

DISSERTATIONES RERUM OECONOMICARUM
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**ESSAYS ON FINANCIAL FRAGILITY –
EVIDENCE FROM THE CORPORATE AND
BANKING SECTORS IN CENTRAL AND
EASTERN EUROPE**

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LIST OF PUBLICATIONS AND CONFERENCE PRESENTATIONS

I Chapters in monographs

1. **Männasoo, K.**, Mayes, D. Investigating the early signals of banking sector vulnerabilities in Central and East European emerging markets. – Financial development, integration and stability: evidence from Central, Eastern and South-Eastern Europe. Edited by Liebscher, K., Christl, J., Mooslechner, P. and Ritzberger-Grünwald, D. Cheltenham and Northampton: Edward Elgar, 2006, pp. 385–413.
2. **Männasoo, K.** Turupõhised indikaatorid panga- ja finantskriiside enneta-misel. – Majandusarengu institutsionaalsed tegurid. Toimetajad Sepp, J. ja Ernits, R. Tartu: Tartu Ülikooli Kirjastus, 2006, lk 279–301.

II Articles in international journals

1. **Männasoo, K.** Firm survival in Estonia. – Eastern European Economics, forthcoming Vol. 46 No. 04, 2008, pp. xxx-xxx.
2. **Männasoo, K.** What feeds banks' appetite for risk-entailing portfolios? – International Research Journal of Finance and Economics, Issue 13, 2008, pp. 183–191.

III Other research articles

1. Hazak, A., **Männasoo, K.** Indicators of Corporate Default – An EU Based Empirical Study. – Working Papers of Bank of Estonia, No. 10, 2007, 25 p.
2. **Männasoo, K.** Determinants of Firm Sustainability in Estonia. – Working Papers of Bank of Estonia, No. 4, 2007, 29 p.
3. **Männasoo, K.** What feeds banks appetite for expanding risk-entailing portfolio: Implications of bank inherent moral hazard. – Doctoral Summer School 2006, 30 July- 2 August 2006, Nelijärve, Estonia. CD-Rom. ISBN 9985-4-0492-0
4. Chen, Y., Funke, M., **Männasoo, K.** Extracting Leading Indicators of Bank Fragility from Market Prices – Estonia Focus. – CESifo Working Paper No 1647, 2006, 25 p. Available at SSRN: <http://ssrn.com/abstract=884344>
5. Chen, Y., Funke, M., **Männasoo, K.** Extracting Leading Indicators of Bank Fragility from Market Prices – Estonia Focus. – Dundee Discussion Papers in Economics, Working Paper No 185, 2005, 25 p.
6. **Männasoo, K.**, Mayes, D. Investigating the Early Signals of Banking Vulnerability in Central and East European Emerging Markets. – Working Papers of Bank of Estonia, No. 8, 2005, 28 p.

7. **Männasoo, K.** The Procyclicality of the Financial Sector: Nature, Implications and Policy Options. – *Kroon&Economy*, 2/2003, 2003, pp 32–47.

IV. Articles in conference proceedings

1. **Männasoo, K.** Determinants of Firm Sustainability in Estonia – Estonian Economic Association Articles from the Annual Conference 2007, Tallinn 2007, pp. 133–164.
2. **Männasoo, K.**, Mayes, D. Investigating the Early Signals of Banking Vulnerability in Central and East European Emerging Markets. – Development and Convergence of Financial Sector of New EU Members, Tallinn Technical University, Tallinn 16.11.–20.11.2005, pp. 133–143.
3. **Männasoo, K.**, Mayes, D. Investigating the Early Signals of Banking Vulnerability in Central and East European Emerging Markets. – 13th Scientific conference on economic policy – Reports-papers of the XIII scientific and educational conference. Tallinn: Mattimar, 2005, pp. 56–64.
4. **Männasoo, K.** How to measure the early signals of banking fragility. – Economic Policy Perspectives of Estonia in the European Union – Reports-papers of the XII scientific and educational conference. Tallinn: Mattimar, 2004, pp. 150–157.

V. Conference presentations

1. **Männasoo, K.** Determinants of Firm Sustainability in Estonia, EMS Konverents. 12.01.–13. 01.2007., Pärnu.
2. **Männasoo, K.**, Mayes, D. Investigating the Early Signals of Banking Vulnerability in Central and East European Emerging Markets, FMA European Conference, 7.06–10.06.2006, Stockholm.
3. Chen, Y., Funke, M., **Männasoo, K.** Extracting Leading Indicators of Bank Fragility from Market Prices – Estonia Focus. – CESifo Area Conference on Macro, Money and International Finance. 24.02–25.02.2006. CESifo Conference Centre, Munich
4. **Männasoo, K.**, Mayes, D. Investigating the Early Signals of Banking Vulnerability in Central and East European Emerging Markets. – 13th Scientific conference on economic policy 30.06.–2.07.2005, Tartu-Värsk.
5. **Männasoo, K.** Pangandussektori haavatavusindikaatoritest Eestis ja teistes Kesk-ja Ida-Euroopa riikides, Finantssektori konverents, 14.12.2004, Tallinn.
6. **Männasoo, K.** How to measure the early signals of banking fragility, XII scientific and educational conference: Economic Policy Perspectives of Estonia in the European Union 1.07–3.07.2004, Tartu-Värsk.

INTRODUCTION

List of publications

The four publications below form the basis of the doctoral dissertation. The papers are referred to in the text according to the numbers indicated in this list.

- I. **Männasoo, K.** What feeds banks' appetite for risk-entailing portfolios? – International Research Journal of Finance and Economics, 2008, Issue 13, pp. 183–191.
- II. **Männasoo, K., Mayes, D.** Investigating the early signals of banking sector vulnerabilities in Central and East European emerging markets – Financial development, integration and stability: evidence from Central, Eastern and South-Eastern Europe. Edited by Liebscher, K., Christl, J., Mooslechner, P. and Ritzberger-Grünwald. Cheltenham and Northampton: Edward Elgar, 2006, pp. 385–413.
- III. **Chen, Y, Funke, M, Männasoo, K.** Extracting leading indicators of bank fragility from market prices – Estonia Focus. – CESIFO Working Paper, 2006, No. 1647, p. 25. Available at SSRN: <http://ssrn.com/abstract=884344>
- IV. **Männasoo, K.** Firm survival in Estonia. – Eastern European Economics, forthcoming 2008, Vol. 46, No 04, pp. xxx–xxx.

Background and motivation for the research

In the aftermath of a series of financial crises throughout the 1990s in Asia, South-America and a number of European countries, such as Nordic countries and Eastern European transition countries, there is a growing body of research on the triggers of financial crises. Alongside the research, a series of policy-driven initiatives has been launched on the global and national level in order to promote financial stability. There is no single, widely accepted and used definition of financial stability; however, attempts at articulating the concept have reached a consensus about financial stability as a macro-economic phenomenon relating to the absence or unlikely occurrence of systemic financial imbalances or financial instability, leading to adverse macro-economic effects (Allen, Wood 2006: 152,159, Schinasi 2004: 3, 6).

To improve surveillance practices in safeguarding financial stability, the International Monetary Fund (IMF) has issued guidelines for compiling a set of financial soundness indicators (FSIs) forming the basis for monitoring the financial system (Financial Soundness... 2006.). FSIs contain aggregate information on financial institutions and indicators that are representative of the markets in which financial institutions operate. The aim of the initiative is to monitor the health and soundness of financial institutions and markets, and of their corporate and household counterparts (Sundararajan *et al* 2002: 2). Hence, FSIs cover a wide set of institutions and markets aggregating a predefined set (core and encouraged) of variables, which are considered to reflect the underlying strengths and vulnerabilities of financial systems. Admittedly, the idea of FSIs is to provide a comparative set of key variables for building up the basis for global macro-prudential analysis; in other words, the assessment and monitoring of the strengths and vulnerabilities of global financial systems. Although FSIs are invaluable as a firsthand source of information on the performance and fragility of the banking industry, the condition of financial and real estate markets, the non-bank financial sector, and corporations and households, cross-country heterogeneities account for a large part of explanations regarding the variability in FSIs (Babihuga 2007: 3, 21). Hence, the national financial stability analysis should not merely rely on a set of FSIs, since they might not bring forward all the necessary information due to non-transparent country-specific factors and information lost in sector aggregation.

As a policy surveillance tool, the IMF FSAP (Financial Sector Assessment Program) approach (Financial Sector Assessment...2005.) provides a universal framework for countries' financial stability analysis, assessment and stress testing (Babihuga 2007: 4). The FSAP framework embeds the standardized FSI-based macro-prudential analysis as well as a large portion of judgmental analysis and expert assessments and is normally conducted on an irregular basis. With this in mind, the toolbox for country or region-specific financial stability monitoring is still an issue for national discretion and of national interest. The analytical framework in use in different countries varies to a great extent and one of the key characteristics reflecting its reliability is the degree to which the monitoring routines are supported by empirical and theoretical research in a particular country or region.

The financial fragility indicators (FFIs) as defined in the present dissertation serve as variables that highlight institution level information on the vulnerabilities or fragilities embedded in banks and corporate sector entities. The advantage of focusing on fragility rather than on actual failure provides an approach to the early recognition of accumulating risks, and these can then be addressed with pre-emptive actions. Honohan (1997:11) notes that there is an interval of heightened vulnerability before a major crisis strikes and this window of time should be used for anticipatory actions. However, a clear distinction should be made here between the pre-crisis period induced by a

regime shift on the one hand and the fragility of the institutions on the other hand. Bell (2000:124) has argued that fragility should be seen as relating to the structure of the financial system (and institutions), which in interaction with some exogenous shock materialises as a crisis. Hence, the fragility is rather a feature of institutions or systems rather than an outcome of different forces like the crisis or the run-up to crisis period.

The FFIs proposed in this thesis paper are based on micro-level analysis as opposed to the sector-aggregate concept of FSIs. Hence the value of FFIs relative to FSIs proves to be their higher sensitivity to firm or bank level features as well as industry structure variables. Financial fragility indicators being defined on the micro-level cannot only be used for diagnosis and prediction of individual bank or firm failure, but can be extended to estimate the systemic epidemics as well. Gonzalez-Hermosillo (1999:1) has proved in her extensive empirical research on US and Central-American banks that banking system distress is a function of the same fundamental macro-micro sources of risk that determine individual bank failures. Worrell (2004:6) has suggested that the analysis of FSIs on the aggregate level should be complemented with discussion and examination of indicators for individual institutions. Calomiris and Mason (2000: 32–33) have demonstrated the importance of bank level disaggregated analysis investigating the causes of U.S. Banks failures during the Great Depression in 1929–1933. They proved that the bank level fundamentals and exogenous shocks played a significantly larger role as compared to the pure contagion argument. Also Taylor (1995: 364) claims that financial fragility on the global level is not very usefully thought about in terms of market volatility only, but can best be defined as the collapse of one or more systemically significant firms in such a way as to shake confidence in the financial system as a whole.

In order to measure fragility one needs to define a reference event. The existing studies have used a variety of events – bankruptcy, regulatory intervention and a number of other failure or default definitions, most of them specific in terms of country legislation and enforcement of supervisory practices. In general terms a financial fragility event as defined in the present thesis refers to various circumstances where the bank or a corporate entity is subject to serious threats to continued economic activity, whether due to idiosyncratic problems, external issues or a combination of these. The manifestation of financial fragility also means that the likelihood of discontinued economic activity results in explicit and/or implicit negative implications, such as bad debt, massive sales of financial assets (securities) or tangible assets (e.g. real estate) or other negative spillover effects triggering further failures or increasing uncertainty on the market.

The aim and tasks of the research

The aim of the research is to explore and explain the logic in the behaviour of the indicators of financial fragility whether born on bank or corporation level, and whether related to external or internal triggers or incentives. The four underlying research papers each provide a focused examination of a particular set of research tasks. A short overview of each of these publications with the main research tasks listed is given below.

Paper I: What feeds banks' appetite for risk-entailing portfolios?

This paper explores from the theoretical perspective what motivates banks to boost their risk-entailing portfolios. The paper seeks to discover whether there are bank inherent drivers that lead to extensive risk tolerance under a particular set of assumptions. Excessive risk tolerance is an important trigger of financial fragility and might eventually lead to bank failure.

Banks find themselves under severe pressure to generate profits for investors and demonstrate superior financial performance to third parties – creditors, customers, supervisory authorities and peers. Circumstances where there is asymmetric information and none of the outsiders can fully track bank operations or assess the true value of its assets might lead to short-terminism (Narayanan, 1985) and gains trading. Narayanan (1985: 1470) has shown that if the management has private information regarding the company's decisions, it may have an incentive to make decisions that result in short-term gains at the expense of the long-term interests of the company; however, he demonstrates that the inclination to short-terminism is inversely related to the management's experience, length of contract and the risk level of the profits. Short-terminism may lead to gains trading – a phenomenon where in order to improve the short-term performance indicators a (pre-mature) sale of assets at a higher market than book value, but with considerable potential for further value appreciation, takes place eroding the bank's long-term profit outlook (Dewatripont and Tirole, 1994).

The optimal level of risky assets is found as a function of the risk free rate, the bank funding rate, bank charter value, accounted losses due to premature sales of risky assets and common shock. The bank charter value is seen as an idiosyncratic factor reflecting the bank's potential to earn some extra future profits on risky assets held in the portfolio. For example, private information known about borrowers and the level of specific expertise would enable a bank to earn incremental profits on its customers. The premature sale of an asset for the bank means that it is losing part of the expected future returns on the asset. Such an adverse impact on the asset return if sold prior to maturity is accounted

for by the bank. The higher the coefficient of accounted losses due to premature sales of assets the higher the recognized latent losses for the bank.

Hence, the key question addressed is how all the above listed factors relate to banks risk feeding incentives?

Paper II: Investigating the early signals of banking sector vulnerabilities in Central and East European emerging markets.

This article seeks to answer the following questions: firstly, whether the set of indicators composed of individual bank level financial data, and macro-economic and banking sector structure variables can discover the underlying fragilities of banks in transition, and hence, predict the subsequent distress. Bongini, Laeven and Majnoni (2002: 1026) have suggested that bank fragility estimation in less developed financial systems has to rely on a multiplicity of indicators in order to gather an accurate assessment.

The study covers 17 countries in transition over the years 1996–2003. The data on roughly 300 banks are extracted from the BankScope database (Bureau van Dijk), and the macroeconomic variables are drawn from IFS (International Financial Statistics, IMF) and Eurostat.

Secondly, taking into account the diversities among the CEE countries in terms of advancement in reforms and in the level of economic development, the indicators' performance is measured separately for the more advanced and the less advanced country groups. This approach has to reveal whether and how advancement in banking sector reforms measured using the EBRD banking sector reform index¹ is reflected in the set of indicators working as signals or predictors of bank fragility. Cross-country differences also come into play in the assessment of model in-time and out-of-time predictive performance. All these aspects of cross-country differences in the transition process have not been addressed much in the literature.

The study employs two definitions of bank failure. The first, 'bank distress', denotes a situation where the institution is at elevated risk of default due to high actual or potential loan losses eroding the capital cushion as reflected in the coverage ratio. The coverage ratio is the ratio of equity capital and loan reserves minus non-performing loans to total assets. Banks with a coverage ratio below 1 are exposed to high risk because while their own funds cover the loan losses in the current period, they would not withstand the same magnitude of losses in

¹ The EBRD banking sector reform index provides a ranking of progress in liberalization and institutional reform of the banking sector, on a scale of 1 to 4+. A score of 1 represents little change from a socialist banking system apart from the separation of the central bank and commercial banks, while a score of 4+ represents a level of reform that approximates the standards and norms of an industrialized market economy.

the next period, if the equity level were held constant. The banks with negative or zero equity are labelled as ‘insolvent’.

Finally, the set of explanatory indicators of bank fragility are measured at two different horizons – at the onset of bank distress and a year before the onset of distress. This approach has to reveal whether the behaviour of bank fragility indicators is non-linear during the run-up to distress and eventual insolvency. Gonzalez-Hermosillo (1999:19–20) has divided the life cycle of bank failure into three phases. The first phase marks an expansive growth period, the second phase is characterized by impairment in asset quality and high exposures to risk, whereas in the final phase problems become evident and external assistance might be needed to resolve the problems.

The results from the fixed-effects panel logit model indicate that all categories of variables whether macroeconomic, firm level financials or structural variables turn out to be significant in explaining bank fragility. Macroeconomic variables tend to extract a signal a year ahead compared to most financial variables. Weak liquidity management extracts a signal of fragility; however, the loan-to-assets ratio considered an indicator of credit risk on mature markets turns out to be non-significant in the transition context and more so in the group of less advanced transition countries. This is evidently a property of immature credit markets. The in- and out-of-sample predictions provided relatively encouraging results with distress episodes predicted in seven countries out of the 17 in-sample and in two countries out of the six out-of-sample.

Paper III: Extracting Leading Indicators of Bank Fragility from Market Prices – Estonia Focus

This paper explores the ability of market indicators to assess risk-taking for individual Estonian banks during the transition period. The study covered six Estonian banks – Eesti Maapank, SEB Eesti Ühispank, Eeva Pank, Hansapank, Hoiupank and Tallinna Pank, which were listed on the Tallinn Stock Exchange within the observation period 1996 to 2004. The inherently forward looking, time-varying distance-to-default measure derived from the Black-Scholes (1973) and Merton (1974) option pricing formula was calculated for each of the banks. Distance-to-default measures the distance between the asset value of the bank and its liabilities at any given point in time. The lower the absolute value of the distance-to-default, the higher the risk of default.

The distance-to-default scores, equity values, equity volatilities and default probabilities were examined for each bank and discussed within the context of a chronology of bank events. Finally, for three banks ranked by internationally recognized rating agencies – Hansapank, Hoiupank and SEB Eesti Ühispank – the Granger causality was estimated between the distance-to-default scores and credit ratings. The Granger causality tests showed that there was no significant

causal effect present for Hansapank, whereas for SEB Eesti Ühispank, the two-way causation or the feedback effect was significant at the 10% level. The one-way significant causality from the distance-to-default measure to rating changes was only found for Hoiupank, which was also the only bank of the three, which eventually failed – being acquired by Hansapank.

All in all the results indicated that the distance-to-default score is a reliable and encompassing measure of bank fragility able to capture latent risks ahead of a crisis. However, one should be cautious about market based fragility indicators for low liquidity or thin market shares. The case of EVEA Pank illustrated that the low liquidity of the bank shares distorted the distance-to-default measure providing no consistent information on bank fragility.

The lesson from the study is that in less developed markets it is important to rely on a multiplicity of fragility indicators complementing each other and serving as a cross check for the other evaluations.

Paper IV: Patterns of firm survival in Estonia

The paper looks at which firm level variables are significant in explaining firm survival versus default. Since firm default might be defined in various ways, and this has strong pre-print on research results, two definitions are considered. The first denotes a situation where the firm falls short of the required capital level. This incidence does not have a one-to-one relationship with bankruptcy or other forms of ceased economic activity. The other definition of failure relates to the exit of the undercapitalised firm. The use and comparison of these two complementary definitions of default enables interesting comparisons between *de jure* failure (i.e. capital below the minimum required level) and *de facto* failure or exiting from business. On the other hand, the two definitions of failure help to address the sensitivity of results issue – often a serious problem in event-based studies.

The research explores the empirical baseline hazard curves for both default definitions across the following sectors: construction, manufacturing, real estate and trade and services. The investigation of baseline hazard curves enables to identify the shape of the hazard curve and whether it differs for the two default definitions. Also, the industry comparison helps to discover whether notable cross-industry differences exist in the baseline hazard. Also, all suspect variables for the default prediction are estimated using both failure definitions, which enables to control for the sensitivity of the results and draw conclusions on the differences between the two event definitions.

The paper draws on company data from the Estonian Commercial Registry over the period 1994–2004. The registry contains population data on Estonian firms. Despite a number of exclusions for eliminating noise, the dataset for

analysis remained highly representative of Estonian firms and hence forms a unique basis for a study of this kind.

Evidence confirms the findings from other countries that firms face a higher risk of being distressed or running into default during their start-up period than in later stages. Manufacturing firms are more robust than trade and services companies. As in other countries, firm survival in Estonia is a positive function of sales mark-up, high and stable asset returns, low leverage and a large assets base.

Research contribution

There is a growing body of research on financial stability issues. However, aspects of financial fragility on the bank or corporate level have not been dealt with in broader context. Instead the two disciplines – the single bank or company studies from the perspective of credit risk versus the macro-prudential perspective at sector level – have been developed in parallel, without too many linkages between them. For instance, Worrell (2004:6) suggests that the analysis of FSIs at the aggregate level should be complemented with discussion and examination of FSIs for individual institutions.

One of the reasons behind the prevalence of the macro-prudential view from the financial stability perspective has been the poor availability of micro-level data and especially in the cross-country context. Hence, the macro-prudential literature misses valuable information that gets lost in the sector-level aggregation process. The structural variability across countries – for example, highly concentrated versus highly competitive markets or the presence of outliers might have a significant impact on the results.

The research on the drivers of financial crises in transition economies is scarce even on the macro level (Komulainen and Lukkarila, 2003: 251). Most of the papers exclude transition countries due to the particularities in their economic structures and reform processes or simply because the data is unavailable or not reliable. Another argument for leaving the transition economies aside is that their level of financial deepening and access to capital markets has been considered fairly low for having major spill-over effects to other parts of the world. The exception here has been Russia, as the size of the country determines its importance in world economy and finance (e.g. Huang et al, 2004).

Hence, the empirical papers – papers II and IV help to bridge some of the gap by looking at the cross-country patterns in bank and company distress based on large micro panel-data sets. The micro-econometric analysis in paper IV provides a deeper picture of the determinants of financial sustainability and enables us to account for the firm-level variability and dynamics in the data.

The third paper contributes by examining the distance-to-default measures calculated on monthly stock market data for six Estonian banks to examine the bank risk profile. The market data analysis is highly limited due to poor access to single bank level, high frequency market data. Hence the study fills the void by placing the market based indicators approach in the transition context coupled with a case-by-case analysis and evaluation on the performance of the risk scores on each of the six Estonian banks encompassed in the study.

The contribution of the theoretical research paper (paper I) is in providing arguments that show how the banks might optimise their short-term profits with the cost of long-term profit outlook engaging themselves in gains trading. A number of factors that are part of the bank's objective function or the short-term profit function, such as interest rates, bank charter value and the accounted loss factor of premature sales are looked at in the model in order to see what the impact is of them on the optimal level of risky assets.

The contributions of individual authors

Two out of the four research papers to be defended (paper I and paper IV) were written in sole authorship. Paper II deals with an investigation of banking sector vulnerabilities in Central and Eastern European transition economies and has been written in co-authorship with Dr. David Mayes. The defendant is the first author of this paper and was responsible for setting up the research problem, accomplishing the empirical analysis and writing the draft version. Dr. David Mayes contributed to the literature review and to the discussion of the research results. Dr. David Mayes was also the correspondent author, responsible for structuring and streamlining the paper for submission for conferences and for publication.

Paper III was written jointly with Dr. Yu-Fu Chen and Dr. Michael Funke. Dr. Chen was responsible for the methodology, calculation of the distance-to-default scores and generation of the graphical output. Dr. Funke, the correspondent author, set up the research problem, conducted the literature survey and drafted the structure and main text of the paper. The defendant was the third author of the paper responsible for data collection and preparation, the estimation of the Granger causalities between the credit ratings and distance-to-default measures and drafting the bank case studies and the background section on Estonian banking sector development. All authors were involved in the discussion of the results.

Research methodology and data

Since the aim of the study is to cast light on common and generalized patterns of financial fragility both the theoretical and econometric approaches are warranted.

Paper I employs a quantitative theoretical approach using mathematical optimisation rules under a predefined set of assumptions – decreasing marginal return on risk entailing investments, asymmetric information and short-terminism. The bank objective function is the short-term profit function, consisting of returns earned on safe assets and risk entailing portfolio net funding costs on borrowed and repayable funds. A necessary condition for bank profit maximization is that it meets the first order condition meaning that the first derivative of the bank profit function equals zero at its maximum value. The inspiration for the underlying set up for the model was found from the Obstfeld and Rogoff (1996: 392–394) debt overhang model, which shows how foreign debt effectively levies a tax on the investments from a debtor's country.

Empirical Studies II and IV are analysed using statistical and econometric approaches. Both of these research papers use discrete dependent variable models such as the binomial fixed-effects panel logit model in study II and the clog-log panel data survival model in study IV. The firm-level unobserved heterogeneities (frailty) have been taken into account while estimating the firm hazard models in study IV. Besides the regression approach, some descriptive statistics and graphical interpretations were used to illustrate and complement the empirical analysis. In study IV the empirical survival curves are investigated with a lifetable method based on Kaplan-Meier product limit survivor function.

Paper III employs methodology based on the Black and Scholes (1973) and Merton (1974) option pricing formula for deriving the distance-to-default measure for banks. The causal relationships between the distance-to-default measures and risk ratings are investigated using Granger causality estimations.

There are certainly a number of other factors, which have an impact upon firm or bank sustainability, but these remain outside the scope of this study. Most of these factors relate to issues to do with managerial failure, weak business projects or even fraudulent behaviour. Unfortunately, all these factors are hard to study empirically or generalize, since these are not easy to measure, categorize or compare across a larger number of firms or banks being highly specific to a particular firm or bank or even to a particular failure episode. The most appropriate methodology for investigating idiosyncratic fragilities would be a case study approach. The econometric approaches employed in the empirical studies enable us to account for the unobserved effects or latent heterogeneities present across the firms and banks under study; however, with no explicit demonstration of the impact of these factors.

Empirical data for paper II was downloaded from the BankScope database (Bureau van Dijk) and consisted of yearly series of individual bank level financial variables from 17 CEE countries over the period 1996–2003. The macroeconomic and bank structural variables for the same study are taken from the IMF IFS database and Eurostat.

The third paper draws on Estonian stock market data extracted from the Tallinn Stock Exchange database and bank balance sheet data from the Bank of Estonia, where the dissertation author was working during the time of the study.

