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An Event Study of Swedish Banks' Stock Price Reactions to the Baltic Crisis

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Abstract

The ongoing financial crisis in the Baltic States has raised concerns about the Swedish banking system. For this purpose we examine how the four largest Swedish banks' stock returns are affected by economic events from the Baltic States, using an event parameter approach. With our event study methodology we can test if the market discriminates between banks with different Baltic loan exposure or if contagion effects are present. For the events that had an impact on the Swedish banks we find evidence that the market only partially separated between the banks according to their exposure.

Key Words: Financial Crisis, Baltic States, Swedish Banks, Event Study

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1 Introduction

The ongoing financial crisis has been one of the most discussed economic topics during the past two years. It is among the most severe economic downturns since the Great Depression in the 1930s and economies worldwide have been affected to some extent. Sweden and the Swedish banks' are no exception to be affected by the markets changing conditions and appetite for risk. The largest concerns are directed to the banks' operations in the Baltic States.

The three Baltic States - Estonia, Latvia and Lithuania - are in a deep economic crisis. They have experienced a journey from high stable GDP growth with almost balanced budgets to a situation with contracting economies. The countries have suffered from large current account deficits and high inflation. The combination of a fixed exchange rate to the euro and high inflation reduced the competitiveness for the countries and priced them out of the market. Furthermore, the countries have experienced a booming real estate market with a large part of the loans given in euro and financed by foreign owned banks. In 2007 the bubble in the Baltic's burst, leading to a slowdown in the banks' credit grant policies. Housing prices declined together with private consumption and investments, reducing the growth in GDP and raised unemployment (Åslund 2009).

The economic development in the Baltic's is of particular interest for the large Swedish banks, since they are among the most exposed to the region. From year 2000-08 the outstanding loans towards the Baltic's has increased from 30 to approximately 425 billion SEK (Forsberg 2009). This has raised concerns among investors regarding credit losses and implications for the financial system.

The purpose with this paper is to examine if potentially important economic events from the Baltic States affect the stock prices of Sweden's four major banks. Our main focus is to examine whether the reactions are in proportion to the banks' respective exposure levels or if contagion effects are present.

In the Swedish financial system, contagion and systematic risk is of particular interest for at least two reasons. At first, the banking sector is highly concentrated and the four largest banks are closely inter-related. Secondly, they are involved in international banking and especially SEB and Swedbank are significantly affected by the troublesome situation in the Baltic States. We chose to concentrate on the relationship between Swedish banks and the crisis in the Baltic region, since this is one of the main concerns for the Swedish banking system in the ongoing financial crisis. In addition, the media coverage of the most exposed banks, SEB and Swedbank, has been extensive.

To our knowledge, the impact of events from the Baltic crisis has not yet been examined on Swedish data. Our ambition is to increase the knowledge of how Swedish banks interact in this financial crisis.

The subsequent parts of the paper are organized in the following way. Section 2 gives an overview of event studies in general and on similar studies regarding banks reactions to financial crises. Section 3 provides a description of the events selected and introduce the methodology for the event analysis. In section 4 we present the results from the event study and in section 5 we analyze our findings. In Section 6 we discuss the robustness of the results and section 7 concludes.

2 Literature review

Economists are often faced with the problem of measuring the effect of an economic event on the value of a firm. At a first glance this seems to be a complicated task however, a measurement can be created relatively easy with an event study, using financial market data. The basic statistical framework is based on measurements of securities abnormal returns and cumulative abnormal returns around the time of an event (MacKinlay 1997).

There exist no unique structure to perform event studies, but several papers and academic literature proposes an outline that is useful to follow. For example, Campbell *et al.* (1997) describes a general set-up which is helpful when conducting an event study. In a first step, the event(s) of interest is defined and the period over which the firms' returns will be examined is determined. Secondly, the *selection criteria* for the inclusion of a given firm have to be determined. This may involve restrictions such as data availability or membership of a specific industry et cetera. Next, the impact of an event is measured with abnormal returns, which is the actual *ex post* return of the security of interest minus the normal return over the event window. The normal return is defined as the return that would be expected in absence of the event. In the next step the parameters in the model are estimated using a subset of data known as the *estimation window*, where the most common is to use days prior the selected event(s). When the normal returns have been estimated, abnormal returns are calculated and the significance of the event(s) impact is tested.

