Back on the Map

Essays on Financial Markets in the Baltic States

Albina Soultanaeva
Abstract

This thesis consists of five self-contained papers, which are all related to the financial markets in the three Baltic States, Estonia, Latvia and Lithuania.

Paper [I] studies the impact of news from the Moscow and New York stock exchanges on the returns and volatilities of the Baltic States’ stock market indices using a time series model that accounts for asymmetries in the conditional mean and variance functions. We find that news from New York has stronger effects on returns in Tallinn. High-risk shocks in New York have a stronger impact on volatility in Tallinn, whereas volatility in Vilnius is more influenced by high-risk shocks from Moscow. Riga does not seem to be affected by news arriving from abroad.

Paper [II] suggests a nonlinear and multivariate time series model framework that enables the study of simultaneity in returns and in volatilities, as well as asymmetric effects arising from shocks and exogenous variables. The model is employed to study the three Baltic States’ stock exchanges. Using daily data, we find recursive structures, with returns in Riga, directly depending on returns in Tallinn and Vilnius, and Tallinn on Vilnius. For volatilities, both Riga and Vilnius depend on Tallinn.

Paper [III] studies the link between political news, and the returns and volatilities in the Baltic States’ stock markets. We find that domestic and foreign non-Russian political news led, on average, to lower uncertainty in the stock markets of Riga and Tallinn in 2001-2003. At the same time, political risk from Russia increased the volatility of the stock market in Tallinn. There is a weak relationship between political risk and the stock market volatility in the Baltic countries in 2004-2007.

Paper [IV] studies the impact of market jumps on the time varying return correlations between stock market indices in the Baltic countries. An EARJI-EGARCH model facilitating direct modeling of the time varying return correlations is introduced. The empirical results indicate that there are quite a large number of identified jumps in the emerging Baltic States’ stock markets. Isolated market jumps in one of the markets generally have no or small effects on the time-varying correlations. In contrast, simultaneous jumps of equal sign increase the average correlation, in some cases by as much as 100 percent.

In Paper [V] the hypothesis that financial development promotes economic growth is tested for the three Baltic countries using a time series approach that allows for interactions between the countries. We find that economic growth is a positive function of financial development, proxied by the amount of bank credit to the private sector, in the long run. The results also show that there is long run interaction between the three Baltic countries.

Key Words: Financial Markets, Time series, GARCH, Asymmetry, News
Acknowledgements

If, when I was studying foreign languages in Russia over ten years ago, somebody would have told me that I would write this thesis and start a career as an economist at a central bank, I would most likely have a good laugh. But as it happened, several years later, I found myself in Umeå, in my first Economics class. And what’s more, I was actually enjoying it! For that I have to thank Kenneth Backlund, Jørn Stage, Olle Westerlund and several other teachers, for their inspiration and encouragement.

A couple of years later I surprised myself (and probably many others) again by joining the Ph.D. program in Economics at Umeå University. Who would have thought that after having spent some 16 years in the educational system I would be inclined to continue studying?! Even though my seemingly endless journey through academia has now (hopefully) come close to its end, there are many people, whose support and encouragement I’ve will treasure for many years to come.

First and foremost, I’d like to express my deepest gratitude to my supervisor Kurt Brännäs. There are many facets of your supervision that I have enjoyed, Kurt. Suggesting topics, discussing ideas, putting out psychological fires and answering the never-ending flow of my questions – are just some that I would like to mention. Also, even though I like to flatter myself sometimes that I write decent English, your proofreading has with no doubt improved the language. Without your continuous support, friendliness and understanding this journey would probably have never ended. Thank you, Kurt!

I’ve also treasured the advice from the co-author of the fourth paper of this thesis, Jörgen Hellström. Not least at times when I was puzzled with the econometrics of our paper or was trying to figure out the programming code for the model. I have also been lucky to work with Carl Lönnbark, co-author of the second paper of this thesis, who besides being a genius at computational econometrics had enough patience and
perseverance to help me estimate the “monster” model in our paper (Carl, I could not find a better word for it!).

Of course, I have also received valuable support from other members of the department. Kalle Löfgren, Tomas Sjöberg, Niklas Hannes, Marie Hammarstedt and Eva Cederblad, among others, deserve special mentioning. I’ve also very much appreciated the support coming from my fellow PhD students during the time when I was muddling through the first and second year courses of the PhD programme, while catching those numerous flights between Umeå and Stockholm. I’d especially like to thank my roomies over the years. I would also like to thank all the people at FIEF, SIFR and Amsterdam Business School for their friendliness during my time there.