Data for paper IV was extracted from the Estonian Commercial registry database covering firm level financial data over the period 1995–2004.

The structure of the Thesis

The present dissertation is based on four separate research papers published by internationally recognized publishers. Hence, the composition of the thesis is aimed at providing linkages between individual publications and serves as an umbrella in order to provide a broader context for the topic under interest – financial fragility in Central and Eastern Europe.

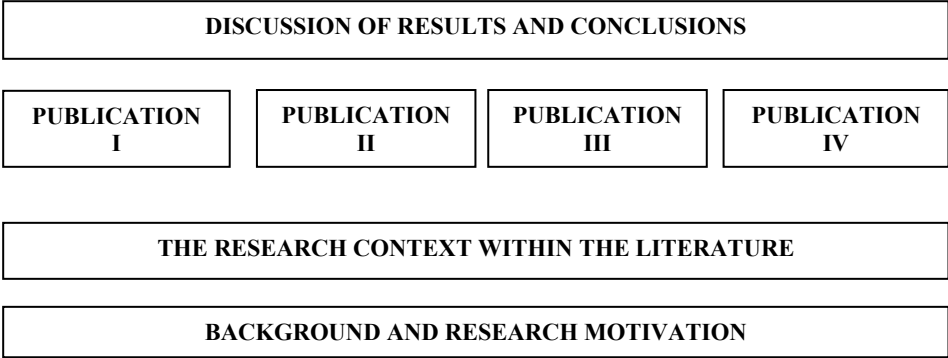


Figure 1. The building blocks of the dissertation structure.

The structural building blocks of the thesis are illustrated in Figure 1 above. The background and motivation for the research provide the reasoning behind the importance and relevance of the research topic in the contemporary research agenda. Understanding the research context within existing literature is critical in order to locate the present study among existing literature on related topics and to explicate the gaps addressed by the research in this thesis. In the final discussions and conclusions, the results on all four publications are discussed, synthesized and key findings and conclusions underlined and summarized.

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Part 1. THE EMPIRICAL AND THEORETICAL BASIS FOR THE RESEARCH

Financial fragility in Central and Eastern Europe

All of the Central and Eastern European transition economies have experienced major changes in their economic, social and political spheres. Due to multiple specific features in the development of these countries, a whole new area of research focused on transition processes has been called into life. Most of the research on transition issues is, however, exploratory and there are few firmly rooted theories at hand.

After the crises in Asia and Latin-America, a plethora of research emerged to investigate the financial systems in these regions and their vulnerabilities to crises (Gonzalez-Hermosillo *et al*, 1997; Hardy and Pazarbasioglu, 1998; Demirgüç-Kunt and Detragiache, 1998, 1999 and others). Although most if not all the transition economies of Central and Eastern Europe have experienced a number of serious incidences of financial distress, the research on these episodes has remained fairly scarce. What can we learn from the experience of transition countries? How do banks and companies survive in such a highly dynamic transition environment? There is still too little research and evidence on these issues.

Although it is often assumed that banking crises in developing countries are intrinsically different to the same in advanced economies, the research so far has provided no definitive empirical answer to this question (Gonzalez-Hermosillo, 1999:10). Bonin and Wachtel (2004: 8) and Bonin *et al* (1998) have discussed financial fragility issues in transition countries including surveys on bank crisis resolution in Russia, China, Poland, Hungary, Czech Republic, Bulgaria and Romania. They claim that institutional and legislative infrastructures play a key role in the early stages of transition, whereas loose regulation has been one of the main triggers behind numerous incidences of bank distress in transition countries. They also stress that a stable macroeconomic environment is a necessary condition for effective financial intermediation and that the macroeconomic consequences of banking crises depend on the depth of the financial system (Bonin and Wachtel 2004: 9). Hence, macroeconomic recovery has been much faster in transition countries with low levels of financial development (Bonin and Wachtel, 2004: 10).

Research on transition has to cope with significant cross-country variances in the content, pace and scope of reforms on the way towards full-fledged market economies. For instance, Bonin *et al* (2005: 51) and Griorian and Manole (2002) have reported significant country and sub-regional differences in commercial bank efficiency across transition economies. This variation can be explained by a wide array of variables including macroeconomic, regulatory,

institutional and financial sector development indicators. In similar way the highly dynamic transition environment implies that the countries are exposed to different paradigms depending on the phase or advancement in transition process. The transition atmosphere is illustrated by Hawkins and Mihaljek (2000: 4), claiming that the revolution in information processing technologies enables skipping of financial development stages, which leads to much faster growth and development than was expected according to the conventional view.

Komulainen and Lukkarila (2003) studied causes of currency and banking crises in 31 emerging markets in Latin-America, Asia, Africa and in Central and Eastern Europe² during 1980–2001. Their panel estimation using the probit model showed a strong link between currency and banking crises in these countries, while the problems in the banking sector were mostly reflected in high private sector liabilities, high public indebtedness and a low lending to deposit ratio. By comparing the financial system pre-and post liberalization periods, they found that indebtedness indicators became more important in predicting crisis during the post-liberalization period, while real variables diminished in significance (Komulainen and Lukkarila 2003: 260, 261). The authors suggest that the indebtedness indicators should receive more attention in future research and be closely monitored by authorities responsible for financial stability. Their study however, does not provide any specific results or conclusions in regard to Central and Eastern European transition countries.

There is very little evidence on market-based indicators in the context of transition economies. However, Männasoo (2006) has investigated the aggregate volatility of the Estonian banking sector share return index using a GARCH analysis. The study revealed that the volatility of the Estonian banking sector share index was not asymmetrical towards a negative shock, which has been observed on mature markets. Also, the expected higher return in exchange for high-volatility shares did not turn out to be significant. Both results explicate the low liquidity and maturity level of stock markets with less fundamentals-based investor control over market volatility. These results have been partly supported by Shields (1997), Ahlstedt (1998) and Hyytinen (1999) in their research on Eastern-European and Scandinavian stock markets. The investors' rational decisions have less impact on emerging stock markets due to large informational asymmetries and less investor experience in newly developed and turbulent trading environments. The results from the Estonian banks stock return index (Männasoo 2006: 299), however, explicated that GARCH-estimated volatilities were higher during the crisis and run-up to crisis period compared to the tranquility period.

Although there has been recent concern about overly turbulent credit growth in transition countries, the study conducted by Egert et al (2006) suggests that in

² Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Russia, Slovenia and Turkey.

most of the Central and Eastern European countries, credit-to-GDP levels have not outpaced the estimated equilibrium levels. They also provide that the much higher credit growth numbers in CEE are the result of initial undershooting in private credit to GDP levels. The country comparisons show that the country closest to the estimated credit-to-GDP level is Croatia, followed by Bulgaria, Estonia, Hungary, Latvia and Slovenia who are near to reaching their equilibrium levels, whereas countries still below the threshold are Lithuania, Poland and Romania. Czech Republic and Slovakia constitute interesting examples with initial overshooting in mid 90s and an eventual decline below their estimated equilibrium levels (Egert et al, 1006:29). The study also provides interesting findings regarding the determinants of credit growth, which turn out to be nominal interest, inflation rate and lending spread as a reflection of financial liberalization and banking sector competition in the 5 CEE countries, while GDP per capita turned out to be a significant explanatory for the Baltic and South-Eastern European countries.

Foreign bank entry and the influence on banking markets in CEE countries were thoroughly studied by Uiboupin (2005). Supported by empirical evidence he shows that the higher penetration of foreign banks helps to improve banking sector stability in four key aspects. Firstly, foreign bank entry is associated with improvement in banking sector asset quality. Secondly, foreign banks are less prone to credit crunch behaviour during distress periods³. Thirdly, foreign banks absorb deposits at bad times and serve as repositories during “flight to safety” periods and finally, the liquidity and capitalization in foreign banks is less volatile over the domestic economic cycles (Uiboupin, 2005: 130–133). Moreover, Grigorian and Manole (2002: 19) and Bonin *et al* (2005: 51) have found strong empirical evidence that foreign ownership is associated with greater bank efficiency in transition countries. Berger (2007: 1969–1971) has conducted a recent study on the determinants of foreign bank penetration comparing the continental “Old Europe” with the transition countries of Eastern Europe – the “New Europe”. He explains the remarkable differences in the share of foreign banking between the “Old” and “New” Europe with net comparative advantages for foreign banks and government explicit and implicit entry barriers. According to Berger (2007: 1970) the foreign bank presence tends to be strongest in these nations of “New Europe” where the removal of state bank domination left a free playing ground for foreign “intruders”.

The research on bank and firm level financial fragilities is a novel field – the more so in a transition context. Each of the four papers comprising the thesis adopts a somewhat different focus on financial fragility whether from the firm

³ De Haas and van Lelyveld (2006: 1944) have provided supportive evidence showing empirically that greenfield foreign banks play a stabilising role in CEE countries keeping their credit base stable in contrast to the domestic banks, which contract their credit during crisis periods.

or bank perspective, and hence, provides new insights and enrichment of the exiting literature in the context of transition economies.

Financial fragility at bank level

Bank fragility issues have been more a subject of empirical than theoretical research, except the literature on bank incentives, which is mostly theoretical, since data availability poses a significant constraint on empirical analysis. Windram (2005: 65) notes that incentive structures, which encourage excessive risk-taking, represent a threat to the stability of the financial system.

The asymmetric information theory (Akerlof: 1970) and principal-agent problem are the theoretical cornerstones behind the analysis of incentive structures. Narayanan (1985) introduced the managerial incentives concept of short-terminism, explaining the decisions aimed at yielding short-term gains at the expense of long-term performance. Windram (2005: 73) however, has argued that not only managerial incentives, but also principal-agent relationship and asymmetric information alone, may lead to more short-term decision making.

An important part of the bank incentives literature investigates the role of deposit insurance, the central bank's role as a Lender of Last Resort and capital rules within banks incentives, claiming that banks incentives became distorted by regulation, eventually leading to a build-up of more risky positions. Gorton and Winton (2002: 88) claim in their extensive literature survey on financial intermediation that most of the literature on bank regulation deals with the paradigm of banking panics⁴, deposit insurance and moral hazard. There is however, no convincing evidence relating deposit insurance with higher moral hazard in the banking sector (Gorton and Winton, 2002: 88).

According to White (2002:146), the potential for moral hazard by banks is ever-present because limited liability creates the incentive for bank owners to engage in riskier activities, in which the bank owners will capture the benefits from the upside outcomes of risky ventures, but their losses from the downside outcomes are limited to their equity stake.

For the purpose of empirical analysis, which aims at defining the fragility factors of a bank, one needs to identify the situations where the fragilities have led to the event – the failure. A proper failure definition enables us to identify and measure those features, indicators or factors that lead to failure.

⁴ Calomiris and Gorton (1991: 112) have defined banking panics as situations where bank debt holders suddenly demand at all or many banks that banks convert their debt claims into cash (at par) to such an extent that the banks suspend convertibility of their debt into cash.

The focused research on financial fragility indicators encompassing a broad range of variables at micro-, macro- and structural level represents a recent trend. Nevertheless, the roots of bank fragility research go back almost 30 years. The first to pioneer the multivariate logit regression analysis on bank failure indicators was Daniel Martin in 1977. His study was aimed at constructing an early warning model expressing the probability of future bank failure as a function of bank financials in the current period (Martin 1977: 249). The study starts with a thorough discussion of the definition of bank failure. He admits that bank failure might not only refer to strictly legal conditions or to a situation where a bank's net worth becomes negative or falls below the prescribed minimum, but also situations where a regulatory agency has initiated a merger (or other corrective action) in order to rescue the bank from imminent failure (Martin 1977: 250). This approach, or using the regulatory intervention as a benchmark for bank failure, has also been used by many later authors – for example, Gonzalez-Hermosillo, Pazarbasioglu and Billings (1997: 298). Demirgüç-Kunt (1989: 2) in his thorough literature review on deposit institution failures uses the term *de facto* failures to denote any regulator-induced cessation of a bank's autonomous operations. Another variant in defining bank failure is to rely on the judgement by supervisory agencies of bank conditions whereby all institutions are divided into problem and non-problem bank categories. The debatable aspect in this approach is the subjectivity in supervisor's assessment of the condition of the bank. A further abstraction as referred to in Martin (1977:254) is to replace the bank failure definition with a more general concept of bank vulnerability. In such a case, the bank is defined as being vulnerable to the extent that it is likely to undergo financial difficulty of any sort, ranging from a temporary decline in earnings to complete failure. The macro-aspect comes into play here, as according to Martin (1977:254), the level of vulnerability has different probabilities of failure depending on the external economic environment. Furthermore, he stresses that bank vulnerability cannot be expressed as a probability of any specific event, since a wide range of possible events are being considered. In light of the above, Martin's definition of failure in his empirical study is not solely an outright bank default or bankruptcy, but also includes supervisory mergers or other emergency measures aimed at resolving imminent failure situations. (Martin 1977: 262).⁵ He employs four broad groups of variables to explain bank failure: (i) asset risk, (ii) liquidity, (iii) capital adequacy, and (iv) earnings. The CAMEL framework (Capital-Assets-Management-Earnings-Liquidity) has later also been extensively used by practitioners in banking supervision area.

⁵ Alternatively Gonzalez-Hermosillo (1999: 24) has used the specific threshold values of bank coverage ratio; in other words, the ratio of equity and loan reserves net non-performing loans to total assets as the measure of individual bank fragility.

The general conclusions from Martin's (1977) study pointed out important implications for further research. He noted that the relevance of each group of explanatory variables varied strongly over the business cycle reflecting the importance of economic variables and sectoral variables explaining bank difficulties. Hence, these early studies of bank fragility and failure have already pointed to the importance of accounting for multiple factors having an impact on bank soundness.

The recent wave in the literature on market based fragility indicators stresses the importance of high frequency market data, such as market prices for debt and equity as a valuable source of early warning signs of fragility (Gropp et al, 2002, Chan-Lau et al, 2004). Gropp et al (2002: 5) have shown that the equity-based distance-to-default measure and subordinated bond spread have highly desirable properties as leading indicators of bank fragility. Namely, that both indicators are complete in the sense that they reflect the three major determinants of default risk – earnings expectation, leverage and asset risk – and they are unbiased in the sense that they reflect these risks correctly (Gropp et al, 2002:5). Their study based on EU banks for the period 1991–2001 revealed that distance-to-default had predictive power as far away from default⁶ as 24 months. Despite the superior performance of market based indicators in fragility prediction, the authors suggest that bank accounting information complements market information rather than substituting it.

Financial fragility at company level

Financial fragility at company level has received less discussion compared to the same about financial institutions, and banks in particular. Mulder *et al* (2002: 3) claim that the impact of corporate balance sheets on the incidence and depth of crises has been subject to little systematic empirical research thus far. Company level research has been seen rather as a micro-centred issue than one of concern from the regulatory and macroeconomic viewpoint. Recently though it has been recognized that company failures might impose a threat to financial stability involving large costs and numerous parties: owners or shareholders, managers, workers, lenders, suppliers, clients, and implicitly also the government (Allen and Wood: 2006: 154, Balcaen and Ooghe 2004: 2, Mulder et al 2002:15, Dimitras et al 1996: 48). Hence, research within the area of corporate failure has been stimulated both by private agents and by government so as to be able to take corrective actions and prevent systemically harmful failures.

Hoshi (1998) has noted that company failures or bankruptcies are more frequently observed in transition countries compared to mature economies and this is obviously not simply a result of inefficiency or lack of demand.

⁶ Fitch/IBCA rating downgrade to below C

Company failures in transition economies are invoked rather by the unstable environment in terms of economic fluctuations, immature regulation and underdeveloped infrastructures. Hence, the large number of bankruptcies in transition economies is likely to be above the economically and socially optimal level, resulting in a portion of production resources remaining underutilized. Hazak and Männasoo (2007) investigated European firm survival patterns using firm financial variables, structural as well as macroeconomic and institutional data. Their research has demonstrated that the firm failure probability in new member states of the European Union is higher compared to the old member states.

Research on predicting firm failure started a couple of decades ago; however, no underlying theory for business failure has been developed so far (Dimitras et al 1996, 487). Beaver (1966) pioneered the line of research that compares and evaluates 30 different financial ratios. Altman (1968) used multivariate discriminant analysis and proposed the well-known Z-score model for predicting corporate bankruptcy. The analysis suggests that an increase in the working capital to assets ratio, retained earnings to assets ratio, profit to assets ratio, market-to-book value ratio and sales-to-assets ratio promote financial strength. Ohlson (1980) was the first to employ a parametric approach (a conditional logit model) for predicting bankruptcy in US firms. He showed that the size of the firm decreases the probability of bankruptcy, while leverage has the opposite effect. Also, firms with good performance measures, such as high profitability and liquidity, were less likely to face bankruptcy. Shumway (2001) argued for survival models, claiming that their performance is superior compared to static logit models, while accounting explicitly for firm survival spells. By applying a discrete data duration model, Shumway (2001) rejects the significance of many of the accounting ratios suggested as relevant for predicting bankruptcy in earlier studies (e.g. Altman 1968, Ohlson 1980). In addition, Shumway (2001) extends the list of covariates using market variables including firm relative market capitalization, past stock returns and the idiosyncratic standard deviation of stock returns. All market-variables turn out to be significant predictors of distress. Walker (2005) combined the discrete duration model and the structural model of Merton (1974), which improved the default prediction for US industrial machinery firms. Most recently the non-parametric, artificial intelligence approaches in corporate failure studies have opened the opportunity to improve failure prediction (see the recent literature survey by Ravi Kumar and Ravi, 2007).

There is a number of failure event definitions to be found from the literature – “business failure” (Balcaen, Ooghe, 2004) or “corporate failure” (Campbell et al, 2005), “firm default” (Walker, 2005), “financial distress” (Altman, 2000), “corporate bankruptcy” (Altman, 1968) and some others, while the explicit definitions vary depending on specific contexts and research interests. On the general level, however, all these definitions aim at explaining the

situations where the company has or is likely to discontinue its operations because of being unable to meet its liabilities.

Along with globalisation, large companies with wide networks have become more systemically important than ever before. On the other hand, increasing competition and industrial consolidation has made the corporate sector more vulnerable to regime shifts – such as a slowing down in economic growth, upsurges in resource costs, interest rate and asset price fluctuations or new regulations. Therefore, the recent theoretical and empirical work on the corporate sector and financial distress (Bernanke and Gertler, 1995; Kim and Stone, 2000) has looked at how firms respond to macroeconomic shocks, and how this response in turn affects financing and investment decisions in the corporate sector, and as a reflection of these decisions, the macro-economy (Sundararajan et al 2002: 25). Mulder et al (2002) have explored the role of corporate, legal and macroeconomic balance sheet indicators in crisis detection across a number of emerging markets in Asia, Africa and Latin-America. The study demonstrated that corporate weaknesses are transmitted through the banking system, and that the corporate balance sheets have a very significant effect on both the likelihood and depth of financial and currency crises.

Hence, the research on company fragility has to focus on both external as well as internal factors that have impact on firm sustainability. In short, financial fragility denotes a company's susceptibility to failure whether called upon by internal or external factors.

Early warning literature

The Asian crisis and collapse in Latin-American banking sectors brought along an increase in early warning literature. Literature surveys are provided by Abiad (2003), Gaytán and Johnson (2002), Bell (2000), Worrell (2004) and others. Most of the research on early warning systems (EWS) is aimed at early detection of the signs of currency or banking crises or both – so called twin-crises. EWS has two key components – early warning indicators and the methodological approach enabling identification of crisis or pre-crisis situations in their early phases. The methodologies range from a non-parametric signal extraction approach (Kaminsky *et al* 1998, Kaminsky, 1998) to the most common regression analyses (Frankel and Rose, 1996; Berg and Pattillo, 1999; Bussiere and Fratzscher, 2002) up to the most recently applied artificial intelligence models – a recent review on a broad range of statistical and intelligent techniques on bank and firm bankruptcy prediction is provided by Ravi Kumar and Ravi (2007).

Ades, Masih and Tenengauzer (1998) suggested the GS-WATCH framework for predicting financial crises in emerging markets. Their framework relies on a set of nine macroeconomic stability indicators analysed using three

different methodological approaches. Subbaraman, Jones and Shiraishi (2003) put forward the Damocles index consisting of ten leading macroeconomic indicators for the early detection of financial crises. Edison (2000) develops a composite financial crisis indicator consisting of eighteen macroeconomic variables. Abiad (2003) proposes a Markov regime-switching approach employing macroeconomic as well as capital flow and financial fragility indicators estimating the crises in five Asian countries. This is only a tiny sample from the volume of papers written on early warning issues. Worrell (2004:16) has summarized the challenges of EWS, suggesting that available techniques for financial soundness assessment either quantitative or qualitative have to be used in combination to offer the best reliability of the framework.

EWS is mostly about building up a framework that makes use of the interaction between a set of early warning indicators and methodological approaches in order to come up with good prediction and applicability. The comparison of early warning systems becomes complicated, since the chosen composition of signal variables and the set of methodologies applied varies to a great degree and depends on the context.

The objective of the current dissertation is not to propose any specific framework for early warning of financial distress, but rather focuses on explaining the financial fragility patterns in transition economies investigated at single bank or company level.

Financial fragility and the related terminology

Financial fragility is defined as a micro-level concept, denoting the vulnerability of an individual institution, whether a bank or a company, to external pressures and risks. The opposite term – financial soundness refers to the resilience of an institution to withstand negative effects. In this way financial soundness promotes the sustainability of an individual institution as well as the system as a whole. Bell (2000:124) has argued that financial fragility should however be viewed in relation to the structure of the financial system (and institutions), which in interaction with exogenous shock may give a cause for a financial crisis. Allen and Wood (2006: 155) claim that financial instability, a serious cause of a financial crisis, can be latent rather than apparent. Hence, if financial fragility becomes widespread or massive across the number of banks or companies the threat of an outburst of financial crisis soars.

The concept of financial stability is pre-dominantly understood in the context of systemic financial crises and macro-level instabilities. Schinasi (2004: 8) defines financial stability in terms of its ability to facilitate and enhance economic processes, manage risks and absorb shocks. He also stresses that financial stability has to be considered as a continuum, changeable over time. Allen and Wood (2006: 159–160) define incidents of financial instability as the

episodes in which a large number of parties, whether households, companies, or governments, experience financial crises which are not warranted by their individual behaviour, and where these episodes exert severe adverse macro-economic effects. They define financial stability as a state of affairs in which an episode of financial instability is unlikely to occur.

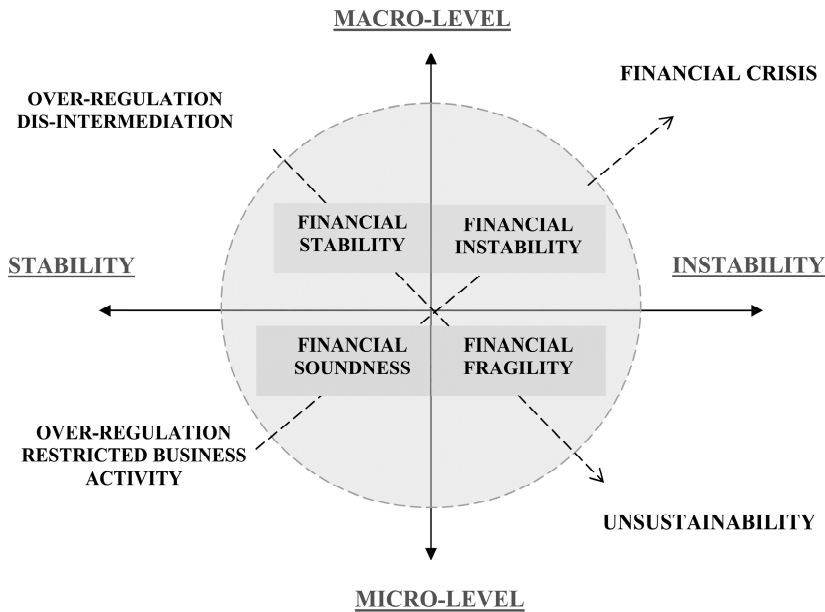


Figure 1. The concepts of financial fragility and financial (in)stability (Author’s illustration)

Figure 1 above illustrates the above discussed core terms on the stability-instability axis both in the micro-and macro perspective. The shaded circle marks the range within which the sustainability on the individual institution level or the financial stability on the system level can be maintained. The extreme values on the stability-instability axis that remain outside the circle pose a serious threat for the institutions or the financial system as a whole. Not only instability but also overprotected financial system stability is a concern. The latter tends to occur in over-regulated environments with restrictions on competition and economic freedom. Gonzalez (2005: 1181) shows empirically that high regulatory restrictions increase banks’ risk-taking incentives and probability of banking crisis by reducing banks’ charter value. The episodes of market de-regulation and liberalization as well as the transition from planned economies to a free market environment have provided ample evidence that an

overly protected environment may create latent problems that surface after the removal of the restrictions (Demirgüç-Kunt and Detragiache: 1998, Eichengreen and Arteta: 2000, Pesola: 2001, Bonin and Wachtel: 2004, and others).

Financial fragility in the context of crisis transmission

Financial fragility issues are strongly related with systemic financial crises. For instance, Gonzalez-Hermosillo (1999:1) has proved in her extensive empirical research on U.S and Central-American banks that banking system crisis is a function of the same fundamental macro-micro sources of risk that determine individual bank failures.

Pesola (2001:3) claims that financial crisis is the joint product of financial fragility and an external shock. Whether the crisis will take place or not depends on the combined effect of the two factors as shown in the simple matrix below (Table 1).

