applied) is the maxim that defines the ultimate social standard of behaviour. Anglo-Saxon countries will traditionally stick to the public interest as the bottom line of policy definition and implementation, but as usual with multi-tier democracies, there are fairly small groups that define what the public interest is, or might be.

The study of public policy should enable us to understand the policy processes better, be better prepared to give professional advice and finally to be able to define policy recommendations in order to make particular policy better and more effective. Public policy analysis can be useful even in its narrative sense i.e. enabling us to understand and single out the best policy actions available and promote those activities that will lead to the best policy outcomes. The policy analysis process should enable us to be able to explain the causes and consequences of a particular policy action. The process of understanding and explaining does not mean that policy analysis should also engage in prescribing what the policy actions, in fact, should be. In other words, understanding why certain policy actions were taken and why the outcomes were what they were does not immediately mean that a policy analyst will engage in prescribing the course of government action. Good policy analysis will focus on explanation of the actions undertaken, rather than prescribing what should be done. Even if an advisory role is expected from a policy analyst, it should be more a view (or professional advice) than policy/political advice. Understanding of a policy action should lead to the point where an analyst will seek to find the causes and consequences of public policies undertaken. Also, policy analysis enables an analyst to forecast and simulate different policy outcomes and test their influence on the wider environment.

In a modern (or post-modern) world, the government sovereignty is largely limited. Therefore, one should be aware of the limits of government power. In a civil (or civic) society, government powers are limited by law and widely upheld standards. However, it is very difficult to ensure that the government will not abuse its own powers. The public policy process is often adversarial and partisan-biased. Namely, politicians belong to different political parties, all of which would like to be in power. In such a process, often the concept of social well-being is blurred by the short-term political gains. But not only politicians may disagree. Policy analysts themselves may also disagree over the problem. Usually the extent of the policy and the costs are the main points of the disagreement, especially in a situation where public finance i.e. becoming more and more limited.

3. Modelling Public Policy Processes

In the policy analysis one may opt to construct and employ a particular model that will simplify the relationships between measurable variables in a way that it will allow an easier and supposedly better understanding of the studied (targeted) phenomena. One should be aware that public policy analysis has some elements of the art in itself. Namely, there is widely practised subjectivity in the interpretation. The same set of information may be interpreted differently, based on the methodological approach or social limitations of an analyst. There are also problems with human research in general and the complexity of human behaviour. But not only has the nature of the object of study

(analysis) added to the problems. Public policy process may be operated in fairly different policy models. For instance, we may choose different models to explain the policy process itself and that choice, to some extent, will limit and influence the policy outcomes that we set out to study and research. One may target the institutional, process, rational, incremental, group, elite, public choice, game theory model, etc. In the institutional model we focus on the institutions as they reduce uncertainty and share human behaviour. The relationship between public policy and government institutions is in fact very close, especially as there is no public policy without the existence and actions taken by the public (government) bodies. The Government (regardless how it is chosen) is supposed to lend some legitimacy to the policies and its policies are to be universally applied throughout the entire society, supposedly ensuring that there will be relatively little conflict and coercion in society.

Institutional analysis usually focused more on the institutions themselves rather than on the content of policy processes and policy outcomes. Policy model focuses more on the policy as political activity and the result of interaction between different political players. We focus on problem identification, agenda setting, policy formulation, policy legitimising, policy implementation and finally policy evaluation. Again, in this analysis we focus more on the processes themselves and again, the content (substance) of the policies implemented are not looked at in much depth. Rationalism sees policies as maximum social gain. In other words, governments should choose policies resulting in gains to society that exceed costs by the largest possible amount. The bottom line of this model is that no policy should be implemented if the costs exceed benefits. Secondly, amongst policy alternatives, a decision-maker should choose the policy that produces the greatest benefit over the costs incurred. Technically, the rational model does not fall on the classical cost-benefit analysis, but an analyst should take into consideration a range of costs, not only those that can be spelt out in monetary terms.

The incremental model sees policy as variations on the past. In other words, *incrementalism* views public policy as a continuation of past government policies, with only incremental modifications. As Lindblom would say, decision makers do not annually review the whole range of existing and proposed policies, identify societal goals, research the benefits and costs of alternative policies in achieving these goals, rank order of references for each policy alternative in terms of the maximum net benefits and then make a selection on the basis of all relevant information (Lindblom, 1959). In fact, time constraints, information and costs prevent policy-makers from identifying the full range of policy alternatives and their consequences. The incremental model states that the current government does not have the resources to research new policy alternatives and even if this is (somehow) done, then there is a risk of failure of new policies and it is therefore better to stick to the proven instruments. Also, there may be heavy investment in the existing programmes, which makes governments consider a significant sunk cost, which precludes

any real radical change. Incrementalism is politically expedient and therefore attractive to hesitant politicians, especially in the times before the general (or sub-national, local) elections.

The group theory model sees policy as group equilibrium, stating that the centre to any political (policy) action is the interaction between the people (see: Truman, 1951). Individuals with defined common interests band together formally or informally to press their demand on government. Truman sees the interest group as 'a shred-attitude group that makes certain claims upon other groups in society' and the group becomes a political group, 'if and when it makes a claim through or upon any of the institutions of government' (Truman, 1951, p. 37). Politics then becomes a struggle amongst different political interest groups to influence public policy and then the political system has to diminish tensions through establishing the rules of the game, arranging compromises and balancing interests, enacting compromises in the form of public policy and enforcing these compromises. Political parties can be seen as a coalition of different groups with one aim – to influence government and dominate the policy processes. The 'harmony' may be influenced by the ways in which society supports the arrangements that exist (constitutional system, etc.); whilst there is some overlapping group membership ('cross-benchers') that can assist in keeping the balance of power right and finally, group competition for those members of society without primary interest in political 'gaming' to assist in achieving an equilibrium in the system.

Elite theory states that policy processes are the preference and values of the governing elite (see: Dye and Zeigler, 2000). The elite theory suggests that people are rather apathetic and poorly informed about the policy processes and that enables elites to share mass opinion on policy questions more than the masses share the elite opinion. The bottom line of this model is that society is divided into many who have no power and a few who control it. Governing elite is not typical of the masses and has its own agenda that differs from the agenda endorsed by society. Elite share the basic ideas with society and only those parts of the mass, who in turn adopt the values of the elite, can be promoted and will be policy enforcers (officials and administrators). Elite is subjected to very little, if any, influence from the masses and elite influences the masses more than the masses influence the elite. In adopting the minimum values shared in society, the elite shows public regard, which is important as underestimating these core values would trigger rare (but possible) reaction by the masses. Elitism does not mean that the policies promoted will be adversarial to the interests (and/or welfare) of the masses, but the sole decision on these issues will rest with the elite, rather than with the masses. Elite invests in a system of mass-information (TV, radio, etc.) and will, through the control of the media, ensure that the masses are controlled, that is, the interests of the elite will be passed downwards without much opposition. The elite shares the consensus about fundamental norms within

society, agrees on the basic rules of the game and the need for the continuation of the social system itself.

The public choice model perceives the policy as collective decision-making by self-interested individuals. It stems from economics, that is, economics applied to non-market decision-making. The public choice theory believes that individuals behave in the same manner in the market and in the policy process. Buchanan claims that individuals come together in politics for their own mutual benefit, just as they come together in the marketplace and by agreeing amongst themselves, they can enhance their own well-being, in the same way as by trading in the market place (Buchanan and Tullock, 1962). The public choice theory is aware of the need for the government to perform particular duties connected with so-called 'market-failures'. Market failures are, for instance, the provision of public goods, dealing with externalities; i.e. the situations where the market itself failed to resolve the problem. Public goods are those goods that must be supplied to everyone if supplied to anyone, and externalities are the situation where the action of one individual, group, government, etc. has negative impact, inducing uncompensated cost to another individual, group or (sub-national) government. In the former case, the government may decide to provide the public goods itself, or to commission someone to do it on its behalf. In the latter case, the government will be interested in regulating activities that initiate externalities or decide to introduce fines for those engaged in activities that affect others whilst also ensuring that they are compensated for their loss. The public choice model helps us understand 'political competition' and why political parties often fail to offer clear policy alternatives during election campaigns. Namely, they are not interested in advancing their principles, but in winning the elections and in order to do that they have to seek a policy position that will be the most appealing to the majority of voters (see: Downs, 1957).

The game theory sees policy as a rational choice in competitive situations. It is assumed that the choice is made in situations where two or more players have choices to make different decisions, but the outcome of their activities depends on choices that they all made. The players are involved in choices that are interdependent and they have to appreciate that their mutual dependence cannot be avoided. It is, in fact, an abstract and deductive model of policy-making, describing how people would go about making a particular decision in a competitive situation, if they were completely rational. It does not, of course, mean that they would opt for a particular choice in 'real' life, as the model does not accommodate for human, sometimes erratic, behaviour. The game theory matrix may look simple, but it does embrace some complex issues as well, especially if there is more than one player in the game and they are, as mentioned, mutually dependent.

Models are simplified reality, and this is their beauty. It is possible to go toward the same 'real life' problem from a variety of different approaches. It assists us in understanding the problem, but it must also be said that too much

simplification can lead to a situation where the problem may be trivialised. If the concept applied in policy analysis is too narrow and focuses on superficial phenomena, an analysis will be unable to analyse and explain the problem. Similarly, if the concept is too broad and embraces overly complex situations and relationships, then again, it will be difficult (if not impossible) to analyse the situation and the policy-analysis process would fail. In the analytical process, it is important to decide what is important/significant and characteristic for particular phenomena. Focus on relevant, significant and real information and data is the key success to defining a manageable well-focussed policy-analysis process. An analyst must be aware of reality, ensure that the communication channels are meaningfully defined, so that there is no undue influence from participants in the process and that players are aware of their relative roles and positions.

4. Making Models Operational

Models make sense when one submerges into the analysis of policy processes. Generally, policy process should be understood as the way policy is made. It can be done in both private and public organisations. However, public policy is a result of engagement into a policy process by public organisations (although it is possible that through the process of delegation, a non-public organisation is authorised to make policies with public policy outreach). In the process of policy analysis we should focus on: 1) problem identification; 2) agenda setting; 3) policy formulation; 4) policy legitimation; 5) policy implementation, and 6) policy evaluation.

In the process of identifying public policy issues, we may rely on public opinion. In public policy, regular opinion surveys are indispensable. One analyses policy effects, media effects, and instability effects on public opinion. There is also a problem with how questions are asked and how normal communication links between the public and policy-makers are maintained. Often, national referendum, as a form of direct democracy, is highly valued by policy analysts. However, even the question of whether or not to hold a national referendum is a prior public policy issue that requires much attention. Other models may offer a somewhat different view. Namely, the elite theory would say that policy agenda is largely driven by the elite and very rarely, other factors will be taken into consideration. In setting the agenda, it is of the utmost importance that the mass-media is used, as it is necessary to mobilise public opinion to support the agenda drawn up by the government. The process of formulation of public policies is a result of interaction between various players: executive, interest groups, the legislator, think tanks, civil society (NGOs), etc. The policy legitimation process follows where we, the policy-makers, try to sell the cause and the instruments to the public or other participants in the policy process. This goes through the law-making process, party influence on many outside the party and within society, etc. When the policy is set, the

policy implementation stage is initiated. Implementation is undertaken by the bureaucracy. In implementing adopted legislation, the bureaucracy is empowered to make by-laws and introduce other formal rules in order to have legislation implemented. The administration will often be the adjudicator and will make a decision in individual cases, taking into consideration the spirit and limits set down by law.

Administration may often exercise discretionary powers, but those are to be defined and limited by the law. If the discretionary powers remain unlegislated, there is a significant risk of discrimination and improper application of legislation and regulation on behalf of the administration. Professionalisation of the public administration is highly correlated with the efficiency of public policy implementation. Bureaucrats generally believe in the cause and their role and it is becoming increasingly important. However, civil servants are also interested in their own well-being and it is therefore necessary to have a civil service system that will accommodate their reasonable expectations. Finally, the policy process should be completed with the policy evaluation, which is the phase when one compares the forecasted and desired effects with those that have been achieved through the policy implementation. Policy evaluation can be a result of intra-government process, where the bureaucracy (civil service) is asked to evaluate the outcomes of a certain policy, or this can be done by interest groups, or independent think-tanks. In the case of the latter there are some controversies raised, as some think-tanks are fairly close to the government and demonstrate a high level of bias in analysing the effectiveness of the government (public) policy. Ideological belonging should not be an important factor in (public) policy analysis, but in fact the ideological stigma plays an important role in assessing the policy results (outcomes). However, the process of policy evaluation is indispensable in correcting the mistakes of the implemented policies and in ensuring that the same type of mistakes will not be repeated in the future.

The policy evaluation process encompasses focussing the effects of policy measures taken into real-world conditions, including an analysis of the impact on situations or groups other than the target group (admitting the existence of spill-over effect); the impact on the future and immediate conditions and the direct and indirect costs associated with the policy implementation, including the definition of incurred opportunity costs. In the evaluation process, one often measures output, which may give misleading results, as the focus ought to be on the outcome (impact) that the policy triggered. Often the policy analysis focuses on policy output and consequently the results are misleading, as outputs require focus on 'material' results of the policy, but it is not clear what the impact of this action was. For instance, certain government policy may result in a number of new roads being built. However, this does not mean that the roads being built will improve the living conditions of the people, since these roads may be access roads to off-city estates of the political elite and do not benefit the overall welfare of the population. Focus

on the policy impact on target and non-target groups is important, as the policy as a social action, may have an externalities effect and may induce changes to non-target groups which were not foreseen during the planning phase. Often, these non-planned spill-over effects may have significant cost implications, as eradication of negative externalities may require additional investment and may influence the overall cost-effectiveness qualities of the introduced policies.

It is often forgotten that public policy has *symbolic impacts*, as well-designed policy has both tangible and symbolic effects. Symbolic impact deals with the perception that individuals have of a government action and their attitudes towards it. Often the general population may show a significant appreciation of government efforts to address a social problem, although tangible results may have not been visible. Symbolic impacts may have more real-programme effects, as it may be visible to the wider society what the societal aspirations are and what the issues that both society and the societal elite regard as important are and, therefore, worth pursuing. In the process of policy evaluation, the government organises hearings, site visits, inspection visits, comparisons with benchmarks, have consultations with citizens and consider citizens' complaints and proposals, etc. Comparisons with similar programmes or policies taken by other governments can be helpful in setting a benchmark standard in an effort to ensure that the principle 'value-for-money' is observed.

5. Borrowing from the Business Management Practices: A Case of Performance Measurement

The policy evaluation process is more likely to be called the 'performance measurement (management) process', as the term is borrowed from business practices. The introduction of a performance measurement (and broader management) system is usually connected with the NPM doctrine. The very essence of NPM is to replace the traditional, hierarchical and bureaucratic model of public service with an administration that is performance-oriented and operates in quasi-market conditions fostering competition amongst suppliers of government-sponsored goods and services. The basic idea was to introduce incentives for innovation and efficiency on the part of public servants, especially those occupying senior positions (*Cf.* Thompson, 1997). One of the perceptions of NPM is given by the OECD, which states that: 'a greater focus on results and increased value for money, devolution of authority and enhanced flexibility, strengthened accountability and control, a client- and service orientation, strengthened capacity for developing strategy and policy, introduction competition and other market elements, and changed relationships with other levels of government' (OECD, 1995, p. 37) are the main features of the NPM model. Within a novel framework, citizens and politicians both have to serve a function in the public policy process as 'customers' of the

government, which is the major player in the evaluation of the performance of public bodies (primarily agencies) on the basis of objective information concerning 'value received' and based on that assessment, resources will be deployed or withheld accordingly.

In his seminal paper, Hood (1991) pointed out the changes that happened to an 'old public administration' model. The change was not only in the methodology applied, based upon 'borrowing' from the private sector, but also on the introduction of strategic concepts and accountability models into public management. The decentralisation meant that each government unit should to be led by a manager who would be accountable and, therefore, his or her performance would be reported and he or she judged on that. Goals, aims and objectives are to be clearly stated, and made quantifiable, so that the mission-driven government can be imposed and the separation of strategic planning and operational execution can be made. The public sector re-focused from the focus on 'the procedure' to the results (management by results). The monolithic structure of the government was replaced by a decentralised organisation, based on the structure of holding. The delineation between 'core' and 'other' functions of the state opened the window of possibility to 'source out' some functions or 'source in' taking into consideration the market situation. The highly hierarchical, military-like structure was replaced by a business-like structure (salaries based on merit, replacing senior civil servants with managers, etc.), which promoted a lean-management model. The NPM is also concerned with the constant decrease in costs of a 'product' and getting 'the best value for money'.

The underlying feature of an NPM model is room for the implementation of a performance measurement/management system. All seven mentioned principles of public management (see: Hood, 1991) are performance centred and without performance management, it would have been very difficult to justify the major change in the public sector. The problem of NPM can be focused on from two conflicting perspectives. Namely, performance measurement systems can be a logical consequence of NPM being implemented or, in fact, NPM can be a result of 'obsession' with performance measurement. In our view, it is possible that both explanations work. In a highly hierarchical organisation there is resistance to change. A formal introduction of a new model is necessary to ignite the change. In our view, this is the case with the continental European models of civil service, where the extent of the public sector is wide, and hierarchy is pre-dominant. However, introducing performance measurement/management initiates further changes.

It is expected that in the new framework, bureaucratic cultures are to be replaced by entrepreneurial cultures and consequently the public will appreciate government more. The public, as a stakeholder, will be firmer in supporting the government and public policy processes will not only be cheaper, but also more effective. The presence of business-like behaviour called for the establishment of 'quasi-markets' as an important, if not key instrument, in

implementing NPM-based reforms. A 'quasi-market can be established for the entire country, or can be done on a segment-by-segment basis. It seems that allocation of resources based on the segmentation approach can give (and gave) generally better results.

In the process of performance measurement in the public sector the central issue is definition of performance measurement indicators. Following the basic underlying rule – you get what you measure – public bodies have to decide what are the measurable variables that will depict the best of what they do and how they do it. This is not an easy task, as far too many fractional interests are conflicting and various pressure groups have fairly diverse views as to what should be the priorities. Since the modern public sector has very diversified activities, it is almost impossible to create an exhaustive list of performance indicators that will satisfy all the requirements. Different indicators are to be in place when one measures the efficiency of regulations and others when budgeting or taxation are to be evaluated (OECD, 1994a). Benchmarking can be another approach (OECD, 1997), but again there is a problem as to how benchmarking is defined. Usually it is defined as promoting best practices (Hansen and Mowen, 2000), while sometimes benchmarking is understood as promoting the minimum that has to be achieved (QAA, 2000). However, it seems that in most cases, benchmarking is understood as promoting positive, best practices across the sector. Developing a benchmarking model can be seen as a step to development of a particular performance management system (Berry and Otley, 1996), through promoting responsibility, authority, and accountability.

However, the performance measurement as an alternative for policy evaluation is just one of the many borrowed concepts from private sector (business) management practices. It is probably one of the best to depict the real difference between what is done in the private and public sectors. Namely, the private sector emphasises heavily upon the use of financial indicators. However, in the public sector, financial indicators are less efficient, as financial variables are more to be regarded as input, rather than output. Regardless of how appealing they may sound, the business practices are to be examined carefully before being applied to the public sector. There are many similarities in the operating conditions, but there is also still a strong notion of 'public service' and the provision of 'public goods' that is prevalent in many civil service systems around the world. There are, of course, those countries which advanced in the change and reform of their public sectors and business-like practices are well-embedded in the way they conduct business, analyse policy situations and try to discharge their duties. But, it seems to us that there it will still be some time before we have a total 'privatisation of the state'. The privatisation of certain publicly-owned industries certainly contributes to the process, but it is not so crucial. The main change target has to be delivery of public services that we still classify as the 'core public services' but they are, in their nature, of a quality that would enable private provision under seri-

ous government regulation and close supervision. It is possible that policing services may be contracted out, or even classical defence services, except in the branch of the armed forces which are very capital intensive (Air Force and Navy). Not many years ago, people doubted that prison (correction) services could be provided effectively by a private organisation. However, experience in the US has shown that 'private prisons' may deliver the public service that is expected, relieving the public purse of unnecessary costs. It is possible that the same may happen to other services that we consider purely public. Health services, education services, additional security services can be provided privately, so where does this 'delegation' process stop?

Recent public administration and public policy literature has argued in favour of professional 'delegation' where not only policy implementation, but also policy defining, are to entrusted to the professional quasi-public or private bodies. The '*delegees*' (or delegates) are to be limited by law and an expected performance contract. This may work for the field of central banking, financial (fiscal) supervision, and some other fields. But, there are claims that there is no reason why all other areas of public policy would not be subjected to the same rules and that is why the policy definition process would not be delegated to a professional body. This may work, but the question is whether at the moment there are enough social safeguards to protect the public from wrong-doings by these bodies. Also, these professional bodies may initially be ready to co-operate very closely with chosen representatives, but over time they may be an alternative social technocratic elite, that will have interests of its own. On the other hand, it is possible that they will be a counter-balance for the elected and/or appointed political elite, but it is also possible that the elites may decide that coercion may give better, rather than conflicting results.

6. Understanding Business Management Practices: What can be Borrowed?

It is difficult to say when interest to management emerged. Evidently, it is possible to trace some roots back to the ancient civilisations. There were traders, craftsmen, artisans, early entrepreneurs and they all needed to manage their businesses. Also, in complex organisations, from the very beginning there was a problem of distinguishing between governance and management, even if both functions were exercised by members of the same family, although different generations. (See: Carlsson, 2001, for an illustrious presentation on the management of the so-called 'Wallenberg Sphere', explaining how the Wallenberg family (through its members) controls vast interests in related companies). Fayol (1949) defined the process of management as forecasting, planning, organising, commanding, co-ordinating and controlling and this definition is still one of the most dominant in literature, although the 'commanding' aspect has somewhat lost its initial appeal (with the acceptance of

workers as stakeholders and genuinely interested in the organisation). Brech (1963; 2002) perceived management as a social process of planning, co-ordination, control and motivation, whilst Peters (1989) perceived management as organisational direction based on sound common sense, pride in the organisation and enthusiasm for its work. Overall, management can be subsumed as the process of delivering (desired) results through people, combining various resources at the manager's disposal, taking into consideration goals, aims and objectives of the organisation and more recently, not neglecting ethical aspects of business conduct. The recent fall of Enron and WorldCom has called for immediate government intervention, which has been done through fairly robust regulatory (re-)capture. General management is conducted within organisations and therefore, the organisational context must be established. At first sight, one may doubt that for financial management within the organisation, but then again the recent development of 'strategic financial management' clearly demonstrates that one must be genuinely interested in the organisation and its needs to ensure that the financial function delivers the best results.

Initially, management was largely perceived as leadership. Successful business people in ancient times were more regarded as leaders than entrepreneurs (in today's sense). Often Machiavelli is cited as one of those who emphasised the importance of leadership, as early as the 15th century, with his seminal book '*The Prince*' (Machiavelli, 1897). His contribution certainly was in emphasising the importance of the organisational power and influence that an individual can exercise within an organisation; pushing the boundaries as to what is moral and the limits of acceptable within society. There were also attempts to use military science literature and apply it to management ('The Art of War'), but the real flourish of management research ('science') happened with the industrial revolution, when the operations became large-scale and required more efficient organisation due to increased competitive pressures. Taylor and Fayol certainly contributed to the launch of distinguishable management literature. There are currently many schools of management developed and approaching management from different points of view (see on different methodological approaches in: Easterby-Smith, Thorpe and Lowe, 1991).

The management process in a business organisation assumes steering the organisation, taking into consideration its own specifics, focussing on human resources (personnel) issues, strategy, marketing and delivery channels, finance and accounting aspects of business, operational issues, and increasingly in recent times, the management of change. All those concepts are not familiar to managers in the public sector, as they have been borrowed, modified and non-modified. In managing an organisation, a manager has to exercise good leadership abilities, manage conflict, motivation and focus on groups and individuals, their needs, abilities, responsibilities and limitations. When dealing with any of these aspects, the manager has to be aware of both individuals

as participant in the process and the group as another fairly different factor. The remit of a manager's duty is to design and re-design the organisational structure and influence (positively) the culture of the organisation, ensuring that there is an on-going process of communication and information-sharing in place and that processes of decision-making are appropriate to the organisation, its goals, aims and objectives. Of course, the organisation cannot progress without development of employees and investment in them.

A manager has to be able to define and implement strategy for the organisation. Particular attention is focussed on public policy, that is to say, how the outside public bodies share the environment in which the business organisation operates. Strategy process is a complex one, and a manager must take into account the true nature of the organisation and see what the limitations are, its strengths and weaknesses and provide sustainable vision, etc. The most important aspect is that the strategy is suitable to the organisation and can be implemented. Under a marketing function, the manager has to define where he or she sees his/her company. Is the company a pioneer, or does it follow the market leader(s), or does it simply want to be technology, supply or staff-led? All those options have credibility depending on the state of organisational development; the potential of the organisation and what limits are imposed by the current and future market(s)? In recent years, business organisations moved from having a 'personnel' function to applying a 'human resources' function. Although it may sound like a classical terminological change, it appears that the focus on human resources is more strategic and developmental, taking into consideration what human resources the company must have to be where it wants, rather than handling the human capital that it has at present.

This strategic focus is important from a developmental point of view, as it allows investment in people and areas that are lagging behind, but are of crucial importance for achieving the desired developmental goals. So, a manager has to formulate HRM policies and strategies, devise continuous staff development, provide the means for implementing HRM policies and procedures, to ensure that the strategic HRM plans are in place and that they are delivered. It is also important to ensure that staff satisfaction is high, so that the turn-over of crucial and necessary staff is low and controllable. When focusing on the operations management aspects of running the business, a manager has to decide on the location, facilities, levels of activity, reliability, safety and product classification, etc. All these aspects are of higher importance to production companies, but also have an increasing importance for service organisations. Deciding on the quality of the product/service that the organisation will deliver has nowadays not only operational, but also strategic implications. Namely, whether the company will employ *total quality management* (TQM) or something else is a strategic decision. Offering substandard products to the highly competitive market will certainly lead to the 'market eviction' of the company. Customers, who have developed a sense of value,

will not go for substandard products, even if they are very cheap compared to the market standard.

The turbulent business conditions, which currently exist, require particular focus on management literature on the change management issues. In fact, the whole second part of the 20th century was marked by ever accelerating change trends. A modern manager has to be fully aware of technological, social, eco-political and expectational aspects of change. Technological change is usually the first to be stressed, but by no means is exclusive. Technological change requires (or initiates) the appropriate societal change, which in turn ensures that the technological change is sustained within society. When technological change did not have social support, history recorded major conflicts. For instance, in the early Industrial revolution, the Ludd movement sabotaged and damaged machines, as they were stealing peoples' jobs. Eco-political changes, usually narrowly seen as calls for ensuring a 'sustainable business' or 'sustainable growth and development' are more increasingly initiated by the third sector organisation (non-governmental organisations, interest and pressure groups, professional association, in other words – Civil Society at large). The most challenging aspect of change to handle is probably the expectational one. Namely, a manager has to forget a stable and steady management environment and be ready to operate effectively in a state of constant flux. Risk management is becoming increasingly important, as it is a requirement of the day to offset the risks using appropriate risk strategies. So, the task put before a manager is to 'sell' to his/her troops that change is good and that it will deliver to all involved, although it is well-documented that there will always be one part of the organisation that will bear more costs than others. This is true for both private and public organisations, companies and the country (see: Šević, 1997). A manager will face a series of conundrums such as location, tradition, success (or perceived success) failure, technology, vested interests, managerial limitations, bureaucracy, redundancy and redeployment challenges, etc. The management of change is becoming an important focus of a modern manager and certainly it will gain even more importance.

A brief survey of main aspects of management provide us with an opportunity ('pick') list, as to what a potential public sector administrator (i.e. manager) can borrow. It seems that the length of the 'pick list' largely depends on the political direction that the national government is taking. In Anglo-Saxon (i.e. Anglo-American) countries the focus has been predominantly on NPM and consequently the 'list' has been endless. There is a spill-over of HRM, finance, accounting, strategy, etc. practices into the public sector. To a large extent, a stakeholder model of corporate governance is replicated to the model of public (policy) governance, and probably – *vice versa*. Accrual accounting, which was considered to be appropriate for the private sector and had limited application to the public sector, is now becoming more or less the norm in the public sector (despite some fierce criticism). Pay flexibilities developed in the last decades of the 20th century rolled over to the public sec-

tor organisations and performance-related pay is becoming increasingly the norm in public sector organisations (still outside the core public services). Therefore, it seems that the list of possible borrowing is inexhaustive. Certainly, the modification of the borrowed concepts will be an additional task for a modern public sector manager, who may be delegated vast powers in designing and implementing public policy processes.

7. Conclusion

The relationship between business and government has traditionally attracted the attention of scholars. All university generalist business degrees will offer in the first year of study a course in business environment or government and business and will largely focus on how the government influences business. The narrow focus will stay within the limits of regulatory capture and legislation, while the wider view will analyse the entire complexity of the relationship between the government and business. Certainly, the relationship is two-way. The government has the power to define and influence the business environment through law enforcement and the introduction of by-law level regulation and engage into '*moral suasion*' forcing businesses to support certain government policies, which have not been put into the form of a law or by-law.

On the other hand, businesses, large individual or business groups and associations are important pressure groups and financiers of politicians' electoral campaigns. Therefore, their interests are heard by government which, when introducing changes, looks carefully into the vested interests of powerful business lobbies. This is for instance, particularly strongly underlined in the theory of regulatory capture (see: Kolko, 1963; Stigler, 1974). The relationship is not simple at all… In fact, it is fairly complicated and largely mutual. However, the stakeholder-type public governance assumes the larger participation of all interested parties and non-government organisations and other representatives of civil society are to be more involved and the government is expected to also accommodate this kind of pressure.

The *Expectational aspects* of the business change process applied to the public sector or public policy context assumes that there is some kind of higher good and therefore state sovereignty is limited and international (or even supranational) legislation is to have overall supremacy. Governments around the world have to subscribe to the minimum principles of civil and human rights, respecting the principles of citizen engagements outside the classical political process (usually perceived by the elected politicians as voting on the general elections).

The modern public policy process is all engaging, taking into consideration the input from all interested parties, organised, semi-organised or the *ad hoc* representatives. At the level of political governance, the supremacy of inter-

national (supranational) standards is unchallengeable. However, at public management level, a modern public sector manager (rather than an administrator) has to juggle the limited (and ever diminishing resources) with the higher expectations exercised by the public. Apparently, there are two opposing tasks, impossible to bring together. However, the change in the work environment for public managers means that they have more power to offer new solutions to both old and new problems in order to ensure that they have delivered the contracted task. The government, on its side, has to offer an inducive environment in which talent will flourish and to which the best managers will be attracted. It is very difficult to say to what extent the modern government may succeed in this, as the public sector is still dependent on the vested political and other interests, exercised by those close to the ruling party (or parties) and the government of the day.

The cross-fertilisation between private and public sector management practices is omnipresent and it seems that it will develop further with the overall support for public sector reforms around the world, focussing on providing cheaper government without seriously affecting the level of services offered (see: Pollitt and Bouckaert, 2000). The strategy formulation process in the public service is increasingly business-like and it seems that this trend is set to continue (see: Joyce, 2000). This is something that has been happening with accounting, as well with the introduction of accrual accounting, in the public sector around the World (in the UK it is knows as 'Resource Accounting'). The interface between the public and private sectors is far reaching and it is difficult, if not impossible, to say where this may end. One thing is sure - there will be more convergences and cross-fertilisation practices for scholars and practitioners to witness (and study).

Postscript: Why the New Journal

Research in social sciences, management and government is becoming increasingly interdisciplinary and this is not only true for empirical, but also for theoretical research. Therefore, it is necessary to provide more *forae* for disseminating research that is multidisciplinary in its nature and where stakeholders do not come from only one discipline or sector of activity. Bringing together management and public policy research is a challenge of its own. It has been successfully done with Accounting and Public Policy (*The Journal of Accounting and Public Policy*) or public policy journals that are outlets for multidisciplinary research (*The Journal of Public Policy*; *The European Journal of Public Policy*), although increasingly the leading journals in management science are more willing to accommodate papers that deal with interface between public policy and business. A number of journals narrowly look at the relationship between government and business, a process that is primarily one-dimensional, where the government dictates the terms of reference for businesses and defines broadly their operational environment.

The European Journal of Management and Public Policy aims at looking at the relationship between government and business from primarily a process perspective, but strongly believing that the process is not only two-dimensional, but rather multidimensional, encompassing a number of stakeholders coming from both private and public sectors. It will also welcome contributions from a single discipline perspective that have the potential to enhance readers' understanding of public and business policy processes and management in both the private and public sectors. The Journal will focus on all countries, regions and continents, despite its title that underlines its European belonging and remit, but will give slight priority to contributions that emphasise the European perspective (most widely understood), promote federalism, decentralisation, devolution and cross-country co-operation.