The first study that applied an event study was Dolley (1933) and a substantial number of papers have since then been published (MacKinlay 1997). As described in Bowman (1983) the roots for modern event studies can be found in the papers by Ball and Brown (1968), where price reactions to the unanticipated component of annual accounting earnings was investigated and in Fama, Fisher, Jensen and Roll (FFJR) (1969) who examined if the stock market was efficient with respect to stock splits.

Typical examples where modern event studies are applicable include merger and acquisitions, stock splits, earning announcements, events during financial crises and announcements of macro economic variables.

Khotari and Warner (2006) describe in their study that, over time, at least two main refinements have been made in the event study methodology. First, there has been a change from monthly to daily security return data. This change has made it possible to obtain more precise measurement of abnormal returns. Implications and the use of daily data are dealt with in Brown and Warner (1985). Second, the methods used to measure abnormal returns and to test for significance have become more sophisticated.

The existing event study literature on the reaction of bank stock prices to financial crises has been done primarily on US data (Crouzille *et al.* 2006). One of the most central questions raised in these papers is if contagion effects are present or if the market is able to discriminate between banks with low as well as high risk exposure. For example, Kilic *et al.* (2000) examined how events of the Mexican peso crisis affected US banks returns and found, on average, evidence for contagion effects. Mathur and Sundaram (1997) analyzed how events of the Brazilian debt crisis affected US banks and concluded that the market was able to differentiate between banks with different exposure. Cornell and Shapiro (1986) investigated how US banks' stock prices reacted to different international debt related news items and concluded that the market reacted rationally. There have also been studies based on European data, and these have been predominantly addressed to the Asian and Russian financial crises in the late 90s. Crouzille *et al.* (2006) examined how a selection of European banks was affected by events from both the Asian and Russian financial crises and found indication of possible contagion effects. Rime (2003) performed an event study for Swiss banks' reaction to the Russian collapse and could not draw any general conclusions regarding the reaction of the market, since the results were mixed.

The models used in the mentioned papers above differ somewhat to traditional event studies such as in FFJR (1969). The reason for this is that event studies examining financial crises often use the same events for all firms as argued in Binder (1985). This poses the problems of event and industry clustering as argued in Henderson (1990). Event clustering refers to events occurring at or near the same time whilst industry clustering refers to events concentrated in the same industry. The clustering problem is solved by using multivariate regression models with dummy variables for the event dates as described in Binder (1985).

3 Database and Methodology

3.1 Data set and description of the events

The data sample covers the four largest Swedish banks Nordea, Svenska Handelsbanken ("SHB"), Swedbank and Skandinaviska Enskilda Banken ("SEB") whose equity is traded on the Swedish stock exchange. Swedbank is the most exposed bank to the Baltic region followed by SEB, Nordea and SHB. The approximate exposure figures are shown in *Table 1* below. We define the Baltic exposure for each bank as the book value of Baltic loans over book value of total loans.

Table 1: The Baltic exposure for each bank

Date	Swedbank	SEB	Nordea	SHB
2007-12-31	16%	11%	2%	0,1%
2008-12-31	17%	11%	3%	0,1%

Source: Annual reports (2007-08).[1]

Daily bank stock prices and daily stock indices, for the sample period January 2007 to the end of March 2009, are taken from Thomson Datastream International and are adjusted for corporate actions, such as stock splits. Furthermore, in our study we have chosen to treat the Baltic States as one region.

During the ongoing financial crisis, a large number of economic events have had an effect on the financial markets in the Baltic States. Our goal is as stated before to examine if a selection of these events affects the Swedish banks' stock prices and if the responses are proportional to their exposure.

[1] Note: The Baltic exposure for SHB year 2007 is received from contact with its investor relations department, since it is not available in the annual report. The figures for SEB include repurchase agreements and off-balance sheet credit exposure.

A list of events was determined by combining the Reuters' and Bloomberg's news archives with surveys and press releases from the Swedish central bank ("the Riksbank"), the International Monetary Fund, the European Investment Bank and the central banks for the Baltic States. *Table 2* below summarizes the selected events.

