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CAPM-β of Carriers and Consolidators in Liner Shipping: Volume Contracts under the Rotterdam Rules in Perspective

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SUMMARY

Liner shipping, which provides transportation by ships operating on a regular schedule between specified ports in accordance with publicly available timetables of sailing dates, is now a mature industry. The various players which are part of the liner shipping industry, namely, ocean carriers, port operators, freight forwarders or consolidators, customs, hinterland haulage carriers, inland navigation carriers, market regulators, etc., are increasingly interdependent on each other leading to inter-industry partnership. The recent global financial crisis has led to better vertical and horizontal cooperation among the ocean carriers and the nodal service providers in the liner shipping industry. However, some of the major liner carriers are yet to post profits as the freight rates were severely affected during the crisis.

Amidst this evolving market environment, the liner shipping industry which used to be highly regulated through the conference system has witnessed the emergence of the contract paradigm of free bargaining norms where there is in place a service contract as promulgated under the Shipping Act of 1984 and the Ocean Shipping Reform Act of 1998 in the United States (US). The uniqueness of individual contracts between shippers and carriers has now been recognized in the US through these Acts for almost three decades. This uniqueness, it would appear, has influenced the development of the volume contract concept in the newly adopted convention called the Rotterdam Rules and has provided the impetus for introducing bargaining freedom in carriage of goods wholly or partly by sea.

The thesis analyses the various economic and financial implications associated with the bargaining freedom under volume contracts through estimation and drawing the time-varying systematic risk, β in the liner shipping industry by using Kalman filters and relate the estimated path of β to market changes during 1980–2013, depending on availability of data. To interpret the market environment in the liner shipping industry, the focus is on two points. The first is that the introduction of policies for promoting competition increases β, and the second is that an increase in market power due to cooperation and concentration among firms reduces β. The result of the analysis is varied across jurisdictions showing a certain degree of dependence on the position of national or regional legislation in which the liner shipping company is operating.

The thesis also attempts to view the volume contract concept from a particular vantage point, namely, the perspective of the shipper, who in the present world trade scenario is often a non-traditional entity such as a logistics service provider, freight forwarder or consolidator. Global players in the consolidation business like DHL and UPS along with a section of the liner shipping carriers, equipped with state of the art information technology, has opened up a new era of cooperation in the liner shipping business with capacity-based pricing, time-based pricing, and service-based pricing. It is submitted that the introduction of volume contracts will enable these consolidation companies to take advantage of the freedom of contract in expanding their business within the mature liner shipping industry thereby creating value for themselves as well as for small and medium shippers. It is notable in this context that consolidators licensed in the US were allowed service contract parity through the NVOCC Service Arrangements (NSA) rule in December 2004, when dealing with their shipper-customers. However, there were certain tariff publication requirements which did not

allow consolidators to reap the full benefit of the NSA rule. In February 2010, the publication requirements were relaxed creating a new wave of opportunity for consolidators. The financial analysis therefore includes estimation and drawing the β in the consolidation business by using Kalman filters and relate the estimated path of β to market changes during the period 1988–2013, depending on availability of data, depicting the growing business opportunity for these nodal service providers who are an important part of the liner shipping industry. The commercial viability of volume contracts with regard to the liner shipping industry is presented in conclusion which also reflect the viewpoints of the authors.

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CHAPTER 1

INTRODUCTION

1.1. Background

The past thirty years witnessed phenomenal growth of containerisation and the liner shipping industry through out the world. Most of the growth was derived through expansion of liner shipping services in new regions of the world fuelled by development of production centres in the Far East and also enhancing the economies of scale by adopting the hub and spoke model. During this period, the introduction of new regulations led to changes in the market power of the liner shipping industry. Particularly, amendments introduced in the US Shipping Act, 1984 (1984 Act) and the subsequent promulgation of the Ocean Shipping Reform Act (OSRA), 1998 which introduced and thereafter refined the so-called service contract mechanism initiated the deregulation process in the US allowing shipping lines to offer rates based on time and volume of cargo so that the freight-rates varied with cargo-volume tendered over a specified period. However, the effect of the 1984 Act was limited, because of the requirement in the statute that the terms and conditions of the contract had to be publicly available and could be demanded by other similarly situated shippers leading to "me-too" contracts. This problem was later rectified by the OSRA in 1998 which finally made freight-rates dependent on market reference points. While it is recognized that the service contract concept has benefited large shippers, there has been a strong complementary trend that has benefited smaller shippers through the growth of large consolidators such as UPS and DHL as well as others, on the international scene. The consolidators licensed in the US were also allowed service contract parity through the NVOCC Service Arrangements (NSA) rule in December 2004, when dealing with their shipper-customers. However, there were certain tariff publication requirements which did not allow consolidators to reap the full benefit of the NSA rule until February 2010, when the publication requirements were relaxed. The new regulatory regime has created a new wave of opportunity for consolidators and will also benefit small and medium shippers.

In carriage of goods by sea, the carrier-shipper relationship, apart from the apportionment of liability between the parties, there is another dimension which is the trade relationship. This component is equally important as the liability regime, if not more so, in terms of the wider picture of international trade is enmeshed with carriage of goods across continents. The pre-existing carriage of goods by sea regimes, namely the Hague/Hague-Visby and Hamburg Rules do not deal with the trade aspects and only regulates the liability aspects. However, the newly adopted carriage of goods by sea convention called the Rotterdam Rules[1] subsumed the US service contract concept through the so-called volume contracts thereby incorporating a trade dimension in a carriage regime. This incorporation attaches the potential to trigger further reorganisation in liner shipping throughout the globe. This thesis first introduces and

[1] The United Nations Convention on Contracts for the International Carriage of Goods Wholly or Partly by Sea, also known as the Rotterdam Rules, was created by the United Nations Commission on International Trade Law (UNCITRAL) through its Working Group III (Transport Law). The final text of the Convention is annexed to General Assembly Resolution 63/122, UN Doc A/RES/63/122. It was also annexed to the "Report of the United Nations Commission on International Trade Law on the work of its forty-first session", UN Doc A/63/17 (2008), Annex I.

demonstrates how the liner shipping companies might be affected through the introduction of volume contracts. It also examines how the freight forwarders or cargo consolidators, who are gaining increased importance in the liner shipping industry, interact with liner carriers and how their businesses might be benefitted through volume contracts. The thesis then discusses how market regulators might improve market efficiency through the introduction of the volume contract concept under the Rotterdam Rules.

1.2. Object and purpose of the thesis

The thesis first focuses on the time-varying systematic risk, β in the liner shipping industry. The thesis estimates and draws the time-varying systematic risk, β in the liner shipping industry by using Kalman filters and make an attempt to relate the estimated path of β to market changes during the period 1980 to 2013, depending on the availability of data. The thesis then tests the hypothesis that introduction of regulatory policies which foster competition in the shipping industry globally increases β and that an increase in market power engendered through cooperation and concentration among companies reduces β. The thesis then focuses on the estimation and drawing the β in the consolidation business by using Kalman filters and relate the estimated path of β to market changes during the period 1988–2013, depending on availability of data, depicting the growing business opportunity for these nodal service providers who are an important part of the liner shipping industry. It is submitted that CAPM-β being the most popular method to estimate cost of equity is an important input not only for the company's management but also for the investors when they construct their portfolios.

The thesis analyses the abundant financial literature which draws connection between β and market regulations affecting a firm's risk. The thesis refers to earlier works which show β decreases if the market has protections, such as antitrust exemption and price regulation to stifle competition. The authors apply this to the liner shipping market to show that β should increase in response to the 1984 Act and the OSRA as the legislation promoted competition in liner shipping. A similar analysis is also made with consolidation firms to examine if β decreases after the passage of the NSA rule in 2004 and further relaxation of publication requirements in 2010. This provide the authors an opportunity to make a prognosis of the volume contract concept under the Rotterdam Rules to predict further changes in the liner shipping market. Perusing existing studies related to issues of market power and CAPM-β, the authors investigate whether that firms with higher monopoly power will lower β for both liner carriers and consolidators. In addition, the thesis examines whether market power and capital intensity are interactive causes of systematic risk β for carriers and consolidators.

The thesis examines the service contract market, which being a futures market has different characteristics than the spot market. In a futures market the expectations on future freight rates increases or decreases are reflected in the actual rates. The carriage of large volumes may cause fierce competition, which may have a rate decreasing effect. It is envisaged by shipping industry experts that in the near future volume contracts will engender futures contracts to be drawn more frequently in liner shipping if the Rotterdam Rules enters into force. It is submitted that global players in the consolidation business like DHL and UPS along with a section of the liner

shipping carriers, equipped with state of the art information technology, has opened up a new era of cooperation in the liner shipping business with capacity-based pricing, time-based pricing, and service-based pricing. The introduction of volume contracts will enable carriers and consolidation companies to take advantage of the freedom of contract in expanding their business while operating in a mature industry.

The specific research questions that are analysed and answered in the thesis are –

(i) Whether volume contracts will increase the systematic risk of liner shipping companies?
(ii) Whether volume contracts will benefit consolidation companies by reducing their systematic risk?

1.3. Research methodology

This research affords an opportunity to the authors to probe into a subject of contemporary interest in liner shipping from a financial perspective, and in particular will contribute to the growing importance of inter-disciplinary research involving law and finance.

The aim of the thesis is to examine the systematic risk of liner shipping and cargo consolidation companies. Capital Asset Pricing Model (CAPM) is used to measure the systematic risk of these companies, denoted by β. For estimation of the parameter β, the Ordinary Least Squares (OLS) method is used. To capture the volatility clustering, Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model is used to calculate systematic risk and is then compared with the results obtained through the OLS method. As the main aim of the analysis is to look at the β's sensitivity to changes in regulation and market power, the Kalman Filter algorithm is used to capture the time-varying β. To get 95% confidence intervals of time-varying β, Root Mean Square Error (RMSE) method is applied. In addition to that, Fama-French Three Factor (FF3F) model is used to confirm or contradict estimations.

The past three decades has witnessed two important changes in the liner shipping market, namely, increased competition engendered through regulatory changes and increased market power through the formation of global alliances. To analyse the liner shipping market, the structure-conduct-performance (SCP) approach is useful. This approach, which is a part of industrial organisation theory, is often applied in market analysis. Under the SCP framework, market performance is specified by market conduct, which in turn is specified by market structure. The market performance shows how successful is the industry in producing goods and services for the benefit of the consumer. Profit rate of the firms could be used as a parameter, as it reflects market performance. Market conduct exhibits the behaviour of the firms in the market, such as, their intern-firm cooperation or pricing strategy. The market structure includes the competitive environment in the market, which can be analysed using parameters such as the number of firms in the market, concentration ratio, etc.

Therefore, using the link between market performance, market conduct and market structure, a relationship between market performance and structure can be analysed.[2]

In the liner shipping industry, the SCP approach has been applied to analyse the competitive market environment in prominent container routes.[3] The relationship between freight capacity, freight rate and profit in world container markets has been examined using SCP approach.[4] One study has observed the changing market structure in liner shipping after the passage of the OSRA using the SCP approach as well.[5]

Factors that may have effect on rate of return may be used as indices of market performance within the SCP framework. A firm's risk structure is one of major factors to determine the rate of return. If the market and power and economic regulation changes the market structure, and it affects the rate of return, then it can be also stated that the risk is also affected by changes in competition and regulation. Therefore, a firm's risk can be used in examining the effects of market change on that particular firm. Therefore, in this thesis CAPM-β is used to measure the systematic risk of the liner shipping and cargo consolidation companies. Similar methodology has been used in other sectors of the transportation industry as well. A detailed discussion on estimation models of CAPM-β is made in Chapter 4 of the thesis.

The thesis draws inspiration with respect to the methodological aspects for the financial analysis from a recently published article investigating the relationship between the CAPM- β and market changes in the Japanese liner shipping industry.[6] The literature survey made in that study led the authors of this thesis to some of the relevant publications which proved helpful in developing an understanding of the behaviour of β and its link to market changes. This thesis then extends the scope of analysis by including the effect of shipping regulation on the cargo consolidation industry which is perhaps the first of its kind. It is also notable in this context that a part of the legal analysis on the effect of volume contracts on liner shipping and the consolidation industry is an extension of the work which one of the authors herein had performed during his doctoral research endeavour.

The sources perused includes major textbooks and publications in the areas of law and finance, peer reviewed journal articles and materials available on-line. The data analysed for this thesis consist of monthly share prices of the leading liner shipping companies and consolidators across the world for the period 1980–2013 and 1988-2013, respectively, depending on availability of data for specific companies. For the

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[2] Koichiro Tezuka, Masahiro Ishii and Motokazu Ishizaka, "Relationship between CAPM-β and market changes in the Japanese Liner Shipping Industry", *Maritime Policy & Management*, May 2012, at p. 298.

[3] J S L Lam, W Y Yap and K Cullinane, "Structure, conduct and performance on the major liner shipping routes", *Maritime Policy and Management*, 34(4), 2007, at pp. 359–382. This study was particularly focused on the relationship between performance and structure. To measure the market structure, statistical dispersion measure, such as, the Gini ratio, concentration ratio, Herfindahl Hirschman Index (HHI) and the entropy coefficient were used.

[4] M Luo, L Fan, and L Liu, "An econometric analysis for container shipping market", *Maritime Policy and Management*, 36(6), 2009, at pp. 507–524.

[5] M Fusillo, "Some notes on structure and stability in liner shipping", *Maritime Policy and Management*, 33(5), 2006, at pp. 463–475.

[6] Tezuka, *supra* note 2.

purpose of comparison, the data for risk-free rate on government bonds of various markets are used along with the share price index from the Stock Exchanges where the respective shares are traded. Eviews and Microsoft Excel software are used to generate the statistical results for the thesis. The company description used in the Annexes is replicated from the information appearing in the DataStream database. In writing this thesis, footnotes are used instead of endnotes as a portion of the text refers to scholarly legal literature. To facilitate the use of referencing in the legal writing style, the use of footnotes has been the choice of the authors. A bibliography is attached at the end of the thesis which lists the books, journal articles, business and newspapers articles and other miscellaneous documents.

1.4. Scheme of the thesis

Following this introduction, Chapter 2 provides a brief description of the liner shipping industry followed by a discussion on the notion of service contracts as found in the US legislation. The chapter then goes on to trace the development of competition policy in liner shipping during the past two decades. It also explains how regulations and policies direct and control behaviours of the associated players who simultaneously account for interdependencies with others.

Chapter 3 discusses the main factors which affect the systematic risk and influence the level of competition in liner shipping and cargo consolidation market. The chapter then goes on to discuss the event study approach including some of its limitations followed by examination of financial models dealing with regulatory changes and changes in market power.

Chapter 4 describes the sample data along with a brief discussion on observatory points for the purpose of the financial analysis.

Chapter 5, which is the penultimate chapter presents the empirical results of the study and provide both financial and legal interpretations as reflected through the results. All the tables and graphs for liner shipping companies and intermediaries are compiled in Annexes I and II, respectively. Annex III presents the tables and graphs for the robustness check.

Finally, Chapter 6 provides a summary and conclusion to the thesis. Suggestions are made, both for financial decision makers and legislators, for the creation of a further competitive transportation industry which will facilitate the growth of international trade and also enhance the interests of the consumers of the society at large.

CHAPTER 2

AN OVERVIEW OF THE VOLUME CONTRACT CONCEPT IN THE CONTEXT OF LINER SHIPPING

2.1. Introduction to liner shipping

Liner shipping is a transportation service following announced and scheduled ports of call. The origin of liner shipping can be traced back to the time of sailing ships. The end of the nineteenth century saw steam-powered ships replacing sailing ships in the liner trade. This transition was both technologically revolutionary and standard setting as steam power essentially improved the speed and reliability of ocean-going ships, and achieved universal adoption throughout the maritime industry. The consequence was over-tonnage which threatened liner operators' large investments in ships and facilities. To prevent over-tonnage, the carriers began to cooperate among themselves leading to the creation of cartels called liner conferences. Legislation was promulgated in the early twentieth century in various parts of the world to provide antitrust protection to liner conferences in shipping.

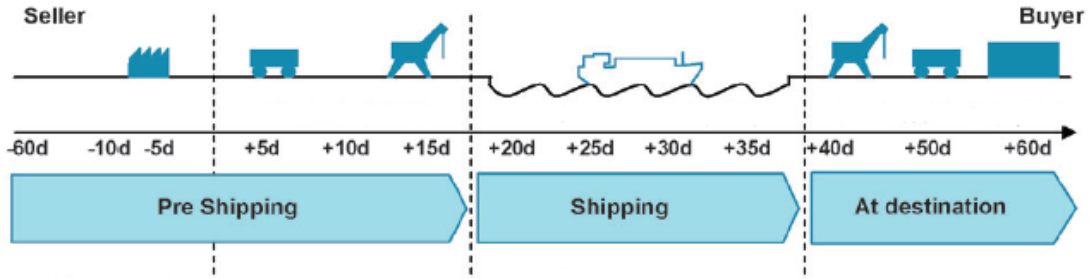
With the advent of containerisation in the mid-twentieth century, liner shipping received its second round of revolutionary technological innovation. Containerisation led to faster loading and unloading of cargo at ports with less turn-around time for ships. Larger and faster container ships led to the hub and spoke maritime transportation model supported by specialised container terminals established in major ports. These terminals transferred cargo from large deep-sea container vessels to smaller feeder vessels allowing liner shipping companies to extract value from the resulting economies of scale.

The modern-day liner shipping companies operate in a highly internationalised market catering to a globalised marketplace where production centres are widely dispersed which underline the need for fully connected and highly integrated distribution systems. In many markets, timely delivery of goods is as critical as offering a competitive freight rate by liner carriers. The liner shipping industry has witnessed continuing restructuring with large, powerful firms enjoying extensive market concentration. These companies also created extensive shipping networks of considerable complexity and specialisation offering increased access to the core markets and to niche markets within them. This led to increased economies of scale and of network density which resulted in larger ships, higher port productivities and the necessity for tighter information control and e-business systems integration. The past two decades also evidenced restructured landside logistics and supply chains modifying and altering network shape.

The various nodal service providers who cater to liner carriers, namely, port operators, consolidation or distribution centres, hinterland service operators such as truck haulage, railway operators, and third party logistics providers contribute to comprehensive service networks. The liner carriers and the nodal service providers select each other in order to obtain better performance in tandem than it could be achieved in isolation. On one hand, the maritime carriers select efficient nodal service providers so that the waiting time and total voyage time could be shortened as well as to avoid potential risks. Sometimes, the carriers even propose and invest in new

landward infrastructure when it is worthwhile to do so. On the other hand, nodal service providers select large carriers so that the capacity of the former can be better utilized and higher profits can be achieved.

The diagram below depicts the shift in focus from unimodal carriage solutions in international trade transactions to a multimodal carriage situation where the emphasis is more on door-to-door transport. Modern businesses in seeking transport solutions not only want transporters to carry cargo from point A to B following a published schedule by offering competitive freight rates, ensuring timely sailing and availability of vessel space but also demands solutions based on supply chain management techniques. A brief discussion on supply chain management aspects is made in the next chapter.



The remainder of this chapter explains the notion of service contracts as found in the US legislation and goes on to trace the development of competition policy in liner shipping during the past two decades. The chapter then explains how regulations and policies direct and control behaviours of the associated players who simultaneously account for interdependencies with others.

2.2. The United States concept of service contracts

Before delving into the intricacies of the relationship between shipper and carrier entering into a volume contract under the Rotterdam Rules, it would be of interest to trace the origins of service contracts in the US. This discussion will provide an understanding of the vital need to include volume contracts in the Rotterdam Rules. A "service contract" in the US is defined under section 3(19) of the 1984 Acts as:

> a written contract, other than a bill of lading or a receipt, between one or more shippers and an individual ocean common carrier or an agreement between or among ocean common carriers in which the shipper or shippers makes a commitment to provide a certain volume or portion of cargo over a fixed time period, and the ocean common carrier or the agreement commits to a certain rate or rate schedule and a defined service level, such as assured space, transit time, port rotation, or similar service features. The contract may also specify provisions in the event of non-performance on the part of any party.

The differential treatment of apparently similarly situated shippers was not allowed in the US for nearly a century. Equal treatment of all shippers, strictly based on published prices and terms of service, was in popular belief considered essential for a fair shipping market.[7] However, the economic wisdom of deregulation of the seaborne

[7] See Marc Levinson, "Two Cheers for Discrimination: Deregulation and Efficiency in the Reform of U.S. Freight Transportation, 1976–1998" published by Oxford University Press on behalf of the Business History Conference (2008), at p.178.

cargo regime in the US between 1984 and 1998 was borne out by the superior performance of the ocean liner market under normal price competition, contrary to long-standing claims from the shipping industry and various academics.[8] Some scholars have concluded that the most important result of freight deregulation was the end of the ban on discrimination which has substantial aggregate benefits for shippers and the economy.[9] However, little has been said in the US in published literature or court decisions on the distributional consequences of service contracts among shippers and the communities in which they are located. The incorporation of volume contracts in the Rotterdam Rules has brought this issue into the forefront internationally. The distributional consequences are difficult to measure even though information on average ocean shipping rates for containers on certain trade routes is available, because there is no information available in the public domain on rates paid by individual shippers or the service terms associated with the published prices.

Prior to 1984, all ocean freight to or from the United States moved under published tariffs and most international shipping lines belonged to liner conferences. These conferences are cartels whose memberships comprise seagoing common carriers engaged in providing sea transport services under a common tariff, deriving their legitimacy largely from statutory enactments supporting their contractual arrangements.[10] The genesis of the conference system dates back to 1875. The first liner conferences covered trade in routes between Britain and India at the behest of

[8] Prior to the deregulation process in the US, a body of theoretical work grew to support claims from ocean carriers, bolstering the argument that they required antitrust immunity. See Stephen Craig Pirrong, "An Application of Core Theory to the Analysis of Ocean Shipping Markets", 35 J.L. & Econ. 89 (1992); William Sjostrom, "Antitrust Immunity for Shipping Conferences: An Empty Core Approach", *Antitrust Bull*., Summer 1993, at p. 419.

[9] For example, Elizabeth E. Bailey, 'Price and Productivity Change Following Deregulation: The US Experience' *The Economic Journal*, Vol. 96, No. 381 (1986), at p. 15, asserts that "the 'losers' from deregulation have been far fewer than might have been imagined… the 'gainers' have included business users most of all as cross-subsidy has ended …" A criticism against Bailey is that she ignores the possibility that businesses could lose from deregulation if their relative freight costs rose as compared to other domestic companies or to competing importers, even if their freight costs fell in absolute terms. Paul W. MacAvoy, *Industry regulation and the performance of the American economy* New York: W.W. Norton, (1992), focuses entirely on the efficiency gains from a macro perspective. From a road transport perspective some authors find that freight transport deregulation brought large economic gains to shippers but add that "the distributional effects that probably exist between small and large shippers make it very unlikely that all shippers have shared in the benefits;" on the distributional point, however, they present no evidence; see Clifford Winston, Thomas M. Corsi, Curtis M. Grimm, Carol A. Evans, *The Economic Effects of Surface Freight Deregulation*, Brookings Institution Press (1990), at p. 41. Mark H. Rose, Bruce E. Seely, and Paul F. Barrett, *The Best Transportation System in the World: Railroads, Trucks, Airlines, and American Public Policy in the Twentieth Century*, Columbus: Ohio State University Press, (2006) at pp. 212–239, ignore discrimination in the wake of deregulation altogether. Richard Vietor, *Contrived Competition: Regulation and Deregulation in America*, Belknap Press (1996) at p. 320, emphasizes that deregulation destroyed existing market segmentation and forced companies to devise new strategies for segmenting markets, although he does not discuss freight specifically. Laurence T. Phillips, 'Contractual Relationships in the Deregulated Transportation Marketplace' 34 *Journal of Law and Economics*, (1992), at pp. 535-564, undertakes a many-faceted examination of the role of contracts in freight transportation, albeit with only minimal evidence on contracts between carriers and shippers. Marc Levinson, *supra* note 7, at p. 179 asserts that studies of the cost impact of maritime deregulation are almost totally lacking, due to unavailability of accurate public information about freight costs.

[10] The Shipping Act of 1984 of the United States, 46 U.S.C. app. § 1702 (7) (2001) defines conference as "an association of ocean common carriers permitted, pursuant to an approved or effective agreement, to engage in concerted activity and utilize a common tariff; but the term does not include a joint service, consortium, pooling, sailing, or transhipment arrangement."

leading British carrier companies.[11] Carriers in the United States followed the British example around the turn of the century. Liner shipping progressed under the conference system and remained largely unchanged until the mid-twentieth century when containerization became predominant.

In the United States a shipping line could choose to join a liner conference or operate outside it if it so wished but the conferences were under compulsion to make themselves available to all shipping lines. The rate structure for goods comprised three levels of possibilities, the first being the standard rate. If a shipper signed a loyalty contract with the carrier, it could gain a benefit of some 15 percent.[12] Under this second level arrangement, the shipper would have to commit the whole of the cargo to the conference or a fixed portion thereof. This arrangement could be risky for the shipper if the first available conference ship happened to be fully booked resulting in a waiting period for the next conference ship with sufficient available space. The third option, the most economical one, would be for the shipper to go with an independent carrier who was not a member of a conference and pay the published rate, provided the carrier was able to handle the business. The risk involved in this option was the possibility of the independent carrier's under-capacity compelling the shipper to ship some of its cargo with a conference carrier. In that case the shipper would have to pay the standard tariff and its overall cost would be considerably higher than the cost it would have incurred under a loyalty contract.

All the above-noted arrangements required the publication of tariffs for all commodities which had to be filed with the Federal Maritime Commission (FMC). As such, the tariffs were publicly available to all prospective shippers and no special treatment by the carrier was allowed in the form of a volume discount or provision of some other preferential service.

Then the 1984 Shipping Act was enacted which was a pioneering piece of legislation heralded as the start of the deregulation process in the United States. Shipping lines were permitted to offer rates based on time and volume of cargo so that the rates varied with cargo volume tendered over a specified period. Obviously, it was the large shippers who benefitted from this liberalization and unsurprisingly, those who opposed it were the same ones who were against any discrimination benefitting large shippers. These were the traditional supporters of regulation in the field of seaborne trade.

Furthermore, under the Act, shipping lines and liner conferences were allowed to enter into arrangements known as service contracts with shippers under which the shipper would agree to provide a designated volume of cargo over a specified period of time. By so doing, it was envisaged that the shipper would secure preferential freight rates as well as a host of other positive returns such as shipboard guarantee of space, orderly sailings and overall reliability of service. Often these contracts would provide coverage of service extending to shore side transportation; in other words, the

[11] The Calcutta Conference was the first and was created at the urging of the steamship leader Sir Samuel Cunard. There is evidence of prototypical conferences existing as early as the 1850s, though they were not modern in the sense that they seem never to have agreed on prices or output. See Chris Sagers, 'The Demise of Regulation in Ocean Shipping: A Study in the Evolution of Competition Policy and the Predictive Power of Microeconomics' 39 Vand. J. Transnat'l L. 779, footnote 37.
[12] See Levinson *supra* note 7, at p. 201.

entire logistical chain could be rendered undivided in so far as billing was concerned. Liquidated damages provisions in the contract were permissible under the legislation for failure of performance of obligations.

The 1984 Act also permitted a departure from the published conference rates through "independent action". Tariffs published under independent action averaged 11-25 percent below standard conference tariffs with respect to a specified commodity.[13] These independently generated rates could force conference carriers to bring down their own published rates in order to compete. Thus the Act engendered a system whereby shippers could freely negotiate rates to their advantage but the necessary terms of a contract had to be made public without discrimination. The hallmarks of common carriage were thus preserved in conjunction with a considerable degree of deregulation of economic transactions between carriers and shippers such as discrimination in relation to volume of cargo. Although the Shipping Act of 1984 permitted service contracts, the effect of that permission was very limited, because of the requirement in the statute that the terms and conditions of the contract had to be publicly available and could be demanded by other similarly-situated shippers. But, it was often not clear what attributes constituted a "similarly-situated" shipper. Of course, the market forces reacted; when a shipping line offered a rate reduction from the conference rate, several small volume shippers wanted to jump on the bandwagon with the so-called "me too" contracts causing carriers to recoil so that only large volume shippers who quickly moved in on the action succeeded. Thus, the 1984 Shipping Act by legitimizing rate discrimination was viewed as favouring large shippers against the interests of their smaller counterparts. It would appear that technically the service contract concept endorsed and supported by legislation largely benefitted the major shippers who had considerably more bargaining clout. However, the conditions under which such discrimination took place was conceivably narrow which made the possibility of such discrimination not widely practical. In fact, it is argued that the "me too" provision in the statute really re-established with the left hand the anti-rate discrimination policy which the service contract provision in the Shipping Act tried to give with the right hand.

Finally, the OSRA enacted in 1998 allowed confidentiality of rates in service contracts and abolished the requirement for carriers to cater to small shippers who wanted similar rates. The new Act by removing the "me-too" requirement and providing for confidentiality fulfilled the formal promise that was in the Shipping Act of 1984 but which was never actualized by the restrictions in that Act. As a result, service contracts came into more frequent use and virtually became the norm through which rates were set. [14] These contracts could cover even a unit as low as a single container.[15] Removal of all of the regulatory strictures made possible by this Act including the legitimization of confidentiality and elimination of the compulsion to offer similar terms to similar shippers became most advantageous for the mega shippers who had negotiating power far in excess of small shippers.

[13] U.S. Federal Maritime Commission, "Section 18 Report on the Shipping Act of 1984," September 1989 at p. 130.
[14] U.S. Federal Maritime Commission, "The Impact of the Ocean Shipping Reform Act of 1998," September 2001, at p. 84.
[15] *Ibid*., at pp. 21–22.

The reduction in barriers to world trade and the emergence of international production centres in Asia impacted the flow of global trade and strategic approaches to international maritime transport. The reforms in 1998 enabled globalized manufacturers and retailers to gain advantageous contractual arrangements which were based on market reference points. While the cost to the shipping line was the base for these arrangements, they were essentially according to market reference points. In other words, the price set was the cost to the manufacturer as the floor, but the actual price established was often well above this level; as high as the market would bear. This shift in philosophy was largely seen as benefitting the major players among the shippers simply because they were the ones who could on a temporal basis supply large volumes of commodities. This in turn enabled carriers to benefit from lower costs.[16] A relevant question in this regard was whether the arrangements engendered by the service contract concept strongly endorsed by legislation exemplified a balance of bargaining power between carriers and shippers or whether it manifested itself as an enhancement of the commercial powers of large shippers. Information itself became a valuable commodity for both parties concerned since rates were no longer required to be published and confidentiality became the rule of the day. Again it was the larger shippers who were better equipped to access information pertaining to the market better than their smaller counterparts. The information in turn became a formidable bargaining tool.