Table 1. Crisis probability (Pesola, 2001:3)

Financial fragility	Shock	
	Weak	Severe
Low	Unlikely	Possible
High	Possible	Likely

The role of financial fragility in the crisis transmission framework and how the crisis is channeled through the parts of the financial system is summarized on Figure 2 showing the vicious circles of financial system breakdown. There are two strongly interrelated wings – the credit channel and the liquidity channel wing. A rush of problems can start from either channels – depending on whether the initial adverse event hits the real economy or the financial sector first. For instance, a trade shock mostly exerts an initial impact upon the real sector or companies closely related to this particular trade channel. Declining demand leads to the deterioration of the company’s financial position. Whether the company is going bankrupt or is able to survive depends on the strength of its financial position as well as managerial capabilities, the diversification of its business lines and its network of suppliers, creditors and clients. Whether there are negative spill-over effects from the corporate sector to the financial sector depends on the fragility of the corporate sector at the time of the shock as well as on the competence of banks in screening the credit applicants and strength in absorbing the increasing credit losses from the existing portfolio. The vicious circle could be discontinued e.g. if the banks are able to absorb the shock

without cutting back their lending to such an extent that this would lead to a credit crunch phenomena or by means of a cut-back in credit supply precipitates a further decline in demand along with propagated uncertainties on the market.

In the worst scenario, a credit channel shock will be transmitted into the financial sector being propagated by the liquidity channel. For example, under high uncertainty – a run to safety or run to liquidity takes place. Market participants demand liquidity in exchange to less liquid financial assets – this in turn leads to a drop in the value of these assets – further feeding uncertainty and increasing demand for liquidity. The banks or other financial intermediaries with a significant portion of their assets placed on capital markets suffer significant losses due to falling prices (Allen and Gale, 2004: 746). Deteriorating bank financials could be prevented if the soundness of the institutions would enable them to absorb the losses and survive. Otherwise, the deteriorating financial position of the banks together with high uncertainty may send a warning signal to depositors, who would run to the bank to withdraw their deposits. Deposit runs or bank panics have a strong contagious effect and at that point; it would be unlikely that the vicious circle could be stopped without public intervention.

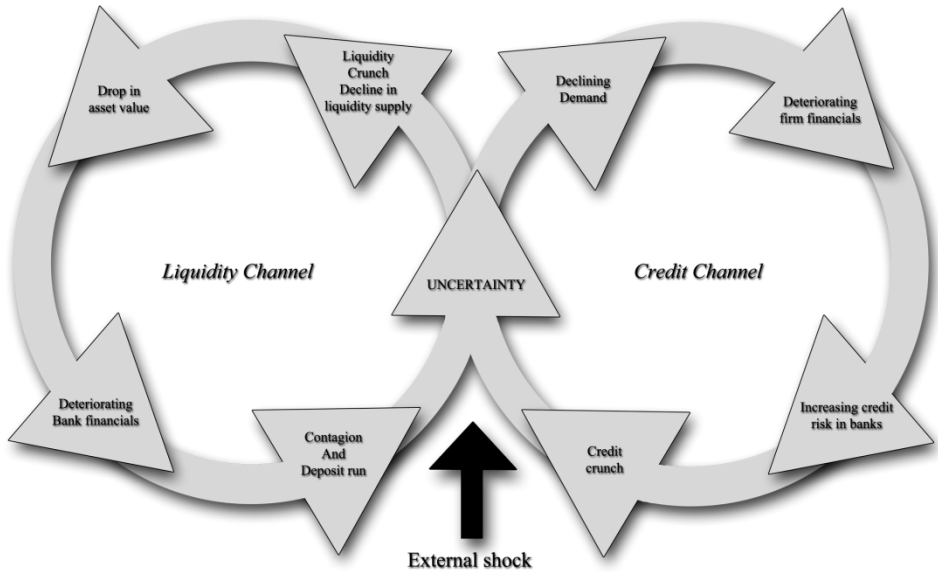


Figure 2: Vicious circles (Author’s illustration)

The key question in every node of the vicious circle is whether the shock is transmitted or not. Here the fragility of the institutions becomes critical. The

higher the fragility of the institutions, the higher is their responsiveness to the shock and the stronger the role in financial crisis transmission mechanism.

Since the vicious circle of financial crisis transmission is a self-reinforcing process comprising different stages that are determined by various factors, a complete understanding of the triggers of the financial crisis process would require a detailed analysis of individual manifestations of financial crises. For instance, the triggers of a credit crunch are expectedly different from the triggers of a liquidity black hole (Morris and Shin, 2004), although eventually both interact and reinforce each other. The sources of financial crisis need to be thoroughly studied in all its aspects in order to come up with early alerts well ahead of problems growing over head.

Part 2. PUBLICATIONS

Männasoo, K.
What feeds banks' appetite for risk-entailing portfolios? –
International Research Journal of Finance and Economics, 2008,
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Männasoo, K., Mayes, D.
Investigating the early signals of banking sector vulnerabilities in Central and
East European emerging markets – Financial development, integration and
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EXTRACTING LEADING INDICATORS OF BANK
FRAGILITY FROM MARKET PRICES –
ESTONIA FOCUS

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EXTRACTING LEADING INDICATORS OF BANK FRAGILITY FROM MARKET PRICES – ESTONIA FOCUS

Abstract

Banking reform has proved to be one of the most problematic elements of economic transition in central and Eastern Europe. Therefore the paper considers the development of the Estonian banking sector and derives individual banks' fragility scores during transition. To this end we use option-based tools and equity prices to estimate distance-to-default measures of banks' distress probabilities. Overall, the results suggest that market indicators are moderately useful for anticipating future financial distress and rating changes in transition economies. The implication for an effective supervisory framework is to use a plurality of risk scores when assessing bank vulnerability.

JEL Code: E44, E58, G21.

Keywords: banking, financial stability, bank fragility, options, Estonia.

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1. Introduction

The number of countries experiencing banking problems has increased dramatically in recent years, with banking crises striking industrial, developing and transition economies alike.¹ Furthermore, the high costs and macroeconomic disruptions caused by such banking crises have become a matter of increasing concern in the international financial community. Effective supervisory capabilities are thus vital to limit the adverse impact of these crises. Therefore, the potential for early warning models of bank vulnerability to serve as supervisory tools has been the subject of a sustained research effort in recent years.

From the existing literature on banking crises two distinct lines of thought on the phenomenon have emerged. The first views banking crises as being related to the macroeconomic business cycle and triggered by sudden changes in perceived aggregate risk. In other words, banks fail through exposure to the same common shock. The second considers banking crises to be random events, unrelated to changes in the macro economy. For example, banking crises can arise as a result of self-fulfilling expectations, as modelled by Diamond and Dybvig (1983), among others. They consider a model with two equilibria, with the “bad one” leading to a self-fulfilling, sunspots-based liquidity crisis in the banking sector. Allen and Gale (2000) and Freixas et al. (2002) model theoretically the idea of contagion arising from the spreading of bank failure through interbank exposures with potentially destabilising consequences for the economy as a whole.²

The qualitative banking and currency crisis literature, beginning with Kaminsky and Reinhart (1999), typically focuses on a combination of events in order to define what constitutes as the beginning of a banking crisis. These may include: (i) bank runs that lead to a closure, merger or takeover by the public sector of one or more financial institutions; and (ii) in the absence of runs, the closure, merger, or takeover of one or more banks or large-scale government assistance to prevent a potential bank run.³

The theoretical and qualitative literature raises the empirical question of how to measure banking fragility or banking crisis precisely. Can the complexity of a crisis be captured by a single indicator? In view of this, our objective is to develop a quantitative fragility score that could predict a banking crisis, and thereby ensuring that less time is devoted to defining the crisis itself.

This paper is composed as follows. In Section 2 the restructuring of the Estonian banking sector during transition is briefly reviewed. The distance-to-default measure is constructed in Section 3. In Section 4

¹ Caprio and Klingebiel (2003) provide a list of 117 systemic banking crises that have occurred in 93 countries since the late 1970s. The paper also provides information on 51 borderline and small (nonsystemic) banking crises in 45 countries. Systemic banking crises, in their definition, are those in which much or all of the banking capital in the country is exhausted. These might sound like rare events, but crises have actually occurred so frequently, in so many countries that they must be considered a global policy issue. According to Caprio and Klingebiel (2003), Estonia experienced systemic banking crises from 1992 to 1995 and a borderline banking crisis in 1998.

² A survey of theoretical models of systemic risk in banking markets is provided in De Brandt and Hartmann (2000).

³ Recently, Demirgüç-Kunt and Detragiache (1998, 2001, 2005) have combined the qualitative approach with a limited number of quantitative criteria.

comprehensive case studies are conducted in order to evaluate the merits and practical usefulness of the methodology with respect to actual Estonian market data. To the best of our knowledge, we are the first to analyse the development and risk of Estonian banks with a dataset of similar quality. The timing and information content of the distance-to-default measures are critically evaluated in section 5. In Section 6 conclusions, as well as a number of policy implications, are presented.

2. Estonian Banking Sector Development and Restructuring During Transition

This section provides a brief overview of the unprecedented transformation of the Estonian Banking system during the transition process of ten years. Initially Estonia inherited a Soviet-style monobank system under which specialised state banks serviced specific sectors of the economy. After regaining the independence in August 1991 Estonia immediately launched the transition process and began developing a modern two-tier banking system with the central bank as its core.⁴ In June 1992 the Estonian national currency, the Estonian EEK, was re-introduced under a currency board system and linked to the Deutsche mark (EEK 8 = DEM 1).⁵

At the beginning of the transition period Estonia had a very liberal policy toward the licensing of new commercial banks. A large number of banks, it was thought, would provide the lending needed to support the emerging private sector.⁶ Little thought was given initially to the implications of this policy with respect to bank soundness and supervision. Therefore, many banks established in early years of transition lacked the necessary expertise and capital base for running a sustainable banking business.

The first systemic full-blown banking crisis to hit Estonia surfaced in 1992-1993. A large proportion of the newly founded credit institutions were not in a position to withstand the numerous stresses and strains associated with such a crisis. Among the most critical precipitators of such bank distress are: pre-monetary reform deposit withdrawal; high costs of funding; weak banking skills and mismanagement; small, but overly risky, loan portfolios; as well as poor accountability and inexperienced supervision.⁷ In the wake of the crisis, more than one-fourth of the banking system went bankrupt and the number of institutions fell sharply, from 42 in 1992 to 24 at the end of 1993. Among other things, Eesti Pank suspended operations of the country's three largest banks. Tartu Commercial Bank was closed and liquidated, the Northern Estonian Bank and the Union Baltic Bank were merged

⁴ During the transition period Estonia earned the nickname "Tiger of the Baltics". When taking-off Estonia has got two things right. The first is openness to foreign trade which is strongly associated with economic growth. The second is competition from foreign firms, whether at home or in export markets, sharply raising productivity.

⁵ The currency board system means that Eesti Pank lending to commercial banks is only possible if there are sufficient excess reserves beyond the amount of foreign exchange reserves necessary to match the currency in circulation. This has indeed been the case in Estonia, since reserves expanded strongly since 1992.

⁶ Contrary to several CEE countries (e.g. Poland, Czech Republic, Hungary), the newly incorporated Estonian banks did not inherit a huge stock of bad loans from the Soviet era.

⁷ For example, in the first years of the transition from central planning to a market-based system banks continued to use the old Soviet Gosbank chart of accounts. In Estonia banks were required to use IAS accounting and reporting requirements for the first time in 1995, although the stronger banks have begun doing so already in 1993.

into one entity and recapitalised. The new entity was launched under the name North Estonia Bank. The increase of the minimum capital requirements from EEK 500,000 to EEK 6 million in October 1992 triggered solvency problems and finally the liquidation of eight small credit institutions in early 1993. In March 1993, ten small rural banks were merged into a new bank Eesti Ühispank (Union Bank of Estonia). Despite this market shakeout, however, stability was not achieved. In 1994 the largest bank at the time, Eesti Sotsiaalpank (Social Bank), experienced liquidity problems and failed in May 1995.

The beginning of a new era in Estonian financial sector development was marked by the enactment of the Law on Credit Institutions in December 1994, which increased the central bank's supervision and enforcement capabilities and incorporated the standards of relevant EU laws. The subsequent years put the banks under severe pressure, forcing weaker players out of the market. The plan for improvements in prudential requirements was particularly challenging - within just four years the bank's own funds were required to reach the level of 5 million ECU, i.e. the level that most European banks adhere to. While the strongest market players were able to accumulate the required capital with new issues on stock market and reinvestments, the weakest had only two options: merge or close down. Stringent capital standards were aimed at consolidating the banking sector, thereby ensuring the improved efficiency and competitiveness. By the end of 1996 the number of banks had shrunk to a more reasonable, although not scale-efficient, level of 13 institutions.⁸

On 2 April 1997, as a reflection of the strain being exerted on Asian financial markets, the central bank issued a statement warning that increases in foreign funding would open banks to adverse spillover effects from international capital markets. The statement also underlined the extra risks borne by overheated real and financial markets. To counter these developments various measures aiming at long-term stability and crisis prevention were introduced.⁹ In practice though the timing of the restrictive actions coincided with a liquidity squeeze in the banking sector and impaired the institution's capability to withstand distress.

Financial turmoil on emerging Asian markets also led to spillover effects in Estonia. On "Black Thursday", 23 October 1997 Tallinn Stock Exchange index (TALSE) plunged by 15%. Two months later TALSE had lost 54% of its pre-crash level and 62% of the peak level recorded on 29 August. Although the Estonian economy recovered relatively smoothly and GDP in 1997 increased by 10.5%, banks did not have time to recover fully from the stock market crash prior to the Russian crisis in 1998. Contraction in foreign funding, further devaluation of securities portfolios, impairment in credit portfolios, as well as restrictions in regulation led to substantial changes in the banking market.

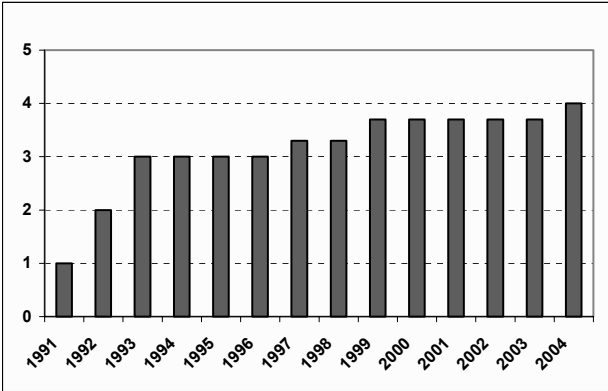
⁸ Tang et al. (2000, pp. 34-36) have estimated the fiscal and quasi-fiscal costs of the first and second systemic Estonian banking crisis (1992-93 and 1994-95) to be about 1.9% of GDP.

⁹ The measures to prevent the expansionary developments include (i) an increased capital requirement of 10% instead of 8% as of October 1997; (ii) governmental reserves were transferred from domestic banks to foreign banks; (iii) an additional liquidity requirement of 2 % as of November 1997 and 3% as of December 1997 was introduced; (iv) effective July 1997 the risk category of claims to local governments was increased from 50% up to 100%; and (v) in December 1997 the general banking reserve requirement of 5% risk weighted assets became effective.

The crisis again took on a systemic scale in the second half of 1998 when five banks faced severe difficulties. These banks constituted 38% of all banking sector assets and approximately 40% of aggregate deposits. All of these banks were either strongly exposed to securities market and/or had a substantial share in projects related to Russia. The aggregate share of nonperforming loans reached the highest level a year after the culmination of Russian crisis, in mid 1999.

By the beginning of 1998 it was clear that a market of less than 1.5 million inhabitants was not large enough to sustain eleven separate banks. The much-needed consolidation and restructuring of the overly fragmented banking sector decreased the number of banks again almost by half. Hitherto widely spread branch networks were cut down and replaced by electronic channels (ATM, internet banking etc). Cost-efficiency and prudent management turned out to be the key factors in surviving the market distress. Two of the largest banks; Hansapank and Eesti Ühispank, covering more than 80% of market; were taken over by foreign investors.¹⁰ Three banks Eesti Maapank, EVEA pank and ERA Pank were forced to close down and two banks - Eesti Hoiupank and Tallinna Pank - were taken over by other domestic banks. One bank – Eesti Forexpank - was temporarily acquired by the central bank. Finally, in April 2005 the sole bank publicly listed on Tallinn stock exchange – Hansapank - was fully overtaken by its strategic investor Swedbank. The financial strength, know-how and expertise of Scandinavian banks concerning risk management, marketing, product development and technology have been essential for the stable development of the Estonian banking sector.

Figure 1: EBRD Index of Banking Sector Reform for Estonia



Note: “1” means little progress beyond establishment of a two-tier system; “4+” corresponds to standards and performance norms of advanced industrial countries’ provision of full set of banking services. 0.3 decimal points have been added or subtracted for “+” or “-” ratings.

The gradual improvement in banking sector environment outlined above is also evident from the EBRD banking sector reform index, which demonstrates very low values in the pre-monetary reform period

¹⁰ Hansabank was acquired by Swedbank (60% stake) and Ühispank by SEB (32% stake).

and the increase in index from 3 at the end of 1996 up to 4 by the end of sample period in 2004. Thus the Estonian banking system has enjoyed a considerable improvement in competence, sophistication, and credibility.¹¹ The tightened regulatory environment has eliminated banks unable to survive in the longer term and has helped the Estonian banking sector approach the optimum banking size and structure.

A more detailed insight in to the development of the Estonian banking system over the period 1992 – 2004 is presented in Table 1. The table reveals the number and distribution of the total number of banks in Estonia as well as the process of consolidation within the banking industry during the run-up to a more open banking-sector environment.

Table 1: Selected Financial Sector Indicators for Estonia (End of Year)

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
# of Banks	42	21	21	15	13	11	6	7	7	7	7	7	9
# of Private Banks	38	17	21	17	12	11	5	6	7	7	7	7	9
# of State-Owned Banks	2	2	1	1	1	0	1	1	0	0	0	0	0
Concentration index C2 (%)	N/A	31.20	36.05	38.71	39.92	47.03	84.80	84.00	83.00	83.33	83.96	83.29	79.10
Concentration index C4 (%)	N/A	57.10	60.00	65.00	68.00	77.00	98.00	98.00	97.36	97.56	97.65	97.84	97.90
Total Assets, EEK billion	4.78	6.39	10.38	15.53	22.94	40.50	40.99	47.07	57.81	68.41	81.69	98.80	133.58
Capital Adequacy (%)	N/A	18.10	13.40	14.50	12.40	13.60	17.00	16.10	13.17	14.39	15.30	14.50	13.40
Foreign Ownership (%)	N/A	N/A	14.73	28.96	33.41	44.20	60.72	61.60	83.60	85.44	85.93	86.12	86.03
Stock market capitalisation to GDP in %	N/A	N/A	N/A	N/A	15	20	11	37	34	27	34	42	51
Stock market turnover to capitalisation in %	N/A	N/A	N/A	N/A	29	167	161	18	19	14	15	18	17

Notes: C2 and C4 gives the share of total assets of the two and four largest banks, respectively. Capital adequacy on solo basis adheres to the Basel I definition i.e. bank own funds divided by risk weighted assets. EUR = 15.6466 EEK. Data source: Bank of Estonia Financial Sector Statistics.

In the next section a method that provides timely information about the contemporaneous state of banks is constructed in order to provide the supervisory agencies with a useful tool for analysing current banking conditions.

¹¹ The tight currency board system, with its fixed exchange rate serving as a nominal anchor, helped contain the effects of the banking crises by giving credibility to the conduct of monetary policy.

3. The Distance-to-Default Measure of Bank Fragility

The aim of this section is to provide a relatively concise, yet self-contained, overview of the asset value model and the time-varying distance-to-default measure which underpins the bank vulnerability analysis for Estonia.¹² Bank fragility refers to the uncertainty surrounding a bank's ability to service its debt and obligations.

Exploiting the option nature of equity and making the simplifying assumptions of the Black and Scholes (1973) and Merton (1974) option pricing formula, the time path of the market value of total assets, proxied by a geometrical Brownian motion, follows the stochastic process

$$(1) \quad \ln V_T = \ln V + \left(r - \frac{\sigma^2}{2} \right) T + \sigma \sqrt{T} \varepsilon_T,$$

which gives the asset value at time T (maturity of debt), given its current value V , and its standard deviation σ .¹³ The standard normal random component is denoted by serially uncorrelated $\varepsilon_T \sim N(0,1)$ and the risk-free interest rate is r , if contingency claims are applicable in a risk-neutral world. The default point on the expiry day ($t = T$) is defined as $\ln V_T = \ln B$ where B is the (constant) amount of debt.¹⁴ The distance from the default point D can then be expressed as:

$$(2) \quad D = \ln V_T - \ln B = \ln V + \left(r - \frac{\sigma^2}{2} \right) T + \sigma \sqrt{T} \varepsilon - \ln B.$$

It is useful to normalise the distance-to-default by the firm's volatility, σ . Some manipulation leads to the normalised distance-to-default

¹² Chan-Lau et al. (2004), Crosbie and Bohn (2003) and Gropp et al. (2002, 2004) have used the same framework. Crouhy et al. (2000) and Saunders and Allen (2002) offer accessible introductions to asset value and credit risk models. Duffie and Singleton (2003) provide an authoritative introduction to and comparison of asset value models.

¹³ The credit risk model considers a firm which is financed through a single debt and a single equity issue. The debt comprises of a bond which matures at time $t = T$. An unobservable process describes the firm's value $V_t = E_t + B$, where E_t and B ascribe the outstanding equity and debt values, respectively. At time T , the firm's debt matures. At that time either $V_T > B$ will hold, or it will not. In the former case, the remaining value of the firm $E_T = V_T - B > 0$ will belong to the equity holders. In the latter case, the firm defaults on its debt and $E_T = 0$. Combining the above possibilities, a general expression for the value of the firm's equity at $t = T$ is $E_T = \max(V_T - B, 0)$. Looking at this formula, it is precisely the payoff of a European-type call option on the firm's value V_T with strike price B . Accordingly, the Black and Scholes (1973) formula for the value of a call option can be applied and investors' implicit views of risk can be extracted from stock prices.

¹⁴ Whereas the relevant measure of the bank's assets is their market value, the book value of debt is the pertinent measure because that is the amount the bank's must repay.

$$(3) \quad DD = \frac{D}{\sigma\sqrt{T}} - \varepsilon = \frac{\ln\left(\frac{V}{B}\right) + \left(r - \frac{\sigma^2}{2}\right)T}{\sigma\sqrt{T}}.$$

The DD risk score can be viewed as a cardinal ranking relative to default risk, instead of the more conventional ordinal rankings offered by rating agencies.¹⁵ Since the random component of the bank's asset returns is log-normally distributed, the corresponding expected default probability in terms of the cumulative Normal distribution N is calculated as

$$(4) \quad prob = N\left[-\frac{\ln\left(\frac{V}{B}\right) + \left(r - \frac{\sigma^2}{2}\right)T}{\sigma\sqrt{T}}\right].$$

The smaller DD is, the higher the default risk is. DD is a metric indicating how many standard deviations the equity holders' call option is in-the-money. The smaller the distance-to-default DD , the more likely a default is to occur. To put it differently, the probability of default is precisely the probability of the call option expiring out-of-the-money. Gropp et al. (2002) have demonstrated that the option-based distance-to-default metric DD is a complete and unbiased indicator which gives an accurate indication of bank distress. DD gives a signal of increased fragility (i) if the bank's asset values decline, (ii) if asset volatility increases, and (iii) if leverage increases. Supervisors may therefore use DD as a screening device to monitor banks.¹⁶

However, things are not quite as simple as this would suggest. In terms of practical implementation of the model, a shortcoming of the asset value model is that the asset value is not observable. This makes assigning values to it and its volatility problematic. Still, the model provides a useful tool for modelling credit risk and bank vulnerability as it is straightforward to show that analytical solutions for both unobserved variables can be calculated from the firm's equity market value, E , and its volatility, σ_E , using the system of equation below:

$$(5) \quad E = V N(d_1) - B e^{-rT} N(d_2),$$

¹⁵ Reality, as usual, is more complicated. For extended frameworks producing default probabilities for more complex capital structures including equity warrants, convertible bonds, preferred equity, and common equity, see Bensoussan et al. (1994, 1995). We do not endeavour to cover this territory as the corresponding data is not available for Estonian banks.

¹⁶ On the contrary, the firm's stock price generally does not satisfy (ii) and (iii) due to the call option implicit in equity.

$$(6) \quad \sigma_E = \left(\frac{V}{E} \right) N(d_1) \sigma,$$

$$(7) \quad d_1 = \frac{\ln\left(\frac{V}{B}\right) + \left(r + \frac{\sigma^2}{2}\right)T}{\sigma\sqrt{T}},$$

$$(8) \quad d_2 = d_1 - \sigma\sqrt{T},$$

Solving backwards yields the asset value V , asset volatility σ , and the option-based DD metric.¹⁷ With these results in mind, we wish to measure market participants' beliefs concerning bank fragility in Estonia during transition, as distilled from equity prices.¹⁸ The results are presented in Section 4.

4. Gauging Option-Based Fragility Scores for Estonian Banks During Transition

We will now apply, on a monthly basis, the method of analysis proposed in the previous section to Estonian banks during the transition period. We shall first review the main data that are available and that have been used in our work. The main challenge when dealing with transition economies is the availability of long time series.

To obtain results on bank fragility we use available monthly data for the transition period for all Estonian banks except one (Eesti Forexpank, since 21.01.1999 renamed Optiva Pank and since 29.12.2000 Sampo Pank) publicly traded on the local stock exchange, either for the whole sample period or some sub-period.¹⁹ It should be noted that mergers and acquisitions and bank failings that occurred midway through our sample period caused some banks to drop out of the data set. Balance sheet data are taken from Bank of Estonia financial statistics, banks public reports and Tallinn Stock Exchange news releases. Daily market values of the equity of banks are from Tallinn Stock Exchange. Equity volatility has been approximated by the volatility of daily stock market returns over the preceding month. We make the common assumption that the maturity of the debt equals one year.