There are many other fond memories I have shared with people who have been with me during some parts of this journey: Henrik, who shared my frustration as we trawled through the endless pages of Matlab code (and learned the hard way how to do the multiple loops in Matlab) during my time at SIFR. Derja, who I cannot thank enough for rescuing me with good advice as I was trying to solve nearly impossible hand-ins from the Financial Econometrics course in Amsterdam. Oskari, who provided me with much needed laughter during our evenings in Amsterdam. And Carina, who after joining me at the Riksbank, brought joy to my evenings by hardly ever refusing a discussion. Carina, even though I am still a bit disappointed that we failed to make ourselves a dinner (not even once!!!) or complete any of our planned morning training sessions, I very much appreciated your words of encouragement.

Obviously, I joined the Riksbank\(^1\) before finishing my PhD, which in the final few months of writing the thesis felt like it was maybe a little too early! But so far it has been a great learning experience and an opportunity to meet plenty of talented people. I would like to thank my

\(^1\)And of course, the usual disclaimer applies; the views expressed in this thesis are solely the responsibility of the authors and should not to be interpreted as reflecting the views of the Riksbank.
colleagues at the Riksbank: some for letting me to take the time to work on this thesis and reminding me to get it done; some for bringing the joy of open-minded discussions to our lunches and making the transition from the academic life easier; others for keeping my competitive spirits up; and all of you for being a wonderful crowd to work with!

Finally, I would like to express my deepest gratitude to my dear friends. Sergej and Natasha, you’ve become my best friends in the recent years. I can never thank you enough for being so generous, caring and understanding, even when I have to miss our evenings together because of work. I am certain that no matter what curve balls life throws at us our friendship will always remain strong. Maria, I am not sure that you will even get to this part of the thesis, since there are too many words and too little mathematical formulas. I must say that it has been a great joy to spend time and discuss things with you. Maybe this equation will help you understand: $J = \sum_{t=1}^{T} (D_t + \varepsilon_t)$, where $J$ = my joy, $T$ = time with you, $D_t$ = discussions and $\varepsilon_t$ = is the error term representing all the spontaneous and wicked things we come up with from time to time.

Further, I owe a great deal to Britt and Olle, Stella and Igor, Johan and Susanne. You all have been like a family to me for which I will be endlessly grateful.

Last but not least, I would like to express my sisterly love and my deepest appreciation to my sister Kristina. Dear sis, you have been there for me throughout my life and always stood behind me no matter what crazy adventures I have chosen to venture on. I am blessed to have you as a sister, not least for teaching me how to sail through deep oceans, both literally and figuratively.

Stockholm, December 2010
Albina
This thesis consist of a summary and the following five self-contained papers:


Introduction and summary

This thesis consists of five independent, although related papers, dealing with several issues in empirical financial economics. Through the use of quantitative methods, the aim of this thesis is to empirically study relevant problems related to the functioning of the financial markets in the Baltic States. The research questions stretch all the way from cross market linkages, importance of extreme events and political news for the stock market dynamics, to a question of what role financial intermediation plays for economic growth. The papers have several things in common; they are all empirical and use time series analysis to study the relevant research questions. Also, they all provide additional knowledge on the financial markets of the three Baltic States, Estonia, Latvia, and Lithuania. Therefore, this helps us gain a deeper and more structured general understanding of these markets that are in an intermediate stage of development, or are so called markets in transition.

1 Introduction

In many financial theories and models, such as modern portfolio theory and option pricing, a trade-off between risk and return plays a prominent role. For example, the Capital Asset Pricing Model (CAPM) (e.g., Markowitz, 1959; Sharpe, 1964; Linter, 1965) postulates an investor’s portfolio selection problem in terms of expected return on an asset and its variance, i.e. its risk or volatility. Similarly, the uncertainty associated with the price of the underlying asset, measured by its volatility is the most important determinant for the price of an option.
Obviously for these reasons, many studies have in addition to studying the returns of financial assets, been interested in the associated volatility, which is often regarded as a measure of risk. However, the choice of risk measure is to a large degree context dependent.\footnote{For further discussion on different risk measures and views on risk, see e.g., Granger (2002).} In this thesis, the focus is on market risk, which in the Financial Times Lexicon is defined as “the risk that an overall market or asset class will change in value according to economic conditions or other factors that may override any characteristics specific to a particular stock, bond, commodity or currency”. In particular, this thesis studies the factors that may affect the market risk in each of the three Baltic States’ stock markets.