While it is recognized that the service contract concept has benefited large shippers, there has been a strong complementary trend that has benefited smaller shippers through the growth of large consolidators such as UPS and DHL as well as others, on the international scene. Some of these consolidators have evolved from small entities operating out of a basement or small office to large and sophisticated shipping, logistics management and supply chain management service providers with operations and offices all across the globe. There is considerable competition among these consolidators which have given them every incentive to negotiate major discounts with asset-based ocean carriers and to pass a good portion of those savings on to their own customers. These have enabled many smaller shippers to get at least part of the benefit of the volume discounts experienced by large shippers. Moreover, as indicated earlier these large consolidators often offer supply-chain management services as well, to the benefit of smaller shippers.[17]

The service contract arrangement based on time-volume supply of goods enabled shippers to make substantial savings on their inventories which in some instances were higher than their savings on freight. This major advantage in the context of service contracts can easily be transposed into the volume contract regime introduced through the Rotterdam Rules. Similar advantages can be gained through a typical volume contract arrangement not only in terms of savings as indicated above, but also provide carriers the opportunity to integrate their operations into the land based logistics side of the global supply chain. Viewed in this light, the management of logistical arrangements can and is gradually becoming an industry in its own right.

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[16] See Hayden G. Stewart, and Fred S. Inaba, "Ocean Liner Shipping: Organizational and Contractual Response by Agribusiness Shippers to Regulatory Change." *Agribusiness* 19 (2003) at p. 462. Data on contracts signed by shipper associations are from *American Shipper*, Feb. 1992, at p. 42.

[17] See Proshanto K. Mukherjee & Abhinayan Basu Bal, "A Legal and Economic Analysis of the Volume Contract Concept under the Rotterdam Rules: Selected Issues in Perspective", *Journal of Maritime Law & Commerce*, Volume 40, Issue No. 4, (October 2009), at p. 589.

Such management would include a variety of logistical activities including shore side transportation, warehousing and reduction of inventory costs. It is stated that advantages such as this would not have been possible without arrangements typical of the volume contract as they can provide commodity owners protection against the risks of stocking and restocking their inventories without the disadvantage of irregularity of shipments.

2.3. Development of competition policy and legislation in liner shipping

Countries that consider themselves essentially free-trading have long had defensive legislation designed to protect their national trade and shipping interests from harm caused by other countries' protectionist measures. For example, the US instituted a regulatory scheme similar to the British conference system, which handled oversight of the international ocean shipping industry. This design was initially embodied in the Shipping Act of 1916.[18] Throughout most of the 20th century, the US continued to regulate the liner industry – first by imposing new and additional standards on the trade, then by introducing partial deregulation in the 1980s and 1990s. Perhaps the most significant changes in the regulation of shipping companies operating in the US foreign commerce came with passage of the Shipping Act of 1984 and the subsequent OSRA 1998, the latter introducing new deregulatory amendments to the 1984 act and 'further signalling a significant paradigm shift in shipping regulation.'[19] The most enduring change brought about by OSRA is a reorientation of the regulatory scheme from common carriage[20] to a predominantly contract-based system. At present, regulation of the international liner industry is continued in the US and entrusted to a quasi-independent regulatory agency known as the Federal Maritime Commission (FMC) which has recently been taking on a more interventionist role[21].

It is to be noted here that the fundamental controversy underlying any regulation is the on-going need to work out the inevitable trade-off between the good of the whole society, on the one hand, and the rights of the individual, on the other. In the words of a notable commentator[22],

> In any regulation, these trade-offs have appeared most clearly as ways of relieving the persistent tension between the forces seeking to implement economic efficiency for the broad benefit of society, and those dedicated to guaranteeing the observance of legal due process for every individual member of that society. At different times in history, each party to these fundamental tensions has established a clear advantage over the other. On

[18] 46 App. U.S.C. § 801 et seq.

[19] See Federal Maritime Commission 42nd Annual Report for Fiscal Year 2003 March 31, 2004, available online at http://www.fmc.gov/UserFiles/pages/File/Annual_Report_FY_2003.pdf

[20] The common carriage approach is generally considered a public service or at times, a public utility. It is often highly regulated, with routes and tariffs, or charges, with liability limits for loss or damage to cargo often fixed by statute. The license to perform common carriage services is often considered something of a concession given by the government for public convenience and necessity. Anyone can ostensibly have his or her goods carried by a common carrier without discrimination. Common carriage requires all liner carriers to establish and make public their tariffs and any changes, before they take effect.

[21] The FMC is responsible for overseeing and enforcing the Shipping Act of 1984, as amended, and the law's implementing regulations. Shippers, ocean common carriers, intermediaries (NVOCCs and ocean freight forwarders), shippers' associations, marine terminal operators, and others are subject to the Shipping Act and the FMC's regulatory purview.

[22] Thomas K. McCraw, *Prophets of Regulation: Charles Francis Adams; Louis D. Brandeis; James M. Landis; Alfred E. Kahn*, Belknap Press of Harvard University Press, 1984, at p. 301.

> balance, however, it seems clear that the concern about legal process has controlled the outcome of regulation more often than has the concern about the substance of economic efficiency. In economists' language, this means that the concern for equity has generally triumphed over the quest for efficiency. In lawyers' terms, it means that in regulation the judicial model has usually triumphed over the legislative and administrative model. In cultural terms, it means that the concern for fairness and for the protection of the diverse interests of all affected individuals has most often won out over the concern for overall growth in the national economy. More generally in political terms, it means that regulation is best understood as a political settlement, undertaken in an effort to keep peace within the polity. Overall, the conclusion appears inescapable that regulation in a country has more often functioned as a protective device rather than as a promotional or developmental one. Of course, protection was not always inappropriate. By holding in check socially destructive forms of behaviour, protective regulation often cushioned the impact of rapid industrial change.

The US maintained a higher level of regulatory oversight of the international liner shipping industry based on British law. Relative to the US, most countries in other continents practised a *laissez faire* approach to regulating their ocean carriers and shippers. The regulatory regimes in the US and Europe varied in their approaches to jurisdiction and the enforcement of regulations governing conduct of shippers, carriers, and intermediaries involved in ocean shipping. In part, these contrasting regulatory perspectives had led to sometimes significantly different economic consequences.[23] It is also notable that while in the US, private parties, such as shippers, carriers, freight forwarders and shippers' associations looked towards FMC action, in Europe, the actors relied on resolutions under private law.

The European Commission's Regulation 4056/86 which had granted liner carriers a block exemption from Europe's competition laws allowing shipping conferences to continue on trade routes to and from Europe was repealed through EC Regulation 1419/2006 in September 2006, which came into effect on October 2008. The repeal of the antitrust exemption prohibits carriers from engaging in collective rate setting and discussing capacity utilization in detail, but carriers are allowed to continue vessel-sharing agreements and other "efficiency-enhancing" operational agreements.[24]

Asian shippers have been pushing for repeal of antitrust immunity among Asian nations but with mixed success. The Asian countries have different dominant roles in liner services, which partly explains the respective position of these countries with respect to liner conferences. China and India are net users of liner services, Japan is a net provider of liner services, and Hong Kong and Singapore are primarily facilitators of liner services. The focal point over rate-setting practices in Asia has been the assessment of terminal handling charges that were instituted by the liner carriers starting in 2001.

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[23] See Richard K Bank, Ashley W Craig and Edward J Sheppard IV, "Shifting Seas: A Survey of US and European Liner Shipping Regulatory Developments Affecting the Trans-Atlantic Trades", *Maritime Economics & Logistics*, (2005) 7, (56–72), at p. 59.

[24] "Antitrust: Commission Adopts Guidelines on Application of Competition Rules to Maritime Transport Services," IP/08/1063, Brussels, 1 July 2008 available online at http://ec.europa.eu/comm/competition/antitrust/legislation/maritime/

China is one of the emerging players in liner shipping and it passed a competition law in August 2007 that came into force in August 2008. The new law does not exempt liner conferences from the law's antitrust provisions.[25] China's policy in this area appears to be in a state of flux, but it is not clear as of yet what the exact implications will be for liner carriers calling at Chinese ports.

India is purportedly moving in the direction of outlawing collective rate setting. The Competition Commission of India, created by a law passed in 2002 appears to be in favour of banning collective-rate setting and has advised India's Ministry of Shipping to curb the practice. However, India's Ministry of Shipping appears to favour further oversight of current shipping practices rather than an outright ban on conferences.[26]

Japan appears to favour the *status quo* allowing the conference system to continue. The position is governed by the Marine Transportation Law 1949 (as subsequently amended), which sets out an overall framework for the regulation and promotion of shipping, including the competition aspects. It adopts a common carriage approach, requiring all liner carriers to establish and make public their tariffs and any changes before they take effect. Agreements between two or more carriers relating to freight rates and other conditions of transport, routes, sailings, etc, are exempted from the Act Concerning Prohibition of Private Monopolisation and Maintenance of Fair Trade 1947 unless unfair trade practices are employed or user interests are unduly impaired by the effective restriction of competition in trade. A "report" of any such agreement must be filed in advance with the Ministry of Land, Infrastructure and Transport. Japan may prove to be a holdout for the conference system due to the fact that large shippers are linked to large ocean carriers in Japan through the *keiretsu* or "group system" of business organization.[27] Also, Japan may favour the carrier's perspective because Japanese ocean carriers rely more on trade outside Japan than they do on trade to or from Japan. Japan does not wish to forego the maritime exemption as liners pump substantial monies into its national economy.[28] Therefore, Japan will probably be the last state internationally to move towards a more market-based system.

Singapore and Hong Kong, like Japan, are also home to major ocean carriers and are world rivals as container transfer hubs, but neither is home to large producers or importers of liner cargo. Understandably, a concern of the Hong Kong and Singapore governments is that they not be too far out of step with the maritime regulatory regimes of the major trading nations using their transport services. Hong Kong's strong tradition for *laissez faire* policies may explain its lack of competition legislation, but it appears to be evaluating the need for a competition policy in the liner sector. Hong Kong has lost some of its market share to mainland Chinese ports, partly because of higher terminal handling charges that are applied across the board by the shipping lines calling at Hong Kong. Singapore granted a five year exemption for liner carriers from its new Competition Act passed in 2004, which took effect from January 2006 and a block exemption for an initial unspecified period for conference and discussion agreements, but subject to review in the light of local and

[25] "China's Anti-trust Act to Outlaw Liner Conferences", *Lloyd's List*, 18 September 2007, p. 1.
[26] "Asia's Antitrust Revolution," *American Shipper*, November 2007, pp. 10-12.
[27] "Internal Struggle," *American Shipper*, June 2007, pp. 50-55.
[28] "Asia Confident of Liner-block Move; Region Expected to Follow in Footsteps of European Repeal," *Lloyd's List*, 20 September 2007, p. 7.

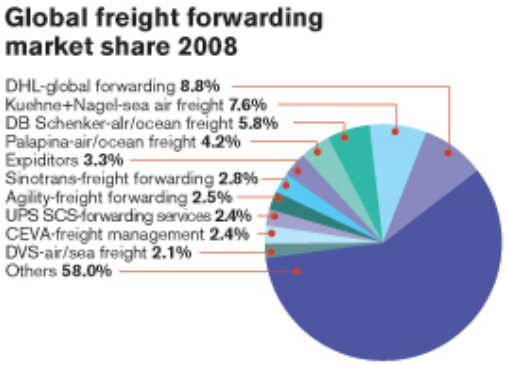
international maritime industry developments. Detailed provisions were subsequently worked out and the Competition (Block Exemption for Liner Shipping Agreements) Order 2006 was given retrospective effect from January of that year. The Singapore Competition Commission stated "it was seeking to create a regulatory environment for shipping lines operating through Singapore that was broadly aligned with that in other major jurisdictions."[29]

2.4. Deregulation and the evolving role of intermediaries in liner shipping

The non-vessel-operating common carriers (NVOCCs) in the United States seemingly play an important role in passing the benefits of the new contract-based regulatory approach in the United States. Taking the cue from the service contract experience in the United States, it has been recognized that the volume contract concept will benefit large shippers. But there has been a strong complementary trend that has benefited smaller shippers through the growth of large consolidators such as UPS and DHL as well as others, on the international scene.

The benefits of consolidators to smaller shippers depend on the existence of vigorous competition among them; otherwise, the consolidators will keep the benefits of their consolidation to themselves. In some markets vigorous competition is evident. The existence of that competition depends on there being a substantial number of competitors in the market, none with market power.

The global forwarding market is highly fragmented with the top 10 consolidators accounting for 42 per cent of the market. The market leader, DHL, controls around 9 per cent of the business. The following pie chart depicts the market share of consolidators in 2008.



The analysis of market shares/market power is revealing and useful, since it shows that no one or a small group of these companies has a commanding market share.

In Europe, a forwarder may perform traditional duties and activities, such as preparing the ocean bill of lading for the vessel carrier, directing cargo to carriers, and/or assisting a shipper with the export transaction; or assume common carrier status by issuing its own house bill of lading, and/or assuming responsibility for the

[29] "Singapore Antitrust Immunity Stays for Liner Groupings," *The Business Times Singapore*, 5 October 2006.

transportation of cargo from origin to destination. The European Union does not regulate the conduct and business of transportation intermediaries as in the United States. The term 'NVOCC' is a unique legal entity created by American law and regulation.[30] European intermediaries are simply referred to as 'forwarders,' and, as a general statement, do not have to comply with the European Union regulatory requirements similar to those of the United States and enforced by the FMC. While, there is no requirement in the European Union for forwarders to obtain a license from Brussels or from a national government or to satisfy certain financial responsibility requirements, there may be certain applicable business licensing requirements promulgated by national, regional, or city governments in the European Union. However, in the United States, it is relatively easy for someone entering the intermediary market to obtain a license, and the financial responsibility requirements are not very onerous. Thus, those requirements do not pose any real barrier to entry or appreciably increase the cost of operation.

Under the United States regulatory scheme, both NVOCCs and forwarders, which are defined as 'Ocean Transportation Intermediaries' under OSRA, are subject to certain licensing and financial responsibility requirements. NVOCCs are prohibited from offering 'service contract' rates to shippers. The FMC in the alternative decided to authorize 'service arrangements' for NVOCCs and shippers in October 2004 to provide a sense of parity with service contracts.[31] Eight petitions were filed with the FMC in 2003 to 2004, on the subject of NVOCC Service Contracts by third-Party Logistics Providers such as UPS, FedEx, BAX Global, and DHL-Danzas, each calling for service contract authority or reform of tariff publication requirements.[32] In response to these petitions, the FMC authorized 'NVOCC Service Arrangements' (NSA). The so-called NSA rule provided 'service contract parity' to NVOCCs acting as carriers, when dealing with their shipper-customers. This was allowed under Section 16 of the Shipping Act, exempting NVOCCs from the tariff publication, adherence, and enforcement requirements of the Shipping Act, subject to certain filing and publication requirements placed on NSAs.[33] In contrast to the service contract rules[34], it is important to note that the NSA rule prohibits shippers' associations that include NVOCCs as members from entering into an NSA.[35] This restriction is comparable to the prohibition in the NSA Rule on NVOCC-to-NVOCC NSAs, where one NVOCC acts as carrier and the other as shipper. In each instance, the FMC determined that permitting such behaviour might eventually lead to anti-competitive activities on the part of the NVOCCs without any effective regulatory oversight by

[30] The Shipping Act defines NVOCC as 'a common carrier that does not operate the vessels by which the ocean transportation is provided, and is a shipper in its relationship with an ocean common carrier.' See 46 U.S.C. app. 1702(17)(B); see also 46 C.F.R. 515.2(o)(2).
[31] For a detailed discussion see Bank, *et al*., *supra*, note 23 at p. 61.
[32] With the passage of the OSRA in 1998 service contract became extremely popular and the FMC recognized that 'service contracts have become the overwhelmingly predominant rate-setting vehicle.' See FMC 42nd Annual Report, *supra* note 19 at p. 7.
[33] See 69 Federal Regulation 75,850 (20 December 2004).
[34] 46 C.F.R. 530 et seq.
[35] Under the NSA Rule, an 'NSA shipper' is defined as 'a cargo owner, the person for whose account the ocean transportation is provided, the person to whom delivery is to be made, or a shippers' association y [t]he term does not include NVOCCs or shippers' associations whose membership includes NVOCCs.' See 46 C.F.R. 531.3(o).

either the FMC or other United States federal agencies, for example, the Department of Justice.[36]

The NVOCCs stressed that contracting authority was a major issue to the evolving international shipping community and thus called upon the FMC to further the deregulatory spirit of OSRA by extending confidential contracting authority to intermediaries. The NVOCCs also emphasized that contract authority was necessary to meet the demands of their shipper-clients, the continuing integration of logistics services across all modes, and responsive to the age-old demand for confidential ocean rates. The NSA rule represents one of those rare occasions when the regulated and the regulator understood the significance of an issue and came together to address it effectively.[37] The FMC has commented that '[t]he [NSA] rulemaking will provide shippers with a broader range of service options, and greater opportunities for integrated supply chain solutions... [A]s the use of NSAs develops over time they will ultimately lead to greater competition and a more efficient shipping industry.'[38] Some shippers' associations have pointed out the NSA rule's prohibition on NVOCC-to-NVOCC arrangements is unnecessary and counter productive.[39]

Until recently, NVOCCs had to additionally publish and maintain a tariff. The critics of the NSA rule were long emphasising that the real issue involved tariff publication and enforcement.[40] In a decision of the FMC issued in February 2010, the Commission ruled that NVOCCs would not have to publish tariffs. The 3-1 decision largely approved a petition submitted by the National Customs Brokers and Forwarders Association, Inc. (NBBFAA) that sought an exemption from the Commission under the Shipping Act of 1984 as amended that would exempt rate tariffs from being published.[41] This is a major development with respect to NVOCCs, as it will appreciably make it easier for them to operate and respond to market conditions. It makes it even more likely that such companies will be able to serve their function of providing the benefits of competition to smaller shippers.

In its decision the Commission permitted licensed NVOCCs to be exempt from the requirement and associated costs of publishing rates under the Shipping Act. This

[36] See generally Federal Maritime Commission Docket No. 04–12, "Notice of Proposed Rulemaking, NVOCC Service Arrangements" (28 October 2004), 46 CFR Part 531, for a full discussion of the FMC's rationale for imposing the restrictions, available online at http://www.fmc.gov/Dockets/04-12%20Proposed%20Rule.htm

[37] See Bank, *et al*., *supra* note 23 at p. 66-67.

[38] See remarks of Steven R. Blust, Chairman of the Federal Maritime Commission, "Federal Maritime Commission News Release", 15 December 2004, available online at http://www.fmc.gov/speeches/newsrelease.asp?SPEECH_ID=184.

[39] On 8 February 2005, the FMC denied Petitions for Reconsideration and Stay filed by the International Shippers' Association and the American Institute for Shippers' Associations. See Docket No. 04-12, available online at http://www.fmc.gov/file.asp?F=4E65356D9726433C8B35736720C6098C.htm&N=04-12+reconsideration+order+2-8-05.htm&C=docket_activity. Additionally, on that day the FMC formally closed-out the eight individual NVOCC petitions filed in 2003 and 2004 seeking service contract authority.

[40] For example, the National Customs Brokers and Forwarders Association of America continue to call for the elimination of tariff publication requirement of the Shipping Act. See Bank, *et al*., *supra* note 23 at p. 67.

[41] See "FMC Approves NVO Tariff Publication Exemption", *National Industrial Transportation League Notice*, 19 February 2010, at p. 1-2; see also R.G. Edmonson, "FMC to Change Tariff Filing Requirements", *The Journal of Commerce Online*, 18 February 2010.

decision was based on the Commission's finding that granting the exemption within certain parameters and conditions will not result in substantial reduction in competition or be detrimental to commerce. In taking this action, the Commission noted that the exemption is voluntary in that NVOCCs may choose whether to utilize the exemption which only applies to licensed NVOCCs; and the exemption which is limited to rates as tariff rules must continue to be published.

2.5. Evolution of the volume contract concept under the Rotterdam Rules and its economic implications

Based on a proposal by the United States delegation,[42] the Rotterdam Rules provide for volume contracts that allow the parties to enter into mutually negotiated agreements, subject to certain safeguards to derogate from the terms of the Rotterdam Rules, regardless of whether such derogation increases or decreases the carrier's obligations. The United States proposal on the OLSA emphasized that flexibility should be granted whenever one or more shippers and one or more carriers enter into agreements providing for the transportation of a minimum volume of cargo in a series of shipments on vessels used in a liner service, and for which the shipper or shippers agree to pay a negotiated rate and tender a minimum volume of cargo. It is to be noted that the definition of volume contract as found in the Rotterdam Rules is broader than that of service contract under the United States Shipping Act of 1984, as it does not require the carrier to undertake any 'defined service level' or to commit to a certain rate or rate schedule. Instead, volume contract is defined solely by reference to the undertakings of the shipper to provide a certain quantity of goods for shipment.

A volume contract is defined in article 1(2) of the Rotterdam Rules as "a contract of carriage that provides for the carriage of a specified quantity of cargo in a series of shipments during an agreed period of time. The specification of the quantity may include a minimum, a maximum or a certain range." A transport document[43] or electronic transport record[44] may be issued in respect of each shipment. The word 'quantity' and the illustrated methods of measurement, suggest bulk cargo carried in the hold of a ship or containerized goods. Based on such presumptions a volume contract might take the form of a liner contract[45] or a non-liner contract[46].

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[42] See, "Proposal by the United States of America, Ocean liner service agreements", UN Doc A/CN.9/WG.III/WP.34, paras. 18-29, at pp. 6-9.

[43] Article 1(14) of the Rotterdam Rules defines "transport document" as a document issued under a contract of carriage by the carrier that: (a) Evidences the carrier's or a performing party's receipt of goods under a contract of carriage; and (b) Evidences or contains a contract of carriage.

[44] Article 1(18) of the Rotterdam Rules defines "electronic transport record" as information in one or more messages issued by electronic communication under a contract of carriage by a carrier, including information logically associated with the electronic transport record by attachments or otherwise linked to the electronic transport record contemporaneously with or subsequent to its issue by the carrier, so as to become part of the electronic transport record, that: (a) Evidences the carrier's or a performing party's receipt of goods under a contract of carriage; and (b) Evidences or contains a contract of carriage.

[45] "Liner shipping" is an industry term of art which means regularly scheduled common carriage of cargo by sea, which is now by far the predominant means of ocean transport but which has only existed since about the time of the Civil War; see Amos Herman, *Shipping Conferences*, Deventer, Netherlands; Boston: Kluwer Law and Taxation Publishers, (1983). Article 1(3) of the Rotterdam Rules defines "liner transportation" as a transportation service that is offered to the public through publication or similar means and includes transportation by ships operating on a regular schedule between specified ports in accordance with publicly available timetables of sailing dates.

Existing research shows that the volume contract concept promotes efficiency in seamless transportation of goods which forms part of the global supply chain management.[47] The object of global supply chain management is to link the market place, distribution network, manufacturing or processing or assembly process and procurement activity in such a way that customers are serviced at a higher level, yet at a lower cost, in a computer literate environment operating within a global infrastructure.[48] Volume contracts can also serve as the potential backbone for multimodal carriage of goods facilitated by containerisation which has become the norm for movement of non-bulk goods worldwide.

As explained earlier, containerised seaborne trade is served by shipping lines offering scheduled services and their operations are evolving as part of the global supply chain management. Thus, apart from providing traditional maritime services, carriers are entering into international logistics activities, impacting on the role of traditional logistics providers whose core activities have not been in the maritime segment of international transport.[49] This process allows shippers the advantage of comparing through-rates rather than rates of different unimodal legs of one shipment which is generally more complex. But comparisons of unimodal leg rates have become easier with increasing sophistication in computers. Furthermore, a recent counter-trend seems to have emerged where shipping lines do not want to be responsible for the through movement, but only for the part they can control, *i.e.*, the sea leg.

The above observations indicate that the tripartite phenomena of technological advancement, current business models and globalization of trade have created the need for contractual arrangements between carriers and shippers which is best served by the volume contract concept. It is envisaged that volume contracts being contracts of carriage will not only foster economic efficiency but will also provide the advantage of a legal framework within which those trading through volume contracts can operate under the carriage liability regime of the Rotterdam Rules. It is also of significance that volume contracts and the maritime-plus[50] approach being within the scope of application of the Rotterdam Rules, the global supply chain management phenomenon is well served.

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[46] Article 1(4) of the Rotterdam Rules defines "non-liner transportation" as any transportation that is not liner transportation.

[47] See Mukherjee & Basu Bal, *supra* note 18.

[48] The preface to the resolution adopted by the General Assembly during the adoption of the Rotterdam Rules considers this by pointing out "... Believing that the adoption of uniform rules to govern international contracts of carriage wholly or partly by sea will promote legal certainty, improve the efficiency of international carriage of goods and facilitate new access opportunities for previously remote parties and markets, thus playing a fundamental role in promoting trade and economic development, both domestically and internationally, …"; see Resolution adopted by the General Assembly on the report of the Sixth Committee (A/63/438), United Nations Convention on Contracts for the International Carriage of Goods Wholly or Partly by Sea, UN Doc. A/RES/63/122.

[49] See Peter Marlow, Rawindaran Nair, "Service contracts - An instrument of international logistics supply chain: Under United States and European Union regulatory frameworks", *Marine Policy* 32 (2008) at p. 493.

[50] See for example, Proposal by the Netherlands on the application door-to-door of the instrument, UN Doc A/CN.9/WG.III/WP.33, para. 1(c).

2.6. Concluding remarks

The Rotterdam Rules govern the legal relationship between carriers and shippers in terms of facilitating the free flow of trade in a manner as economically efficient as possible. As has been discussed, within the service contract regime from which the volume contract concept is derived there are some winners and some losers. There is an air of functional tension between equity and efficiency fostering healthy debate.

In the context of this discussion it is important to recognize the fact that the service contract regime is simply one that provides for open market negotiation of economic trade advantages between carrier and shipper which in effect stimulates competition. It is recognized in this vein that the liner conference system on the face of it is discriminatory in nature; it runs afoul of the basic tenets of anti-trust or anti-combines laws. Even so, governments recognize that while competition is a good thing, cutthroat competition spells inefficiency. They have thus in their wisdom caused legislation to be enacted which endorses the conference system and provides it immunity from the anti-trust or anti-combines laws in their jurisdictions.

In the United States, OSRA has achieved the technique of combining free market conditions with limited controls over that freedom providing a generally workable solution acceptable to both carriers and shippers. Other jurisdictions may be able to avail of similar free market conditions through the introduction of volume contracts which might have been achieved through liner conference reviews. In the opinion of the authors, introducing the notion of service contracts through volume contracts in the Rotterdam Rules to other jurisdictions is more than picking fruit ripened on the trees of a decade of commercial and deregulatory experience in the US. A proper understanding of the trade aspects of volume contracts will help governments to decide whether or not to accept the Rotterdam Rules taking account of their respective constitutional dictates. The ensuing financial analysis is an attempt to facilitate legislators in understanding the consequences of the evolving commercial and business issues related to the liner shipping industry, which the Rotterdam Rules might govern if it enters into force in the future.

CHAPTER 3

EFFECT ON RISK DUE TO MARKET CHANGES IN LINER SHIPPING AND CONSOLIDATION BUSINESSES

The reorganisation of the liner shipping market that was triggered world-wide by regulatory changes in the US followed by several other jurisdictions has been described in some detail in the previous chapter. This chapter discusses the main factors which affect the systematic risk and influence the level of competition in liner shipping and cargo consolidation market. The chapter then goes on to discuss the event study approach including some of its limitations followed by examination of financial models dealing with regulatory changes and changes in market power.

3.1. Factors affecting market risk

For the purpose of analysis made in this thesis, the main factors which affect the systematic risk and influence the level of competition in liner shipping and cargo consolidation market are –

(i) the existence of protectionism hindering competition or legislation providing for antitrust exemption to liner shipping;
(ii) the number and distribution of firms operating in the liner shipping market;
(iii) the extent to which these liner shipping firms compete against each other and cooperate with each other; and
(iv) the emergence of cargo consolidators acting as large shippers through service contract parity.

The sample period chosen for the liner shipping companies is January 1980 to March 2013, during which the world liner shipping market has seen extensive changes. The various factors which affected liner shipping may be categorised as changes caused due to revision in regulation and alteration in market power. One study, which focussed on regulatory changes in inter-company behaviour in liner shipping, observed that the behaviour of companies altered between 1980 and 2000.[51] A similar approach is adopted in this thesis in reviewing the relevant liner shipping companies.

As mentioned earlier in Chapter 2, the passage of the 1984 Act and the subsequent amendment through OSRA in 1998 paved the path for deregulation in the US and promote competition in liner shipping. The subsequent demise of the conference system in Europe and in other jurisdictions furthered the deregulatory process across the globe although none of them introduced the service contract mechanism like the US. It is instructive to note at this point that out of the top twenty-five liner shipping companies in the world, two are based in Western Europe while most of the others are headquartered in Asia. None of the American liner companies feature in the top twenty-five list. It is also to be noted that states which identify themselves primarily with cargo owning interests may also be major flag states regardless of whether they operate in an open or closed registry system or any other alternative type of registry. Therefore, the assumption that there is a divide between traditional maritime states as

[51] Ravinder Nair, *Economic Regulation and Structural Change*, VDM: Saarbrucken, Germany, 2009.

representing carrier interests and developing countries with primarily cargo owning interests is no longer valid. The advent of multiple registry types leading to varieties of flag states has in practical terms obliterated the original polarized characteristics of states opting for a carrier friendly regime nurturing the century-old conference system.

The deregulatory move along with the service contract mechanism found in the US affected the global liner shipping industry to a great extent as US is one of the largest trading countries in the world. Liner shipping caters to a substantial part of this international trade flow to and from the US. The liner carriers in the wake of deregulation established new inter-company strategic cooperation after the passage of the 1984 Act to stabilize competition.[52] Thirteen major liner shipping companies established the Transpacific Stabilization Agreement (TSA) in 1989. Similarly, the Westbound Transpacific Stabilization Agreement was established in 1991, and the Trans-Atlantic Conference Agreement in 1994. Under TSA, companies exchange information about demand and supply to stabilise competition, and formulate guidelines for mark-up on the freight rate. In addition to these, a global alliance to construct a worldwide network emerged in the mid-1990s.[53]

Turning to the consolidation companies, during the early 1990's traditional freight forwarders found a business opportunity in the liberalised transportation sector. With the advent of service contracts in the US, the roles of third party agents in negotiating contracts became more valuable. Along with the many duties that traditional freight forwarders carry out at present,[54] they became more involved in cargo consolidation and rate negotiating. Freight forwarders used their influence to generate service contracts that shippers cannot acquire on their own. The leverage of the freight forwarder was derived from its contracts, experience, reputation, and large volume shipments. Rate negotiation is a time-intensive job which requires the extensive facilitation and has to be conducted skilfully with carriers.