The Journal will focus on both micro and macro research, company and country studies, particular policy problems or global policy challenges. Problems and emerging issues in both (advanced) developed and developing/transitional countries are welcome for consideration. There is equal preference for theoretical and empirical papers; all schools of thought are welcome as long as their methodological approaches are soundly and consistently applied and do not leave any room for any reasonable methodological challenge within the adopted school of thought. The Journal aims to provide a critical forum for all scholars and practitioners and all those interested in the issues facing modern management and public policy, regardless of the viewpoint, discipline or ideological preference.

At the bottom line, the Journal must endorse the remit of its publisher, the European Center for Peace and Development (ECPD) at the University for Peace established by the United Nations, and to promote peace, co-operation and mutual understanding between the countries, members of the United Nations and all nations and people in the World. The Journal and the Publisher strongly believe that all readers are stakeholders in this enterprise. So, good luck to us all!

LITERATURE

Berry, B. and D. Otley (1996), *Performance Measurement and Control: Research and Practice*, London: CIMA Publishing

Brech, E. F. L., ed. (1963), *The Principles and Practice of Management*, 2nd edition, London: Longmans

Brech, E. F. L. (2002), *The Evolution of Modern Management: A History of the Development of Managerial Practice, Education, Training and Other Aspects in Britain from 1852 to 1979*, Bristol: Thoemmes

Buchanan, J. M. and G. Tullock (1962), *The Calculus of Consent*, Ann Arbor: The University of Michigan Press

Carlsson, R. H. (2001), *Ownership and Value Creation Strategic Corporate Governance in the New Economy*, Chichester: John Wiley & Sons

Downs, A. (1957), *The Economic Theory of Democracy*, New York: Harper & Row

Dye, T. R. and H. Zeigler (2000), *The Irony of Democracy*, Fort Worth: Harcourt Brace (millennium edition)

Easterby-Smith, M., R. Thorpe and A. Lowe (1991), *Management Research An Introduction*, London: SAGE Publications

Fama, E. and M. Jensen (1983a), Separation of Ownership and Control, *Journal of Law and Economics*, **26**(2), pp. 302-326

Fama, E. and M. Jensen (1983b), Agency Problems and Residual Claims, *Journal of Law and Economics*, **26**(2), pp. 327-349

Fayol, H. (1949), *General and Industrial Management*, London: Pitman [original published as: *Administration Industrielle et Generale*, Paris: Dunod, 1916]

Hansen, D. R. and M. M. Mowen (2000), *Management Accounting*, London: International Thompson Publishing

Hood, C. (1991). A Public Management for All Seasons?, *Public Administration*, **69**, pp. 3-19

Hood, C. (1995), The "New Public Management" in the 1980s: Variations on a Theme, *Accounting, Organizations and Society*, **20**(2/3), pp.93-109

Joyce, P. (2000), *Strategy in the Public Sector A Guide to Effective Change Management*, Chichester: John Wiley & Sons

Kolko, G. (1963), *The Triumph of Conservatism: A Reinterpretation of American History 1900-1916*, New York: The Free Press

Lindblom, C. E. (1959), The Science of Muddling Through, *Public Administration Review*, **19**, pp. 79-88

Machiavelli, N. (1897), *The Prince*, Oxford: Publisher unknown [also Chicago: The University of Chicago Press, 1985]

McNamara, K. R. (2002), Rational Fictions: Central Bank Independence and the Social Lo\gic of Delegation, *West European Politics*, **25**(1), pp. 47-76

OECD (1994a) *Performance Measurement in Government: Issues and Illustrations*,

OECD Public Management Occasional Papers No. 5, Paris: OECD

OECD (1994b), *Performance Management in Government: Performance Measurement and Results-Oriented Management*, Public Management Occasional Papers No. 3, Paris: OECD

OECD (1995), *Governance in Transition: Public Management Reforms in OECD Countries*, Paris: OECD

OECD (1997), *Benchmarking, Evaluation and Strategic Management in the Public Sector*, OECD Working Paper No. 67, Paris: OECD

Osborne, D. and T. Gaebler (1992), *Reinventing Government*, London: Addison-Wesley

Peters, T. J. (1989), *Thriving on Chaos: Handbook for a Management Revolution*, London: Pan Books in association with Macmillan

Pollitt, C. and G. Bouckaert (2000), *Public Management Reform A Comparative Analysis*, Oxford: The Oxford University Press

Quality Assurance Agency (2000), *Consultative Material on Benchmarking in Accounting*, QAA, mimeo

Šević, Ž. (1997), Law and Economics of (Economic) Policy Reform, in: Ž Šević and G. Wright, eds., *Transition in Central and Eastern Europe*, Belgrade: YASF, Vol. I, pp. 152-172;

Stigler, G. (1974), The Economic Theory of Regulation, *Bell Journal of Economics and Management Science*, **5**, pp. 3-21

Thompson, J. (1997), *Quasi-Markets and Strategic Change in Public Organizations*, Chicago: The University of Chicago, mimeo

Truman, D. B. (1951), *The Government Process*, New York: Knopf

CHANDRASEKHAR KRISHNAMURTI

Globalisation and Asian Financial Crisis: An Overview

The last two decades of financial market developments represent a very interesting period for various reasons. First, this period has been characterized as one that has achieved significant strides in the globalisation of financial markets. Second, in spite of rapid advances in technology and communication, we still continue to experience periodic crisis affecting the emerging markets of Latin America, Asia and Eastern Europe. Despite the improvements in our understanding of how markets work and the role played by macroeconomic factors, we have not been able to come up with early warning systems of potential economic crises. Finally, despite the elimination of barriers to international investment, the world's advanced countries are not fully globalised.

In spite of the advances in our knowledge as to how financial markets work, there remain considerable gaps in that knowledge. Some of the unanswered questions are listed below:

1) What are the prerequisites for financial liberalisation of emerging market economies?
2) What factors preclude total globalisation of financial markets in the developed economies of the world today?
3) On what basis should emerging market investors select the countries to include in order diversifying globally?
4) How should investors with limited investment resources select specific stocks in order to diversify globally?

The current issue of the European Journal of Management and Public Policy is devoted to studies that address some of the above questions. These studies describe various facets of internationalisation that enhances our knowledge of financial markets. Our objective is that we will be able to draw valuable lessons that are useful, not only for academicians and students, but also for policy makers.

We have included four papers that focus on some of the most important critical issues pertaining to globalisation of financial markets. The paper by Randhawa offers valuable lessons regarding the preconditions that must exist before an emerging country takes up financial market liberalisation. The Agarwala paper focuses on the existence of the interesting home bias phenomenon. His research shows that the periodic occurrence of downturns in major international markets is biased towards the portfolios of US investors. Typically, they

hold a portfolio of equities that is preponderantly weighted in favour of domestic equities. He offers an explanation that is enshrined in prospect theory. The third paper of Lamba, Sequeira and King offers insights to the transmission of volatility between major developed and emerging Asian markets. The last paper by Sankaran and Krishnamurti offers a heuristic approach to the problem of asset selection when confronted with transaction cost barriers. Ostensibly, such barriers are an obstacle to international investment.

The Asian crisis of 1997 can be characterised as a critical watershed event that shocked most orthodox economists. Unlike the recurring crises in Latin American, economies, which were brought about by severe macroeconomic imbalances, the countries affected by the Asian meltdown had sound macroeconomic performance prior to the crisis. So what went wrong? Consistent with their reputation, economists offered several explanations. Several accomplished economists offered fundamental structural weaknesses of financial institutions as the dominant factor that caused the crisis. There is widespread belief that the financial system was afflicted by deep flaws. These include excessive leverage, a banking system extremely dependent on directed lending, connected lending and other damaging collusive relationships.

The orthodoxy in the IMF pushed capital account liberalisation very strongly onto emerging markets. A fundamental problem with this approach is the proc-cyclical nature of these flows as outlined lucidly in Stiglitz (2002).Due to liberalisation, capital flows into a country during a boom and exacerbates inflationary pressures. During recessions, capital typically flows out of the country when it needs the most. Indonesia offers an interesting case study of a situation where financial liberalisation unaccompanied by sound and prudential regulations, most probably caused severe and catastrophic instability.

Corsetti, Pesenti, and Roubini (1998) present empirical evidence that shows that crises are systematically associated with fundamental weaknesses in the real and financial sectors of the economy. Randhawa explores this explanation further in the context of the economic crisis in Indonesia.

Randhawa uses Indonesia data to show that weak regulation, a large presence of government owned banks and distorting government policies all contributed to cause significant financial fragility. Randhawa's paper fills some of the gaps that remain in our understanding of how macroeconomic policy and structural changes affect firm level behaviour. Randhawa focuses on three issues. First, he describes the architecture of the Indonesian domestic financial system which is characterised by a rapidly expanding banking sector. Second, he illustrates in detail the ineffective regulation and supervision manifest in the phenomenally high growth rate of credit due to rapidly escalating injection of subsidised credit provided by the central bank. Finally, he focuses on the consequences of the unorthodox liberalisation strategy whereby capital account liberalisation preceded deregulation and stabilisation of the domestic financial sector.

Clearly, the Indonesian experience illustrates the rationale behind the premium placed on sound supervision and regulation in the context of financial liberalisation. This is especially so in the case of emerging markets, where market discipline is weak. In such a situation, the flaws in regulatory framework will be especially damaging. There is a lesson from this experience which is applicable to all emerging economies which are contemplating financial liberalisation before ensuring that sound supervisory and regulatory mechanisms are in place.

Randhawa's study offers some prescriptions for policy makers. He concludes that in the presence of weak supervision, lack of proper enforcement of prevailing regulations, the absence of well-developed capital markets, the government's preponderant influence in credit decisions, financial liberalisation triggered excessive credit expansion and risky lending behaviour.These resulted in increasing financial fragility in the banking sector and eventually culminated in a devastating financial crisis.

Despite the rapid strides made towards globalisation of financial markets, the enigmatic phenomenon of home bias still prevails. Home bias is characterised by the holding of a disproportionately large fraction of investment in domestic securities than is justified by the international capital asset pricing model (CAPM). The home bias has remained unexplained for most of the last three decades of financial research. There have been three categories of explanations for this enigmatic empirical phenomenon. The first explanation is based on the superior hedging characteristics offered by home equity for hedging against domestic risks. Barriers to international diversification have been offered as the second category of justification regarding home bias. The statistical weaknesses of CAPM tests to verify home bias represents the last category of explanations for the home bias phenomenon.

While barriers to cross-border investments are still widely prevalent in developing countries, the advanced economies of the world have dismantled restrictions to foreign investments over the last two decades. The continued existence of home bias therefore represents a puzzle that is not satisfactorily explained by existent financial theory.

Agarwala provides an interesting new perspective on this persistent problem. He focuses on the home bias situation prevailing in the US and comes up with a novel explanation. Using the EAFE (Europe, Australia and Far East) index as the proxy for international investing, Agarwala shows that the optimal mix should contain at least a minimum of 45 per cent weighting for EAFE with the remainder invested in domestic US securities. In contrast, the actual holdings of EAFE investments by individual and institutional investors average about 10 per cent as from 1996.

In searching for alternative explanations of this phenomenon, Agarwala maps the efficient frontier under different stock market conditions. The preferred mix of US investors – 90 per cent domestic stocks and 10 per cent foreign

stocks – plots on the lower, inefficient segment. The 100 per cent EAFE portfolio plots on the upper tip of the efficient frontier under normal conditions. This portfolio flips over to the lower tip of the inefficient portion of the frontier during bear markets. Interestingly, the 100 per cent US portfolio does best in bear markets and plots in the upper tip of the frontier.

In holding 90 per cent US stocks, investors seem to be overweighting the smaller probability of market crashes and suffering an opportunity loss by not holding a more diversified portfolio of international stocks. Their preference for holding mostly US stocks (90 per cent weightage) seems to be in accordance with a behavioural bias enshrined in the prospect theory that overweights the probability of a market crash.

Recent work by Coval and Moskowitz (1999) shows that investment decisions are also affected by geographic proximity. Geographic proximity reduces the information asymmetry faced by potential investors. They document the interesting phenomenon of "home bias at home". Investment managers in the US exhibit a preference for investing in locally headquartered firms suggesting that asymmetric information prevailing between local and non-local investors. The insight gained by these papers is that, despite technological progress, there remain barriers to international investment that are explained by behavioural biases or informational asymmetry.

One of the unintended consequences of globalisation is the spillover of volatility between equity markets. Recent examples of catastrophic consequences of such spillovers include the international stock market crash of 1987 and the Asian financial crisis. While existent research has documented the strength of relationships between major developed markets and the direct economic consequences of those linkages, very little empirical work has been accomplished on the linkages between emerging markets and the stock markets of advanced economies.

The Lamba, Sequeira and Kang study fills this important gap. One of the objectives of their study is to examine the influence of developed markets on emerging markets. Their study focuses five developed markets – the US, UK, France, Germany and Japan and four emerging markets – Taiwan, South Korea, Thailand and India. Interestingly, two of these economies were severely affected by the Asian crisis of 1997.

One of the major empirical findings of Lamba, Sequeira and Kang is that the US market is the most influential market and the main transmitter of volatility to the other markets – both advanced and emerging. Another remarkable result documented by their study is the strong bilateral linkage between France and Germany, the two major participants in the evolving European Economic Union experiment. This strong bilateral relationship perhaps denotes the strength of economic integration between these two key West European economies. There is scant evidence of leadership within the emerging markets studied. Although there is limited evidence indicating the

dominance of South Korea within emerging markets, this relationship fades when the influence of developed markets is considered. Another noteworthy finding is that the major developed countries are the principal source of volatility transmission in emerging markets.

The Lamba, Sequeira and Kang study holds important implications for international investing for investors from emerging markets. Volatility spillovers from developed to developing countries is much stronger than those prevailing between developing countries. Given the dangers of contagion, amply demonstrated by the Asian Financial Crisis of 1997, it behoves investors to diversify into markets belonging to other regions than those to which they belong.

One of the basic tenets of modern finance is that investors should diversify their holdings in equities in order to minimize idiosyncratic risk. In spite of this wisdom being available to the lay investor for over forty years, empirical evidence indicates that even in the US only about 11 per cent of investors hold a diversified portfolio of stocks. Among the explanations offered to illustrate this apparent contradiction between theory and practice are the high transaction costs. Presumably, individual investors find this an insurmountable barrier and end up holding fewer stocks than that entailed by a fully diversified portfolio.

The Sankaran and Krishnamurti paper takes an interesting approach to tackle this problem. They develop a heuristic procedure and apply this method on a set of Korean stocks. The procedure involves selecting a subset of stocks that, together, mimic the stock market index. One of the significant advantages of the procedure is that the user can specify the maximum number of stocks that are to be chosen. This procedure should be especially useful for individual investors who can choose a small number of stocks that effectively track the index. They can thus hold diversified portfolios, therefore obviating the transaction cost barrier.

The paper develops two variations of the procedure – one using the single index model and the other using the constant correlation method. The single index assumes that the market is the only priced factor that determines individual stock returns. The constant correlation method assumes that all stocks have the correlation between themselves. This assumption has been shown to be more robust empirically than the supposition that each pair of securities have a unique correlation in their stock returns. The paper theoretically derives the two procedures.

The data requirements for the procedure are relatively modest. The empirical section of the paper demonstrates the efficacy of the procedure developed utilising data from the Korean Stock Exchange. Although Korea has attained the status of a medium income country, its stock exchange continues to suffer from the drawbacks of other emerging markets such as illiquidity and lack of depth. The choice of Korea is appropriate to ensure applicability of the proce-

dure to other developing countries with relatively underdeveloped stock markets. Typically, the top stocks in emerging markets are highly liquid. But as we move down to medium size stocks the liquidity dries up rather quickly.

The procedures developed in the paper can be profitably adopted by institutional investors who wish to have exposure to several markets, including emerging markets. Financial institutions such as pension funds typically allocate a large portion of the managed funds to track the index, leaving a smaller fraction for active management. For example, the College Retirement Equity Fund (CREF) commits approximately 75 per cent of the funds in its stock account to track the Russell 3000 index, leaving only about a quarter of the funds for active management. Market-tracking portfolios with small numbers of stocks can be used by institutions to save considerable transaction costs without significant loss of diversification. Market-tracking portfolios are especially useful for index funds which need to balance the benefits of higher tracking efficiency with the additional transaction costs.

The Sankaran and Krishnamurti paper also holds important implications for investment behaviour of Capital constrained individual investors. They can utilise the technique used in the paper to construct a small yet fully diversified portfolio. Technologically savvy investors, with access to public data on specific international stocks, can use the procedures outlined to build their own portfolios with exposure to selected foreign markets. Such a service can also be provided by brokerage institutions with a user friendly graphical interface.

REFERENCES

Corsetti, Giancarlo, Paolo Pesenti and Nouriel Roubini (1998), *Fundamental Determinants of the Asian Crisis: A Preliminary Empirical Assessment*, Working Paper.

Coval, J.D., and T.J. Moskowitz (1999), "Home Bias at Home: Local Equity Preference in Domestic Portfolios", *Journal of Finance* 54 (6), 2045-73.

DIPINDER S. RANDHAWA*

Financial Liberalisation, the Origins of Financial Fragility and Financial Crisis – The Indonesian Experience

Abstract

Financial liberalisation programs in emerging market economies have yielded ambiguous results, a number of economies have experienced financial crisis en route to creating market-oriented economies. This study considers the Indonesian experience – an economy that embarked upon a radical reform program, and during the crisis of 1997, experienced a severe economic downturn. The focus is on an investigation into the origins and causes of the increasing fragility in the financial sector in the years preceding the financial crisis. The paper examines the relationship between financial sector reforms and financial fragility. Three specific developments are considered. i) the structure of the domestic financial system, heavily oriented towards the banking system, ii) lax regulation and supervision and iii) an unorthodox liberalisation strategy characterised by early deregulation of the capital account. Liberalisation was accompanied by fundamental structural change and instability in macroeconomic relationships. Investigation of the Central Bank's and state-owned bank's behaviour provides evidence of moral hazard problems. Increasing fragility in the Indonesian financial sector originated from structural weaknesses in the banking system aggravated by poor supervision and weak enforcement of prudential regulations.

1. Introduction

The severity and speed with which the 1997 Asian crisis spread, caught all, policymakers, market analysts and researchers by surprise. Prior to the onset of the crisis, the affected countries (Indonesia, Malaysia, the Republic of Korea, and Thailand) exhibited robust macroeconomic indicators reflected in sustained high growth rates and inflation at single-digit rates. Export performance had been relatively strong and current account deficits, seemingly manageable. The large and widening current account deficits were not accompanied by deterioration in countries' ability to service their foreign debts from export revenues.[1] Furthermore, all the countries had sizeable holdings of foreign-exchange reserves. In contrast to the experiences of Latin Ameri-

* The author benefited from comments on an earlier version of this paper from seminar participants at the FMA meetings in Toronto and at the National University of Singapore, and from Chandrashekhar Krishnamurthy and Guan Hua Lim. Fransiska Susanto provided extremely able research assistance.

can economies in the eighties, the crisis in the Asian countries does not seem to have been driven by severe macroeconomic imbalances in the form of Balance of Payments crisis (World Bank, 1998/1999).

This paper examines the origins and causes of increasing fragility in the Indonesian financial sector in the years preceding the financial crisis. Its contribution lies in the investigation of the linkages between financial liberalisation and the growth of financial fragility in a rapidly liberalising developing economy. We focus on three sets of issues: a) the architecture of the domestic financial system dominated by a rapidly expanding banking sector; b) ineffective regulation and supervision manifest in the extremely high rate of growth of credit and rising injections of subsidised credit provided by the central bank, the Bank of Indonesia and c) the unorthodox liberalisation strategy whereby capital account liberalisation preceded deregulation and stabilisation of the domestic financial sector. A rapidly expanding banking sector initially nurtured by rapid real growth was soon the victim of its own success, as the central bank sought to maintain growth via injection of subsidised credit into the dominant state-owned banking sector.

Since the inception of financial reforms in the sixties, Indonesia has followed an unorthodox liberalisation strategy. The capital account was opened at the very outset of reforms and full currency convertibility introduced prior to stabilisation of the domestic economy and implementation of internal financial sector reforms. Subsequently, entry requirements into the banking sector were relaxed without commensurate changes in the regulatory environment. This paper attempts to demonstrate that these developments, coupled with the central bank's liberal lending policies, contributed to increasing fragility, and eventually a crisis, in the financial sector.

The specific reforms and policy initiatives we consider are: liberalisation of entry rules for the banking sector; liberalisation of the capital account and the liberal extension of credit by the Bank of Indonesia, the Central Bank to state-owned banks. Though these reforms and policy initiatives are by no means unique to Indonesia, their simultaneous occurrence coupled with the distinct sequences of liberalisation may be distinctive. These developments, as we show, have profound implications for the growth of financial fragility. We analyse the consequences of structural changes and the entry of foreign capital into the banking system, for financial fragility. The role of bank ownership in motivating lending decisions also provides evidence of manifestations of moral hazard problems in lending. The theoretical foundations for our study are located in the '3rd generation' of models of financial crises (Krugman,

[1] Widening current account imbalances in Asian countries reflected a combination of slower export growth and continued increases in domestic demand (*Bank for International Settlements-67th Annual Report*, 1997).

1999) wherein the focus of investigation falls upon developments in the financial sector in the time period preceding the crisis.

The paper is organised as follows. The next section provides a brief description and an account of financial reforms in Indonesia. This is followed by a survey of the literature on the Asian crisis, with a focus on the Indonesian experience. Section 4 discusses the implications of the liberalisation strategy for the efficiency of financial intermediation and credit allocation. Section 5 elaborates on the resultant link between financial reforms and financial fragility. In Section 6, the implications of the regulatory regime for financial instability are elaborated. The consequences of an open capital account in the absence of effective regulation are discussed in Section 7. Section 8 concludes.

2. The Background: The Indonesian Experience

Indonesia is a large heterogeneous economy. Until the eighties, primary goods dominated by natural resources accounted for most of its exports. Following the oil price increase in 1973, oil and oil based products accounted for an increasing share of total exports. The growth strategy until the early eighties was the classic import substitution industrialization. The financial sector, dominated by the banking sector was under state ownership. It was in 1978 that a paradigm shift towards export promotion was instituted. The financial sector underwent commensurate changes

Financial reforms in Indonesia were implemented over several periods, in response to a series of financial crises. The first, from 1966 to 1973, began with significant liberalisation measures to rehabilitate an economy on the brink of collapse. This was part of a push by a new government to stop hyperinflation. From 1974 until 1983, the Indonesian financial scene was characterised by increasing government and central bank controls, negative real interest rates and widespread use of subsidised credit schemes. The second period, from 1982 to about 1990, was also driven by necessity. A fall in oil prices forced the government to restructure the economy further, moving it away from a dependence on oil revenues to become internationally competitive in a broad range of non-oil manufactured products. The government implemented two major financial sector reforms in 1983 and 1988. These reforms were followed by a series of other reforms, from 1989 to 1993, which aimed to strengthen the prudential regulation and supervision of banks. The third phase, from 1994 onwards, was driven primarily by the emergence of a competitive regional environment characterised by competitive liberalisation. The investment liberalisation measures of June 1994, permitting 100 percent foreign ownership, were designed to increase Indonesia's attractiveness as an investment location in the face of increased competition (Soesastro, 1999).

The banking sector was oligopolistic, dominated by the state-owned banks. Politically, there was a general interventionist bias to economic policy and a reluctance to rely upon market-based control mechanisms, reflected in the extensive level of government ownership and control in the economy (Lane, Cole and Slade; 1993). The abundance of financial resources generated by the oil boom led the government to focus primarily on allocation of those resources to desired uses, rather than on improving the efficiency of the financial system.

The financial system in Indonesia is a bank-oriented system. Table 1 provides evidence of commercial banks' dominance over the financial sector. Other financial institutions, such as savings banks, leasing companies, insurance firms, securities companies, and pension funds have grown rapidly, but as a group these sectors constitute a relatively small part of the financial sector. Despite the 1983 and 1988 financial reforms, this group of banks still held over 90 per cent of the gross assets of the financial system in 1988 and 1991 (see Table 1). In terms of total assets, the core of the Indonesian financial sector after the financial reforms has continued to be the banking system. The domination of the financial sector by commercial banks is mirrored in a heavy reliance of businesses on debt financing. This has adverse effects at the microeconomic level, because it has led to an unbalanced funding structure among firms in the real sector. A highly leveraged financial system simultaneously renders enterprises and their banks vulnerable to internal and external shocks. The most notable characteristic of the Indonesian banking system is the overwhelming dominance of the state banks. They have been the instruments through which Bank Indonesia disbursed credit to targeted groups during the 1974-83 period. The playing field for the state banks and the private banks was far from level – state banks had easier access to Bank Indonesia credit, they were allowed a much more extensive branch network and they were the only banks in which public enterprises could hold accounts. Foreign banks were even more disadvantaged as they had no access to Bank Indonesia credit and were not permitted to open more than two branches.

Following the 1988 reforms, the state-owned banks remained the dominant players in the banking industry. However, the state-owned banks experienced a particularly sharp decline in market share, along with commercial banks. In contrast, the market shares of the private banks grew rapidly from only 7.6 percent in 1987 to 34.7 percent in 1997 (see Table 2). Private banks began to dominate the banking sector for the first time since 1994 when their market share (36 percent) exceeded the state banks' market share (33 per cent). Foreign banks have also grown since the 1988 reform. Compared with a 3.3 percent market share in 1988, foreign banks have grown significantly to increase their share to 10.48 percent in 1997. Increased competition in the financial industry following the reforms has had an effect on the proportion of market share among commercial banks. Thus, financial reforms did reduce the dominance of state-owned banks in the banking system.

Table 1. – THE STRUCTURE OF THE FINANCIAL SECTOR: SHARE IN ASSETS (percentage) 1969–1994

Type of Institutions	Share in Assets (percentage)				
	1969	1982	1988	1991	1994
Bank Indonesia (Central Bank)	57.7	42.4	36.8	23.8	21.0
Deposit Money Banks	42.3	52.9	56.9	68.5	79.0
- State Banks	30.3	37.9	34.5	30.2	30.9
- Private National Banks	3.7	5.8	13.1	25.2	33.6
- Regional Government Banks	4.0	4.1	4.4	6.3	6.7
- Foreign/Joint Venture Banks	4.3	3.6	2.8	5.2	6.5
- Savings Banks	0.1	1.4	2.1	1.6	1.3
Non-Bank Financial Institutions (NBFIs)	…	2.5	2.7	2.1	n.a.
Leasing Companies	…	0.4	1.5	1.8	n.a.
Insurance Companies	…	1.6	1.6	3.5	n.a.
Other Credit Institutions	…	0.3	0.6	0.4*	n.a.
Total	100.0	100.0	100.0	100.0	100.0
Total (Trillions Rupiah)	0.7	32.3	115.5	218.5	

Note: *December 1990
Source: Adapted from Nasution (1998a; 1998b).

Table 2. – THE STRUCTURE OF THE BANKING SECTOR: SHARE IN ASSETS (percentage) 1987 – 1997

Year	*Bank Indonesia*	*Deposit Money Banks*[b]			
		State Banks	Private Banks	Regional Government Banks (*Provincial)*	Foreign & Joint Banks
1987	42.45	37.22	7.56	4.42	3.32
1988	40.15	37.70	9.64	4.77	3.04
1989	35.65	44.43	14.85	1.86	3.20
1990	32.20	42.84	19.45	1.61	3.90
1991	28.52	39.91	24.21	2.07	5.30
1992	26.18	38.25	27.19	2.17	6.17
1993	24.24	35.62	31.23	2.32	7.00
1994	21.54	33.06	35.98	2.51	7.45
1995	19.47	32.00	38.48	2.55	7.88
1996	19.07	29.52	41.96	2.24	7.45
1997	26.30	28.14	34.66	1.71	10.48

Notes: [a]On March 31 of the related year.
[b]*Deposit money banks* are commercial institutions whose demand deposits are important or form a large of their total liabilities.

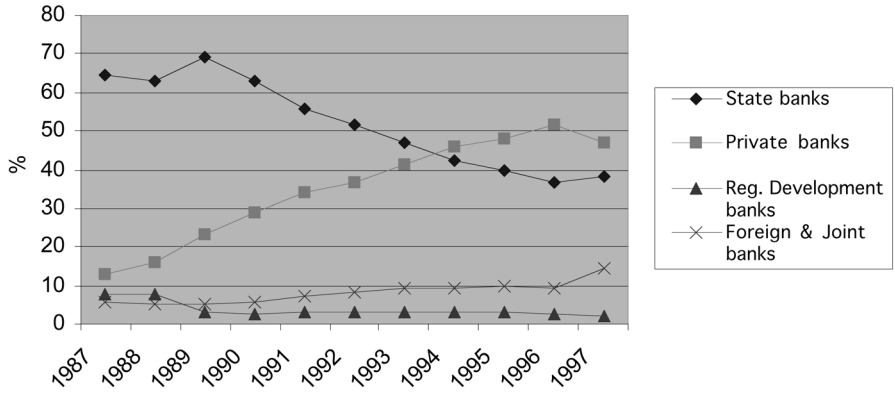
Sources: *BI Report for the Financial Year*; and *SEACEN Financial Statistics*, July 1994.

Table 3. – SHARE OF TOTAL CREDIT in Rupiah and Forex by Group of Banks 1981–1997 (percentage)

Year	State Banks	Reg. Government Banks	Private Banks	Foreign & Joint Banks
1981	78.31	3.29	11.10	7.30
1982	78.34	3.48	11.68	6.50
1983	75.62	3.18	14.55	6.66
1984	74.37	2.84	16.95	5.83
1985	72.54	3.02	19.37	5.06
1986	70.40	3.03	21.80	4.77
1987	68.80	3.05	23.69	4.46
1988	67.44	2.82	25.24	4.51
1989	62.91	2.58	29.55	4.95
1990	55.19	2.37	36.06	6.37
1991	53.06	2.32	37.08	7.54
1992	55.51	2.45	34.44	7.59
1993	47.61	2.37	40.22	9.80
1994	42.36	2.22	45.69	9.72
1995	39.84	2.23	47.59	10.33
1996	37.19	2.20	51.19	9.42
1997	40.53	1.99	44.62	12.85

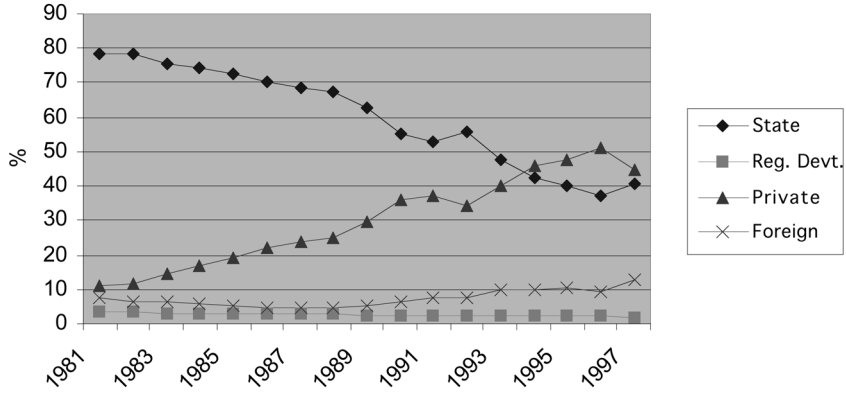
Source: Bank Indonesia, *Indonesian Financial Statistics*, various issues.

Graph 1. – DEPOSIT MONEY BANKS: SHARE IN ASSETS 1987–1997 (percentage)



Indonesian commercial banks had increased their lending substantially during the period of financial reforms through 1990. Part of the credit expansion was financed by foreign borrowing. The less regulated and supervised bank operations for over two years following the 1988 reforms allowed banks to expand credit freely. The new freedom to borrow abroad in 1989 allowed large-scale short-term private sector capital inflows in 1989-91 which contributed

Graph 2. – SHARE OF TOTAL CREDIT BY GROUP OF BANKS 1981–1997 (in percentage)



to banks' rapid credit expansion and inflation. The new rules and regulations were only introduced in February 1991.

3. The Asian Crisis

The causes of the crisis have been investigated extensively. The major findings regarding the causes may be classified as fundamental and structural weaknesses (Corsetti, Pesenti and Roubini, 1998a, 1998b, 1998c), moral hazard stemming from implicit guarantees (Krugman, 1999; Bisignano, 1999), and financial panic or contagion (Radelet and Sachs, 1998; Chang and Velasco, 1998a, 1998b; Calvo and Fernandez-Arias, 1998).

Though most of the explanations for the crisis focused on the financial sector, a few studies examined the behaviour of firms in the years preceding the crisis. (Claessens, Djankov and Lang 1998, Pomerleano 1999). However, there remain considerable gaps in our knowledge of how macroeconomic policy and structural changes affect behaviour at the micro (firm and bank) level. The affected countries exhibited similarities in many aspects of their macroeconomic performance. Nevertheless, there are a number of structural factors, policy issues, and institutional idiosyncrasies that set them apart. As their experiences since the summer of 1997 demonstrate, these differences are profoundly important in helping understand behaviour at the microeconomic level – at the level of the individual, bank, and enterprise, and thereby provide a sharper understanding of developments at the macro level. This study considers a country specific experience to obtain insights into the origin and spread of the crisis. Among the Asian countries, Indonesia suffered the sharpest plunge in its currency. Indonesia also experienced the most severe dislocation in the financial system during the crisis.