We first calculate the distance-to-default fragility scale DD and the corresponding expected default probabilities for each sampled bank and for each time period t , using equity market and balance-sheet

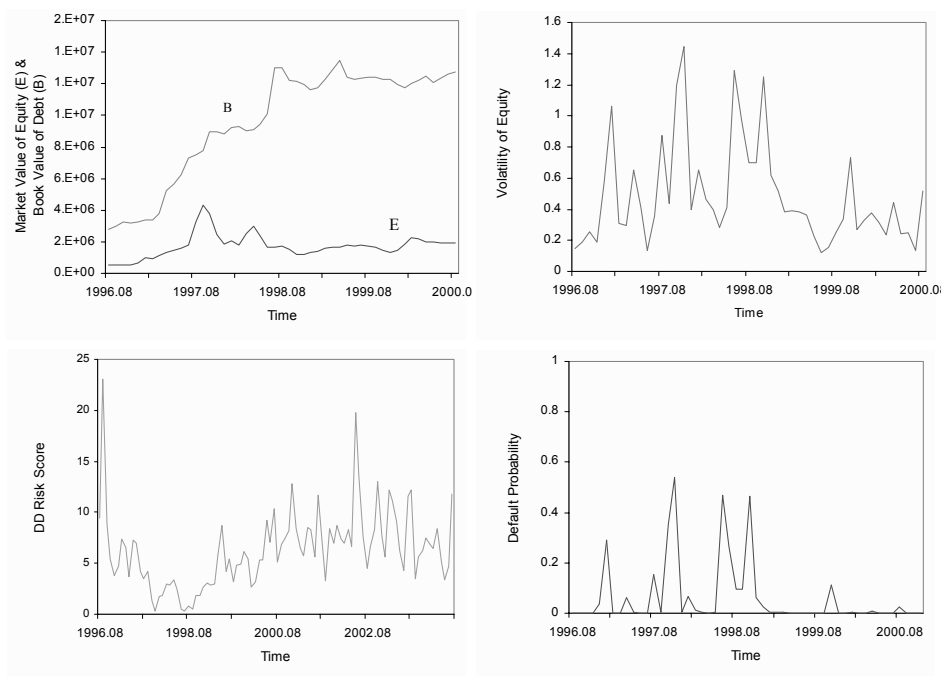
¹⁷ In equation (5) the option value of equity is computed by "European options". Alternatively, one might also compute the market value of equity by "American options" which can be exercised anytime before T . The quantitative results, however, show only minor differences: the DD values are higher in terms of American options but the difference is small. The corresponding results are available upon request.

¹⁸ Alternatively, the banking crisis literature has also suggested to use the share of non-performing loans as a measure of bank distress. Unfortunately, for many countries (including Estonia), such data are available only at low frequencies.

¹⁹ The choice of the sample period is based on data availability. The DD risk score requires that banks are publicly traded and therefore the value of equity is market determined. Prior to the opening of the Tallinn stock exchange in May 1996, data is not available.

data. Our sample represents all relevant financial institutions.²⁰ The time dimension of the dataset is constrained by the unavailability of longer stock price series for Estonian banks. Despite this restriction, several of the banks selected faced insolvency, mergers and failure-like episodes during the sample period. The results for the distance-to-default score DD and the corresponding expected default probabilities are illustrated in Figures 2 to 7 below. A concise overview over historic evolutions is also provided.

**Figure 2: The Behaviour of the DD Risk Score and Underlying Components for SEB Eesti
Ühispank (Union Bank of Estonia)
(Sample Period August 1996 to August 2000)**



Notes: The data after August 2000 is ignored since σ is very small due to the takeover by SEB (Svenska Enskilda Banken).

The images for Eesti Ühispank, in Figure 2, indicate that the DD measures and default probabilities have fluctuated with substantial peaks and troughs. SEB Eesti Ühispank's primary strategic objective

²⁰ Although the banks in our sample are few in number, they account for around 80% of the banking sector's total assets over the sample period. Further information about the market shares is provided in Appendix A.

over the sample period was to establish a secure position among the largest universal banks in Estonia with ambitions to extend its operations to neighbouring Baltic States and Saint-Petersburg.²¹

The bank's risk measures indicate the period of increasing risk peaking in the aftermath of the stock market crash in October 1997. This period leading up to increased fragility was marked by rocketing share prices and high volatility. Within one year the Ühispank share price had grown eightfold. On 11 September 1997 Ühispank received the investment level rating BBB- from IBCA. This reinforced the euphoria and Ühispank subsequently issued subordinated debt, not just with the objective of meeting the increased minimum regulatory capital as of 1 October 1997 but mainly for funding expansionary strategies. In September 1997 the bank released the news that it would enter the Russian market by opening a bank in Saint Petersburg. Shortly after this decision the spillover effects from the Asian crisis reversed the stock market and volatilities increased. Uncertainty spread rapidly and market participants became more cautious regarding the downside risk of the stock market and risk of financial instability escalated.

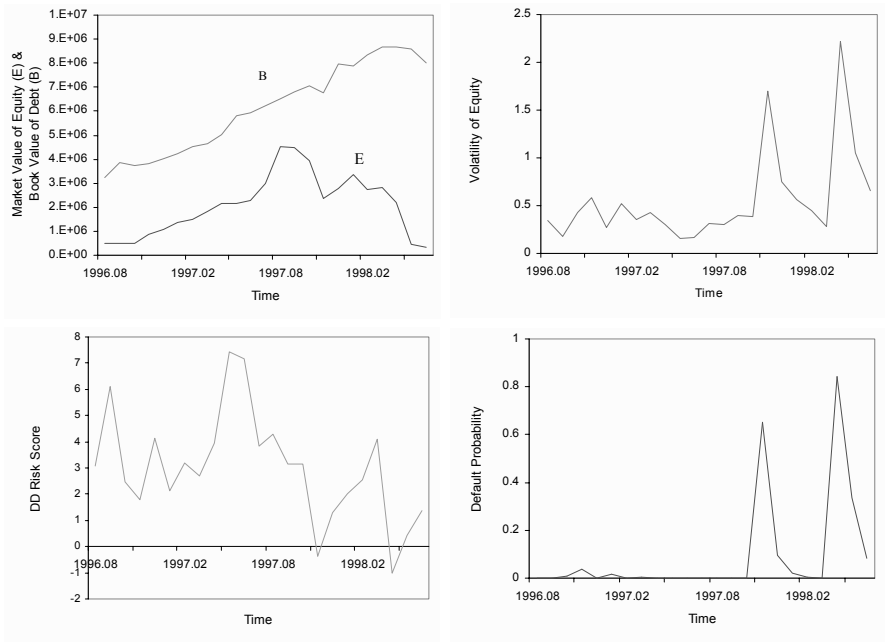
In November 1997 Eesti Ühispank issued a profit warning. In addition, the distress of Eesti Maapank was shaking the Estonian banking sector stability, culminating in the closure of the bank in June 1998. Consolidation became critical in order to survive. Eventually, on 22 April 1998, after long and stressful negotiations Ühispank and Tallinna Pank completed a merger. Ühispank declared losses from October 1998, which summed up to a total loss above 290 million EEK as of the end 1998, leading to a further deterioration of confidence. In this situation the SEB proposal to acquire 32% of Ühispank share was received with great relief. This move restored confidence in the bank. Moody's confirmed the Ühispank pre-crisis ratings, but indicated a positive outlook for the bank. Standard & Poor issued the bank with a rating of BB which put the Estonian banking sector risks on an equal level with Hungary, Poland and Slovenia, but higher relative to other Baltic states due to the vulnerability of the economy from external risks. On 12 October 1999 SEB increased the strategic ownership to 50.15%. The consecutive takeover on 27 October 2000 finally increased the SEB ownership to 95%. By the end of 2000 SEB full ownership resulted in the termination of trade in Ühispank shares on the Tallinn Stock Exchange.

The results for Hoiupank are provided in Figure 3. Hoiupank was the successor of the Soviet regime savings bank, inheriting a broad depositors base of domestic households. After the merger with Tööstuspank in September 1996 its share of corporate customers rose significantly and Hoiupank achieved the position of second largest market player until Ühispank and Põhja-Eesti Pank merged in May 1997. At the same time, Hoiupank successfully issued debt (400 million EEK) on the international capital markets and received a 160 million EEK subordinated loan from Credit Suisse First Boston. On 26 September 1997 Moodys issued the bank with the long-term credit rating Baa2 and the financial strength rating D+. The prospects for attracting further foreign funding were better than ever. On 30 September 1997 Hoiupank acquired FABA bank in Moscow and declared its intention to invest 30

²¹ Ühispank was Estonia's third largest bank after Hansapank and Hoiupank until May 1997 when it surpassed Hoiupank and has since retained position of second largest bank.

million EEK over the next 18 months. In this environment the Bank of Estonia announced its intention to sell its share in Hoiupank to the present strategic investor Swedbank, whose holding was already 12.5%. The transfer of whole Eesti Pank stake to Swedbank would have increased the Swedbank holding up to 25%. In view of this announcement, the Hoiupank management indicated their reluctance to cooperate with Swedbank and “share the cake”. The bank management launched the initiative to issue 3 million shares to Hoiupank staff. Flourishing stock market and good access to external liquidity offered a favourable platform for the realisation of the plan. In order to finance the purchase of shares the Hoiupank staff members limited company applied for a 6 months credit from Japanese Daiwa bank. The loan was collateralised with Hoiupank shares, but Hoiupank management also agreed to offer a Hoiupank guarantee to the credit. This decision turned out to be a fatal mistake.

Figure 3: The Behaviour of the DD Risk Score and Underlying Components for Hoiupank
(Sample Period August 1996 to June 1998)



At the beginning of October 1997 Bank of Estonia declared its intention to sell the rest of Hoiupank shares to Swedbank. Hoiupank staff had to hasten the issue project, but it was already too late. The stock market crash at the end of October and the consecutive Russian crisis drove Hoiupank shares below the minimum value necessary to cover the collateral of the Daiwa loan due in April 1998 and the

need for consolidation became acute.²² In January 1998, Hoiupank and Hansapank had already released a letter of intention for merger. The merger was to serve mutual interests – Hansapank was in need to increase the share capital and Hoiupank foresaw the troubles arising from the Daiwa affair. The merger contract was finally signed in June 1998 and Bank of Estonia approved the merger in July.²³ Trade in Hoiupank shares was terminated at 15 July 1998.

The dating of the *DD* scores and default probabilities in Figure 3 seems reasonable and reflects the impacts of the stock market crash in October 1997 and the Daiwa affair in spring 1998. *DD* started to decline already in June 1997 picking up the steadily increasing volatilities at the outset of stock market crash. As expected, the *DD* (default probability) decrease (increase) in the wake of the Daiwa affair was rather pronounced with a two month lead. The results therefore indicate that the option-based measures are indeed able to anticipate future rating changes.

The results for Eeva Pank are illustrated in Figure 4. Eeva Pank was the smallest bank publicly listed on the stock market, enduring poor liquidity and high volatility. The market value of EEEA Pank remained moderate even at the peak in Tallinn Stock Exchange. On average the bank covered 2% of the market share over the sample period. EEEA Pank initially advocated the provision of a broad service range.

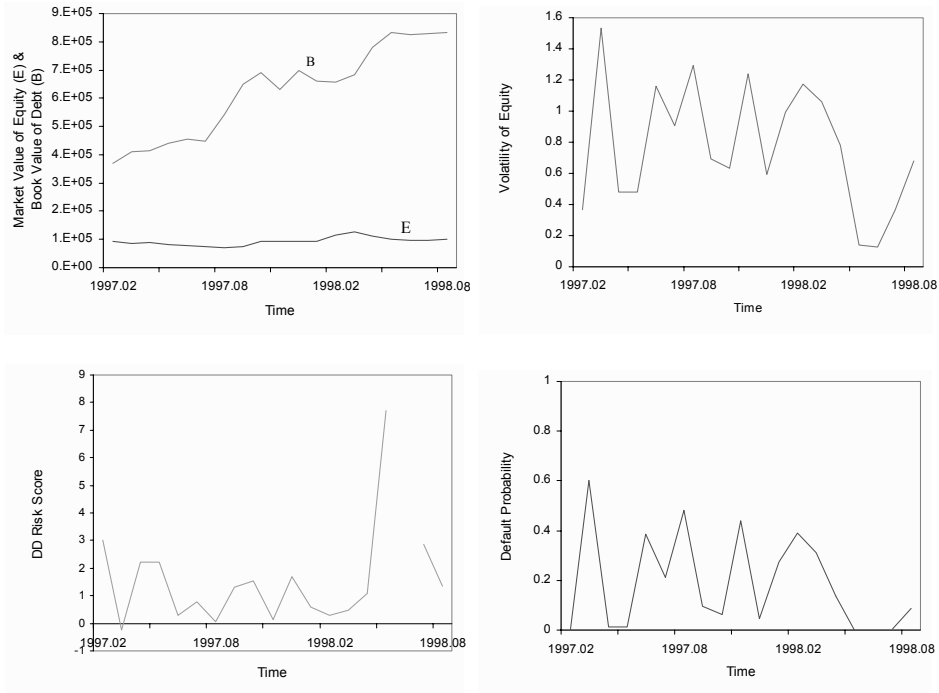
This strategy, however, turned out to be costly for a small bank, hindering operational efficiency. For attracting customers the bank offered favourable deposit rates and “tailor-made” services for corporate customers, mainly small and medium size enterprises whose access to credit in larger banks was more complicated. In 1997 along the upturn in stock market the bank saw opportunities for improvement in profitability. As of 23 April 1997 the bank council continued to see healthy profit growth for 1997 from 13 million EEK up to 15 million EEK. This profit increase had to be achieved with enforced activity on capital and money markets. In 1997 the bank purchased Russian government bonds for 146.8 million EEK. This fatal investment accounted for almost 20% of the bank’s assets. Bank reports remained optimistic until the third quarter of 1997. On 5 November 1997, however, the management announced a decrease in profitability due to the declining market value of the trading portfolio. The shortage of liquidity in the aftermath of stock market crash in October 1997 forced the bank to increase deposit rates substantially. Unlike the market leaders, EEEA Pank did not have access to international capital markets or syndicated credit-lines. Therefore, news of ERA Pank’s desire to acquire 33% of EEEA bank shares in December 1997 was welcomed. At 18 August 1998 ERA Pank acquired about 33% of EEEA Pank shares and replaced one board member. After the devaluation of the Russian rouble in August 1998, Eeva Pank’s balance sheet weakened substantially and it emerged that the bank was unable to fully satisfy the legitimate claims of its customers. However, weaknesses in risk management

²² At 20 May 1998 Hoiupank declared potential losses from the Daiwa loan reaching up to 225 million EEK.

²³ The case of Hoiupank shows that cronyism does not necessarily stop at Estonia’s border. In 1997 several senior managers took out a \$ 1.5 million foreign loan, using the bank’s equity as collateral, in order to buy – for themselves – part of the bank’s new equity offerings. The scheme was derailed by the stock market crash. The managers were fired as the bank merged with a competitor.

and loan assessment systems and poor corporate governance were also important contributors to these problems. At that point, EVEA Pank was effectively insolvent. Therefore, the bankruptcy procedure against EVEA Pank was launched at 2 October 1998.²⁴

Figure 4: The Behaviour of the *DD* Risk Score and Underlying Components for Eeva Pank
(Sample Period February 1997 to August 1998)



Note: The σ variable for June 1998 is so small that the numerical program terminated the *DD* calculation.

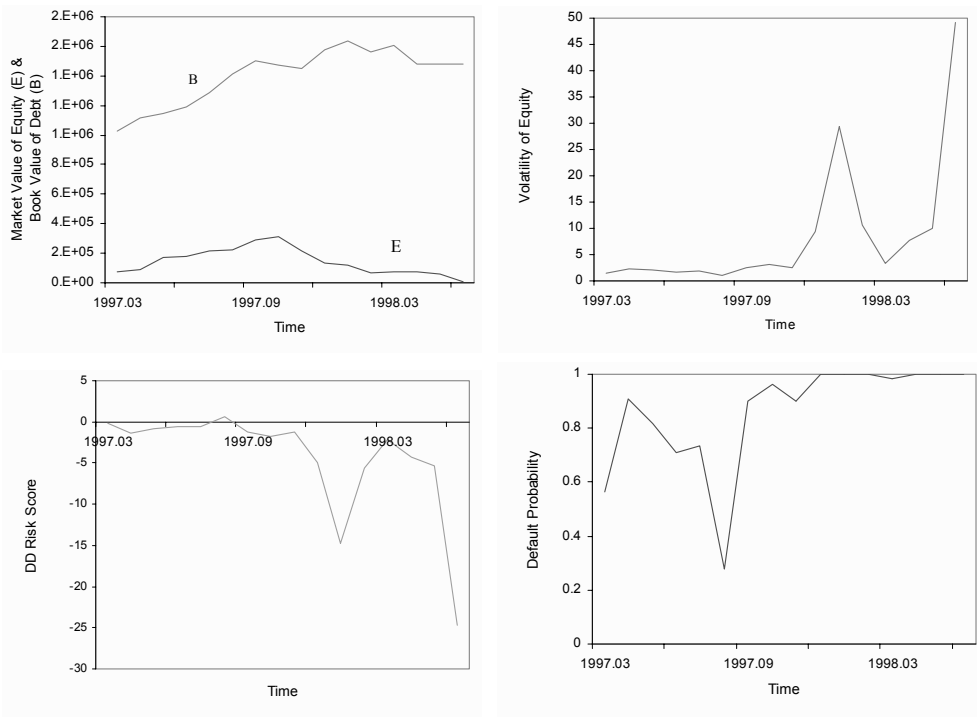
There is no denying that although insolvency was foreseeable, the *DD* risk score and the corresponding default probabilities failed to indicate the likelihood of EVEA Pank to fall into crisis in summer 1998. A fairly concentrated shareholding structure and noisy measurement of share process in thin markets led to this result. Thus, the results provide evidence against the notion that market price data are uniformly reliable.

The results for Eesti Maapank are available in Figure 5. Eesti Maapank was instituted in 1995 by way of a merger of four smaller local banks, which were unable to meet the minimum capital adequacy

²⁴ The bankruptcy proceeding was initiated because equity capital of EVEA Pank was less than ECU 5 million. In

requirement at the end of 1995 or further down the road. The mergers took place as follows: 20 November 1995 the merger of Virumaa Kommertspank and Rahvapank; 11 December 1995 merger of Virumaa Kommertspank and Keila Pank and 2 January 1996 merger between Virumaa Kommertspank and Maapank. On 10 May 1996 the shareholders of the merged institution decided to name the bank Eesti Maapank. The audited financial statements of the merged institution as of 1995 indicated losses of 27.3 million EEK. Although the institution fell short of the prudential ratios, the Bank of Estonia was eager to offer the new entity more time to establish a well-functioning bank. The expected synergies, however, never emerged and the new institution was undermined by opportunism and internal conflicts. In May 1997, after long negotiations EBRD agreed to acquire 19% of bank shares. At the same time Swedfund granted Maapank a 7 year maturity subordinated loan of 24 million EEK. These developments were of significant help for the undercapitalised bank. Further optimism emerged along with the stock market boom.

Figure 5: The Behaviour of the DD Risk Score and Underlying Components for Eesti Maapank
(Sample Period March 1997 to June 1998)



addition, EVEA Pank did neither meet the capital adequacy ratio nor the established reserve requirement.

Losses stemming from weaknesses in risk management and loan assessment systems and poor corporate governance could be offset, the bank believed, by speculative trading on bull markets. While the bank's trading portfolio was of negligible value at the beginning of 1996, the value at the end of 1997 was already 500 million EEK outnumbering the bank own funds more than seven times. In September 1997 Maapank even announced its intention to list its shares on Tallinn Stock Exchange, but the subsequent developments scuppered this plan.

Maapank initially managed to hide its true losses in the aftermath of Asian crisis, but at the beginning of 1998 insiders were already aware that the bank was technically insolvent and its operations were dependent on overnight money market liquidity. Short-term borrowing was the only way the bank could meet its liabilities and reserve requirements. On 9 March 1998 an audit of Coopers & Lybrand discovered hidden losses of 192 million EEK not accounted for in bank financial statements. From April of that year Maapank encountered difficulties in securing funding from the money market and therefore the bank failed to meet reserve requirements. On 8 June 1998 Bank of Estonia terminated Eesti Maapank's banking licence and bankruptcy procedures were opened on 16 June 1998. All in all, the bank was kept going for six months by implicit government support before half-hearted regulators finally decided to force Maapank into bankruptcy. The low *DD* scores and high default probabilities illustrated in Figure 5 accurately capture the high-risk bank and anticipate that the tightening of prudential requirements would prove fatal for Maapank.²⁵

The behaviour of the *DD* risk score and underlying components for Hansapank are depicted in Figure 6. Hansapank is Estonia's biggest financial institution. Hansapank has been Estonia's most successful bank throughout the transition period. Hansapank assumed the position as market leader by the end of 1994 and has successfully defended this position ever since. In December 1995 Hansapank became the first Estonian bank to be listed on the Helsinki stock exchange. It was also, in October 1994, the first bank to receive a loan without government guarantee from the EBRD.

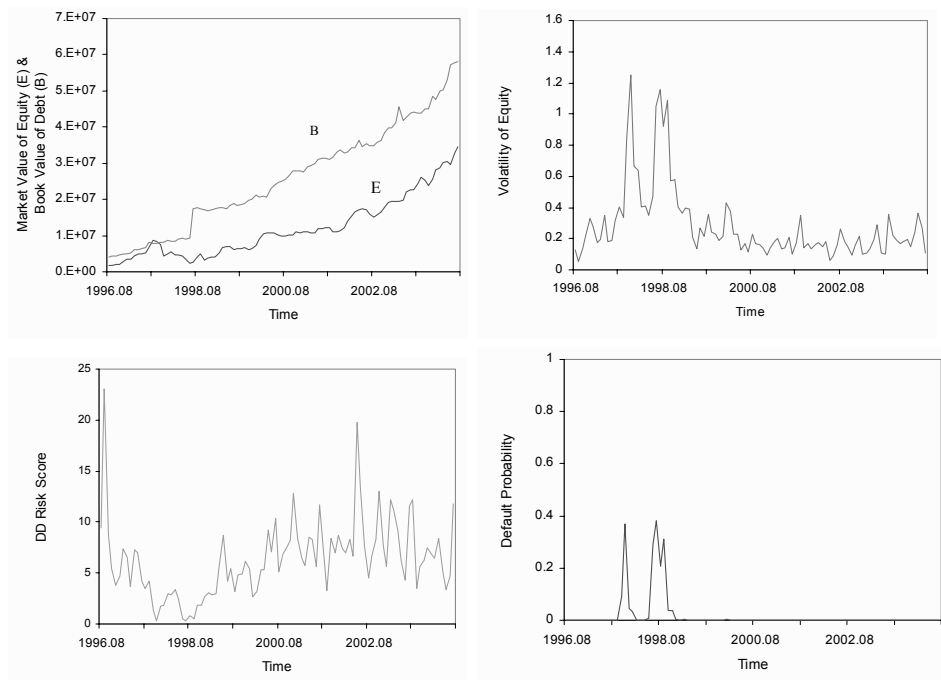
Hansapank was the first bank to acknowledge the constraints of the domestic market. As early as Spring 1996 Hansapank acquired a bank in Latvia and by the end of 2001 Hansapank was represented in all of the Baltic states.

After the stock market peak Hansapank experienced liquidity shortages, coinciding with the first signs of the imminent Asian crisis in September 1997. On 1 September 1997 the executive board of the bank made a proposal to enlarge the Hansapank capital base in order to fund expansionary strategies in Baltic region. On 13 October 1997 an extraordinary shareholder meeting decided to enlarge the bank capital according to the following schedule: 5.5 million shares before 28 February 1998; 1 million shares before 11 October 1998 and 1 million shares toward Hansapank employees before 11 October 2000. The subsequent stock market plummet just ten days later rendered this plan unattractive. In order to overcome the funding constraints and address the medium term strategic objectives Hansapank

²⁵ Their shares were not listed, but traded on the OTC market. Therefore the market was rather thin and highly volatile.

proposed a merger with Hoiupank in January 1998. The merger, however, was only finalised half a year later, in June 1998, after Hoiupank eventually realized its financial impairment in the aftermath of Asian and Russian crises. Moody's reacted to the merger by downgrading Hansapank long term rating from Baa2 to Baa3.

Figure 6: The Behaviour of the *DD* Risk Score and Underlying Components for Hansapank
(Sample Period August 1996 to July 2004)

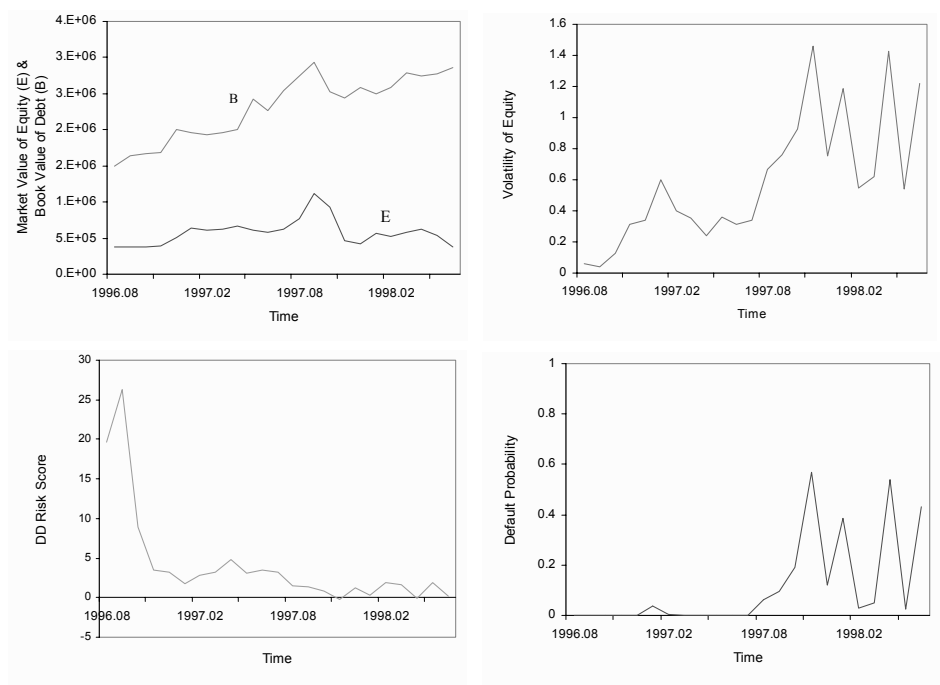


Further tensions grew in tandem with the Russian crisis. The closure of Maapank cultivated serious mistrust towards banking sector. After the devaluation of the Russian rouble in August 1998, Hansapank obtained a DM 10 million subordinated loan in September 1998. In the wake of Russian crisis the Swedish banks SEB and Swedbank discerned the opportunity to acquire Estonian banks. On 29 September 1998 Swedbank and SEB publicly confirmed the SEB sale of all Hansapank shares to Swedbank. As a result the Swedbank share in Hansapank rose to 48.7%. Although Swedbank claimed its long-term objective was to hold only 25-35% of Hansapank shares, it increased its ownership further and finally in April 2005 Swedbank bought up the minority shares and achieved full ownership.