Table 2: Economic events from the Baltic States

Date	Event	Description
2008-04-28	**E1**	2008-Q1 GDP growth eases to 6,4% y/y in Lithuania.
2008-05-09	**E2**	2008-Q1 GDP growth tumbles to 3,6% y/y in Latvia.
2008-05-14	**E3**	2008-Q1 GDP growth slows to 0,4% y/y in Estonia.
2008-10-14	**E4**	IMF officials: The Baltic states could follow Icelandic scenario.
2008-11-07	**E5**	Moody's report that Estonian bank credit outlook is negative.
2008-11-10	**E6**	Nationalization of Parex bank in Latvia.
2008-12-05	**E7**	Moody's report that Lithuanian bank credit outlook is negative.
2008-12-09	**E8**	Largest drop in Estonian GDP y/y rate in 14 years.
2008-12-19	**E9**	IMF and Latvia agrees on rescue package.
2009-01-13	**E10**	Anti-government riots in Latvia.
2009-02-06	**E11**	Lithuania launches economic stimulus plan.
2009-02-13	**E12**	GDP collapse in Estonia down 9,4% y/y.
2009-02-20	**E13**	Latvian government falls, PM resigned.
2009-02-27	**E14**	The Riksbank lends to the Estonian central bank.
2009-03-13	**E15**	EIB lends 1,15b € to support SME's in Lithuania.

Source: Bloomberg and Reuters' archives.

The most commonly known events in our list are the nationalization of Parex Bank, the agreement of the rescue package between IMF and Latvia and the fall of the Latvian government due to the economic crisis. In addition to these, we include other economical and political events from all the Baltic States that might have an impact on the valuation of Swedish banks' exposed to the region.

Our hypothesis regarding the selected events is that they will affect some of the banks valuation, and that SEB and Swedbank will be the most affected, since they are the two most exposed to the Baltic's. We expect that the Baltic States GDP reports for the first quarter 2008 and the GDP collapse in Estonia in the fourth quarter, to have a negative impact on the Swedish banks' stock prices with exposure to the region. The GDP collapse in Estonia was the largest drop in the country's history and the GDP estimates for the first quarter confirmed a slowdown.

The announcement by Dominique Strauss-Kahn, managing director of the IMF, stated that there is a risk for banks in the Baltic States to follow the Icelandic scenario with nationalized banks due to increased exposure to struggling property markets. This may negatively influence the market and affect the Swedish banks. Likewise, we expect a negative impact of the reports from Moody's, confirming that the ongoing economic slowdown will affect the asset quality of Lithuanian and Estonian banks. Regarding the nationalization of Parex Bank, we anticipate that this government intervention will have a negative effect. However, we make no prior assumptions about the signs of the effects regarding the international agreements and political events.

3.2 Event analysis methodology

3.2.1 Bank stock price responses to the events from the Baltic States

At first we apply an event parameter approach based on the market model to test if the events from the Baltic States indeed resulted in price responses for the Swedish banks. This is done irrespective of the individual bank's exposure to the Baltic States. Clustering effects and industry induced correlation of returns may be a problem, since all firms in our sample are from the same industry and affected simultaneously by the economic events of interest. To deal with these potential problems, we estimate a multivariate regression based on Zellner's (1962) seemingly unrelated regression (SUR) developed by Binder (1985) and used for instance by Smirlock and Kaufold (1987), Unal *et al.* (1993) and Rime (2003). This allows for correlation between residuals when a system of equations is estimated simultaneously. The multivariate regression model is estimated as follows:

$$\begin{cases} R_{Swed,t} = \alpha_1 + \beta_1 R_{M,t} + \sum_{i=1}^{n} \gamma_{1,i} D_i + \varepsilon_{1,t} \\ R_{SEB,t} = \alpha_2 + \beta_2 R_{M,t} + \sum_{i=1}^{n} \gamma_{2,i} D_i + \varepsilon_{2,t}. \\ R_{Nord,t} = \alpha_3 + \beta_3 R_{M,t} + \sum_{i=1}^{n} \gamma_{3,i} D_i + \varepsilon_{3,t}. \\ R_{SHB,t} = \alpha_4 + \beta_4 R_{M,t} + \sum_{i=1}^{n} \gamma_{4,i} D_i + \varepsilon_{4,t} \end{cases} \quad (1)$$

Where $R_{j,t}$ = the return on the stock of bank *j* on day *t.*

α_j, β_j = regression parameters for bank *j.*

$R_{M,t}$ = the return of the OMX Stockholm market index

D_i = dummy variable equal to one on the event day *i* and zero otherwise.