A leading interpretation of the Asian meltdown focuses on structural problems and fundamental weaknesses as crucial elements in the genesis of the crisis, as well as of its spread across countries (Corsetti, Pesenti and Roubini 1998a, 1998c). According to the 'fundamentalist' view, the Asian crisis was caused by basic economic weaknesses. Proponents of this view argue that Asia's healthy macroeconomic indicators, such as low inflation, balanced fiscal policy, low government debt and high rates of domestic saving and investment painted a misleading picture. They argue that, in reality, Asia's economies suffered from serious structural problems as well as policy inconsistencies.

Table 4. – SECTOR CONTRIBUTION TO COMMERCIAL BANKS' OUTSTANDING CREDITS 1980–1997 (% of total credit)

Year	Agriculture	Mining	Manufacturing Industry	Trade	Service	Others	Total
1980	6.85	23.71	28.11	25.10	12.01	4.23	100
1981	8.00	16.67	27.19	30.14	13.63	4.37	100
1982	7.87	11.30	30.13	31.71	14.34	4.65	100
1983	8.01	5.27	34.03	33.54	14.88	4.26	100
1984	7.01	2.04	35.44	33.72	16.84	4.95	100
1985	7.47	1.16	34.26	32.74	18.88	5.47	100
1986	8.30	1.56	35.65	33.25	16.24	4.99	100
1987	8.43	1.22	34.65	32.52	16.25	6.92	100
1988	8.50	1.05	35.23	32.71	16.06	6.45	100
1989	8.40	0.94	32.32	31.96	15.51	10.86	100
1990	7.40	0.63	31.45	30.66	17.75	12.10	100
1991	7.50	0.66	29.36	29.29	17.79	15.40	100
1992	8.36	0.62	30.34	26.80	21.05	12.83	100
1993	8.02	0.52	34.23	25.15	23.84	8.24	100
1994	7.34	0.42	31.88	23.49	26.90	9.97	100
1995	6.62	0.39	30.73	23.11	28.38	10.77	100
1996	6.02	0.58	26.92	24.10	31.29	11.10	100
1997	6.88	1.41	29.53	21.76	30.03	10.39	100

Note:
– *Agriculture sector* includes plantation development, procurement of agriculture equipment
– *Mining sector* includes oil, coal, iron ore, etc.
– *Manufacturing sector* includes transportation, basic metal industries, food, paper, cement, textiles, clothing, leather industries, etc.
– *Trade sector* includes retail trade, distribution & wholesale purchasing of domestically produced goods.
– *Services sector* includes construction (housing developments), real estate.

Source: *Indonesian Financial Statistics*, Bank Indonesia, several issues.

Corsetti, Pesenti and Roubini (1998a) argue that fundamental imbalances triggered the currency and financial crisis in 1997, even if, once the crisis started, market over-reaction and herding caused the plunge of exchange

rates, asset prices and economic activity to be more severe than warranted by the initial weak economic conditions. The empirical evidence in Corsetti, Pesenti and Roubini (1998c) shows that crises are systematically related to the fundamental weaknesses in the real and financial sectors of the economy.[2]

It is widely believed that the main problem in East Asia was not macroeconomic, but structural. Deep flaws afflicted the financial system, including excessive leverage, and a banking system based excessively on directed lending, connected lending and other collusive personal relationships.

Some analysts blame moral hazard induced by implicit public guarantees and the presence of fixed or quasi-fixed exchange rates. Krugman argues that the root of the problem is the implicit government guarantee to financial bodies and the absence of adequate supervision. Bisignano (1999) finds that the combination of moral hazard and weaknesses in prudential regulation and supervision of both banks and non-bank financial intermediaries has shifted credit markets from equilibrium with excess borrowing to one with excessive credit rationing, resulting in a severe liquidity crisis. The weaknesses in financial transparency, corporate governance, and prudential regulation and supervision in a high-growth environment led to excessive credit creation, asset price booms and large foreign currency exposure.

Other analysts identify poor regulation and supervision of financial institutions as the primary cause of the crisis (Asian Development Outlook, 1999). Financial sector supervision in East Asia has been generally weak and regulations relatively lax. Countries lacked the institutional capacity to cope with the rapid expansion of domestic credit during the 1990s. Reporting and provisioning requirements for non-performing loans were inadequate in several countries. In several East Asian countries, capital adequacy requirements were more lenient than those suggested by the Bank for International settlement (BIS), although these economies face higher risks than the industrial countries that follow BIS standards (Global Development Finance, 1998).

Finally, many countries lacked effective exit mechanisms for failed institutions, therefore insolvent banks were allowed to continue lending. These problems were exacerbated by the rapid liberalisation of the financial markets without a commensurate strengthening of supervision and regulation. Liberalisation in the absence of adequate regulations or supervision greatly increased the vulnerability of financial systems.

There is an evolving consensus that financial liberalisation has elicited mixed responses. The positive results of financial liberalisation often coincided with increasing financial instability (in the form of high and volatile interest rates) and financial crises. However, whether financial liberalisation helped to trigger or aggravate financial crises is an often-debated issue. The question ex-

[2] They adopt the methodology suggested in previous studies. See Sachs, Tornell and Velasco (1996), and Kaminsky, Lizondo and Reinhart (1998).

amined in this study is the relationship between financial sector reforms and financial fragility. This study attempts to fill this gap by examining a country specific experience to obtain insights at the microeconomic level into the consequences of financial liberalisation.

3b. The Financial Crisis in Indonesia

Among the Asian countries, Indonesia suffered the sharpest fall in its currency. Indonesia experienced the most dislocation in the financial system during the crisis. Studies on the recent financial crisis (currency crisis and banking crisis) in Indonesia identify several factors as the causes of the crisis. Nasution (1999b) posits that the roots of the present financial crisis are overinvestment in the non-traded sector, a manufacturing industry that requires high protection, and a weak financial system.[3] The financial system, particularly the banking system, was plainly dysfunctional because of a combination of an ineffective central bank and direct government intervention in selection of banks' credit customers. However, Radelet (1998) argues that the 'seeds of Indonesia's implosion' were a series of financial sector reforms that led to a rapid expansion of the banking system (without adequate supervision and prudential regulations) and an increasing concentration of credit.

The 1983 and 1988 financial reforms overhauled the function and structure of the banking system in Indonesia. The monopoly power of the state-owned banks has been eroded and private sector financial conglomerates are on the rise. The relaxation of barriers to market entry and reduction in government controls strengthened competition in the banking industry and induced the formation of financial conglomerates owned by the private sector. On the other hand, the credit policy remains segmented and procyclical. Therefore, the main question to be examined in this study is the relationship between financial sector reforms and financial fragility.

4. The Efficiency of Intermediation

Financial sector reforms could be expected to improve the efficiency of the banking system. Measures that encourage entry and the opening of new branches, reduce the burden of reserve requirements, and make interest rates responsive to market forces should reduce the overall costs of intermediation by narrowing the spread between rates paid on deposits and rates charged on loans. It is difficult to form any expectations with respect to the pattern of spreads for state banks after the reform measures of 1983. State banks had to contend with a new environment in which they decided on credit allocation themselves and faced interest rates determined by market pressures. The 1988

[3] The investment has been funded by massive capital inflows as shown by widening current account deficit and mounting external debt.

banking reforms could be expected to influence spreads more predictably because they more clearly fostered competition and reduced the direct costs of intermediation (Chant and Pangestu, 1994).

The interest spreads of the private banks narrowed considerably with heightened competition. This is evidence that the private banks reacted to deregulated markets by aggressively competing via the pricing of their services. The empirical findings suggest that a decrease in the spreads led to the credit expansion and an increase in foreign liabilities. By contrast, interest spreads at the state banks had been virtually unchanged since deregulation. It may indicate that the costs of intermediation in the state banks were not affected by the financial reforms because of the heavy influence of Bank Indonesia. In addition, the private banks' interest spreads are higher than the state banks'. This may reflect a higher risk in private banks compared with state banks.

Table 5. –LIQUIDITY CREDITS AND BANK LENDING 1981–1997

Year	Liquidity credits*	Growth rate (% per annum)	Total Lending	Liquidity credit/ bank lending
1981	2,548	33.9	7,510	8.9
1982	3,742	61.4	10,251	10.5
1983	4,365	24.9	12,943	10.4
1984	6,938	150.9	17,943	18.8
1985	7,631	126.0	21,193	36.0
1986	8,672	13.6	25,258	34.3
1987	10,261	18.3	31,505	32.6
1988	13,472	31.3	42,454	31.7
1989	16,228	20.5	62,910	25.8
1990	13,658	-15.8	96,978	14.1
1991	14,094	3.2	112,825	12.5
1992	14,581	3.4	122,918	11.9
1993	12,821	-12.1	150,271	8.5
1994	13,788	7.5	188,880	7.3
1995	17,093	23.97	234,611	7.3
1996	20,600	20.5	292,921	7.03
1997	24,957	21.1	378,134	6.6

Sources: Bank Indonesia, Indonesian Financial Statistics, several editions.

4b. The Efficiency of Credit Allocation

By the early 1980s, the previous credit policies had led to a distorted, repressed and segmented financial system. Credit allocation was heavily influenced by all kinds of special programs. Bank Indonesia required that a minimum proportion of loans should be made by the banks to 'priority' sectors (at a set interest rate). This so-called 'liquidity credit' program benefited both

borrowers and banks.[4] The banks that originated loans could refinance part of them with Bank Indonesia at concessionary interest rates. The interest rates paid by borrowers were also particularly favourable.

Most liquidity credits were allocated by state banks (Table 5) because most government priority lending programs were closed to private banks. The position of the state banks as recipients of preferential funding treatment and the lack of competition for deposits due to interest-rate ceilings allowed the state banks to become dominant financial intermediaries.

The 1983 reform removed the eligibility for categories of credit that accounted for almost 50 per cent of the outstanding loans at that time. The scope of liquidity credits was reduced as part of an overall program of removing controls from repressed credit markets. The PAKJAN reforms of early 1990 further restricted the categories of credit eligible under the program.[5] However, the problem was different in 1990 because previous reforms had shifted the balance away from controls. The 1990 reform reflected concerns that the liquidity credit program committed Bank Indonesia to supply base money to the banks regardless of the state of credit conditions.

Sectoral concentration ratios rose as a response to the subsidised-credits program. The positive relationship between *liquidity credit* and the concentration of bank credit would imply that the subsidised-credits program by authorities does not improve the efficiency of credit allocation, and thus increase the fragility in the financial sector.[6]

Credit allocation was inefficient, as loans did not always reach the intended beneficiaries and projects with a low return were financed. The large loan subsidies encouraged a misdirection of funds, short-changing intended beneficiaries. From the standpoint of efficiency, the subsidised rates encouraged financing of low-return projects, or ones with levels of capital intensity inappropriate for a low-wage, labour surplus country. Equalisation of the marginal efficiency of investment across sectors, a partial measure of allocative efficiency, was hindered by the targeted nature of directed credit. The existence of high percentages of rediscount and subsidised credit insurance from a state-owned insurance company weakened the incentive of state banks to choose viable projects or to supervise them once funded.[7] Recipients of pre-

---

[4] Liquidity credit is provided by Bank Indonesia to refinance credits extended by commercial banks to selected sectors (*Indonesian Financial Statistics*, Bank Indonesia).

[5] After the 1990 reforms, only a limited range of finance, centered on the procurement and production of food stocks, qualified for liquidity credits. See Chant and Pangestu (1994).

[6] The sectoral concentration ratio is measured as the sum of shares of credit to the services sector in total credits. Since most of the credit to the services sector go to the construction and real estate sectors, known as risky sectors; therefore, an increase in the sectoral concentration ratio increases the fragility in the banking sector.

[7] Woo and Nasution (1989) point out that state banks rarely met their credit targets, a result that they hypothesise may have been due to large bribes called for by these banks, bribes that raised the cost of their credit above that of private banks.

ferred credit grew into huge conglomerates that controlled a large proportion of GDP and engaged in a vast range of mainly rent-seeking activities.

5. Issues pertaining to Regulation and Supervision

Weak regulation and supervision are the most widely recognised sources of vulnerability in developing countries' banking systems. The problems of supervision and regulation often arise in the aftermath of financial liberalisation when banks are freed to enter new lines of business and make new, unfamiliar investments.[8] The removal of controls on lending and offshore borrowing may prompt a sudden expansion of business. If banks have inadequately trained personnel to evaluate the risks of the increase in their lending, the quality of their asset portfolios will decline.[9] If they engage in connected lending (in which loans go mainly to influential insiders), more resources for the banks only adds risk and worsens the allocation of funds. Financial liberalisation thus places a premium on sound supervision and regulation while at the same time straining the capacity of regulators to carry out their tasks.

Flaws in the regulatory structure will be especially damaging where market discipline is weak. And market discipline will be least effective where there are defects in the accounting, disclosure and legal frameworks for banking. Banks will be able to disguise loan losses, announcements of which typically require management to take corrective action. They will overstate income and disguise the extent of their financial difficulties until it is too late. Thus, where accounting and disclosure are inadequate, neither regulators nor shareholders will be able to effectively discipline management (Eichengreen and Rose, 1998).[10]

There is the possibility that government supervision and regulation are themselves a source of perverse incentives. Managers of state banks are often susceptible to political pressures to engage in directed lending; if supervisors see the allocation of loans as a device for furthering certain political objectives rather than maximizing the return on bank capital, problems of bank insolvency and illiquidity may result. A deposit insurance scheme in conjunction with a regulator who subscribes to the 'too big to fail' principle will encourage bank management to assume excessive risk and relieve customers and shareholders of all incentive to monitor its behaviour.

---

[8] See Goldstein and Turner (1996) and Honohan (1997).

[9] If the proper bank supervisory structure is not in place when liberalisation comes, the appropriate constraints on risk-taking behaviour may be non-existent, with the result that bank balance sheets are likely to suffer difficulties in the future (Mishkin, 1999).

[10] Demirguc-Kunt and Detragiache (1997) find that a measure of the strength of law enforcement is strongly associated with the incidence of banking crises.

Financial Liberalisation, Bank Lending Behaviour and Financial Fragility

Increased freedom of entry into the financial sector and freedom to bid for funds through interest rates and other instruments often leads to excessive risk taking, especially in the absence of prudent regulatory control. As an illustration, implicit guarantees of a government bailout of depositors, together with weak prudential legislation and supervision permitting unsound lending patterns, could trigger excessive risk taking following deregulation.

Financial liberalisation typically is accompanied by aggressive behaviour on the part of banks. In order to raise deposits, banks increase interest rates and fund more risky projects. Given the existence of deposit insurance (implicit or explicit), depositors find it profitable to move to these banks. Although the purpose of prudential regulation is to impede this tendency, during the early years of liberalisation, the capacity for supervision is usually poor. Increased freedom, without adequate supervision and implicit government guarantees, leads to excessive credit expansion and risky lending.

Rapid rates of credit expansion often have paradoxically coincided with high real interest rates in the wake of financial liberalisation. Lifting restrictions on bank lending often releases pent-up demand for credit in the liberalised sectors (e.g. real estate, securities activities).[11] Lowering reserve requirements permits banks to accommodate increased loan demand – as does the inflow of foreign capital, often attracted by reforming economies. Yet bank credit managers reared in an earlier controlled financial environment may not have the expertise needed to evaluate new sources of credit and market risk.[12]

At the same time, the entry of new competitors (foreign and domestic) may well increase the pressures on banks to engage in riskier activities. Easier access to offshore markets may also allow banks to evade domestic restrictions on riskier activities. Unless the supervisory and regulatory framework is strengthened before the liberalisation of financial markets, bank supervisors may have neither the resources nor the training needed to adequately monitor and evaluate these new activities.

6. Foreign Capital Inflows & Foreign Exchange Exposure

Until 1989, the authorities imposed limits on inflows of foreign direct investments as well as offshore borrowing by the domestic banks. The exchange swap facility was also subject to quantitative ceilings. Both ceilings on foreign borrowings and on the swap facility of banks were rationed with administra-

[11] Caprio *et al.* (1994) report that banks tended to expand their real estate lending immediately after financial sector liberalisation or the relaxation of lending guidelines.

[12] Managing the risk of a bank loan portfolio is a complex task, and bank staff trained in a tightly regulated financial system may not have the skills and experience necessary.

tive mechanisms. On the supply side, the availability of subsidised interest rates from state-owned banks practically eliminated incentives for domestic companies to borrow overseas. On the demand side, however, few Indonesian companies were creditworthy in international financial markets.

A new policy package introduced in March 1989, to supplement the October 1988 package, removed the ceiling on foreign commercial borrowing by banks and replaced it with a new prudential limit on net open positions of banks.[13] The new freedom to borrow abroad allowed large-scale short-term private sector capital inflows in 1989-91, which contributed to banks' rapid expansion and inflation (Nasution, 1999). To slow down the capital inflows, the authorities imposed special quantitative ceilings on offshore borrowing by the public sector (including state-owned enterprises) in October 1991.[14]

In practice, net capital inflows have led to an expansion of domestic credit, reflecting the interplay of government policies, private investment decisions, and the behaviour of financial institutions (including the rest of the financial sector). When the banking system is sound and efficient and there is effective regulatory and supervisory control over banks, capital flows will not create additional risks for the financial system, or increase the probability of financial problems. When extending credit, banks are able to anticipate the effect of a reversal of capital flows on the revenues of their borrowers (interest rate and exchange rate risks) by pricing loans accordingly; accumulating reserves against such loans, and reducing the concentration of their loan portfolios to sectors that may be affected by such reversals.

However, when credit institutions operate in a regulatory environment that allows them to misallocate and mismanage their balance sheets, as was the case in Indonesia, an expansion of bank credit induced by capital inflows will create further opportunities for banks to expose the financial system to a larger risk of financial loss. Implicit bank deposits' insurance induced banks to increase their risk exposure and to pay little attention to loan quality and to matching the maturities of deposits with that of loans–the former being considerably shorter than the latter. By raising funds in foreign currency on international markets and lending them to local borrowers, Indonesian banks, and by default, the Bank of Indonesia exposed the financial system to foreign exchange risk. The banking system became more vulnerable because of the rapid growth in lending that exacerbated the maturity and currency mismatches between bank assets and liabilities. Loan quality had already been deteriorating. Thus, the trigger point for a rapid capital outflow had been established.

---

[13] Net open positions are the gaps between banks' liabilities and assets denominated in foreign currencies, relative to their capital.

[14] Offshore borrowings by state-owned banks and enterprises, including the private sector relying on public entities for their bankability, are required to obtain approvals from authorities. Ceilings on offshore borrowings of purely private sector enterprises are not binding, but these enterprises are required to report their borrowings to the authorities.

7. Conclusions

We find that government subsidised-credits led to the increases in sectoral concentration ratio and banks' foreign borrowing, thus increasing the fragility and vulnerability of the financial sector. The subsidised-credits were refinanced by the central bank at relatively favourable rates, and state banks therefore had little incentive to assess and price their credit risk properly. Loans were allocated to particular sectors, thus increasing the concentration of credit. The positive relationship between 'liquidity credit' and the concentration of bank credit would imply that the subsidised-credits program by authorities do not improve the efficiency of credit allocation, and thus increase the fragility in the financial sector.

Indonesia experienced a surge in capital flows in the 1990s. Foreign capital was attracted as a result of wide-ranging market reforms undertaken in the late 1980s. However, the massive capital inflows resulted in over-investment, particularly in the non-tradable sector and asset overvaluation, notably in real estate. This misallocation was accentuated by the near absence of capital markets which could have provided a forum for additional information production and resource mobilization, as well as all the attendant diversification benefits.

When credit institutions operated in a regulatory environment that allowed them to misallocate and mismanage their balance sheets, an expansion of bank credit induced by capital inflows created further opportunities for banks to expose the financial system to a larger risk of financial loss. Implicit bank deposits' insurance could induce banks to increase their risk exposure and to pay little attention to loan quality and to matching the maturities of deposits with that of loans–the former normally being shorter than the latter. By raising funds in foreign currency on international markets and lending them to local borrowers, banks were exposed to another type of risk, foreign exchange risk. The banking system might become more vulnerable because of a rise in lending that may exacerbate the maturity and currency mismatches between bank assets and liabilities and reduce loan quality. Hence, sudden capital outflows may result in a financial crisis.

Growing currency and maturity mismatches exposed Indonesian banks to exchange rate and interest rates risk. The liberalisation of the capital account, reform of the financial sector, and advances in technology and information processing had made it easier for Indonesians to denominate deposits in foreign currencies. The high ratios of dollar deposits as a percentage of M2 and excess liquidity of commercial banks held in US dollars also indicate the tendency to denominate debts instruments in foreign currency (Nasution, 1999). With much of their debt denominated in foreign currencies, bank and firm balance sheets were hit hard when the *rupiah* depreciated sharply in 1997. The indebtedness of Indonesian banks and firms rose and their net worth fell.

In conclusion, in the presence of weak supervision; lack of enforcement of existing regulations; the government's heavy influence in credit decisions ('*moral hazard*' problems) and the absence of capital markets, financial liberalisation resulted in excessive credit expansion and risky lending behaviour, that led to increasing financial fragility in the banking sector, eventually resulting in a severe financial crisis.

REFERENCES

Asian Development Bank. 1999. *Asian Development Outlook 1999*. Oxford University Press.

Bank for International Settlements. 1997. *BIS 67th Annual Report*.

Bank of Indonesia, *Indonesian Financial Statistics*, various issues.

Bisignano, Joseph. 1999. "Precarious Credit Equilibria: Reflections on the Asian Financial Crisis." *BIS Working Papers*, No. 64.

Calvo, Guillermo and Eduardo Fernandez-Arias. 1999. "The New Features of Financial Crises in Emerging Markets."

Caprio, Gerard, Izak Atiyas, and James A. Hanson. 1994. "Policy Issues in Reforming Finance: Lessons and Strategies." In *Financial Reform: Theory and Experience*, edited by Gerard Caprio, Jr., Izak Atiyas, and James A. Hanson. Cambridge University Press.

Chang, Roberto, and Andres Velasco. 1998a. "Financial Crises in Emerging Markets: A Canonical Model." *NBER Working Papers Series*, No. 6606. Cambridge: National Bureau of Economic Research.

Chang, Roberto, and Andres Velasco. 1998b. "Asian Liquidity Crisis." *NBER Working Papers Series*, No. 6796. Cambridge: National Bureau of Economic Research.

Chant, John, and Mari Pangestu. 1994. "An Assessment of Financial Reform in Indonesia, 1983-90." In *Financial Reform: Theory and Experience*, edited by Gerard Caprio, Jr., Izak Atiyas, and James A. Hanson. Cambridge University Press.

Claessens, Stijn, Simeon Djankov and Larry Lang. 1998. "East Asian Corporates: Growth, Financing and Risks Over the Last Decade." World Bank.

Cole, David C., and Betty F. Slade. 1996. "Building A Modern Financial System: The Indonesian Experience." Cambridge University Press.

Corsetti, Giancarlo, Paolo Pesenti and Nouriel Roubini. 1998a. "What Caused the Asian Currency and Financial Crisis? Part I: A Macroeconomic Overview."

Corsetti, Giancarlo, Paolo Pesenti and Nouriel Roubini. 1998b. "Paper Tigers? A Model of the Asian Crisis."

Corsetti, Giancarlo, Paolo Pesenti and Nouriel Roubini. 1998c. "Fundamental Determinants of the Asian Crisis: A Preliminary Empirical Assessment."

Demirguc-Kunt, Asli, and Enrica Detragiache. 1998a. "The Determinants of Banking Crises in Developing and Developed Countries." *IMF Staff Papers*, No. 91, pp. 401-19.

Diaz-Alejandro, Carlos. 1985. "Goodbye Financial Repression, Hello Financial Crash." *Journal of Development Economics* 19.

Eichengreen, Barry and Andrew K. Rose. 1998. "Staying Afloat When the Wind Shifts: External Factors and Emerging-Market Banking Crises." *NBER Working Paper Series*, No. 6370. Cambridge: National Bureau of Economic Research.

Frankel, Jeffrey A. and Andrew K. Rose. 1996. "Currency Crashes in emerging Markets: An Empirical Treatment." *Journal of International Economics*, Vol. 41, pp. 351- 366.

Goldstein, Morris. 1998. "The Asian Financial Crisis: Causes, Cures, and Systemic Implications." *Policy Analyses in International Economics*, 55. Institute for International Economics.

Goldstein, Morris, and Philip Turner. 1996. "Banking Crises in Emerging Economies: Origins and Policy Options." *Bank for International Settlements Economic Papers*, 46(October).

Gonzalez-Hermosillo, Brenda. 1996. "Banking Sector Fragility and Systemic Sources of Fragility." *IMF Working Paper* 96/12.

Honohan, Patrick. 1997. "Banking System Failures in Developing and Transition Countries: Diagnosis and Prediction." *Bank of International Settlements Working Papers*, No. 39.

Krugman, Paul. 1999. "Balance Sheets, The Transfer Problem, and Financial Crises."

Lane, Christopher E., David C. Cole and Betty F. Slade. 1993. "Indonesia, 1974-90." In *Monetary Policy in Developing Countries*, edited by Sheila Page. London: Routledge.

Mishkin, Frederic S. 1999. "Lessons from the Tequila Crisis." *Journal of Banking and Finance*, 23, pp. 1521-1533.

Nasution, A. 1998a. "'Big Bang' versus 'Go Slow': Indonesia and Malaysia." In *Financial Reform in Developing Countries*, edited by Jos M. Fanelli and Rohinton Medhora. New York: St. Martin's Press.

Nasution, A. 1998b. "Management of the Financial Sector: The Case of Indonesia."

Nasution, A. 1999a. "The Banking System and Monetary Aggregates Following Financial Sector Reforms: Lessons from Indonesia." *Research for Action 27*, UNU World Institute for Development Economics Research (UNU/WIDER).

Nasution, A. 1999b. "The Financial Crisis in Indonesia." In *East Asia's Financial Systems: Evolution & Crisi.5s*, edited by Seiichi Masuyama, Donna Vandenbrink, Chia Siow Yue. Institute of Southeast Asian Studies.

Pomerleano, Michael. 1998. "The East Asia Crisis and Corporate Finances: The Untold Micro Story." World Bank Working Paper No. 1990.

Radelet, Steven and Jeffrey Sachs. 1998b. "The East Asian Financial Crisis: Diagnosis, Remedies, Prospects." *Harvard Institute for International Development*.

Radelet, Steven and Jeffrey Sachs. 1999. "What Have We Learned, So Far, From the Asian Financial Crisis?"

Soesastro, Hadi. 1999. "Current and Capital Account Liberalisation: Issues Facing Indonesia." In *Vietnam and the East Asian Crisis*, edited by Suiwah Leung. Northampton, MA: Edward Elgar Publishing.

Sundararajan, Vasudevan and Tomas Balino, (Eds.). 1991. *Banking Crises: Cases and Issues*. Washington: International Monetary Fund.

Woo, Wing Thye, Bruce Glassburner and Anwar Nasution. 1994. *Macroeconomic Policies, Crises, and Long-Term Growth in Indonesia, 1965-90*. The International Bank for Reconstruction and Development, The World Bank.

World Bank. 1989. *World Development Report 1989*. New York: Oxford University Press for the World Bank.

World Bank. 1998/99. *Global Economic Prospects* 1998/99.

AMOD KUMAR AGARWALA*

Home Bias in US Portfolios

Abstract

Home bias, the ownership of disproportionately more home-country financial instruments than justified by CAPM, is one of the most enigmatic phenomena in Financial Economics. Inexplicability on grounds of hedging various risks and strong indications of financial market integration across national boundaries, lends intrigue to this phenomenon. Lack of power in statistical tests of market integration hypotheses to verify home bias makes the problem worse.

We empirically examine the hypothesis that high international correlations in bear markets, specifically between US and EAFE, make diversification as dictated by Markowitz theory ineffective and hence could be a possible reason for home bias. The findings indicate that correlations do not shoot up during bear markets.

We report a new finding regarding the returns of the US and EAFE indices during periods of bear markets that can potentially explain the phenomenon in conjunction with prospect theory. Specifically, we find that the variance and returns of the US index are higher than those of EAFE index during bear markets i.e. the US market outperforms EAFE during bear periods. The Markowitz frontier flips over so that a 100 per cent US assets portfolio is at the upper tip of the efficient part of the frontier while the 100 per cent EAFE is at the lower inefficient end. The observed US portfolios are efficient during bear periods. Moreover, with only small foreign equity holdings, the portfolios become risk-seeking during bear periods. In a demonstration of Kahneman and Tversky's idea of overweighting uncertainty, the US investors overweight both the smaller probability of market crashes and the smaller probability of smaller losses from a domestic portfolio. Hence, they overweight domestic stocks to the extent of being on the tip of the efficient frontier during the bear period, thus minimizing shorter-term losses rather than maximizing longer-term gains by diversifying.

1. Introduction

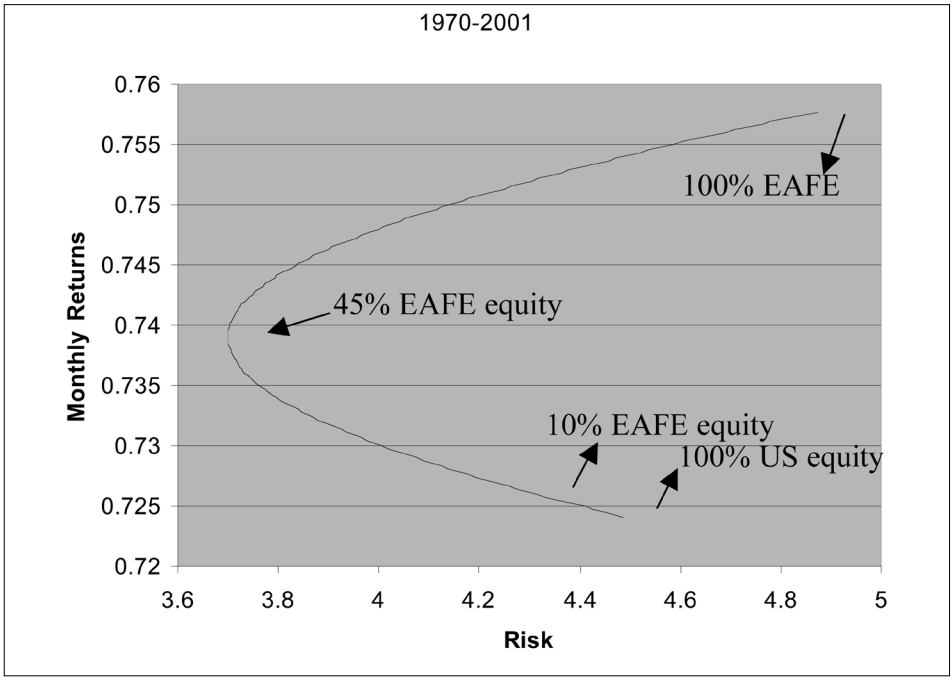
Finance literature has shown extensively that US investors, both individually and institutionally, underweight foreign assets in their portfolio, contrary to the predictions of the standard portfolio diversification theory. To understand the nature of this home bias refer to Figure 1, which plots the annual return of a portfolio with varying compositions of EAFE[1] and US indices. EAFE is

* I would like to thank Chandrasekhar Krishnamurti of Nanyang Business School (NBS) for guidance in preparation of the final draft and Robin Grieves, formerly Senior Fellow at NBS, for introducing me to the home bias puzzle.

[1] Europe Australia and Far East

a reasonable representative of the developed world's capital markets extraneous to the United States because of the extensiveness of its coverage and has been used extensively in finance literature in the past. Mean annual returns on the EAFE and US indices[2] over the last 3 decades have been 12.12 and 11.14 respectively, while the standard deviations have been 16.85 and 15.07 respectively. The correlations between the EAFE and US indices over the last 30 years has been approximately 0.52. This low correlation is the source of the gains from international diversification. The Markowitz mean-variance efficient portfolio starts from about 45 per cent[3] of wealth invested in the EAFE index and the remaining in the US index. Any fraction less than 0.45 invested in EAFE will clearly make the portfolio composition inefficient. The fraction of wealth invested in EAFE stocks for both the individual and institutional US investor was found to be just 4 per cent in 1987 and has grown to about 10 per cent[4] in 1996. This fraction is still far too small to be easily justifiable. By implication, US investors do not hedge their risks across countries very well. Researchers in other countries [see, for example, Kang and Stulz

Figure 1. – EX-POST MARKOWITZ PORTFOLIO FRONTIER FOR US INVESTORS FOR THE LAST THREE DECADES



[2] The indices used are Morgan Stanley Capital Indices, which are weighted by market capitalization and are widely used academically. The EAFE index is also in US Dollar value.

[3] Using the S&P 500 instead of the MSCI US index results in an optimal weight of 39% for EAFE equity as reported in some finance literature including Lewis (1999).

[4] Tesar and Werner (1998), Bohn & Tesar (1996) and French & Poterba (1991)

(1997)] have observed similar home bias. Though the phenomenon has been observed even for debt capital markets, this paper considers equity home bias only for the purpose of concise and focused exposition.