In view of EU accession the struggle for improved efficiency became even more important. The small market limitation had to be compensated with improving cost-efficiency and regional expansion. In 2003 Hansapank entered the Russian market with a leasing subsidiary. In March 2005 Hansapank acquired the Kvest bank in Moskow. In November 2005 Moodys upgraded the bank's financial strength rating up to C+ and gave a positive outlook on the bank's prospects.

How does *DD* react to these developments and, through *DD*, what types of changes in bank fragility can be captured? *DD* measures in Figure 6 clearly demonstrate the turmoil in stock market in Autumn 1997 and the subsequent distress related to the Russian crisis in the second half of 1998. The *DD* fragility indicator declined 3-4 months prior to the outbreak of stock market crash, and preceded the first manifestations of the Russian crisis; the Hoiupank Daiwa loan affair; one month ahead and the Maapank failure two months ahead. In this sense, *DD* for Hansapank can again be considered to be a forward-looking indicator.

Figure 7: The Behaviour of the *DD* Risk Score and Underlying Components for Tallinna Pank
(Sample Period August 1996 to June 1998)



Finally, the calibration results for Tallinna Pank are summarised in Figure 7. Tallinna Pank's strength was good corporate governance. In mid-1996 the bank succeeded in issuing subordinated debt to

Swedfund and to a Nederland Development bank FMO, besides it received a 12 million DM credit line from EBRD. These and subsequent foreign capital injections enabled Tallinna Pank to enter the neighbouring markets in Latvia and Lithuania. By the end of 1996 Tallinna Pank acquired 20% of Latvian Saules Banka and instituted a leasing subsidiary in Riga. A year later a leasing business was also founded in Lithuania.

During the financial turmoil of autumn 1997 markets for liquidity were squeezed. In December 1997 the bank cut its profit outlook of 1997 by 22.7% but nonetheless the outlook was brighter. In that same month the bank received a 10 year maturity subordinated loan from the EBRD, which helped to strengthen the bank's capital base. The bank decided to remain an independent bank and refused to accept the Ühispank merger proposal.

The situation, however, worsened at the onset of the Russian crisis in Spring 1998 and the need for consolidation became acute in order to survive in the hostile banking environment. Tallinna Pank was seen as the desired partner. In March 1998 Tallinna Pank received three proposals for mergers – from Investeermispank, Ühispank, and Hansapank. As Investeermispank was considered too small and Hansapank was already in negotiations with Hoiupank, the most reliable option turned out to be Ühispank. On 22 April 1998 the merger between Tallinna Pank and Ühispank was finalised.²⁶

The *DD* measures pick up the increasing default risk since July 1997, i.e. three months ahead of the stock market crisis. Contrary to its larger competitors, however, Tallinna Pank's *DD* score did not improve during the first six months of 1998, i.e. during the short tranquillity period between the stock market crash and outbreak of the Russian crisis. The default probabilities remained at a significantly higher level compared to the pre-crash period until the takeover acquisition in mid 1998.

Prima facie, the results of the Estonian case study appear to indicate that the banking crises were triggered by idiosyncratic and common shocks. Market revaluations occurred rapidly, and exhibit cross-bank patterns consistent with reasonable inferences. Furthermore, the risk score differences across banks also indicate that news about one bank did not cause investors to make inappropriate inferences about the conditions of other banks.²⁷ The next section evaluates the timeliness of market valuations in comparison to credit rating risk scores for Hansapank, Hoiupank and Ühispank. We are forced to conduct this exercise on this subset of banks for which we have rating information.

5. The Timeliness of the *DD* Risk Score Changes versus Credit Rating Migrations

There is indeed considerable debate about the merits of option-based fragility indicators. This section therefore intends to provide an analysis of the informational content and timing of alternative fragility indicators. In addition to the *DD* risk score, we look at the information content of credit ratings (*R*)

²⁶ At 22 July 1998 Tallinn Stock exchange terminated the trade of Tallinna Pank shares.

²⁷ This result seems to reject the possibility that bank investors routinely engage in "pure contagion" inferences about all banks.

and compare them with the *DD* measure.²⁸ Our aim is to detect whether there exists a significant link between the market assessment, as measured by *DD*, and the rating agencies' decisions to revise a given rating.²⁹ Does rating agencies' access to unique private information permit earlier identification of changes in bank condition? Since the assessments differ, it would be surprising if they collected exactly the same information at exactly the same times.

We have converted the monthly history of credit ratings of each sampled bank base on Moody's and Standard & Poor's ratings and converted every alphabetic rating into a numerical value in order to make it comparable with the distance-to-default measure. We opt for a nonlinear conversion in order to reflect the fact that rating changes tend to be associated with increasingly larger changes in default probabilities when they take place at the lower end of the rating scale.³⁰ More specifically, every grade has been transformed into the value of the historical default frequency as observed by Estrella (2000). The resulting grades are given in Table 2.

Table 2: Conversion of Alphabetic Ratings into Numerical Values

Moody's	Standard & Poor's	Fitch	Average One Year Default Rates	Numerical Grade
A1	A+	A+	0.00015	1
A2	A	A	0.0002	1.3
A3	A-	A-	0.00035	2.3
Baa1	BBB+	BBB+	0.0012	8.0
Baa2	BBB	BBB	0.00135	9.0
Baa3	BBB-	BBB-	0.00305	20.3

In order to assess the usefulness of *DD* in a systematic, operational manner, we use Granger causality tests. The Granger causality approach to the question of whether a variable x causes a variable y is to see how much of the current x can be explained by lagged values of x and then to test whether lagged values of y improve the fit. The variable x is said to be Granger-caused by y if the lagged variables of y

²⁸ A chronology of rating migrations for Hansapank and Ühispank is provided in the Appendix B. Hoiupank has only experienced two rating readjustments: to Baa2 at 26 September 1997 and to Baa3 at 29 May 1998. The presence of government guarantees complicates the process of interpreting market assessments. If de facto or conjectural government guarantees blunt investors' risk exposure, clear evidence of *DD* risk score changes may be difficult to find because they believe that the government will insulate them from losses. In Appendix B we therefore also provide support ratings where available.

²⁹ A number of studies have addressed the issue of whether equity data can usefully supplement numerical ratings in the US. Krainer and Lopez (2001) find that stock market information can help forecast downgrades in the supervisory ratings assigned to commercial banks. Gunther et al. (2001) find that stock prices provide useful predictive information even when taking into account past supervisory ratings. Bongini et al. (2002) have analysed the performance of alternative indicators of bank fragility in the East Asian countries during the years 1996-1998. Please note that numerical supervisory ratings from the Bank of Estonia are not available over the entire sample period and therefore cannot be used as a benchmark for banks' soundness.

³⁰ In particular, the equity market is likely to be more sensitive to information about troubled, low-rated banks with high potential for failure.

are statistically significant. If not, then y does not Granger-cause x . Note that feedback is possible; x Granger-causes y and y Granger-causes x .³¹

There are many ways in which to implement a test of Granger causality. One particularly simple approach uses the autoregressive specification of a bivariate vector autoregression for x and y . Technically a F -test can then be conducted to test for Granger causality. The test results for our historical sample are provided in Table 3.

Table 3 provides a very mixed picture. It appears that Granger causality runs one-way from the distance to default measure (DD) to rating changes (R) for Hoiupank. For SEB Eesti Ühispank two-way causation (feedback) is indeed the case at the 10% level, while no causal effect can be detected for Hansapank. Neither market indicators nor rating scores cause each other; consistent with the hypothesis that both indicators are quite different. The analysis thus reveals that no one screen consistently outperforms the alternative measure in flagging higher-risk banks. Our results therefore indicate that market and ranking assessments complement one another quite well. Ranking agencies may obtain private information that is not available to market analysts. On the other hand, market analysts may be more forward-looking, making market assessments better predictors of future changes in bank condition.³² In other words, optimal vulnerability forecast would be based on both information sets.

Table 3: Pairwise Granger Causality Tests

Bank	Obs.	Lags	Null Hypothesis	F -Statistic
<i>Hansapank</i>	93	3	DD does not Granger cause R	0.71 (0.54)
			R does not Granger cause DD	0.02 (0.99)
<i>Hoiupank</i>	19	3	DD does not Granger cause R	4.60 (0.02)
			R does not Granger cause DD	1.01 (0.42)
<i>SEB Eesti Ühispank</i>	39	9	DD does not Granger cause R	2.23 (0.06)
			R does not Granger cause DD	1.98 (0.09)

Notes: (i) The probability values are given below the F -statistics in brackets. (ii) Before coming to actual estimation, it is prudent to take a look at the time series characteristics of the data. A model in levels with integrated variables can display serious distortions in the test statistics and the Granger causality tests become even theoretically invalid. Pre-testing using unit root (ADF) tests leads us to difference all $I(1)$ variables. (iii) A caveat of the approach is that Granger-causality tests are sensitive to the choice of lag length. In a first step, we have estimated the appropriate lag lengths via the BIC information criterion. If it turns out that there is remaining autocorrelation, then the lag length is increased and a Hendry-type testing down procedure takes place until no trace of serial autocorrelation can be found. (iv) In order to avoid losing observations at the beginning of sample period due to missing rating assignments before September 1997 the banks have been given risk grade equivalent to historical average default probability of unrated banks about equal to rating Baa3 or BBB-. This approach has been used by FDIC in scoring U.S banks. The arbitrarily given risk grades for observations pre September 1997

³¹ Although it is natural to test for so-called Granger causality, the term is a misnomer since it has nothing to do with causality in the more common use of the term.

³² To be valuable, the DD market indicators need not be superior to ratings. They just have to add a new perspective or dimension that helps to provide a more complete picture of a bank's financial soundness.

are also supported by the fact that according to the new Basel framework (option 1) the unrated banks attain risk scores one category less favourable than the sovereign of incorporation. Since September 1997, Estonian Sovereign rating was equal to Baa1, so the unrated banks risk score roughly equal to Baa3 is in principle consistent with this concept.

We close this section with a word of caution. While the evidence seems relatively strong, we should not forget that our sample is fairly small and the sample period extends only over a few years.³³ Keeping in mind this limitation, looking ahead the results in this paper underline the importance of using a plurality of risk scores when assessing bank vulnerability.

6. Conclusions

The Baltic countries have grown rapidly in the past ten years and have started to regain the ground lost under communism. Estonia is growing at about 8% a year. At that rate, its standard of living will double in about a decade. Over this transition period, Estonia's banking system has undergone a significant transformation from a mono-banking system to a two-tiered system comprising of a central bank and commercial banks.

Against this background we explore for individual Estonian banks the ability of market indicators to assess risk taking in banks during the transition period. Equity-based risk scores depend upon expected future payoffs to investors and are therefore inherently forward looking. What are the overall lessons that can be derived from the evidence? All in all, our results indicate that the distance-to-default measure of bank vulnerability is a reliable and encompassing measure of bank fragility. In particular, the results suggest that the high-frequency fragility measures extracted from market data are a promising, relatively low cost, early warning tool for bank fragility and therefore have practical value for supervisors.³⁴ On the other hand, the option-based risk scores should be taken with a grain of salt when they are based on thin markets. In less developed markets it is therefore important to rely on a multiplicity of fragility indicators complementing each other and serving as a cross check of other evaluations, both for central banks and for the public at large. Another caveat pertains to our results, which stems from the small number of banks in the sample. Further systematic evidence on this issue would therefore be very useful since progress in this area will sharpen our understanding of financial markets.

³³ Some notes of caution are in order concerning the empirical analysis of Estonian data. First, the market data are only available for a small number of banks. Second, there is a rather small trading volume for some banks, reliability of price information is therefore not entirely satisfactory. The fact that the market is still not deep enough implies that the time series of *DD* may be subject to disturbing factors such as temporary mispricing.

³⁴ Note that our empirical results and conclusions are based on historical data. We have no guarantee that stock market signals would continue to be useful under a regime that explicitly incorporates stock market signals into supervisory policy. One potential problem with market price based measures of risk is that bilateral causality may emerge. In considering the role of market prices in monetary policy operations, Bernanke and Woodford (1997) have pointed out that bilateral causality may emerge between market prices and market participants' expectations concerning future monetary and supervisory policies.

Appendix A: Market Shares From 1993 Through 2003 As Measured by Total Assets in %

	31.12. 1993	31.12. 1994	31.12. 1995	31.12. 1996	31.12. 1997	31.12. 1998	31.12. 1999	31.12. 2000	31.12. 2001	31.12. 2002	31.12. 2003	31.12. 2004
Eesti Maapank	2.63%	3.07%	4.57%	4.64%	4.41%	N/A	N/A	N/A	N/A	N/A	N/A	N/A
SEB Eesti Ühispank	13.88%	16.77%	17.75%	16.52%	24.47%	33.21%	29.65%	26.73%	31.60%	29.90%	30.80%	30.90%
Evea Pank	1.52%	1.99%	1.82%	1.78%	2.02%	1.45%	N/A	N/A	N/A	N/A	N/A	N/A
Hansapank	15.01%	20.42%	22.72%	25.30%	24.77%	51.95%	54.82%	56.76%	53.10%	53.20%	50.40%	48.20%
Hoiupank	12.07%	14.75%	17.44%	19.81%	23.77%	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Tallinna Pank	5.31%	6.10%	7.15%	9.89%	7.74%	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Appendix B: Chronology of Rating Changes for Hansapank and SEB Eesti Ühispank

Hansapank		SEB Eesti Ühispank	
<i>Moody's Long-Term Ratings:</i>		<i>Moody's Long-Term Ratings:</i>	
26 September 1997	Baa2	23 July 1997	Baa3
23 July 1998	Baa3	14 March 2000	Baa2
24 August 1999	Baa2	14 November 2000	Baa1
14 March 2000	Baa1		
28 January 2002	A2		
12 December 2002	A1		
<i>Moody's Financial Strength Ratings:</i>		<i>Moody's Financial Strength Ratings:</i>	
26 September 1997	D+	24 August 1999	D
2 May 2001	C-	14 November 2000	D & Positive Outlook
29 July 2002	C & Positive Outlook		
2 May 2003	B/C		
<i>Standards & Poors:</i>		<i>N/A</i>	
11 April 2000	BBB	-	-
<i>Fitch LT:</i>		<i>Fitch LT:</i>	
28 February 2002	A-	11 September 1997	BBB-
29 April 2004	A	4 March 2000	BBB
		29 September 2000	BBB+
<i>Fitch Support Rating:</i>		<i>Fitch Support Rating:</i>	
28 June 2001	3	Before 4 March 2000	4
Before 6 November 2003	2	4 March 2000	3
After 6 November 2003	1	After 22 July 2003	1

Notes: Support ratings offer Fitch's judgement of a potential supporter's (either a sovereign state's or an institutional owner's) propensity to support a bank and of its ability to support it. Its ability to support is set by the potential supporter's own Fitch Long-term debt rating, both in foreign currency and, where appropriate, in local currency. Support ratings have a direct link to Long-term debt ratings, but they do not, however, assess the intrinsic credit quality of a bank. Rather they communicate Fitch Ratings' judgement on whether the bank would receive support should this become necessary. "1" denotes a bank for which there is an extremely high probability of external support. The potential provider of support is very highly rated in its own right and has a very high propensity to support the bank in question. "5" denotes a bank for which external support, although possible, cannot be relied upon. Data sources: Banks homepages and HEX homepage (previous Tallinn Stock Exchange).

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CONCLUSIONS

This section deals with the discussion and placement of the results of the research on bank fragility and firm fragility in the existing literature, explicates the conclusions and draws linkages between the studies presented in part 2. A summary table (Table 1, pages 121–122) is added to provide a comprehensive overview of the research questions, context, methodology and data as well as conclusions and findings across the four studies forming the core of the dissertation.

Discussion of conclusions on bank fragility

The research on bank incentives, which might harm the soundness of the institution as well as lead to severe negative externalities for the marketplace, is highly diverse. The high-level picture on incentives, which feeds the risk appetite of the bank, is missing.

So far, a large part of the blame for the emergence of destructive incentives in the banking sector has been put on regulation – deposit insurance and capital adequacy regulation in particular. The former has been seen as the precipitator of bank moral hazard or engagement in risky ventures due to reduced depositor control and market discipline. Another argument suggests that deposit insurance commitments on the part of the government have led to “too-big-to-fail” issues. The latter, capital adequacy requirements have been criticized for enabling capital arbitrage or hidden risky lending covered by a seemingly high capital cushion. Both regulations however, have been called into existence to increase the soundness of the financial system and avoid a rush of banking panics.

Bank inherent factors, which foster hazardous behaviour, have deserved less attention in the literature. Although, White (2002:146) and Dow (2000:29) have stressed that bank owners have only a limited downside risk – a loss equal to their equity stake in the bank – there is significant potential for upside benefits from risky ventures. The equity holders therefore, have an incentive to maximize the return on debt-holders’ (depositors) funds by holding an excessive portfolio of risky assets. This phenomenon has also been referred to as risk-shifting (Holmström and Tirole, 1997) or “gambling for resurrection” (Gorton and Winton, 2002: 89). Dow (2000: 39) has also pointed to the “collective over-exposure” problem whereby the whole financial sector is overexposed to a particular risk, but no individual bank has any incentive to correct the problem, since there is no over-exposure at individual bank level.

Another argument for bank inherent hazards is that banks are inclined to behave in a myopic manner, which may cause distress if fundamental changes on the market are not addressed by timely adjustments in the risk strategy. Dewatripont and Tirole (1994) stress managerial hazard as a critical factor for

prudential banking. Managers who have an incentive to demonstrate good performance may be willing to engage in gains trading – that is (premature) sales of assets at a higher market than book value even if it is profitable in the long-term to retain those assets to earn further returns on them. This aspect of managerial incentive was referred to as “short-terminism” by Narayanan (1985) who has shown that if the management has private information, it may engage in decisions that bring short-term gains at the expense of the long-term profit outlook of the bank.

The theoretical article (Study I) on bank incentive for increased risk taking aims to observe the factors that promote hazardous behaviour in a particular set up with asymmetric information and gains trading options for optimizing short-term profit at the cost of long-term returns on investments.

Bank profit is set up as a function of risky and risk-free assets, risk-free interest rates, the funding rate, external or common shock variables, bank charter value and the accounted loss factor for premature sales. The key assumption in interpreting optimization results is that risky assets (loans) are in an imperfectly elastic supply to individual banks and this implies that *ceteris paribus* if a bank is willing to increase its lending volume it must accept a reduction in the marginal return on the portfolio (Klein, 1971: 207).

One might argue that the proposed theoretical framework does miss the interest costs on deposits, which constitute an essential part in banks interest bearing liabilities. The rationale behind leaving the aspect of deposits aside is that the framework assumes the presence of information asymmetries. Hence, the depositors are not in a position to adequately assess the true risk in a bank's assets to request higher deposit rates. Hence, the deposit rates are fully exogenous in the model and would cancel out in the derivation process.

The optimization results lead to the conclusion that a higher risk-free interest rate implies a decrease in the level of risky assets. Evidently the higher risk-free rate will increase the return on investments and this implies that less risky assets should be kept in the portfolio. Growing interest rates are transmitted into higher loan rates, which gives rise to adverse selection problems with more high-risk projects passing to the portfolio. Stiglitz and Weiss (1981:394) argued that in a world with imperfect information, the expected return for the bank may increase more slowly than the interest rate, and beyond a point called the “bank-optimal” rate it may start to decrease. Hence, more cautious lending is warranted at times of interest rate growth.

The higher the probability of a negative shock hitting the banking sector, the greater the likelihood of the banks being forced to liquidate their assets prematurely, which means lost future earnings. A negative shock is accompanied by increasing asset returns, which contain the expected risk costs. The model results suggest that the optimal behaviour for the banks is to cut back growth in risky portfolios in expectation of a negative shock.

The model conclusions also suggest that the higher the bank repayable debt and funding rate of this debt the higher the likelihood of premature sales of risk-bearing assets. The optimal behaviour for a bank with high-debt repayables is to control the size of risk-bearing assets. Since the premature sale of assets is costly in terms of the future profit outlook, the indebted banks should strive to improve liquidity instead of increase returns earned on the loan portfolio. Anderson (2002) has provided supportive evidence for the last argument with the result that there was a positive relationship found between the leverage and holding of liquid assets based on the panel study of Belgian and UK firms.

The model also provides results for bank level variables such as the bank charter value and accounted loss factor due to premature sales of risky assets. Both factors turned out to have an ambiguous effect on the level of risky assets in the banks' accounts. There are two counterbalancing forces at play here. Firstly, a higher charter value means that the bank is less likely to sell its assets pre-maturely, since its position is strong on the market or its expertise level keeps the business robust even during hard times. In such a position the bank might not reduce its exposure to risk, which means that the likelihood of suffering high costs at times of failure are high. In this case the model suggests cutting back on risky portfolios. On the other hand, high charter value might inflect that high costs of premature sales are recognized, which means that the bank takes a cautious position in order to safeguard its assets and earnings in future periods. In the last case, the optimal behaviour is to enable growth in risk entailing portfolios.

The same ambiguity applies to the accounted loss factor due to the premature sale of risky assets. As far as the bank recognizes that the cost of premature sales is high, it is less likely to engage into overly risk-tolerant activities, implying that exposures to risky assets are put under control. This behaviour itself leads to a lower probability of asset liquidation and sometimes even an increase in the bank's risky portfolio would be optimal. At the same time the high loss factor *per se* shows that the bank should keep an eye on risky positions, since their liquidation means that lost earnings are considerable. On the other hand, banks that do not account for full losses of asset liquidation *ex ante* should cut back their risk entailing exposures since they are the ones most likely to end up in involuntary asset liquidation scenarios.

The main contribution of the proposed theoretical approach is that it offers a new angle for the investigation of bank incentives under a specific set of assumptions using gains-trading options and decreasing returns on investment.

The empirical research on bank fragility indicators started off with evidence from the US banking system where the data availability at single bank level enabled to run the first econometric models as early as the late 1970s (Martin, 1977). Since then a number of papers have been issued that seek to improve the prediction of bank fragility using more advanced methodologies and/or the introduction of new explanatory variables. Amongst the bulk of papers based on

US banking sector evidence (Lane et al, 1986; Demirgüç-Kunt, 1989; Whalen, 1991; Thompson, 1991; Wheelock and Wilson, 2000 and others) studies on other countries – Argentina (Dabos and Escudero, 2004), Mexico (Gonzalez-Hermosillo et al, 1997), Turkey (Canbas, Cabuk and Bilgin Kilic, 2004); and the regions, East Asia (Bongini, Laeven and Majnoni, 2002) and Latin America (Arena, 2005) have also been published. Although most of these studies use the richness of single bank level data, the limited number of sample countries does not enable us to control for the broad list of macroeconomic or external triggers of bank failure.

After the severe financial instability episodes in East-Asia and Latin-America late in the 1990s, a new wave of bank fragility research emerged, this time however, cross-country comparative studies took the lead with the main focus on spill-over effects, macroeconomic factors and financial liberalization issues (Demirgüç-Kunt and Detragiache, 1998; 1999; Hardy and Pazarbasioglu, 1998 and others). Unlike the studies focused on bank-level data, this line of research looks at systemic banking crises instead of single bank failure.

The definition and dating of systemic banking crisis, however, is to a large extent judgmental. To identify systemic crises, Caprio and Klingebiel (1996, 2003), Lindgren, Garcia and Saal (1996), Demirgüç-Kunt and Detragiache (1998a, 1999) have used a number of criteria whereby at least one of following conditions must apply: (1) Non-performing loans (NPL) to total banking sector assets above 10%; (2) the ratio of NPL to total assets greater than 2% of GDP; (3) the cost of a rescue operation being at least 2% of GDP; (4) large scale nationalization; (5) extensive bank runs and (6) the application of emergency measures such as deposit freezes, prolonged bank holidays and deposit guarantees. The arbitrariness in defining the presence, severity and duration of the financial crises poses a severe challenge in interpreting the results. However, all of the criteria used to define a systemic banking crisis relate explicitly or implicitly to major bank failures.

The selection of sample countries is heavily biased towards emerging markets in Asia, Latin-America and Africa. The limited number of developed economies in these studies mostly include the Nordic countries, but also Portugal, Spain and USA, and all of them experienced episodes of banking crises in the past or have otherwise played an important role in the banking sector stability of the region. The transition economies in the CEE region are poorly covered despite a number of severe crisis episodes over the last 10–15 years.

Eichengreen and Arteta (2000) have investigated the sensitivity of the results based on systemic banking crisis prediction models. Their key conclusion is that not all variables suggested as early warning indicators of systemic banking crisis turned out to be robust across different sample selections or model specifications. However, some results appeared to be more robust such as rapid domestic credit growth, large bank liabilities relative to reserves and domestic

financial liberalisation, which all seem to be influential in generating systemic banking crises.

Both strands of the literature – single bank fragility prediction versus systemic banking crisis models are important; however, much remains to be done in putting together the strengths from both approaches. Hence, the added value needs to be derived from empirical research that uses bank-level panel data applied in the cross-country context. This research agenda enables us to include a holistic set of fragility indicators starting from bank financials up to structural variables such as market concentration and ending with macro-economic indicators and external spill-over effects. The author has contributed to the last type of literature with a panel data study of banks in Central and Eastern European (CEE) transition countries and southern-European emerging economies. There are altogether 17 countries⁷ with nearly 300 banks presented in the study.