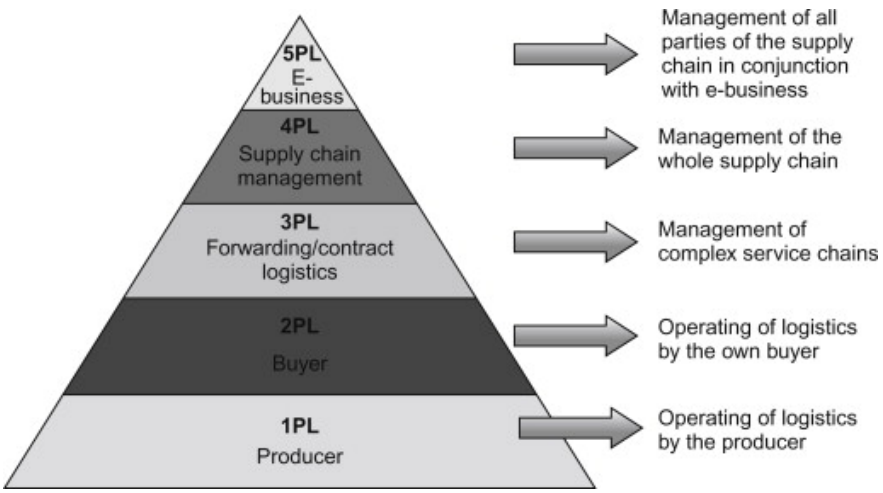
The freight forwarders or third-party agents, referred to as consolidators in this thesis, consolidate shipments to create large-volume recurrent lots. Third-party agents may or may not do any rate negotiating for their customers. However, rate negotiating third-party agents has gained increased popularity under the service contract regime. Third party logistics providers (popularly referred to as 3PL, or sometimes TPL) carry out the practice of using third party agents to benefit small and medium shippers. A 3PL is a firm (third party), neither shipper (first party) nor carrier (second party), that

[52] See in general D K Ryoo and T W Lee, "The role of liner shipping co-operation in business strategy and the impact of the financial crisis on Korean liner shipping industries" in C. Th. Grammenos (ed.), *The Handbook of Maritime Economics and Business*, London and Hong Kong: LLP, 2002, at pp. 346–374; See also Ravinder Nair, *ibid*.

[53] M Fusillo, "Structural factors underlying mergers and acquisitions in liner shipping", *Maritime Economics and Logistics,* 2009, Vol. 11(2), at pp. 209–226, examines the factors affecting mergers and acquisitions after the OSRA was enacted.

[54] Traditionally, the responsibilities of freight forwarders were simply logistical matters. Their tasks included booking space with a carrier, obtaining export clearance, arranging for products to be containerized, completing export documentation, assembling cargo insurance, advising on domestic and foreign regulations, and contributing assistance on labelling, marking and packaging for the shipper. Many shippers have strong connections with their freight forwarders because of the variety of personalized tasks the freight forwarders offer to their customers. Many shippers distinguish their relationship as one of partnership rather than a customer relationship.

provides a one stop shop service to its customers of outsourced logistics services for part, or all of their supply chain management functions. Third party logistics providers typically specialize in integrated operations, warehousing and transportation services that can be scaled and customized to customer's needs based on market conditions and the demands and delivery service requirements for their products and materials. This is in line with the contemporary notion of outsourcing of roles by private firms so that they can be more focused on their core business. On the other hand, this became a new business opportunity for logistics firms.[55] Emergence of fourth-party logistics (4PL), which acts as an integrator that assembles the resources, capabilities and technology of its own organisation and other organisations to design, build and run comprehensive supply chain solutions has widened the revenue earning scope of the logistics industry. Meanwhile, the fifth party logistics (5PL) will use e-procurement to carry out full-scale operation. A key function of the 5PL is to aggregate the demands of the 3PL into a bulky volume for negotiating more favourable rates with transportation companies regardless of which generation of logistics solution belongs to all. The figure below shows in diagrammatic form the various functions of different logistics service providers.



In order for 3PL to provide quality services, there are some important conditions. First, there must be available, capable logistics firms which have global coordination networks, suitable information and communication technologies, and familiarity with customs or trade rules and regulations in various countries where their clients have businesses. Second, the regulatory environment in countries, where 3PL firms can operate, needs to allow and foster such services. Third, there needs to be a vigorous

[55] It is interesting to note that advancements in technology and the associated increases in supply chain visibility and inter-company communications have given rise to a relatively new model for third-party logistics operations – the "non-asset based logistics provider." Non-asset based providers perform functions such as consultation on packaging and transportation, freight quoting, financial settlement, auditing, tracking, customer service and issue resolution. However, they do not own any physical freight distribution assets of their own. A non-assets based provider consists of a team of domain experts with accumulated freight industry expertise and information technology assets. They fill a role similar to freight agents or brokers, but maintain a significantly greater degree of "hands on" involvement in the transportation of products. To be useful, such providers must show its customers a benefit in financial and operational terms by leveraging exceptional expertise and ability in the areas of operations, negotiations, and customer service in a way that complements its customers' pre-existing physical assets.

competitive market among logistics providers in order for smaller and medium shippers to benefit. As discussed above, no one or a small group of these companies has a commanding market share.

Pursuant to the discussion presented above, in analysing the stock prices of liner shipping companies, the sample period is divided into three parts; first to observe the effect of deregulation in the US and then the subsequent cooperation between companies. The January 1980 to March 2013 dataset, depending on the availability of data for specific companies, is divided in three phases. The first period is from 1980 to 1989, the second from 1990 to 1997, and the third from 1998 to 2013. The first period marks the phase of increasing competition because of the 1984 Act. During the second period, the degree of competition decreased because of cooperative arrangements between liner shipping companies while mergers or acquisitions took place to increase market concentration. In the beginning of the third period OSRA is enacted thereby making the use of service contracts extremely popular with carriers and large shippers.

The sample period in analysing the stock prices of consolidation companies is also divided into three parts, to observe the effect of deregulation in the US introduced through the NSA rule. The January 1988 to March 2013 dataset, depending on the availability of data for specific companies, is divided in three parts. The first period is from 1988 to 2004, the second from 2005 to 2009, and the third from 2010 to 2013. The first period marks the phase when consolidators were not allowed to enter into service contracts. During the second period, the firms registered in the US were allowed to enter into service contracts although with stricter publication requirements. Finally, the third period when consolidation firms were allowed to enter into service contracts with less publication requirements.

It is notable that the global financial crisis affected world trade and the liner shipping and cargo consolidation industry in 2008. The effects of the crisis are evident from some parts of the data but no detailed comments will be presented in this thesis while analysing the data. The details of data and period division are described in Chapter 4.

3.2. Challenges for measurements using the event study approach

For the purpose of this thesis, one of the main factors central to the changes in the market environment is change in regulation. Policy changes, for example, made through amendment of laws, promulgation of new laws, or passing of a new decision by a regulatory body are those events which influences the stock price and value of the firm. The event-study approach is a representative method for analysing the events affecting a firm's value represented through the stock price when an event that has an impact on the market occurs. The aim of such a study is to measure how firm's value changes due to economic events where such events can be M&A, accounting information, new debt or equity, or when macroeconomic variables are announced. In this thesis, the approach used is analysing the liner shipping stocks is similar to that of one study examining the relationship between CAPM-β and market changes in the Japanese liner shipping industry.[56] The event study approach has been used by several other studies in analysing the usefulness of share returns to measure the effects of

[56] Tezuka, *et al*, *supra* note 2.

regulation on the power industry even though the time when the change of market expectations is not known.[57] Another study, which used this approach to investigate the changes of stock market price of liner shipping companies due to mergers and acquisitions, found that the prices changed notably and it was consistent with other studies in finance literature. The study found that the announcement of merger or acquisition has a significant and positive effect on the stock price.[58]

The event study approach is not independent of challenges. While the approach is often used to analyse impact of a certain development, one study indicates its limitations.[59] The first limitation is related to specifying the occurrence of the event. Since this approach examines the reaction of stock prices to additional news in the market, it is based on the assumption that the time of an event is identified clearly. However, in law making, several steps are necessary which may take a long period of time. Therefore, it becomes difficult to specify the point at which an event happens. One commentator states that not knowing when the market takes into account the change for the future cash flows is the main limitation to find how powerful is the impact of the regulation on changes in the share price.[60] Legalistically speaking, the passage of a new law or amending a new law takes effect from a certain date. However, the above-noted criticisms of the event study approach holds ground to a certain extent, particularly because of the fact that lawmakers consult the various stakeholders in the industry concerned during the law making process. The stakeholders, during the negotiation process with lawmakers, often anticipate the changes to be brought about in the market upon the entry into force of the new law and starts realigning their businesses to survive in the new regulatory environment. The second limitation relates to the fact that introduction of regulatory change affects parts of the industry differently, both in positive and negative ways.[61] This limitation is observable in this study as well if the maritime consolidation business is seen as a part of the larger liner shipping industry. Also notable in this context is that many large liner carriers have invested in the cargo consolidation business along with new investments made in providing supply chain management services.[62]

To obtain significant results, the time when an event happens and its effects has to be clear. The use of event study approach is not always suitable when looking at the effects of changes in institutions. Another important challenge of the event-study approach is the possibility that the composition of the risk can change itself in the market environment.[63] There is an assumption that the β does not change and it is

[57] See G W Schwert, "Using financial data to measure effect of regulation", *Journal of Law and Economics*, 24, 1981, at pp. 121–158.; K Schipper and R Thompson, "The impact of merger-related regulations on the shareholders of acquiring firms", *Journal of Accounting Research*, 21(1) 1983, at pp.184–221; J J Binder, "Measuring the effects of regulation with stock price data", *The RAND Journal of Economics*, 16(2) 1985, at pp. 167–183.

[58] See P Panayides and X Gong, "The stock market reaction to merger and acquisition announcements in liner shipping", International Journal of Maritime Economics, 4, 2002 at pp. 55–80.

[59] J J Binder, "The event study methodology since 1969", *Review of Quantitative Finance and Accounting*, 11(2), 198, at pp. 111–137.

[60] G W Schwert, *supra* note 57.

[61] P A Grout, A Zalewska, "The impact of regulation on market risk", *Journal of Financial Economics*, 80, 2006, at pp.149–184.

[62] For example, Maersk Group, which owns Maersk Line - the largest container shipping company in the world with 15% market share in liner shipping, also owns Damco - one of the world's largest providers of freight forwarding and supply chain management services.

[63] Tezuka, *supra* note 2.

constant over time. If the β varies over time then adopting such an approach is not useful. It is, however, a stylized fact of empirical evidence that βs are not stable over time, with evidence on β instability dating back to the early 1970s.[64]. Moreover, there is evidence in a study that US transportation industry has a time-varying β.[65]

The risk configuration of the whole industry could be affected due to major changes in market power and regulation, rendering the event-study approach inapplicable. In this thesis, the time-series relationships between the market structure and systematic risk in liner shipping and consolidation businesses are observed.

3.3. Regulatory changes affecting the liner shipping and consolidation market

Liner shipping which transports a substantial portion of international trade has seen varying economic regulations imposed over decades.[66] For the purpose of conducting the financial analysis in this thesis it is essential to consider the relationship between economic regulation and β. Although a study on the effects of deregulation on β is uncommon in the field of shipping, they are relatively common in the field of public service, such as the electric power industry. In the transportation industry, one study focussing on the regulatory changes in the railroad sector was conducted to estimate the path of β.[67] It was found that after introduction of new economic regulations, β decreases, but not significantly. In analysing the US power industry, another study found that the level and intensity of regulation has a strong effect on the systematic risk.[68] It was depicted in that study that systematic risk is endogenous and is lower when the degree of regulation is more intense. Other investigations examining the effects of use of fuel adjustment clauses found that when used by electric utilities companies, the systematic risk changes.[69] They estimate the effects of introducing fuel cost regulations on each firm's equity in the US power industry.

The remainder of this section briefly discusses some of the models which were used by various scholars to analyse the relationship between regulations and a firm's risks. Grout and Zalewska[70] looked at the profit-sharing regulations and their effects on a company's risk. They gave a simple theoretical illustration as to why the changes in

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[64] See R Buckland, P Fraser, " Political and regulatory risk: Beta sensitivity in U.K. electricity distribution", *Journal of Regulatory Economics*, 19, 2001, at pp. 5–25, referring to studies conducted by various scholars such as Blume in 1971 and 1975, Gonedes in 1973, Meyers in 1973 and Baesel in 1974.

[65] S X Gong, M Firth, K Cullinane, "Beta estimation and stability in the US-listed international transportation industry", *Review of Pacific Basin Financial Markets and Policies*, 9(3), 2006 at pp. 463–490.

[66] See B Gardner, P Marlow, R Nair, " The economic regulation of liner shipping: The impact of US and EU regulation in US trades" in C. Th. Grammenos (ed.), *The Handbook of Maritime Economics and Business*, London and Hong Kong: LLP, 2002, at pp. 327–346; see also, Nair, *supra* note 51.

[67] See S Peltzman, "Toward a more general theory of regulation", *Journal of Law and Economics*, 19, 1976 at pp. 211–246.

[68] See S W Norton, "Regulation and systematic risk: The case of electric utilities", *Journal of Law and Economics*, 28, 1985 at pp. 671–686.

[69] See F Scott, "Fuel-adjustment clauses and profit risk" in M A Crew (ed.) *Issues in Public-Utility Pricing and Regulation*, Massachusetts: Lexington Books, 1980, at pp. 77–92; see also S W Norton, "Regulation and systematic risk: The case of electric utilities", *Journal of Law and Economics*, 28, 1985 at pp. 671–686.

[70] P A Grout, A Zalewska, "The impact of regulation on market risk", *Journal of Financial Economics*, 80, 2006 at pp. 149–184.

regulations have an effect on a firm's risk. Under a profit-sharing regulation, the profit of a firm can be represented as a restricted deviation around target profit level:

$$\hat{\pi} = \pi^* + \gamma(\tilde{\pi} - \pi^*)$$

where π^* is target profit level, $\gamma < 1$ is a positive constant representing the proportion of profit the firm is allowed to keep if its profit exceeds the target profit and $\tilde{\pi}$ is the profit the company would earn under price-cap regulation.

After derivation, they get that under the profit-sharing regulation, the systematic risk is:

$$\hat{\beta} = \gamma\beta$$

where β is systematic risk without profit-sharing regulation. A profit sharing β is a proportion γ of price-cap β. If there is more profit sharing, the lower is γ and the lower is systematic risk of a firm.

Binder and Norton used a different model to find regulations effect on systematic risk.[71] They constructed a one-period model where a relationship between β and competitive market was formalised. They assumed that by setting prices, the regulator has control of entry and surplus allocation. The study tested "buffering hypothesis" which means that rate-of-return regulation reduces firm's exposure to market risk as compared to no regulation.[72] The equation of systematic risk of equity for company *i* used in the study is as follows:

$$\beta_i = (1 - \theta) * \frac{p_I - w_i E(Q_i)}{V_i} * \frac{Cov(U_i, R_M)}{VarR_M}$$

where θ is buffer parameter and it is from 0 to 1. It is a ratio between the level of regulation and the level of competition. $E(Q_i) = \overline{Q_\iota} + U_i$ is expected output, $\overline{Q_\iota}$ is determined variable and U_i is random variable which is demand shock and $E(U_i) = 0$. New policies which are in favour of competition, decreases the value of θ and increases β, if all things are constant.

From the above discussion it is clear that β is expected to decrease for liner shipping companies if the market is protected through price regulation or antitrust exemptions which suppresses competition. Applying the above reasoning to the liner shipping market, it is reasonable to expect that β would rise as a consequence of the passage of the 1984 Act and the subsequent promulgation of OSRA in 1998, which raised global competition within the liner shipping industry. On the other hand, in 2004 and 2010, it is expected that β will decrease within the consolidation industry, as the deregulated market environment is more favourable for them.

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[71] J J Binder, S W Norton, "Regulation, profit variability and beta" *Journal of Regulatory Economics*, 15, 1999, at p. 249–265.

[72] The buffering hypothesis was proposed by Peltzman. See Peltzman, *supra* note 67. The results of the analysis in Binder and Norton's study supported Pletzman's hypothesis.

3.4. Changes in market power

The instant thesis also focuses on the cooperative behaviour of liner shipping firms and market power. Current studies on market competition and collusion in the liner shipping industry is summarised by Sjostrom.[73] He categorises liner shipping conferences under four distinctive models, namely, monopolistic cartels, contestable markets, destructive competition and empty cores. Firstly, a link between market power and market β has to be made, before an analysis on the effects of the change in market structure indicated by market concentration ratio and other risk factor in the liner shipping industry is made. Prior studies on this relationship between market power and β are described in the remainder of this section.

A study from the 1980's show that companies with higher monopoly power will have lower β.[74] Moreover, it was stated that market power and capital intensity are interactive causes of systematic risk. Another study finds that there is no strong relationship between an individual company's market power and its risk, but there exist a strong negative relationship between industry concentration and the market risk of the firms industry.[75]

A study by Alexander and Thistle showed a negatively correlated systematic risk, oligopolistic product market and size of a firm. They state that this negative correlation between systematic risk and size of a firm can be due to market power, entry barriers or differential efficiency. Concentration due to entry barriers is negatively correlated with systematic risk, while concentration due to differential efficiency may be either positively or negatively correlated with systematic risk.[76]

Other studies show that there are some conditions to have such a relationship. Binder in his theoretical work states that market concentration and systematic risk do not necessarily have a relationship, if they compete in a perfect market with different technologies.[77] Wong points out a different relationship between systematic risk and markets where there exist oligopolistic competition.[78] A negative relationship is showed and only if all firms employ the same production technology.

The Herfindahl–Hirschman Index (HHI) is used to measure the market concentration in the liner shipping industry by calculating the market concentration ratio. The main advantage of using HHI is that it takes into account the number of liner shipping companies and differences of their market shares. One investigation concerning the market concentration in the liner shipping industry raised the issue of whether or not

[73] W Sjostrom, "Liner shipping: Modelling competition and collusion" in C. Th. Grammenos (ed.) *The Handbook of Maritime Economics and Business*, London and Hong Kong: LLP, 2002, at pp. 375–396.
[74] M G Subrahmanyam, S B Thomadakis, "Systematic risk and the theory of the firm", *Quarterly Journal of Economics*, 94, 1980, at p. 437–451.
[75] R C Moyer, R Chatfield, "Market power and systematic risk", *Journal of Economics and Business*, 35, 1983, at pp. 123–130.
[76] D L Alexander, P D Thistle, "Market power efficiency and the dispersion of systematic risk", *Review of Industrial Organization*, 14, 1999, at pp. 377–390.
[77] J J Binder, "Beta, firm size and concentration", *Economic Inquiry*, 30, 1992 at pp. 556–563.
[78] K P Wong, "Cournot oligopoly and systematic risk", *Journal of Economics and Business*, 46, 1995 at pp. 227–233.

there existed an oligopoly during the period between 1999 and 2009.[79] The study concluded that liner shipping market is characterised by increased concentration. On the other hand, this industry may still be considered as fragmented when compared to other industries, such as, banking, media and air transport.[80] It is instructive to note that although this thesis is dealing with a larger sample period than the period considered in the aforesaid study, but the sample period of the latter falls within the sample period of the former. For the period between 1980 to 1999 CR4 concentration ratio is used. CR4 is the simplest concentration measure which shows the cumulative share of 4 largest liner shipping companies in the market.[81] The next chapter shows that the liner shipping market stabilised since 1999 and the observatory point chosen in this thesis shows that greater market power reduces β.

The cargo consolidation industry has historically been a fragmented one. Small local players based in one location could compete with larger forwarders by using their agility and industry knowledge. The HHI figures for consolidators for the period from 2005 to 2010 is extracted from a study available online.[82] Through 2005 to the beginning of 2007 the HHI for the consolidation industry drifted downwards to 205 implying that the larger players were losing market-share. However, by 2008 the market structure appears to turn remarkably, increasing to 227 in that year and continuing to climb steadily to 258 in 2010. The quantitative change is not huge but the trend is clear. The industry is undergoing change with greater power gravitating towards the top ten consolidators.[83]

[79] C Sys, "Is the container liner shipping industry an oligopoly?" *Transport Policy*, 16, 2009 at pp. 259–270.
[80] The liner shipping industry may be considered still fragmented as HHI values are lower than 1000 which is the marker for more concentrated sectors. The figure1000 would indicate a sector with large players with substantial pricing power.
[81] C Sys, "Measuring concentration in the container liner shipping industry", *Proceedings of the NECTAR Conference, Porto*, 2007.
[82] See "Leading freight forwarders increase market dominance" available online at http://www.eft.com/freight-transport/exclusive-leading-freight-forwarders-increase-market-dominance.
[83] *Ibid*.

CHAPTER 4

DATA AND ESTIMATION MODELS

In this chapter, the sample data is described followed by a discussion on the proposed observatory points for the purpose of the financial analysis.

4.1. Data resource

The data resource involves two co-existing businesses, namely, liner shipping companies and cargo consolidators.

For liner shipping, some of the largest publicly traded companies are selected across various jurisdictions after perusing the list of top 30 companies.[84] The data includes stock prices of the following liner carriers:

Country[85]	Name of the Parent Company of the Liner Shipping Company	% of Market Share in 2012	Stock Exchange Traded
Denmark	AP Moeller - Maersk A/S	15.2	Copenhagen
Hong Kong	China Shipping Container Lines Company Limited	3.5	Hong Kong
	Orient Overseas (International) Limited	2.9	Hong Kong
Taiwan	Evergreen Marine Corp	4.3	Taiwan
	Yang Ming Marine Transport Corp	2.1	Taiwan
	Wan Hai Lines Ltd.	0.9	Taiwan
Korea	Hanjin Shipping Holdings Co. Ltd	3.7	Korea
Chile	Compania Sud Americana de Vapores SA (CSAV)	1.5	Santiago

The above listed companies comprises of approximately one-third of the total liner shipping market. It is notable that most of the liner-shipping companies listed above are subsidiaries of their respective parent companies. Generally, the parent company has other shipping related businesses which are registered as separate subsidiaries. The data used in this thesis are stock prices of the parent company, shares of which are publicly traded. The authors of the thesis are aware that the stock prices of the parent company might be affected due to changes in circumstances of other businesses of the parent but it is submitted that liner shipping constitutes as their primary business. Therefore, the authors choose to use the stock prices of the parent company, as the results of the analysis would not differ to any considerable extent.

For global cargo consolidation and freight forwarding industry, some of the largest publicly traded companies are selected across various jurisdictions after perusing the

[84] See Alphaliner, available online at http://www.alphaliner.com/top100/

[85] The country mentioned herein represents where the liner shipping company is headquartered. The companies are listed countrywise to aid jurisdiction specific analysis.

list of top 25 companies.[86] The data include stock prices of the following consolidators:

Country	Name of the Consolidation Company	Ocean TEUs in 2012	Stock Exchange Traded
United States	UPS Supply Chain Solutions	500,000	NASDAQ
	Expeditors International of Washington	892,682	NASDAQ
	UTi Worldwide Inc	484,000	NASDAQ
	C.H. Robinson Worldwide Inc	262,117	NASDAQ
Germany	DHL	2,724,000	Frankfurt
Switzerland	Kuehne + Nagel International Ltd	3,274,000	SIX
	Panalpina	1,310,000	SIX
Denmark	DSV A/S	727,861	Copenhagen
Australia	Toll	520,000	ASX

The above listed cargo consolidation companies operate in both airfreight and ocean shipping markets. The stock prices of these companies might be affected due to changes in circumstances of airfreight industry as well as the ocean shipping industry. However, ocean transport forms a substantial part of their business, as represented by the TEU figures. Therefore, the authors choose to use the stock prices of these companies, as the results of the analysis would not differ to any considerable extent.

When there are more than one company for a particular country, then the average rate of log-return is taken to assess how the whole market was affected in that country. For the analysis, monthly rate of log-return on equity for each firm and the market-wide rate of log-return, calculated from stock price data on the Stock Exchanges. All data is collected with the help of DataStream. As this analysis requires risk-free rate and excess log-returns on markets, yield of 10-year government bonds are used as risk free rate except for US, Chile and Korea.[87]. The data is not adjusted for dividend returns, as each country has different tax implications. Moreover, some of the market indices used do not have adjustments for dividend returns. Also, for the robustness check, SMB and HML factors are employed.[88] Possibly, larger samples would let to see a longer time-varying β but the main intention is to find the effects of changes in regulation on the liner shipping and consolidation businesses by looking at long-term behaviour of β. To test whether the data contains unit-root, augmented Dickey-Fuller (ADF) tests were performed.

[86] See Patrick Burnson, "Top 25 Freight Forwarders: Thriving in the complexity", available online at http://www.logisticsmgmt.com/article/top_25_freight_forwarders_thriving_in_the_complexity

[87] The data available for US and Chile is the yield of 20 year government bonds while for Korea is the yield of 3 year government bonds

[88] See K Kubota, H Takehara, "Re-examination of the effects of Fama–French Factor model", *Modern Finance*, 22, 2007, at pp. 3–23.

The descriptive statistics for liner shipping and consolidation companies are shown in Annexes I and II, respectively. There are five descriptive statistics in Annex I and five descriptive statistics in Annex II. They are shown in tabular form for each country. The acronyms, which are fully described in the list of abbreviations, represent company and market index log-returns. Acronyms are also given for each of the companies, market indices and averages.

Before estimation, an examination of the data set is made to see if there are any outliers. For example, Table 2.1 in Annex I shows descriptive statistics of Hong Kong liner shipping companies, the average and Hang Seng index. The table shows that the maximum value of China Shipping Container Lines Company Limited is 0.446094, and the minimum value is -0.555867. The average value is -0.027908. Both minimum and maximum values look like outliers. If they are considered as outliers – they are deleted from the sample, as it can affect the β results. To see, if they are outliers, the first figures in both Annex I and Annex II show the line graphs of excess log-returns. As it can be seen in Figure 2.1, China Shipping Container Lines Company Limited has one outlier: in 2011 10, so the lowest value is removed. The highest value does not look like it was rare, more similar values can be seen, so it is not treated as an outlier. All parameters were checked, and if there were outliers – they are mentioned under each line graph of excess log-returns.

4.2. Sample period and observatory points for liner shipping companies

The path of time-varying β is plotted during the sample period from January 1980 to March 2013, depending on availability of data for specific liner shipping companies.[89] To observe long-term behaviour of β, the sample period is divided into three parts which are as follows:

a) From January 1980 to December 1989: a period of increasing competition for liner shipping companies serving the Atlantic and Pacific routes to the US due to the introduction of the 1984 Act in the US which deregulated liner conferences thereby promoting competition.
b) From January 1990 to May 1998: a period when competition was reduced in liner shipping through inter-firm cooperation.
c) From June 1998 to March 2013: a period of increased competition due to the passage of the OSRA in May 1998 in the US.

The two observatory points are as follows:

Observatory point 1: New policies which promote competition or easing of regulation increase β.

Observatory point 2: Increased concentration between firms or higher market power due to cooperation reduces β.

The two points will be observed in the following fashion.

[89] The availability of data for each liner company is mentioned in Annex I of this thesis.

In the first instance, for period a) the values of β is observed before and after 1984, when the US Shipping Act was enacted. Observatory point 1 implies that β increases when the market protected by regulation is made to compete by the passage of the Shipping Act. So it is expected that systematic risk will rise during period a).

In the second instance, during period b) and c), from the point of view of observatory point 2, the sample companies in the liner shipping industry seem to have a decreased competition as inter-firm cooperation came into play as the TSA was initiated. Moreover, the HHI index during period 1999 to 2008 has nearly doubled.

The third point notable in this context is that for period c), the 1998 OSRA which was promulgated to promote market competition should have impact for the structure of the market. Taking observatory point 1 into account, because of the new Act the β is expected to increase in the period c). On the other hand, due to observatory point 2, there was an increase in global alliances and market concentration during this period. All things considered, the β in period c) is expected to be flat or to be indecisive.

In summary, during the period a) the β is expected to increase and to decrease during period b). Due to conflicting factors of observatory points 1 and 2, the β is indecisive.

4.3. Sample period and observatory points for intermediaries

For the consolidation business, the path of time-varying β is plotted during the sample period from January 1988–March 2013, depending on availability of data. Since most of the businesses are newly established, the sample period is shorter as compared to liner shipping companies.

To observe behaviour of β, the sample period is divided into two parts which are as follows:

a) From January 2004 to February 2010: a period when consolidators licensed in the US were allowed service contract parity through the NVOCC Service Arrangements (NSA) rule in December 2004, when dealing with their shipper-customers.
b) From March 2010 to March 2013: a period when the publication requirements were relaxed in February 2010 which created a new wave of opportunity for consolidators.

The two observatory points are as follows:

Observatory point 1: Regulation providing increased business opportunity through forward contracting decreases β.

Observatory point 2: Further changes in regulation providing increased business opportunity due to relaxed publication requirements decreases β.

In summary, during period a) the β is expected to decrease and during period b) the β is expected to decrease further.

4.4. Estimation models

4.4.1. Estimation models of CAPM β

It is to be noted that the measure of factor sensitivity captures the degree of effect of how the return on each stock is changed due to changes in the market environment. The most popular systematic risk measure comes from the capital asset pricing model (CAPM), which is known as CAPM-β. CAPM is also a method used for the estimation of company's cost of equity – the expected return that purchasers of common stock in the firm require. This is an important input for decisions when firm's capital is raised and investments are made and when investors construct their portfolios.[90] The equation is:

$$\beta = \frac{Cov\ (R_i, R_m)}{V(R_m)}$$

Here R_i and is the returns of stock i and the market portfolio, and Cov (.,.) and V(.) are covariance and variance.

In the thesis, the following model is used to estimate the β:

$$R_{i,t} - R_{f,t} = \alpha_i - \beta_i\left(R_{mt} - R_{ft}\right) + \varepsilon_{i,t}$$

R_{mt} denotes the log-return on the market portfolio at time t, R_{ft} is the risk free rate at time t, and ε is a process of white noise. White noise has constant mean and variance, and zero autocovariances, except at lag zero (there is no correlation within observations with all other values appearing sequentially).[91]

First of all, it is run as OLS regression which is also known as the classical linear regression model. The assumptions of OLS are - the errors have zero mean, the variance of the errors is constant and finite over all values of x_t, the errors are linearly independent of one another, there is no relationship between the error and corresponding x variable and errors are normally distributed.[92]

The next step is a GARCH (1,1) regression. GARCH model forms the most popular way through which the variance of returns can be modelled.

The GARCH (1,1) model is described as follows:

$$R_{i,t} - R_{f,t} = \alpha_i - \beta_i\left(R_{mt} - R_{ft}\right) + u_{i,t}$$

$$u_{i,t} = z_{i,i}\sqrt{h_{i,t}}, \qquad h_{i,t} = \alpha_0 + \alpha_1 u_{i,t-1}^2 + y_1 h_{i,t-1}$$

$u_{i,t}$ is error term for i at time t and $h_{i,t}$ is conditional variance.

[90] Michael R King, The cost of equity for global banks: a CAPM perspective from 1990 to 2009, *BIS Quarterly review* (September 2009): 59-73

[91] See in general, Chris Brooks, *Introductory Econometrics for Finance*, 2nd edition, Cambridge University Press (2008).

[92] *Ibid.*

Using the GARCH it is possible to interpret the current value of the conditional variance as a weighted value (weighted by the estimated coefficients) of past squared error terms and past variances that departs from the mean value of the squared error terms.

GARCH models are supposed to meet the non-negativity constraints in order to avoid negative variances through time. Usually, it is found that a GARCH (1,1) (i.e., 1 lagged value of the squared errors and 1 lagged value of the conditional variance) are sufficient to capture the dynamics in volatility.[93]

In Annex I there are tables which show OLS and GARCH (1,1) results for the liner shipping companies and averages, and in Annex II there are OLS and GARCH (1,1) results for the consolidation industry's companies and averages.

For the overview, all β coefficients are significant at 1% level, where constant terms in nearly all regressions are insignificant (both for OLS and GARCH (1,1) results and both industries). In general, the liner shipping industry has higher β values compared to the consolidation industry.