In this paper, we examine the hypothesis that international correlations become very high during bear markets. High correlations would have significant impact on portfolio allocation, as it could mean that international diversification would not be very helpful during bear markets. My findings negate the hypothesis of high correlations. we then go on to demonstrate that the variance and returns of the US index are higher than those of EAFE index during bear markets i.e. the US market outperforms EAFE during bear markets with greater volatility. Hence, during bear markets the Markowitz frontier flips over so that a 100 per cent US assets portfolio is at the upper tip of the efficient part of the frontier while the 100 per cent EAFE is at the lower inefficient end. The observed US portfolios are mean-variance efficient in the short bear periods, even in their apparent lack of diversification in the long term, and offer minimisation of losses during bear periods at the expense of greater returns in the long term. Using prospect theory's idea of overweighted uncertainty, we argue that the US investors first overweight the small probability of market crashes and subsequently overweight the probability of greater returns from the more volatile domestic stock during bear periods. We offer this as a possible explanation for home bias.

The home bias puzzle has remained unsolved for the better part of the last three decades. Three types of explanations based on

i. better hedging capacity of home equity against domestic risks,
ii. barriers to international diversification as in Stulz (1994) and Cooper and Kaplanis (1990) *and*
iii. statistical weakness of tests to verify home bias using CAPM as in Stulz (1994)

have been offered in the past. In Section 2, we shall briefly explore the literature on these hypotheses. In Section 3, we examine the index returns for the EAFE and US indices for their international correlations during bear markets to verify if they are higher during the volatile markets than the long term average. We examine worst days (using daily data) and the worst months (using monthly data) for the US markets and the statistics for the corresponding days on the EAFE index. My findings do not show any significantly high correlations and hence we reject this hypothesis. The significant new finding regarding the reversed returns of the US and EAFE indices during periods of bear markets is reported in Section 4 where we explain home bias using prospect theory.

2. Review of Existing Literature

2.1. International Capital Asset Pricing Model (ICAPM)

There are at least two components of the demand for foreign stocks among domestic investors. From Figure 1, it is clear that the 45 per cent EAFE portfolio is the hedge portfolio that eliminates unwarranted risk for which the market will not reward the investor and hence 45 per cent in EAFE stocks is the minimum that anyone is expected to invest. A lesser degree of risk averseness will cause an additional demand for foreign stocks and the investor shall move higher along the efficient frontier or better still, move upward along the Capital Market Line (not shown in Figure 1). This second component can be called the speculative demand. These two demands for foreign stocks can be formulated as

$$\chi^{f} = \frac{\sigma_{h}^{2} - \sigma_{hf}}{Var(r^{f} - r^{h})} + \frac{(Er^{f} - Er^{h})/\gamma}{Var(r^{f} - r^{h})} \qquad \text{Equation 1 (Lewis 1999)}$$

where χ^{f} is the fraction of wealth invested in foreign stocks, the first term on the right denotes the hedging demand while the second term denotes the speculative demand (Adler and Dumas (1983)). The term γ is a measure of risk averseness and varies from one, denoting less risk averse, to higher numbers denoting higher degree of risk averseness. Calculations show that with a risk averseness of one, χ^{f} should be 75.9 per cent and that no degree of risk averseness can justify the observed χ^{f} of a meager 10 per cent. Hence, risk averseness completely fails to explain home bias.

Under the simplest form of ICAPM,

$$E(r^{f} - r^{h}) = a\beta_{f-h} \qquad \text{Equation 2 (Lewis 1999)}$$

where r^{f}-r^{h} is the return on foreign assets (r^{f}) in excess of the return on home assets (r^{h}) and the $\beta_{f\text{-}h}$ is the ratio of the covariance between r^{f}-r^{h} and the return on the world portfolio r^{w} and the variance of r^{w}. Thus, the foreign stocks are priced according to their betas with the world portfolio. This model assumes the integration of international capital markets. Integration implies lack of barriers to diversification into foreign securities. Furthermore, this assumption requires existence of purchasing power parity across countries. Evidence from the literature on this pricing relationship is mixed. On the one hand, the precise form of this single beta relationship is rejected while on the other hand, multi-factor models that use more than one beta have been able to demonstrate better pricing relationships.

Based on ICAPM, Lewis (1999) is an excellent account of literature pointing out the failure of the hypotheses that home bias offers better hedging capacity

of home equity against domestic risks like domestic inflation and domestic untradables. Lewis (1999) also examines issues with the statistical uncertainty about home bias.

There are several intuitive explanations for home bias but there is no conclusive empirical evidence to confirm their validity or to reject them. One such belief, which is perhaps informed by the statistical uncertainty over US home bias, is that since American multinational companies (MNC), (they form a big share of the capitalization of the domestic indices) have operations worldwide, their returns capture the behaviour of foreign markets (or indices) and hence there is no need for explicit ownership of foreign equity. However, this could possibly indicate existence of higher correlations between US index of which MNCs form a significant capitalisation and the foreign index. However, this contradicts common knowledge that foreign and US indices are not strongly correlated. Jacquillat and Solnik (1978) have demonstrated that MNC stocks move quite closely with domestic indices and not foreign indices and hence argue that it is necessary to invest proportionately in foreign equity that does not follow the behaviour of the domestic MNC stocks.

Another anecdotal argument to explain home bias, that may have its foundations in fundamental finance theory, takes the form that sufficient diversification is achieved by properly selecting approximately 20–25 stocks. If there are a sufficient number of domestic companies (like MNCs) whose stocks incorporate or mimic the behaviour of foreign markets, explicit need for foreign equity is eliminated. Brewer (1984) demonstrates that fewer MNC stocks are needed to minimise portfolio risk to a given level compared to other domestic stocks. There is no conclusive literature on both of these propositions.

2.2. Barriers to International Investment

One of the critical assumptions of ICAPM is market integration across national boundaries. However, tests of this model against a null hypothesis that "pricing relationships posited by these models do not hold" are not very powerful against alternative hypotheses that there are some barriers to international investment as reported in Stulz (1994).[5] If there are some barriers to international investment such that they will cause abnormal returns, although small, from the point of view of ICAPM, empirical tests will not be able to detect these abnormal returns. Cooper and Kaplanis (1990) show that even these small abnormality in returns due to deadweight costs as small as 1 per cent are sufficient to justify the observed home bias These barriers can take the form of withholding taxes imposed by governments on the returns to investments made by foreigners in their country equities. For an investor to still be willing to take a position in the foreign assets, diversification or hedg-

[5] In other words, the problem is that these models accept two contradicting hypotheses about market integration.

ing benefits from the foreign assets should be large enough to offset the lower effective returns.

There is insufficient empirical work that quantifies the significance of any existing barriers to investment. The estimates of barriers are also imprecise. A barrier that could reduce the return on foreign securities by 200 basis points annually would be economically significant and would be sufficient to explain most of the home bias phenomenon as reported by Cooper and Kaplanis (1990). However, an asset-pricing model that fails to reject (accepts) the null hypothesis of market integration is unable reject that such significant barriers exist. The main conclusion of the empirical work on integration of markets is that when one focuses on indices across countries, much of the evidence is consistent with market integration. The problem with most empirical work is that the tests seem to have limited power in assessing the importance of barriers to international investment. Further, if home bias is the outcome of investors' optimization, existing tests of international asset pricing models even with multiple betas do not have sufficient power to provide support for this view. Obstfeld and Rogoff (2000) propose a hypothesis that explains home bias with certain threshold trade costs that they believe would negate gains from international diversification. Empirical work is needed to verify the hypothesis. One must be mindful that most literature covers barriers within the developed world. There is a lot of anecdotal evidence about barriers to foreign investment in the economies of the developing world, but that is not a focus of this paper, which seeks to explain home bias within the developed world.

3. High Correlations in Bear Markets[6]

Longin and Solnik (2001) reports a widely held belief that bear markets exhibit high international correlations. If true, this could provide a possible answer to the home bias puzzle. If bear markets were indeed highly correlated internationally, then the optimal portfolio weight for EAFE equity would reduce from the present optimal value of 45 per cent and could be much closer to the observed 10 per cent. In such a scenario, it could be argued that investors may not really have the incentive to diversify since diversifications fails when it is needed most i.e. during bear times. To verify this proposition, analysis of the US and EAFE indices was carried out in three ways as follows.

In the first exercise, using monthly data, 50 months were identified during which the MSCI US index had the worst returns during the last 3 decades. Correlations were computed for the US returns and the corresponding EAFE index returns for those 50 months. Contrary to expectation, this correlation was found to be the same 0.52 as for the entire 3-decade period. However, when the mean-efficient frontier was plotted for these months, the optimal EAFE weight was found to be a significantly reduced 25 per cent only. This

[6] See Appendix A for figures.

was caused by a significant drop in the US variance from ~20 per cent for the 1970-2001 period to ~10 per cent for the worst 50 months and the rise in EAFE variance from ~24 per cent to ~30 per cent which caused a drop in covariance from 11.27 per cent to 8.55 per cent. Similar analysis was performed for the worst US 20 months and the correlation was again found to be 0.52. The optimal portfolio weight this time was a still lower 23 per cent. It is clear that the dip in covariance in the returns for the US and the EAFE indices is not enough to justify the small 10 per cent weight for EAFE observed in practice. In the second exercise, similar analysis was performed on the daily returns of the worst 100 days for the US index in the last 5 years and the worst 50 days. Again, the deviation from the long-term optimal portfolio was found to be very small. For the worst 100 days, the optimal portfolio was found to have 43 per cent EAFE stocks and the worst 50 days portfolio was found to have 50 per cent EAFE stocks. This again, does not corroborate the hypothesis that diversification fails in bear markets.

A third attempt was made to analyse the correlations during bear markets: this time a continuous period of poor returns rather than pick poor return days from the entire 5 year period (see Appendix B for a graph of the indices). For instance, the period from 2 August to 26 September 2001, during which the MSCI US tumbled 202 points or 17 per cent from 1160 to 958 and the EAFE index fell by 17 per cent from 1271 to 1051, was examined. As listed in Table 1, the correlation for daily returns was found to be 0.46 only and the optimal portfolio weight was again found to be 55 per cent EAFE. Extending the period till 5th December during which the US index recovered to 1107, the optimal portfolio weight was again found to be the same 56 per cent for EAFE. The correlations for other bear periods are listed in Table 1 and no period is observed to exhibit high correlations.

Table 1. – DAILY RETURN STATISTICS FOR THE EAFE AND US MSCI INDICES DURING BEAR PERIODS

	EAFE Mean Daily Return (%)	US Mean Daily Return (%)	EAFE Variance	US Variance	Daily Return Correlation	Index Correlation
Bear Period						
20 July to 5 Oct 1998	-0.477802364	-0.297083521	2.330020248	3.785836964	0.371389922	0.838054
20 July to 27 Nov 1998	-0.037088676	0.030187456	2.559901897	2.809248326	0.376185977	0.84485
4 Sept to 18 Oct 2000	-0.416522408	-0.396638431	0.509158419	1.224812611	0.340516844	0.905031
4 Sept to 7 Nov 2000	-0.154073921	-0.12279455	0.720853594	1.459177599	0.475106368	0.913617
1 Feb to 4 April 2001	-0.331859227	-0.461338064	2.02623747	2.421336074	0.53419977	0.979698
1 Feb to 22 May 2001	-0.098664788	-0.042964133	1.537784104	2.49294886	0.563014806	0.944755
2 Aug to 26 Sept 2001	-0.418916552	-0.45533179	1.91842106	2.140203267	0.458629007	0.955151
2 Aug to 5 Dec 2001	-0.063306555	-0.038157332	1.577938772	1.790315864	0.490233848	0.921322

Thus, in all the three experiments, diversification never seems to have failed contrary to the claim of the popular hypothesis. However, then the intrigu-

ing question is "where did this myth originate from?" A casual glance at the graphs of the US and EAFE indices for the last five years or even the last 3 decades, tells that they are very similar and that the correlations might be very high for the index themselves. Upon calculation, the correlations for the daily index values for the last 5 years was found to be 0.83; an astounding 0.96 for 2nd August to 26th September; and 0.92 for the period from 2nd August to 5th December as shown in the last column of Table 1. However, statistically, these high correlation figures are not surprising because they are for two graphs that have either growth or decline in them. The statistical significance of these figures is not much and they can be misleading as in the case of the hypothesis just proven incorrect. Indeed, for a proper analysis of the indices the returns have to be computed first. In the following section, we examine an interesting feature of the daily return characteristics in Table 1 that can potentially explain the home bias phenomenon.

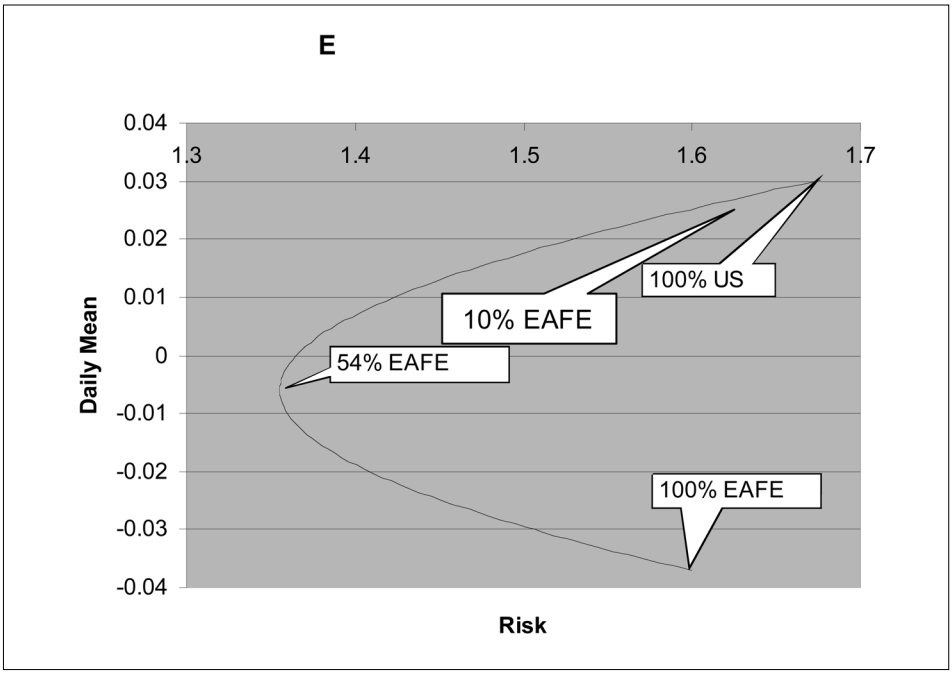
4. Reversed Returns in Bear Markets and Prospect Theory[7]

A casual inspection of the EAFE Mean and the US Mean columns shows that EAFE returns are actually less than the US returns contrary to the long-term performance of the two indices. There are four bear market periods shown in Table 1. For each period, first the downward portion of the cycle (period of falling index or returns) is analysed. Then the complete cycle is analysed. The 4 periods vary in duration. Out of the 8 rows shown in Table 1, only 2 rows show US returns to be less than the EAFE returns, although, the US variance (risk) is consistently greater than that of EAFE in all the 8 rows. This reversal of the returns for the US and EAFE indices in the short term during stock market crashes, is consistent with their long term behaviour because in the long turn the US index is known to be less volatile than EAFE and thus should show better returns during periods of negative returns. This observation can be captured in the statement that the mean-risk parabola for a portfolio of US and EAFE stocks is actually inverted for the bear market periods with the 100 per cent US portfolio lying at the tip of the efficient Markowitz frontier as seen in Figure 2.

The reverted behaviour of the portfolio during bear markets is a likely reason for the home bias phenomenon. Clearly, we can observe that diversification into worldwide stocks has negative impact on portfolio returns during stock-market crashes because US indices exhibit better returns during bear periods. Moreover, portfolios with only 10 per cent EAFE holdings exhibit a higher degree of risk appetite during the bear market than portfolios that with greater EAFE holdings. Hence, even though US portfolios are on the inefficient part of the Markowitz frontier in the long run, the same portfolios are close to the upper extreme of the efficient frontier during the bear markets. This

[7] see Appendix B for figures

Figure 2. – EX-POST MARKOWITZ PORTFOLIO FRONTIER FOR US INVESTORS FOR A BEAR PERIOD (20 JULY TO 27 NOVEMBER, 1998)



implies that US investors prefer to maximize returns (minimize losses) when the markets are low even if they have to forfeit longer-term gains.

The obvious question is why do investors make their portfolio allocation decisions according prospective losses during a bear period rather than according to prospective long-term gains. The theory of rational expectations cannot explain this search for better returns observed in the US markets during stock market crashes even at the expense of longer term gains. However, prospect theory in behavioural finance can help us "rationalize" this observation. Specifically, the phenomenon of overweighting uncertainty is of immediate consequence to us. First, by giving more weight to possible crashes in portfolio allocation, the investors have overweighted the smaller probability of market crashes. Subsequently, by choosing to be on the tip of the Markowitz frontier during a crash, the investors have again overweighted the smaller probability (greater variance and hence greater uncertainty) of smaller losses. Looked at in another way, on the one hand the investors are far more frightened of the possible losses during crashes than they are attracted by potential long-term gains; on the other hand, they are risk seeking once a market crash happens. Kahneman and Tversky (1979) has shown that in such complex settings individuals consistently fail to make choices according to rational expectations and exhibit subcertainty and subadditivity in their probability-weighting schedule.

Appendix C exhibits the bear period characteristics in EAFE local currency terms as calculated by MSCI. It is again observed that the US returns have greater variance and a greater mean than EAFE. Thus, we have offered a new explanation for the home bias puzzle which says that the possible short term losses from international diversification during bear markets make the investors avoid international diversification and thus forsake the likely gains in the long term from the same international diversification.

5. Conclusions

Much finance and macroeconomic literature has been devoted to the investigation of the home bias puzzle. Explanations based on better hedging capacity of domestic inflation and domestic untradables have been offered but empirical results have rejected them and in fact sometimes offered foreign securities as a better hedge, worsening the problem. Some have argued that CAPM is not very robust in pricing securities in integrated markets and any estimation of home bias using CAPM is flawed. More importantly, it has been demonstrated that the returns and risks of the US and EAFE indices are not statistically different for US investors and hence efforts to form efficient portfolios may not always be well informed. It has also been argued that US markets span foreign-country mutual funds and hence can be a cause of the home bias. The problem with these explanations is that they are not general and are empirically untenable for other countries like those of G5. Some arguments have been based on the lack of power of tests based on CAPM to reject contradicting null hypotheses about market integration. Such tests cannot reject both the market integration hypothesis as well as the hypothesis that economically significant barriers to integration exist. Thus, home bias has remained unsolved in general for the last 3 decades.

This paper explored the hypothesis that diversification fails in bear markets as popularly believed and hence could cause Home Bias. Three experiments were conducted on the Morgan Stanley Capital Indices for the US and EAFE markets. Correlations between the returns for the worst US months and days and corresponding EAFE returns were calculated but were found to be in the proximity of 0.5 which is also the historically observed long term value for the US and EAFE index. Thus, no significant reduction in weight for the optimal EAFE fraction of the US portfolio was found. Particularly, bear periods of continuous diminishing returns were also examined but the correlations remained approximately 0.5. Thus, we have cast doubt on the proposition that international bear markets have high correlations. However, it was also discovered that the US and EAFE indices themselves are highly correlated and in the particular bear period, they had a near perfect correlation of 0.96. However, statistical analysis shows that these high correlations are not of much significance the growth/decline in the indices has to be broken down to returns and then analysed.

This paper reports that the US market outperforms EAFE during bear market periods. All the four specific periods analysed over the last 5 years showed lesser EAFE returns over the complete cycle. This could be the possible cause for the home bias phenomenon, as US investors prefer to avoid large short term losses during bear periods than diversify for long-term gains. The empirical causal link between this dismissal of home bias in the short term and the motivations behind the choice of portfolio by the investors can be established using prospect theory's idea of overweighting uncertainty. We have argued that the US investors first overweight the smaller probability of market crashes and subsequently overweight the smaller probability of greater returns from the more volatile domestic stock during bear periods. To make our findings more robust, further analysis must be done of more bear periods from the longer past than the 5 years examined here. Thus, we have offered a possible explanation for the long-standing home bias phenomenon.

REFERENCES

Adler, M. and Dumas, B. 1983. International portfolio choice and corporate finance: a synthesis. *Journal of Finance* 38(3), 925-84.

Baxter, M. and Jermann, U. 1997. The international diversification puzzle is worse than you think. *American Economic Review* 87(1), 170-80.

Bekaert, G. and Urias, M. 1996. Diversification, integration, and emerging market closed-end funds. *Journal of Finance* 51(3), 835-69.

Bohn, H. and Tesar, L. 1996. US equity investment in foreign markets: portfolio rebalancing or return chasing? *American Economic Review* 86(2), 77-81.

Brewer, H. 1984. Diversify internationally through multinational portfolios. *Journal of the Institute of Certified Financial Planners*, 209-19.

Cooper, I. and Kaplanis, E. 1990. *What explains the home bias in portfolio investment?* Unpublished Working Paper, London Business School.

Ferson, W. and Harvey, C. 1993. The risk and predictability of international equity returns. *Review of Financial Studies* 6(3), 527-66.

French, K. and Poterba, J. 1991. International diversification and international equity markets. *American Economic Review* 81(2), 222-26.

Harvey, C. 1991. The world price of covariance risk. *Journal of Finance* 46(1), 111-57.

Jacquillat, B. and Solnik, B. 1978. Multinationals are Poor Tools for Diversification. *Journal of Portfolio Management* 4(2).

Kahneman, D. and Tversky, A. 1979. Prospect theory: An analysis of decision under risk. *Econometrica* 47(2), 263-292.

Kang, J. and Stulz, R. 1997. Why is there home bias? An analysis of foreign portfolio equity ownership in Japan. *Journal of Financial Economics* 46(1), 3-28.

Lewis, K. 1999. Explaining home bias in equities and consumption. *Journal of Economic Literature* 37(2), 571-608.

Longin, F. and Solnik, B. 2001. Extreme correlation of international equity markets. *Journal of Finance* 56(2), 649-676.

Obstfeld, M. and Rogoff, K. 2000. *The six major puzzles in international economics: is there a common cause*? NBER Working Paper 7777.

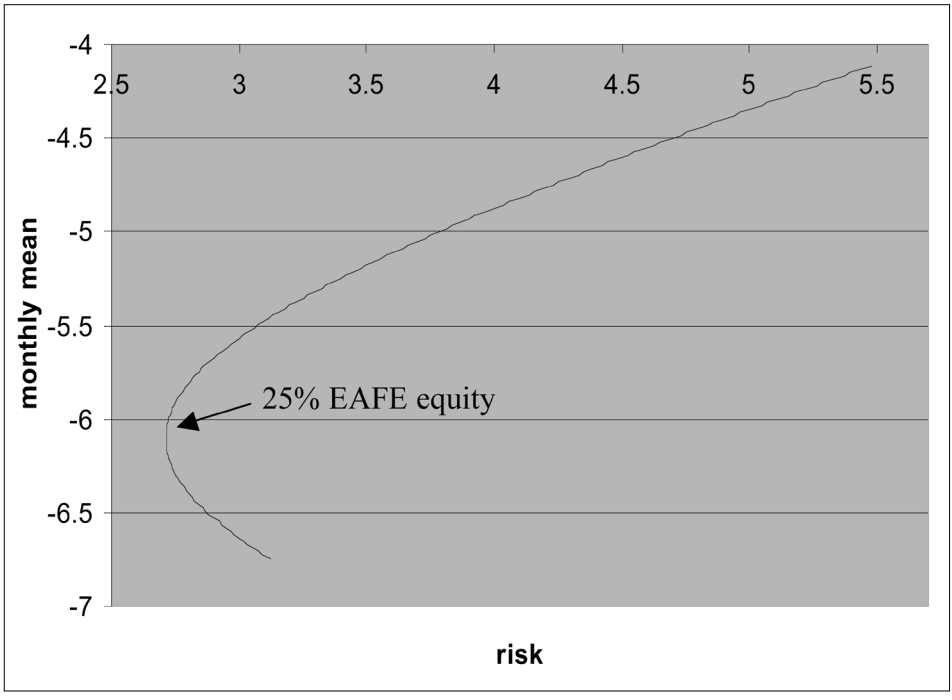
Stulz, R. 1994. *International Portfolio Choice and Asset Pricing: An Integrative Survey*. NBER Working Paper No. 4645.

Tesar, L. and Werner, I. 1998. The internationalization of securities markets since the 1987 cash. In *Brookings Wharton papers on Financial Services*. R. Litan and Santomero (Eds.) Washington: The Brookings Institution.

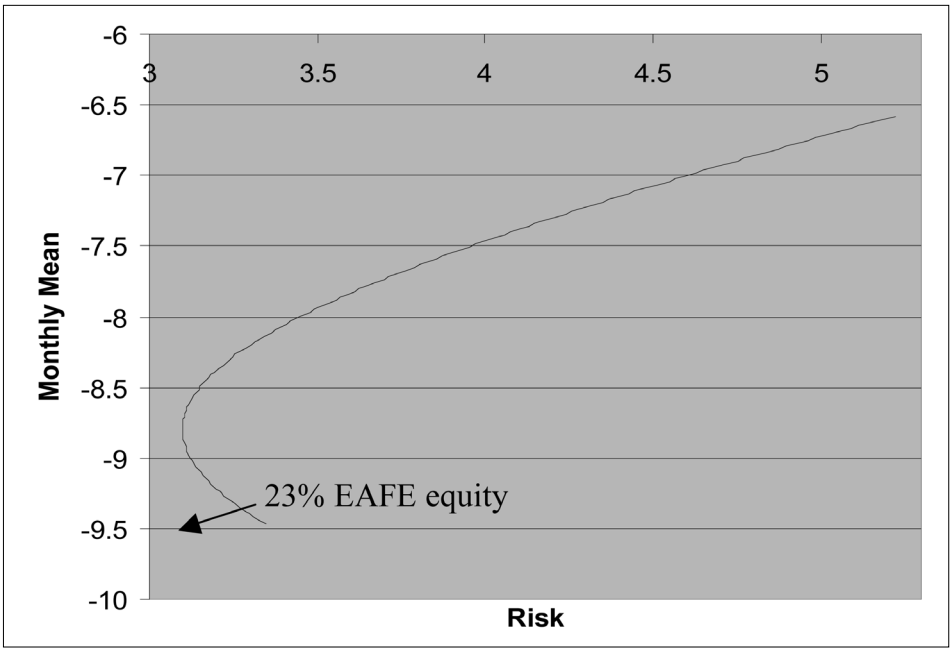
www.msci.com

Appendix A: Markowitz Portfolio Frontiers

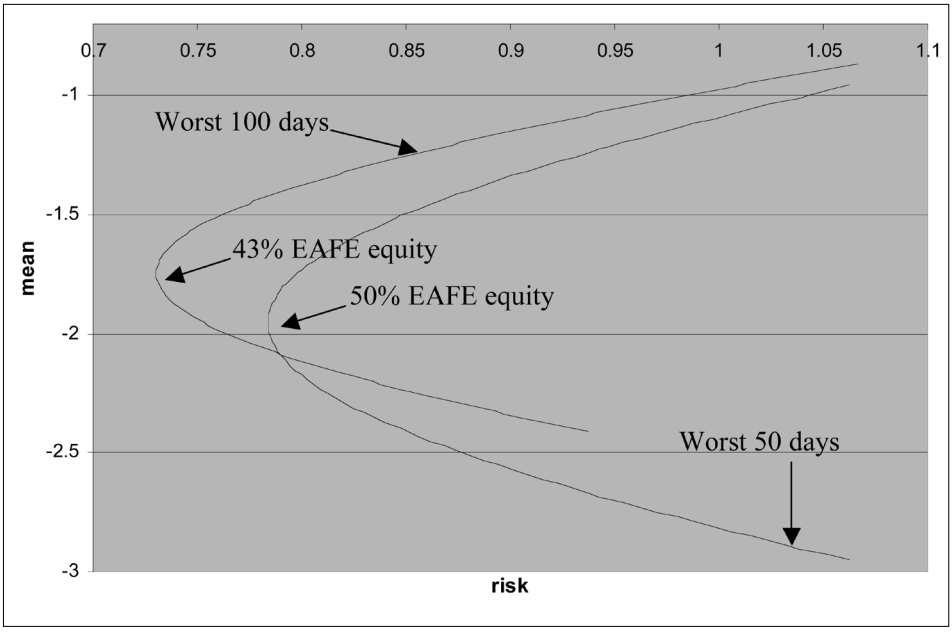
Panel A: worst 50 months for US index



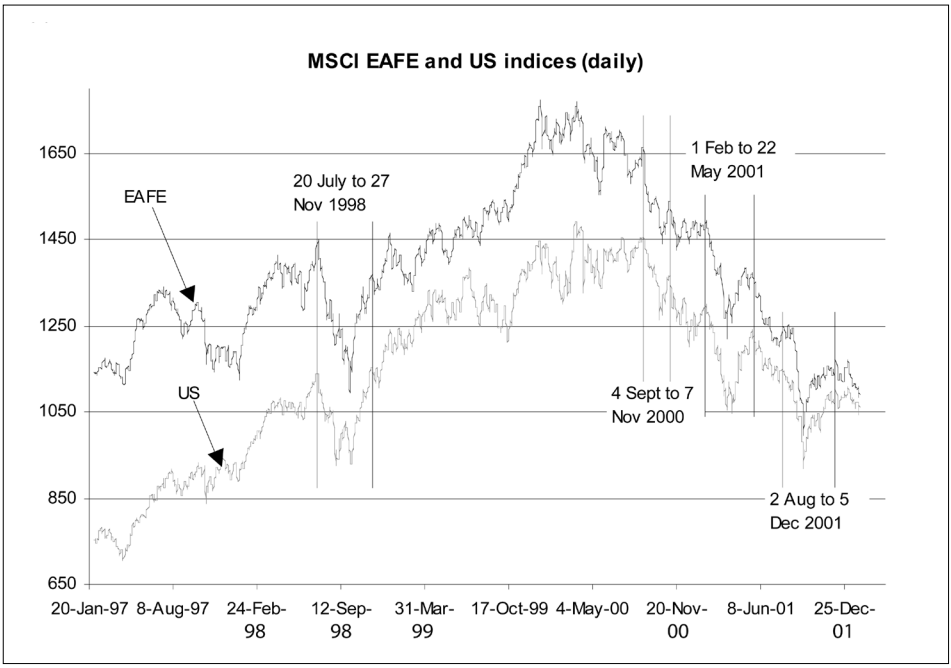
Panel B: worst 20 months for US index



Panel C: worst 100 and 50 days for US index

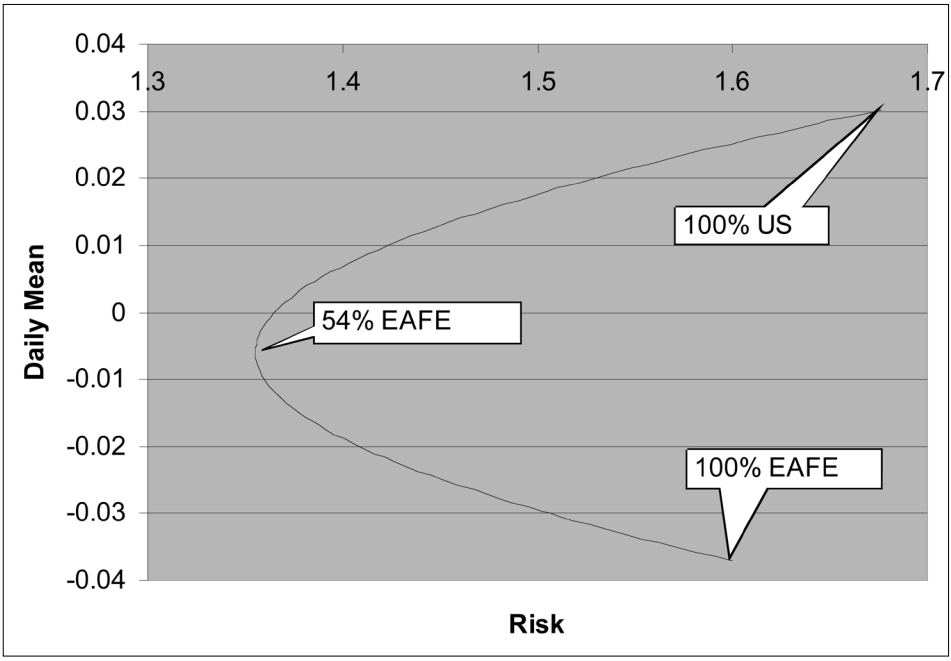


Appendix B: Inverted Markowitz Frontiers for Bear Periods

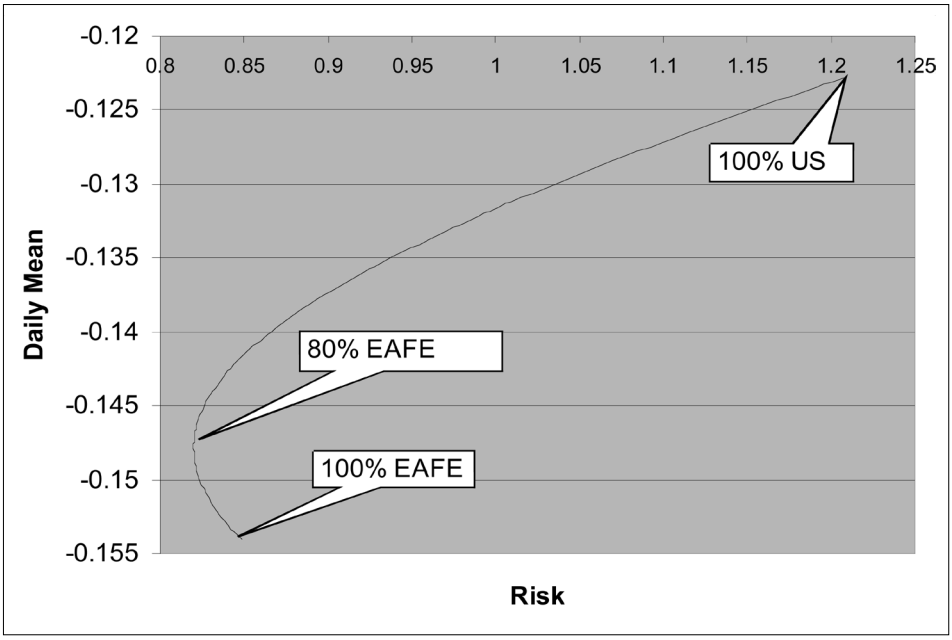


Continuous bear periods that were examined

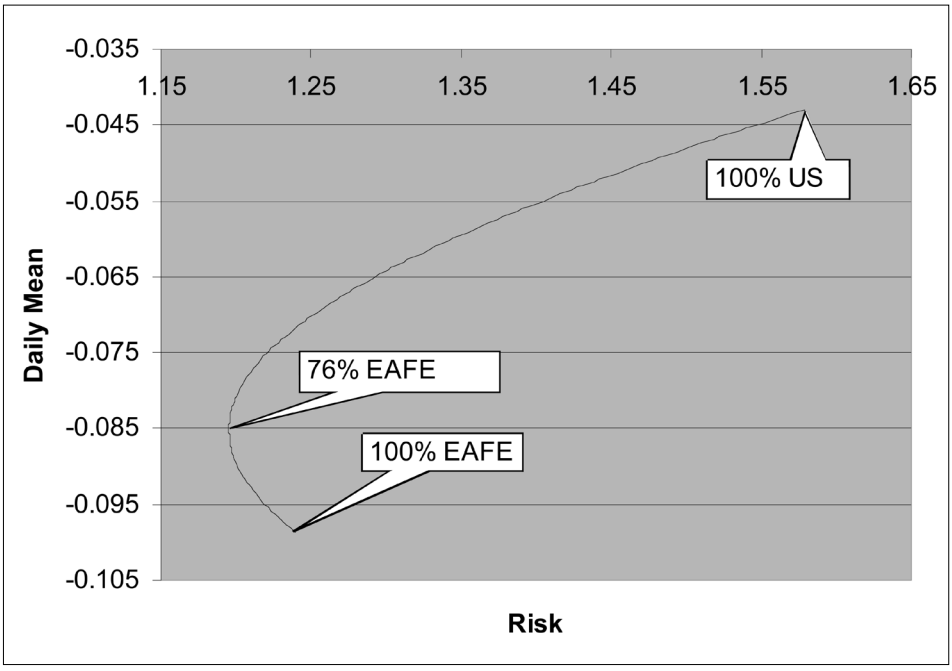
Panel A: frontier for 20 July to 27 November, 1998