Historically, a standard way of measuring risk has been through the variance of asset returns. Recent evidence however shows that the risk, also referred to as volatility, of financial assets is not constant, but changes over time. In particular, within financial markets, it can often be observed how large returns tend to be followed by large returns, and small returns tend to be followed by small returns (in both cases, either positive or negative). Hence, periods of high (low) return variance or volatility are often followed by periods when the variance of returns is high (low). Moreover, in empirical finance it is now well understood that financial time series data displays asymmetric behavior. An example of this behavior is that large negative returns appear more frequently than large positive returns. Indeed, on Friday October 24, 2008, Japan’s Nikkei index sank 9.6 percent, Stockholm’s OMX and Germany’s DAX index dropped 8.2 and over 9 percent, respectively; while we rarely observe positive daily returns of the same magnitude on most of the stock markets. Another example is that large negative returns are often a prelude to a period of substantial volatility, while large positive returns are less so. Needless to say such features should be incorporated in models used for studying the time-varying volatility. Throughout this thesis,
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the time series models capturing the characteristic features of financial
time series data are used to describe the risk in the Baltic States’ stock
markets.

As illustrated above, many international stock markets in Asia, Eu-
rope, and even the US dropped by about 10 percent on Friday October
24, 2008. This is just one of many examples that illustrate the existing
linkages between the financial markets across the world. In fact, acad-
emic research emphasized quite early that not only domestic but also,
and more importantly, international factors play a role in the pricing of
domestic securities.

In general, an accurate assessment of the degree of interdependence
among international stock markets is important for several reasons. For
investors that follow an international diversification strategy, the design
of a well-diversified portfolio crucially depends on correctly understand-
ing how closely international stock markets may be interlinked. Changes
in international cross market linkages call for an adjustment of a port-
folio. In addition, policy makers are interested in cross market linkages
because of their implications for the stability of the international finan-
cial markets (e.g., Hartmann et al., 2004). To this end, Paper [I] of
this thesis studies whether the return and volatility dynamics of the
Baltic States’ stock markets are influenced by the Russian and US stock
markets.

It can also be argued that growing political and economic integra-
tion as well as technological advances in financial markets play a role
for growing linkages between financial markets. Also, markets that are
located in the same region may have stronger linkages than anticipated
by investors (e.g., Fazio, 2007). Paper [II] suggests a model framework
that enables us to study the joint evolution of stock market returns and
volatilities, and applies the model on the three closely related Baltic
States’ stock markets.

While there is a general consensus on the importance of cross market
Introduction and summary

linkages, there is far less agreement on what causes changes in stock market volatility. Some studies show that volatility is driven by the arrival of new and unanticipated information that alters investors’ expectations about stock returns (e.g., Engle and Ng, 1993). In particular, one may expect that specific news events, related, for example, to changes in the local or global economic or even political as well as regulatory environments, may explain changes in market returns or in the underlying volatility. More importantly, financial markets in their initial or intermediate stage of development are often particularly sensitive to political risk factors and news events (e.g., Bailey and Chung, 1995; Durnev et al., 2004; Goriaev and Zabotkin, 2006). Paper [III] of this thesis explores the importance of different political news for the stock market movements in the three Baltic countries.

Another important debate in empirical finance concerns the question of whether financial crises, extreme events, or just large shocks to a particular market, can increase the co-movements between international financial markets. There are numerous examples of how large shocks arising within a financial market of a particular country may be transmitted to other markets and countries. The most common examples are the Asian crises in 1997 or the Russian Bond default in August 1998, which both had repercussions for many international bond, equity, and currency markets. More recently, in the aftermath of the subprime crisis in the US, prices of many financial assets fell, which clearly illustrated that the dependence between financial assets has been underestimated. However, it may sometimes be difficult to define particular shocks, news, or other extreme events that have an impact on the co-movements or correlations between markets. To shed some light on the issue, Paper [IV] of this thesis studies the impact of extreme events, measured as large discrete changes in stock market returns, and referred to as jumps, on the co-movement between the stock markets in the three Baltic States.