The lowest value of β is in consolidation industry in the US, where UPS has only 0.268 for OLS and 0.376 for GARCH (1,1). The highest value belongs to liner shipping industry, where China Shipping Container Lines Company Limited has CAPM- β 1.77 in OLS and 1.65 in GARCH (1,1). Mostly, OLS and GARCH (1,1) are close to each other. The biggest inconsistency is in UTi Worldwide Inc. where the result of OLS is 0.57 and for GARCH (1,1) 0.90 (figures 6.8 and 6.9 in Annex I), which is nearly double.

For the comparison, Kavussanos *et. al.* estimated CAPM- β for shipping industry and they got 0.64-0.67 at 5% significance level.[94] Drobetz *et. al.* estimated the systematic risk for the United States, United Kingdom, Japan and Germany shipping industries. Here they got 0.8749, 0.8456, 0.8909 and 1.3778, respectively.[95]

For the comparison, Maersk which is a Danish company has OLS β 1.13 whereas the Taiwanese average β is 0.80. Thus, looking regionally, the markets which are close geographically have similar β coefficients (compared Denmark to Germany and Taiwan to Japan with the coefficients from Kavussanos *et. al*). On the other hand, Hong Kong's average is 1.47 and Korean company Hanjin Shipping Holdings Co. Ltd. has OLS of 1.21. Differences can be caused due to different sample periods, number of sample firms and estimating methods. For example, Drobetz *et. al.* use a seemingly unrelated regressor (SUR) to estimate systematic risk with one-factor and four-factor models.

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[93] *Ibid.*

[94] M. G. Kavussanos, S. N. Marcoulis, *Risk and Return in Transportation and Other US and Global Industries*, The Netherlands: Kluwer Academic Publishers, 2001.

[95] W. Drobetz, D. Shilling, L. Tegtmeier, "Common risk factors in the returns of shipping stocks", *Maritime Policy and Management*, 2010, 37(2), at pp. 93–120.

4.4.2. Time varying β and Kalman filter

The ensuing text is mainly explanatory which introduces the use of Kalman filter. Since the values of β are different in the sample period, it is essential to estimate the time-variant path of β. It is assumed that β follows a process than can be expressed as follows:

$$R_{i,t} - R_{ft} = \alpha_i + \beta_i(R_{mt} - R_{ft}) + \varepsilon_{i,t}$$

$$\beta_{i,t} = \beta_{i,t-1} + v_t$$

Traditional CAPM gives the theoretical background, and assuming a constant risk and return relationship[96], the return generating process gives the following equation -

$$R_{i,t} = R_f + \beta_i(R_{mt} - R_{ft}) + \varepsilon_{i,t}$$

By subtracting the risk free-rate from both sides we get equation:

$$R_{i,t} - R_{ft} = \alpha + \beta_i(R_{mt} - R_{ft}) + \varepsilon_{i,t}$$

Then on the left side we have excess log-returns, and because of assumption that markets are efficient, α is insignificantly different from zero.

The aim of this thesis is to look at the β's sensitivity to regulatory factors, so the equation from above becomes:

$$R_{i,t} - R_{ft} = \alpha + \beta_t(R_{mt} - R_{ft}) + \varepsilon_{i,t}$$

Time-varying β is denoted by β_t.

In this thesis we focus on a time-varying model and use the Kalman Filter procedure for the maximum likelihood estimation of parameters of interest.

By allowing time-variation to follow a process that can be described as:

$$R_{i,t} - R_{ft} = \alpha + \beta_t(R_{mt} - R_{ft}) + \varepsilon_{i,t}$$

$$\beta_{i,t} = \beta_{i,t-1} + v_t$$

The first part is the same, the second describes the process that determines $\beta_{i,t.}$. In this state representation of the Kalman filter, β of firm i at time t is determined from the previous time point $\beta_{i,t-1}$ and white noise error term v_t. A random walk is adopted which corresponds as a filter of the data.

[96] R Buckland, P Fraser, "Political and regulatory risk: Beta sensitivity in U.K. electricity distribution", *Journal of Regulatory Economics*, 19, 2001, at pp. 5–25.

Once this is done, accuracy of the forecasts is assessed. To assess it, root mean square error (RMSE) is used, which is calculated:

$$RMSE_i = \sqrt{\sum_{t=1}^{T} \frac{(\hat{r}_{it} - r_{it})^2}{T}}$$

Where r_{it} is $R_{i,t} - R_{ft}$, and 'hat' denotes the 'estimated' risk premium.

There are three steps are in the Kalman filter: prediction, correction, and smoothing. First, the value of the state variable is estimated with the use of initial values, and predicted value of the observable variable is calculated. After that, if there is a realisation of the value of the observable variable, the estimated value of the state variable must have a correction. This correction is dependent on the variance of estimated error. These two steps are carried out over the whole sample period. Lastly, the sequence of state variables is smoothed.[97]

[97] For a detailed discussion on Kalman Filters see Peter S. Maybeck, *Stochastic Models, Estimation and Control: Volume 1*, Academic Press (1979) available online at http://www.cs.unc.edu/~welch/kalman/media/pdf/maybeck_ch1.pdf.

CHAPTER 5

EMPIRICAL RESULTS

This chapter presents the empirical results of the study and provide both financial and legal interpretations as reflected through the results. All the tables and graphs for liner shipping companies and intermediaries are compiled in Annexes I and II, respectively.

5.1. Estimated paths of time varying β for liner shipping companies

In the figures showing the time-varying β of various liner shipping companies in Annex - I, the solid blue lines demonstrate the estimated smoothed time paths of β and the red lines show 95% RMSE confidence intervals.

The first country in this analysis is Denmark, which is the home for one of the leading liner shipping company, namely Maersk[98]. Figure 1.2, which shows the time-varying β of Maersk, depicts that the β starts to increase gradually from 1993 till 2000. From 2001 the β becomes flat and then there is slight decrease from 2008 onwards. It is not consistent with our expectations during the second period but is consistent during the third.

The second country under investigation is Hong Kong. The time-varying β of Hong Kong companies is demonstrated in Figure 2.2, which includes the average of the two companies, namely CSCL and Orient Overseas. Due to lack of the data available, here we can look just at the time-varying β from 1997 (the third phase). The results of Orient Overseas Limited shows that from 1997 β decreases a little bit to 0.4 and then from 2000 to 2009 it steadily rose up to 1.2. During the next four years it decreased minimally and became flat. There is more variation in CSCL. From 2004 to 2007 the β was stable, and then from the middle of 2007 to 2008, the β rose from 1 to 2, then till 2009 it fluctuated a bit but remained at 1.9. Then it decreased in 2010 to 1.3 but slowly came back to 1.8 by the end of 2012. The average of these two companies does not have that many fluctuations. From 2004 to the beginning of 2007, the β is constant at 1.1. Thereafter, it rises and from 2007 to 2013 it is 1.3 with a fluctuation during 2007 – 2009 period.

The third country is Taiwan. In Figure 3.2 it is seen that it is consistent with the various phases discussed under observatory points. Yang Ming Marine Transport Corp. has β of 1.1 in 1995, and it decreases till 2001 to 0.6. Then, from it rose up to 1.5 in 2013. Similar view is for Wan Hai Lines Ltd., where it starts with 0.5 in 1996 and it decreases to 0.1 in 2001. Then, in 2002, there is a sharp rise and it rises to 1.5 by the end of 2012.

Due to singular covariance matrix problem, it has not been possible to present time-varying β of Evergreen Marine Corp. but it has been possible to demonstrate how the whole average of the 3 companies moved. It is seen that it 2001, the β decreases twice – from 1 to 0.5. That is the lowest value in the whole graph. Afterwards, there is a rise like in previous two companies, and it rises by three times up to 1.5. Thus, all three

[98] It is notable in this context that the revenue for Maersk Line in 2012 is 27,118 million USD, which is 45% of the entire revenue generated by all businesses of Maersk.

Taiwanese graphs have similar view to what we expected, i.e., a decrease in β due to higher market power, and increase due to implementation of OSRA.

The fourth country is Korea and the company investigated is called Hanjin Shipping Holdings Co. Ltd. How the β varied over the time can be seen in figure 4.2. Here a very similar view emerges as for the graphs in 3.2. Here the β once decreases from 1995 to 1998 by 0.2. Then it is stable and from 2001 it starts to increase up till 2013 and it increased from 1 to 1.7.

Figure 5.2 depicts the graph for the liner shipping company CSAV from Chile during the period 1994 to 2013. Once again, a similar tendency as Taiwan and Korea is noticed. There is a stable β from 1994 to the middle of 2000. Then, the β starts to increase, and rises from 0.9 to 1.9.

5.2. Estimated paths of time varying β for intermediaries

This section describes the time varying β of consolidation industry. Starting with the country that has some of the leading consolidation companies in the world, in Annex – II, figure 6.2 demonstrates time varying β of US companies. There are four of them, and the average is shown as the US market's β movement.

The data for Expeditors International of Washington starts from 1985 and it has β equal to 1. By 2001, it reaches the minimum value as low to 0.4. From that time, the β stars to rise till 2006, then it's flat to 2009. After 2009, it raises once again up to nearly 1 in 2011. After that, the β is flat with a slightly decreasing trend.

The second consolidator company is C.H. Robinson. This company has less variation compared to the previous one. The company starts with β of 0.5 in 1998, and it's CAPM- β decreases up to 0.35 in 2001. After that, the β stars to rise and by 2005 it goes up to 0.6. After that, the β becomes fairly flat and stable.

The third company, UPS, demonstrates perfectly of what is expected from the described observatory points in Chapter 4.3. UPS starts in 2000 with a negative β with a little less than 0. It reaches 0.8 in 2004 (a sharp rise in β) and it starts to decrease. By 2009, the β is as low as 0.5. During the next 4 years, it goes up but after that that it once again starts to decline. That falls exactly in place with the expectations of the authors.

The fourth company is UTi Worldwide Inc, which has really similar view to Expeditors International of Washington. The β rises from 2000 at 0.2 to 2006 where the β becomes equal to 1. Then it is flat till 2009. After that there is a slight increase followed by a slight decrease in the end period.

Looking at the average of these companies, it is seen that there are less fluctuations and the β is in a lower interval (starts with 0.3 and ends with 0.9; while looking at single companies the lowest value was -0.05 and the highest was 1.1). There is a constant rise of β in the average of 4 companies. Only in 2011, it can be stated that the β stops to rise and subsequently decreases. Overall, two out of three periods show the view of the authors' expectations. Up till 2004, β increased, and this is what was expected. From 2005 to 2010 there was a continuation of increase in β, while it was

expected to decrease. It is notable that a portion of this period marked the global financial crisis which affected the transportation and cargo consolidation business to a great extent. After that, from 2011 it is seen that β slowly starts to decrease and it once again falls in line with the authors' expectations.

For the second country, Germany, figure 7.2 demonstrates the time varying β of the Deutsche Post which owns DHL. In the first view, it looks like the company has a flat β. It varies just with 0.05. Here, the company starts with β 0.95 in 2000 and reaches 1 in 2009. After that, the β starts to decrease very slowly.

The third country for the consolidation industry is Switzerland. It has two publicly traded companies which are in top 25 freight forwarders list. The variations are demonstrated in figure 8.2.

Kuehne Nagel has a very fluctuating CAPM- β. The company starts with β 0.9 in 1994 and in 1997 it starts to decrease to reach 0.5 in 1998. Then there is a rise in 1999 and in the middle of 2000 it returns to 0.5. Then, it starts to increase and in 2002 when it reaches its peak value of 1. Once again, it starts to decrease up to 0.4 in 2004. Then, the β increases and in 2009 has a value of 0.9. And from that period, the β decrease and in 2013 the value is 0.7.

Panalpina has a different view. From 2005 to 2009 the β moves from 1 to 1.2. In the middle of 2009, it is seen that the β starts to decrease and in 2013 the β value is 0.75.

A very similar view to Panalpina is seen in the average of two Swiss companies. The average starts with 0.8 in 2005. Similar to Panalpina, β increases till 2009 where it is 0.95. Then, it starts to decrease and goes down to 0.5 in 2013. On the other hand, it is also very similar to Kuehne Nagel, where it also is increasing till 2009 and starts to decrease after that. The only difference is that it fluctuates while is decreasing.

DSV is a Danish freight forwarder and it has a similar view to the expectations of the authors. It is seen that the company has a β of about 0.78 for 8 years beginning from 1987. Then it rises up till 2009 and β is equal to 0.95. A decrease begins in 2010. It is not a sharp decrease but it is a continuous up till 2013. Also, to be noted, the rise from 2003 to 2009 is not so steep compared to the previous years. This might be also interpreted as that maybe new regulation in 2004 stopped the sharp increase in β. All this information can be seen in figure 9.2.

The last country under investigation is Australia and it has one company called Toll. Here the authors do not see any of the expected results. It is observed that up till 2001 the β is decreasing, where it decreases from 1.15 in 1995 to 0.6 in 2001. Then, there is a continuous increase. In 2009 it is seen that it becomes even steeper. Therefore, the results are opposite to all 3 periods where the authors expect first an increase, then a decrease and then another subsequent decrease.

5.3. Interpretation of the results

This part of the chapter provides interpretation of the results of β considering the observatory points which are discussed in sections 4.2 and 4.3 of Chapter 4 above.

The β of Maersk is mostly rising since 1984. The rise from 1984 to 1990 is due to US Shipping Act of 1984 which fostered competition in the market. From 1990 to 1998 the β was expected to decrease but we see that there is increase in that period. This period was supposed to have inter-firm cooperation as such as TSA was initiated and the competition for Maersk supposed to decrease. The reasoning of increase in systematic risk of this company could be due to lower CR4 concentration ratio. Maersk has always been a key player and falls into those 4 companies all the time. From 1980 to 1998, the CR4 concentration ratio has been decreasing which implies that the industry became less concentrated and this could imply a rise in β of Maersk company. After that, in 1998 OSRA came into account and this was not in favour to liner shipping companies. But HHI has increased during that time. Thus, due to these two factors, it is seen that the β starts to decrease slowly from 2008.

Moreover, the regulatory environment in Europe where the European Commission's Regulation 4056/86 which had granted liner carriers a block exemption from Europe's competition laws allowing shipping conferences to continue on trade routes to and from Europe was repealed through EC Regulation 1419/2006 in September 2006, which came into effect on October 2008. The repeal of the antitrust exemption prohibits shipping companies from engaging in collective rate setting and discussing capacity utilization in detail, but they are allowed to continue vessel-sharing agreements and other "efficiency-enhancing" operational agreements.[99] Although Maersk is one of the largest liner shipping companies in the world with an estimated global market share of 15.4% in 2012, the cooperative mechanism which the Japanese firms created after 1984, leading to the fall in β between 1990 and 1998, as depicted through the results of Tezuka *et. al.*[100] could not be replicated in the European context. It is important to note that Japan has so far not encouraged free competition between shipping lines in its national jurisdiction due to the fact that large shippers are linked to large ocean shipping companies in Japan through the *keiretsu* or "group system" of business organization. Japanese legislators continue to favour the Japanese liner companies' perspective because these companies rely more on outside trade than they do on trade to or from their home country. Japan as a net provider of liner shipping services does not wish to forego the maritime exemption as income from liner shipping benefits its national economy. Perhaps, Japan will be one of the last few countries internationally to move towards a more market-based system.

Turning to the average of two Hong Kong companies, it is seen that from 2004 to 2013, the β is somewhat flat with increase and decrease from 2007 to 2010. This could be due to financial crisis. Looking at companies, Orient Overseas (International) Limited has a β decrease till 1999 and it starts to rise. The decrease falls into the second period and when there was an increase in inter-firm cooperation. The increase could be due to new OSRA regulation. From 2009 the β is flat. This could be implication of global recession or increase in market concentration. China Shipping Container Lines Company Limited has a very similar view to the average of two companies and the reasoning might be the same. Also notable in this context is that Hong Kong's strong tradition for *laissez faire* policies may explain its lack of competition legislation, but it appears to be evaluating the need for a competition

[99] "Antitrust: Commission Adopts Guidelines on Application of Competition Rules to Maritime Transport Services," IP/08/1063, Brussels, 1 July 2008 available online at http://ec.europa.eu/comm/competition/antitrust/legislation/maritime/

[100] See Tezuka *et. al*., *supra* note 2.

policy in the liner sector. Hong Kong has lost some of its market share to mainland Chinese ports, partly because of higher terminal handling charges that are applied across the board by the shipping lines calling at Hong Kong.

The Taiwanese companies provide a slightly different view. By looking at the average of three Taiwanese companies, it is seen that the trend to decrease in the systematic risk has a longer period. Here it is observed that β decreases up till 2001. Then, there is an increase in CAPM- β and this could be due to that the effects of OSRA took longer time to affect Taiwanese companies. From 2004, it is seen that β starts to decrease. The reason would be that the market reorganised and increasing market concentration became main player in the systematic risk. From 2009, the β once again starts to increase. Like it was before, here there reason might be the effect of the global financial crisis which reduced international trade and hugely impacted liner shipping freight rates. Both Yang Ming Transport Corp and Wan Hai lines Ltd have similar β movements and the reasoning would be similar for the average of Taiwanese companies. The only difference would be that for the Wan Hai lines Ltd the β increases up till 1999.

The decrease of β for Korean company Hanjin Shipping Holdings Co. Ltd would be due to increased cooperation of liner shipping companies. Once again, the increase period starts when OSRA regulation has been accepted. Thus, there is a chance that the market realised the effects of it later and the increase in β starts in 2001. A change in trend is seen like in other countries, is once again 2008, a year when global recessions has started. This could be once again a reason why there is a change in trend of β movement of Hanjin.

The systematic risk of CSAV (company from Chile) starts to increase from 2000. And again, the reasoning would be that the market took longer time to take in account the effects of OSRA. Even thought that the HHI increases, the company has a high rise in systematic risk. From 1994 up till 2000 the company, comparing to Maersk, did not have an increase. The difference is that CSAV is 10 times smaller in size compared to Maersk and it could be that decrease in concentration during that period had more effects for the bigger companies and smaller companies could use the advantages of cooperation.

In interpreting the movement of β for freight forwarders it is observed that in the US, between 2000 and 2008 the cargo consolidation market shows a gradual increase in systematic risk. From 2008 the further increase in β may be due to the beginning of global recession which affected the transportation industry. From 2010 the systematic risk becomes stable which could be interpreted as an indication of change in regulation which reduced the tariff publication requirements for NVOCCs. Compared to liner shipping industry, consolidators have a slow increase in market concentration of levels. From 2005 to 2007, the concentration rate was even decreasing, and it decreased to 205 and increased to 258 in 2010. Compared to liner shipping industry, it is a very low increase, as in the liner shipping industry market concentration increased from 336 in 1999 to 644 in 2009.

Comparing the companies based in the US individually, for all four companies the β was increasing from 2001. When the companies were faced with the challenges posed by the global financial crisis in 2008, it is observed that two of them have an increase

in β during that period while the other two seems not to be really affected. The possible reasoning could be that the HHI increased and some big players in the freight forwarding industry could be better positioned to serve large customers and heavy investments in IT could also have led to improve productivity and abilities to reflect on short-term market changes.[101] From 2011, for three of the four companies, the β starts to decrease. It can be stated that this decrease is due to the relaxed tariff publication requirements, which has been discussed in detail earlier in this thesis.

In Germany, Deutsche Post shows a really low variation indicating that the company used the global financial crisis in its favour. When the systematic risk for the other consolidators increased, it seems that DHL has taken advantage of its leading position and increased market concentration. However, the movements during all period are really small for Deutsche Post as it varies between 0.9 and 1 making clearer interpretations difficult.

The Swiss companies seem to also have benefitted during the financial crisis. The systematic risk of the average of two companies started to decline in 2009. The reasoning would be once again, that these two companies were able to cope with the changed market environment. Moreover, a continuity of decrease was followed by the new 2010 regulation, where consolidators were able to compete in the market more easily. Panalpina's systematic risk moves in the same way like the average; thus, the reasoning would be the same. Kuehne Nagel International Ltd also lost some systematic risk during the recession time. What is different is that it did not continue to decrease, and there was an increase from 2010 to 2012.

The Danish company DSV once again had in its favour the financial crisis and that would be the reason why it has a declining β from 2009. Also, the company could take the benefits of the 2010 regulation. On the other hand, 2011 looks only a continuity of 2009, and it is hard to state, whether the new regulation make a big impact for the company. Also, market concentration increased but the β looks quite stable.

The Australian company Toll Holdings Limited does not behave like the earlier discussed companies and it could be due to different location of its main market. For them, unlike European companies, global crisis raised the β. On the other hand, it is seen that from 2011 β stops to increase and becomes flat.

In an attempt to provide reasoning for the behaviour of β in Australia from a legal perspective, it is submitted that liner conferences which are permitted under Part X of the Australian *Trade Practices Act 1974*, as amended by the *International Liner Cargo Shipping Act 2000*. The interpretation is broad and covers traditional conferences and discussion agreements. Shipping lines are allowed to co-operate in the provision of services, capacity agreements, service levels, rates and technical agreements. Exemptions are limited to liner shipping activities covering ocean transport and loading and discharging operations at cargo terminals, including inland cargo terminals. As far as possible, protection available to cargo interests is extended to cover importers' inward shipments. Powers are available to the Minister for Transport and Regional Services and the Australian Competition and Consumer

[101] See *supra* note 82.

Commission to respond to conduct likely to cause an unreasonable increase in freights and/or an unreasonable decrease in services. No unreasonable restrictions must be placed on new parties seeking to join a conference. In 2005, the Australian Productivity Commission, an independent government agency charged with reviewing the economic effects of government policy, undertook a further review of the arrangements to determine the continuing justification of the Acts or any changes required to improve their effectiveness. The Commission reported in 2005 that it's 'strongly preferred option is to repeal' the ocean liner shipping exemption under Australian competition law. While cargo interests appear to be reasonably satisfied with the principles of the current system, it appears that regulators might take a less benign view. This situation has an effect on the cargo consolidation industry which will gain from any deregulatory move in this regime.

It is evident from the above discussion that Australian cargo consolidators whose business is primarily focussed in the Asia Pacific region do not follow the global trend both from a regulatory and a global market perspective. The other global consolidators considered in this study have a much wider market reach and have been affected by the NSA rules to a certain extent although many of their home jurisdictions do not have such mechanisms as seen in the US.

5.4. Robustness check using FF3F model and estimated time paths

To confirm the results as described above, Fama-French 3 Factor (FF3F) model is used. Fama and French introduced this model through two scholarly publications.[102] This model is different, as it is not a one-factor model and it is more explanatory. With this model we also get OLS, GARCH (1,1) and time-varying β. This model can be described by the equation below:

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_i\left(R_{m,t} - R_{f,t}\right) + s_i SMB_t + h_i HML_t + \varepsilon_{i,t}$$

The difference between the log-returns on portfolios for large stocks and small stocks is small (market capitalization) minus big (SMB) and the difference between log-returns on a portfolio of high and low book-to-market ratios is high (book-to-market ratio) minus low (HML). The data we use for SMB and HML is from a website regularly updated and maintained by Kenneth R. French.[103] There is data for US, and it is used for the robustness check in the US consolidation industry. Moreover, a robustness check is made for DSV, a consolidators company from Denmark. Also for Maersk, the Danish liner shipping company and for some of the Hong Kong liner shipping companies a robustness check is made. For the Danish companies, European factors data is used. For Hong Kong companies, Asia Pacific data is used (which excludes Japan). All robustness check results are presented in Annex III. Firstly, it is possible to find tables for the liner shipping industry (also graphs of time-varying β), and after for the consolidation industry.

[102] See E. F. Fama and K. R French, "The cross section of expected stock returns", *Journal of Finance*, 47, 1992, at pp. 427–465. See also E. F. Fama and K. R French, "Common factors in the returns on stock and bonds", *Journal of Financial Economics*, 33, 1993, at pp. 3–56.
[103] See http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

All new βs calculated are statistically significant, and other parameters are insignificant. So, at looking time-varying parameters the authors only concentrate on β. All in all, time-varying βs are really similar to single-factor model βs.

Comparing time-varying β of Maersk, (figures 11.1 and 1.2) the β rises, but not like in the single factor. In figure 11.1, β rises from 1992 to 2006, and in figure 1.2, there is a higher rise and from 2005 there is a decrease. OLS and GARCH (1,1) β results are higher by 0.05. In Hong Kong, time varying β is nearly the same, and similar OLS and GARCH (1,1) results. Looking at US consolidators, OLS is higher for C.H. Robinson than GARCH (1,1) in tables (6.4 and 6.5) where in tables 13.3 and 13.4 it can be see that there is an opposite situation. The biggest difference in time-varying β graphs is within UPS, where the β starts to rise from 0 in figure 6.2 and in figure 13.1 it starts from -0.4. With RMSE β could be even -0.8. DSV also shows similar OLS and GARCH (1,1) results and a similar graph. In conclusion, the results pass the robustness check as FF3F results seem to be consistent as there are not many deviations from the results we have in Annex I and Annex II.

CHAPTER 6

SUMMARY AND CONCLUSION

This thesis focuses on the various economic and financial implications associated with the bargaining freedom introduced through the volume contract concept under the Rotterdam Rules. The experience from deregulation of the liner conference system initiated through service contracts in the US and its extension by providing service contract parity to consolidators is extrapolated to the volume contract concept to make a prognosis of the future landscape of the global liner shipping and cargo consolidation market.

The thesis analyses the market environment in the global liner shipping and cargo consolidation industry by drawing the paths of the time-varying systematic risk, β from 1980–2013 for the liner shipping industry and from 1988-2013 for the cargo consolidation industry, depending on the data available for each company. The thesis identified two factors which affect β, namely, changes in regulation and market power. The path of β was drawn by using Kalman filter along with estimates of β with the market model and the FF3F model. The long-term behaviour of β was observed and interpreted in the penultimate chapter of the thesis.

Two observatory points were established to observe the effects of market changes on the risk in the liner shipping and consolidation industry. For the liner industry, the first observatory point relates to increase in β due to changes in regulation promoting competition, and the second relates to decrease in β due to an increase in market power due to cooperation and concentration among companies. For the consolidation business, the first observatory point conveys a decrease in β due to the regulations allowing more business opportunities through forward contracting, and the second relates to further decrease in β due to relaxed publication requirements.

This study contributes to the growing financial literature of linking the behaviour of β to market changes and observing the long-term behaviour of β using set observatory points. This study has shown that CAPM- β in financial theory is related to the framework of market analysis in industrial organization theory. It is also found that the behaviour of β is linked to market changes through the detailed literature survey.

For the liner shipping industry, the results are mostly in conformity with the first observatory point suggesting an increasing trend in β during the period 1980-1989 which reflects regulatory changes in the liner shipping business. However, the β follows a decreasing trend during the period 1990-1998 for certain markets, consistent with the second observatory point, suggesting that market risk was reduced through cooperation between liner shipping companies which entered into various market stabilization agreements. However, the effect of cooperation was limited to certain markets in Asia and European firms were largely unaffected which is obvious from the results of Maersk. After 1998, the β rises shortly due to the passage of OSRA and then flattens for most companies which may be due to offsetting of the two conflicting factors arising from the first and second observatory points. Also notable in this context is that the liner shipping industry experienced an unprecedented boom between 2000 and 2006 with rise of production centres in China and other parts of Asia feeding to the demands from the consumer markets in Europe and North

America. The period between 2008 to 2010 sees a rise in β for most liner shipping companies as this period marks the turmoil of the global financial crisis on the liner shipping industry as a whole which witnessed dramatic fall in freight rates.

The analysis of the cargo consolidation industry did not reap consistent results across continents as the change in regulation through the introduction of the NSA rule in 2004 and further relaxation in the publication requirements in the US in 2010 has not been propagated to other parts of the world. Moreover, the NSA rule was introduced during a period when the world economy was subsequently hit by a financial crisis which affected the liner shipping business to a considerable extent. As explained below, the use of service contracts cannot be fully appreciated at such a juncture of economic turmoil and it is submitted that a detailed study at a future occasion might generate more obvious results. However, some of the results of the US based consolidation companies are in line with the general hypothesis suggested by the authors.

It has been repeatedly stated in this thesis that the global financial crisis has had an affect on the systematic risk of the companies analysed herein. It is notable in this context that the use of service contracts is more frequent in the time of economic boom rather than in time of bust. Large shippers and consolidators are encouraged to use service contracts when they anticipate a rise in future freight rates of liner carriers. Therefore, the effects of deregulation on liner shipping and cargo consolidation industry that can be expected during boom period is considerably different than during a period of economic downturn. It has to be borne in mind that while it is true that in most cases of carriage under a service contract a rate applies that is different from that for ordinary shipments, there are some good economic reasons including the following:

(i) The service contract market, being a future market is different from the spot market. In a future market the expectations on future price increases or decreases are reflected in the actual prices.
(ii) In the spot market sometimes 'marginal pricing', *i.e.*, the price not covering the fixed costs, occurs. For large quantities in a future market, marginal pricing is unusual because pricing below costs can lead to insolvency of the carrier.
(iii) Large quantities may lead to economy of scale with a corresponding price decreasing effect.[104]
(iv) Special logistical requirements may lead to additional costs and, therefore, may have a price increasing effect.
(v) The carriage of large volumes may cause fierce competition, which may have a price decreasing effect.

All of the above mentioned factors lead to the result that the price per unit in a service contract will be different from an ordinary shipment on the spot market. Whether the

[104] Long-term, larger quantities may lead to economics of scale because larger ships may result in lower costs per TEU. Short-term, larger quantities will increase the level of occupancy of a vessel. Each vessel, however, has in a certain trade an optimal occupancy level in the order of 85 – 90 per cent of its theoretical total capacity. When the occupancy increases beyond such optimum, the costs connected with shifting containers in ports during loading/unloading operations may become higher than the gross profit margin of the containers that are carried beyond the optimal number.

freight rate for shipments under a service contract will be higher or lower than for shipments on the spot market will depend on the combined effect of factors (i) to (v) above.

Another relevant issue is whether service contracts are a dominant factor in the market. In the non-United States trades, provided shippers are free under the law or commercial considerations to select their carriers, it is estimated that some 50 to 70 per cent of the total number of shipments[105] are carried under the rate agreement system[106]. Even where volumes are large, relatively speaking not many such consignments are carried under volume contracts. Only when there is a scarcity of shipping space there is a tendency for an increase in the numbers of service contracts. This is because under such circumstances, certainty of space may become more important for shippers than it would have been otherwise. However, under normal circumstances if the average occupancy level of liner ships is around 75 per cent, it is estimated that no more than 20 to 25 per cent of the total number of shipments would be carried under service contracts.[107]

A similar experience is expected to follow in the transportation industry if and when the use of volume contracts becomes a reality. Therefore, the use of volume contracts during the time of economic boom will have a positive effect on the systematic risk of cargo consolidators while it might have a negative effect on the liner carriers given that there will be increased competition due to the deregulatory effect. The results will also vary depending on the market concentration of the companies. On the whole, the volume contract regime will result in increased benefit to the shippers involved in international trade and thereby benefitting the consumers who are end users of the commodities transported by ships.

The authors recognise that the β might have been affected by other factors such as, fluctuations in foreign exchange rates or crude oil prices. The dynamics of world trade also changed during the 1990s with the emergence of China as one of the leading players in the manufacturing business. The impacts of these factors were not removed from the data. Future research may be possible in this area which can consider these factors.