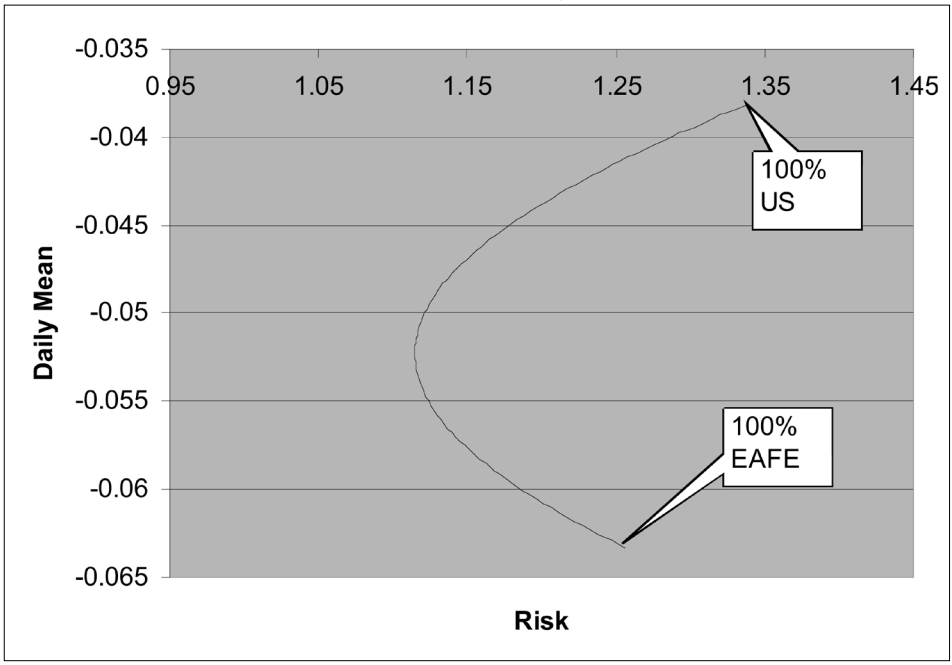
Panel B: frontier for 4 Sept 2000 to 7 Nov, 2000



Panel C: frontier for 1 Feb 2001 to 22 May, 2001



Panel D: frontier for 2nd August to 5 December, 2001

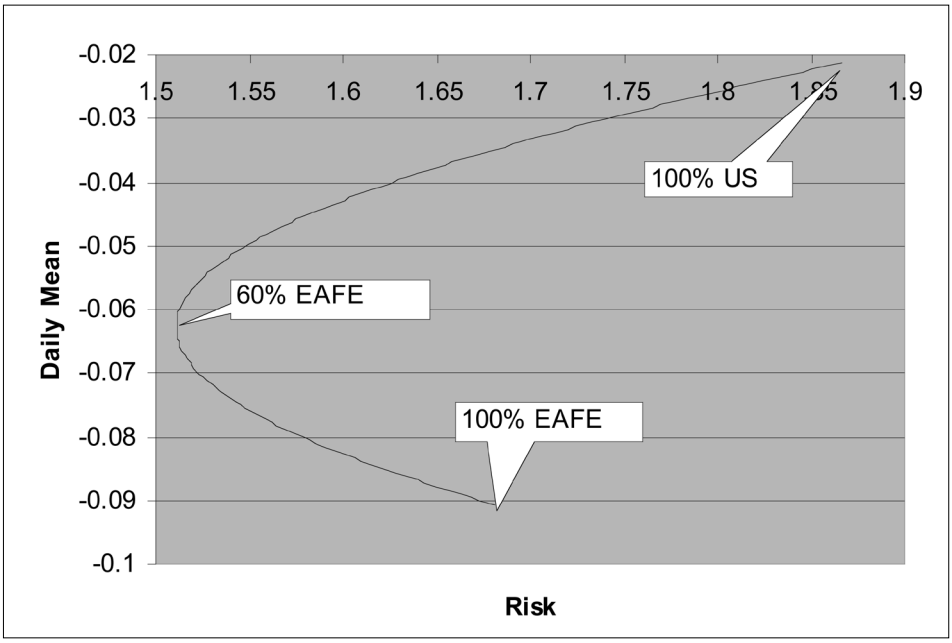


Appendix C: Results computed in EAFE's Local Currency

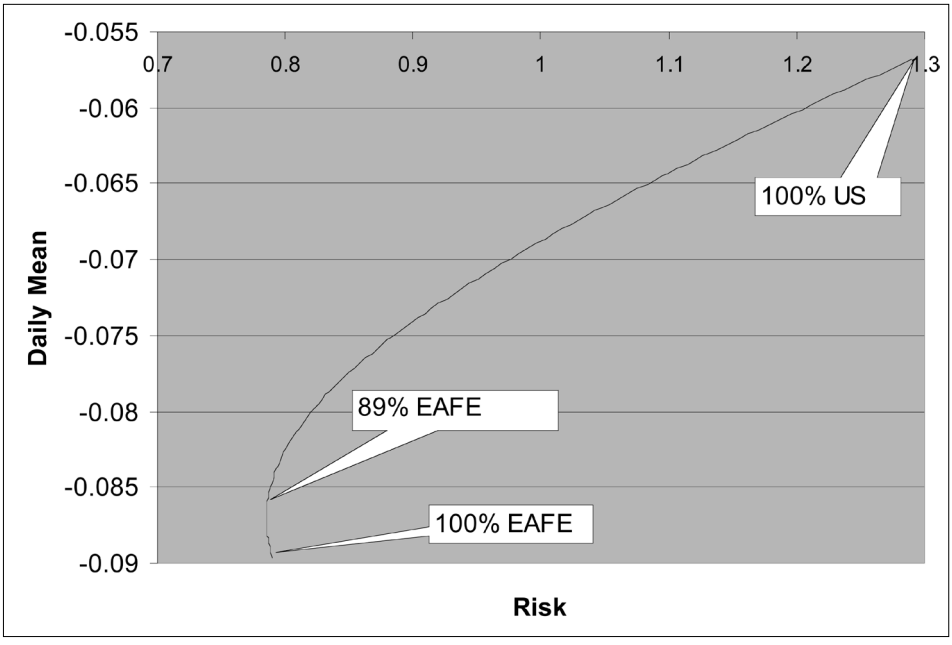
Table 2. – BEAR MARKET STATISTICS FOR THE EAFE AND US MSCI INDICES

Period	EAFE Mean	US Mean	EAFE Variance	US Variance	Correlation
20 July to 5 October 1998	-0.576978609	-0.39472747	2.662915034	4.442567564	0.468422197
20 July to 27 Nov 1998	-0.090662132	-0.021294405	2.824898161	3.484490569	0.475673401
4 Sept to 18 Oct 2000	-0.308470234	-0.28770018	0.547435813	1.442063635	0.444669358
4 Sept to 7 Nov 2000	-0.089590148	-0.056840767	0.623986979	1.664003508	0.529845463
1 Feb to 4 April 2001	-0.244609748	-0.371114163	1.43647584	2.459792299	0.479737466
1 Feb to 22 May 2001	-0.032459166	0.02558753	1.165650338	2.587642854	0.552921096
2 Aug to 26 Sept 2001	-0.520158749	-0.556218562	2.086203095	2.380316783	0.509629432
2 Aug 2001 to 5 Dec 2001	-0.066787917	-0.041030265	1.97198219	2.309333972	0.600349631

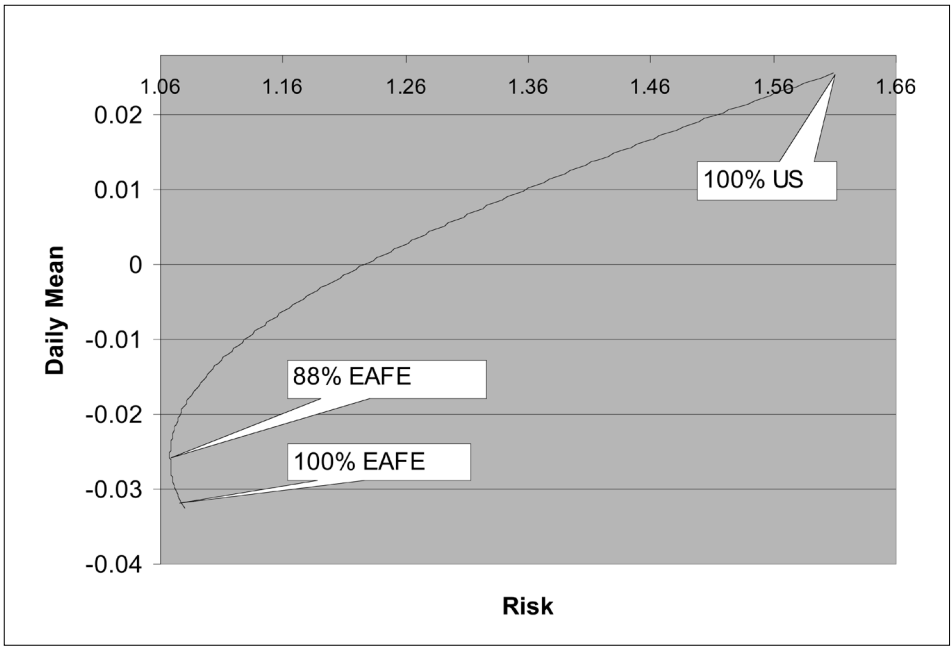
Panel A: 20 July to 27 November, 1998



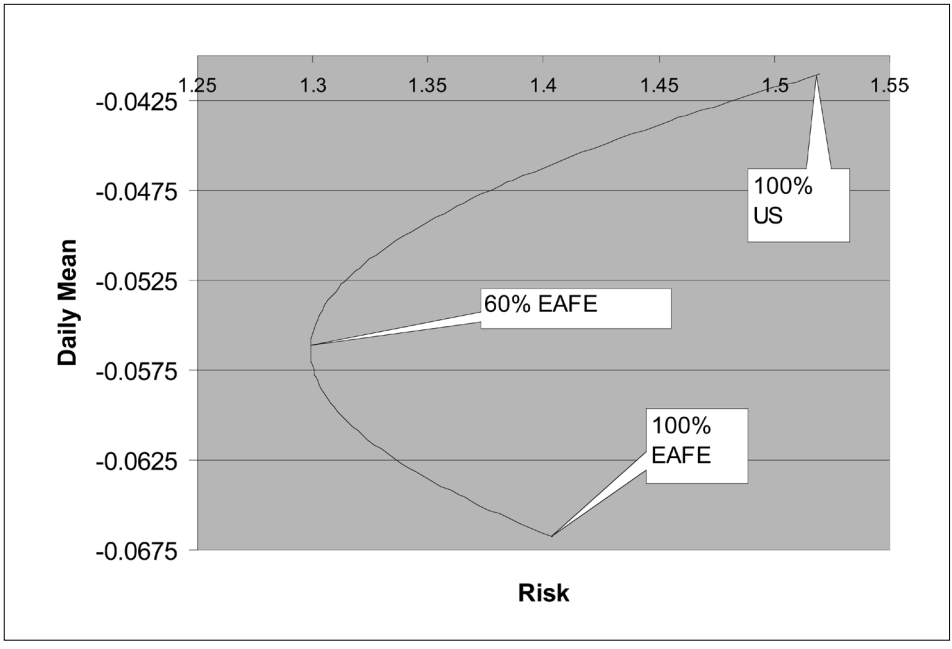
Panel B: 4 Sept 2000 to 7 Nov, 2000



Panel C: 1 Feb 2001 to 22 May, 2001



Panel D: 2 nd August to 5 December, 2001



JOHN M. SEQUEIRA
ASJEET S. LAMBA

Efficient Estimation of Volatility Relationships between International Equity Markets*

Abstract

In this paper, we investigate return volatility relationships among the five largest developed equity markets of the US, the UK, France, Germany and Japan, and four selected emerging Asian markets of Taiwan, South Korea, Thailand and India. Using daily returns, we use an alternative approach to estimating the transmission of return volatility across these equity markets. Specifically, we analyse the interactions among these markets as a volatility system of seemingly unrelated regressions where we first estimate separate GARCH(1,1)–M processes for each market as well as the conditional variances of their co-integrating relationship. This method overcomes the problems associated with MGARCH models that have been used in the past. Our empirical results show that the US market is the most influential and is the major transmitter of volatility to markets in the UK, Germany, Japan, South Korea, Thailand and India. We also find a two-way, bilateral volatility relationship between the French and German markets. Among the developed markets, the UK and Japan do not have a significant influence on the return volatility in other markets. Examining the emerging markets in isolation of the developed markets, we find that the South Korean market is the dominant market. This dominance, however, diminishes when we include the developed markets into the volatility system. We do not find significant linkages among the return volatilities in the emerging markets themselves and find that volatility transmissions to emerging markets originate from the major developed markets.

1. Introduction

International financial market integration and volatility spillovers between equity markets have been an area of research that has generated much interest among practitioners and academic researchers. Evidence of this can be seen following the October 1987 crash, which appeared to have a common effect among many international equity markets. The recent episode of the Asian financial crisis during 1997–98 further highlights the significance of these studies. Roll (1989) and Jeon and Chiang (1991) suggest that the free flow of information and capital, facilitated by increased market deregulation, and the improvement in electronic coordination across national stock markets have led to markets becoming more interdependent. Numerous studies have examined stock market interdependencies with substantial attention focused

* Funding for this study was provided under the International Collaborative Research Grant scheme of the University of Melbourne, and is gratefully acknowledged. The standard disclaimer applies.

on the international transmission of stock return movements and their volatility, particularly between the US, UK and Japanese markets.[1] Overall, the evidence from these studies can be summarised as follows: (1) market return volatility is time-varying; (2) when volatility is high, price changes in major stock markets tend to become highly correlated; (3) correlations in volatility and price changes appear to be transmitted mainly from the US to other markets; and (4) lagged price spillovers and lagged volatility spillovers are found between major stock markets.[2]

Although there has been considerable research examining volatility transmission among markets, most studies focus on the major developed markets, particularly the US, UK and Japan. Much less attention has been paid to emerging markets in the Asian region and their inter-relationships with developed markets. Moreover, these studies typically utilise unilateral information flows from one market to another. For example, Hamao, et al (1990) employ univariate Generalised Autoregressive Conditional Heteroskedasticity (GARCH) models to examine return and volatility interdependencies among markets in the US, UK and Japan. They find that over their sample period, which includes the October 1987 crash, each market is affected by volatility shocks in the two previously open foreign markets, except for Japan, which does not significantly influence the US. They also find that Japan is most influenced by volatility spillovers from foreign markets, while the US and UK are only moderately affected by spillovers from foreign markets. In contrast, Koutmos and Booth (1995) report that the volatility spillovers between the US and Japan are significant in both directions during the post-October 1987 crash period.

Some studies that look beyond unilateral flows include Eun and Shim (1989), Janakiramanan and Lamba (1998), King and Wadhwani (1990), Theodossiou and Lee (1993) and Koutmos and Booth (1995). For example, Eun and Shim (1989) use a nine-market vector autoregression (VAR) model to investigate the international transmission mechanism of stock market movements. They find that during 1980–85 innovations in the US market are rapidly transmitted to the rest of the world, although shocks in other markets do not have much effect on the US market. Janakiramanan and Lamba (1998) also use the VAR model and study the dynamic relationships between Pacific-Basin markets and the US during 1988–96. By measuring the overall importance of an individual market in generating variations in its own returns and in other markets' returns, they find evidence that the US market greatly influences

[1] See, for example, Bennett and Kelleher (1988), Eun and Shim (1989), von Furstenberg and Jeon (1990), Hamao, Masulis and Ng (1990), King and Wadhwani (1990), Schwert (1990), Susmel and Engle (1990), Neumark, Tinsley and Tosini (1991), and Becker, Finnerty and Tucker (1992), among others.

[2] Lagged spillovers refer to correlations between the foreign daytime return volatility and the subsequent domestic daytime return volatility, without including any overlapping trading hours.

other markets, but that the influence has diminished over recent years. In addition, they find that markets that are geographically and economically closer to each other exert significant influence over one another.

King and Wadhwani (1990) examine the intra-day transmission of market volatility among markets in the US, UK and Japan. Based on the notion that rational traders in one country should use price movements in another country to infer changes in underlying economic fundamentals, they develop a "contagion" model for international volatility transmission around the October 1987 crash. They find significant volatility spillovers between the US and UK markets. They also highlight the observation that weak evidence for contagion in normal times does not prevent contagion from being significant in times of greater volatility. Theodossiou and Lee (1993) employ a multivariate GARCH-in-Mean (GARCH-M) model, and find that the US market is the major transmitter of volatility to markets in Japan, UK, Canada and Germany.[3] Koutmos and Booth (1995), use a multivariate EGARCH model to study price and volatility transmissions across the US, UK and Japan and find that the interaction among these markets has increased substantially in the post-October 1987 crash period.[4]

Unlike these studies that estimate multivariate GARCH processes, we simplify the estimation method and analysis by first estimating a univariate GARCH-M process for each market's return volatility. We then propose an alternative empirical model to analyse the volatility transmission among daily market returns. Specifically, we analyse the interaction between market returns as a volatility system, which comprises a system of individual conditional variances for each individual market. Our model also includes the conditional volatility of an error-correcting process for the long-run relationship between each market's returns.

Our analysis focuses on the five largest developed markets of the US, the UK, France, Germany and Japan, and their influence on four selected emerging markets in the Asian region, which are Taiwan, South Korea, Thailand and India. We chose these emerging markets because they have been somewhat neglected by previous researchers and because they are in different stages of their development. Previous research suggests that emerging markets are typically much smaller, less liquid, and more volatile than developed markets. This research has found three market return characteristics: high average returns, high return volatility and low correlations both across emerging

---

[3] Engle, Lilien and Robins (1987) proposed the Autoregressive Conditional Heteroskedasticity in Mean (ARCH-M) model, which extends the ARCH model by allowing the conditional mean to be a function of the conditional variance. Hence, the risk of an asset can be equated to its variance while allowing its expected return in equilibrium to depend upon this risk.

[4] Nelson (1991) developed the EGARCH model which allows an examination of asymmetric volatility transmission where negative returns predict higher volatility than positive returns of the same magnitude.

markets and with developed markets (Bekaert, et al, 1997). The focus of our paper is to apply our proposed model to examine the transmission of market volatility among selected developed markets, among selected emerging markets and across these markets.

The remainder of this paper is organised as follows. Section 2 describes the data used and provides some summary statistics on the data. Section 3 outlines the volatility systems estimated and Section 4 presents and discusses the empirical results. Section 5 concludes the paper.

2. Data and Summary Statistics

Table 1 provides information on the five developed and four emerging markets analysed. For each market, we obtained daily opening and closing index values over the period from February 19, 1992 to November 30, 2000, measured in local currency terms, from Datastream.[5] Daily market returns are computed as follows:

$$r_t^j = ln\left(\frac{PC_t^j}{PO_t^j}\right), \tag{1}$$

where PO_t^j and PC_t^j are market j's open and close index values on day t, respectively.[6]

Table 2 presents some summary statistics for the stock index returns analysed. Among the developed markets, the US market experienced the highest mean daily return, while Germany's market registered the lowest daily mean return. Japan's returns are the most volatile among developed markets, followed by France and Germany. The mean daily returns in the four emerging markets are all negative over the entire sample period and are characterised by high volatility. The Asian financial crisis during 1997-98 is the likely cause of the negative and highly volatile returns observed. The returns in all markets are highly leptokurtic with Jarque-Bera (JB) statistics rejecting normality in all return series. As Engle (1982) and Bollerslev (1986) pointed out, excess kurtosis may

[5] Market indices in local currency terms have also been used by Eun and Shim (1989), Theodossiou and Lee (1993), and Koutmos and Booth (1995). Karolyi (1995) uses indices denominated in both local currencies and US dollars.

[6] When observations are not available in one market due to non-trading days or holidays, observations on all markets corresponding to the date are not used, resulting in a total sample size of 1540 observations. The index data are not adjusted for dividend payments, which is consistent with French, Schwert and Stambaugh (1987) and Poon and Taylor (1992) who provide evidence that adjustments for dividends do not have a significant effect on the empirical results.

be due to time-varying volatility, which can be modelled as ARCH or GARCH effects. With the exception of France, Germany and Thailand, the Ljung-Box (LB) Q-statistics for all other return series are statistically significant, indicating evidence of serial correlation. Finally, the Ljung-Box Q-statistics for all squared returns are highly significant, suggesting the presence of GARCH effects.

Table 1. – INTERNATIONAL STOCK MARKET INDICES AND TRADING HOURS[a]

			Trading Hours	
Market	*Stock Exchange*	*Stock Index*	*Local Time*	Greenwich *Mean Time*
US	*New York Stock Exchange*	*S&P 500*	09:30 - 16:30	14:30 - 21:30
UK	*London Stock Exchange*	*FT-SE 100*	08:00 - 16:30	08:00 - 16:30
France	Paris Stock Exchange	CAC 40	09:00 - 17:30	08:00 - 16:30
Germany	Frankfurt Stock Exchange	DAX 30	09:00 - 20:15	08:00 - 19:15
Japan	*Tokyo Stock Exchange*	*Nikkei 225*	09:00 - 15:00	00:00 - 06:00
Taiwan	Taiwan Stock Exchange	TSE Weighted	09:00 - 12:00	01:00 - 04:00
South Korea	Korea Stock Exchange	KOSPI	09:00 - 15:00	00:00 - 06:00
Thailand	Stock Exchange of Thailand	SET	10:00 - 16:30	03:00 - 09:30
India	Bombay Stock Exchange	BSE 30 Sensitive	10:00 - 15:30	04:30 - 10:00

[a] Trading hours are as of November 2000. Except for the Taiwan Stock Exchange, which also trades on alternate Saturdays, all other stock exchanges listed trade from Monday to Friday.

3. Methodology

As Table 1 shows, the developed and emerging markets operate in different regions and time zones, resulting in different opening and closing times. Thus, we expect a shock (or innovation) occurring in the US or European markets today (day t) will be assimilated in markets in the Asian region on the following trading day (day t+1). The effects, if any, of shocks in the Asian markets will likely be assimilated in the US and European markets on the same trading day (day t).

Among the developed markets, the UK, French and German markets close before the US market, but there is a short period during which the markets are simultaneously open for trading. Due to these sequential closing times, markets closing earlier will have "same day" (day t) volatility effects on markets closing later in the day. Further, these earlier closing markets will experience day t-1 volatility effects from later closing markets. Hence, volatility in the Japanese market on day t-1 may affect the US and European markets on day t. Among the emerging markets, Taiwan closes first, followed by South Korea, Thailand, and India. Similar to developed markets, there is also a period of time over which trading in these markets overlaps.

Table 2. – SUMMARY STATISTICS FOR DAILY STOCK INDEX RETURNS DURING FEBRUARY 1992 - NOVEMBER 2000[a]

Statistics	US	UK	France	Germany	Japan	Taiwan	South Korea	Thailand	India
Mean returns (%)	0.036	-0.012	-0.013	-0.050	-0.022	-0.200	-0.083	-0.154	-0.094
Standard deviation (%)	0.950	0.872	1.043	0.982	1.349	1.471	1.711	1.730	1.523
Skewness	-0.198	-0.078	-0.207	-0.551	0.321	0.068	-0.098	-0.149	-0.144
Kurtosis	7.113	4.535	4.313	6.107	6.406	5.386	4.896	6.128	5.338
Jarque-Bera	1095.63*** (0.000)	152.80*** (0.000)	121.67*** (0.000)	697.51*** (0.000)	770.74*** (0.000)	366.48*** (0.000)	233.18*** (0.000)	633.44*** (0.000)	356.13*** (0.000)
Q_{12} (LB)	28.20***	14.08	7.21	16.65	19.58*	22.51**	35.19***	17.47	22.39**
	(0.005)	(0.296)	(0.843)	(0.163)	(0.075)	(0.032)	(0.000)	(0.133)	(0.033)
Q_{24} (LB)	44.31***	43.33**	12.47	28.59	33.17	32.16	67.25***	20.07	36.35*
	(0.007)	(0.009)	(0.974)	(0.236)	(0.101)	(0.123)	(0.000)	(0.693)	(0.051)
	189.04***	400.69***	137.44***	861.55***	197.50***	163.77***	639.45***	269.15***	665.33***
Q_{12}^2(LB)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Q_{24}^2(LB)	344.80***	789.70***	227.22***	1657.60***	246.73***	225.24***	1106.40***	299.61***	763.82***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

[a] The sample period spans February 19, 1992 to November 30, 2000 (1540 observations). Daily returns for market j is defined as,. Under the null hypothesis of normally distributed returns, the Jarque-Bera test statistic is asymptotically distributed as a $\chi 2$ with 2 degrees of freedom. ρk is the k-th order autocorrelation function. Qk(LB)[Qk2(LB)] is the Ljung-Box Q-statistic for the k-th order serial correlation for daily raw [squared] returns. Under the null hypothesis of no serial correlation, the Qk(LB) [Qk2(LB)] statistic is asymptotically distributed as a $\chi 2$ with k degrees of freedom. Asymptotic p-values are shown in parentheses.
* , ** and *** denote statistical significance at the 10 per cent, 5 per cent and 1 per cent levels, respectively.

3.1 The Full Volatility System

Based on their opening and closing times, we use the following volatility system for daily returns in the five developed markets:

$$\text{var}(r_t^{US}) = \alpha_0 + \alpha_1 \text{var}(r_{t-1}^{US}) + \alpha_2 \text{var}(r_t^{UK}) + \alpha_3 \text{var}(r_t^{FR}) + \alpha_4 \text{var}(r_t^{GM}) + \alpha_5 \text{var}(r_{t-1}^{JP}) + \alpha_6 \text{var}(z_t^{Dev}) + \varepsilon_t^{US}, \quad (2\text{-}1)$$

$$\text{var}(r_t^{UK}) = \beta_0 + \beta_1 \text{var}(r_{t-1}^{US}) + \beta_2 \text{var}(r_{t-1}^{UK}) + \beta_3 \text{var}(r_t^{FR}) + \beta_4 \text{var}(r_{t-1}^{GM}) + \beta_5 \text{var}(r_{t-1}^{JP}) + \beta_6 \text{var}(z_t^{Dev}) + \varepsilon_t^{UK}, \quad (2\text{-}2)$$

$$\text{var}(r_t^{FR}) = \theta_0 + \theta_1 \text{var}(r_{t-1}^{US}) + \theta_2 \text{var}(r_t^{UK}) + \theta_3 \text{var}(r_{t-1}^{FR}) + \theta_4 \text{var}(r_{t-1}^{GM}) + \theta_5 \text{var}(r_{t-1}^{JP}) + \theta_6 \text{var}(z_t^{Dev}) + \varepsilon_t^{FR}, \quad (2\text{-}3)$$

$$\text{var}(r_t^{GM}) = \gamma_0 + \gamma_1 \text{var}(r_{t-1}^{US}) + \gamma_2 \text{var}(r_t^{UK}) + \gamma_3 \text{var}(r_t^{FR}) + \gamma_4 \text{var}(r_{t-1}^{GM}) + \gamma_5 \text{var}(r_{t-1}^{JP}) + \gamma_6 \text{var}(z_t^{Dev}) + \varepsilon_t^{GM}, \quad (2\text{-}4)$$

$$\text{var}(r_t^{JP}) = \delta_0 + \delta_1 \text{var}(r_{t-1}^{US}) + \delta_2 \text{var}(r_{t-1}^{UK}) + \delta_3 \text{var}(r_{t-1}^{FR}) + \delta_4 \text{var}(r_{t-1}^{GM}) + \delta_5 \text{var}(r_{t-1}^{JP}) + \delta_6 \text{var}(z_t^{Dev}) + \varepsilon_t^{JP}, \quad (2\text{-}5)$$

The corresponding volatility system for the emerging Asian markets is:

$$\phi_6 \text{var}(r_{t-1}^{TW}) + \phi_7 \text{var}(r_{t-1}^{KO}) + \phi_8 \text{var}(r_{t-1}^{TH}) + \phi_9 \text{var}(r_{t-1}^{IN}) + \phi_{10} \text{var}(z_t^{Dev}) + \phi_{11} \text{var}(z_t^{Emg}) + \varepsilon_t^{TW}, \quad (2\text{-}6)$$

$$\text{var}(r_t^{KO}) = \eta_0 + \eta_1 \text{var}(r_{t-1}^{US}) + \eta_2 \text{var}(r_{t-1}^{UK}) + \eta_3 \text{var}(r_{t-1}^{FR}) + \eta_4 \text{var}(r_{t-1}^{GM}) + \eta_5 \text{var}(r_t^{JP}) + \eta_6 \text{var}(r_t^{TW}) + \eta_7 \text{var}(r_{t-1}^{KO}) + \eta_8 \text{var}(r_{t-1}^{TH}) + \eta_9 \text{var}(r_{t-1}^{IN}) + \eta_{10} \text{var}(z_t^{Dev}) + \eta_{11} \text{var}(z_t^{Emg}) + \varepsilon_t^{KO}, \quad (2\text{-}7)$$

$$\text{var}(r_t^{TH}) = \pi_0 + \pi_1 \text{var}(r_{t-1}^{US}) + \pi_2 \text{var}(r_{t-1}^{UK}) + \pi_3 \text{var}(r_{t-1}^{FR}) + \pi_4 \text{var}(r_{t-1}^{GM}) + \pi_5 \text{var}(r_t^{JP}) +$$
$$\pi_6 \text{var}(r_t^{TW}) + \pi_7 \text{var}(r_t^{KO}) + \pi_8 \text{var}(r_{t-1}^{TH}) + \pi_9 \text{var}(r_{t-1}^{IN}) +$$
$$\pi_{10} \text{var}(z_t^{Dev}) + \pi_{11} \text{var}(z_t^{Emg}) + \varepsilon_t^{TH}, \text{ and} \quad (2\text{-}8)$$

$$\text{var}(r_t^{IN}) = \varsigma_0 + \varsigma_1 \text{var}(r_{t-1}^{US}) + \varsigma_2 \text{var}(r_{t-1}^{UK}) + \varsigma_3 \text{var}(r_{t-1}^{FR}) + \varsigma_4 \text{var}(r_{t-1}^{GM}) + \varsigma_5 \text{var}(r_t^{JP}) +$$
$$\varsigma_6 \text{var}(r_t^{TW}) + \varsigma_7 \text{var}(r_t^{KO}) + \varsigma_8 \text{var}(r_t^{TH}) + \varsigma_9 \text{var}(r_{t-1}^{IN}) +$$
$$\varsigma_{10} \text{var}(z_t^{Dev}) + \varsigma_{11} \text{var}(z_t^{Emg}) + \varepsilon_t^{IN}. \quad (2\text{-}9)$$

In the above system, r_t^j is the daily return on market *j's* index on day *t*. The conditional variances of the market returns on day *t* and *t–1* are represented by $\text{var}(r_t^j)$ and $\text{var}(r_{t-1}^j)$, respectively, where *j* denotes the particular market index analysed.[7] ε_t^j is random identically and independently distributed error term, and z_t^{Dev} and z_t^{Emg} are the error-correction terms for the developed and emerging markets respectively. The conditional variances of the error-correction terms are expressed as:

$$\text{var}(z_t^{Dev}) = \text{var}(\mu^{Dev} + P_t^{US} - \lambda_1 P_t^{UK} - \lambda_2 P_t^{FR} - \lambda_3 P_t^{GM} - \lambda_4 P_t^{JP}), \text{ and} \quad (3\text{-}1)$$

$$\text{var}(z_t^{Emg}) = \text{var}(\mu^{Emg} + P_t^{KO} - \lambda_5 P_t^{TW} - \lambda_6 P_t^{TH} - \lambda_7 P_t^{IN}), \quad (3\text{-}2)$$

where μ^{Dev} and μ^{Emg} are the respective drift terms in these co-integrating regressions, and P_t^j denotes the closing index value of market *j* on day *t*. Assuming that these markets have a long-run price relationship, any divergence among these markets will tend to be corrected in the long-run via a co-integrating relationship between their index values. The importance of this mean-reverting tendency in the nine markets is captured by the two error-correction terms.