$\gamma_{j,i}$ = captures the effect of event *i* for bank *j.*

$\varepsilon_{j,t}$ = regression residual for bank *j* on day *t.*

The above linear equation system (1) is estimated for all banks over the time interval starting 2007-01-02 and ending 2009-03-26. The coefficient of interest is $\gamma_{j,i}$, which measures the price response (abnormal return) of the specified event. The sign of the coefficient determines whether the event had a negative or positive impact on the stock prices. The t-value of the dummy coefficient is used to assess the significance of the abnormal returns.

To examine the magnitude and significance of the price responses the events had on the Swedish banks, the following two hypotheses are tested using Wald-tests.

Hypothesis 1 (H_1): *The abnormal return for each bank on the event day equals zero.*

$$(\gamma_1 = \gamma_2 = \gamma_3 = \gamma_4 = 0)$$

Similar test framework is used in Rime (2003) to test the equality of the dummy coefficients across the estimated equations.

If H_1 is not rejected, then it is problematic to further examine the relationship between market response and the exposure level for the banks. Investors might have the knowledge about the banks' exposure, but due to that there is no market response, there will be no relationship between stock price response and exposure level. Alternatively, the event might have too small impact on the stock price relative to noise in the model, that a detection of a stock price response is not possible. Similar hypothesis and argumentation is used in Smirlock and Kaufold (1987). A related hypothesis to H_1 is whether the price response is equal across banks.

Hypothesis 2 (H_2): *The abnormal returns are equal across all banks on the event day.*

$$(\gamma_1 = \gamma_2 = \gamma_3 = \gamma_4)$$

If H_2 is not rejected, given the exposure level of the banks, there is evidence that the market did not distinguish among the exposure levels of the Swedish banks (Unal *et al.* 1993).

3.2.2 The exposure levels to the Baltic States are included in the model

If H_2 is rejected, it is important to examine whether the observed difference is in proportion to exposure for each bank or not. The task is to test whether investors rewarded or punished the banks in proportion to the bank specific Baltic exposure variable. This is examined in a SUR framework, following Smirlock and Kaufold (1987) and Unal *et al.* (1993), the following system of equation is estimated.

$$\begin{cases} R_{Swed,t} = \alpha_1 + \beta_1 R_{M,t} + \sum_{i=1}^{n} \lambda_{1,i} D_i EXP_1 + \varepsilon_{1,t} \\ R_{SEB,t} = \alpha_2 + \beta_2 R_{M,t} + \sum_{i=1}^{n} \lambda_{2,i} D_i EXP_2 + \varepsilon_{2,t} \\ R_{Nord,t} = \alpha_3 + \beta_3 R_{M,t} + \sum_{i=1}^{n} \lambda_{3,i} D_i EXP_3 + \varepsilon_{3,t} \\ R_{SHB,t} = \alpha_4 + \beta_4 R_{M,t} + \sum_{i=1}^{n} \lambda_{4,i} D_i EXP_4 + \varepsilon_{4,t} \end{cases} \quad (2)$$

The variables in this system (2) are the same as in equation system (1), except that the dummy variables are weighted by the level of exposure to the Baltic States. The EXP variable is the Baltic exposure for each bank, calculated as the book value of Baltic States loans over book value of total loans for each bank at the end of year 2007 and 2008. The banks' exposure levels at the end of each year are used for events in the upcoming year. The system is estimated over the same period as in equation system (1).

We are now able to test if the stock price response is proportional to exposure, as in Smirlock and Kaufold (1987), we test the following hypothesis.

Hypothesis 3 *(H_3): The event parameters λ_j are equal across all the four banks.*

$$(\lambda_1=\lambda_2=\lambda_3=\lambda_4)$$

If H_3 is not rejected, there is support for the *rational-pricing* hypothesis described in Bruner and Simms (1987). Under this hypothesis, economic events from the Baltic States would affect the banks in proportion to their exposure. An alternative hypothesis focuses on *contagion* effects. Under this hypothesis, the market would not be able to distinguish among the exposure levels of different banks. Instead the economic event would generate contagion effects, affecting the Swedish bank system as a whole (Karafiath *et al.* 1991). Thus, the price response to the specified event is not proportional to exposure across banks.

4 Presentation of the results

In this section we estimate the daily abnormal returns related to the events selected using the event parameter approach described in equation system (1). In these regressions we do not consider the banks' Baltic exposure level. The purpose of this first stage is to examine if the Baltic events selected coincided with abnormal returns for the banks.