This thesis provides a methodological perspective for financial experts to analyse the evolution of the liner shipping industry and the growing importance of cargo consolidators in enhancing the efficiency though use of economy of information and forward contracting in the maturing liner shipping business landscape. Moreover, there is an emerging area called supply chain finance which will go hand in hand with supply chain management, where the two are considered as two sides of the same coin. In early 2013, the banking industry released a unique set of legal and technology standards to unlock the potential of the supply chain finance market. The cargo consolidation companies, which at present have the best view of the location of goods, are not used to sharing the information held with them. They have developed their own practices around shipment and tracking where the goods are but have not thought about turning this into something to trigger financial services which is a huge

[105] See Mukherjee & Basu Bal, *supra* note 18, at p. 603.
[106] "Rate agreements" here refers to cargo carried either under the agreed rates or under lower spot rates.
[107] See Mukherjee & Basu Bal, *supra* note 18, at p. 603.

loss to corporations involved in international trade and the banks which finance international trade transactions. While there is an opportunity for banks to work with these consolidation companies using global information systems like GPS, it would mean that the latter would have to change their business practices. In addition, if more information is available with the banks on the fluctuating value of goods while they are being transported, they will also have the possibility to offset collateral against capital turning the entire supply chain into a financial asset. It is submitted in this context that the role of forward contracting through use of volume contracts will provide more commercial certainty to both consolidators and banks in relation to transportation of goods which forms a part of the supply chain.

The thesis also makes an attempt to facilitate legislators in understanding the consequences of the evolving commercial and business issues related to the liner shipping industry, which the Rotterdam Rules might govern if it enters into force in the future. A proper understanding of the commercial aspects of volume contracts will help governments to decide whether or not to accept the Rules taking account of their respective constitutional dictates. It is submitted that with the increasing role of consolidators in the liner shipping sector, small and medium shippers will benefit in the long-term from use of volume contracts.

LIST OF ABBREVIATIONS IN THE ANNEXES

ERDSB - excess log-returns of Maersk
ERWIND – excess log-returns of FTSE Denmark 20 Index
ERCSCL – excess log-returns of China Shipping Container Lines Company Limited
EROROC – excess log-returns of Orient Overseas (International) Limited
ERHNKG – excess log-returns of the Hang Seng index
AVERAGE2 – excess log-returns of 2 Hong Kong companies
EREVE - excess log-returns of Evergreen Marine Corp. (Taiwan) Limited
ERYMM - excess log-returns of Yang Ming Marine Transport Corporation
ERWHL - excess log-returns of Wan Hai Lines Limited
ERTAIW - excess log-returns of TAIEX
AVERAGE3 – excess log-returns of the average three Taiwanese companies
ERHJS – excess log-returns of Hanjin Shipping Holdings Co. Limited
ERKORCOMP – excess log-returns of KOSPI
ERVPR – excess log-returns of CSAV
ERIGPAGEN – excess log-returns of IGPA
EREXPD – excess log-returns of Expeditors International of Washington Inc.
ERCHRW – excess log-returns of C.H. Robinson Worldwide Inc.
ERUPS – excess log-returns of UPS
ERUTIW – excess log-returns of UTi Worldwide Inc.
AVERAGE 4 – excess log-returns of the four US companies
ERNASDA – excess log-returns of Nasdaq Composite
ERDPW – excess log-returns of Deutsche Post
ERRMDAX – excess log-returns of MDAX
ERKUHNE – excess log-returns of Kuehne Nagel International Ltd
ERPANALP – excess log-returns of Panalpina
ERSWISSMI – excess log-returns of Swiss Market Index
AVERAGE2a – excess log-returns of the average of two Swiss companies
ERDSV – excess log-returns of DSV A/S
ERTOLX – excess log-returns of Toll Holdings Limited
ERASX – excess log-returns of All Ordinaries

ANNEX – I

DATA RESOURCE AND EMPIRICAL RESULTS OF LINER SHIPPING COMPANIES

Country 1 – Denmark

AP Moeller Maersk A/S is a Denmark-based shipping and logistics company. It operates within such business units, as Maersk Line, which offers global container services; Maersk Oil, engaged in the oil and gas production and exploration activities; APM Terminals, which is engaged in container terminal activities and repair of containers, among others; Maersk Drilling, which is engaged in the offshore drilling activities and operation of land rigs; Maersk Supply Services, which is engaged in the supply vessel activities with anchor handling and platform supply vessels; Maersk Tankers, engaged in the tanker shipping of crude oil, oil products and gas; Damco, engaged in the logistics and forwarding activities; SVITZER, responsible for the towing and salvage activities; Dansk Supermarked Group, which operates supermarkets, department stores discount stores; Maersk FPSOs and Maersk LNG, which operates floating oil and gas production units, as well as is engaged in other businesses.

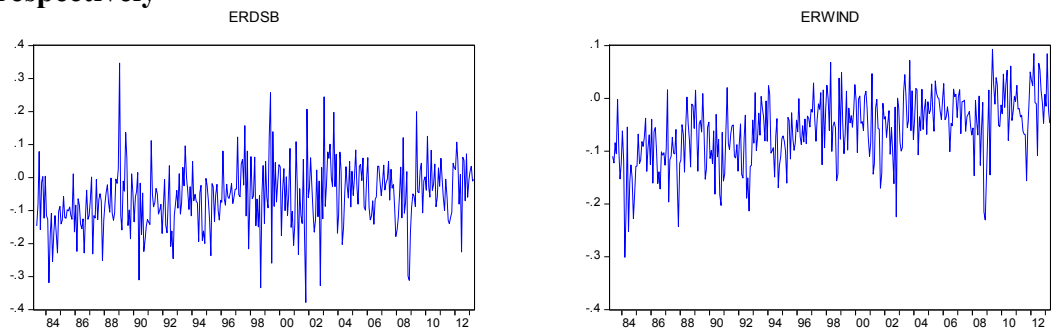
FTSE Denmark 20 index is used. It includes largest 20 Danish listed companies.

Data available between: 1983 - 2013

Table 1.1 – Descriptive statistics 1983 - 2013

	ERDSB	ERWIND
Mean	-0.058108	-0.060114
Median	-0.059015	-0.055150
Maximum	0.346589	0.092917
Minimum	-0.378267	-0.300985
Std. Dev.	0.097231	0.063947
Skewness	0.152595	-0.456039

Figure 1.1 – Line graph of excess log-returns of Maersk and market index respectively



Outliers: in Maersk 1989 01

Table 1.2 - OLS results for Maersk

Dependent Variable: ERDSB
Method: Least Squares
Date: 04/22/13 Time: 18:57
Sample (adjusted): 1983M05 2013M03
Included observations: 359 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ERWIND	1.126447	0.051307	21.95497	0.0000
C	0.008717	0.004506	1.934572	0.0538

R-squared	0.574504	Mean dependent var	-0.059236
Adjusted R-squared	0.573312	S.D. dependent var	0.094981
S.E. of regression	0.062043	Akaike info criterion	-2.716419
Sum squared resid	1.374218	Schwarz criterion	-2.694785
Log likelihood	489.5972	Hannan-Quinn criter.	-2.707816
F-statistic	482.0207	Durbin-Watson stat	2.215808
Prob(F-statistic)	0.000000		

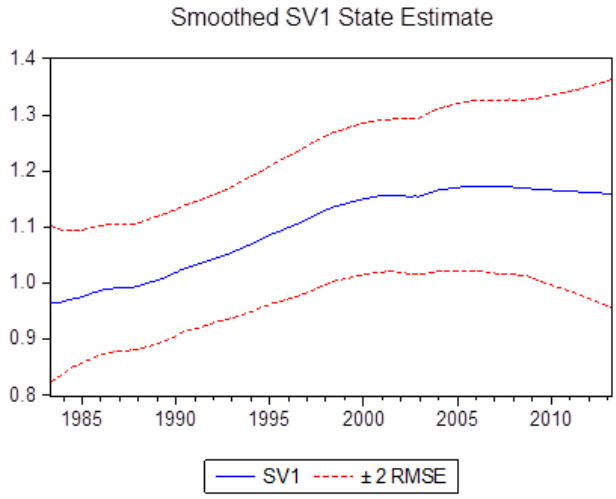
Table 1.3 - GARCH (1,1) results for Maersk

Dependent Variable: ERDSB
Method: ML - ARCH (Marquardt) - Normal distribution
Date: 04/22/13 Time: 18:58
Sample (adjusted): 1983M05 2013M03
Included observations: 359 after adjustments
Convergence achieved after 14 iterations
Presample variance: backcast (parameter = 0.7)
GARCH = C(3) + C(4)*RESID(-1)^2 + C(5)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
ERWIND	1.101974	0.048926	22.52351	0.0000
C	0.008022	0.004099	1.957085	0.0503
Variance Equation				
C	0.000174	7.92E-05	2.194383	0.0282
RESID(-1)^2	0.120201	0.043058	2.791639	0.0052
GARCH(-1)	0.834654	0.052568	15.87754	0.0000

R-squared	0.574165	Mean dependent var	-0.059236
Adjusted R-squared	0.572972	S.D. dependent var	0.094981
S.E. of regression	0.062068	Akaike info criterion	-2.838517
Sum squared resid	1.375313	Schwarz criterion	-2.784432
Log likelihood	514.5138	Hannan-Quinn criter.	-2.817010
Durbin-Watson stat	2.223866		

Figure 1.2 – Time-varying β of Maersk



Country 2 - Hong Kong

Data available between: 1996 - 2013

China Shipping Container Lines Company Limited is principally engaged in operation and management of container shipping. The Company is also involved in the provision of port services. The Company operates Pacific lines, Europe/Mediterranean lines, Asia-Pacific lines and China domestic lines, among others. During the year ended December 31, 2011, the Company handled approximately 7,438,002 twenty-foot equivalent units (TEUs). The Company operates its businesses in domestic and overseas markets.

Data available between: 2004 - 2013

Orient Overseas (International) Limited is an investment holding company. Through its subsidiaries, the Company engages in the provision of container transport and logistics services. Its container transport and logistics include global containerized shipping services in trade lanes, covering Trans-Pacific, Trans-Atlantic, Asia/Europe, Asia/Australia and Intra-Asia trades, and integrated services over the management and control of storage and flow of goods. As of December 31, 2011, the Company owned 45 vessels after sold four vessels. The Company's subsidiaries include Cargo System Warehouse and Transport Ltd., Consolidated Leasing & Terminals, Inc., Containers No. 1 Inc., Containers No. 2 Inc., Dongguan Orient Container Co. Ltd., Far Gain Investment Ltd., Glory Top Investment Ltd., Hai Dong Transportation Co. Ltd. and Kenwake Ltd., among others.

Data available between: 1996 - 2013

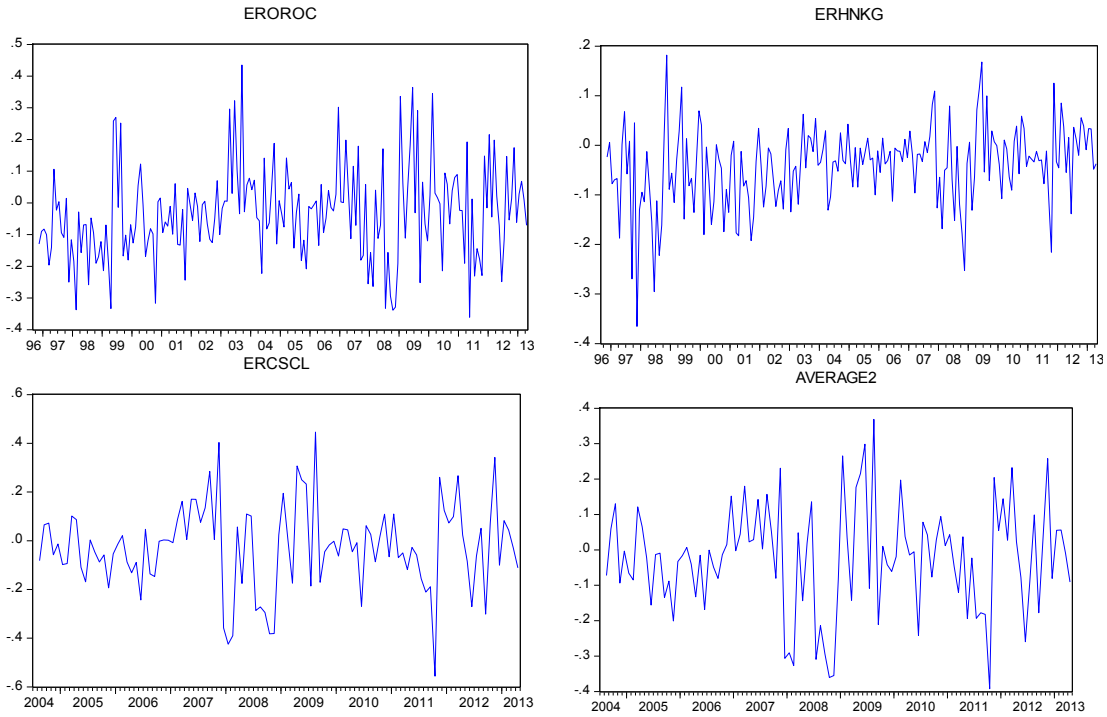
The Hang Seng Index is used which is the main index of Hong Kong stock market. It has 48 largest companies and it has about 60% of capitalisation of the whole Stock Exchange.

Data available between: 1996 – 2013

Table 2.1 - Descriptive statistics depending on availability of data

	ERCSCL	ERROC	AVERAGE2	ERHNKG
Mean	-0.027908	-0.020607	-0.024257	-0.023667
Median	-0.013959	-0.014503	-0.013366	-0.022071
Maximum	0.446094	0.364404	0.368782	0.168005
Minimum	-0.555867	-0.360825	-0.392448	-0.252454
Std. Dev.	0.176022	0.152962	0.150771	0.068224
Skewness	-0.122419	0.129169	-0.123099	-0.349741

Figure 2.1 – line graph of excess log-return for Orient Overseas (International) Limited, market index, China Shipping Container Lines Company Limited and the average of two companies



Outliers: no outliers for Orient Overseas (International) Limited, 1 outlier in 1997 11 for market index, 1 outlier in 2011 10 for China Shipping Container Lines Company Limited and no outliers in the average of two companies

Table 2.2 – OLS results for Orient Overseas (International) Limited

Dependent Variable: EROROC
Method: Least Squares
Date: 05/24/13 Time: 20:54
Sample (adjusted): 1996M11 2013M03
Included observations: 197 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ERHNKG	0.673863	0.126023	5.347150	0.0000
C	-0.004773	0.010975	-0.434893	0.6641

R-squared	0.127876	Mean dependent var	-0.032511
Adjusted R-squared	0.123403	S.D. dependent var	0.144993
S.E. of regression	0.135752	Akaike info criterion	-1.145874
Sum squared resid	3.593577	Schwarz criterion	-1.112542
Log likelihood	114.8686	Hannan-Quinn criter.	-1.132381
F-statistic	28.59201	Durbin-Watson stat	1.933970
Prob(F-statistic)	0.000000		

Table 2.3 – GARCH (1,1) results for Orient Overseas (International) Limited

Dependent Variable: EROROC
Method: ML - ARCH (Marquardt) - Normal distribution
Date: 05/24/13 Time: 20:55
Sample (adjusted): 1996M11 2013M03
Included observations: 197 after adjustments
Convergence achieved after 64 iterations
Presample variance: backcast (parameter = 0.7)
GARCH = C(3) + C(4)*RESID(-1)^2 + C(5)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
ERHNKG	0.627094	0.120295	5.212968	0.0000
C	-0.007083	0.011848	-0.597864	0.5499
Variance Equation				
C	0.002346	0.001868	1.255513	0.2093
RESID(-1)^2	0.077913	0.052053	1.496808	0.1344
GARCH(-1)	0.795887	0.142297	5.593135	0.0000

R-squared	0.127253	Mean dependent var	-0.032511
Adjusted R-squared	0.122777	S.D. dependent var	0.144993
S.E. of regression	0.135800	Akaike info criterion	-1.143400
Sum squared resid	3.596145	Schwarz criterion	-1.060069
Log likelihood	117.6249	Hannan-Quinn criter.	-1.109667
Durbin-Watson stat	1.922165		

Table 2.4 – OLS results for China Shipping Container Lines Company Limited

Dependent Variable: ERCSCL
Method: Least Squares
Date: 04/27/13 Time: 00:52
Sample (adjusted): 2004M08 2013M03
Included observations: 104 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ERHNKG	1.773962	0.183494	9.667703	0.0000
C	0.015878	0.012677	1.252545	0.2132

R-squared	0.478166	Mean dependent var	-0.022832
Adjusted R-squared	0.473050	S.D. dependent var	0.168975
S.E. of regression	0.122661	Akaike info criterion	-1.339744
Sum squared resid	1.534659	Schwarz criterion	-1.288890
Log likelihood	71.66668	Hannan-Quinn criter.	-1.319141
F-statistic	93.46449	Durbin-Watson stat	1.840512
Prob(F-statistic)	0.000000		

Table 2.5 – GARCH (1,1) results for China Shipping Container Lines Company Limited

Dependent Variable: ERCSCL
Method: ML - ARCH (Marquardt) - Normal distribution
Date: 04/27/13 Time: 00:52
Sample (adjusted): 2004M08 2013M03
Included observations: 104 after adjustments
Convergence achieved after 15 iterations
Presample variance: backcast (parameter = 0.7)
GARCH = C(3) + C(4)*RESID(-1)^2 + C(5)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
ERHNKG	1.651191	0.216487	7.627213	0.0000
C	0.012077	0.012977	0.930617	0.3521
Variance Equation				
C	0.001286	0.001340	0.959750	0.3372
RESID(-1)^2	0.072011	0.077867	0.924794	0.3551
GARCH(-1)	0.847758	0.142156	5.963590	0.0000

R-squared	0.475831	Mean dependent var	-0.022832
Adjusted R-squared	0.470692	S.D. dependent var	0.168975
S.E. of regression	0.122935	Akaike info criterion	-1.336281
Sum squared resid	1.541526	Schwarz criterion	-1.209147
Log likelihood	74.48662	Hannan-Quinn criter.	-1.284775
Durbin-Watson stat	1.810890		

Table 2.6 – OLS results for average 2

Dependent Variable: AVERAGE2
Method: Least Squares
Date: 05/24/13 Time: 21:08
Sample (adjusted): 2004M08 2013M03
Included observations: 104 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ERHNKG	1.469978	0.166375	8.835325	0.0000
C	0.011360	0.011494	0.988288	0.3254

R-squared	0.433532	Mean dependent var	-0.020717
Adjusted R-squared	0.427978	S.D. dependent var	0.147051
S.E. of regression	0.111218	Akaike info criterion	-1.535614
Sum squared resid	1.261672	Schwarz criterion	-1.484761
Log likelihood	81.85194	Hannan-Quinn criter.	-1.515012
F-statistic	78.06297	Durbin-Watson stat	1.902194
Prob(F-statistic)	0.000000		

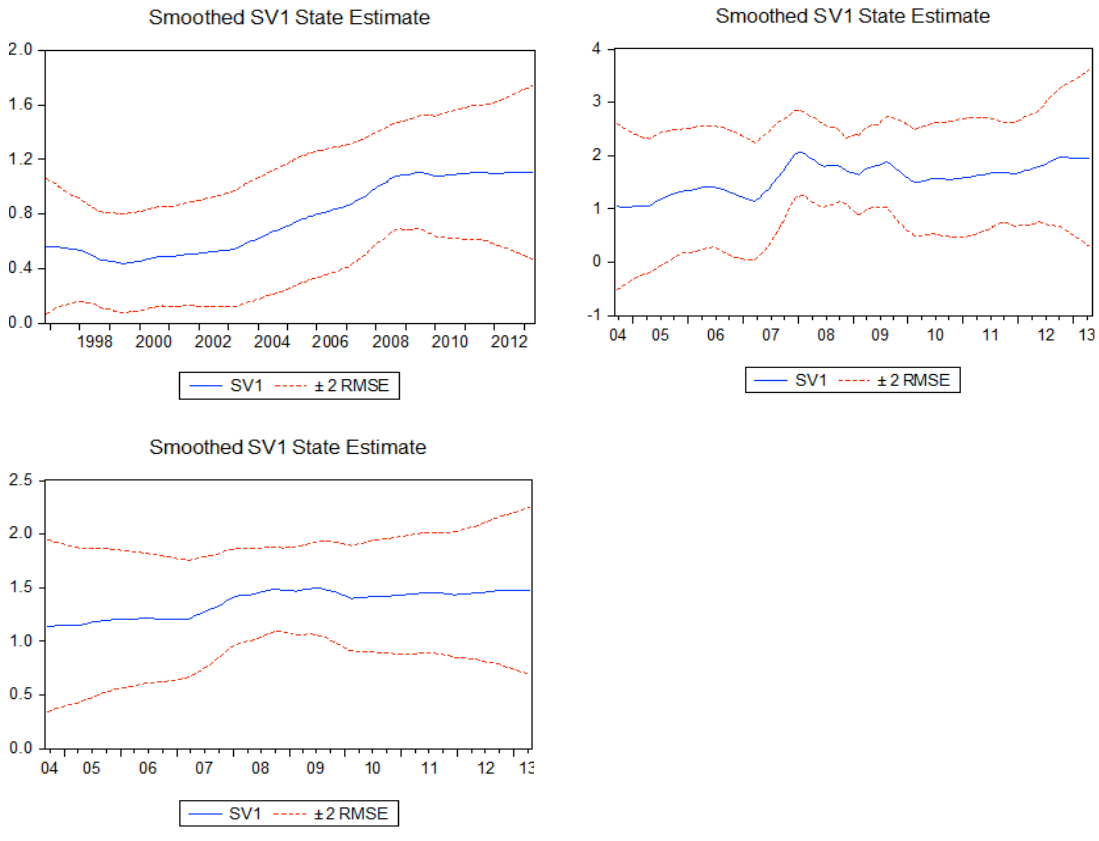
Table 2.7 – GARCH (1,1) results Average 2

Dependent Variable: AVERAGE2
Method: ML - ARCH (Marquardt) - Normal distribution
Date: 05/24/13 Time: 21:09
Sample (adjusted): 2004M08 2013M03
Included observations: 104 after adjustments
Convergence achieved after 9 iterations
Presample variance: backcast (parameter = 0.7)
GARCH = C(3) + C(4)*RESID(-1)^2 + C(5)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
ERHNKG	1.505586	0.175603	8.573813	0.0000
C	0.014729	0.013391	1.099982	0.2713
Variance Equation				
C	0.011305	0.010744	1.052195	0.2927
RESID(-1)^2	-0.121588	0.024247	-5.014437	0.0000
GARCH(-1)	0.222288	0.854136	0.260249	0.7947

R-squared	0.432963	Mean dependent var	-0.020717
Adjusted R-squared	0.427404	S.D. dependent var	0.147051
S.E. of regression	0.111273	Akaike info criterion	-1.524873
Sum squared resid	1.262938	Schwarz criterion	-1.397739
Log likelihood	84.29341	Hannan-Quinn criter.	-1.473367
Durbin-Watson stat	1.909817		

Figure 2.2 - Time-varying β of Orient Overseas (International) Limited, China Shipping Container Lines Company Limited and average of 2



Country 3 – Taiwan

Evergreen Marine Corp. (Taiwan) Ltd. is principally engaged in the international marine transportation services. The Company operates marine lines, including across the Pacific, Far East to Europe/Mediterranean, Far East to South Africa/East Coast of South Africa, East Africa, as well as along Asian coast, among others. The Company is also involved in the leasing of cabins, the provision of agent services and others. On December 31, 2012, the Company finished the merger of its two wholly owned subsidiaries, Clove Holding Ltd. (Clove) and Ample Holding Ltd. (Ample), with Clove to survive and Ample to be dissolved.

Data available between: 1995 - 2013

Yang Ming Marine Transport Corp. is a Taiwan-based company principally engaged in shipping industry. The Company operates its businesses primarily through the provision of marine cargo transportation services, ship leasing, as well as agent operation of ships, among others. As of December 31, 2011, the Company operated 87 ships, including 85 bulk goods cargos and two coal carriers. The Company operates various ship routes, such as Asia-America, North America-South America, North America-Northwest Europe, Asia-Northwest Europe, Asia-Mediterranean, Asia-Black Sea, as well as intra-Asia, among others.

Data available between: 1995 - 2013

Wan Hai Lines Ltd. is principally engaged in the international marine transportation industry. The Company operates its businesses through shipping business, shipping agency services, the operation of port container stations, as well as the leasing and sale of ships and containers. The Company provides full-container shipping services, covering the ports of Mainland China, Taiwan, Kanto and Kansai of Japan, South Korea, Thailand, Indonesia, Philippines, Singapore, Malaysia, Hong Kong, Vietnam, India, Pakistan, Sri Lanka, Iran, the Middle East, the United States, Netherlands, Belgium, Germany, Romania, Ukraine and Turkey, among others. The Company also involves in the general agency services of cargo transportation of a Norway car-carrier company in Taiwan.

Data available between: 1996 - 2013

Taiwan Capitalization Weighted Stock Index (TAIEX) includes all listed stocks (excluding newly listed stocks and preferred stocks) in Taiwan Stock Exchange (TWSE).

Table 3.1 – Descriptive statistics depending on availability of data

	EREVE	ERYMM	ERWHL	ERTAIW	AVERAGE3
Mean	-0.033202	-0.033664	-0.030567	-0.030506	-0.032478
Median	-0.039604	-0.043688	-0.035505	-0.022340	-0.039263
Maximum	0.382630	0.395915	0.306017	0.169333	0.322991
Minimum	-0.515417	-0.359154	-0.408014	-0.261824	-0.344585
Std. Dev.	0.126506	0.126748	0.099456	0.077750	0.105678
Skewness	0.260889	0.465986	-0.112138	-0.274542	0.249888

Figure 3.1 - line graph of excess log-return for Evergreen Marine Corp. (Taiwan) Ltd, Yang Ming Marine Transport Corp, index of Taiwan market, Wan Hai Lines Ltd and average of 3 companies

Outliers: one outlier in 2001 10 for Evergreen Marine Corp, no outliers for Yang Ming Marine Transport Corp, no outliers for Taiwan market, two outliers in 2000 09 and 2002 02 for Wan Hai Lines Ltd, one outlier in 2003 01 in the average of 3 companies

Table 3.2 – OLS results for Evergreen Marine Corp. (Taiwan) Ltd

Dependent Variable: EREVE
Method: Least Squares
Date: 04/23/13 Time: 12:29
Sample (adjusted): 1995M01 2013M01
Included observations: 217 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ERTAIW	0.879086	0.086293	10.18726	0.0000
C	-0.004314	0.007247	-0.595259	0.5523

R-squared	0.325554	Mean dependent var	-0.033200
Adjusted R-squared	0.322417	S.D. dependent var	0.119352
S.E. of regression	0.098245	Akaike info criterion	-1.793528
Sum squared resid	2.075204	Schwarz criterion	-1.762377
Log likelihood	196.5978	Hannan-Quinn criter.	-1.780944
F-statistic	103.7802	Durbin-Watson stat	2.105355
Prob(F-statistic)	0.000000		

Table 3.3 – GARCH (1,1) results for Evergreen Marine Corp. (Taiwan) Ltd

Dependent Variable: EREVE
Method: ML - ARCH (Marquardt) - Normal distribution
Date: 04/23/13 Time: 12:30
Sample (adjusted): 1995M01 2013M01
Included observations: 217 after adjustments
Convergence achieved after 27 iterations
Presample variance: backcast (parameter = 0.7)
GARCH = C(3) + C(4)*RESID(-1)^2 + C(5)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
ERTAIW	0.861079	0.075157	11.45701	0.0000
C	-0.004870	0.007462	-0.652689	0.5140
Variance Equation				
C	0.000553	0.000506	1.092936	0.2744
RESID(-1)^2	0.049140	0.030379	1.617577	0.1058
GARCH(-1)	0.894373	0.078741	11.35840	0.0000

R-squared	0.325417	Mean dependent var	-0.033200
Adjusted R-squared	0.322280	S.D. dependent var	0.119352
S.E. of regression	0.098255	Akaike info criterion	-1.810858
Sum squared resid	2.075625	Schwarz criterion	-1.732981
Log likelihood	201.4781	Hannan-Quinn criter.	-1.779399
Durbin-Watson stat	2.107428		

Table 3.4 – OLS results for Yang Ming Marine Transport Corp

Dependent Variable: ERYMM
Method: Least Squares
Date: 04/23/13 Time: 12:32
Sample (adjusted): 1995M01 2013M01
Included observations: 217 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ERTAIW	0.924408	0.090450	10.22009	0.0000
C	-0.005030	0.007596	-0.662197	0.5086

R-squared	0.326969	Mean dependent var	-0.035405
Adjusted R-squared	0.323838	S.D. dependent var	0.125234
S.E. of regression	0.102978	Akaike info criterion	-1.699423
Sum squared resid	2.279975	Schwarz criterion	-1.668272
Log likelihood	186.3874	Hannan-Quinn criter.	-1.686839
F-statistic	104.4502	Durbin-Watson stat	2.031827
Prob(F-statistic)	0.000000		

Table 3.5 – GARCH (1,1) results for Yang Ming Marine Transport Corp

Dependent Variable: ERYMM
Method: ML - ARCH (Marquardt) - Normal distribution
Date: 04/23/13 Time: 12:32
Sample (adjusted): 1995M01 2013M01
Included observations: 217 after adjustments
Convergence achieved after 26 iterations
Presample variance: backcast (parameter = 0.7)
GARCH = C(3) + C(4)*RESID(-1)^2 + C(5)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
ERTAIW	0.972706	0.082349	11.81206	0.0000
C	-0.004937	0.008302	-0.594679	0.5521
Variance Equation				
C	0.000356	0.000274	1.300985	0.1933
RESID(-1)^2	0.005577	0.012038	0.463317	0.6431
GARCH(-1)	0.963837	0.027491	35.06013	0.0000

R-squared	0.325933	Mean dependent var	-0.035405
Adjusted R-squared	0.322798	S.D. dependent var	0.125234
S.E. of regression	0.103058	Akaike info criterion	-1.705124
Sum squared resid	2.283483	Schwarz criterion	-1.627246
Log likelihood	190.0059	Hannan-Quinn criter.	-1.673665
Durbin-Watson stat	2.035111		

Table 3.6 – OLS results for Wan Hai Lines Ltd

Dependent Variable: ERWHL
Method: Least Squares
Date: 04/23/13 Time: 12:38
Sample (adjusted): 1996M07 2012M11
Included observations: 197 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ERTAIW	0.639703	0.073247	8.733538	0.0000
C	-0.010668	0.005992	-1.780346	0.0766

R-squared	0.281171	Mean dependent var	-0.029365
Adjusted R-squared	0.277485	S.D. dependent var	0.092415
S.E. of regression	0.078553	Akaike info criterion	-2.239980
Sum squared resid	1.203269	Schwarz criterion	-2.206648
Log likelihood	222.6381	Hannan-Quinn criter.	-2.226487
F-statistic	76.27468	Durbin-Watson stat	2.171694
Prob(F-statistic)	0.000000		