We make two main assumptions in our empirical models. First, while there exists mutual interactions among the developed markets, we assume that the emerging markets do not influence the volatility in developed markets. Second, in addition to having mutual interactions among emerging markets, we assume that the developed markets also influence the volatility in emerging markets. Thus, for the full volatility system model, only $\text{var}(z_t^{Dev})$ is included

[7] Specifically *j* is denoted as *US* for the US index, *UK* for UK index, FR for the French index, *GM* for the German index, *JP* for the Japanese index, *TW* for the Taiwan index, *KO* for the South Korean index, *TH* for the Thai index, and IN for the Indian index.

in equations (2-1) through (2-5) for developed markets. For emerging markets, however, both var(z_t^{Dev}) and var(z_t^{Emg}) are included in equations (2-6) through (2-9). It is also important to note that the other interaction terms, namely, the covariances between the individual markets, are excluded from the system's time series specifications and are subsumed into the error terms of the volatility system, as their effect on the system is not expected to be significant.

As shown in equation (2-1), our volatility system postulates that the conditional variance of the US stock market returns is explained by its own lagged conditional variance, the conditional variances of the UK, French and German market returns, and the conditional variance of the lagged Japanese market returns. In addition, the conditional variance of the co-integration equation between the five developed markets defined in equation (3-1), models the conditional volatility of the long-run price relationship among these developed markets.

Equation (2-2) represents the conditional variance of the UK stock market returns as being explained by the conditional variances of its own lagged conditional variance, the conditional variance of the French market returns, the conditional variances of the lagged US, German and Japanese market returns, and the conditional variance of the co-integrating equation between the five markets. Similarly, equations (2-3) through (2-5) model the conditional volatility for the French, German, and Japanese markets. The corresponding conditional volatility models for the emerging markets of Taiwan, South Korea, Thailand and India are outlined in equations (2-6) through (2-9).

3.2 Partial Volatility Systems

Adopting a similar methodology, we formulate two partial volatility systems; one for developed markets and the other for emerging markets. The partial volatility system for developed markets, which is similar to the volatility system described in equations (2-1) through (2-5), is represented as:

$$\text{var}(r_t^{US}) = \alpha_0 + \alpha_1 \text{var}(r_{t-1}^{US}) + \alpha_2 \text{var}(r_t^{UK}) + \alpha_3 \text{var}(r_t^{FR}) + \alpha_4 \text{var}(r_t^{GM}) + \alpha_5 \text{var}(r_{t-1}^{JP}) + \alpha_6 \text{var}(z_t^{Dev}) + \varepsilon_t^{US}, \quad (4\text{-}1)$$

$$\text{var}(r_t^{UK}) = \beta_0 + \beta_1 \text{var}(r_{t-1}^{US}) + \beta_2 \text{var}(r_{t-1}^{UK}) + \beta_3 \text{var}(r_t^{FR}) + \beta_4 \text{var}(r_{t-1}^{GM}) + \beta_5 \text{var}(r_{t-1}^{JP}) + \beta_6 \text{var}(z_t^{Dev}) + \varepsilon_t^{UK}, \quad (4\text{-}2)$$

$$\text{var}(r_t^{FR}) = \theta_0 + \theta_1 \text{var}(r_{t-1}^{US}) + \theta_2 \text{var}(r_t^{UK}) + \theta_3 \text{var}(r_{t-1}^{FR}) + \theta_4 \text{var}(r_{t-1}^{GM}) + \theta_5 \text{var}(r_{t-1}^{JP}) + \theta_6 \text{var}(z_t^{Dev}) + \varepsilon_t^{FR}, \quad (4\text{-}3)$$

$$\text{var}(r_t^{GM}) = \gamma_0 + \gamma_1 \text{var}(r_{t-1}^{US}) + \gamma_2 \text{var}(r_t^{UK}) + \gamma_3 \text{var}(r_t^{FR}) + \gamma_4 \text{var}(r_{t-1}^{GM}) + \gamma_5 \text{var}(r_{t-1}^{JP}) + \gamma_6 \text{var}(z_t^{Dev}) + \varepsilon_t^{GM}, \text{ and} \quad (4\text{-}4)$$

$$\text{var}(r_t^{JP}) = \delta_0 + \delta_1 \text{var}(r_{t-1}^{US}) + \delta_2 \text{var}(r_{t-1}^{UK}) + \delta_3 \text{var}(r_{t-1}^{FR}) + \delta_4 \text{var}(r_{t-1}^{GM}) + \delta_5 \text{var}(r_{t-1}^{JP}) + \delta_6 \text{var}(z_t^{Dev}) + \varepsilon_t^{JP}. \quad (4\text{-}5)$$

Similarly, the partial volatility system for emerging markets is represented as:

$$\text{var}(r_t^{TW}) = \phi_0 + \phi_1 \text{var}(r_{t-1}^{TW}) + \phi_2 \text{var}(r_{t-1}^{KO}) + \phi_3 \text{var}(r_{t-1}^{TH}) + \phi_4 \text{var}(r_{t-1}^{IN}) + \phi_5 \text{var}(z_t^{Emg}) + \varepsilon_t^{TW}, \quad (5\text{-}1)$$

$$\text{var}(r_t^{KO}) = \eta_0 + \eta_1 \text{var}(r_t^{TW}) + \eta_2 \text{var}(r_{t-1}^{KO}) + \eta_3 \text{var}(r_{t-1}^{TH}) + \eta_4 \text{var}(r_{t-1}^{IN}) + \eta_5 \text{var}(z_t^{Emg}) + \varepsilon_t^{KO}, \quad (5\text{-}2)$$

$$\text{var}(r_t^{TH}) = \pi_0 + \pi_1 \text{var}(r_t^{TW}) + \pi_2 \text{var}(r_t^{KO}) + \pi_3 \text{var}(r_{t-1}^{TH}) + \pi_4 \text{var}(r_{t-1}^{IN}) + \pi_5 \text{var}(z_t^{Emg}) + \varepsilon_t^{TH}, \text{ and} \quad (5\text{-}3)$$

$$\text{var}(r_t^{IN}) = \varsigma_0 + \varsigma_1 \text{var}(r_t^{TW}) + \varsigma_2 \text{var}(r_t^{KO}) + \varsigma_3 \text{var}(r_t^{TH}) + \varsigma_4 \text{var}(r_{t-1}^{IN}) + \varsigma_5 \text{var}(z_t^{Emg}) + \varepsilon_t^{IN}. \quad (5\text{-}4)$$

This system is similar to the volatility system depicted in equations (2-6) through (2-9) but after excluding the influence of the five developed markets.

4. Empirical results

For each market, we estimate the following GARCH(1,1)-M model:

$$r_t^j = a + bh_t^j + \varepsilon_t^j, \qquad \text{and} \tag{6-1}$$

$$h_t^j = \omega + \alpha\varepsilon^{2j}_{t-1} + \beta h_{t-1}^j, \qquad \omega < 0,\ \alpha \geq 0 \text{ and } \beta \geq 0, \tag{6-2}$$

where r_t^j and h_t^j represent the conditional mean and conditional variance of daily returns for market j, respectively, and a and ω are constants. The restrictions $\omega > 0$, $\alpha \geq 0$ and $\beta \geq 0$ ensure that the conditional variance (h_t^j) is always positive. The results from these GARCH(1,1)-M models are presented in Table 3. Panels A and B show the parameter estimates for the conditional mean and variance equations for each market, while Panel C shows the diagnostic test statistics for each market's GARCH-M model. We find strong and significant GARCH effects in all market return series, as indicated by the respective α and β coefficients. The β coefficients in all the conditional variance equations are larger than the α coefficients, suggesting that large market surprises induce relatively small revisions in future volatility.

As Panel C of Table 3 shows, there is a reduction in the excess kurtosis and in the Jarque-Bera normality statistic across all markets when the GARCH(1,1)-M model is fitted to the respective market return series. With the exception of South Korea and Thailand, the Ljung-Box Q-test statistics for standardised residuals and squared standardised residuals are all insignificant, indicating that the GARCH-M model is successful in capturing the fat-tailed and time-varying nature of the respective return series. Moreover, insignificant results from the Lagrange Multiplier (LM) test also confirm that the GARCH-M model is adequate in accounting for the serial correlation in returns. Significant results from the Wald test indicate overall significance in the estimated conditional variance equations in all nine markets.

For the South Korean market, an additional AR(1) term in the mean equation is required to absorb excess serial correlation in the residuals at 12 lags and squared residuals at 24 lags. However, an AR(1)-GARCH(1,1)-M model estimated for this market does not yield significant improvements to parameter estimates based on the AIC and SIC. Hence, for the volatility system estimated later, the GARCH(1,1)-M is applied to South Korean market returns. For the Thai market, although the Q_{12} (LB) test statistic is significant, all other Ljung-Box and LM diagnostic test statistics are insignificant, suggesting that the GARCH-M model is adequate in modelling its conditional mean and variance equations.

We next examine each market's index series for unit roots using the augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests. For index levels the ADF and PP tests are generally not significant suggesting the presence

Table 3. – UNIVARIATE GARCH(1,1)-M MODEL ESTIMATES FOR DAILY STOCK MARKET RETURNS DURING FEBRUARY 1992 - NOVEMBER 2000[a]

Parameter	US	UK	France	Germany	Japan	Taiwan	South Korea	Thailand	India
				Panel A: Conditional Mean Returns Equations					
a	-0.0001 (0.663)	-0.0004 (0.156)	-0.0007 (0.297)	0.0002 (0.352)	-0.0009 (0.148)	-0.0041*** (0.000)	-0.0006 (0.184)	0.0005 (0.423)	5.96E-05 (0.898)
b	8.710* (0.053)	3.551 (0.457)	7.090 (0.267)	-5.827* (0.056)	5.184 (0.202)	10.609*** (0.003)	-0.462 (0.808)	-5.637** (0.012)	-2.995 (0.218)
				Panel B: Conditional Variance Equations					
ω	5.84E-07* (0.072)	-2.84E-07 (0.181)	3.65E-06** (0.015)	8.66E-07* (0.077)	1.14E-05** (0.012)	1.29E-05*** (0.001)	7.69E-07 (0.354)	6.52E-06*** (0.001)	7.12E-06*** (0.000)
α	0.0564*** (0.000)	0.047*** (0.000)	0.073*** (0.000)	0.117*** (0.000)	0.115*** (0.000)	0.137*** (0.000)	0.097*** (0.000)	0.124*** (0.000)	0.164*** (0.000)
β	0.9387*** (0.000)	0.956*** (0.000)	0.894*** (0.000)	0.879*** (0.000)	0.823*** (0.000)	0.809*** (0.000)	0.908*** (0.000)	0.861*** (0.000)	0.814*** (0.000)
Statistics	**US**	**UK**	**France**	**Germany**	**Japan**	**Taiwan**	**South Korea**	**Thailand**	**India**
				Panel C: Diagnostic Tests[b]					
Log Likelihood	5155.52	5231.11	4891.13	5294.90	4546.67	4407.83	4328.17	4202.10	4422.32
Skewness	-0.556	-0.070	-0.170	-0.612	-0.010	-0.151	0.102	-0.022	-0.041
Kurtosis	5.867	3.620	3.695	5.331	5.313	4.218	3.252	4.628	3.544

Table 3. – (continued)

Statistics	US	UK	France	Germany	Japan	Taiwan	South Korea	Thailand	India
					Panel C: Diagnostic Tests[b]				
Jarque-Bera	606.74***	25.92***	38.46***	444.96***	343.22***	101.07***	6.74**	170.25***	19.45***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.034)	(0.000)	(0.000)
Q_{12} (LB)	14.167	9.237	10.988	6.363	5.408	10.822	15.611	23.225**	14.504
	(0.290)	(0.683)	(0.530)	(0.897)	(0.943)	(0.544)	(0.210)	(0.026)	(0.270)
Q_{24} (LB)	26.214	23.852	16.359	16.132	13.160	17.266	37.742**	28.080	27.255
	(0.342)	(0.470)	(0.875)	(0.883)	(0.963)	(0.837)	(0.037)	(0.257)	(0.293)
Q_{12}^2(LB)	11.070	14.883	7.8201	8.454	3.064	7.408	21.858**	7.600	12.447
	(0.523)	(0.248)	(0.799)	(0.749)	(0.995)	(0.830)	(0.039)	(0.816)	(0.410)
Q_{24}^2(LB)	18.342	25.085	19.081	12.956	8.669	21.107	33.841*	12.581	21.098
	(0.786)	(0.401)	(0.748)	(0.967)	(0.998)	(0.632)	(0.088)	(0.973)	(0.633)
TR_{12}^2	11.132	15.239	8.136	8.587	3.215	7.311	23.087**	7.745	12.387
	(0.518)	(0.229)	(0.774)	(0.738)	(0.994)	(0.836)	(0.027)	(0.805)	(0.415)
TR_{24}^2	18.002	25.670	19.011	13.508	9.180	21.574	32.914	13.160	22.251
	(0.803)	(0.370)	(0.751)	(0.957)	(0.997)	(0.605)	(0.106)	(0.963)	(0.564)
F_{WA}	12309.29***	36099.86***	2253.74***	6756.10***	733.56***	1197.93***	14664.37***	4486.97***	3238.85***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

[a] A univariate GARCH(1,1)-M model for the daily market returns of the developed and emerging markets is:
where rtj and htj represent the conditional mean and variance equations of market j respectively and a and ω are constants. The sample period is from February 19, 1992 to November 30, 2000 (1540 observations). Standard errors and test statistics are computed using quasi-maximum likelihood estimation based on Bollerslev and Wooldridge (1992).

[b] Qk(LB) [Qk2(LB)] is the Ljung-Box Q-statistic for the k-th order serial correlation for standardised [squared standardised] residuals. Under the null hypothesis of no serial correlation, Qk(LB) [Qk2(LB)] is asymptotically distributed as a $\chi 2$ with k degrees of freedom. TRk2 is the Lagrange Multiplier test statistic for lags up to k-th order. Under the null hypothesis of no GARCH errors, TR2 is asymptotically distributed as a $\chi 2$ with k degrees of freedom. FWA is the robust Wald test statistic for overall significance of the estimated conditional variance parameters. Asymptotic p-values of parameter estimates and diagnostic tests are in parentheses.

* , ** and *** denote statistical significance at the 10 per cent, 5 per cent and 1 per cent levels, respectively.

Table 4. – UNIT ROOT TESTS FOR STOCK MARKET INDEX LEVELS AND THEIR FIRST DIFFERENCES DURING FEBRUARY 1992 - NOVEMBER 2000[a]

Statistics	US	UK	France	Germany	Japan	Taiwan	South Korea	Thailand	India
				Panel A: Index Levels					
ADF τ	1.832	1.399	2.133	1.376	-0.894	-0.376	-0.548	-0.806	-0.150
ADF τ_μ	-0.386	-0.837	0.572	-0.331	-2.654	-1.674	-1.484	-0.433	-2.553
ADF τ_τ	-2.437	-2.872	-1.734	-2.500	-2.895	-1.544	-1.661	-2.049	-3.012
PP τ	1.737	1.332	1.999	1.397	-0.826	-0.350	-0.591	-0.839	-0.074
PP τ_μ	-0.440	-0.885	0.419	-0.354	-2.495	-1.696	-1.555	-0.497	-2.697
PP τ_τ	-2.501	-2.987	-1.748	-2.457	-2.781	-1.506	-1.715	-2.001	-3.060
				Panel B: First Differences in Index Levels					
ADF τ	-17.777	-17.452	-17.392	-16.965	-15.569	-16.228	-16.152	-16.206	-16.720
ADF τ_μ	-17.958	-17.563	-17.549	-17.080	-15.578	-16.222	-16.147	-16.217	-16.720
ADF τ_τ	-17.954	-17.557	-17.635	-17.086	-15.572	-16.247	-16.174	-16.269	-16.717
PP τ	-38.021	-37.340	-38.207	-36.897	-40.426	-37.781	-37.145	-36.718	-37.929
PP τ_μ	-38.117	-37.396	-38.296	-36.954	-40.422	-37.769	-37.133	-36.716	-37.922
PP τ_τ	-38.105	-37.383	-38.336	-36.947	-40.409	-37.776	-37.140	-36.737	-37.914

[a] The augmented Dickey-Fuller (ADF) test statistics are computed using five lags. Five non-zero autocovariances (truncation lags for serial correlation) in the Newey-West (1987) correction are used for the Phillips-Perron (PP) tests. The τ, $\tau\mu$, and $\tau\tau$ are t-statistics from the regressions that include (a) neither a drift nor a trend term, (b) only a drift term, (c) both a drift and trend term, respectively. Results for both tests are qualitatively similar for up to ten lags. All test statistics are highly significant at the 1 per cent level for first differences in index levels.

Table 5. – CO-INTEGRATION TESTS AND ERROR-CORRECTION MODEL FOR DEVELOPED MARKETS DURING FEBRUARY 1992 - NOVEMBER 2000

Panel A: Multivariate Co-integration Tests[a]

Null Hypothesis	Trace Statistic	Critical Values at	
		1%	5%
No co-integration, $r = 0$	93.737**	76.07	68.52
At most 1 co-integrating vector, $r \leq 1$	42.601	54.46	47.21
At most 2 co-integrating vectors, $r \leq 2$	24.016	35.65	29.68
At most 3 co-integrating vectors, $r \leq 3$	7.976	20.04	15.41
At most 4 co-integrating vectors, $r \leq 4$	1.354	6.65	3.76

Panel B: Error-Correction Model[b]

	μ^{Dev}	P_t^{US}	P_t^{UK}	P_t^{FR}	P_t^{GM}	P_t^{JP}
Coefficient	481.970	1.000	-0.256	-0.103	0.066	-0.006
			(0.019)	(0.020)	(0.025)	(0.003)

[a] The Johansen (1988) multivariate co-integration approach is used to test for a long-run equilibrium relationship among the five developed stock market indices of US, UK, France, Germany and Japan. The sample period is from February 19, 1992 to November, 30 2000 (1540 observations). It is assumed that each stock market index series contains a deterministic trend, while the error-correction term contains a drift but no trend. Based on the AIC and SIC, the lag length in the co-integration and error-correction tests is set equal to 1. Critical values are reported in Osterwald-Lenum (1992).

b By normalizing the US price index to an identity matrix, the error-correction term is obtained by estimating the following co-integrating equation:

$$z_t^{Dev} = \mu^{Dev} + P_t^{US} - \lambda_1 P_t^{UK} - \lambda_2 P_t^{FR} - \lambda_3 P_t^{GM} - \lambda_4 P_t^{JP},$$

where z_t^{Dev} is the equilibrium error-correction term and μ^{Dev} is the drift term. P_t^j denotes the price index of market j on day t. Asymptotic standard errors of non-normalised variables in the co-integrating equation are shown in parentheses.
* and ** denote statistical significance at the 5 per cent and 1 per cent levels, respectively.

of a unit root in all nine stock indices (Panel A). For first differences in the indices the ADF and PP tests are highly significant implying that these stock index series are each integrated of order one, or I(1) (Panel B). Tables 5 and 6 present the results from the Johansen (1988) co-integration tests for developed markets and emerging markets, respectively, as well as the estimates of their respective error-correction terms. The null hypothesis of no co-integration is strongly rejected, suggesting the presence of at least one co-integrating vector among the developed and emerging markets.[8]

[8] Evidence of co-integration necessarily means that deviations, in the form of information shocks, from this long-run relationship would prompt price adjustments back to a long-run equilibrium. Moreover, this finding supports the view of financial integration and linkages across international equity markets.

Table 6. – CO-INTEGRATION TESTS AND ERROR-CORRECTION MODEL FOR EMERGING MARKETS DURING FEBRUARY 1992 - NOVEMBER 2000

Panel A: Multivariate Co-integration Tests[a]

Null Hypothesis	Trace Statistic	Critical Values at	
		1%	5%
No co-integration, $r = 0$	47.519*	54.46	47.21
At most 1 co-integrating vector, $r \leq 1$	22.365	35.65	29.68
At most 2 co-integrating vectors, $r \leq 2$	9.819	20.04	15.41
At most 3 co-integrating vectors, $r \leq 3$	2.973	6.65	3.76

Panel B: Error-Correction Model[b]

	μ^{Emg}	P_t^{KO}	P_t^{TW}	P_t^{TH}	P_t^{TN}
Coefficient	360.280	1.000	0.056	-0.298	-0.339
			(0.030)	(0.083)	(0.072)

[a] The Johansen (1988) multivariate co-integration approach is used to test for a long-run equilibrium relationship among the four emerging stock market indices of South Korea, Taiwan, Thailand and India. The sample period is from February 19, 1992 to November 30, 2000 (1540 observations). It is assumed that each stock market index series contains a deterministic trend, while the error-correction term contains a drift but no trend. Based on the AIC and SIC, the lag length in the co-integration and error-correction tests is set equal to 1. Critical values are reported in Osterwald-Lenum (1992).

[b] By normalizing the Japan price index to an identity matrix, the error-correction term is obtained by estimating the following co-integrating equation:

$$z_t^{Emg} = \mu^{Emg} + P_t^{KO} - \lambda_5 P_t^{TW} - \lambda_6 P_t^{TH} - \lambda_7 P_t^{IN},$$

where z_t^{Emg} is the error-correction term and μ^{Emg} is the drift term. P_t^j denotes the price index of market j on day t. Asymptotic standard errors of non-normalised variables in the co-integrating equation are shown in parentheses.
* and ** denote statistical significance at the 5 per cent and 1 per cent levels, respectively.

4.1 Full Volatility System Results

The full volatility system comprising all nine stock markets, represented by equations (2-1) through (2-9), is estimated using a seemingly unrelated regression (SUR) model.[9] Estimates for the coefficients of the respective market conditional variances are presented in Table 7. Our results show that the US market is clearly the most dominant market since the conditional variance of the US market, var(r_{t-1}^{US}), is significant for all markets except France and Taiwan. This suggests that the US is a major transmitter of volatility to these markets, a result that is consistent with previous literature that the US market

[9] In contrast to previous studies that estimate MGARCH models, which suffer from various estimation problems related to the non-convergence of the iterative procedure to estimate the likelihood function, our volatility system model relies on a straightforward estimation using the seemingly unrelated regression (SUR) estimation procedure

Table 7. – FULL VOLATILITY SYSTEM COEFFICIENT ESTIMATES DURING FEBRUARY 1992 - NOVEMBER 2000[a]

Variable	var(r_t^{US})	var(r_t^{UK})	var(r_t^{FR})	var(r_t^{GM})	var(r_t^{JP})	var(r_t^{TW})	var(r_t^{KO})	var(r_t^{TH})	var(r_t^{IN})
Constant	2.68E-06*** (0.003)	-1.97E-06*** (0.000)	6.16E-06*** (0.000)	-3.40E-06** (0.040)	1.01E-05*** (0.004)	1.00E-05 (0.055)	4.08E-07 (0.927)	3.47E-06 (0.615)	-5.88E-06 (0.346)
var(r_{t-1}^{US})	0.953*** (0.000)	0.018*** (0.000)	-0.003 (0.794)	0.067*** (0.000)	0.130*** (0.000)	0.055 (0.228)	0.088** (0.025)	0.112* (0.068)	0.098* (0.079)
var(r_t^{UK})	-0.007 (0.553)		0.019 (0.184)	0.032 (0.149)					
var(r_{t-1}^{UK})		0.952*** (0.000)			-0.117*** (0.010)	-0.066 (0.320)	0.045 (0.423)	0.048 (0.584)	0.069 (0.385)
var(r_t^{FR})	-0.003 (0.746)	0.032*** (0.000)		0.037** (0.045)					
var(r_{t-1}^{FR})			0.913*** (0.000)		0.033 (0.403)	0.100* (0.067)	-0.061 (0.191)	0.063 (0.386)	0.052 (0.424)
var(r_t^{GM})	0.031*** (0.000)								
var(r_{t-1}^{GM})		0.002 (0.498)	0.019** (0.016)	0.916*** (0.000)	-0.011 (0.669)	-0.029 (0.401)	0.005 (0.874)	-0.055 (0.225)	-0.088** (0.033)
var(r_t^{JP})							0.016 (0.235)	0.018 (0.377)	0.036* (0.054)
var(r_{t-1}^{JP})	-0.001 (0.771)	-6.37E-05 (0.966)	-0.001 (0.776)	-0.004 (0.413)	0.888*** (0.000)	-0.006 (0.699)			

Table 7. (Continued)

Variable	var(r_t^{US})	var(r_t^{UK})	var(r_t^{FR})	var(r_t^{GM})	var(r_t^{JP})	var(r_t^{TW})	var(r_t^{KO})	var(r_t^{TH})	var(r_t^{IN})
var(r_t^{TW})							0.0099 (0.289)	-0.0198 (0.177)	-9.61E-05 (0.994)
var(r_{t-1}^{TW})						0.905*** (0.000)			
var(r_t^{KO})								0.010 (0.326)	0.004 (0.671)
var(r_{t-1}^{KO})						0.005 (0.561)	0.964*** (0.000)		
var(r_t^{TH})									-0.002 (0.830)
var(r_{t-1}^{TH})						0.003 (0.708)	0.003 (0.577)	0.937*** (0.000)	
var(r_{t-1}^{IN})						-0.001 (0.885)	-0.005 (0.426)	-0.007 (0.502)	0.928*** (0.000)
var(z_t^{Dev})	-1.48E-10 (0.139)	9.94E-11* (0.052)	2.13E-10* (0.073)	5.76E-11 (0.757)	2.13E-09*** (0.000)	4.92E-10 (0.342)	3.34E-10 (0.454)	7.57E-11 (0.913)	1.83E-10 (0.771)
var(z_t^{Emg})						4.64E-11 (0.398)	1.19E-11 (0.797)	1.84E-11 (0.800)	2.22E-10*** (0.001)

a Seemingly unrelated regression estimation is used to estimate the full Volatility System, which represents the volatility relationship between the nine stock markets of US, UK, France, Germany, Japan, Taiwan, South Korea, Thailand and India. The sample period is from February 19, 1992 to November 30, 2000 (1540 observations). The individual conditional variance of each market is represented by equations (2-1) to (2-9). var(rtj) and var(rt-1j) is the conditional variances of market j's returns and lagged returns respectively. var(ztDev) and var(ztEmg) represent the conditional variance of the error-correction terms for developed and emerging markets, respectively, which are defined as follows:

$$z_t^{Dev} = \mu^{Dev} + P_t^{US} - \lambda_1 P_t^{UK} - \lambda_2 P_t^{FR} - \lambda_3 P_t^{GM} - \lambda_4 P_t^{JP} \text{ and } z_t^{Emg} = \mu^{Emg} + P_t^{KO} - \lambda_5 P_t^{TW} - \lambda_6 P_t^{TH} - \lambda_7 P_t^{IN},$$

where ztDev and ztEmg are the equilibrium error-correction terms for developed and emerging markets respectively on day t, and μDev and μEmg are the respective drift terms. Ptj denotes the price index of market j on day t. Asymptotic p-values of coefficient estimates for the conditional variances in the volatility system are shown in parentheses.

* , ** and *** denote statistical significance at the 10 per cent, 5 per cent and 1 per cent levels, respectively.

exerts substantial influence on several international equity markets.[10] The US market, in turn, is affected only by the German market, implying that a bilateral, two-way volatility relationship exists between these two markets.

It is interesting to observe that the influence of the UK market is much weaker compared to the influence of France and Germany. The UK market appears to affect only Japan since the conditional variance of UK lagged returns, var(r_{t-1}^{UK}), is significant only for this market. The UK market itself is significantly influenced by the US and France. Hence, the US and France each represent a unilateral, one-way influence to the UK market since these two markets are not influenced by the UK market.

The conditional variance of French market returns, var(r_t^{FR}), is significant for the UK and German markets, while the conditional variance of French lagged returns, var(r_{t-1}^{FR}), is significant for the Taiwanese market. The conditional variance of German returns, var(r_t^{GM}), is significant for the US market while the conditional variance of German lagged returns, var(r_{t-1}^{GM}), is significant for both the French and Indian markets. These results suggest that the French market influences volatility in the UK, German and Taiwanese markets, while the German market influences volatility in the US, French and Indian markets. The results also suggest the existence of a bilateral, two-way volatility relationship between the French and German markets.

The Japanese market influences only the volatility of the Indian market, although the influence is only moderately significant. The volatility processes of the other Asian emerging markets and all other developed markets remain essentially unaffected by Japan. Also, only the volatility processes of the developed markets appear to influence the four emerging markets, and there is a notable absence of mutual volatility interactions among the emerging markets.

4.2 Partial Volatility System Results for Developed and Emerging Markets

The partial volatility system for the five developed markets is estimated using the same methodology as for the full volatility system, and the results are presented in Table 8. We find that the SUR model results for the partial volatility system are quantitatively similar to the results for the full volatility system (see Table 7). That is, both sets of results yield similar conclusions with respect to the volatility relationships among developed markets. This implies that the addition of emerging markets into the system of developed markets does not appear to influence the volatility relationships among the developed markets.

---

[10] See, for example, Eun and Shim (1989), Janakiramanan and Lamba (1998), King and Wadhwani (1990) and Theodossiou and Lee (1993).