The study employs two definitions of bank failure. The first is ‘bank distress’ and denotes a situation where the institution is at elevated risk of default due to high actual or potential loan losses eroding the capital cushion as reflected in the coverage ratio. The coverage ratio is the ratio of equity capital and loan reserves minus non-performing loans to total assets. Banks with a coverage ratio below 1 are exposed to high risk because while their own funds cover loan losses in the current period, they would not withstand the same magnitude of losses in the next period, if the equity level were held constant. The banks with negative or zero equity are labelled as ‘insolvent’. To recognise bank fragilities early, the distress event is defined as a target variable in econometric estimations.

Taking into account the diversities among CEE countries in terms of advancement in reforms and the level of economic development, the performance of indicators is looked at separately for the more advanced and the less advanced country groups according to the EBRD banking sector reform index⁸. The results showed that the indicators had broadly similar patterns in differentiating between sound and fragile banks in both groups of countries. The more advanced countries however, appeared somewhat more sensitive to market forces such as movements in trade income and growth in private lending. The less advanced transition countries on the other hand turned out to be more dependent on major regime changes such as bank privatization, inflationary pressures and exchange rate jumps. Interestingly, the high loan-to-

⁷ Bosnia-Herzegovina, Croatia, Czech Republic, Cyprus, Estonia, Latvia, Lithuania, Macedonia, Malta, Moldova, Poland, Romania, Russia, Slovenia, Slovakia, Turkey, Ukraine.

⁸ Griorian and Manole (2002) and Bonin *et al* (2005) have reported significant sub-regional and country differences in commercial bank efficiency across a wide range of transition economies.

asset ratio, which has been considered as a sign of exposure to credit risk, did not work in the conventional way in the case of transition economies, being a negative function of bank distress in the less advanced transition countries group. The reason here might be that in less developed financial markets the higher loan-to-assets ratio is a sign of more advanced banks having creditworthy customers rather than a sign of over-exposure to credit risk.

Additionally, the set of explanatory indicators of bank fragility have been measured at two different horizons – at the onset of bank distress and a year before the onset of distress to control for the dynamics of the bank failure life-cycle process (Gonzalez-Hermosillo, 1999:19–20). The results prove that the behaviour of the indicators varies depending on the chosen time horizon preceding distress. This time-variation in signalling variables is a feature of boom-bust cycle driven crises. Hence, the paper reaffirms the “boom bust” cycle volatilities as the underlying pattern of instability in the CEE region. Honohan (1997:3) provides a description of the endogenous boom and bust cycles, where banks riding on a wave of optimism end up with poor long-term prospects. He notes that the endogenous type of crisis results from a hybrid of macro and micro causes, whereas for the endogenous boom to take place there needs to be microeconomic deficiencies in bank behaviour as well as triggers at the macroeconomic level.

In the literature, the boom and bust cycle volatilities have also been associated with coinciding financial liberalization (Bell, 2000:114). To some extent the transition process might compare to financial liberalization and linkages between the two offer new insights into our understanding of the environmental impact on bank stability.

All-in-all, the study has found several patterns that cast light on the issues of bank distress in transition countries and emerging Southern-European markets, whereas a fragile funding base in an environment of adverse dynamics and major regime changes stand out as key triggers of distress. The overall conclusion beyond the context of transition is that distress is a complex event that is often precipitated not just by one or two factors, but by a series of mutually reinforcing bank-specific, macroeconomic and structural variables that show considerable dynamics as the event evolves. The complexity of interactions between variables cannot be fully explored using parametric models; the value of the estimation lies rather in exploration of common, dominating features of fragility indicators and not in providing a clear formula or threshold values for predicting bank distress episodes.

The market-based approach relying on calculated distance-to-default scores was applied to six Estonian banks that had equity price history available. This approach assumes that equity markets are efficient in processing available information and that equity-holders respond rationally to news concerning the market and bank idiosyncratic risks (Gropp et al, 2002:7). There might be concern that these assumptions are not fulfilled in emerging markets during the

transition period. Männasoo (2006) has found that GARCH estimated volatilities for Estonian banking sector returns were symmetric in terms of negative and positive shocks and that the average asset return was not a relevant predictor of the expected return volatility. Both results refer to poor information processing and immature investor behaviour. However, the estimated GARCH model did not take into account the investors ability to use information to discriminate between the banks, but rather looked at the volatility of banking sector aggregate returns across time.

Despite the concerns mentioned above the study (study III) revealed that even in newly developed stock markets, the distance-to-default measure is capable of capturing and foreseeing the underlying bank fragilities. Due to the small number of banks there was no possibility of checking the statistical significance of the results. However, the good background knowledge enabled us to apply a case-by-case approach to demonstrate the accuracy and performance of the distance-to-default measure in recognizing and extracting signals ahead of the events observed during the sample period. Hence, contrary to studies by Gropp et al (2002) and Chan-Lau et al (2004) there is no single distress event defined that serves as the baseline for the assessment of the goodness and accuracy of distance-to-default in measuring and predicting an event. Instead, for each of the six Estonian banks a number of common and bank idiosyncratic events have been observed starting from a stock market crash to major changes in bank ownership structures or changes in credit ratings up to the incidences of deep insolvency. Hence, the performance of distance-to-default, equity volatilities and leverage was analysed graphically and descriptively in the context of diverse events. The results implied that bank fragility towards common risks was different and that the investors were able to discriminate between weak and strong players, hence the possible claim that bank investors routinely engage in “pure contagion” was rejected.

The results also implied that the market-based measures are sensitive to liquidity. The higher the liquidity and the deeper the market for bank equity shares the more accurate and prompt are the assessments based on distance-to-default. For instance, the information content of the distance-to-default measure was very low for EEA Pank, with shares of poor liquidity and low market turnover. Gropp et al (2002: 5) refrain from low liquidity securities in their study on market based indicators of bank fragility in order to abstract from the noise.

The search for causalities between the distance-to-default measures and credit ratings was limited to only three banks – Hansapank, Hoiupank and SEB Eesti Ühispank, for which the credit rating information was available. Only for Hoiupank, which was also the only one that ceased to exist at the end of the observation period, was there found statistically significant causality from distance-to-default to rating change. For the other banks either no statistically significant causality was found (Hansapank) or feedback causality was revealed

(SEB Eesti Ühispank). Hence, these results do not imply any strong conclusions about the Granger causal relationships between distance-to-default and credit ratings. Evidently, it might also be due to the small sample and short history of credit ratings that the information content remains too limited to extract any reliable results.

Having the three papers on bank fragility at hand – one theoretical and two empirical papers – one might ask whether it is possible to indicate some correlations between them or even find some supporting or conflicting evidence between them. However, several of the aspects dealt with in the theoretical paper, such as bank charter value or even more the accounted loss factor on premature sales, are hard to test empirically due to non-availability or non-comparability of respective data. On the other hand, the distance-to-default indicator, which encompasses earnings expectations, market and credit risks embedded in bank assets, hardly lends itself to comparisons with individual balance sheet indicators – each capturing a single risk category.

However, few linkages between papers I and II can be found in respect to GDP growth as a proxy of common shock and the interest rate variable, which is supposed to be inversely related to the level of risky assets in the bank. The proxy for interest rates used in the empirical paper on CEEC banks was the 3-month EURIBOR rate. The evidence revealed that increasing interest rates trigger bank distress, which in turn suggests that the banks that engaged into high-risk activities were the ones more likely to become distressed. The rationale behind this is likely to be the scenario where these banks, which are exposed to overly high risks during the low interest rate period, had hard times after reversal.

The evidence for the GDP growth indicates that negative GDP growth leads to a higher number of distress episodes. The arguments from the theoretical paper suggest that a negative common shock such as a decline in GDP, for example, implies greater caution on the part of banks in expanding their risk portfolios. Hence, having too much exposure to risk during a GDP slowdown is not optimal behaviour from the perspective of long-term sustainability and refers to a potential source of financial fragility. Hence, the short-terminism argument in the theoretical paper (study I) has found support from the empirical part of the research.

Discussion of results on firm fragility

There is a plenty of research on firm default, but the studies vary to a great degree firstly in terms of their definition of a default event – filing for bankruptcy, poor credit rating, de-listing from the stock exchange, liquidation or exit; and secondly, in terms of sample features – particular country or region, industry sectors, sample period, quoted versus non-quoted firms etc.

The earliest study to employ a parametric approach and a conditional logit model for predicting firm bankruptcy was conducted by Ohlson (1980). The event of interest was the legal definition of bankruptcy according to US bankruptcy regulation and the sample firms had to be listed on the stock exchange or at least tradable on an open market. Small private firms and firms operating in utilities, transportation or the financial sector were excluded. Shumway (2001) introduced the hazard model approach into the field of firm bankruptcy prediction and demonstrated its superior predictive performance over the static logic models. The firm in his study was considered to be bankrupt if it filed for any type of bankruptcy within 5 years of delisting from the NYSE (New York Stock Exchange) or AMEX (American Stock Exchange) (Shumway, 2001: 113). Also, broader definitions of default such as a poor credit rating or de-listing from the stock exchange have been used to define firm default (Campbell, 2005; Walker, 2005).

Likewise, the three studies on the default and survival of Estonian firms use a mixture of default definitions, methodological approaches as well as sample characteristics. Künnapas (1999) has investigated bankruptcies in Estonian manufacturing firms in the period 1996–1998 using the Altman Z-score model. Lukason (2006) estimated the bankruptcy probability of Estonian retail and wholesale companies using a logit model. His chosen default definition is based on explicit data either on firm bankruptcy or liquidation due to non-compliance with the minimum net assets requirement during the period 2000–2003. Masso et al (2007) focused on discovering evidence on firm demographics in Estonia and their event definitions relate to firm exit and entry patterns studied using survival analysis. This diversity across studies makes the comparability of results hard if not infeasible. On the other hand, the richness of approaches enables us to open different angles or perspectives for observing firm survival issues. The author's paper on firm survival in Estonia helps to complement the present knowledge in the field. As for the variety of default definitions, the article bridges part of the gap using two complementary definitions of firm default. The determinants of capital deficit⁹ as well as firm liquidation after running into a capital deficit are examined and compared, to see whether and to what extent the two complementary event definitions matter. Using more than one event definition helps to check the sensitivity of the results within the framework of the characteristics of the same sample, methodology and time period.

The literature, which addresses both firm default at the micro level and corporate sector vulnerability from the financial stability perspective is relatively scarce. The long research history on firm-level bankruptcy risk goes

⁹ According to the Estonian Commercial Code (§ 176) firms have to hold their equity above a minimum of 50% of their nominal statutory capital. All firms falling short of this required equity level are treated as having a capital deficit.

back more than 40 years. The key questions addressed in this strand of the literature focus on firm financials, which could signal the likelihood of default. The aspects of systemic or corporate sector level distress have deserved more attention since the major financial turmoil of the 90s. This literature however, predominantly employs aggregated corporate sector data aimed at providing cross-country comparisons. The literature on firm demographics is placed somewhere in-between and mostly focuses on firm performance at industry level. The main interest in this line of research relates to firm entry and exit patterns, job flows and the viability of start-ups. Paper III seeks to explore the patterns of firm failure in the Estonian context with the aim of coming up with a brief list of robust indicators of default, which do not matter only for specific types of firms. The suggested indicators take into account the industry sector where the firm operates, its legal form of establishment (whether OÜ or AS type of limited liability company¹⁰) and the length of time it has survived in business.

The indicators, which turned out to be significant in predicting both instances of firm financial fragility – capital deficit and the eventual liquidation after running into a capital deficit – broadly confirmed the findings from the literature. Namely that firms with a larger assets base, low leverage and high asset returns are less likely to fail, confirming similar evidence from mature economies. Also, strong efficiency in terms of higher sales per operating expenses and lower volatility in asset returns proved to signal the sustainability of the firm. Interestingly, the high leverage and low assets return were more strongly correlated with capital deficit than with the eventual liquidation of the firm. On the contrary, the low sales to expenses figure was a rather stronger trigger of firm liquidation than the simple warning sign of capital deficit. Hence, the effect of low returns and high leverage are not as fatal to firms in Estonia compared to poor operational measures such as the ability to make sales at a commensurate cost. Some support for this is provided by the results from the study on default indicators in EU companies (Hazak, Männasoo 2007), which demonstrates that firms in new member countries of the EU27 were to a lesser degree endangered by bankruptcy due to higher leverage or lower returns compared to their counterparts in the old EU15 countries. The reasons here might be that in Estonia, like many other new EU member countries, only stronger firms are able to access external funding, whereas the high leverage might not only be a sign of over-indebtedness, but rather an indicator of credibility and good access to external funding. The story in respect to low elasticity of profitability or asset returns in regard to the probability of failure might be related to the fact that businesses in emerging markets such as in Estonia are relatively more risky and the expected returns on these markets

¹⁰ AS-type of companies are required to hold ten-times higher minimum equity level compared to OÜ-type of companies whose shares are not freely tradable.

exceed that of mature markets. Hence, higher returns on firm assets are not only a sign of a strong market position, which would serve as a signal of sustainability in mature economies, but might refer to significant risks embedded in the businesses set up in the emerging market context.

The empirical hazard curves (lifetable curves) indicated that Estonian firms, similar to their counterparts elsewhere round the globe, are more vulnerable in the start-up period, whereas the risk of running into a capital deficit decreases in a monotonous manner up to the seventh year of operations. There is a slight upward trend visible after the first seven years survived. In the construction sector, the upward trend starts even a year earlier. U-shaped hazard curves have been documented in the literature (e.g. Kaniovski and Peneder, 2008: 55) and have also been confirmed by the evidence based on EU27 companies (Hazak, Männasoo, 2007). The life pattern of firms consists of three parts where the start-up period marks the fight for survival coupled with a high likelihood of failure due to a number of reasons including high start-up costs, problems in building up credibility to attract customers and creditors. The risks, however, fall rapidly within the first years survived and a stable, low risk period is reached around the third-fourth year in business and lasts for about 4–5 years. Beyond that period signs of concern start to increase again – the business plans might become out-dated and the risks assumed in earlier periods accumulate. The hazard rate takes an upward trend; however, the risk remains below the level of hazard observed during the start-up period.

As expected, the hazard rates for a capital deficit event exceeded those related to firm exit, it was however, surprising that the difference was about ten times. This evidence explicates that although the triggers of both event definitions are similar in their impact, the actual exit or liquidation of the firm is far less frequent relative to the incidences of capital deficit.

In the industry comparison, the trade and service sector companies in Estonia turned out to be most vulnerable compared to manufacturing, construction or real-estate firms. Similar evidence has been provided by Kaniovski and Peneder (2008: 50), who conclude that services firms are more prone to failure and exit compared to manufacturing firms, especially those that are capital or knowledge intensive.

Synthesized approach to the findings of the research

This part of the doctoral thesis has to integrate four separate research papers each dealing with a particular problem set within the framework of financial fragility. A summary table (Table 1, pages 109–110) below provides a comprehensive overview of the research questions, research context, methodology and data as well as conclusions and findings across the four studies.

Most of the financial fragility literature has a fragmented view – either focusing on the banking sector or the corporate sector. For example, Allen and Gale (2004: 769) have stressed the importance of investigating the link between the financial sector and the real sector in order to find out why financial crises have such rapid and important effects on real activity. Also, the strands of literature dealing with the macro-prudential view versus credit risk at a single institution level need to be better integrated.

Hitherto, the financial sector has been seen as the main source of worry from the perspective of financial stability – whereas the banks that play a central role in financial intermediation have been the ones mostly blamed for invoking financial crises or even macroeconomic distress (Allen and Wood, 2006:157). Notwithstanding the fact that banks have a special role in the economic system being the key liquidity repositories, which can lead to deposit run phenomena for instance, one has to admit that there are strong linkages between the banking sector and the corporate sector and also that incentives are born on the institutional level and not only caused by the contagious role that banks play in the financial system. Choosing one perspective to look at the issues of financial fragility results in ignoring the chicken-and-the-egg problem evident in the financial stability field.

The clear rationale for studying bank fragility is that banks are the main source of external financing for firms, and therefore, providers of liquidity to the market. Banks play a central role in the credit channel through which the economic cycles are affected. Credit tightening has been seen as one of the important propagators of economic distress. On the other hand, along with the growth of global capital markets, real sector companies securities holdings and share of funds raised on capital markets is rapidly increasing. This has brought them closer in nature to financial institutions, who are strong players on international capital markets. Hence, both are vulnerable to capital market spillover effects.

On the other hand, the economies of scale argument is becoming increasingly important across a number of industries, which means that consolidation is taking place in the financial sector as well as in the corporate sector. Hence, contagion is not the sole feature of the financial sector or banks in particular, but also an increasingly important issue in the case of systemically important corporations or highly concentrated real sector industries.

Table 1: Summary of the research articles

Research questions	Context of the research Data or assumptions	Conclusions and findings
Paper I: What feeds Banks' appetite for risk-entailing portfolios		
1. Are there bank inherent drivers, which lead to extensive risk tolerance under a particular set of assumptions?	Objective function: Short-term profit maximization under the following assumptions:	1. The analysis explicates that banks might engage in gains trading and "short-terminism" whilst maximizing their short-term profits.
2. Which factors are they, and what is their impact on the optimal size of risk entailing portfolio?	1. Asymmetric information 2. Declining returns on investment in risky assets 3. Gains-trading option	2. The increase in the risk-free interest rate warrants a decrease in the level of risky assets, the same applies when increasing debt costs. Also, the expected negative shock implies that the risk exposures should be reduced. The bank charter value and the accounted loss factor due to pre-mature sales of risky assets have an ambiguous effect in respect to the optimal level of risky assets.
Paper II: Investigating the early signals of banking sector vulnerabilities in Central and East European emerging markets		
1. Can the set of indicators composed of individual bank level financials, macroeconomic and banking sector structure variables discover the underlying fragilities of banks and hence predict subsequent distress?	CEE countries (17): Bosnia-Herzegovina, Croatia, Cyprus, Czech Republic, Estonia, Latvia, Lithuania, FYR Macedonia, Malta, Moldova, Poland, Romania, Russia, Slovenia, Slovakia, Turkey, Ukraine.	1. The estimations revealed that all groups of indicators whether bank-specific financials, banking sector structure variables or macroeconomic indicators were significant in explaining bank distress. The in-sample prediction was accurate for 7 countries out of 17 and the out-of-sample prediction was accurate for recognizing distress episodes in 2 countries out of 6.
2. Is advancement in banking sector reforms reflected in the set of indicators working as signals or predictors of bank fragility and how?	Yearly observations: 1996–2003 Data sources: Bank-level variables: BankScope Macroeconomic and banking sector variables: IMF IFS, Eurostat.	2. The countries with less advanced banking systems are more dependent upon regime changes such as bank privatizations, inflationary pressures and jumps in exchange rates. The more advanced country group in terms of banking sector reforms was rather vulnerable to market factors such as dropping trade returns or high exposure to credit risk.
3. Does the behaviour of bank fragility indicators support the life-cycle argument of bank failure as argued by Gonzalez-Hermosillo (1999:19–20)?		3. The life-cycle argument of Gonzalez-Hermosillo (1999: 19–20) found proof in the empirical analysis, which revealed that several indicators of distress behave differently depending on the horizon preceding the event.

Research questions	Context of the research Data or assumptions	Conclusions and findings
<p>Paper III: Extracting leading indicators of bank fragility from market prices – Estonia Focus</p>		
<p>1. How does the distance-to-default measure assess risk taking in Estonian banks during the transition period?</p> <p>2. Does a significant link exist between the market assessment as measured by distance-to-default, and the rating agencies' decisions to revise a given rating?</p>	<p>Monthly stock return and balance sheet data on the following Estonian banks:</p> <p>SEB Eesti Ühispank: 8.1996–8.2000</p> <p>Hoiupank: 8.1996–6.1998</p> <p>Evea Pank: 2.1997–8.1998</p> <p>Eesti Maapank: 3.1997–6.1998</p> <p>Hansapank: 8.1996–7.2004</p> <p>Tallinna Pank: 8.1996–6.1998</p>	<p>1. The distance-to-default measure is able to capture the underlying bank fragilities working as a reliable early warning indicator, except for the banks whose shares have very poor liquidity (EVEA Pank)</p> <p>2. The Granger causality estimations did not prove any significant or consistent causality between the distance-to-default and risk ratings, which implies that one must rely on a multiplicity of fragility indicators complementing each other to assess bank fragility.</p>
<p>Paper IV: Firm survival in Estonia</p>		
<p>1. Which firm-level variables turn out to be significant in explaining the sustainability of the firm?</p> <p>2. Do the two default definitions – short of required minimum statutory capital and firm exit after being short of statutory capital – resemble one another or differ and to what extent?</p> <p>3. Does the U-shaped baseline hazard curve find support based on data about Estonian firms?</p> <p>4. How do the industries compare in terms of the hazard rate?</p>	<p>Estonian public and private limited liability companies financial data as reported to the Estonian Commercial registry.</p> <p>Industries: manufacturing, trade and services, construction and real estate.</p> <p>Early observations 1994–2004</p>	<p>1. The findings from the literature are broadly confirmed showing that a larger assets base, low leverage, high asset return and strong sales-to-operating cost ratio improves the firm's outlook for survival.</p> <p>2. The baseline hazard for insufficient statutory capital exceeded the actual exit about ten times. The triggers of both events, however, were broadly the same. Although, the high leverage and low assets return were somewhat more strongly correlated with negative equity than with eventual liquidation of the firm. On the contrary, low sales to expenses ratio was rather a strong trigger of firm liquidation, than a warning of falling short of required capital.</p> <p>3. The hazard rate almost monotonously decreases over the time survived with a slight indication of a U-shaped hazard or upward trend after the seventh year in business.</p> <p>4. The trade and services industry demonstrates the highest hazard rates compared to other industries.</p>

At closer inspection there are relatively few arguments for purely bank-propagated instances of financial fragility and negative spill-over effects. According to the “financial fragility hypothesis” provided by Bandt and Hartmann (2000: 13–14), the three interrelated features of the contagious role of banks can be separated. Firstly, the structure of the banks' balance sheet with long-term assets without an objective market price and the instantly recallable current deposits makes them subject to deposit runs at times of high uncertainty. Secondly, the banks as the main players in payment and settlement systems have a high degree of interconnected exposures with other participants in the system. Finally, the nature of financial contracts forming the predominant part in bank assets and liabilities are subject to highly judgmental valuation, which leads to high volatility and the accompanying risks. Beyond the first of these arguments, companies are to a varying degree subject to interconnected exposures as well as value fluctuations in their financial assets.

FINANCIAL FRAGILITY INDICATORS		
ENDOGENOUS	MARKET-BASED	EXOGENOUS
<u>Balance-Sheet</u>	<u>Equity share return</u>	<u>Macroeconomic</u>
Leverage	Distance-to-default	GDP growth
Liquidity	Market value of equity	Private lending
Asset composition	Volatility of equity	Inflation
		Interest rate
<u>Cost-Income flows</u>	<u>Credit ratings</u>	Exchange rate
Earnings		
Efficiency		<u>Structural</u>
		Ownership
<u>Other</u>		Concentration
Charter value		
Risk management		<u>Regulative</u>
		Legal form
		Reforms index

Figure 3: A summary of key financial fragility indicators

Figure 3 above summarizes and categorizes the key financial fragility indicators as dealt with in the present thesis. The indicators can be divided into three large sub-categories according to their endogenous versus exogenous character. The market-based indicators fall between these two because the market valuation of

the equity of the banks or real firms embeds both the idiosyncratic as well as the exogenous component. On the general level, banks and corporations are subject to broadly similar risks and challenges, such as the macroeconomic turbulences – either caused by fluctuations in domestic or external demand. Also, the market structure (e.g. concentration and competition) and legislation or regulation play a significant role in how the banks and corporations behave and to what degree their incentives and behaviour is sound. Both of these aspects have deserved more attention in the context of the banking sector as regulation and entry barriers have an important impact on banking sector structure and bank incentives. In the case of corporations, the sector concentration issues have to some degree been looked at under the firm demographics literature (see Masso et al, 2007 and Kaniovski and Peneder, 2008 and Konings and Xavier, 2002). To the best knowledge of the author the research on how regulatory or legal issues affect corporate sector prudence and incentives at single institution level is virtually absent.

As for future research, the emerging discussion on how to integrate the macro-prudential view and institution level view of financial fragility is a challenge on the research agenda. Crockett (2001:11) has noted that a more complex approach is warranted in order to improve our understanding of the financial stability concept.

Though, both strands of financial stability literature – micro-focused versus macro-prudential – remain important as trying to compare, complement and refocus them would add many new insights to this line of research.

Along with the growing evidence from micro-level financial fragility analyses, it has become possible to make conclusions about the factors that need to be controlled for in order to come up with a better picture about the true precipitators of financial fragility. For now there are too few studies at hand that control for a number of factors having an explicit or implicit impact upon firm or bank soundness. In particular, the transition countries have been subject to a list of legislative, structural and political changes, which have impacted on financial fragility.

Suggestions for future research

The research of financial fragility offers plentiful opportunities for new findings and insights both in the theoretical and empirical strands of the research. However, the issues of urgent political and research interest would suggest more extensive use of market indicators and measures of financial system infrastructure to improve understanding and measurement of underlying financial fragilities.

Market-based indicators, such as stock prices or subordinated debt prices, have been found to be very useful in explaining the fragility of institutions (e.g.

Gropp *et al*, 2002, Chan-Lau *et al*, 2004; Chen *et al*, 2006). Market prices carry valuable, high-frequency information, but this information is available only for a restricted number of listed firms or banks. For instance, in Eastern Europe or other emerging markets with low penetration of financial markets, the use of market-based indicators for financial fragility analysis remains fairly limited.

The infrastructure of the financial system has mostly been looked at from the banks and their required capital and deposit insurance regulation point of view (e.g. Diamond and Dybvig, 1983, Diamond and Rajan, 2000, 2001). Other aspects of financial infrastructure and its arrangements, such as disclosure rules, entry barriers, ownership structure or penetration of e-business, have remained overlooked. Hence, the patterns of financial fragility are likely to be more diverse than the research has been able to cover so far. Extending our understanding of the field of financial fragility, however, requires wider availability of information on both the single institution level and the financial system as a whole.