Table 3.7 – GARCH (1,1) results for Wan Hai Lines Ltd

Dependent Variable: ERWHL
Method: ML - ARCH (Marquardt) - Normal distribution
Date: 04/23/13 Time: 12:38
Sample (adjusted): 1996M07 2012M11
Included observations: 197 after adjustments
Convergence achieved after 25 iterations
Presample variance: backcast (parameter = 0.7)
GARCH = C(3) + C(4)*RESID(-1)^2 + C(5)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
ERTAIW	0.781808	0.073710	10.60661	0.0000
C	-0.009963	0.006188	-1.610055	0.1074
Variance Equation				
C	0.002300	0.001473	1.561775	0.1183
RESID(-1)^2	0.258940	0.112382	2.304103	0.0212
GARCH(-1)	0.387193	0.304129	1.273120	0.2030

R-squared	0.265897	Mean dependent var	-0.029365
Adjusted R-squared	0.262132	S.D. dependent var	0.092415
S.E. of regression	0.079383	Akaike info criterion	-2.243189
Sum squared resid	1.228837	Schwarz criterion	-2.159859
Log likelihood	225.9541	Hannan-Quinn criter.	-2.209457
Durbin-Watson stat	2.115813		

Table 3.8 – OLS results for average of 3 companies

Dependent Variable: AVERAGE3
Method: Least Squares
Date: 05/02/13 Time: 18:33
Sample (adjusted): 1996M07 2013M01
Included observations: 199 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ERTAIW	0.862738	0.071242	12.10995	0.0000
C	-0.008117	0.005942	-1.366147	0.1735

R-squared	0.426744	Mean dependent var	-0.034264
Adjusted R-squared	0.423834	S.D. dependent var	0.102874
S.E. of regression	0.078087	Akaike info criterion	-2.251993
Sum squared resid	1.201216	Schwarz criterion	-2.218895
Log likelihood	226.0733	Hannan-Quinn criter.	-2.238597
F-statistic	146.6509	Durbin-Watson stat	2.039542
Prob(F-statistic)	0.000000		

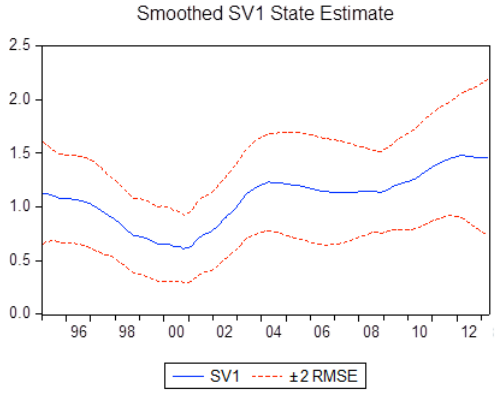
Table 3.9 – GARCH (1,1) results for average of 3 companies

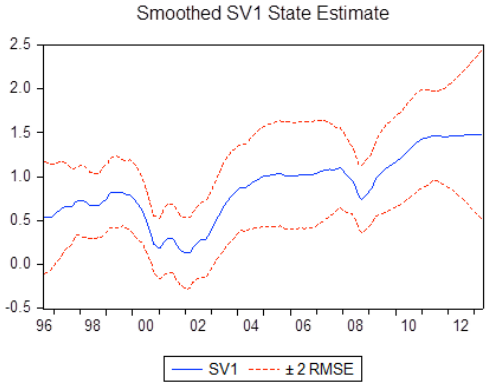
Dependent Variable: AVERAGE3
Method: ML - ARCH (Marquardt) - Normal distribution
Date: 05/02/13 Time: 18:34
Sample (adjusted): 1996M07 2013M01
Included observations: 199 after adjustments
Convergence achieved after 22 iterations
Presample variance: backcast (parameter = 0.7)
GARCH = C(3) + C(4)*RESID(-1)^2 + C(5)*GARCH(-1)

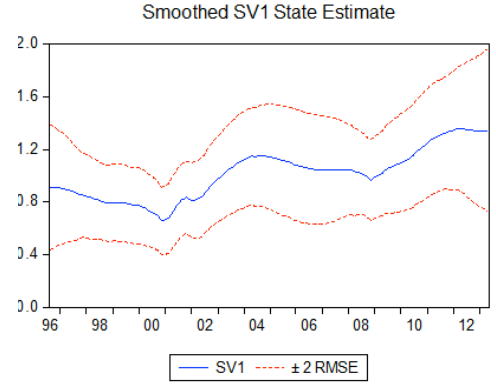
Variable	Coefficient	Std. Error	z-Statistic	Prob.
ERTAIW	0.903912	0.068222	13.24952	0.0000
C	-0.007186	0.006059	-1.185930	0.2356
Variance Equation				
C	0.000502	0.000453	1.108305	0.2677
RESID(-1)^2	0.059494	0.043769	1.359273	0.1741
GARCH(-1)	0.857744	0.104449	8.212109	0.0000

R-squared	0.425762	Mean dependent var	-0.034264
Adjusted R-squared	0.422847	S.D. dependent var	0.102874
S.E. of regression	0.078154	Akaike info criterion	-2.266903
Sum squared resid	1.203272	Schwarz criterion	-2.184157
Log likelihood	230.5569	Hannan-Quinn criter.	-2.233414
Durbin-Watson stat	2.027426		

Figure 3.2 - Time-varying β of Yang Ming Marine Transport Corp, Wan Hai Lines Ltd, and average 3 (note – could not get for Evergreen Marine Corp. (Taiwan) Ltd)







Coutry 4 – Korea

Hanjin Shipping Holdings Co. Ltd. is a Korea-based holding company engaged in the management of its subsidiaries. As of December 31, 2011, the Company had two subsidiaries: HANJIN SHIPPING CO., LTD., engaged in marine transportation business, as well as CyberLogitec Co.,Ltd., engaged in information technology (IT) business, providing IT services and solutions for marine transportation and logistics.

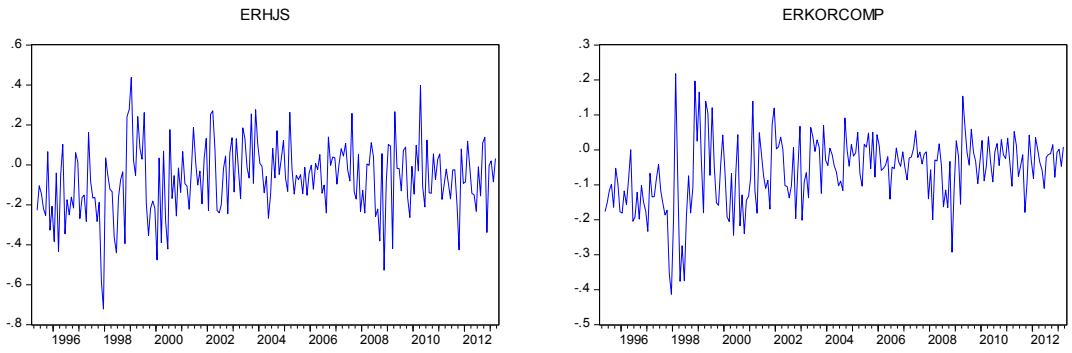
Data available between: 1995 – 2013

The **Korea Composite Stock Price Index (KOSPI)** is the main index of Korea Stock Exchange and it has all listed stocks.

Table 4.1 – Descriptive statistics 1995 - 2013

	ERHJS	ERKORCOMP
Mean	-0.070681	-0.061469
Median	-0.065028	-0.047105
Maximum	0.437375	0.217948
Minimum	-0.722023	-0.413044
Std. Dev.	0.178170	0.098531
Skewness	-0.253458	-0.439495

Figure 4.1 – Line graph of excess log-returns of Hanjin Shipping Holdings Co., Ltd and Korean market index



Outliers: 1 outlier in 1997 12 for Hanjin Shipping Holdings Co., Ltd and no outliers for Korean market index

Table 4.2 – OLS results for Hanjin Shipping Holdings Co. Ltd

Dependent Variable: ERHJS
Method: Least Squares
Date: 04/23/13 Time: 12:16
Sample (adjusted): 1995M05 2013M02
Included observations: 214 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ERKORCOMP	1.212530	0.091869	13.19843	0.0000
C	0.004903	0.010356	0.473413	0.6364

R-squared	0.451059	Mean dependent var	-0.067638
Adjusted R-squared	0.448470	S.D. dependent var	0.172894
S.E. of regression	0.128400	Akaike info criterion	-1.258030
Sum squared resid	3.495155	Schwarz criterion	-1.226572
Log likelihood	136.6092	Hannan-Quinn criter.	-1.245318
F-statistic	174.1984	Durbin-Watson stat	2.147685
Prob(F-statistic)	0.000000		

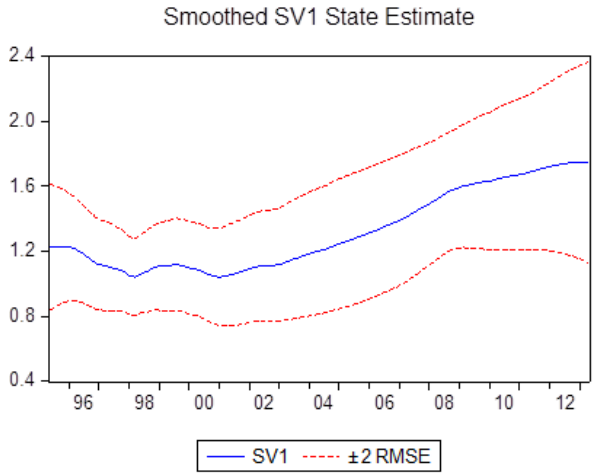
Table 4.3 – GARCH (1,1) results for Hanjin Shipping Holdings Co. Ltd

Dependent Variable: ERHJS
Method: ML - ARCH (Marquardt) - Normal distribution
Date: 04/23/13 Time: 12:16
Sample (adjusted): 1995M05 2013M02
Included observations: 214 after adjustments
Convergence achieved after 10 iterations
Presample variance: backcast (parameter = 0.7)
GARCH = C(3) + C(4)*RESID(-1)^2 + C(5)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
ERKORCOMP	1.262525	0.085697	14.73242	0.0000
C	0.005813	0.009976	0.582719	0.5601
Variance Equation				
C	0.001442	0.001460	0.988276	0.3230
RESID(-1)^2	0.050879	0.040046	1.270509	0.2039
GARCH(-1)	0.863105	0.112321	7.684278	0.0000

R-squared	0.450147	Mean dependent var	-0.067638
Adjusted R-squared	0.447553	S.D. dependent var	0.172894
S.E. of regression	0.128507	Akaike info criterion	-1.250773
Sum squared resid	3.500963	Schwarz criterion	-1.172129
Log likelihood	138.8327	Hannan-Quinn criter.	-1.218994
Durbin-Watson stat	2.142361		

Figure 4.2 – Time-varying β of Hanjin Shipping Holdings Co. Ltd



Country 5 – Chile

Compania Sud Americana de Vapores SA (CSAV) is a Chile-based holding company engaged in the maritime transport, shipping and freight and cargo services. The Company's activities are structured in two business segments, maritime freight transport and freight and vessel maritime services. Maritime freight transport is engaged in the transport of freight containers and on a minor scale, bulk transport and cars. Freight and vessel maritime services is engaged in the port services of loading and unloading, terminal concessions, tug boat services, warehouse services and container dockyard, among others. As of December 31, 2011, the Company's major shareholder was Maritima de Inversiones SA whith 20.63% of its interest. In addition, its investment portfolio included 13 fully consolidated subsidiaries, such as Inversiones Plan Futuro SA, Norgistics Holding SA and CSAV Agency LLC, among others.

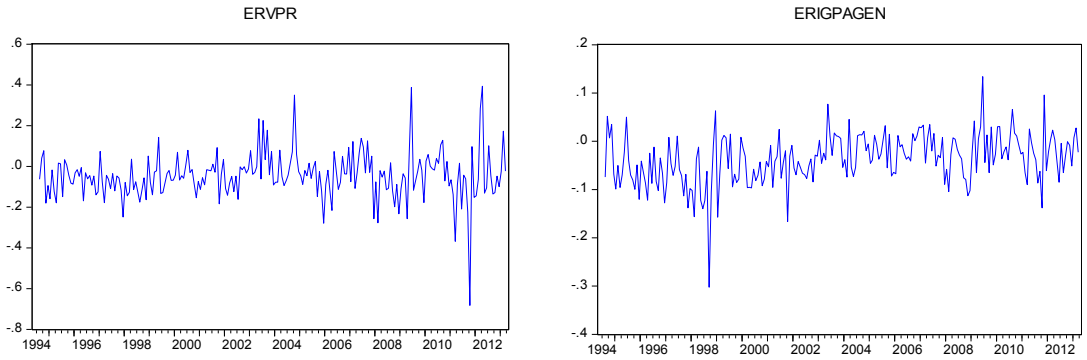
The General Stock Price Index (IGPA) is a market capitalisation-weighted index contains most of the listed stocks.

Data available between: 1994 - 2013

Table 5.1 – Descriptive statistics 1994 - 2013

	ERVPR	ERIGPAGEN
Mean	-0.045372	-0.037136
Median	-0.046634	-0.037216
Maximum	0.393150	0.133910
Minimum	-0.682597	-0.302337
Std. Dev.	0.113178	0.051635
Skewness	-0.037984	-0.506418

Figure 5.1 – Line graph of excess log-returns of CSAV and market index



Outliers: 1outlier in 2011 10 for CSAV and 1 outlier in 1998 09 for market index

Table 5.2 – OLS results for CSAV

Dependent Variable: ERVPR
Method: Least Squares
Date: 04/22/13 Time: 18:26
Sample (adjusted): 1994M08 2013M01
Included observations: 222 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ERIGPAGEN	1.125539	0.125967	8.935202	0.0000
C	-0.002235	0.007529	-0.296874	0.7668

R-squared	0.266270	Mean dependent var	-0.042178
Adjusted R-squared	0.262935	S.D. dependent var	0.105139
S.E. of regression	0.090264	Akaike info criterion	-1.963186
Sum squared resid	1.792472	Schwarz criterion	-1.932532
Log likelihood	219.9137	Hannan-Quinn criter.	-1.950810
F-statistic	79.83783	Durbin-Watson stat	1.881543
Prob(F-statistic)	0.000000		

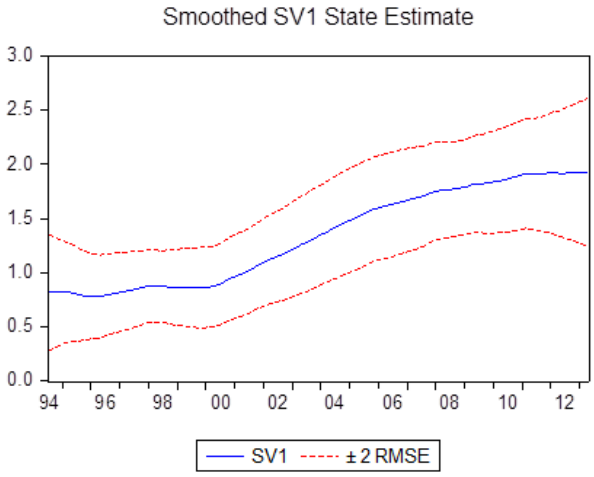
Table 5.2 – GARCH (1,1) results for CSAV

Dependent Variable: ERVPR
Method: ML - ARCH (Marquardt) - Normal distribution
Date: 04/22/13 Time: 18:26
Sample (adjusted): 1994M08 2013M01
Included observations: 222 after adjustments
Convergence achieved after 25 iterations
Presample variance: backcast (parameter = 0.7)
GARCH = C(3) + C(4)*RESID(-1)^2 + C(5)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
ERIGPAGEN	1.092639	0.125418	8.711987	0.0000
C	-0.004461	0.007027	-0.634832	0.5255
Variance Equation				
C	0.004579	0.003463	1.322138	0.1861
RESID(-1)^2	0.082668	0.037049	2.231290	0.0257
GARCH(-1)	0.350713	0.456237	0.768708	0.4421

R-squared	0.265941	Mean dependent var	-0.042178
Adjusted R-squared	0.262604	S.D. dependent var	0.105139
S.E. of regression	0.090284	Akaike info criterion	-1.950126
Sum squared resid	1.793277	Schwarz criterion	-1.873489
Log likelihood	221.4640	Hannan-Quinn criter.	-1.919185
Durbin-Watson stat	1.878605		

Figure 5.2 – Time-varying β of CSAV



ANNEX – II

DATA RESOURCE AND EMPIRICAL RESULTS OF GLOBAL CARGO CONSOLIDATOR COMPANIES

Country 1 – US

Expeditors International of Washington Inc. is engaged in the business of providing global logistics services. The Company offers its customers an international network supporting the movement and positioning of goods. The Company's services include the consolidation or forwarding of air and ocean freight. In each United States office, and in many overseas offices, the Company acts as a customs broker. The Company also provides additional services, including distribution management, vendor consolidation, cargo insurance, purchase order management and customized logistics information.
Data available between: 1984 - 2013

UTi Worldwide Inc. is a holding company. The Company is an international, non-asset-based supply chain services and solutions company, which provides services through a network of offices and contract logistics centers. As of January 31, 2012, the Company operated a global network of freight forwarding offices and contract logistics and distribution centers in a total of 59 countries. In addition, it serves its clients in 83 additional countries through independent agent-owned offices. The Company operates in two segments: Freight Forwarding, and Contract Logistics and Distribution. The Freight Forwarding segment includes airfreight forwarding, ocean freight forwarding, customs brokerage and other related services. The Contract Logistics and Distribution segment includes all operations providing contract logistics, distribution and other related services. Effective October 31, 2011, the Company completed the acquisition of UTi Logistics Israel, Ltd. (UTi Israel).
Data available between: 2000 - 2013

C.H. Robinson Worldwide Inc. (C.H. Robinson) is a third party logistics company. The Company provides freight transportation services and logistics solutions to companies of all sizes, in a variety of industries. It operates through a network of 235 offices, in North America, Europe, Asia, South America, Australia, and the Middle East. As a part of its transportation services, it provides a range of value-added logistics services, such as freight consolidation, supply chain consulting and analysis, optimization, and reporting. In addition to transportation and logistics services, it offers two other services: sourcing services and fee-based information services. The Sourcing business is primarily the buying, selling, and marketing of fresh produce. In October 2012, the Company sold its payment services business, T-Chek Systems, Inc. to Electronic Funds Source, LLC. In November 2012, the Company finalized the acquisition of Phoenix International, Inc.
Data available between: 1997 - 2013

United Parcel Service Inc. (UPS) is a package delivery company that operates in the United States less-than-truckload industry, and the provider of global supply chain management solutions. The Company delivers packages each business day for 1.1 million shipping customers to 7.7 million consignees in over 220 countries and territories. During the year ended December 31, 2011, UPS delivered an average of

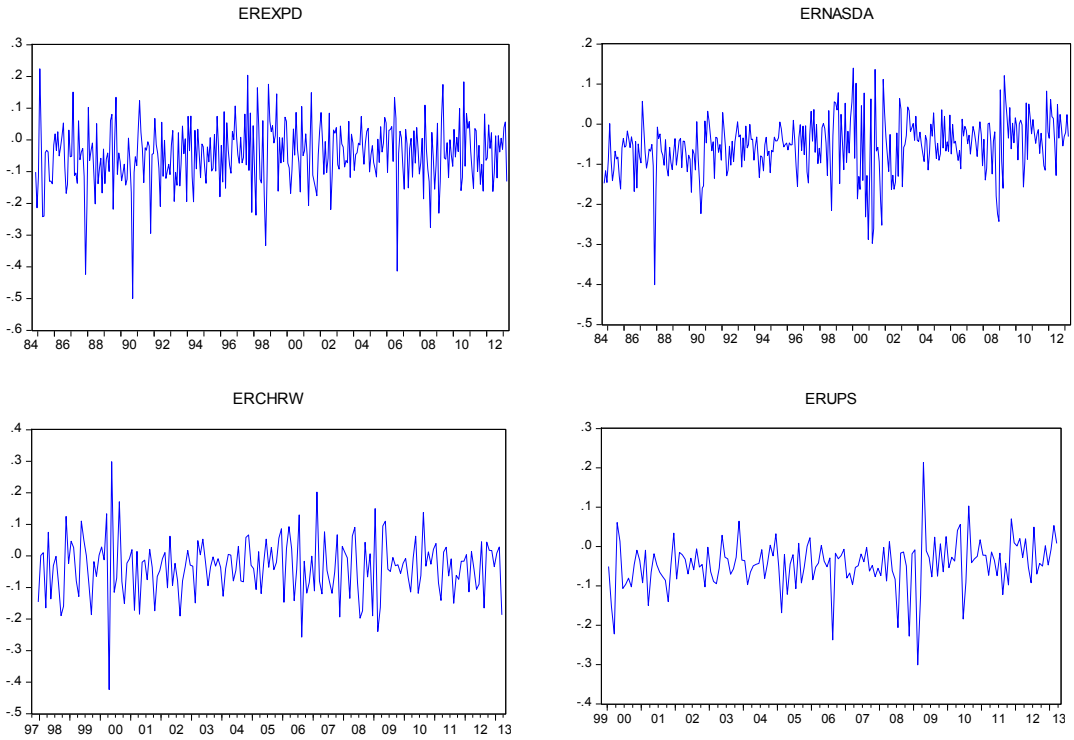
15.8 million pieces per day worldwide, or a total of 4.01 billion packages. Total revenue in 2011 was $53.1 billion. It serves the global market for logistics services, which include transportation, distribution, forwarding, ground, ocean and air freight, brokerage and financing. It operates in three segments: U.S. Domestic Package, International Package and Supply Chain & Freight. In February 2012, it acquired Kiala S.A. In February 2011, the Company announced the expansion of its UPS Express Freight service into Israel and Slovakia. In December 2011, it acquired Pieffe Group.
Data available between: 1999 - 2013

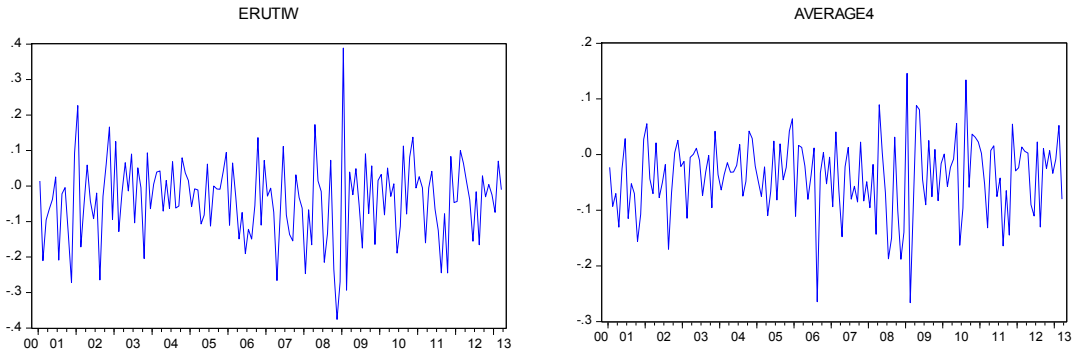
The **Nasdaq Composite** is a stock market index which contains not only common stocks but also similar securities which are listed in NASDAQ stock market and has over 3000 components. As consolidators are service companies involved with newest technologies and their businesses are around the world, this index has been chosen as it is not exclusively US index and is highly followed by technology and growth companies.

Table 6.1 – Descriptive statistics depending on availability of data

	EREXPD	ERCHRW	ERUPS	ERUTIW	AVERAGE4	ERNASDA
Mean	-0.037491	-0.035578	-0.042770	-0.038894	-0.038683	-0.043638
Median	-0.034131	-0.030870	-0.042449	-0.028986	-0.031500	-0.037772
Maximum	0.183241	0.202531	0.213514	0.388808	0.145851	0.136435
Minimum	-0.413277	-0.257247	-0.300918	-0.375928	-0.266133	-0.297484
Std. Dev.	0.087495	0.080856	0.060550	0.112448	0.068280	0.072504
Skewness	-0.538882	-0.157217	-0.485632	-0.060958	-0.449753	-0.679191

Figure 6.1 – Line graph of returns excess log-returns of Expeditors International of Washington, market index, C.H. Robinson, UPS, UTi Worldwide Inc and the average of 4 companies





Outliers: 1 outliers in 1990 08 for Expeditors International of Washington, 1 outliers in 1987 11 for market index, 2 outliers in 2000 04 and 2000 05 for C.H. Robinson, 2 outliers in 2009 02 and 2009 04 for UPS, 2 outliers in 2008 11 and 2009 01 for UTi Worldwide Inc, 2 outliers in 2006 08 and 2009 02 for the average of 4 companies

Table 6.2 – OLS results for Expeditors International of Washington

Dependent Variable: EREXPD
Method: Least Squares
Date: 04/26/13 Time: 22:48
Sample (adjusted): 1984M11 2013M01
Included observations: 339 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ERNASDA	0.688501	0.066948	10.28407	0.0000
C	-0.007986	0.005745	-1.389971	0.1655

R-squared	0.238869	Mean dependent var	-0.044840
Adjusted R-squared	0.236610	S.D. dependent var	0.094627
S.E. of regression	0.082678	Akaike info criterion	-2.141843
Sum squared resid	2.303616	Schwarz criterion	-2.119271
Log likelihood	365.0425	Hannan-Quinn criter.	-2.132848
F-statistic	105.7622	Durbin-Watson stat	2.203904
Prob(F-statistic)	0.000000		

Table 6.3 – GARCH (1,1) results for Expeditors International of Washington

Dependent Variable: EREXPD
Method: ML - ARCH (Marquardt) - Normal distribution
Date: 04/26/13 Time: 22:49
Sample (adjusted): 1984M11 2013M01
Included observations: 339 after adjustments
Convergence achieved after 11 iterations
Presample variance: backcast (parameter = 0.7)
GARCH = C(3) + C(4)*RESID(-1)^2 + C(5)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
ERNASDA	0.619791	0.042186	14.69170	0.0000
C	-0.008513	0.006009	-1.416726	0.1566
Variance Equation				
C	0.005776	0.002716	2.126518	0.0335
RESID(-1)^2	-0.060449	0.005917	-10.21562	0.0000
GARCH(-1)	0.234816	0.399962	0.587095	0.5571

R-squared	0.235378	Mean dependent var	-0.044840
Adjusted R-squared	0.233109	S.D. dependent var	0.094627
S.E. of regression	0.082867	Akaike info criterion	-2.123119
Sum squared resid	2.314182	Schwarz criterion	-2.066688
Log likelihood	364.8686	Hannan-Quinn criter.	-2.100631
Durbin-Watson stat	2.200068		

Table 6.4 – OLS results for C.H. Robinson

Dependent Variable: ERCHRW
Method: Least Squares
Date: 04/26/13 Time: 22:59
Sample (adjusted): 1997M12 2013M01
Included observations: 182 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ERNASDA	0.408302	0.080497	5.072264	0.0000
C	-0.017535	0.007281	-2.408474	0.0170

R-squared	0.125058	Mean dependent var	-0.035487
Adjusted R-squared	0.120197	S.D. dependent var	0.091510
S.E. of regression	0.085835	Akaike info criterion	-2.061856
Sum squared resid	1.326171	Schwarz criterion	-2.026647
Log likelihood	189.6289	Hannan-Quinn criter.	-2.047583
F-statistic	25.72786	Durbin-Watson stat	2.576294
Prob(F-statistic)	0.000001		

Table 6.5 – OLS results for C.H. Robinson

Dependent Variable: ERCHRW
Method: ML - ARCH (Marquardt) - Normal distribution
Date: 04/26/13 Time: 22:59
Sample (adjusted): 1997M12 2013M01
Included observations: 182 after adjustments
Convergence achieved after 20 iterations
Presample variance: backcast (parameter = 0.7)
GARCH = C(3) + C(4)*RESID(-1)^2 + C(5)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
ERNASDA	0.370840	0.079696	4.653187	0.0000
C	-0.022217	0.005636	-3.941713	0.0001
Variance Equation				
C	0.002834	0.000845	3.354438	0.0008
RESID(-1)^2	0.350606	0.115680	3.030824	0.0024
GARCH(-1)	0.278523	0.120976	2.302297	0.0213

R-squared	0.122899	Mean dependent var	-0.035487
Adjusted R-squared	0.118026	S.D. dependent var	0.091510
S.E. of regression	0.085941	Akaike info criterion	-2.145472
Sum squared resid	1.329443	Schwarz criterion	-2.057450
Log likelihood	200.2379	Hannan-Quinn criter.	-2.109789
Durbin-Watson stat	2.578229		

Table 6.6 – OLS results for UPS

Dependent Variable: ERUPS
Method: Least Squares
Date: 04/23/13 Time: 17:11
Sample (adjusted): 2000M01 2013M01
Included observations: 157 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ERNASDA	0.268211	0.051864	5.171469	0.0000
C	-0.032063	0.004756	-6.741861	0.0000

R-squared	0.147152	Mean dependent var	-0.044753
Adjusted R-squared	0.141650	S.D. dependent var	0.055095
S.E. of regression	0.051044	Akaike info criterion	-3.099614
Sum squared resid	0.403845	Schwarz criterion	-3.060681
Log likelihood	245.3197	Hannan-Quinn criter.	-3.083802
F-statistic	26.74409	Durbin-Watson stat	2.125272
Prob(F-statistic)	0.000001		

Table 6.7 – GARCH (1,1) results for UPS

Dependent Variable: ERUPS
Method: ML - ARCH (Marquardt) - Normal distribution
Date: 04/23/13 Time: 17:12
Sample (adjusted): 2000M01 2013M01
Included observations: 157 after adjustments
Convergence achieved after 25 iterations
Presample variance: backcast (parameter = 0.7)
GARCH = C(3) + C(4)*RESID(-1)^2 + C(5)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
ERNASDA	0.375539	0.041597	9.027982	0.0000
C	-0.025499	0.004655	-5.477499	0.0000
Variance Equation				
C	0.000297	0.000114	2.608206	0.0091
RESID(-1)^2	-0.038753	0.017762	-2.181827	0.0291
GARCH(-1)	0.885476	0.052702	16.80165	0.0000

R-squared	0.122858	Mean dependent var	-0.044753
Adjusted R-squared	0.117199	S.D. dependent var	0.055095
S.E. of regression	0.051766	Akaike info criterion	-3.222931
Sum squared resid	0.415349	Schwarz criterion	-3.125599
Log likelihood	258.0001	Hannan-Quinn criter.	-3.183401
Durbin-Watson stat	2.123470		

Table 6.8 – OLS results for UTi Worldwide Inc

Dependent Variable: ERUTIW
Method: Least Squares
Date: 04/23/13 Time: 17:16
Sample (adjusted): 2001M01 2013M01
Included observations: 145 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ERNASDA	0.568633	0.113255	5.020830	0.0000
C	-0.014905	0.009358	-1.592841	0.1134

R-squared	0.149866	Mean dependent var	-0.039520
Adjusted R-squared	0.143921	S.D. dependent var	0.103734
S.E. of regression	0.095979	Akaike info criterion	-1.835677
Sum squared resid	1.317312	Schwarz criterion	-1.794619
Log likelihood	135.0866	Hannan-Quinn criter.	-1.818994
F-statistic	25.20873	Durbin-Watson stat	2.324107
Prob(F-statistic)	0.000002		