Table 8. – PARTIAL VOLATILITY SYSTEM COEFFICIENT ESTIMATES FOR DEVELOPED MARKETS DURING FEBRUARY 1992 - NOVEMBER 2000a

Variable	$\text{var}(r_t^{US})$	$\text{var}(r_t^{UK})$	$\text{var}(r_t^{FR})$	$\text{var}(r_t^{GM})$	$\text{var}(r_t^{JP})$
Constant	2.69E-06*** (0.003)	-1.96E-06*** (0.000)	6.17E-06*** (0.000)	-3.40E-06** (0.040)	1.01E-05*** (0.004)
$\text{var}(r_{t-1}^{US})$	0.953*** (0.000)	0.018*** (0.000)	-0.003 (0.802)	0.067*** (0.000)	0.130*** (0.000)
$\text{var}(r_t^{UK})$	-0.007 (0.551)		0.019 (0.184)	0.032 (0.149)	
$\text{var}(r_{t-1}^{UK})$		0.952*** (0.000)			-0.117*** (0.010)
$\text{var}(r_t^{FR})$	-0.003 (0.750)	0.032*** (0.000)		0.037** (0.045)	
$\text{var}(r_{t-1}^{FR})$			0.914*** (0.000)		0.033 (0.399)
$\text{var}(r_t^{GM})$	0.031*** (0.000)				
$\text{var}(r_{t-1}^{GM})$		0.002 (0.499)	0.019** (0.016)	0.916*** (0.000)	-0.011 (0.665)
$\text{var}(r_{t-1}^{JP})$	-0.001 (0.750)	-0.0001 (0.941)	-0.001 (0.739)	-0.004 (0.414)	0.888*** (0.000)
$\text{var}(z_t^{Dev})$	-1.47E-10 (0.143)	1.00E-10** (0.050)	2.15E-10* (0.070)	5.74E-11 (0.757)	2.14E-09*** (0.000)

[a] Seemingly unrelated regression estimation is used to estimate the Partial Volatility System, which represents the volatility relationship between the five developed stock markets of US, UK, France, Germany and Japan. The sample period is from February 19, 1992 to November 30, 2000 (1540 observations). The individual conditional variance of each market is represented by equations (4-1) to (4-5). $\text{var}(r_t^j)$ and $\text{var}(r_{t-1}^j)$ are the conditional variances of market j's returns and lagged returns respectively. $\text{var}(z_t^{Dev})$ represents the conditional variance of the error-correction term for developed markets, which is defined as follows:

$$z_t^{Dev} = \mu^{Dev} + P_t^{US} - \lambda_1 P_t^{UK} - \lambda_2 P_t^{FR} - \lambda_3 P_t^{GM} - \lambda_4 P_t^{JP},$$

where z_t^{Dev} is the equilibrium error-correction term for developed markets on day t and μ^{Dev} is the drift term. P_t^j denotes the price index of market j on day t. Asymptotic p-values of coefficient estimates for the conditional variances in the volatility system are shown in parentheses.
*, ** and *** denote statistical significance at the 10 per cent, 5 per cent and 1 per cent levels, respectively.

The results for the partial volatility system for emerging markets are presented in Table 9. We find that the dominant market in this system is South Korea, where its conditional variance significantly accounts for the volatility of the Thai and Indian markets. In fact, the South Korean market is the only emerging market to have any significant volatility effects on other emerging markets. Volatility from other emerging markets does not have any significant impact on each other. These results imply that when the four emerging markets are examined in isolation of the developed markets, South Korea appears as the major transmitter of volatility and is hence a dominant influence to this group of countries.

Table 9. – PARTIAL VOLATILITY SYSTEM COEFFICIENT ESTIMATES FOR EMERGING MARKETS DURING FEBRUARY 1992 – NOVEMBER 2000[a]

Variable	var(r_t^{TW})	var(r_t^{KO})	var(r_t^{TH})	var(r_t^{IN})
Constant	1.74E-05*** (0.000)	5.68E-07 (0.857)	1.36E-05*** (0.005)	4.69E-06 (0.289)
var(r_t^{TW})		0.015 (0.108)	-0.015 (0.308)	0.006 (0.628)
var(r_{t-1}^{TW})	0.908*** (0.000)			
var(r_t^{KO})			0.025*** (0.003)	0.015** (0.042)
var(r_{t-1}^{KO})	0.003 (0.635)	0.980*** (0.000)		
var(r_t^{TH})				-0.001 (0.932)
var(r_{t-1}^{TH})	0.003 (0.663)	0.006 (0.270)	0.940**** (0.000)	
var(r_{t-1}^{IN})	0.002 (0.813)	0.001 (0.888)	0.002 (0.838)	0.937*** (0.000)
var(z_t^{Emg})	3.80E-11 (0.484)	1.87E-11 (0.688)	1.07E-11 (0.882)	2.21E-10*** (0.001)

[a] Seemingly unrelated regression estimation is used to estimate the Partial Volatility System, which represents the volatility relationship between the four emerging stock markets of Taiwan, South Korea, Thailand and India. The sample period is from February 19, 1992 to November 30, 2000 (1540 observations). The individual conditional variance for each market is represented by equations (5-1) to (5-4). var(r_t^j) and var(r_{t-1}^j) are the conditional variances of market j's returns and lagged returns, respectively. var(ztEmg) represents the conditional variance of the error-correction term, which is defined as follows:

$$z_t^{Emg} = \mu^{Emg} + P_t^{KO} - \lambda_5 P_t^{TW} - \lambda_6 P_t^{TH} - \lambda_7 P_t^{IN},$$

where and z_t^{Emg} is the equilibrium error-correction term for emerging markets on day t and μ^{Emg} is the drift term. P_t^j denotes the price index of market j on day t. Asymptotic p-values of coefficient estimates for the conditional variances in the volatility system are shown in parentheses.
* , ** and *** denote statistical significance at the 10 per cent, 5 per cent and 1 per cent levels, respectively.

Comparing the results in tables 7 and 9, we note two major differences. First, the dominant influence of South Korea on the Thai and Indian markets no longer exists when the volatility processes from developed markets are included in the system. This suggests that any significant volatility transmissions to these emerging markets originate mainly from the developed markets. Second, volatility transmission to emerging markets does not arise from mutual volatility interactions among the emerging markets themselves.

5. Summary and Conclusions

In this paper, we examined the dynamics of return volatility in five major developed markets and four selected emerging Asian markets. Using GARCH-M modelling and a volatility system approach, we obtained important insights into the volatility interdependence and linkages across these equity markets. We find co-integrating relationships between the five developed markets and four emerging markets supporting the view of capital market integration and inter-market linkages.

Our findings are consistent with Eun and Shim (1989) and Janakiramanan and Lamba (1998), who show that the US market is the dominant player with respect to its influence on volatility in the other international equity markets. The US represents the major transmitter of volatility to the markets in UK, Germany, Japan, South Korea, Thailand and India, in that US returns volatility accounts for a significant proportion of the conditional volatility in these markets. Our results are also consistent with the findings of Hamao, et al (1990), in that the daily price volatility spills over from the US to UK and Japan and from the UK to Japan. Consistent with Theodossiou and Lee (1993), we also find strong volatility spillover effects occurring from the US to UK, Germany and Japan. Lastly, we find that a two-way, bilateral volatility relationship exists between the German and French markets, and that the UK and Japan do not have a significant influence on the volatility in other markets.

Within the emerging markets group, we find that the South Korea has a dominant influence with on the other four emerging markets. This dominance, however, diminishes when developed markets are included in the volatility system. We find that volatility transmissions to the emerging markets appear to originate mainly from developed markets and not from among these emerging markets.

References

Becker, K. G., Finnerty, J. E. and Tucker, A. L., 1992. T*he intraday interdependence structure between US and Japanese equity markets*. Journal of Financial Research 15, 27-37.

Bennett, P. and Kelleher, J., 1988. *The international transmission of stock price disruption in October 1987*. Federal Reserve Bank of New York Quarterly Review, 17-26.

Bollerslev, T., 1986. *Generalised autoregressive conditional heteroskedasticity*. Journal of Econometrics 31, 307-327.

Bollerslev, T. and Wooldridge, J. M., 1992. *Quasi-maximum likelihood estimation and inference in dynamic models with time-varying covariances*. Econometric Reviews 11, 143-172.

Bollerslev, T., Chou, R. Y. and Kroner, K. F., 1992. *ARCH modelling in finance: A review of the theory and empirical evidence*. Journal of Econometrics 52, 5-59.

Dickey, D. A. and Fuller, W. A., 1979. *Distribution of the estimators for autoregressive time series with a unit root*. Journal of the American Statistical Association 74, 427-431.

Dickey, D. A. and Fuller, W. A., 1981, *Likelihood ratio statistics for autoregressive time series with a unit root*, Econometrica 49, 1057-1072.

Eun, C. S. and Shim, S., 1989. *International transmission of stock market movements*. Journal of Financial and Quantitative Analysis 24, 241-256.

Engle, R. F., 1982. *Autoregressive conditional heteroskedasticity with estimates of the variance of UK inflation*. Econometrica 50, 987-1008.

Engle, R. F. and Granger, C. W. J., 1987. *Co-integration and error correction: Representation, estimation, and testing*. Econometrica 55, 251-276.

Engle, R. F., Lilien, D. M. and Robins, R. P., 1987. *Estimating time varying risk premia in the term structure: the ARCH-M model*. Econometrica 55, 391-407.

French, K. R., Schwert, W. G. and Stambaugh, R. F., 1987. *Expected stock returns and volatility*. Journal of Financial Economics 19, 3-29.

Glosten, L. R., Jaganathan, R. and Runkle, D. E., 1993. *On the relation between the expected value and the volatility of the nominal excess return on stocks*. Journal of Finance 48, 1779-1801.

Hamao, Y., Masulis, R. W. and Ng, V., 1990. *Correlations in price changes and volatility across international stock markets*. Review of Financial Studies 3, 281-307.

Janakiramanan, S. and Lamba, A. S., 1998. *An empirical examination of linkages between Pacific-Basin stock markets*. Journal of International Financial Markets, Institutions and Money 8, 155-173.

Jeon, B. N. and Chiang, T. C., 1991. *A system of stock prices in World stock exchanges: Common stochastic trends for 1975-1990*. Journal of Economics and Business 43, 329-338.

Johansen, S., 1988. *Statistical analysis of co-integrating vectors*. Journal of Economic Dynamics and Control 12, 231-254.

Karolyi, A. G., 1995. *A multivariate GARCH model of international transmissions of stock returns and volatility: The case of the United States and Canada*. Journal of Business and Economic Statistics 13, 11-25.

Karolyi, A. G. and Stulz, R. M., 1996. *Why do markets move together? An investigation of US-Japan stock return comovements*. Journal of Finance 51, 951-986.

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

Koutmos, G. and Booth, G. G., 1995. *Asymmetric volatility transmission in international stock markets*. Journal of International Money and Finance 14, 747-762.

Lin, W. L., Engle, R. F. and Ito, T., 1994. *Do bulls and bears move across borders? International transmission of stock returns and volatility*. Review of Financial Studies 7, 507-538.

Ljung, G. M. and Box, G. E. P., 1978. *On a measure of fit in time series models*. Biometrika 65, 297-303.

MacKinnon, J. G., 1991. *Critical values for co-integration tests*. In: Engle, R.F., Granger, C.W.J., (eds.), *Long-run Economic Relationships: Readings in Co-integration*. Oxford University Press, New York, 267-276.

Nelson, D. B., 1991. *Conditional heteroskedasticity in asset returns: A new approach*. Econometrica 59, 347-370.

Neumark, D., Tinsley, P. A. and Tosini, S., 1991. *After-hours stock prices and post-crash hangovers*. Journal of Finance 46, 159-178.

Newey, W. K. and West, K. D., 1987. *A simple, positive semi-definite, heteroskedasticity and autocorrelation consistent covariance matrix*. Econometrica 55, 703-708.

Osterwald-Lenum, M., 1992. *A note with quantiles of the asymptotic distribution of the maximum likelihood co-integration rank test statistics*. Oxford Bulletin of Economics and Statistics 54, 461-472.

Phillips, P. C. B. and Perron, P., 1988. *Testing for a unit root in time series regression*. Biometrika 75, 335-346.

Poon, S. H and Taylor, S. J., 1992. *Stock returns and volatility: An empirical study of the UK stock market return*. Journal of Banking and Finance 16, 37-59.

Roll, R., 1989. *Price volatility, international stock market links, and their implications for regulatory policies*. Journal of Financial Services Research 3, 211-246.

Schwert, W.G., 1990. S*tock volatility and the Crash of '87*. Review of Financial Studies 3, 77-102.

Susmel, R. and Engle R. F., 1994. *Hourly volatility spillovers between international equity markets*. Journal of International Money and Finance 13, 3-25.

Theodossiou, P. and Lee, U., 1993. *Mean and volatility spillovers across major national stock markets: Further empirical evidence*. Journal of Financial Research 16, 337-350.

von Furstenberg, G. M. and Jeon, B. N., 1989. *International stock price movements: Links and messages*. Brookings Papers on Economic Activity 1, 125-167.

Zellner, A., 1962. *An efficient method of estimating seemingly unrelated regressions and tests for aggregation bias*. Journal of the American Statistical Association 57, 348-368.

JAYARAM K. SANKARAN
CHANDRASEKHAR KRISHNAMURTI

On the optimal selection of market–tracking portfolios under limited diversification

Abstract

Modern portfolio theory implies that investors should hold well-diversified portfolios. However, several individual investors are ill-diversified, ostensibly due to high transaction costs. In this paper, we develop analytical procedures using the single index and constant correlation methods to construct index tracking portfolios. The procedures developed here identify portfolios of stocks which mimic the market and which contain only a small number of stocks (the exact number is to be specified by the user). Our procedures represent important decision making tools that are expected to be useful to both individual investors and professional portfolio managers.

Our paper is motivated by the following factors: (i) active trading is costly due to information and transaction costs; (ii) existing techniques for passive portfolio construction do not clearly follow from asset pricing models; and (iii) existing procedures are too complex to be used by individual investors on account of the informational and computational requirements. Another noteworthy feature of our procedures is their ease of implementation and their utility to investors who are interested in investing in emerging capital markets and who do not have access to traded index funds.

1. Introduction

One of the implications of modern portfolio theory is that investors should hold well-diversified portfolios. The virtual elimination of unsystematic risk is the rationale behind diversification. In a practical sense, it is not necessary to hold a very large number of stocks to achieve diversification. A standard rule of thumb is that a portfolio of about forty stocks will have a standard deviation of returns that is remarkably close to the standard deviation of market returns (Brigham and Gapenski (1990)). The above facts imply that investors should diversify and that they need to hold about forty stocks.

Contrary to the above implication, Blume, Crockett, and Friend (1971) found that only 11 per cent of individual U.S. investors held more than ten stocks. A plausible explanation for the fact is that transaction costs and budget constraints preclude the holding of large portfolios by individual investors (transaction costs include direct costs such as brokerage commissions and indirect costs such as the cost of analysing securities).

A useful and interesting approach to tackle the transaction cost problem is to formulate a strategy which will identify portfolios that contain only a small

number of securities and yet mimic a broad market index. Such a procedure would be potentially useful to individual investors as well as institutional investors. Individual investors who have access to only limited funds can use this approach to achieve adequate diversification by investing in a small number of securities.

Financial institutions such as pension funds typically allocate a large portion of the managed funds to track the index leaving a smaller fraction for active management. For example, the College Retirement Equity Fund (CREF) commits approximately 75 per cent of the funds in its stock account to track the Russel 3000 index, leaving only about a quarter of the funds for active management. Market-tracking portfolios with small numbers of stocks can be used by institutions to save considerable transaction costs without significant loss of diversification. Market-tracking portfolios are especially useful for index funds which need to balance the benefits of higher tracking efficiency with the additional transaction costs.

In this paper, we develop two procedures that are easy to implement and that identify small portfolios that mimic a broad market index. Both procedures identify the stocks to hold as well as their relative proportions, subject to an upper limit on the number of stocks, which the user of the procedure(s) must specify.

One procedure uses the single index model while the other uses the constant correlation assumption. (We leave the extension of our procedure to the multi-index case for future work.) *Both find portfolios that are optimal ex-ante, under their respective assumptions*. The single index model is chosen for the benefit of analytical tractability. The constant correlation assumption has been found to provide better estimates of future correlation coefficients than more sophisticated models (see Elton and Gruber (1995), pp. 168-169). Empirical, rather than theoretical, considerations have determined our choice of the constant correlation assumption.

We determine the efficiency of tracking of the procedures by measuring the correlation coefficient between the returns on the chosen market index and the returns of the "small" market-tracking portfolio selected by our procedures. (The average returns of the portfolios that are selected by either procedure equal that on the chosen market index.)

The CREF uses the correlation coefficient to measure tracking efficiency (it tries to achieve a tracking efficiency of 99 per cent as measured by a correlation coefficient of 0.99 with the index). Meade and Salkin (1989) state that a high correlation coefficient is a necessary condition for good tracking efficiency. Since there are no universally accepted definitions of tracking efficiency, we use a definition that is acceptable to practicing portfolio managers.

The data required for the procedures are relatively modest; the time series of individual stock returns and the returns of the market index are the only data required. We have implemented the procedures using data from the Korean

Stock Exchange. We also demonstrate the efficacy of our procedures on a holding period that does not overlap with the estimation period.

We believe that the procedures developed in the paper for selecting optimal portfolios, containing a small number of stocks, are useful for practising investors. Individual investors with limited resources can use the procedures to form small portfolios that minimise transaction costs, but yet effectively track the market. Professional portfolio managers can use the procedures to develop new index products with the objective of effectively capturing market-wide movements with minimal transaction costs. Managers of international/global funds can use our procedures to select a small subset of stocks from each market to include in their portfolios. Such a strategy would essentially capture the benefits of investing in growing stock market economies whilst minimizing transaction, search, and information costs.

The remainder of the paper is organised as follows. We provide a brief review of the relevant literature in section 2. In section 3, we describe the notation and the problem formulation, as well as efficient, optimum-seeking procedures to track the market index, based on the single index and constant correlation assumptions. In section 4, we provide empirical results regarding the performance of our procedures. Our conclusions are offered in the last section.

2. Literature Review

Managers of mutual funds typically follow "active management", "passive management", or a combination of the two strategies. In active management, fund managers attempt to identify and actively trade undervalued securities whose values are expected to go up in the future. In passive management, investment managers hope to reproduce the return behaviour of a chosen market index. In a sense, a passive management strategy does not involve the "active seeking of undervalued stocks" or trading activities to profit from undervalued securities. Pure active management seeks to maximise returns but is fraught with the risk that the portfolio is under-diversified. Pure passive management involves controlling the composition of the portfolio to capture the market movements, whilst at the same time keeping the overall risk within limits. This is attained by minimising the tracking error.

In the last decade, the use of passive management strategies has increased tremendously in the advanced financial markets of the world. One reason for the increase in passive management is the realisation that most securities are efficiently priced and therefore the cost and risk of detecting undervalued securities is quite high. We term this the informational cost of active management. A second factor is that active trading involves substantial transaction and administrative costs.

An index fund is a passively managed portfolio that is designed to track a chosen market index. Its major attraction is that the only risk associated with the investment is the market risk - firm-specific risk is diversified away. In practice, equity and bond index funds exist. We focus only on equity index funds in this paper.

Meade and Salkin (1989) describe three approaches to index fund construction. The first approach involves full replication, that is, all shares in the index are held in the same proportion as in the index. This approach entails high set-up, maintenance, and divestment costs, but is compensated by good tracking of the index and little need for managerial attention. The second approach, namely, stratification, requires that shares be selected to achieve the same sectoral representation and capitalisation as the index but eliminates companies below a certain level of capitalisation. The third approach uses sampling, wherein the shares of a small number of companies are selected to match the overall return behaviour of the market index. The benefits of the sampling approach are its lower set-up and maintenance cost. The efficacy of the method depends on the database quality and the constancy of the relationship between individual share returns and index returns. Our procedures, which entail the selection of stocks to maximise the efficacy of tracking, are akin to the third approach.

In a subsequent paper, Meade and Salkin (1990) address the problem of developing policies that minimise the running costs of equity index funds. Meade and Salkin consider both `retail' funds (where cash flows in and out of the fund according to the needs of the investors, i.e., in an unpredictable fashion) and `private' funds, where a fixed sum of money is invested for an indeterminate period.

In the context of managing index-tracking portfolios, Connor and Leland (1995) note that the practice of maintaining a positive cash-holding saves significantly on transaction costs because temporary cash inflows and outflows can be absorbed into the cash inventory. They use a mean-variance framework to analyze the cash management problem for an index-tracking portfolio. Adcock and Meade (1994) develop and illustrate an algorithm which incorporates the transaction costs that are incurred in the readjustment of equity index tracking funds.

Rudd (1980) provides evidence, which indicates that the majority of American index funds do not actually hold all the stocks in the chosen index. Some of them hold as little as 35 stocks to match the 500-stock S&P 500 index. The minimisation of transaction and administrative costs is the major advantage of holding as few stocks as possible. While inadequate diversification and "tracking error" are the major disadvantages of holding very few stocks, portfolios of as few as 10 stocks can provide adequate mimicking ability because the fully diversified index can be matched by an adequately diversified 10-stock portfolio (Evans and Archer (1968)).

When the set of securities to be included is pre-specified, the problem of optimal index fund construction reduces to finding the optimal weight for each of the securities in the set. This can be solved quite easily by quadratic optimisation, *without recourse to any assumption about the correlation structure of stock returns*. However, it is truly formidable to find the optimal set of securities in which to invest (subject to a cardinality constraint) unless we make a simplifying assumption about the correlation structure.

In this paper, we develop procedures that involve neither stratification nor other types of constraints on the formation of portfolios. We believe that our contribution is significant because under certain assumptions about the correlation structure of stock returns, these procedures are provably optimal (ex-ante) in constructing a passive portfolio.

We use two models of stock return behaviour to derive our optimal procedures. The first model, the single index model, assumes that securities systematically move together in response to a common factor (market index). The second model, the constant correlation model, assumes that a common correlation coefficient between security returns provides the best estimate for future prediction. The common correlation is estimated by averaging the correlations across all pairs of securities. This method implicitly assumes that the observed pairwise differences in correlation from the average are random and therefore unstable. Aneja, Chandra, and Gunay (1989) present a simplified approach to estimate the average that does not require the estimation of pairwise correlations for obtaining the average. Thus, the procedure does not entail cumbersome computations. The utility of the constant correlation method is further buttressed by the finding of Elton, Gruber, and Urich (1978) that the forecasting power of the method is superior to that of the single index model and other more sophisticated models.

3. The Algorithms

We address the problem of finding a portfolio

(a) which uses at most k securities from a universe of n stocks,

(b) whose expected return equals the expected return on the index, and

(c) whose return has the largest correlation with that on the index, among all portfolios that satisfy conditions (a) and (b).

We assume the existence of a risk-less asset, which may be lent or borrowed at the same rate. (The upper limit, k, on the number of securities does not include the risk-less asset.) Then, the following assertion is easily established (we omit the proof).

Fact 1: Let $\{x_i: i = 1, \ldots, n\}$ denote the weights in a portfolio whose return has a correlation of r with the index. Then, we can always obtain a portfolio with weights $\{x_i: i = 0, \ldots, n\}$ (where x_0 corresponds to the investment in the risk-

less asset) whose expected return equals that on the index, and whose return has a correlation of r with the return on the index.

The significance of Fact 1 is that our problem may be redefined as one of finding a portfolio whose correlation with the index is maximised among all portfolios that comprise at most k of the n securities in the universe (and that do not involve investment in the risk-less asset).

Below, we define some standard notation that is applicable regardless of the model of stock returns (e.g., single index, constant pairwise correlations) that we use.

x_i: The weight of security i, i = 1,…,n, in the portfolio.

$\tilde{R}_i$: The return on security i, i = 1,...,n (a random variable).

$\tilde{R}_i$: The return on the market index, which is to be tracked (a random variable).

c_i: The correlation of $\tilde{R}_i$ with $\tilde{R}_I$, i = 1,...,n.

s_i: The standard deviation of $\tilde{R}_i$, i = 1,...,n.

s_I: The standard deviation of $\tilde{R}_I$.

In the appendix, we establish the validity of all the algorithms that are presented in this section.

The Single Index Model of Stock Returns

We now present an efficient procedure that finds optimal portfolios under the single index model. For this purpose, we define some additional notation.

β_i: The market-beta of security i.

$Var(\varepsilon_i)$: The non-systematic risk of security i, i = 1,...,n.

From the assumptions of the single index model, one may deduce that for i = 1,...,n, $c_i = \beta_i . s_I / . \sqrt{(\beta_i s_I)^2 + Var(\varepsilon_i)}$

The Assumption of Constant Pairwise Correlations

4.1. PROCEDURE Single_Index

(a) If stocks can be sold short, the optimal portfolio comprises the first *k* securities in descending order of |ci|. Further, the weight of an arbitrary security, i, in the portfolio is proportional to $\beta_i/Var(\varepsilon_i)$.

(b) If stocks cannot be sold short, the optimal portfolio comprises those stocks (i) which are among the first k securities in descending order of ci and (ii) whose correlations with the index are positive. Further, the weight of an arbitrary security, i, in the portfolio is proportional to $\beta_i/Var(\varepsilon_i)$.

We now present optimum-seeking algorithms under the assumption of constant pairwise correlations for both cases, viz., short-selling allowed, and short-selling disallowed. For this purpose, we define p as the correlation between any pair of security returns. We assume that $0 < p < 1$.

4.2. Procedure const_corr_short_selling

1. f := $-\infty$.
2. For t := 0 to k do:
   a. Let S = {1, ..., t, n-k+t+1, ..., n}, and compute w(S) where w(S) = $\left(\frac{1}{1-p}\right).\left(\sum_{i\in S} c_i^{\,2} - \frac{p.\left(\sum_{i\in S} c_i\right)^2}{p(|S|-1)+1}\right)$.
   b. If w(S) > f, F := S and f := w(S).
3. F is the optimal set of securities to invest in. For i $\in$ F, xi is proportional to.

$$\left(\frac{1}{(1-p).s_i}\right).\left(c_i - \frac{p.\left(\sum_{j\in F} c_j\right)}{(|F|-1).p+1}\right)$$

4.3. Procedure const_corr_no_short_selling

1. Initialise m as 1.
2. If m $\le$ k-1 and cm+1 > p.
   $\left(\frac{\sum_{j=1}^{m} c_j}{(m-1).p+1}\right)$,
   then go to step 4.
3. The optimal portfolio comprises securities 1,…,m, and for i = 1,...,m, the optimal weight of security i is proportional to .

$$\left(\frac{1}{(1-p).s_i}\right).\left(c_i - \frac{p.\left(\sum_{j=1}^{m} c_j\right)}{(m-1).p+1}\right)$$

4. Increment m by 1 and go to step 2.

5. Empirical Results

We use data from the Korean Stock Exchange provided by the Pacific-Basin Capital Markets Research Center of the University of Rhode Island for our empirical tests. The market index that is used as the target for tracking, is the monthly equally weighted index (with dividends reinvested). The market tracking subset is chosen from the universe of all stocks for which data are available on the tape. For the sake of brevity, we report empirical results only for the single index variant of the procedure assuming that short-selling is disallowed (i.e., for the procedure Single_Index).

In Table 1, we report results of the correlation between the return on our optimal small portfolio (the portfolio is optimal ex-ante, under the single index model of stock returns) and the return on the market index for various sizes of portfolios from 1 through 40. Our estimation period for implementing the procedure runs from 1984 to 1986. In the second column (Opt. Sel., Opt. Wts.), we show results for portfolios selected by the procedure, Single_Index (for the case when short-selling is disallowed). The weights (relative proportions) are also provided by the procedure. The third column presents results when the stocks are picked through Single_Index and equal weighting is given to all stocks in the portfolio. In the fourth and fifth columns, results are provided for cases when stocks are randomly selected to form the portfolios. The results in the fourth column are based on optimal weights given by the single index method for the case when short-selling is disallowed. The results shown in the fifth column are based on equal weights.

Table 1. – CORRELATIONS DURING THE ESTIMATION PERIOD 1984–86 FOR PORTFOLIOS CHOSEN BY SINGLE_INDEX (NO SHORT-SELLING)

No. of Securities	Optimal Selection Optimal Weights	Optimal Selection Equal Weights	Random Selection Optimal Weights	Random Selection Equal Weights
1	0.7183	0.7183	0.4891	0.4891
2	0.7884	0.7884	0.1524	0.5440
3	0.8183	0.8153	0.6306	0.6687
4	0.8645	0.8632	0.7063	0.6943
5	0.8816	0.8816	0.7795	0.7131
6	0.8871	0.8857	0.7491	0.6592
7	0.8827	0.8804	0.7592	0.6523
8	0.8811	0.8690	0.7631	0.6448
9	0.8741	0.8611	0.7800	0.6238
10	0.8823	0.8721	0.7960	0.6613
20	0.9198	0.9113	0.8628	0.8331
30	0.9193	0.9134	0.8471	0.8537
40	0.9079	0.8986	0.9327	0.8930

A comparison of columns two and five indicate the efficacy of the procedure for various portfolio sizes ranging from one through forty. Our procedure produces an index-tracking portfolio of sise ten with a correlation of 0.88

with the market as compared to 0.66 when stocks are randomly chosen and equally weighted. We interpret this finding as empirical evidence supporting the practical utility of the procedure. The results also indicate that the optimal selection of stocks is more important than the derivation of optimal weights from the procedure. The benefits of using the procedure are most pronounced for small portfolios up to sise ten. The advantages of optimal selection diminish for larger-sized portfolios and literally vanish for a portfolio of forty stocks.

In column 1 of Table 1, contrary to what one might normatively expect, the correlations are not monotonic in the number of securities – this reflects the imperfection of the single-index model of stock returns.

In Table 2, we compare the correlations obtained for the portfolios selected by using the single index procedure with the subsequent performance in a non-overlapping holding period. We use the same estimation period, namely, 1984-86, and the holding period runs from 1987 to 1989.

Table 2. – CORRELATIONS AND BETAS DURING THE ESTIMATION PERIOD 1984-86 AND HOLDING PERIOD 1987-89 FOR PORTFOLIOS CHOSEN BY SINGLE_INDEX (NO SHORT-SELLING)

No. of Securities	Estimation Period Correlation	Holding Period Correlation	Estimation Period Beta	Holding Period Beta
1	0.7183	0.7009	1.56	1.18
2	0.7884	0.7908	1.55	1.09
3	0.8183	0.8142	1.66	1.05
4	0.8645	0.8680	1.56	0.98
5	0.8816	0.8699	1.52	1.02
6	0.8871	0.8984	1.55	1.07
7	0.8827	0.9026	1.54	1.08
8	0.8811	0.9062	1.62	1.06
9	0.8741	0.9092	1.64	1.03
10	0.8823	0.9224	1.68	1.00
20	0.9198	0.9425	1.66	0.98
30	0.9193	0.9350	1.62	0.94
40	0.9079	0.9545	1.57	0.94

The optimal portfolios perform admirably well during the holding period and in most cases, the correlations in the holding period exceed the values obtained during the estimation period. We also provide betas (measure of systematic risk) computed during the estimation and holding periods. Estimation period betas are quite high and average about 1.6, but holding period betas are close to 1.0. (We did not set any constraints regarding beta for choosing the securities and the weights. Nevertheless, most of market-tracking portfolios that are constructed by the procedure have betas close to 1.0.) This desirable feature of the portfolios is an additional benefit of our procedures. Our observation that the betas of portfolios tend to move towards 1.0 over time is consistent with the empirical evidence gathered from the U.S. market (see Blume [1975]).

Table 3 presents the optimal weights in the portfolio yielded by Single_Index (for the case when short-selling is disallowed) for the estimation period 1984-86 and for an upper limit of ten stocks. It is seen that the weights range from 6.4 per cent to 12.5 per cent. Portfolio managers normally do not like to invest very small or very large proportions in any single security. The optimal weights do not indicate very small or very large weighting to any security. This feature is quite typical of the portfolios generated by our procedures. Therefore, we are able to conclude that our procedures are of practical use to investment managers. Furthermore, since betas are close to one and the sise of portfolios required to achieve good tracking is modest, we believe that our procedures are also of practical utility to individual investors. The amount of capital required to implement the tracking portfolio is likely to quite small.

Table 3. – OPTIMAL WEIGHTS FOR A PORTFOLIO OF SISE TEN USING SINGLE_INDEX (NO SHORT-SELLING) FOR THE ESTIMATION PERIOD 1984-86

Company Number	Optimal Weight
7507	0.116
7549	0.125
6200	0.101
3704	0.111
5201	0.103
4552	0.094
8200	0.099
6401	0.104
4603	0.064
7812	0.083

6. Conclusion

In this paper, we derive analytical procedures to construct market-tracking portfolios, which contain only a small number of securities. We demonstrate the efficacy of the procedures using the single index version for the 1984-86 estimation period. We also find that the optimally determined portfolio tracks the market particularly well during the 1987-89 holding period. The other attractive features of the procedures are that the betas are typically close to one during the holding period and that the relative proportions to be held of each security are not unusually large or small. Therefore, our optimal procedures achieve adequate diversification even for small portfolios. Our procedure entails revision of portfolios when tracking deteriorates. Further research on the portfolio revision problem, the use of alternate stock return models, and alternate tracking error measures are potential areas of future research that are likely to be useful to academicians and practitioners.

REFERENCES

Adcock, C.J., and Meade, N. A simple algorithm to incorporate transactions costs in quadratic optimisation. *European Journal of Operational Research*, 1994, *79*(1), 85-94.

Aneja, Y.P., Chandra, R., and Gunay, E.A. A portfolio approach to estimating the average correlation coefficient for the constant correlation model. *Journal of Finance*, 1989, *44*, 1435-1438.

Blog, B., van der Hoek, G., Rinnooy Kan, A.H.G., and Timmer, G.T. The optimal selection of small portfolios. *Management Science*, 1983, *29*, 792-798.

Blume, M. Betas and their regression tendencies. *Journal of Finance*, 1975, *30*, 785-796.

Blume, M.E., Crockett, J., and Friend, I. Stock ownership in the United States: Characteristics and trends. *Survey of Current Business*, 1971, *54*(11), 16-40.

Brigham, E., and Gapenski, L. *Intermediate financial management*, third edition. Hinsdale, Ill.: Dryden Press, 1990.

Connor, G., and Leland, H. Cash management for index tracking. *Financial Analysts Journal*, 1995, *51*(6), 75-80.