In general, a better understanding of stock market developments and
co-movements between financial assets or markets is important for investors whose portfolio selection problem depends on the return and risk characteristics of assets included in the portfolio. However, in line with their development, financial markets are also becoming more important for the stability and growth of the economy (see, e.g., Pagano, 1993; Levine, 1997; Thiel, 2001; and Wachtel, 2003 for a review of the earlier literature and theoretical rationale). The Economist (2008) noted for example that, although stock markets play a relatively small role in the economies of East European countries, stock market declines in the aftermath of the global financial crises of 2008 may well have exacerbated the negative impact on domestic demand and economic actors’ confidence, and hence on the growth in the region during this period. Still, many developing economies, including so called transition economies, have primarily a bank-based financial system (Berglöf and Bolton, 2002). Hence, Paper [V] of this thesis, instead of focusing on stock markets, examines the role the bank-based financial intermediation played for economic growth in the three Baltic countries.

In what follows, the topics introduced above are reviewed in more detail, and the contributions of this thesis are related to the existing literature. But first of all, the next section provides a brief description of the three Baltic States’ stock markets.

2 The Baltic States’ Stock Markets

Trading on the stock exchanges in the three Baltic States was first launched in the mid-1990s. In Estonia however, a foreign currency and securities exchange, the predecessor of the Tallinn Stock Exchange, was functioning between 1920 and March 1941, after which it was closed following Soviet occupation in Estonia. Still, unlike mature stock markets of advanced economies, the stock markets in the three Baltic countries have begun to develop rapidly, only in the last decade.
Table 1: Some basic facts about Baltic stock markets.

<table>
<thead>
<tr>
<th>Year</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
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<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009*</th>
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<tr>
<td>Riga</td>
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<td>846</td>
<td>692</td>
<td>900</td>
<td>1207</td>
<td>2122</td>
<td>2034</td>
<td>2098</td>
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<td>1013</td>
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<td>16.8</td>
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<td>32.2</td>
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<td>123</td>
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<td>227</td>
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<td>166</td>
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<tr>
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<tr>
<td>Riga</td>
<td>63</td>
<td>63</td>
<td>62</td>
<td>56</td>
<td>39</td>
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<td>46</td>
<td>51</td>
<td>43</td>
<td>42</td>
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<td>42</td>
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<td>172.3</td>
<td>65.2</td>
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</table>

* Indicates that statistics are for the first half of the year. MEUR= Million Euro.
In Table 1, the yearly turnover volume, market capitalization at the end of the year, number of listed companies and average company size are presented for the stock exchanges in Estonia (Tallinn), Latvia (Riga), and Lithuania (Vilnius) between 2000 and the first half of 2009.

The table shows that the three Baltic States’ stock exchanges are still relatively small, even though they developed well in the years prior to the financial crisis in 2007-2008. The market capitalization more than doubled for all three stock exchanges over the period 2000-2006. By the end of 2006, the stock markets in the Baltic countries had a capitalization of 12 to 35 percent relative to domestic GDP, whereas for most of the developed country stock exchanges market capitalization was well above 100 percent. As such, it seems more reasonable to compare the Baltic States’ stock markets to other stock markets in Central and Eastern Europe, i.e. so called transition economies, where, for example, the Warsaw stock exchange had a market capitalization to GDP of 41 percent in the end of 2006.3

Another important characteristic of stock markets is their liquidity, which is often measured by market turnover defined as the ratio of the total value of trading to market capitalization. A high ratio indicates that the market is relatively liquid. The three Baltic exchanges showed low liquidity, where the Tallinn stock exchange was the most liquid one during the considered time period. The market turnover on the Riga stock exchange has declined dramatically since 2000, which could in part be explained by the decreasing number of listed companies. Overall, it is of no surprise that the stock markets in the three Baltic States have been less liquid during the 2000s than their counterparts in developed countries. However, Estonian stock market seems to have performed well in terms of liquidity when compared to, for example, the Warsaw stock exchange, where the market turnover was about 40 percent in 2005 and 2006. In general, the lower market turnover in CEE countries, compared

3Source: The World Federation of Exchanges (WFE).
to developed markets, can be attributed to ownership concentration. Indeed, over 85 percent of investors in the Estonian securities market had investments amounting to 10 million Estonian Kroon (or over 600 thousand Euros) by the end of 2009.\footnote{Source: The Estonian Central Register of Securities.}

In addition, the stock markets in the Baltic States have a large representation of institutional investors. For example, by the end of 2009, institutional investors represented 79 percent of the total market participants of the Latvian Stock exchange, whereas in Estonia and Lithuania about 92 percent of total investments were made by the institutional investors. Also, foreign investors represent a large share of total investments in the three markets. For example, by the end of 2009 non-residents represented 34, 53, and 65 percent of total investments in the stock exchanges in Lithuania, Latvia, and Estonia, respectively. In Estonia, Nordic investors represented over 48 percent of total investments on the Tallinn stock exchange. This is not surprising, since, as Bengtsson et al. (2007) found, different performance measures clearly illustrate that the Baltic exchanges outperformed Nordic exchanges during the whole period of 2000-2006.