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SUMMARY IN ESTONIAN

ETTEVÕTETE JA PANKADE FINANTSHAAVATAVUS KESK- JA IDA-EUROOPAS

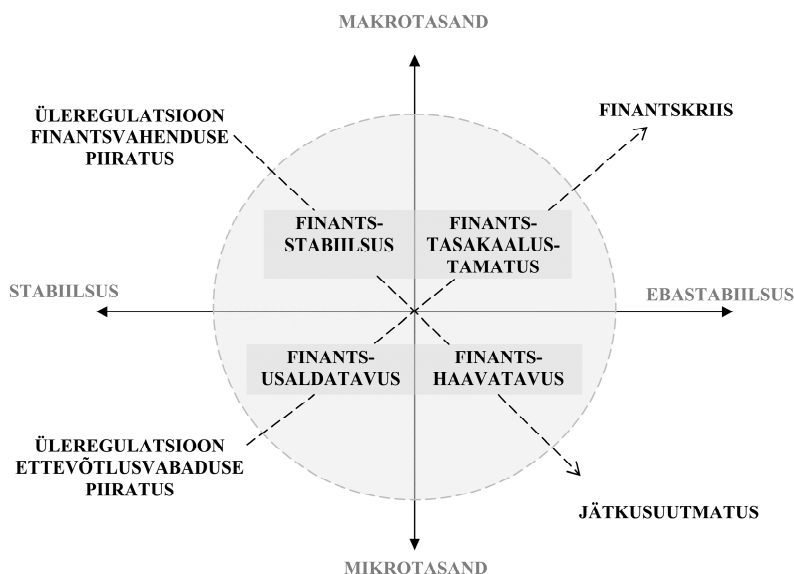
Töö eesmärk ja aktuaalsus

Finantskriiside ennetamisega seonduvad küsimused pälvivad üha enam tähelepanu nii finantssektoris töötavate erialaspetsialistide kui ka akadeemiliste ringkondade seas. Schinasi (2004: 3) tõdeb, et finantsstabiilsuse (ingl k. *financial stability*) analüüs on alles „lapsekingades” võrreldes näiteks makromajandusliku või rahaturu stabiilsuse analüüsiga. Kuigi tänaseni puudub finantsstabiilsuse ühene ja üldtunnustatud definitsioon on enamik autoreid ühel meelel selles, et finantsstabiilsus on makrotasandi kontseptsioon hõlmates finantssüsteemi kui tervikut (Allen ja Wood, 2006: 152,159, Schinasi, 2004: 3,6). Schinasi (2004: 6,8) on defineerinud finantsstabiilsust kui finantssüsteemi võimet toetada majandusarengut ning majandussüsteemi toimimise efektiivsust. Seejuures vaatlleb Schinasi (2004: 7) finantsstabiilsust pideval skaalal ehk mitte pelgalt finantskriisi esinemise puudumisena vaid pigemini finantssüsteemi võimena seista vastu nii endogeensetele kui välisteguritest tingitud ohtudele, mis võivad tuua kaasa finantssüsteemi ning majanduse kui terviku tasakaalustamatuse ning toimimisvõime halvamise. Allen ja Wood (2006:160) defineerivad finantsstabiilsust olukorrana, kus finantstasakaalustamatuse (ingl. k. *financial instability*) tekkimine ning selle mõju avaldumine majandusagentide, ehk majapidamiste ning ettevõtete, majanduslikele otsustele on ebatõenäoline. Seejuures finantstasakaalustamatust vaadeldakse olukorrana, mis põhjustab suurele hulgale majandusagentidest, olgu nendeks majapidamised, ettevõtted või valitsused, märkimisväärseid majanduslikke kahjusid, sõltumatult nende endi individuaalsetest valikutest.

Niisiis on finantsstabiilsuse käsitluste ühisnimetajaks vaade finantssüsteemile kui tervikule makrotasandil. Samas sõltub finantssüsteemi stabiilsus tema erinevate osade – finantsasutuste ja ettevõtete, finantsturgude ning infrastruktuuri tugevustest ja nõrkustest ning nende koostoimimisvõimest. Finantsasutuste ja ettevõtete tugevust finantsstabiilsuse kontekstis märgib finantsusaldatavus, tähistades üksiku institutsiooni jätkusuutlikkust ehk võimet absorbeerida riske ning tagada tegevuse jätkupidevus. Vastandmõistetena on kirjanduses palju viidatud finantshaavatavusele, mis käesoleva doktoritöö kontekstis tähistavad ettevõtte või finantsasutuse vastuvõtlikkust negatiivsetele mõjuritele, mis seavad ohtu jätkusuutlikkuse nii mikrotasandil kui pahatihti läbi kriisi võimendumise ning edasikandumismehhanismide ka makrotasandil. Bell (2000: 124) on väitnud, et finantshaavatavus on institutsioonide ja finantssüsteemi omadus, mis reageerides väliste šokkidele võib realiseeruda finantskriisina.

Seega on finantshaavatavus ning finantsstabiilsus omavahel tihedalt seotud, kuigi vaatenurk ning rõhuasetused on nähtuste uurimisel erinevad. Suurimaks väljakutseks teema käsitlemisel ongi kujunenud erinevate tasandite käsitlemine komplekselt, et saavutada võimalikult terviklikku arusaama finantsstabiilsuse kui nähtuse olemusest ning teguritest, mis seda mõjutavad (Crockett 2001:11).

Joonis 1 (lk 133) kujutab skemaatiliselt mõistete jaotust makro- ja mikro-tasandil ning stabiilsuse-ebastabiilsuse pideval skaalal. Ringiga märgitud alal on tegemist tavapärase turumehhanismi toimimisega nii mikro- kui makrotasandil. Seevastu ringist väljapoole jäävad piirkonnad tähistavad piirsituatsioone, milles tavapärase majandustegevus on häiritud või koguni võimatu. Seejuures on majandustegevuse toimimine negatiivselt mõjutatud nii liigsest ebastabiilsusest kui ka ülemäärasest stabiilsusest. Viimane on enamasti seotud ülereguleerituse, finantsturu toimimise või ettevõtlusvabaduse piiramisega. Viimatinimetatud olukorrad toovad enamasti kaasa ebaefektiivsuse ning arengu pidurdumise. Seetõttu võivad ülereguleeritud keskkonnas toimunud ettevõtted osutada turumajanduse tingimustele üleminekul jätkusuutmatuteks, mis omakorda võimendab keskkonna ebastabiilsust tuues kaasa turutõrkeid ning finantsprobleeme ülejäänud finantsasutustele ning ettevõtetele (vt punkteeritud jooned, Joonis 1 lk 133). Nimetatud arengud on eriti ilmekalt väljendunud siirdeprotsessides, mille kohta leiab arvukaid näiteid ka Kesk-ja Ida-Euroopas (Demirgüç-Kunt and Detragiache: 1998, Eichengreen and Arteta: 2000, Pesola: 2001, Bonin and Wachtel: 2004, and others).



Joonis 1. Finantshaavatavuse ja finantsstabiilsuse käsitlustasandid (autori koostatud).

Muuhulgas annab finantsstabiilsuse ning finantshaavatavuse valdkonna olulisest tunnistust Rahvusvahelise Valuutafondi (RVF) initsiatiiv finantsusaldatavuse indikaatorite¹¹ (ingl. k. *Financial Soundness Indicators*) arvutamiseks ja avaldamiseks üle maailma. Nimetatud initsiatiivi raames kogutavad indikaatorid hõlmavad nii finantsasutuste kui ka ettevõtete agregeeritud finants- ja struktuurinäitajaid, toomaks välja võimalikke ohte finantsstabiilsusele. Samas on finantsusaldatavuse indikaatoritega seonduv uurimistöö veel algusjärgus ning tänaseni napib nii empiirilisi kui teoreetilisi käsitusi antud teemal. Esimeses, hiljuti ilmunud empiirilises uurimuses (Babihuga, 2007) analüüsiti finantsusaldatavuse indikaatorite seotust riigi makronäitajatega. Ilmnes, et finantsusaldatavuse indikaatorite korrelatsioon majandussükliga on tugev, mistõttu finantsusaldatavuse indikaatorite võrdlemine üle majandussüklite nii ühe riigi piires kui riikidevaheliselt võib viia ekslike järeldusteni. Lisaks võimendab finantsusaldatavuse indikaatorite varieeruvust riigiti erinev majanduse arengutase, struktuur ja stabiilsus. (Babihuga 2007: 21). Siit tuleneb, et riigi finantsstabiilsuse piisavaks hindamiseks jääb agregeeritud finantsusaldatavuse indikaatorite rahvusvahelisest võrdlemisest väheseks, kusjuures arvestades keskkonna ja riigi eripärasid ning agregeerimisel kaduma mineva informatsiooni hulka võivad nimetatud järeldused koguni eksitavateks osutuda. Eelnevast tulenevalt on käesolevas doktoritöös seatud eesmärgiks uurida finantsstabiilsuse teemat finantssüsteemi ühe keskseima komponendi tasandil, milleks on majandussüsteemis tegutsevad ettevõtted ja finantsasutused, sh eriti pangad. Viimased on ka kõige vahetumalt mõjutatavaks osaks finantssüsteemi stabiilsuse tagamisel ja kriiside ennetamisel. Näiteks on Honohan (1997:2) rõhutanud, et mõned pangad suudavad üle elada ka väga ränkaid makromajanduslikke kriise, mis viitab pangasise poliitika ja finantsugevuse olulisusele hoidmaks ära ohte jätkusuutlikkusele. Ettevõtete ja pankade tasandil tehtav ennetustöö kannab tunduvalt paremaid vilju kui sekkumine juba tärnanud kriisiprotsessi, millest pole enamasti võimalik kahjusid kandmata väljuda. Niisiis on antud doktoritöös seatud keskele kohale finantsasutuste ja ettevõtete finantshaavatavus kui probleemide lähteallikas, mitte nende tagajärg – finantskriis.

Finantshaavatavuse indikaatorid aitavad tuvastada ja mõõta ettevõtte või panga finantsseisundi haavatavust erinevate mõjurite suhtes. Teisisõnu on indikaatorid finantshaavatavuse peegeldused ehk mõõdikud, mis aitavad finantshaavatavust tuvastada ja mõõta, kuid ei pruugi nähtust kogu selle kompleksuses täielikult avada. Indikaatorite leidmiseks tuleb esmalt määratleda situatsioonid, milles finantshaavatavus on avaldunud ning selleks on erinevaid

¹¹ Finantsusaldatavuse indikaatorid on indikaatorid, mida koostatakse finantsinstitutsioonide ja -turgude ning nende vastaspooleks olevate ettevõtete ja kodumajapidamiste kriisidele vastupanuvõime ning finantsusaldatavuse seireks. Finantsusaldatavuse indikaatorid hõlmavad mõlemat nii finantsinstitutsioonide agregeeritud informatsiooni kui finantsturgude indikaatoreid. (Sundararajan et al 2002: 2)

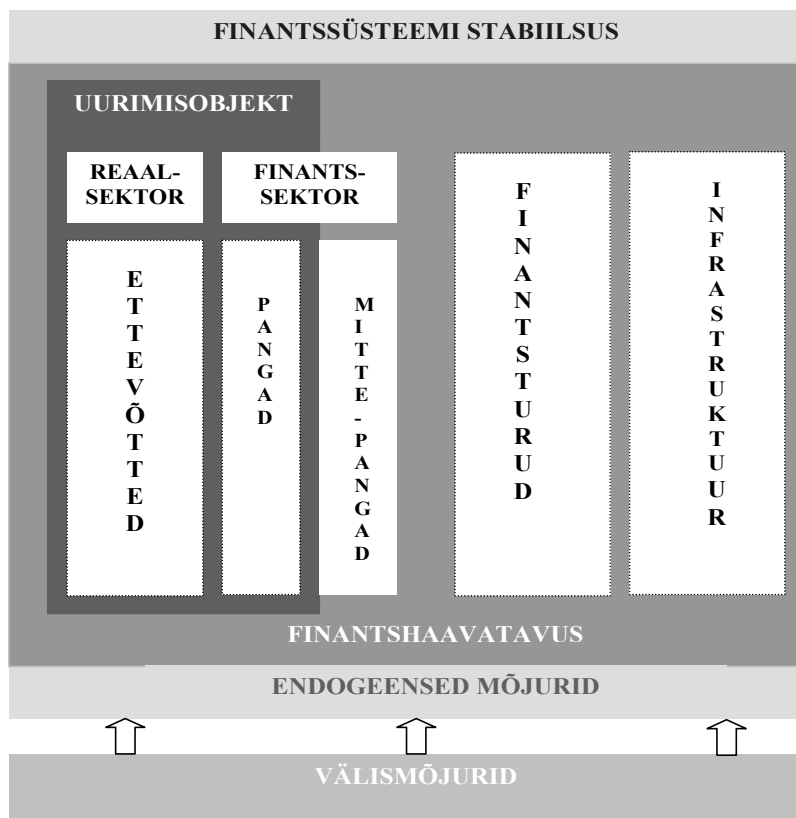
võimalusi. Näiteks on ettevõtte või panga finantshaavatavust uuritud järgmiste sündmuste valguses: maksejõuetus, pankrot, sundlikvideerimine, aktsiaturu nimekirjast kustutamine või halb krediidiireiting. Finantshaavatavuse avaldumine on suuresti kontekstispetsiifiline ja seetõttu on kontseptuaalse lähenemise huvides finantshaavatavuse realiseerumine lahti mõtestatud laias tähenduses, tähistades kõiki olukordi, kus panga või ettevõtte jätkusuutlikkus on ohustatud kas seoses majanduskeskkonnast tulenevate mõjudega või ettevõtte- või panga siseste probleemidega.

Reaalsektor ning finantssektor on omavahel tihedalt seotud, mistõttu võivad ühe tasakaalustamatuse mõjud hõlpsalt üle kanduda teisele (Allen ja Wood, 2006: 154, 159). Niisiis on finantshaavatavuse avaldumise oluliseks tunnuseks asjaolu, et ettevõtte või panga finantsraskustega võivad kaasneda negatiivsed mõjud nendega vahetult seotud osapooltele (näiteks rahastajad, kliendid ja koostööpartnerid), kui ka sektori usaldusväärsusele ja turu toimimisele laiemalt. Antud lähenemist toetab Taylor'i (1995: 364) argument, mille kohaselt on finantskriisid põhjustatud pigemini finantsasutuste või ettevõtete finantshaavatavusest kui makrotasandi negatiivsete mõjude kandumisest ning võimendumisest finantsturul. Käesoleva doktoritöö raames vaadeldakse finantshaavatavust nii ettevõtete kui pankade tasandil ning tuuakse üldistavalt välja seosed, mille kaudu võivad riskid ühest sektorist teise kanduda.

Kesk- ja Ida-Euroopa (KIE) riikides on finantsstabiilsuse ja finantshaavatavuse temaatikat suhteliselt vähe uuritud, seda eeskätt võrreldes Lõuna-Ameerika ja Aasia riikidega, kuigi kõigi nimetatud regioonide ühiseks tunnuseks on mitmed viimaste aastakümnete jooksul kogetud tõsised finantskriisid. Tekib küsimus, miks on KIE riigid uurimustes tagaplaanile jäänud? Osaliselt on seda põhjendatud KIE riikide kohta saadaolevate andmete nappuse ja ebapiisava usaldusväärsusega. Samuti mainitakse KIE riikide spetsiifikat üleminekul plaanimajanduselt turumajandusele, mis muudab analüüsi märkimisväärselt komplitseeritumaks (Demirgüç-Kunt ja Detragiache, 1998). Tuleb tõdeda, et KIE regiooni uurimine pole lihtne ülesanne arvestades riikide eripära nii reformide sisus kui läbiviimise protsessis. Nimetatud erisusi KIE riikide vahel ning teiste regioonide taustal pole senises finantsstabiilsuse alases kirjanduses piisavalt käsitletud ega rõhutatud. Käesoleva doktoritöö ülesandeks on nimetatud teadmiste vajakut vähendada sünteesides olemasolevaid teadmisi ettevõtete ja pankade haavatavusest, lisades sellele uusi aspekte ning asetades teema seni väheuuritud KIE riikide konteksti. Allen ja Gale (2004:770) on tõdenud, et Kesk- ja Ida-Euroopa riikide üleminekuprotsess, Euroopa ühise majandusruumi areng ning finantsturgude globaliseerumise hoogustumine rõhutab finantsüsteeme puudutavate uuringute vajadust ja olulisust.

Uurimuse objekt

Käesoleva doktoritöö uurimisobjektiks on pankade, kui kõige suuremat süsteemset mõju omavate finantsasutuste ning reaalsektori ettevõtete finantshaavatavus. Finantshaavatavuse uurimiseks kasutatakse mitmeid finantshaavatavuse indikaatoreid ehk mõõdikuid, mis peegeldavad ettevõtte või panga jätkusuutlikkust erinevate nii endogeemsete kui välismõjurite toimimise korral.



Joonis 2. Uurimuse objekt (autori koostatud)

Finantshaavatavuse temaatika on tihedalt seotud finantssüsteemi stabiilsuse ehk finantsstabiilsusega. Finantssüsteemi elementideks on turuosalised ehk finantsvahendustevõtted ja reaalsektori ettevõtted, kuid ka finantsturud ning infrastruktuur. Nimetatud elemendid on omakorda vastastikku tihedates seostes, näiteks võimaldab kõrgeltarenenud finantsturu infrastruktuur parandada finantsurgude läbipaistvust ning ettevõtluse või finantsvahendustegevuse toimimise

Ülaltoodud joonis (Joonis 2, lk 136) illustreerib uurimisobjekti ehk ettevõtete ja pankade finantshaavatavuse seoseid finantssüsteemi kui terviku stabiilsusega ning neid omakorda mõjutavate välis- ja endogeensete mõjuritega. Välismõjuritena saab vaadelda näiteks majanduskasvu või intressimäära muutust, endogeensete mõjuritena seevastu näiteks ettevõtte või finantsasutuse finantsvõimendust või kapitaliseeritust.

Käesolevas doktoritöös on rakendatud nii empiirilisi uurimismeetodeid statistikast ja ökonomeetriast kui kasutatud majandusteooria metodoloogilisi võtteid teoreetilise mudeli püstitamisel ja lahendamisel optimeerimise teel.

Valdav osa uuringute aluseks olevast materjalist on seotud finantsstabiilsuse, panga riskide või ettevõtte jätkusuutlikkuse alase kirjandusega. Enamus kasutatud kirjandusest on empiiriline, kuna teoreetilisi mudeleid või kinnitatud seisukohti on antud teema kohta vähe. Enamik teoreetilise rõhuasetusega käsitlustest keskendub kitsapiiriliste probleemiasetuste lahendamisele fikseeritud eelduste tingimustes (vt põhjalik kirjanduse ülevaade Gorton ja Winton, 2002).

Uurimisprobleemide püstitamisel on käesolevas töös tuginetud seni vähe-
käsitletud aspektidele, mistõttu nii uurimisobjekti definitsioon kui probleemi-
asetus on paljuski uudne.

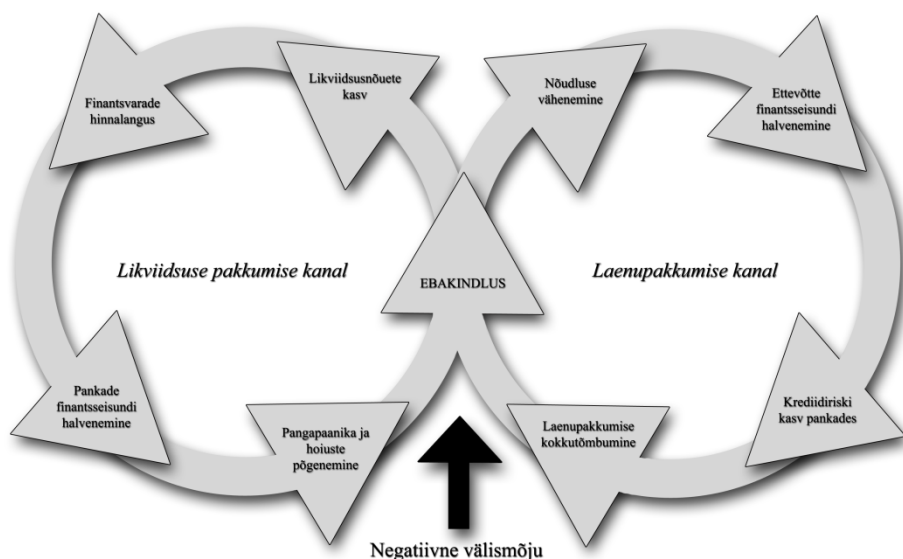
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Empiirilised andmed pärinevad artikkel II puhul andmebaasist BankScope (Bureau van Dijk), mille baasil vaadeldakse 17 KIE riigi panga aastaseid finantsnäitajaid perioodil 1996–2003. Võrdlusandmed riikide makronäitajate ning pangandussektori struktuurinäitajate kohta pärinevad põhiliselt RVF andmebaasist *International Financial Statistics*. Pankade aktsiatulukuse andmed (publikatsioon III) on saadud endiselt Tallinna Börsi veebilehelt ning finantsandmed Eesti Panga finantsstatistika andmebaasist ajavahemikul, mil dissertant töötas Eesti Pangas. Andmed Eesti ettevõtete jätkusuutlikkuse uuringu tarbeks (artikkel IV) pärinevad Äriregistri andmebaasist, sisaldades ettevõtete finantsandmeid aastatel 1995–2004.

Teoreetiline taust

Finanthaavatavuse teemat puudutavas kirjanduses valitseb võrdlemisi suur killustatus. Enamik töödest keskendub kas üksnes pankade probleemidele või ettevõtete probleemidele, kusjuures mõlemat poolt ühendavaid käsitlusi napib (Worrell, 2004:6). Teiselt poolt eristub makrovaateline käsitlus mikrotasandi riskidele koonduvast vaatest. Domineeriv osa kirjandusest toetub empiirilistele uurimustele.

Senini on enamik finantsstabiilsuse ja -haavatavusega seonduvast kirjandusest seadnud uurimisfookusesse pangad või finantsasutused laiemalt. Seejuures on riskiallikana vaadeldud eeskätt finantssektorit ning eriti panku nende erilise rolli tõttu likviidsuse pakkujatena turul. Kindlasti ei saa vastustada pankade eripärast ning keskset rolli finantsstabiilsuse seisukohalt, eriti mis puudutab pankade haavatavust “hoiuste põgenemise” fenomeni suhtes. Teisalt on pankade ja reaalmajanduse vastastikused seosed finantsstabiilsuse seisukohalt äärmiselt olulised. Tänapäeval on ettevõtluse ja pankade seotusele finantsmaailmas suhteliselt vähe tähelepanu pööratud. Allen ja Gale (2004: 769) on toonud välja vajaduse uurida senisest enam finantssektori ja reaalsektori seoseid ning põhjuseid miks avaldavad finantskriisid sedavõrd tugevat ning kiiresti edasikanduvat mõju reaalsektorile. Seda enam on probleemistiku kooskäsitlemine õigustatud kaasaegse majandusruumi arenguloogikat jälgides. Reaalsektori ettevõtted pole kaugeltki pelgalt kauba tootjate või teenuse osutajate rollis, vaid omavad märkimisväärses mahus finantsvarasid ning osalevad aktiivselt aktsiaturgudel nii investorite kui emitentidena. Piirid finantsasutuste ja reaalsektori ettevõtete vahel on hägustumas niihästi tegevusalade, finantskäitumise kui ka suuruse ja süsteemse mõju aspektist. Ettevõtete konsolideerumine on toonud kaasa märkimisväärse turujõu ja mõjuga turuosalisi, mille tegevusraskused ei puuduta pelgalt vahetult seotud osapooli – kreditorid, hankijad, kliendid ja aktsionärid, vaid kandub läbi nende kaudselt palju laiemasse ringi ning halvimaltel juhtudel kahjustab terve sektori või isegi majanduse usaldusväarsust.



Joonis 3. Finantssüsteemi tasakaalustamatuse ahel (autori koostatud)

Ülaltoodud joonis (Joonis 3) illustreerib finantssüsteemi kokkuvarisemise ahelat, milles mõjud kanduvad ühelt süsteemiosaliselt teisele ning võimendavad kriisi koondmõju. Joonisel moodustub kaks poolust, millest üks peegeldab kriisi transmissiooni läbi laenukanali ning teine läbi likviidsuskanali. Tegelikkuses võib kriisi lähtekoldeks osutuda nii üks kui ka teine ning välistatud pole ka mõlema kanali samaaegne toimimine. Kirjanduses on palju vaadeldud finants- ja reaalsektori vahetõrje kriisi tekkemehhanismis ning siin pole võimalik üheselt määratleda, kumba vaadelda kriisi lähtepõhjuseks. Näiteks kaubanduskriisi puhul saab esimese löögi ettevõtlussektor läbi nõudluse languse, mille negatiivsed mõjud kanduvad halvimal juhul ka finantssektorisse. Esineb ka finantssektorist alguse saavaid kriise, kus turul valitsev ebakindlus saab alguse teatud välisest šokist, näiteks globaalsete aktsiaturgude kukkumisest, millest põhjustatuna langeb usaldus finantssektori vastu, tekib kõrgendatud likviidsusnõudlus, mis omakorda viib finantsvarade hinnad veelgi sügavamasse langusse. Pankade ja finantsasutuste finantsvarade väärtuse langus toob kaasa kapitalipuhvrite ammendumise ning lõppkokkuvõttes võib tingida turuosaliste usalduse kaotuse finantssektori jätkusuutlikkusesse koos hoiuste massilise väljavõtmisega pankadest (Allen and Gale, 2004: 747), mis viib pangapaanikani ning finantssüsteemi toimimisvõime halvamiseni. Antud kriisimehhanismide ülekandumise takistuseks saab olla vaid institutsioonide – pankade ja ettevõtete tugevus. Mida vähem haavatavad on ettevõtted ja pangad, seda vähem tõenäoline on kriisi edasikandumine, laienemine ja võimendumine.