Elton, E.J., and Gruber, M.J. *Modern portfolio theory and investment analysis*, fifth edition. New York: John Wiley and Sons, 1995.

Elton, E.J., Gruber, M.J., and Urich, T.J. Are betas best? *Journal of Finance*, 1978, *33*(5), 1375-1384.

Evans, J.L., and Archer, S.H. Diversification and the reduction of dispersion: an empirical analysis. *Journal of Finance*, 1968, *29*, 761-767.

Meade, N., and Salkin, G.R. Index funds - construction and performance measurement. *Journal of the Operational Research Society*, 1989, *40*(10), 871-879.

Meade, N., and Salkin, G.R. Developing and maintaining an equity index fund. *Journal of the Operational Research Society*, 1990, *41*(7), 599-607.

Patel, N.R., and Subrahmanyam, M.G. A simple algorithm for optimal portfolio selection with fixed transaction costs. *Management Science*, 1982, *28*, 303-314.

Rudd, A. Optimal selection of passive portfolios. *Financial Management*, 1980, *9*, 57-66.

Sankaran, J.K., and Patil, A.A. On the optimal selection of portfolios under limited diversification, *Journal of Banking and Finance*, 1999, 23, No. 11, 1655-1666.

Sharpe, W.F. A simplified model for portfolio analysis. *Management Science*, 1963, *9*, 277-293.

Appendix

To facilitate the presentation of our key results, we introduce some additional notation.

$\tilde{R}_p$: The return on the portfolio in which for i = 1,...,n, X_i is the investment (not the weight) in security i (a random variable).

s_p: The standard deviation of $\tilde{R}_p$.

c_p: The coefficient of correlation between $\tilde{R}_p$ and $\tilde{R}_I$.

σ_{iI}: The covariance between $\tilde{R}_i$ and $\tilde{R}_I$.

σ_{pI}: The covariance between $\tilde{R}_p$ and $\tilde{R}_I$.

Our problem may be formulated as:

$$\text{Max } c_p \equiv \frac{\sigma_{pI}}{s_p s_I}$$

such that at most k from among $\{X_i: i = 1,...,n\}$ are non-zero, and

if short-selling is disallowed, all of $\{X_i: i = 1,...,n\}$ are non-negative.

Note that the objective (viz., the correlation coefficient) is dimensionless. Hence, without loss of generality, we can impose the additional constraint on the problem that

$$\sum_{i=1}^{n} \sigma_{iI} X_i = 1.$$

Then, the problem transforms to:

Min $(s_p)^2$

such that

$$\sum_{i=1}^{n} \sigma_{iI} X_i = 1,$$

at most k from among $\{X_i: i = 1,...,n\}$ are non-zero, and if short-selling is disallowed, all of $\{X_i: i = 1,...,n\}$ are non-negative.

In this reduction, we forego the stipulation that the amount invested in a security corresponds to the purchase or short-sale of an integral number of lots of that security. Nevertheless, this reduction has several desirable features. When the set of securities is fixed, the problem of determining $\{X_i: i = 1,...,n\}$ reduces to the minimisation of a positive definite quadratic function subject to a single linear constraint.

We consider two assumptions of the correlation structure of stock returns: the single index model of Sharpe (1963); and the assumption of constant pairwise correlations (see Elton and Gruber (1995), pp. 168-169).

For a subset S of the universe of securities, let P(S) denote the problem:

Min $(s_p)^2$

such that

$$\sum_{i \in S} \sigma_{iI} X_i = 1, \quad (1)$$

and if short-selling is disallowed, all of $\{X_i: i \in S\}$ are non-negative.

Further, let w(S) denote the maximum correlation with the return on the index that is obtainable using only securities in S; if v(S) denotes the optimal objective value of P(S), then

$$w(S) = 1 / (s_I . \sqrt{v(S)})$$

A.1 Assuming the Single Index Model

Note that under the single index model, for all i, $= \beta_i (s_I)^2$. Owing to (1), P(S) reduces to

Min $Var(\varepsilon_i).X_i^2$

such that

$$\sum_{i \in S} \sigma_{iI} X_i = 1$$

and if short-selling is disallowed, all of $\{X_i: i \in S\}$ are non-negative.

In the following proposition, $\underline{S}$ denotes $\{i \in S: \beta_i > 0\}$.

Proposition 1:

(i) If short-selling is allowed, an optimal solution to P(S) is:
X_i is proportional to $\beta_i/Var(\varepsilon_i)$, and

$$w(S)^2 = \frac{\sum_{i \in S} \beta_i^2 . s_I^2 / Var(\varepsilon_i)}{1 + \sum_{i \in S} \beta_i^2 . s_I^2 / Var(\varepsilon_i)}. \quad (2)$$

(ii) If short-selling is not allowed, an optimal solution to P(S) is:
X_i is proportional to $\beta_i/Var(\varepsilon_i)$ for $i \in \underline{S}$,
X_i is zero for $i \notin \underline{S}$, and

$$w(S)^2 = \frac{\sum_{i \in \underline{S}} \beta_i^2 . s_I^2 / Var(\varepsilon_i)}{1 + \sum_{i \in \underline{S}} \beta_i^2 . s_I^2 / Var(\varepsilon_i)}.$$

In both cases, $\{X_i: i \in S\}$ may be normalised in the obvious way. Proposition 1 follows from a simple application of the Karush-Kuhn-Tucker conditions for optimality and hence, the proof is omitted.

From the assumptions of the single index model, one may deduce that for all i,

$$c_i^{\,2} = \frac{(\beta_i . s_I)^2}{(\beta_i . s_I)^2 + Var(\varepsilon_i)}.$$

Thus, for all i,

$$\frac{c_i^{\,2}}{1 - c_i^{\,2}} = \frac{(\beta_i . s_I)^2}{Var(\varepsilon_i)}. \tag{3}$$

From (2) and (3), it follows that

$$\frac{w(S)^2}{1 - w(S)^2} = \sum_{i \in S} \frac{c_i^{\,2}}{1 - c_i^{\,2}}. \tag{4}$$

If short-selling is not allowed, then we should replace S in the right-hand-side of (4) by $\underline{S}$.

The expression $\gamma/(1-\gamma)$ goes from 0 to infinity as γ increases from 0 to unity and vice versa. Hence, it is apparent from (4) that if S should contain no more than *k* securities, then w(S) is maximised when S comprises those securities with the *k* largest and positive values of $|c_i|$ in the case of short-selling (c_i, in the case of no short-selling). The optimal weights and the maximum correlation can be obtained from (i) and (ii) in the statement of Proposition 1. Thus, the procedure, SINGLE_INDEX, is validated.

The following proposition establishes that the marginal benefit from diversification decreases with the number of securities in the portfolio. For ease in exposition, we state and prove the proposition for the case when short-selling is disallowed - the case when short-selling is allowed is proved in an entirely analogous manner. Let U(k) denote the correlation of the return on the market index with the return on that portfolio which maximises the correlation among all portfolios that contain at most k securities; then, assuming that the securities are numbered in non-increasing order of $\{c_i\}$ and that $c_k > 0$,

$$U(k) = \sqrt{\frac{\sum_{i=1}^{k} \left(\frac{c_i^{\,2}}{1 - c_i^{\,2}} \right)}{1 + \sum_{i=1}^{k} \left(\frac{c_i^{\,2}}{1 - c_i^{\,2}} \right)}}.$$

If $c_k \leq 0$, then both summations in the expression for U(k) are over 1,…,m (and not 1,…,k), where m is the largest-numbered security for which $c_m > 0$.

Proposition 2: For k ≥2, U(k) - U(k-1) ≥ U(k+1) - U(k).

Proof of Proposition 2: We assume that $c_{k+1} \geq 0$ because otherwise U(k) = U(k+1) and the proof of the proposition is immediate. For k ≥ 2, let $V(k) = U(k)^2$. Then, V(k+1) – V(k) = (U(k+1) – U(k)).(U(k+1) + U(k)), and

V(k) – V(k-1) = (U(k) – U(k-1)).(U(k) + U(k-1)). Since U(k+1) ≥ U(k) ≥ U(k-1), if we can show that V(k+1) – V(k) ≤ V(k) - V(k-1), then it will follow that for k ≥ 2, U(k+1) – U(k) ≤ U(k) – U(k-1).

$$\text{Now, } V(k) - V(k\text{-}1) = \frac{\sum_{i=1}^{k}\left(\frac{c_i^{\,2}}{1-c_i^{\,2}}\right)}{1+\sum_{i=1}^{k}\left(\frac{c_i^{\,2}}{1-c_i^{\,2}}\right)} - \frac{\sum_{i=1}^{k-1}\left(\frac{c_i^{\,2}}{1-c_i^{\,2}}\right)}{1+\sum_{i=1}^{k-1}\left(\frac{c_i^{\,2}}{1-c_i^{\,2}}\right)}.$$

Letting

$$\theta = \sum_{i=1}^{k-1}\left(\frac{c_i^{\,2}}{1-c_i^{\,2}}\right)$$

it follows that

$$V(k) - V(k\text{-}1) = \frac{\theta + \left(\frac{c_k^{\,2}}{1-c_k^{\,2}}\right)}{1+\theta+\left(\frac{c_k^{\,2}}{1-c_k^{\,2}}\right)} - \frac{\theta}{1+\theta} = \frac{\left(\frac{c_k^{\,2}}{1-c_k^{\,2}}\right)}{\left(1+\theta+\frac{c_k^{\,2}}{1-c_k^{\,2}}\right).(1+\theta)}.$$

Similarly

$$V(k+1) - V(k) = \frac{\frac{c_{k+1}^{\,2}}{1-c_{k+1}^{\,2}}}{\left(1+\theta+\frac{c_k^{\,2}}{1-c_k^{\,2}}+\frac{c_{k+1}^{\,2}}{1-c_{k+1}^{\,2}}\right).\left(1+\theta+\frac{c_k^{\,2}}{1-c_k^{\,2}}\right)}.$$

From a comparison of the expressions for V(k+1) - V(k) and V(k) - V(k-1), it is immediate that for k ≥ 2, V(k+1) - V(k) ≤ V(k) - V(k-1).

Q.E.D. (Proposition 2.)

A.2 Assuming Constant Pairwise Correlations

It is apparent from the assumption of constant pairwise correlations that for all i and j, σ_{ij} may be written as $p.s_i.s_j$ where p is the constant correlation coefficient between any pair of security returns. In what follows, if • is a vector and S is some subset of {1,...,n}, then $\bullet^S$ is the sub-vector of • that corresponds to S. Then, under the variable transformation $Y_i = s_i X_i$ for all i, P(S) reduces to

$$\text{Min } Y^{S\prime}\, C^S\, Y^S$$

$$\sum_{i\in S} c_i Y_i = 1/s_I$$

such that

and

if short-selling is disallowed, $Y_i \geq 0$ for all $i \in S$,

where C^S is an |S|x|S| matrix whose diagonal entries are unity and off-diagonal entries are p.

Once again, we assume that the securities are numbered in non-increasing order of $\{c_i\}$.

The case when short-selling is allowed

We begin by stating a proposition. Let c^S denote the sub-vector of $(c_1, \ldots, c_n)$ that corresponds to the set of securities, S.

Proposition 3: The optimal value of Y^S in P(S) is $(1/s_I)$.

$$\left(C^{S^{-1}}{}_{c}S\right) \Big/ \left({}_{c}S' C^{S^{-1}}{}_{c}S\right)$$

and

$$w(S) = \sqrt{{}_{c}S' C^{S^{-1}}{}_{c}S}\,.$$

Proposition 3 can be proved through a straight-forward application of the Karush-Kuhn-Tucker conditions and the proof is omitted here. Our problem reduces to

$$\text{Max } w(S) = \sqrt{{}_{c}S' C^{S^{-1}}{}_{c}S}$$

such that

$S \subseteq \{1,...,n\}$ and $|S| = k$.

We first need a simple lemma which is easily proved through algebra.

Lemma 4: For all S such that $|S| = k$, $C^{S^{-1}}$, is a matrix whose diagonal entries are $[-(k-2).p-1]/[(I-1).p^2 - (k-2).p-1]$ and whose off-diagonal entries are $p/[(k-1).p2 - (k-2).p-1]$

From Lemma 4, it may be deduced that

$$w(S)^2 = \left(\frac{1}{1-p}\right).\left(\sum_{i\in S} c_i{}^2 - \frac{p.\left(\sum_{i\in S} c_i\right)^2}{p(|S|-1)+1}\right). \qquad (5)$$

Since $0 < p < 1$, our problem becomes

$$\text{Max} \left(\sum_{i \in S} c_i^{\,2} - \frac{p.\left(\sum_{i \in S} c_i \right)^2}{p(|S|-1)+1} \right)$$

such that

$S \subseteq \{1,...,n\}$, $|S| = k$.

It turns out that Patel and Subrahmanyam (1982) (henceforth, P&S) have studied the above problem in the context of designing an optimal portfolio in the presence of fixed transaction costs. (The difference is that the corresponding expression in their paper contains the ratio of the average excess return over the risk-less rate to the standard deviation for each security, instead of the correlation with the market-index.)

P&S give two results regarding optimal portfolios, the second of which is incorrect. The result of P&S that we use is that there is an optimal portfolio under which security j is not held unless either s or t is also held, where $s < j < t$. (Actually, P&S formally prove this only for $s = j-1$ and $t = j+1$ but it is trivial to generalise their proof.) This result implies that there is an optimal portfolio in which the set of securities is of the form $\{1, ..., u_k, l_k, ..., n\}$ where $u_k + n - l_k + 1 = k$. Thus, with each k ($k = 1, ..., n$), we may associate a number u_k which signifies the index set of securities held in an optimal portfolio with k securities. P&S also claim that if $c_i \geq 0$ for all $i = 1,...,n$, then u_{k+1} equals either u_k or $u_k + 1$. Unfortunately however, the proof of that claim is invalidated by a very slight algebraic error; in the last inequality on p. 308 of Patel and Subrahmanyam (1982), the term "(m-2)" is incorrectly used in place of "(m-1)".

Nevertheless, based on P&S' first result, we can use the algorithm, Const_Corr_Short_Selling, to find an optimal portfolio when short-selling is allowed.

The case when short-selling is disallowed

For the case when short-selling is disallowed, we need a procedure Find-Portfolio which designs a portfolio comprising a subset S of at most a specified number r of securities among those indexed in F. For $t = 1,...,|F|$, let i(t) be that security in F with the t^{th} largest value of $\{c_i: i \in F\}$.

Find-Portfolio

Inputs: A set of securities, F, and a natural number, r (which is at most |F|).

Output: A portfolio comprising a subset of at most r securities from F.

1. *If* $c_{i(1)} \leq 0$, *then* set $t = 0$ and go to step 4;
   else, initialise t to 1.

2. *If* $t \geq r$ or $c_{i(t+1)} \leq p$.

$$\left(\frac{\sum_{u=1}^{t} c_{i(u)}}{(t-1).p+1} \right),$$

then go to step 4;

else, increment t by 1.

3. Go to step 2.

4. Construct the weights $\{x_i\}$ as follows:
for $u = 1,...,t$, $x_{i(u)}$ is in proportion with

$$\left(\frac{1}{(1-p).s_{i(u)}} \right).\left(c_{i(u)} - \frac{p.\sum_{v=1}^{t} c_{i(v)}}{(t-1).p+1} \right) \tag{6}$$

for $u = t+1,...,|F|$, $x_{i(u)} := 0$. (7)

For each set of securities, F, let S_F be the subset of F corresponding to securities that are chosen for investment by FIND-PORTFOLIO when $r = |F|$. The following proposition validates FIND-PORTFOLIO.

Proposition 5: For each set of securities, F,

$$w(F) := \sqrt{\left(\frac{1}{1-p} \right).\left(\sum_{i \in S_F} c_i^{\,2} - \frac{p.\left(\sum_{i \in S_F} c_i \right)^2}{p(|S_F|-1)+1} \right)}. \tag{8}$$

Further, the portfolio that attains w(F) is given by equations (6)-(7).

Proposition 5 can be proved along the lines of Elton and Gruber (1995) {pp. 205-206}, and hence, we omit the proof here. If $c_i \leq 0$ for all $i = 1,...,n$, then it is optimal to invest in none of the n securities. Hence, to avoid trivialities, we assume that $c_1 > 0$.

By a sheer mathematical coincidence, in the case when constant pairwise correlations are assumed, the present problem is equivalent to that of finding portfolios that contain at most a specified number of securities and that maximise the ratio of the average excess return to the standard deviation. This equivalence does not hold when the single index model of stock returns is assumed. In fact, under that model, while the present problem is very tractable, the theory of computational complexity implies that the problem of finding optimal portfolios that contain at most, a specified number of securities and

that maximise the ratio of the average excess return to the standard deviation, is intractable (Blog *et al.*(1983)). The following results are proved in Sankaran and Patil (1999).

Proposition 6, given below, is the key result that underlies our algorithm for the case of no short-selling and constant pairwise correlations.

Proposition 6 [cf. Proposition 2 in Sankaran and Patil (1999)]: Let F be a set of *m* ($2 \le m \le n$) securities such that $S_F = F$. Let L denote the largest-numbered security in F. (Thus, L has the smallest value of *c* among all the securities in F.) Let j be a security which is not in F such that $j < L$. Then, $w(F \cup \{j\} \setminus \{L\}) \ge w(F)$.

Proposition 6 has an important corollary. To state it, we define a k-optimal portfolio as one that maximises the correlation with the market-index over all portfolios that comprise at most k securities ($k \ge 2$).

Corollary 7 [cf. Corollary 3 in Sankaran and Patil, (1999)]: There is a k-optimal portfolio which comprises securities {1,...,s} for some $s \le k$. Further, Find-Portfolio finds such a portfolio when r = k and F = {1,...,k}.

Corollary 7 implies that the algorithm, Const_Corr_No_Short_Selling, is valid. Let K denote the largest value of k for which the algorithm includes *all* the securities 1,…,k. For k = 1,...,K, let W(k) denote the correlation of the return on the market index with the return on the portfolio that is optimal among those that contain at most k securities; then,

$$W(k) = \sqrt{\left(\frac{1}{1-p}\right).\left(\sum_{i=1}^{k} c_i^{\,2} - \frac{p.\left(\sum_{i=1}^{k} c_i\right)^2}{(k-1).p+1}\right)}.$$

The following proposition implies that the marginal benefit from diversification decreases with the number of securities in the portfolio.

Proposition 8 [cf. Proposition 4 in Sankaran and Patil (1999)]: For k = 2,...,K-1, $W(k) - W(k-1) > W(k+1) - W(k)$.

About the Authors

Amod Kumar Agarwala is pursuing a Master's Degree in Business Administration at the Indian Institute of Management Calcutta, India. In April-May 2005, Amod will join Merrill Lynch, New York as a Summer Analyst. Prior to joining the MBA programme, Amod was a research and development engineer at the Satellite Engineering Centre at Nanyang Technological University (NTU), Singapore, where he was involved in the development of X-Sat, Singapore's first indigenous satellite. He worked on radio frequency design, signal and grounding architecture and satellite configuration besides handling systems engineering for the project. He graduated from NTU in 2002 with a degree in Electrical and Electronic Engineering. He has actively pursued his strong interest in financial and economic research since his final undergraduate year and has written several essays which he is now compiling into a polemic on globalisation. Amod has also represented his universities in national and international debating contests. His website is www.freewebs.com/akaideas.

Asjeet S. Lamba is a Senior Lecturer with the Department of Finance at the University of Melbourne. He has over 18 years of teaching experience in the areas of corporate finance and international finance. Asjeet has also taught in the MBA programs at the Australian National University and Monash University and in executive education programs associated with the ANZ Bank. The focus of Asjeet's current research is on the transmission of information among equity markets and the valuation implications of corporate events such as international joint ventures and acquisitions, share buybacks, corporate litigation and insider trading. He has written extensively in his areas of interest including several refereed publications in the *Journal of Financial Research*, *Journal of International Financial Markets, Institutions and Money* and *Pacific-Basin Finance Journal*. He has presented over fifty papers at finance industry and academic conferences. Asjeet is also a CFA charterholder.

Chandrasekhar Krishnamurti is an Associate Professor at the Nanyang Business School of Nanyang Technological University. He teaches at both the graduate and undergraduate levels. He holds a Ph.D. in Finance from the University of Iowa, USA. He has a wealth of teaching, research and consulting experience having worked in the US, India and Singapore. His research interests span several areas such as: market microstructure, risk management using derivatives, emerging markets and international finance. He has been a consultant for the Financial Institutions Reform and Expansion (FIRE) project funded by USAID and administered by Price Waterhouse LLP, USA. His research work regarding Nasdaq, New York Stock Exchange, Paris Bourse, and stock exchanges in emerging countries have been published in the following journals: Journal of Banking and Finance, Financial Management, Quarterly Journal of Business and Economics, Journal of Financial Research and Managerial Finance. He has coducted Executive Training programmes on the following topics: Derivatives and Risk Management, Investment Strategies for Individual Investors.

Dipinder Randhawa is currently a Research Fellow at the Saw Centre for Financial Studies at the National University of Singapore. His wide ranging research interests include banking, financial fragility and related issues. His research work has been presented at several high-level international conferences and published in refereed international journals. He has also taught at several universities in Asia and the US. He holds a Ph.D. from Syracuse University.

Jay Sankaran is an Associate Professor in operations management at the Department of Information Systems & Operations Management of the University of Auckland Business School in Auckland, New Zealand. Jay's research interests span both modelling and empirics in logistics and supply chain management with an emphasis on the New Zealand context. Jay has a PhD in management science from the Graduate School of Business, The University of Chicago. The present paper is related to other research that he has conducted on limited-diversification portfolio optimisation with Ajay Patil that appeared in the Journal of Banking & Finance.

John Sequeira is currently an Assistant Professor of Finance at the National University of Singapore Business School. Prior to joining academia, he was a Training Manager at the Keppel Bank of Singapore. In 2002, he was awarded the Department Outstanding Educator Award and was subsequently placed on the list of NUS Excellent Teachers in 2003. His research interests are in Financial Econometrics and Equity Valuation and he has published in the *Journal of Banking and Finance, Journal of Multinational Financial Management* and *Journal of Economic Surveys.* He has previously served as a member of the editorial board of *Accounting and Finance* and as a session organiser for the International Congress on Modelling and Simulation. He is currently a member of the Corporate Governance and Financial Reporting Centre at the National University of Singapore.

Željko Šević is the Reader of Accounting, Finance and Public Policy in the University of Greenwich Business School, where he also serves as the Head of the Department od Accounting and Finance. He has been educated in Serbia, the UK and Netherlands and has held a visiting academic position in Australia, Austria, Japan, Croatia, Poland and Bulgaria. Prior to becoming a full-time academic Dr Šević served as the Deputy Minister and Head of the Youth Department in the Ministry of Youth and Sports of the Republic of Serbia (1991-1993) and gained experience, at the senior level, in NGOs (1989-1991) and in the private sector (1994). His current research interests are in the public sector reform in Japan and Vietnam (on-going projects), and accounting reform in the public sector with the particular emphasis on the use of management accounting in public sector restructuring and the design of effective financial/fiscal information systems.

Detailed instruction for authors

The Journal solicits papers which are 8,000 to 10,000 words in length. Shorter papers between 5,000 and 8,000 words will also be considered for publication, especially if they are review articles or if they put forward new, insufficiently explored ideas and approaches (often deemed to be premature by other journals). Book reviews should exceed 2,000 words and reviewers are required to submit a copy of the book reviewed if they initiate a review of the publication.

All submissions must be in English. However, as this journal belongs to the UN family, it encourages the translation of works originally written in other languages into English. Nevertheless, submission to the journal implicates that the paper has not been published elsewhere (regardless of the language of publication) and that it is not submitted for publication in any other medium.

All papers submitted for publication should be sent electronically to the Editor at the following address: Z.Sevic@gre.ac.uk or ecpd@eunet.yu

Submission of a paper will be held to imply that it contains original unpublished work. The Editor does not accept responsibility for damage or loss of papers submitted. Upon acceptance of an article, author(s) will be asked to transfer copyright of the article to the publisher – the European Center for Peace and Development at the University for Peace established by the United Nations (ECPD). This transfer will ensure the widest possible dissemination of information.

Manuscripts should be double-spaced with wide margins. All pages should be numbered consecutively. Titles and subtitles should be kept as short as possible. References, tables and legends for figures should be inserted into the main text and also submitted as separate files with the final version of the paper. This final version should be sent in hard copy form and on a 3.5" diskette or a CR-Rom to the editor at the following address: Zeljko Sevic, The Business School, University of Greenwich, Old Royal Naval College, 30 Park Row, Greenwich, London SE10 9LS, England, UK or ECPD, Terazije 41, 11000 Belgrade.

The first page of the manuscript should contain the following information: the title; the name(s) and institutional affiliation(s) of the author(s) and an abstract of not more than 200 words. At the bottom of the cover page, please provide the full postal address, telephone number, fax number, and E-mail address of the corresponding author. Please also supply up to five key words with up to three Journal of Economic Literature codes.

In principle, any acknowledgements, and information on grants received should be given in a first footnote, which should not be included in the consecutive numbering of footnotes, and marked with a asterisk (*).

Footnotes should generally be avoided. The Journal's view is that if the material is worth including in the paper, it should be incorporated into the text. However, footnotes can be used for very long lists of references that would otherwise break up the text, or for material that is substantive but takes the reader too far afield to be easily integrated into

the text. Acknowledgments also belong in the footnotes (e.g., "We thank John Long for suggesting this new approach/test/interpretation.") A general guideline is no more than one footnote to every 4-5 pages of text, not including acknowledgments and long lists of references. Footnotes are numbered consecutively in Arabic superscripts. Footnotes must not, under any circumstances, include displayed formulae or tables.

Displayed formulae should be numbered consecutively throughout the manuscript as (1), (2), etc. against the right-hand margin of the page. Section headers are left-justified with Arabic numerals. Only the first word is capitalized. Headers are in boldface type, and subheads are in italics. A period follows the last numeral. As headers and subheads introduce text, it is preferable that they not be immediately followed by additional subheads. References in the text to other sections of the paper are capitalized (e.g., "as noted in Section 2.2").

The first line of each paragraph is indented. The use of the active voice greatly improves the readability of a paper (e.g., "the tests show" or "we show," not "it is shown"), but authors should avoid the use of 'I', since good academic writing should be depersonalised. Italics, quotation marks, and capital letters are considered to be distracting and should be kept to a minimum (although the words a priori, etc., i.e., e.g., et al., ex ante, and ex post are italicised). Special terms can be italicised but only at the first occurrence, and all foreign (non-English) words should be italicised. Abbreviations should be kept to a minimum, and the full text with an abbreviation in brackets should be given when the term is used for the fist time. Do not assume that all readers are familiar with the abbreviations/acronyms that are used in your paper. The use of appendices is discouraged but if they are used, please refer to them as Appendix A, Appendix B, etc.

The Journal endorses full Harvard referencing style. Potential authors are strongly encouraged to consider the latest edition of the Chicago Manual of Style, before submitting their paper. The list of references should appear at the end of the main text (after any appendices, but before tables and legends for figures). It should be double-spaced and listed in alphabetical order by author's name. Everything in the list of references should be cited in the text, with no discrepancies in the spelling of the authors' names or in the date of publication. In the reference list, there are no quotation marks, no underlines, and no italics. The authors' last names and first initials are used. Only the first word of an article title is capitalised. Book and journal titles take normal initial capitals. References should appear as follows:

For Monographs/Books:

Hunt, B. and D. Targett (1995), *The Japanese Advantage? The IT Battleground in Europe, Oxford*: Butterworth Heinemann in association with "Management Today".

For Contributions to Collective Works (book chapters – edited volumes/conference proceedings):

Barsoux, J.-L. and P. Lawrence (1991), Countries, Cultures and Constraints in R. Calori and P. Lawrence, eds. *The Business of Europe: Managing Change*, London: SAGE Publications, 198-217.

For Journals:

Kornai, J. (1993), The Evolution of Financial Discipline under the Post-Socialist System, *Kyklos*, **46**(3), 315-336.

For Unpublished material:

Bonin, J. P. and M. E. Schaffer (1995), *Banks, Firms, Bad Debts, and Bankruptcy in Hungary 1991-94*, CEP Discussion Paper No. 234, London: Centre for Economic Performance at LSE

For WWW material:

CATO Institute (1998), *Rita Gluzman, Petitioner v. United States of America, Respondent, Brief of Amicus Curiae the Cato Institute in Support of the Petition for a Writ of Certiorari to the United States Court of Appeals for the Second Circuit*, http://www.cato.org/pubs/legalbriefs/gluzman.pdf [*accessed* 15th March 2001]

Journal titles *should not* be abbreviated. Also, the location of the university or publisher must only be a city. Do not provide information on a county, state or a country.

Citations in the text and footnotes should include the surname of the author(s) followed by the year of publication in brackets, such as (Merton, 1986). If the author refers to a direct quotation, this should be given under quotation marks and page number should be provided, such as (Merton, 1986: 3). If there are more than three authors credited to a single publication, the reference is referred to as the first author's surname, followed by et al. typed in italic, whilst all the authors will be listed at the end of the paper in the list of references. For instance, (Merton, *et al.*, 1986). Note that where there are more than two authors, their names should be separated by commas and multiple parenthetical citations should be separated by semicolons.

Use commas in numbers with more than three digits (e.g., 1,234 vs. 1234). Per cents appear as 12.34 per cent (not 12.34%). In principle, avoid the use of symbols in the main text. Decimals are preceded by a zero, as in 0.1234 (not .1234). A number or percent at the beginning of a sentence is spelled out (e.g., "Forty-two of these firms are in the full sample…") but it is preferable to use a different construction (e.g., "The full sample includes 42 of these firms…"). Months and years are written without commas or apostrophes (e.g., 1980s, January 1990).

Any illustrations will be reproduced photographically from originals supplied by the author; the publisher will not redraw them. Please provide all illustrations in duplicate (two high-contrast copies). Care should be taken that lettering and symbols are of a comparable size. The illustrations should not be inserted in the text, and should be marked on the back with figure number, title of paper, and author's name.

Tables should be numbered consecutively in the text in Arabic numerals and inserted into the main text. However, they must also be printed on separate sheets and saved into separate files labelled appropriately in an understandable manner (table 1, table 2, etc.) when the final version of the accepted paper is submitted in electronic and hard copy to the Editor. The legends, axis labels, column and row labels and footnotes for all figures and tables should be clear enough so they are self-contained; that is, the content of the table or the figure must be understandable without reading the text of the article and authors should avoid describing the same material presented in the tables in the main text. Each table must have a title (at the top) followed by a descriptive legend. The source(s) of the table must be given below the table, following the word 'Source:' written in italic script (For example: '*Source*: John, 1992, p. 23'). Authors must check tables to be sure that the title, column headings, captions, etc. are clear and to the point. All graphs and diagrams should be referred to as figures (e.g., Fig. 1), and should be numbered consecutively in the text in Arabic numerals. Illustrations for papers submitted as electronic manuscripts should be in traditional form.

The legends and captions for tables or figures should be complete enough that the table or figure can stand on its own. Large tables and graphs must be presented in landscape format, and tables should be typed in 9 pt script, while the main text is typed in 12 pt script. In particular, the TITLE AND LEGEND of the table or figure must describe the content of the numbers or symbols in the body of the table or the content of the figure. For example, a table legend that says "Descriptive Statistics" is unsatisfactory.

Equations in the text are indented on a separate line with the number of the equation right-justified. All equations are numbered, even if they are never referred to in the text. In general, equations are punctuated as normal parts of a sentence if the sentence continues after the equation, as follows:

Revenue, R is calculated as

$$R = P^*V \tag{1}$$

where

– P is the selling price, and
– V is the volume of sales in units.

Ensure that the letter "I" and digit "1", and also the letter "O" and digit "0" are used properly, and format your article (tabs, indents, etc.) consistently. Characters not available on your word processor (Greek letters, mathematical symbols, etc.) should not be left open but indicated by a unique code (e.g., alpha, @, etc., for the Greek letter "alpha"). Such codes should be used consistently throughout the entire text and a list of codes should accompany the electronic manuscript. Do not allow your word processor to introduce word breaks and do not use a justified layout. Please adhere strictly to the general instructions below on style, arrangement, and, in particular, the reference style of the Journal.

Any manuscript that does not conform to the set instructions will be returned to the author(s) for necessary amendments before being sent to the referees.

Once the accepted paper is ready for going to print, the page proofs will be sent to the corresponding author. Proofs should be corrected carefully; the responsibility for detecting errors lies with the author. Corrections should be restricted to instances in which the proof is at variance with the manuscript. Each author will receive 5 reprints of his/her paper and a copy of the journal issue in which the paper has appeared. All the reprints will be sent to the corresponding author and he/she will be responsible for distributing reprints and copies of the journal to other co-authors.

Potential authors are strongly encouraged to consider the Journal of Financial Economics' style guide as this promotes good academic writing. However, if there is an inconsistency between the above instructions and the JFE style-sheet, the authors should adhere to the above stipulated guidelines. JFE style-guide can be accessed via WWW at http://jfe.rochester.edu.