The first four papers of this thesis study the returns and risks on the three Baltic stock markets in more detail. In particular, this thesis considers such issues, as cross-market linkages, since they can affect the decision making process of institutional investors following an international diversification strategy.

3 Background and contribution of the thesis

Most of the studies within financial economics describe asset returns as a function of past returns\footnote{Campbell, Lo and MacKinlay (1997) provide two main reasons for using returns rather than asset prices. First, for an average investor, return on an asset provides a complete summary of the investment opportunity independent of the size of an} and possibly other explanatory variables. In
other words, the returns of financial assets are commonly modeled with various Autoregressive Moving Average (ARMA) model specifications. However, it seems reasonable to assume that investors react differently to positive and negative shocks (up markets versus down markets).\textsuperscript{6} The Autoregressive asymmetric Moving Average (ARasMA) model of Brännäns and De Gooijer (2004), which is an extension of the asymmetric Moving Average (asMA) model proposed by Wecker (1981) is a suitable candidate for this purpose since it allows asset returns to respond asymmetrically to own past innovations (or shocks).

As noted in the Introduction, one of the prominent stylized facts of financial asset returns is that their volatility changes over time. In particular, periods of large movements in prices alternate with periods during which prices hardly change. This characteristic feature, commonly referred to as volatility clustering, can be studied using the Autoregressive Conditional Heteroscedastic (ARCH) model of Engle (1982). The ARCH model and its extensions, most notably the Generalized ARCH model (GARCH) introduced by Bollerslev (1986) has been very successful in modeling time varying volatility in financial series.

In addition, volatile periods are often initiated by a large negative shock, which suggests that positive and negative shocks may have an asymmetric impact on the conditional variance or volatility. This so-called “leverage effect” was first acknowledged by Black (1976) and is one of the most common explanations for the asymmetry in time-varying volatility.\textsuperscript{7} Standard GARCH models cannot capture such asymmetric investment. Second, return series have more attractive statistical properties, such as stationarity, which makes them more appropriate for most of the time series models for financial assets or markets.

\textsuperscript{6}Morris and Shin (2004) distinguish, for example, between risk-averse long horizon traders and short horizon traders, whose incentives to sell the asset increase when asset prices fall close to their loss limit.

\textsuperscript{7}Black (1976) suggested that a possible explanation for this phenomenon may be the way firms are financed. When the value of a stock of a particular firm falls, the debt-to-equity ratio, commonly referred to as leverage of the firm, increases, which in turn may lead to an increase in the volatility of the returns on equity.
effects of positive and negative shocks. Instead, positive and negative shocks of the same magnitude have the same effect on conditional volatility (or risk) – that is, the sign of the shock is not important. Hence, several non-linear extensions of the standard GARCH models, designed to allow for different effects of positive and negative shocks on the time-varying risk, have been developed in the literature. The extensions of the GARCH models, which allow for asymmetric effects, include, for example, the Exponential GARCH (EGARCH) model of Nelson (1991), the GJR-GARCH model introduced by Glosten, Jagannathan and Runkle (1993) and the Quadratic GARCH (QGARCH) model by Sentana (1995), and its extension to the asymmetric Quadratic GARCH (asQGARCH) model by Brännäs and De Gooijer (2004). The extended versions of these types of models are used in this thesis (Paper [I] - [IV]) to study the dynamics of the stock markets in the Baltic States.

In particular, Paper [I] of this thesis extends the ARasMA-asQGARCH model of Brännäs and De Gooijer (2004) to take into account the fact that changes in stock market prices may be driven not only by own shocks but also, by the stock market reaction to movements in other markets. The extended model allows us to capture any potential asymmetric impact of positive and negative shocks from the most influential US and closely located Russian stock markets on the return and volatility dynamics of the Baltic States’ stock markets. The transmission of shocks in this paper could either be explained by the real economic, financial, or even political interrelations between the countries or may be a result of the behavior of institutional investors who rebalance their portfolio whenever new information arrives.