Publikatsioonide sisukokkuvõte ja järeldused

Antud doktoritöö keskmeks on neli teaduspublikatsiooni, mille ühiseks nimeajaks on püüdlus avastada uusi vaatekohti või leida empiirilisi võrdlusvõimalusi olemasoleva kirjandusega finantshaavatavuse teemal. Eeskätt on kõigi nelja uurimistöö kirjutamisel peetud eesmärgina silmas vastuse leidmist küsimusele, millised tegurid muudavad ettevõtteid ja panku haavatavateks teatud kriitilistes situatsioonides, olgu selleks majanduslangus, finantseerimisvõimaluste ahenemine või kallinemine, turukonkurentsi tihenemine, uued regulatiivsed nõuded või muud asjaolud. Samuti püüab töö tuvastada indikaatoreid mis pankade ja ettevõtete finantshaavatavust ära tunda ning ennetavalt signaliseerida suudavad. Alljärgnevalt on toodud kokkuvõtted kõigi nelja teaduspublikatsiooni kohta, millele järgnev tabel koondab nimetatud publikatsioonide uurimiseesmärgid ja -ülesanded, konteksti ning tulemused ja järeldused (vt Tabel 1 lk 144–146).

Publikatsioon I: Panga riskitolerants finantshaavatavuse mõjutegurina (*What feeds banks' appetite for risk-entailing portfolios?*)

Pankade ekspansiivse laenupoliitika kõrgerioodid ning nende sageli kahetsusväärsed tagajärjed on huvipakkuvaks teemaks pankade käitumise modelleerimisel. Finantshaavatavuse kontekstis kuulub panga moraalarisk ning riskikäitumine laiemas mõttes endogeensete finantshaavatavuse mõjurite hulka. Ebamõistlik riskitolerants suurendab finantshaavatavust ning võib seada ohtu panga jätkusuutlikkuse.

Kirjanduses on välja toodud mitmeid tegureid, mis toovad kaasa pankade lühinägeliku käitumise ning kaasnevate riskide alahindamise. Enamik uurimusi on antud küsimust käsitlenud regulatsioonide (eeskätt hoiusekindlustuse, aga ka kapitalinõuete) mõju seisukohalt. Teisisõnu nähakse pankade riskikäitumise (sh moraalariski) soodustajana regulatsioone, mis kahandavad riski võtmisega kaasnevaid kulusid hoiustajatele või rahapaigutajatele, ning seeläbi väheneb panku korrale kutsuv turudistsipliin (ingl. k. *market discipline*) või hakkavad pangad täiendavat tulu otsima kapitaliarbitraažist ehk võimalusest sama kapitalikulu juures kõrget ent märkimisväärse riskiga kasumit teenida. Regulatsioonide mõju kõrval on siiski teisi olulisi tegureid, mis pankade „riskiisu“ suurendavad – eeskätt pankurite piiratud omavastutus, millega kaasneb lühinägelik käitumine, ning kasumite ümbermängimine (ingl. k. *gains trading*) ehk tegevus, millega suurendatakse lühiajalisi kasumeid tuleviku kasumite arvelt.

Artiklis esitatud teoreetiline mudel eeldab, et pank maksimeerib lühiajalist kasumit tingimustes, kus on kaks valikut – hoida riskantsete varade (ehk laenude) portfelli pikaajalise kasumi teenimiseks või müüa see maha, kaotades sellega võimaluse saada tulu laenuportfelli amortiseerumise perioodi jooksul,

kuid saades kohest müügitulu, mille arvelt kahandada kohustuste teenindamise kulusid. Teadaolevalt on pankade mitte-likviidsete varade, eeskätt laenuportfelli likvideerimisväärtus märkimisväärselt madalam selle väärtusest jätkuva tegutsemise korral, mistõttu jääb pangal enneaegsest müügist tingituna osa kasumist tulevikus saamata. Mudeli teiseks oluliseks eelduseks on asjaolu, et pankadele on laenupakkumise maht piiratud ehk iga täiendav laenupakkumine kahandab laenuühikult teenitavat piirtulu.

Mudel osutab, et riskivaba intressimäära langus ning panga ressursihinna langus nagu ka positiivne majanduskeskkond innustavad panku laenuportfelle paisutama. Samas mida parem on konjunktuur, seda kahjumlikum on antud olukorras portfelli likvideerida. Teisisõnu, mida suurem on likvideeritav portfelli, seda suurem on selle võimaliku müügihinna langus ning saamatajäänud kasum. Niisiis peaksid spetsiifiliste (ingl. k. *idiosyncratic*) probleemidega pangad hoiduma laenuportfelli kasvatamisest ka majanduskeskkonna kõrgfaasis. Panga äriiline väärtus (*charter value*) ja varade enneaegsest likvideerimisest tingitud kahju suurus omavad kahesugust ning vastassuunalist mõju. Ühelt poolt vähendavad mõlemad tegurid tõenäosust, et pank otsustab varade likvideerimise kasuks – ehk suurendavad panga huvi riskantsete varade portfelli kasvatamise vastu. Teiselt poolt suurendavad mõlemad tegurid panga kahjumit varade likvideerimise korral, ehk pangale on kasulik riskantseid varasid mitte suurendada. Varade enneaegsest likvideerimisest tingitud kahju hinnang on omamoodi panga moraaliriski pöördväärtuse mõõdikuks. Mida kõrgemaks hindab pank saamata jäänud tuleviku kasumeid portfelli likvideerimise korral, seda väiksem on panga moraalirisk ehk lühinägelikkus strateegilistes valikutes.

Artikli panuseks on pakkuda välja omalaadne vaatenurk panga riskikäitumisele, modelleerides pangale optimaalset riskiportfelli kindlapiirilistel eeldustel.

Publikatsioon II: Pankade finantshaavatavusest Kesk- ja Ida-Euroopa üleminekuriikides (*Investigating the early signals of banking sector vulnerabilities in Central and East European emerging markets*)

Antud empiiriline uurimus toetub Kesk-ja Ida-Euroopa pankade paneelandmetele, kattes ajavahemikku 1996–2003. Lisaks pankade finantsandmetele on uurimusse kaasatud nii finantssektori struktuursed näitajad kui riikide makromajanduslikud andmed. Töö tulemused kinnitavad, et pankade finantsraskuste selgitamisel on oluline roll kõigil ülalnimetatud andmekategooriatel. Kuna analüüsihorisondina võrreldakse kahte perioodi – pankrotistumisele vahetult eelneva perioodi näitajate muudud ning sellele eelneva perioodi näitajate muudud, on ilmne, et ühe ja sama selgitava näitaja käitumine oleneb sellest millises pankrotieelses ajahorisondis seda vaadelda. KIE riikide puhul leidis kinnitust tõusu-mõõna-tsükli fenomen, millest

tingitud „mullistused“ on üheks tüüpilisemaks pangakrahhide arengumustriks. Seejuures on pangakrahhide puhul tegemist keeruka sündmuste ja protsesside ahelaga, mistõttu otsingud “töökindlate” kriisiindikaatorite leidmiseks on ilmselt määratud läbikukkumisele.

Uuringusse oli kaasatud 17 siirderiiki ning Lõuna-Euroopa arenevat turgu, hõlmates Bosnia-Herzegovinat, Horvaatiat, Küprost, Tšehhi Vabariiki, Eestit, Lätit, Leedut, Makedooniat, Maltat, Moldaaviat, Poolat, Rumeeniat, Venemaad, Sloveeniat, Slovakkia, Türgit ja Ukrainat. Kuna valimisse kuuluvate riikide reformide ning majanduse arengukiirus erineb suurel määral, siis jaotati riigid EBRD pangandusreformi indeksi alusel kahte gruppi. Esimesse ehk kõrgema reformiarenguga riikide hulka langesid 10 EL liikmesriiki ning Horvaatia, jättes ülejäänud riigid teise kategooriasse. Võrreldes omavahel erineva arengukiirusega siirderiike selgus, et pangad madalama arengutasemega siirdemajandustes olid tundlikumad režiimimuutuste nagu pankade erastamine, inflatsiooni-surve ning valuutakursimuutuste suhtes. Samas kõrgema reformitempoga riikides sõltus pankade jätkusuutlikkus pigem turu- ja krediidiriskist.

Fikseeritud efektidega logistilise mudeli hinnangud osutasid, et pankade haavatavust oli raskem hinnata kõrge turuvälise sekkumisega riikides nagu Poola, Horvaatia ja Sloveenia.

Publikatsioon III: Eesti pankade turupõhised finantshaavatavusindikaatorid (*Extracting leading indicators of banks fragility from market prices – Estonia focus*)

Uurimus keskendub Eesti pankade turupõhiste ehk aktsiatulukusel rajanevate mõõdikute hindamisel panga finantshaavatavuse peegeldajana ning eelhoitava indikaatorina. Analüüsi objektiks on kuus Eestis tegutsevat või tegutsenud panka – Eesti Maapank, SEB Eesti Ühispank, Eeva Pank, Hansapank, Hoiupank and Tallinna Pank, mille aktsiad olid kas lühema või pikema perioodi jooksul ajavahemikus august 1996 – juuli 2004 noteeritud Tallinna Väärtpaberibörsil. Black-Scholes (1973) ja Mertoni (1974) optsioonmudelid tuletatult arvatati igale pangale kuise sagedusega kaugus-maksevõimetusest (ingl k *distance-to-default*) riskiskoor. Kaugus maksevõimetusest on olemuselt ettevaatav ning ajas muutuv riskimõõdik, mis näitab panga turuväärtuse ning kohustuste raamatupidamisliku väärtuse vahet. Mida madalam on mõõdiku väärtus, seda kõrgem on risk et pank osutub jätkusuutmatuks.

Kaugus-maksevõimetusest skoori, omakapitali turuväärtust ning selle volatiilsust analüüsiti iga panga kohta eraldi võttes aluseks panga kohta teadaolevat sündmuste kronoloogiat. Kolme panga (Hansapank, Hoiupank and SEB Eesti Ühispank) kohta, millele oli omistatud rahvusvaheline riskireiting leiti ka kaugus-maksevõimetusest mõõdiku ning riskireitingu vahelised Grangeri kausaalsushinnangud. Grangeri kausaalustesti tulemused osutasid, et Hansapanga

puhul puudusid statistiliselt olulised kausaalsed seosed riskireitingu ning optsioonimudeli baasil arvutatud riskimõõdiku vahel. SEB Eesti Ühispanga puhul esines statistiliselt oluline vastassuunaline kausaalne mõju, seevastu kui ainsana Hoiupanga korral esines ühesuunaline statistiliselt oluline kausaalne seos kaugus-maksevõimetusest indikaatorilt riskireitingu suunas. Teisisõnu võis üksnes Hoiupanga puhul tõdeda, et kaugus-maksevõimetusest indikaator ennetas riskireitingut. Seejuures oli Hoiupank ka ainus pank, mis seoses finantsraskuste tekkimisega iseseisva turutegevuse lõpetas seoses ülevõtmisega Hansapanga poolt.

Kokkuvõttes näitasid tulemused, et kaugus-maksevõimetusest osutub usaldusväärseks ning sisukaks panga haavatavusindikaatoriks, kätkedes endas ka eelhoiatava signaali omadusi. Samas osutas uurimus asjaolule, et õhukese turuga ning madala likviidusega aktsiad ei suuda panga haavatavuse kohta sisukat sõnumit kanda (EVEA Pank).

Uuringu järelduseks on tõdemus, et kuigi turupõhised indikaatorid on operatiivsed ning sisukad finantshaavatavuse indikaatorid on siirderiikide õhukese ning madala likviidsusega finantsturgude kontekstis vaja usaldusväärse hinnangu kujundamiseks kasutada erinevaid, üksteist täiendavaid haavatavusindikaatoreid.

Publikatsioon IV: Eesti ettevõtete jätkusuutlikkuse tegurid (*Patterns of firm survival in Estonia*)

Uurimus keskendub Eesti ettevõtete jätkusuutlikkuse tegurite väljaselgitamisele. Ettevõtte jätkusuutlikkust vaadeldakse kahel tasandil, millest esimene keskendub seadusega ettenähtud omakapitali nõude täitmisele või mittetäitmisele¹² ning teine seab tingimuseks ettevõtte jätkuva tegutsemise Äriregistri andmete kontekstis. Seega kontrollitakse ettevõtte jätkusuutlikkust kahe erineva tingimusega, mis võimaldab kontrollida tulemuste sensitiivsust.

Jätkusuutlikkust mõjutavate tegurite valik toetub ettevõtte struktuuri ja finantsnäitajatele. Esimeste hulgas vaadeldakse ettevõtte suurust (SKP¹³ deflaatoriga korrigeeritud ettevõtte koguvarede logaritmnäitaja) ning ettevõtte asutamise vormi (aktsiaselts või osaühing). Finantsnäitajatest hinnatakse võlakoorumust, varade tulukust, müügi juurdehindlust ning varade tulukuse volatiilsust. Võrrandi seletavate näitajate valikul on lähtutud nii senises kirjanduses käsitletust, näitaja tõlgenduse selgusest riski kontekstis, olulisust Wilcoxon testi baasil ning samuti andmete esinduslikkusest ja kvaliteedist.

¹² Jätkusuutlikkuse kriteerium toetub Eesti Äriseadustiku § 176-le, mille kohaselt on ettevõtte kohustatud hoidma oma omavahendite taste vähemalt 50% ulatuses seadusega ettenähtud minimaalsest aktsia- või osakapitalist.

¹³ Sisemajanduse koguprodukt

Tabel 1: Uurimistulemuste kokkuvõte

Uurimisküsimused	Uurimiskontekst: andmed ja eeldused	Järeldused ja uurimisleiud
Publikatsioon I: Panga riskitolerants finantshaavatavuse mõjutegurina		
<p>1. Kas pankadele on omased sisemised ajendid, mis viivad liigsele riski tolerantsile tuues kaasa ülemäärase riskiportfelli kasvu?</p> <p>2. Millised on need mõjurid, mis toovad kaasa riskantsete varade kasvu portfellis, pidades silmas panga lühiajalist kasumi maksimeerimise eesmärki asümmeetrilise informatsiooni ja investearingu langeva piirtootluse tingimustes.</p>	<p>Sihifunktsioon: Lühiajaline kasumi maksimeerimine alljärgnevatel eeldustel:</p> <ol style="list-style-type: none">1. Asümmeetriline informatsioon2. Investearingu langev piirtootlus3. Pikaajaliste tulude ümbermängimine lühiajalisteks (ingl. k. <i>gains trading</i>)	<ol style="list-style-type: none">1. Eelduste püstitamine ja kirjanduse analüüs osutab, et pangad võivad kalduda lühiajaliste eesmärkide teenimisele, millega kaasneb ka pikaajaliste tulude ümbermängimine lühiajaliseks (ingl. k. <i>gains trading</i>)2. Riskivaba intressi langus toob lühiajalise kasumi maksimeerimise olukorras kaasa pankade huvi kasvatada riskantseid portfelle. Sama mõju avaldub ka panga sisselaenatava raha hinna languse korral. Samuti toovad positiivsed ootused majanduskeskkonna suhtes kaasa julgema riskiportfelli kasvu. Panga ärilise-väärtuse (ingl. k. <i>Charter value</i>) ning enneaegse varaportfelli likvideerimise kahju hindamise parameeter omavad vastassuunalist ning seega ebaselget mõju panga riskiportfelli kasvule.

Uurimisküsimused	Uurimiskontekst: andmed ja eeldused	Järeldused ja uurimisleiud
<p>Publikaatsioon II: Pankade finantshaavatavusest Kesk- ja Ida-Euroopa üleminekuriikides</p> <p>1. Kas panga finantsnäitajad, makromajanduse indikaatorid, pangandussektori struktuurnäitajad ning pangandussektori arengutaseme- ehk reformiindeks suudavad peegeldada panga haavatavus-riskse ning aitavad ennustada võimalikku pangakriisi?</p> <p>2. Kuidas käituvad panga haavatavust peegeldavad indikaatorid kiiremini arenenud ning aeglasema reformitempoga siirderiikide võrlduses? Kas siin on erisusi?</p> <p>3. Kas panga haavatavusindikaatorite käitumine kinnitab Gonzalez-Hermosillo (1999:19–20) poolt välja toodud kriisi elutsükli teooriat?</p>	<p>KIE riigid (17): Albaania, Valgevene, Bosnia-Hertsegoviina, Bulgaaria, Horvaatia, Tšehhi Vabariik, Eesti, Ungari, Läti, Leedu, Makedoonia, Moldova, Poola, Rumeenia, Venemaa, Serbia, Sloveenia, Slovakkia, Ukraina.</p> <p>Aastased vaatlused: 1996–2003</p> <p>Andmeallikad: Pangapõhised näitajad: BankScope Makromajanduslikud näitajad ja pangandussektori struktuurimuutujad: IMF IFS, Eurostat.</p>	<p>1. Hinnangud osutasid, et kõik indikaatorite grupid (pangapõhised näitajad, pangandussektori struktuuri indikaatorid ning makro- ja väliskeskonna muutujad) osutasid pangaprobleemide kirjeldamisel oluliseks.</p> <p>2. Vähemarenenud pangandussüsteemiga riikides on pankade haavatavus suuremas sõltuvuses institutsionaalsetest teguritest ning režiimimuutustest, näiteks privatiseerimine, inflatsiooni- ning valuutakursi muutused. Seevastu enamarenenud siirderiikides omavad pankade jätkusuutlikkuse aspektist olulisemat rolli turutegurid, nagu kauplemisportfelli tulude kahanemine ning eralaenamise kasv.</p> <p>3. Gonzalez-Hermosillo (1999:19–20) kriisi elutsükli teooria leidis KIE riikide pankade andmetel kinnitust. Teisisõnu käitusid haavatavusindikaatorid sõltuvalt kriisile eelnenud ajahorisondist väga erinevalt, andes ka erinägilisi statistilisi tulemusi.</p>
<p>Publikaatsioon III: Eesti pankade turupõhised finantshaavatavusindikaatorid</p> <p>1. Kuidas on võimalik hinnata Eesti pankade finantshaavatavust toetudes Black and Scholes (1973) ja Merton (1974) optsioonimudelitest tuletatud kaugus-maksevõimetusest (<i>distance-to-default</i>) riskimõõdikule?</p> <p>2. Kas esineb Grangeri kausaalne seos panga krediidireitingu ning kaugus maksevõimetusest (<i>distance-to-default</i>) riskimõõdiku vahel ning kui esineb, siis milline on kausaalsuse suund?</p>	<p>Eesti kommertsbankade kuised bilansi ja aktsiatulukuse andmed järgmistel vaatlusperioodidel:</p> <p>SEB Eesti Ühispank: 8.1996–8.2000 Hoiupank: 8.1996–6.1998 Evea Pank: 2.1997–8.1998 Eesti Maapank: 3.1997–6.1998 Hansapank: 8.1996–7.2004 Tallinna Pank: 8.1996–6.1998</p>	<p>1. Kaugus-maksevõimetusest (<i>distance-to-default</i>) riskinäitaja suudab signaalselt panga finants-haavatavust ning toimib operatiivse eelhoiatusindikaatorina, välja arvatud väga madala aktsia-likviiduse ning piiratud aktsiakäibe mahuga pankade, näiteks EVEA Panga puhul.</p> <p>2. Grangeri kausaalsushinnangud ei toonud välja statistiliselt olulist kausaalset suhet krediidireitingute ning kaugus-maksevõimetusest (<i>distance-to-default</i>) riskinäitajate vahel. Tulemus osutab sellele, et panga haavatavuse hindamisel arenevate turgude kontekstis on vajalik kasutada erinevaid, üksteist täiendavaid haavatavusindikaatoreid.</p>

Uurimisküsimused	Uurimiskontekst: andmed ja eeldused	Järeldused ja uurimisleiud
Publikatsioon IV: Ettevõtete jätkusuutlikkus Eestis		
<p>1. Millised ettevõtetetasandi muutujad on ettevõtete jätkusuutlikkuse kirjeldamisel ning prognoosimisel olulised?</p> <p>2. Kas ja millisel moel erinevad tulemused rakendades kahte erinevat ettevõtte finants-raskustesse sattumise definitsiooni – minimaalse omakapitali nõude mittetäitmine ning omakapitalinõuet mittetäitva ettevõtte turult lahkimine?</p> <p>3. Kas senises empiirilises kirjanduses väljatoodud ettevõtete U-kujuline elukõver leiab kinnitust ka Eesti ettevõtete andmetel?</p> <p>4. Millised on majandusharude vahelised erinevused elukõveras?</p>	<p>Eesti Äriregistrile esitatavad Eesti ettevõtete finantsaruannete andmed. Uurimisvalimisse kuuluvad vaid aktsiaseltsi või osahinguna asutatud ettevõtted.</p> <p>Majandusharud: tööstus, kaubandus, ehitus ja kinnisvara.</p> <p>Aastased vaatlused: 1994–2004</p>	<p>1. Tulemused kinnitavad varasemas kirjanduses välja-toodud tulemusi: suurem varade maht, madalam finantsvõimendus, kõrge varade tootlus ning tugev müügikäibe ja tegevuskulude suhe parandab ettevõtte jätkusuutlikkuse väljavaateid. Huvitavaks leiuks osutus asjaolu, et AS tüüpi ettevõtted võrreldes OÜ tüüpi ettevõtetega osutusid 1,5–2 korda tõenäolisemalt sattuvat olukorda, kus rikuti minimaalse omakapitali nõuet või kus toimus likvideerimine omakapitali ebapiisavuse tõttu.</p> <p>2. Omakapitali miinimumnõude mittetäitmise baasrisk osutus kümme korda kõrgemaks tõenäosusest, millega kapitalinõuet mittetäitev ettevõtte turult lahku. Mõlemat sündmust mõjutavad tegurid olid seejuures sarnased, va asjaolu, et madal varade tulukus ja kõrge finantsvõimendus olid tugevamalt seotud omakapitali ebapiisavuse tekkimisega, mitte aga niivõrd oluline ettevõtte turult lahkumise põhjuse. Seevastu madal müügikäibe ja tegevuskulude suhe peegeldas pigem ettevõtte suutlikkust turul püsima jääda kui põhjustas omakapitali nõude mittetäitmist.</p> <p>3. Alustavate ettevõtete baasrisk on kõrgem, ehk ettevõtete riskikõver on ajas langev.</p> <p>4. Võrreldes teiste majandusharudega osutus ettevõtete baasrisk kõrgemaks kaubanduse ja teeninduse sektoris.</p>

Analüüsimetoodika baseerus diskreetse kestvusanalüüsi meetodi kasutamisele cloglog mudeli näol. Kuna tegemist oli aastase sagedusega andmetega, siis on diskreetsed mudelid kohasemad, kuna erinevalt pidevatest kestvusanalüüsi mudelitest (nt Weibull, Cox jt) ei eeldata sündmuste ajalise kokkulangevuse (ingl. k. *ties*) välistamist.

Töö tulemused kinnitasid kirjanduses väljatoodud seaduspärasid, mille kohaselt ettevõtete haavatavus on kõrgem turule sisenemise etapis. Samuti on suuremad ettevõtted väiksematega võrreldes jätkusuutlikumad. Tööstusharude lõikes on suuri investeeringuid eeldavad tootmisettevõtted jätkusuutlikumad võrreldes kaubandus- ja teenindusettevõtetega. Finantsnäitajate osas parandavad ettevõtte jätkusuutlikkuse väljavaateid tugev ja stabiilne varade tulukus, piisav juurdehindlusvaru ning mõõdukas võlakooormus. Töö uudeks, avastuslikuks tulemuseks oli ettevõtte juriidilise vormi (aktsiaselts või osaühing) olulisus jätkusuutlikkusele. Üllatuslikult ilmnis, et kõrgemat omakapitalinõuet täitvad aktsiaseltsid osutuvad vähem jätkusuutlikeks võrreldes osaühingutega. Ilmselt on antud tulemust mõjutanud olulisel määral uurimisperioodi 1994–2004 vältel kehtestatud regulatsioonid, eeskätt kohustus registreerida aktsiad Eesti Väärtpaberite Keskdepositooriumis. Passiivne kodumaine aktsiaturg ning karmistunud regulatsioonid, mis põhjustasid täiendavaid kulusid aktsiaseltsidele, tingides ettevõtete ümbervormistamist osaühinguteks ning aktsiaseltside likvideerimist.

Soovitusi tulevasteks uuringuteks

Finantshaavatavuse temaatikas on rohkelt uurimisruumi nii teoreetilisel kui ka empiirilisel suunal. Enim praktilist kasu ning poliitilist huvi võiks oodata senisest laialdasemast turuindikaatorite, nagu aktsia- ja võlakirjade ning eriti allutatud võlakirjade hindade, aga ka finantssüsteemi infrastruktuuri tegurite nagu elektrooniliste kanalite areng, finantsturu läbipaistvust toetavate avalikustamisinõuete ja turudistsipliini, turule sisenemise barjääride, omandistruktuuri ning muude finantsturu korraldusega seotud aspektide kasutamisest finantshaavatavuse ning finantsstabiilsuse analüüsis.

Senised tulemused turupõhiste indikaatorite rakendamisel haavatavusindikaatoritena on paljulubavad (Gropp *et al*, 2002, Chan-Lau *et al*, 2004; Chen *et al*, 2006 jt), kuid antud uurimissuuna arengu takistuseks on andmete piiratud kättesaadavus ning eriti on see lähenemine raskendatud vähem arenenud või õhukeste finantsturgudega riikides ja piirkondades, mille hulka kuuluvad valdavalt ka Kesk- ja Ida-Euroopa üleminekuriigid.

Finantssüsteemi infrastruktuuri aspekte on tänaseni uuritud eeskätt pankade kapitalinõuete ning hoiusekindlustuse regulatsioonide kontekstis (Diamond ja Dybvig, 1983, Diamond ja Rajan, 2000, 2001). Alternatiivseid infrastruktuuri indikaatoreid on vaadeldud väga piiratud ulatuses, kui üldse. Seega puudub tänaseni piisav teadmine sellest, kuidas mõjutavad erinevad finantssüsteemi infrastruktuuri tegurid süsteemi kui terviku stabiilsust ning selle osade finantshaavatavust.

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- finantsriskide makrokäsitlus
- finantsstabiilsus.

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