Table 6.9 – GARCH (1,1) results for UTi Worldwide Inc

Dependent Variable: ERUTIW
Method: ML - ARCH (Marquardt) - Normal distribution
Date: 04/23/13 Time: 17:17
Sample (adjusted): 2001M01 2013M01
Included observations: 145 after adjustments
Convergence achieved after 18 iterations
Presample variance: backcast (parameter = 0.7)
GARCH = C(3) + C(4)*RESID(-1)^2 + C(5)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
ERNASDA	0.904279	0.131881	6.856769	0.0000
C	-0.003545	0.009497	-0.373233	0.7090
Variance Equation				
C	0.000400	0.000242	1.654988	0.0979
RESID(-1)^2	0.049137	0.053582	0.917037	0.3591
GARCH(-1)	0.884698	0.069505	12.72856	0.0000

R-squared	0.096710	Mean dependent var	-0.039520
Adjusted R-squared	0.090394	S.D. dependent var	0.103734
S.E. of regression	0.098934	Akaike info criterion	-1.903751
Sum squared resid	1.399678	Schwarz criterion	-1.801105
Log likelihood	143.0220	Hannan-Quinn criter.	-1.862043
Durbin-Watson stat	2.431754		

Table 6.10 – OLS results for the average of 4 companies

Dependent Variable: AVERAGE4
Method: Least Squares
Date: 04/26/13 Time: 23:22
Sample (adjusted): 2001M01 2013M01
Included observations: 145 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ERNASDA	0.516689	0.058612	8.815466	0.0000
C	-0.013425	0.004932	-2.722180	0.0073

R-squared	0.352098	Mean dependent var	-0.035558
Adjusted R-squared	0.347567	S.D. dependent var	0.063279
S.E. of regression	0.051113	Akaike info criterion	-3.095872
Sum squared resid	0.373588	Schwarz criterion	-3.054814
Log likelihood	226.4507	Hannan-Quinn criter.	-3.079189
F-statistic	77.71244	Durbin-Watson stat	2.332831
Prob(F-statistic)	0.000000		

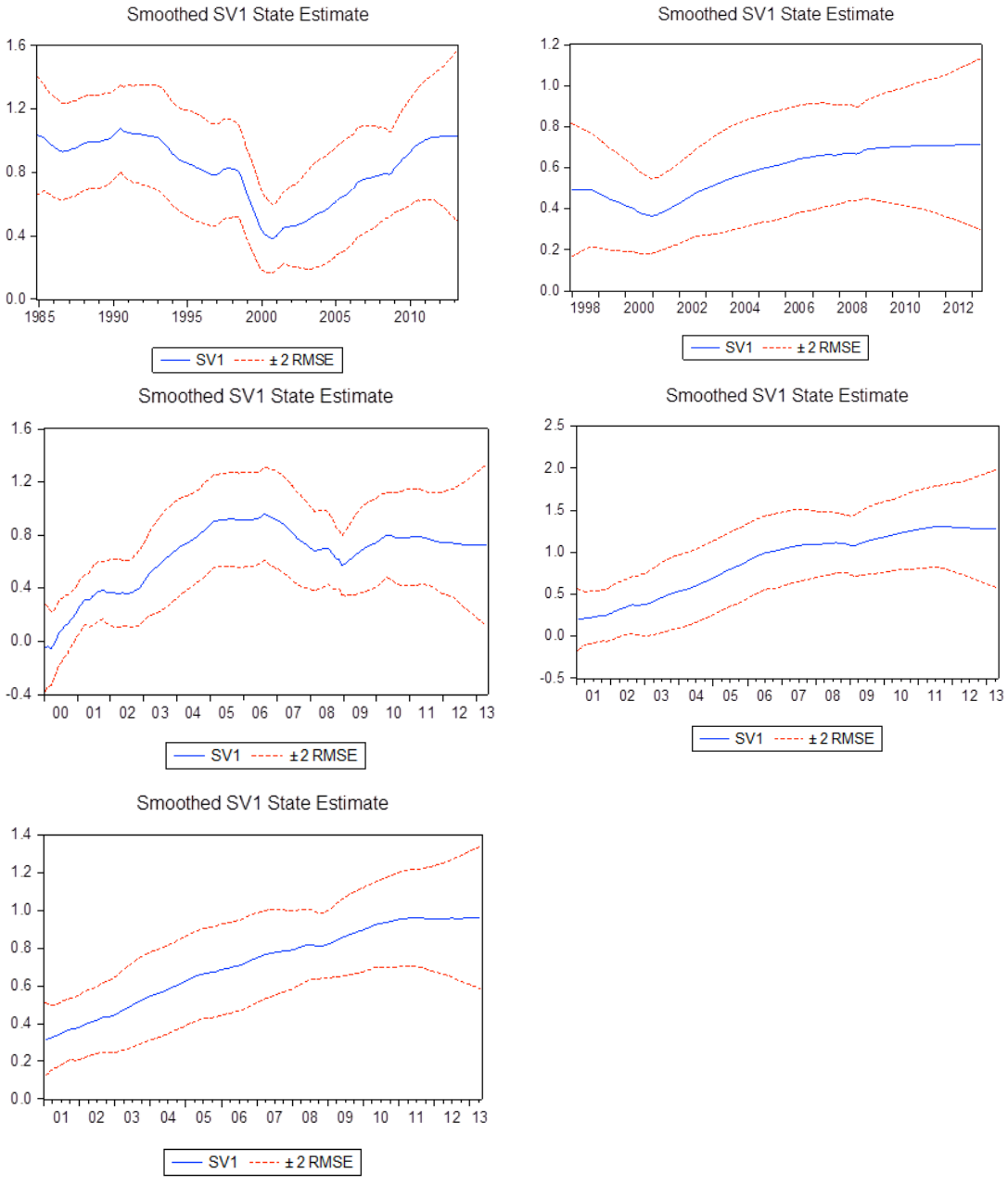
Table 6.11 – GARCH (1,1) results for the average of 4 companies

Dependent Variable: AVERAGE4
Method: ML - ARCH (Marquardt) - Normal distribution
Date: 04/26/13 Time: 23:22
Sample (adjusted): 2001M01 2013M01
Included observations: 145 after adjustments
Convergence achieved after 73 iterations
Presample variance: backcast (parameter = 0.7)
GARCH = C(3) + C(4)*RESID(-1)^2 + C(5)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
ERNASDA	0.643814	0.070263	9.162890	0.0000
C	-0.008831	0.004932	-1.790597	0.0734
Variance Equation				
C	0.000192	0.000103	1.864772	0.0622
RESID(-1)^2	0.009763	0.034704	0.281315	0.7785
GARCH(-1)	0.897213	0.058120	15.43713	0.0000

R-squared	0.330601	Mean dependent var	-0.035558
Adjusted R-squared	0.325920	S.D. dependent var	0.063279
S.E. of regression	0.051954	Akaike info criterion	-3.113321
Sum squared resid	0.385983	Schwarz criterion	-3.010675
Log likelihood	230.7158	Hannan-Quinn criter.	-3.071613
Durbin-Watson stat	2.331880		

Figure 6.2 – Time-varying β of Expeditors, CHRW, UPS, UTi Worldwide Inc and the average of 4 companies



Country 2 – Germany

Deutsche Post AG is a Germany-based logistics services provider. The Company operates four main business divisions: Mail; Express; Global Forwarding, Freight, and Supply Chain. The Mail business division comprises the transport and delivery of written communications and serves as an end-to-end service provider for the management of written communications. The Express business division offers international and domestic courier and express services to business and private customers. The Global Forwarding, Freight business division comprises the transportation of goods by rail, road, air and sea. The Supply Chain business division is engaged in contract logistics and provides warehousing and transport services, as well as services along the entire supply chain in the different sectors. The Company diversifies its activities into geographical areas, including Germany, rest of Europe, the Americas, Asia Pacific and Other regions.

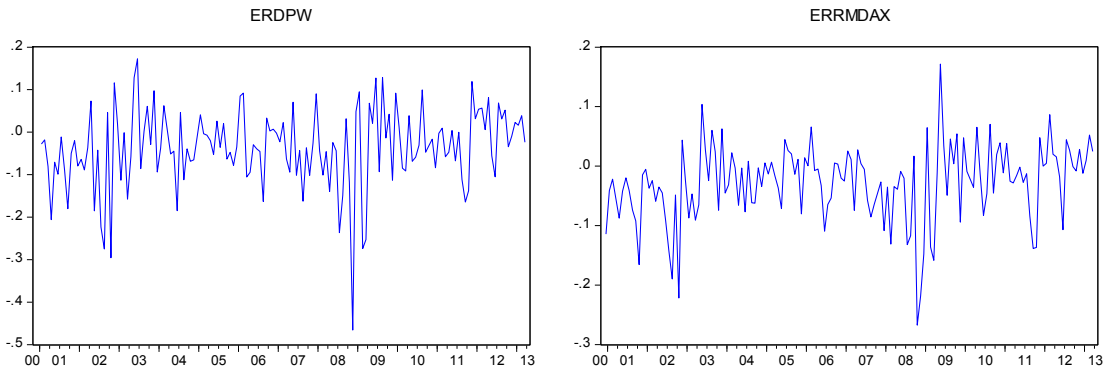
Data available between: 2001 – 2013

The **MDAX** is a stock index which has 50 Prime Standard shares and is calculated by Deutsche Börse.

Table 7.1 – Descriptive statistics 2001 – 2013

	ERDPW	ERRMDAX
Mean	-0.037451	-0.028554
Median	-0.034778	-0.020480
Maximum	0.172592	0.171546
Minimum	-0.465845	-0.267273
Std. Dev.	0.093697	0.064601
Skewness	-0.948271	-0.689700

Figure 7.1 – Graph line of excess log-returns of Deutsche Post and market index



Outliers: 1 outlier in 2008 11 for Deutsche Post and 2 outliers in 2008 10 and 2009 05 for market index (decided not to remove outliers as after removing them there is singular covariance and the coefficients are not unique)

Table 7.2 – OLS results for Deutsche Post

Dependent Variable: ERDPW
Method: Least Squares
Date: 04/23/13 Time: 18:10
Sample (adjusted): 2001M01 2013M03
Included observations: 147 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ERRMDAX	1.057200	0.082461	12.82058	0.0000
C	-0.007264	0.005808	-1.250821	0.2130

R-squared	0.531302	Mean dependent var	-0.037451
Adjusted R-squared	0.528069	S.D. dependent var	0.093697
S.E. of regression	0.064367	Akaike info criterion	-2.634908
Sum squared resid	0.600758	Schwarz criterion	-2.594221
Log likelihood	195.6657	Hannan-Quinn criter.	-2.618376
F-statistic	164.3674	Durbin-Watson stat	2.567408
Prob(F-statistic)	0.000000		

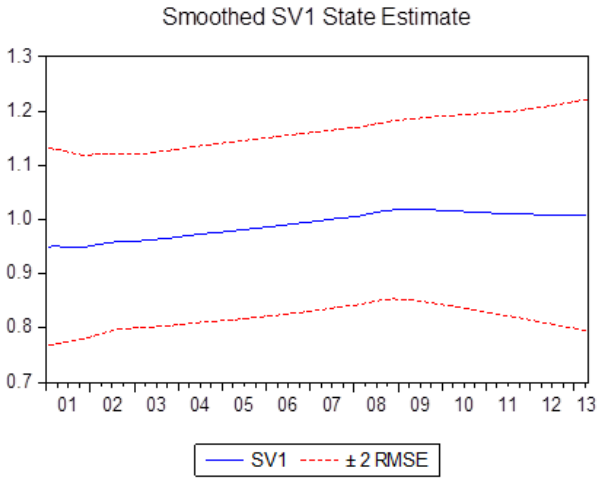
Table 7.3 – GARCH (1,1) results for Deutsche Post

Dependent Variable: ERDPW
Method: ML - ARCH (Marquardt) - Normal distribution
Date: 04/23/13 Time: 18:11
Sample (adjusted): 2001M01 2013M03
Included observations: 147 after adjustments
Convergence achieved after 27 iterations
Presample variance: backcast (parameter = 0.7)
GARCH = C(3) + C(4)*RESID(-1)^2 + C(5)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
ERRMDAX	1.036552	0.057400	18.05843	0.0000
C	-0.006860	0.005540	-1.238197	0.2156
Variance Equation				
C	0.000412	0.000416	0.989873	0.3222
RESID(-1)^2	0.129390	0.065107	1.987350	0.0469
GARCH(-1)	0.768638	0.139309	5.517496	0.0000

R-squared	0.530986	Mean dependent var	-0.037451
Adjusted R-squared	0.527751	S.D. dependent var	0.093697
S.E. of regression	0.064389	Akaike info criterion	-2.698106
Sum squared resid	0.601163	Schwarz criterion	-2.596390
Log likelihood	203.3108	Hannan-Quinn criter.	-2.656778
Durbin-Watson stat	2.564130		

Figure 7.2 – Time-varying β of Deutsche Post



Country 3 – Switzerland

Kuehne Nagel International Ltd is a Switzerland-based holding company and transport and logistics operator. The Company is divided into six operating segments: Seafreight; Airfreight; Road & Rail Logistics; Contract Logistics; Real Estate, and Insurance Brokers. Furthermore, the Company diversifies its activities into four geographical regions: Europe; Americas; Asia-Pacific, and Middle East, Central Asia and Africa. Within the Seafreight, Airfreight and Road & Rail Logistics operating segments, the Company's group is engaged in transportation services, including carrier services and contracts of carriage related to shipment. The Contract Logistics operating segment is engaged in the provision of services related to warehouse and distribution activities. The Insurance Brokers operating segment is principally engaged in the brokerage services of insurance coverage, mainly marine liability. The Company's real estate portfolio comprised, as of year-end 2011, 124 logistics facilities.

Date available between: 1994 - 2013

Panalpina WeltTransport Holding AG (Panalpina) is a Switzerland-based holding company engaged in the provision of freight forwarding and logistics services. The Company's core activities comprises air freight, including such products as Priority, Standard, Economy and Now; ocean freight, embracing such products as FCL (Full Container Load), LCL (Less-than-Container Load), NCL (Non-Containerized Load), and logistics, offering supply chain management solutions to the Telecom, Hi-tech, Automotive, Retail and Fashion, as well as Healthcare and Chemical sectors. Panalpina provides a range of special services, such as shock sensitive cargo handling and temperature-controlled transportation. It operates worldwide in Asia Pacific, Central and South America, Europe/Africa/Middle East/Commonwealth of Independent States (CIS) and North America through its numerous subsidiaries. It has its own branches in over 80 countries and collaborates closely with partner companies in further 80 countries.

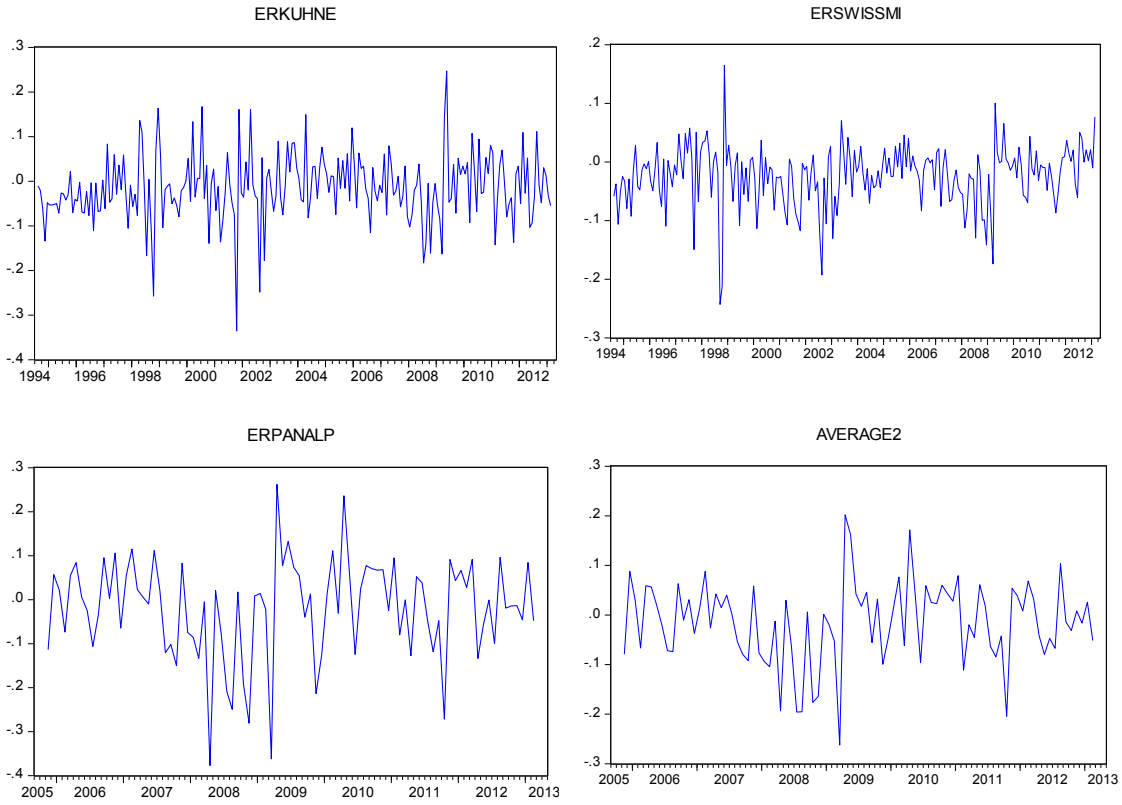
Date available between: 2005 - 2013

The **Swiss Market Index (SMI)** is Switzerland's main index in the country. It contains 20 largest and most liquid SPI large and mid-cap securities.

Table 8.1 – Descriptive statistics depending on availability of data

	ERKUHNE	ERPANALP	ERSWISSMI	AVERAGE2a
Mean	-0.011427	-0.018455	-0.019474	-0.014941
Median	-0.021298	0.001054	-0.011138	-0.005291
Maximum	0.247090	0.261952	0.100149	0.202160
Minimum	-0.182990	-0.377082	-0.173720	-0.262327
Std. Dev.	0.073319	0.114162	0.046619	0.083142
Skewness	0.303167	-0.764109	-0.630499	-0.393077

Figure 8.1 – Line graph of excess log-returns of Kuehne Nagel International Ltd, Swiss Market index, Panalpina and the average of two companies



Outliers: one outlier in 2001 10 for Kuehne Nagel International Ltd, 2 outliers in 1998 09 and 1998 11 for market index**,** 4 outliers in 2008 04, 2009 03, 2009 04 and 2010 04 for Panalpina, and two in 2009 03 and 2009 04 for the average of the two companies

Table 8.2 – OLS results for Kuehne Nagel International Ltd

Dependent Variable: ERKUHNE
Method: Least Squares
Date: 04/23/13 Time: 15:24
Sample (adjusted): 1994M08 2012M11
Included observations: 220 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ERSWISSMI	0.600797	0.093594	6.419162	0.0000
C	0.000655	0.004982	0.131543	0.8955

R-squared	0.158969	Mean dependent var	-0.013505
Adjusted R-squared	0.155111	S.D. dependent var	0.072088
S.E. of regression	0.066262	Akaike info criterion	-2.581366
Sum squared resid	0.957148	Schwarz criterion	-2.550515
Log likelihood	285.9502	Hannan-Quinn criter.	-2.568907
F-statistic	41.20564	Durbin-Watson stat	2.149027
Prob(F-statistic)	0.000000		

Table 8.3 – GARCH (1,1) results for Kuehne Nagel International Ltd

Dependent Variable: ERKUHNE
Method: ML - ARCH (Marquardt) - Normal distribution
Date: 04/23/13 Time: 15:25
Sample (adjusted): 1994M08 2012M11
Included observations: 220 after adjustments
Convergence achieved after 116 iterations
Presample variance: backcast (parameter = 0.7)
GARCH = C(3) + C(4)*RESID(-1)^2 + C(5)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
ERSWISSMI	0.574208	0.079297	7.241233	0.0000
C	-0.002851	0.001646	-1.731839	0.0833
Variance Equation				
C	0.000123	7.95E-05	1.547194	0.1218
RESID(-1)^2	-0.058385	0.009524	-6.130178	0.0000
GARCH(-1)	1.035068	0.019263	53.73273	0.0000

R-squared	0.157054	Mean dependent var	-0.013505
Adjusted R-squared	0.153187	S.D. dependent var	0.072088
S.E. of regression	0.066337	Akaike info criterion	-2.653009
Sum squared resid	0.959327	Schwarz criterion	-2.575881
Log likelihood	296.8310	Hannan-Quinn criter.	-2.621863
Durbin-Watson stat	2.142788		

Table 8.4 – OLS results for Panalpina

Dependent Variable: ERPANALP
Method: Least Squares
Date: 05/04/13 Time: 15:22
Sample (adjusted): 2005M11 2012M10
Included observations: 84 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ERSWISSMI	0.780208	0.229648	3.397402	0.0011
C	-0.001461	0.010684	-0.136751	0.8916

R-squared	0.123392	Mean dependent var	-0.016466
Adjusted R-squared	0.112701	S.D. dependent var	0.094656
S.E. of regression	0.089163	Akaike info criterion	-1.973185
Sum squared resid	0.651900	Schwarz criterion	-1.915308
Log likelihood	84.87377	Hannan-Quinn criter.	-1.949919
F-statistic	11.54234	Durbin-Watson stat	1.962569
Prob(F-statistic)	0.001052		

Table 8.5 – GARCH (1,1) results for Panalpina

Dependent Variable: ERPANALP
Method: ML - ARCH (Marquardt) - Normal distribution
Date: 05/04/13 Time: 15:20
Sample (adjusted): 2005M11 2012M10
Included observations: 84 after adjustments
Convergence achieved after 35 iterations
Presample variance: backcast (parameter = 0.7)
GARCH = C(3) + C(4)*RESID(-1)^2 + C(5)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
ERSWISSMI	0.746168	0.250580	2.977758	0.0029
C	0.002111	0.000200	10.53799	0.0000
Variance Equation				
C	0.000173	0.000996	0.173539	0.8622
RESID(-1)^2	-0.119841	0.061056	-1.962810	0.0497
GARCH(-1)	1.090081	0.144768	7.529872	0.0000

R-squared	0.121138	Mean dependent var	-0.016466
Adjusted R-squared	0.110421	S.D. dependent var	0.094656
S.E. of regression	0.089277	Akaike info criterion	-2.015374
Sum squared resid	0.653575	Schwarz criterion	-1.870682
Log likelihood	89.64570	Hannan-Quinn criter.	-1.957209
Durbin-Watson stat	1.946038		

Table 8.6 – OLS results for the average of 2 companies

Dependent Variable: AVERAGE2a
Method: Least Squares
Date: 05/04/13 Time: 15:38
Sample (adjusted): 2005M11 2012M12
Included observations: 86 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ERSWISSMI	0.676769	0.182835	3.701524	0.0004
C	-0.001682	0.008417	-0.199881	0.8421

R-squared	0.140236	Mean dependent var	-0.014589
Adjusted R-squared	0.130001	S.D. dependent var	0.076162
S.E. of regression	0.071039	Akaike info criterion	-2.428195
Sum squared resid	0.423909	Schwarz criterion	-2.371117
Log likelihood	106.4124	Hannan-Quinn criter.	-2.405223
F-statistic	13.70128	Durbin-Watson stat	2.064597
Prob(F-statistic)	0.000382		

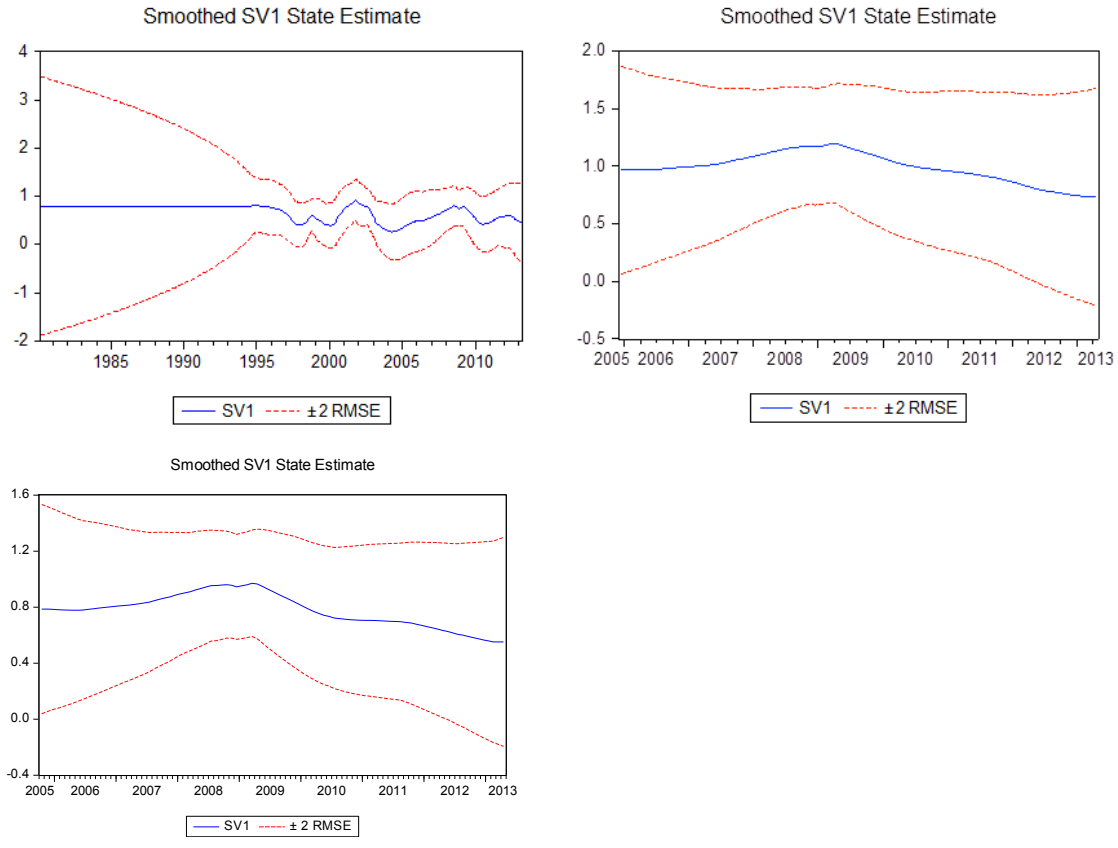
Table 8.7 – GARCH (1,1) results for the average of 2 companies

Dependent Variable: AVERAGE2a
Method: ML - ARCH (Marquardt) - Normal distribution
Date: 05/04/13 Time: 15:39
Sample (adjusted): 2005M11 2012M12
Included observations: 86 after adjustments
Convergence achieved after 25 iterations
Presample variance: backcast (parameter = 0.7)
GARCH = C(3) + C(4)*RESID(-1)^2 + C(5)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
ERSWISSMI	0.712743	0.182830	3.898395	0.0001
C	-0.000825	0.008990	-0.091772	0.9269
Variance Equation				
C	0.004058	0.011664	0.347919	0.7279
RESID(-1)^2	-0.054376	0.114694	-0.474092	0.6354
GARCH(-1)	0.233191	2.288320	0.101905	0.9188

R-squared	0.139835	Mean dependent var	-0.014589
Adjusted R-squared	0.129595	S.D. dependent var	0.076162
S.E. of regression	0.071056	Akaike info criterion	-2.360047
Sum squared resid	0.424107	Schwarz criterion	-2.217353
Log likelihood	106.4820	Hannan-Quinn criter.	-2.302619
Durbin-Watson stat	2.077275		

Figure 8.2 – Time-varying β for Kuehne Nagel International Ltd, Panalpina and the average of 2 companies



Country 4 – Denmark

DSV A/S is a Denmark-based company engaged in the provision of transport and logistics services. The Company's operations are divided into three business areas. The DSV Air and Sea business area specializes in the handling of air and sea freight to destinations around the world. The DSV Road business area offers transportation of full, part and group loads by road inside Europe. The DSV Solutions business area specializes in logistics solutions across the entire supply chain, from design through freight management, customs clearance, warehousing and distribution to information management and e-business support. As of December 31, 2012, the Company was active in more than 70 countries in Europe, the Americas, Asia, Africa and Australia.

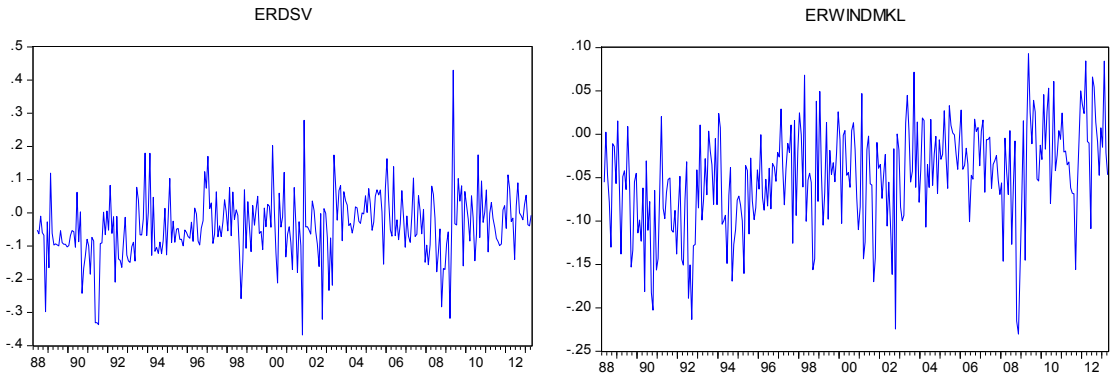
FTSE Denmark 20 index is used. It includes largest 20 Danish listed companies.

Data available between: 1988 – 2013

Table 9.1 – Descriptive statistics 1988 - 2013

	ERDSV	ERWINDMKL
Mean	-0.040124	-0.048847
Median	-0.043460	-0.044816
Maximum	0.429899	0.092917
Minimum	-0.368054	-0.230282
Std. Dev.	0.097900	0.059214
Skewness	0.058317	-0.439596

Figure 9.1 – Excess log-returns for DSV and market index



Outliers: 1 outlier in 2009 05 for DSV and no outliers for the market index

Table 9.2 – OLS results for DSV

Dependent Variable: ERDSV
Method: Least Squares
Date: 04/23/13 Time: 14:28
Sample (adjusted): 1988M06 2013M03
Included observations: 298 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ERWINDMKL	0.829698	0.079750	10.40380	0.0000
C	-0.000778	0.006111	-0.127343	0.8988

R-squared	0.267760	Mean dependent var	-0.041701
Adjusted R-squared	0.265286	S.D. dependent var	0.094182
S.E. of regression	0.080729	Akaike info criterion	-2.188754
Sum squared resid	1.929073	Schwarz criterion	-2.163941
Log likelihood	328.1243	Hannan-Quinn criter.	-2.178822
F-statistic	108.2390	Durbin-Watson stat	1.921195
Prob(F-statistic)	0.000000		

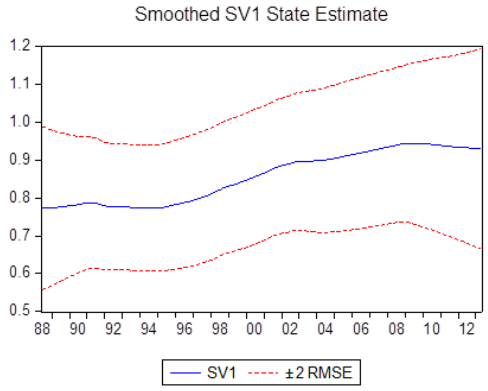
Table 9.3 – GARCH (1,1) results for DSV

Dependent Variable: ERDSV
Method: ML - ARCH (Marquardt) - Normal distribution
Date: 04/23/13 Time: 14:28
Sample (adjusted): 1988M06 2013M03
Included observations: 298 after adjustments
Convergence achieved after 12 iterations
Presample variance: backcast (parameter = 0.7)
GARCH = C(3) + C(4)*RESID(-1)^2 + C(5)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
ERWINDMKL	0.848160	0.074244	11.42401	0.0000
C	0.002179	0.006081	0.358342	0.7201
Variance Equation				
C	0.002120	0.001438	1.474341	0.1404
RESID(-1)^2	0.135249	0.052665	2.568115	0.0102
GARCH(-1)	0.532460	0.249479	2.134292	0.0328

R-squared	0.267153	Mean dependent var	-0.041701
Adjusted R-squared	0.264678	S.D. dependent var	0.094182
S.E. of regression	0.080762	Akaike info criterion	-2.218737
Sum squared resid	1.930671	Schwarz criterion	-2.156705
Log likelihood	335.5918	Hannan-Quinn criter.	-2.193906
Durbin-Watson stat	1.923085		

Figure 9.2 – Time-varying β of DSV



Country 5 – Australia

Toll Holdings Limited is an Australia-based company. It operates in six segments: Toll Global Resources, which is engaged in logistics services to the mining and resource sector together with project based activities; Toll Global Logistics, which includes integrated logistics services and supply chain management to national and multi-national customers; Toll Global Forwarding, which is engaged in the provision of global freight forwarding services by air, sea and land; Toll Global Express, which is engaged in the provision of express and overnight parcel services with a focus on the Asia-Pacific region; Toll Domestic Forwarding, which includes Intermodal freight forwarding services within Australia and New Zealand by road, rail and sea, and Toll Specialised and Domestic Freight, which provides specialized full container load (FCL) and less than a container load (LCL) forwarding services. In July 2012, it sold of its Australian finished vehicle distribution service to PrixCar.