The presence of strong economic ties and policy coordination between countries, may also explain why markets that are located in the same region may have strong linkages (e.g., Koch and Koch, 1991; Chen et al., 2002). In fact, given that shocks are commonly interpreted as news, and that different closely related financial markets may be af-
fected by at least certain news events simultaneously, it is of interest to consider multivariate models that describe joint movements in the financial time series. Consequently, multivariate models with GARCH-type specifications for the time-varying volatility emerge as a natural extension of the univariate models (see Bauwens, Laurent and Rombouts, 2006, for a survey). An alternative motivation for multivariate models is that the construction of a well-diversified portfolio crucially depends on the co-movements between assets included in the portfolio. Indeed, the ability to capture spillovers or shocks that are transmitted across different assets and markets is the most important feature of the multivariate models (e.g., Karolyi, 1995; Bonfiglioli and Favero, 2005). To this end, Paper [II], [III] and [IV] of this thesis, study the dynamics of the Baltic States’ stock markets while allowing for interaction between the markets using various multivariate time series model frameworks.

In particular, Paper [II] of this thesis suggests a nonlinear multivariate time series model framework that enables us to study simultaneity in stock market returns and volatilities using daily data. Hence, this draws a lesson from the earlier literature suggesting that stock markets can move simultaneously in part because they are exposed to common information. In addition, the information transmission between markets is particularly fast, if it is not limited by institutional constraints and other practical considerations such as common trading platform (Fleming et al., 1998). Indeed, several models allowing for simultaneity in returns models have been developed quite recently (e.g., Rigobon and Sack, 2003; De Wet, 2006; Lee, 2006). Obviously, and more interestingly, market risks, i.e. volatilities, may also move simultaneously. Gannon and Choi (1998) and Gannon (2004, 2005) have addressed this question using realized volatilities, i.e. squared returns. However, given the attractive features of the non-linear GARCH models it seems natural to extend this model framework to allow for simultaneity in volatilities. Paper [II] of this thesis is, to the authors’ knowledge, the first
in the literature to propose a non-linear multivariate model that allows for simultaneity in both returns and volatilities along with asymmetric effects.

Several studies have also showed that return and volatility dynamics in different financial markets is related to the underlying information flow, including the arrival of new and unanticipated information (e.g., Andersen and Bollerslev, 1998; Chang and Taylor, 2003; Kalev et al., 2004). Hence, besides capturing the impact of various shocks on the return and volatility dynamics, it may be of interest to study the effects of different public news announcements that reflect changes in the local or global economic, political, or regulatory environments. In particular, political news has been found to play a role in the stock market dynamics of emerging markets (e.g., Bailey and Chung, 1995; Chan and Wei, 1996; Chan et al., 2001; Kim and Mei, 2001). To this end, Paper [III] of this thesis contributes to this literature by studying the importance of different political news for the stock market movements in the Baltic countries. The underlying motivation for our analysis is, in part, due to the fact that emerging and transition markets are particularly sensitive to political factors and events (e.g., Bailey and Chung, 1995; Durnev et al., 2004; Goriaev and Zabotkin, 2006). The impact of different political news on the behavior of the Baltic States’ stock markets is also of special interest because of the abundance of political events and recent developments in the countries.

Although the models described above are adequate in terms of accounting for volatility clustering, cross-market linkages (or spillovers), and asymmetric effect of positive and negative shocks, they do not fully explain sudden and large discrete changes (referred to as jumps or unusual news events) often found in financial assets returns (e.g., Maheu and McCurdy, 2004). Such features can instead be studied using a mixed GARCH-jump model, where the GARCH part explains the smooth changes in volatility while the jump part explains infrequent
large discrete movements in asset returns (e.g., Press, 1967; Chan and Maheu, 2002; Maheu and McCurdy, 2004). Moreover, a mixed GARCH-jump model can be particularly useful in explaining the changing nature of cross-market co-movements or correlations. To shed some light on the issue, Paper [IV] introduces a model that enables us to study the impact of large discrete changes in stock market returns (i.e. jumps) on time-varying return correlations. More specifically, it studies whether the correlations of returns between the Baltic States’ stock markets differ when there are smooth changes in market returns and large discrete changes.

To empirically assess the sources and characteristics of changing return and volatility dynamics is essential for many financial and economic decisions, not least for portfolio composition, risk measurement, and risk management. In the case of the Baltic States, understanding the stock market dynamics is particularly important due to the large participation of institutional and international investors. However, in transition countries other aspects of financial intermediation, namely the banking sector often plays a greater role for the domestic real economy (e.g., Berglöf and Bolton, 2002). Still, despite the period of high economic growth combined with rapid expansion of the banking sector (primarily foreign-owned banks) during several years prior to the financial crises of 2007-2008, the recent experiences regarding the relationship between financial intermediation and economic growth in the three Baltic States have, to the author’s knowledge, not been studied in the academic literature. Hence, while Paper [I]-[IV] focuses on the stock markets in the three Baltic States, Paper [V] of this thesis uses the Johansen (1988, 1995) time-series approach to explore the role bank-based financial inter-

For example, there is ample empirical evidence that cross-market linkages increase after a large shock to one country, or group of countries or during a financial crisis (e.g., Karolyi and Stulz, 1996; Ramchand and Susmel; 1998; Longin and Solnik, 1995, 2001). This effect has been commonly referred to as contagion (e.g., Claessens, 2001; Forbes and Rigobon, 2002) between the financial markets.
mediation plays in the economic development of the three Baltic States (see e.g., Pagano, 1993; Levine, 1997; Thiel, 2001; and Wachtel, 2003 for a review of the earlier literature and theoretical rationale).

4 Summary of the papers

Paper [I]: Influence of News from Moscow and New York on Returns and Risks of Baltic State Stock Markets

This paper studies whether the US and Russian stock markets influence the price and volatility dynamics of the Baltic States’ stock markets. Obviously, the question of whether the Baltic stock markets react to the information flow from abroad becomes even more important given a large proportion of foreign institutional investors in the Baltic markets. In particular, if international investors seek to diversify their portfolio by shifting their trading into international markets, risk reduction may prove difficult if the stock markets in the Baltic States are strongly interlinked with other markets, and in this case with the US and Russian stock markets.

The US stock market is often considered as the most influential producer of information that is transmitted to other stock markets (e.g., Eun and Shim, 1989; Koch and Koch, 1991; Liu and Pan, 1997; Forbes and Chinn, 2004). This has also been the case for the stock markets in Central and Eastern European (CEE) countries (see, for example, Tse et al., 2003, for the results for the Warsaw Stock Exchange). Spillovers from the Russian stock market can on other hand be explained by economic, historical, and political ties between the countries as well as the geographical proximity (e.g., Koch and Koch, 1991; Pajuste et al., 2000; Forbes and Chinn, 2004).

This paper employs an econometric model that is designed to capture the return and volatility dynamics of the Baltic stock markets as well as impacts of foreign shocks. Furthermore, this paper allows for an
asymmetric impact of both domestic and foreign shocks. For example, to study the asymmetric impact of shocks (or news) from abroad on the stock market returns, news is split into good and bad, where the term "good news" denotes positive past returns and the term "bad news" denotes negative past returns. In order to capture the asymmetric impact of volatility shocks from abroad, shocks are instead categorized as being of "high" and "low" volatility.

The overall findings suggest that there are substantial differences among Baltic States’ stock markets, with respect to the market adjustment to information arriving from abroad. For example, news from New York has stronger effects on returns in Tallinn than news from Moscow. High-risk shocks in New York have a stronger impact on volatility in Tallinn, whereas the volatility of Vilnius is more influenced by high-risk shocks from Moscow. Riga does not seem to be affected by news arriving from abroad.

**Paper [II]: Simultaneity and Asymmetry of Returns and Volatilities: The Emerging Baltic States’ Stock Exchanges**

This paper suggests a nonlinear time series model framework that enables us to study simultaneity in stock market returns and volatilities, as well as asymmetric effects arising from shocks. We argue that simultaneity is important if there are strong linkages between markets. Information processing may be in particular fast in some marketplaces, where linkages between markets are not limited by institutional constraints, and other practical considerations such as a common trading platform. Also, simultaneity may be particularly relevant for markets that may be exposed to common information, for example because they belong to the same geopolitical region.

This paper focuses on the joint modeling of the three Baltic stock markets, while allowing for simultaneity in both returns and volatilities. Furthermore, this paper allows for asymmetry in returns and volatility.
dynamics and the impact of exogenous variables, such as spillovers from the Russian stock market.

The estimation results indicate recursive structures with returns in Riga directly depend on returns in Tallinn and Vilnius, and Tallinn on Vilnius. For volatilities, both Riga and Vilnius depend on Tallinn. In addition, we find evidence of asymmetric effects of shocks arising in Moscow and in Baltic States on both returns and volatilities.