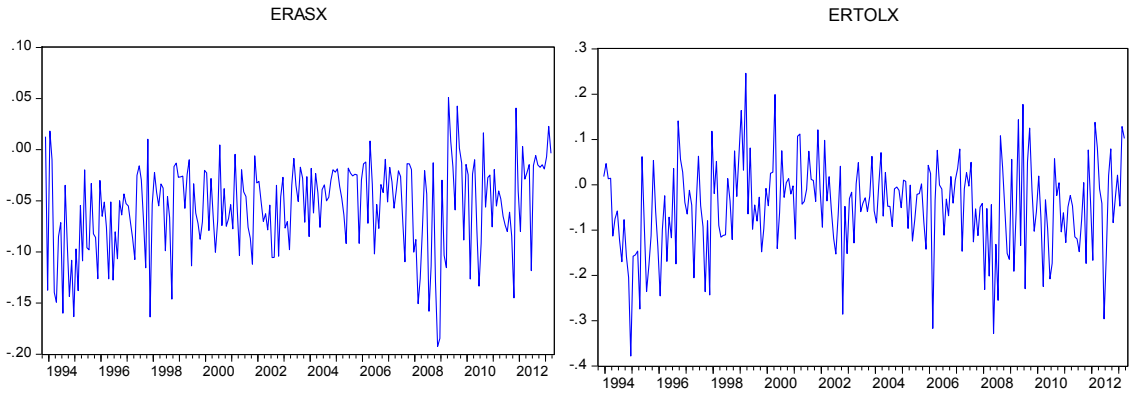
All Ordinaries index ("All Ords", AOI) is used and it has over 95% of all listed stocks included in Australian Securities Exchange (ASX).

Data available between: 1993 – 2013

Table 10.1 – Descriptive statistics 1993 - 2013

	ERTOLX	ERASX
Mean	-0.047748	-0.056482
Median	-0.043410	-0.050906
Maximum	0.245924	0.051047
Minimum	-0.378132	-0.192404
Std. Dev.	0.100131	0.043684
Skewness	-0.285423	-0.557571

Figure 10.1 – Line graph of excess log-returns of Toll and market index



Outliers: none

Table 10.2 – OLS results for Toll

Dependent Variable: ERTOLX
Method: Least Squares
Date: 04/23/13 Time: 14:00
Sample (adjusted): 1993M12 2013M03
Included observations: 232 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ERASX	1.131871	0.131428	8.612116	0.0000
C	0.016182	0.009377	1.725709	0.0857

R-squared	0.243840	Mean dependent var	-0.047748
Adjusted R-squared	0.240553	S.D. dependent var	0.100131
S.E. of regression	0.087261	Akaike info criterion	-2.031246
Sum squared resid	1.751326	Schwarz criterion	-2.001533
Log likelihood	237.6245	Hannan-Quinn criter.	-2.019263
F-statistic	74.16854	Durbin-Watson stat	1.861683
Prob(F-statistic)	0.000000		

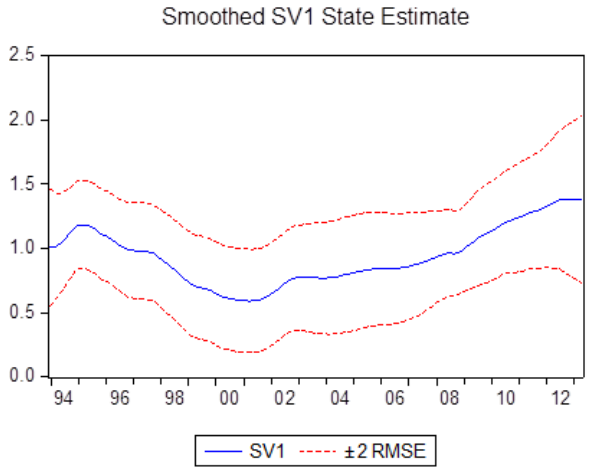
Table 10.3 – GARCH (1,1) results for Toll

Dependent Variable: ERTOLX
Method: ML - ARCH (Marquardt) - Normal distribution
Date: 04/23/13 Time: 14:00
Sample (adjusted): 1993M12 2013M03
Included observations: 232 after adjustments
Convergence achieved after 23 iterations
Presample variance: backcast (parameter = 0.7)
GARCH = C(3) + C(4)*RESID(-1)^2 + C(5)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
ERASX	1.148645	0.133586	8.598551	0.0000
C	0.016589	0.009796	1.693437	0.0904
Variance Equation				
C	0.006597	0.009182	0.718482	0.4725
RESID(-1)^2	-0.029296	0.049280	-0.594488	0.5522
GARCH(-1)	0.153497	1.223441	0.125463	0.9002

R-squared	0.243757	Mean dependent var	-0.047748
Adjusted R-squared	0.240469	S.D. dependent var	0.100131
S.E. of regression	0.087266	Akaike info criterion	-2.007364
Sum squared resid	1.751517	Schwarz criterion	-1.933081
Log likelihood	237.8542	Hannan-Quinn criter.	-1.977406
Durbin-Watson stat	1.862187		

Figure 10.2 – Time-varying β of Toll



ANNEX – III
ROBUSTNESS CHECK
Liner shipping

Country - Denmark

Table 11.1 – OLS results for Maersk

Dependent Variable: ERDSB
Method: Least Squares
Date: 04/27/13 Time: 00:02
Sample (adjusted): 1990M06 2013M02
Included observations: 273 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ERWIND	1.177203	0.068230	17.25350	0.0000
SMB	0.002910	0.001766	1.648062	0.1005
HML	0.001297	0.001597	0.812269	0.4174
C	0.007264	0.005055	1.437130	0.1518

R-squared	0.570773	Mean dependent var	-0.047829
Adjusted R-squared	0.565986	S.D. dependent var	0.096368
S.E. of regression	0.063487	Akaike info criterion	-2.661412
Sum squared resid	1.084240	Schwarz criterion	-2.608526
Log likelihood	367.2827	Hannan-Quinn criter.	-2.640182
F-statistic	119.2361	Durbin-Watson stat	2.244654
Prob(F-statistic)	0.000000		

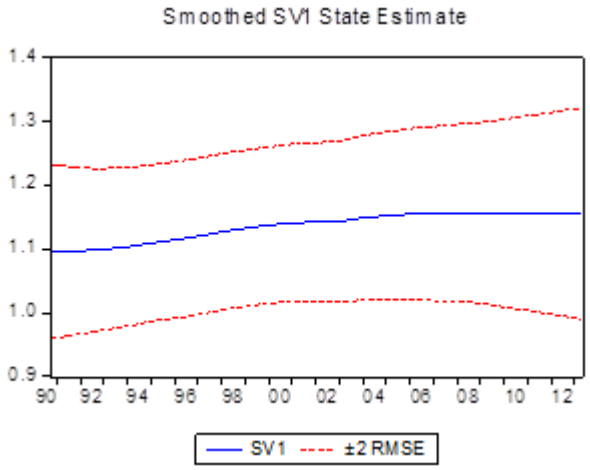
Table 11.2 - GARCH (1,1) for Maersk

Dependent Variable: ERDSB
Method: ML - ARCH (Marquardt) - Normal distribution
Date: 04/27/13 Time: 00:02
Sample (adjusted): 1990M06 2013M02
Included observations: 273 after adjustments
Convergence achieved after 18 iterations
Presample variance: backcast (parameter = 0.7)
GARCH = C(5) + C(6)*RESID(-1)^2 + C(7)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
ERWIND	1.165887	0.059812	19.49266	0.0000
SMB	0.000728	0.001434	0.507316	0.6119
HML	0.000823	0.001556	0.528873	0.5969
C	0.008459	0.004361	1.939688	0.0524
Variance Equation				
C	0.000163	9.41E-05	1.728454	0.0839
RESID(-1)^2	0.158636	0.058465	2.713337	0.0067
GARCH(-1)	0.809506	0.062038	13.04865	0.0000

R-squared	0.567390	Mean dependent var	-0.047829
Adjusted R-squared	0.562566	S.D. dependent var	0.096368
S.E. of regression	0.063737	Akaike info criterion	-2.811984
Sum squared resid	1.092785	Schwarz criterion	-2.719434
Log likelihood	390.8358	Hannan-Quinn criter.	-2.774832
Durbin-Watson stat	2.237370		

Figure 11.1 – Time-varying β of Maersk



Country – Hong Kong

Table 12.1 – OLS results for Orient Overseas (International) Limited

Dependent Variable: EROROC
Method: Least Squares
Date: 04/27/13 Time: 00:36
Sample (adjusted): 1996M11 2012M12
Included observations: 194 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ERHNKG	0.648471	0.132598	4.890497	0.0000
SMB	0.003303	0.003236	1.020685	0.3087
HML	-0.004054	0.002799	-1.448719	0.1491
C	-0.000984	0.011360	-0.086637	0.9311

R-squared	0.141914	Mean dependent var	-0.031211
Adjusted R-squared	0.128366	S.D. dependent var	0.145562
S.E. of regression	0.135899	Akaike info criterion	-1.133406
Sum squared resid	3.509023	Schwarz criterion	-1.066028
Log likelihood	113.9404	Hannan-Quinn criter.	-1.106123
F-statistic	10.47437	Durbin-Watson stat	1.980719
Prob(F-statistic)	0.000002		

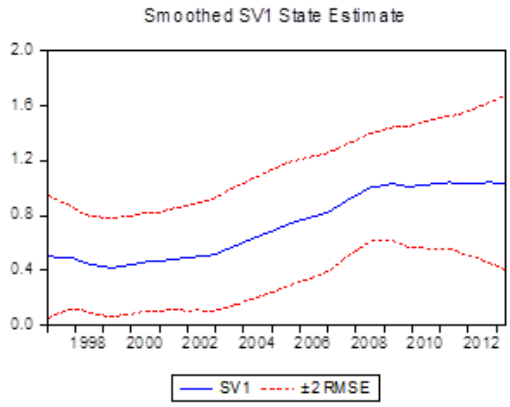
Table 12.2 – GARCH (1,1) results for Orient Overseas (International) Limited

Dependent Variable: EROROC
Method: ML - ARCH (Marquardt) - Normal distribution
Date: 04/27/13 Time: 00:36
Sample (adjusted): 1996M11 2012M12
Included observations: 194 after adjustments
Convergence achieved after 52 iterations
Presample variance: backcast (parameter = 0.7)
GARCH = C(5) + C(6)*RESID(-1)^2 + C(7)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
ERHNKG	0.665574	0.118265	5.627802	0.0000
SMB	0.004544	0.002599	1.748515	0.0804
HML	-0.004156	0.002394	-1.736380	0.0825
C	0.004134	0.010567	0.391228	0.6956
Variance Equation				
C	0.024761	0.008940	2.769618	0.0056
RESID(-1)^2	-0.104403	0.028081	-3.717867	0.0002
GARCH(-1)	-0.262309	0.473337	-0.554170	0.5795

R-squared	0.140181	Mean dependent var	-0.031211
Adjusted R-squared	0.126605	S.D. dependent var	0.145562
S.E. of regression	0.136036	Akaike info criterion	-1.136472
Sum squared resid	3.516112	Schwarz criterion	-1.018559
Log likelihood	117.2377	Hannan-Quinn criter.	-1.088726
Durbin-Watson stat	2.008062		

Figure 12.1 - Time-varying β of Orient Overseas (International) Limited



Consolidators

Country – US

Table 13.1 – OLS results for Expeditors International of Washington

Dependent Variable: EREXPD
Method: Least Squares
Date: 04/26/13 Time: 22:50
Sample (adjusted): 1984M11 2013M01
Included observations: 339 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ERNASDA	0.675011	0.068959	9.788653	0.0000
SMB	0.001084	0.001540	0.703877	0.4820
HML	0.001882	0.001575	1.195208	0.2329
C	-0.009302	0.005858	-1.587938	0.1132

R-squared	0.242322	Mean dependent var	-0.044840
Adjusted R-squared	0.235537	S.D. dependent var	0.094627
S.E. of regression	0.082736	Akaike info criterion	-2.134591
Sum squared resid	2.293165	Schwarz criterion	-2.089447
Log likelihood	365.8132	Hannan-Quinn criter.	-2.116601
F-statistic	35.71347	Durbin-Watson stat	2.215682
Prob(F-statistic)	0.000000		

Table 13.2 – GARCH (1,1) results for Expeditors International of Washington

Dependent Variable: EREXPD
Method: ML - ARCH (Marquardt) - Normal distribution
Date: 04/26/13 Time: 22:50
Sample (adjusted): 1984M11 2013M01
Included observations: 339 after adjustments
Convergence achieved after 24 iterations
Presample variance: backcast (parameter = 0.7)
GARCH = C(5) + C(6)*RESID(-1)^2 + C(7)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
ERNASDA	0.661158	0.055294	11.95715	0.0000
SMB	0.001174	0.001284	0.913883	0.3608
HML	0.001931	0.001509	1.279706	0.2006
C	-0.009792	0.005752	-1.702479	0.0887
Variance Equation				
C	0.001085	0.001861	0.583227	0.5597
RESID(-1)^2	-0.003557	0.019973	-0.178112	0.8586
GARCH(-1)	0.840622	0.277730	3.026759	0.0025

R-squared	0.242223	Mean dependent var	-0.044840
Adjusted R-squared	0.235437	S.D. dependent var	0.094627
S.E. of regression	0.082742	Akaike info criterion	-2.119986
Sum squared resid	2.293465	Schwarz criterion	-2.040983
Log likelihood	366.3376	Hannan-Quinn criter.	-2.088503
Durbin-Watson stat	2.216382		

Table 13.3 – OLS results for C.H. Robinson

Dependent Variable: ERCHRW
Method: Least Squares
Date: 04/26/13 Time: 23:00
Sample (adjusted): 1997M12 2013M01
Included observations: 182 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ERNASDA	0.416563	0.081578	5.106340	0.0000
SMB	-0.001181	0.001876	-0.629404	0.5299
HML	-0.001647	0.001939	-0.848973	0.3970
C	-0.016369	0.007416	-2.207401	0.0286

R-squared	0.129185	Mean dependent var	-0.035487
Adjusted R-squared	0.114509	S.D. dependent var	0.091510
S.E. of regression	0.086112	Akaike info criterion	-2.044607
Sum squared resid	1.319914	Schwarz criterion	-1.974189
Log likelihood	190.0592	Hannan-Quinn criter.	-2.016060
F-statistic	8.802104	Durbin-Watson stat	2.537396
Prob(F-statistic)	0.000018		

Table 13.4 – GARCH (1,1) results for C.H. Robinson

Dependent Variable: ERCHRW
Method: ML - ARCH (Marquardt) - Normal distribution
Date: 04/26/13 Time: 23:00
Sample (adjusted): 1997M12 2013M01
Included observations: 182 after adjustments
Convergence achieved after 29 iterations
Presample variance: backcast (parameter = 0.7)
GARCH = C(5) + C(6)*RESID(-1)^2 + C(7)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
ERNASDA	0.431024	0.081373	5.296894	0.0000
SMB	0.001445	0.001354	1.067175	0.2859
HML	-0.000973	0.001677	-0.580121	0.5618
C	-0.020394	0.006205	-3.286922	0.0010
Variance Equation				
C	0.000945	0.000695	1.359915	0.1739
RESID(-1)^2	0.195292	0.076544	2.551374	0.0107
GARCH(-1)	0.677485	0.135929	4.984099	0.0000

R-squared	0.116379	Mean dependent var	-0.035487
Adjusted R-squared	0.101486	S.D. dependent var	0.091510
S.E. of regression	0.086743	Akaike info criterion	-2.127092
Sum squared resid	1.339326	Schwarz criterion	-2.003861
Log likelihood	200.5653	Hannan-Quinn criter.	-2.077135
Durbin-Watson stat	2.532445		

Table 13.5 – OLS results for UPS

Dependent Variable: ERUPS
Method: Least Squares
Date: 04/26/13 Time: 23:08
Sample (adjusted): 2000M01 2013M01
Included observations: 157 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ERNASDA	0.257495	0.051864	4.964774	0.0000
SMB	0.002385	0.001204	1.979878	0.0495
HML	0.000775	0.001304	0.594119	0.5533
C	-0.033058	0.004887	-6.764616	0.0000

R-squared	0.168581	Mean dependent var	-0.044753
Adjusted R-squared	0.152278	S.D. dependent var	0.055095
S.E. of regression	0.050727	Akaike info criterion	-3.099583
Sum squared resid	0.393699	Schwarz criterion	-3.021717
Log likelihood	247.3173	Hannan-Quinn criter.	-3.067959
F-statistic	10.34089	Durbin-Watson stat	2.209500
Prob(F-statistic)	0.000003		

Table 13.6 – GARCH (1,1) results for UPS

Dependent Variable: ERUPS
Method: ML - ARCH (Marquardt) - Normal distribution
Date: 04/26/13 Time: 23:08
Sample (adjusted): 2000M01 2013M01
Included observations: 157 after adjustments
Convergence achieved after 25 iterations
Presample variance: backcast (parameter = 0.7)
GARCH = C(5) + C(6)*RESID(-1)^2 + C(7)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
ERNASDA	0.371724	0.041701	8.913939	0.0000
SMB	0.000466	0.001340	0.347447	0.7283
HML	0.000919	0.001251	0.734453	0.4627
C	-0.026189	0.004682	-5.593321	0.0000
Variance Equation				
C	0.000297	0.000116	2.557193	0.0106
RESID(-1)^2	-0.041059	0.018288	-2.245143	0.0248
GARCH(-1)	0.887489	0.055205	16.07633	0.0000

R-squared	0.127427	Mean dependent var	-0.044753
Adjusted R-squared	0.110318	S.D. dependent var	0.055095
S.E. of regression	0.051967	Akaike info criterion	-3.201322
Sum squared resid	0.413186	Schwarz criterion	-3.065057
Log likelihood	258.3038	Hannan-Quinn criter.	-3.145980
Durbin-Watson stat	2.135071		

Table 13.7 – OLS results for UTi Worldwide Inc

Dependent Variable: ERUTIW
Method: Least Squares
Date: 04/26/13 Time: 23:14
Sample (adjusted): 2001M01 2013M01
Included observations: 145 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ERNASDA	0.597857	0.116599	5.127461	0.0000
SMB	0.002146	0.003077	0.697193	0.4868
HML	-0.003902	0.003049	-1.279927	0.2027
C	-0.012937	0.009869	-1.310895	0.1920

R-squared	0.162986	Mean dependent var	-0.039520
Adjusted R-squared	0.145177	S.D. dependent var	0.103734
S.E. of regression	0.095909	Akaike info criterion	-1.823644
Sum squared resid	1.296982	Schwarz criterion	-1.741527
Log likelihood	136.2142	Hannan-Quinn criter.	-1.790277
F-statistic	9.151967	Durbin-Watson stat	2.300839
Prob(F-statistic)	0.000014		

Table 13.8 – GARCH (1,1) results for UTi Worldwide Inc

Dependent Variable: ERUTIW
Method: ML - ARCH (Marquardt) - Normal distribution
Date: 04/26/13 Time: 23:14
Sample (adjusted): 2001M01 2013M01
Included observations: 145 after adjustments
Convergence achieved after 20 iterations
Presample variance: backcast (parameter = 0.7)
GARCH = C(5) + C(6)*RESID(-1)^2 + C(7)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
ERNASDA	0.904223	0.134336	6.731046	0.0000
SMB	0.000139	0.003404	0.040975	0.9673
HML	-5.45E-05	0.002696	-0.020215	0.9839
C	-0.003574	0.009673	-0.369439	0.7118
Variance Equation				
C	0.000399	0.000259	1.537524	0.1242
RESID(-1)^2	0.049335	0.054202	0.910213	0.3627
GARCH(-1)	0.884698	0.069901	12.65639	0.0000

R-squared	0.097456	Mean dependent var	-0.039520
Adjusted R-squared	0.078253	S.D. dependent var	0.103734
S.E. of regression	0.099592	Akaike info criterion	-1.876181
Sum squared resid	1.398523	Schwarz criterion	-1.732477
Log likelihood	143.0231	Hannan-Quinn criter.	-1.817789
Durbin-Watson stat	2.431280		

Table 13.9 – OLS results for the average of 4 companies

Dependent Variable: AVERAGE4
Method: Least Squares
Date: 04/26/13 Time: 23:25
Sample (adjusted): 2001M01 2013M01
Included observations: 145 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ERNASDA	0.539205	0.059512	9.060433	0.0000
SMB	-0.000503	0.001616	-0.311186	0.7561
HML	-0.002934	0.001544	-1.899966	0.0595
C	-0.011054	0.005111	-2.162920	0.0322

R-squared	0.368626	Mean dependent var	-0.035558
Adjusted R-squared	0.355192	S.D. dependent var	0.063279
S.E. of regression	0.050813	Akaike info criterion	-3.094126
Sum squared resid	0.364058	Schwarz criterion	-3.012009
Log likelihood	228.3242	Hannan-Quinn criter.	-3.060759
F-statistic	27.44078	Durbin-Watson stat	2.250173
Prob(F-statistic)	0.000000		

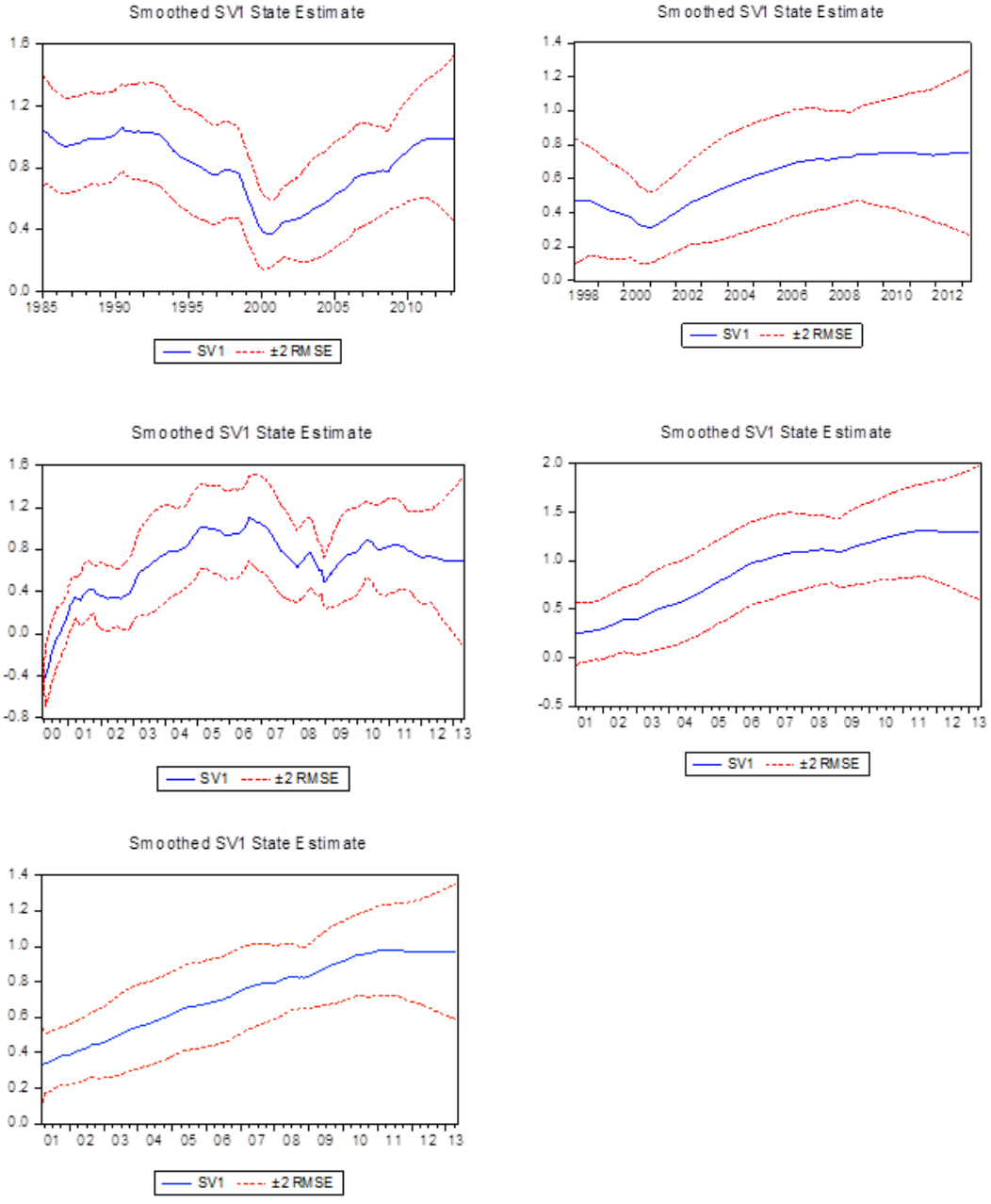
Table 13.10 – GARCH (1,1) results for the average of 4 companies

Dependent Variable: AVERAGE4
Method: ML - ARCH (Marquardt) - Normal distribution
Date: 04/26/13 Time: 23:26
Sample (adjusted): 2001M01 2013M01
Included observations: 145 after adjustments
Convergence achieved after 46 iterations
Presample variance: backcast (parameter = 0.7)
GARCH = C(5) + C(6)*RESID(-1)^2 + C(7)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
ERNASDA	0.664092	0.067521	9.835336	0.0000
SMB	-0.001591	0.001657	-0.960171	0.3370
HML	-0.002170	0.001486	-1.460612	0.1441
C	-0.006860	0.005023	-1.365852	0.1720
Variance Equation				
C	0.000184	0.000101	1.826438	0.0678
RESID(-1)^2	0.004616	0.039757	0.116113	0.9076
GARCH(-1)	0.904018	0.061290	14.74985	0.0000

R-squared	0.343678	Mean dependent var	-0.035558
Adjusted R-squared	0.329713	S.D. dependent var	0.063279
S.E. of regression	0.051807	Akaike info criterion	-3.106092
Sum squared resid	0.378443	Schwarz criterion	-2.962388
Log likelihood	232.1917	Hannan-Quinn criter.	-3.047701
Durbin-Watson stat	2.276677		

Figure 13.1 – Time-varying β of Expeditors International of Washington, C.H. Robinson, UPS, UTi Worldwide Inc and the average of 4 companies



Country – Denmark

Table 14.1 – OLS results for DSV

Dependent Variable: ERDSV
Method: Least Squares
Date: 04/26/13 Time: 23:49
Sample (adjusted): 1990M07 2013M02
Included observations: 272 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ERWINDMKL	0.868471	0.086955	9.987553	0.0000
SMB	0.001407	0.002228	0.631674	0.5281
HML	0.001936	0.002016	0.960147	0.3378
C	0.001702	0.006442	0.264139	0.7919

R-squared	0.306571	Mean dependent var	-0.038954
Adjusted R-squared	0.298808	S.D. dependent var	0.095634
S.E. of regression	0.080081	Akaike info criterion	-2.196952
Sum squared resid	1.718688	Schwarz criterion	-2.143926
Log likelihood	302.7855	Hannan-Quinn criter.	-2.175664
F-statistic	39.49497	Durbin-Watson stat	1.936275
Prob(F-statistic)	0.000000		

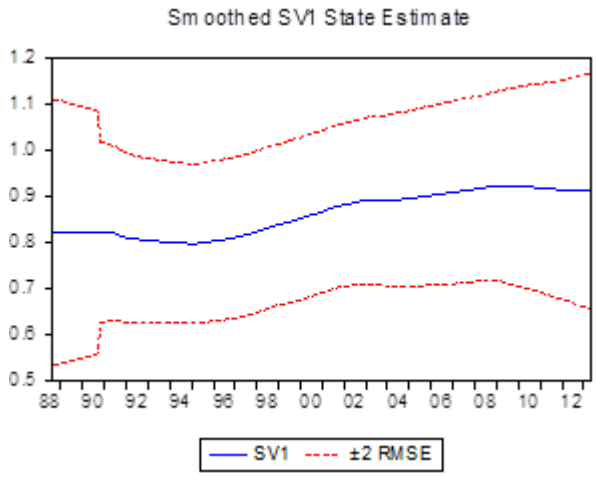
Table 14.2 – GARCH (1,1) results for DSV

Dependent Variable: ERDSV
Method: ML - ARCH (Marquardt) - Normal distribution
Date: 04/26/13 Time: 23:49
Sample (adjusted): 1990M07 2013M02
Included observations: 272 after adjustments
Convergence achieved after 17 iterations
Presample variance: backcast (parameter = 0.7)
GARCH = C(5) + C(6)*RESID(-1)^2 + C(7)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
ERWINDMKL	0.878469	0.077843	11.28515	0.0000
SMB	0.001462	0.002009	0.727697	0.4668
HML	0.002436	0.001604	1.517975	0.1290
C	0.004511	0.006272	0.719292	0.4720
Variance Equation				
C	0.001672	0.001152	1.451462	0.1467
RESID(-1)^2	0.150987	0.059067	2.556189	0.0106
GARCH(-1)	0.583064	0.211831	2.752492	0.0059

R-squared	0.305656	Mean dependent var	-0.038954
Adjusted R-squared	0.297883	S.D. dependent var	0.095634
S.E. of regression	0.080134	Akaike info criterion	-2.232622
Sum squared resid	1.720956	Schwarz criterion	-2.139826
Log likelihood	310.6366	Hannan-Quinn criter.	-2.195367
Durbin-Watson stat	1.937958		

Figure 14.1 – Time-varying β of DSV



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