In addition, the paper outlines the benefits of the suggested model for portfolio allocation and value at risk (VaR) studies. Portfolio allocation results indicate that optimal portfolio weights are more sensitive to shocks when simultaneity is not accounted for. Also, VaR measures indicate that the variability in losses that may occur due to shocks in the market is larger when simultaneity is not accounted for.

**Paper [III]: Impact of Political News on the Baltic Stock Markets**

This paper examines the importance of different publicly available news releases for the stock market movements in the Baltic countries. More specifically, it looks at the number of political news headlines during a day, as a proxy for the information flow.

The underlying motivation for the analysis is in part due to the fact that emerging and transition markets are particularly sensitive to political factors and events (e.g., Bailey and Chung, 1995; Durnev et al., 2004; Goriaev and Zabotkin, 2006). Given the recent historical development of the Baltic States, it is interesting to study whether the origin of political risk matters for investors’ perception of market risk. In particular, this paper explores whether the political risk (i.e. political events) related to Russia versus the domestic and other foreign political issues, excluding Russia, have different impacts on the stock markets in the Baltic countries.

A priori, it seems reasonable to assume that the risk factors related to
Russia have become less important over time, whereas European factors have become more important for investors’ perception of the market risk in the Baltic countries. Thus, in the paper we consider two different time periods to explore whether the sensitivity to different political events has changed over time.

We employ a multivariate time series model designed to catch the impact of news on returns and volatility. Besides capturing the news impact, this model allows us to capture asymmetric effects of positive and negative shocks on volatility as well as volatility spillovers across markets. Also, the model allows us to study whether news affecting the market risk in one of the Baltic countries has any impact on the market risk in the other two countries.

Overall, our results indicate that the impact of news can depend on both the origin and the nature of political news events, but also that the sensitivity to political factors changed over time following the favorable economic and political development of the markets in transition, and the Baltic countries in particular.

**Paper [IV]: The Impact of Stock Market Jumps on Time-Varying Return Correlations: Empirical Evidence from the Baltic Countries**

This paper studies the impact of large discrete changes in stock market returns, i.e. jumps, on time-varying return correlations. More specifically, we study whether the correlations of stock market returns differ when there are smooth changes in market returns or jumps.

The paper contributes to the existing literature in several ways. First, this paper extends an existing model framework that jointly captures smooth changes in returns and jumps, to a specification that also considers time-varying return correlations. Second, we utilize a data driven procedure to identify jumps, whereas in the majority of the earlier literature that considers transmission of large shocks between fi-
nancial markets, shocks, extreme events, or market crashes are usually pre-defined by authors. Finally, the effect of return jumps on the time-varying return correlations is studied more directly than in the previous literature on jumps, which has primarily focused on the correlations between the jumps or on jump spillovers. We argue that high correlation between the jumps does not necessarily imply a high correlation between returns since the jumps may be in different directions (i.e. leading to lower or higher returns).

The study is performed on stock market data for the three Baltic countries. The empirical results indicate that there are quite a large number of identified jumps in the Baltic States’ stock markets. The main finding is that isolated market jumps in one of the markets generally have no or small effects on the time-varying correlations. In contrast, simultaneous positive jumps increase the average correlation, in some cases with as much as 100 per cent, whereas simultaneous negative jumps have a smaller effect on the average correlation.

**Paper [V]: Financial Intermediation and Economic Growth: Evidence from the Baltic countries**

The purpose of this study is to contribute to the empirical evidence on the relationship between bank-based financial intermediation and economic growth in the Central and Eastern Europe (CEE) countries. In particular, we examine the relationship between financial sector development, proxied by the level of bank credit to the private sector, and economic growth in the Baltic countries over the period 1995-2008. In addition, since all three Baltic countries are likely to be closely interrelated, we use a time-series approach that allows for cross-country dependence in the empirical analysis.

Overall, the results indicate that banking sector development can cause economic growth in the long run in the Baltic States. The results also show that the three Baltic countries are indeed interrelated. Using
impulse responses, we illustrate for example that economic growth in Latvia and Lithuania reacts positively to shocks in economic growth in Estonia. Also the credit development in Latvia and Lithuania responds positively to a shock in economic growth in Estonia. These interactions can in part, be explained by the trade pattern between the countries or the fact that the banking sector in three Baltic States is dominated by the same foreign-owned banks that reallocate capital over the geographical region on the basis of expected returns and risks.
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Introduction and summary

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