4.1 Results for the event coefficients in equation system (1)

Table 3 presents the results from the event parameter regressions for each event and bank. The first column (γ) presents the abnormal returns for each bank and event and the second column represents the t-values. The events that had a significant impact on the banks are marked with one or two stars (*) depending on the significance level.

Table 3: Results from the estimation of equation system (1)

		Swedbank		SEB		Nordea		SHB	
Date	Event	γ	t-value	γ	t-value	γ	t-value	γ	t-value
2008-04-28	E1	-0.0622	-2.37 **	-0.0069	-0.28	-0.0089	-0.49	-0.0064	-0.36
2008-05-09	E2	0.0051	0.2	0.0062	0.25	-0.0006	-0.03	0.0008	0.05
2008-05-14	E3	-0.0302	-1.15	-0.0460	-1.86 *	-0.0111	-0.62	-0.0024	-0.13
2008-10-14	E4	-0.0470	-1.79 *	0.0089	0.36	-0.0010	-0.05	-0.0037	-0.21
2008-11-07	E5	-0.0326	-1.24	-0.0381	-1.54	-0.0058	-0.32	0.0007	0.04
2008-11-10	E6	-0.0797	-3.03 **	-0.0689	-2.78 **	-0.0185	-1.03	-0.0104	-0.58
2008-12-05	E7	-0.0409	-1.55	-0.1234	-4.97 **	-0.0049	-0.27	-0.0028	-0.16
2008-12-09	E8	-0.0217	-0.82	-0.0785	-3.17 **	-0.0019	-0.11	-0.0113	-0.64
2008-12-19	E9	-0.0313	-1.19	-0.0048	-0.19	-0.0137	-0.76	0.0086	0.49
2009-01-13	E10	-0.0240	-0.91	-0.0307	-1.24	-0.0059	-0.33	0.0148	0.84
2009-02-06	E11	-0.0220	-0.84	0.0813	3.27 **	0.0156	0.86	0.0139	0.78
2009-02-13	E12	-0.0669	-2.55 **	-0.0201	-0.81	-0.0073	-0.4	-0.0308	-1.74 *
2009-02-20	E13	-0.0396	-1.5	-0.0035	-0.14	-0.0063	-0.35	-0.0311	-1.75 *
2009-02-27	E14	-0.0890	-3.39 **	-0.0365	-1.48	-0.0168	-0.94	-0.0136	-0.77
2009-03-13	E15	-0.0274	-1.04	-0.0887	-3.59 **	-0.0061	-0.34	0.0092	0.52

(**) Significant on the 5% level (*) Significant on the 10% level

From *Table 3* we can observe that five events for Swedbank and six events for SEB are significant, whilst when observing the results for the two other banks only two events for SHB and no events for Nordea are significant at the 5-10% significance level. Moreover, 11 events out of 15 are significant for at least one bank at the 10% level.

4.2 Testing hypothesis H_1 and H_2

In our first hypothesis we test whether our dummy coefficients for each event simultaneously are equal to zero for our different banks or not. With our second hypothesis we test whether the price responses are equal across the banks. The results obtained from these two tests are presented event by event in *Table 4* below. Column three and four represents the F-statistic and the P-value for the two tests.

Table 4: Results from the tests of H_1 and H_2

Date	Event	Hypothesis 1 (γ1 = γ2 = γ3 = γ4 = 0)		Hypothesis 2 (γ1 = γ2 = γ3 = γ4)	
		F-statistic	P-value	F-statistic	P-value
2008-04-28	**E1**	**1.98**	**0.0944 ***	**2.18**	**0.0883 ***
2008-05-09	**E2**	0.02	0.9991	0.03	0.9943
2008-05-14	**E3**	0.96	0.4273	1.10	0.3490
2008-10-14	**E4**	1.69	0.1494	2.09	0.0993 *
2008-11-07	**E5**	0.73	0.5701	0.88	0.4508
2008-11-10	**E6**	**2.69**	**0.0295 ****	**2.53**	**0.0559 ***
2008-12-05	**E7**	**8.23**	**0.0000 ****	**10.79**	**0.0000 ****
2008-12-09	**E8**	**3.31**	**0.0103 ****	**4.26**	**0.0053 ****
2008-12-19	**E9**	0.74	0.5614	0.92	0.4312
2009-01-13	**E10**	0.91	0.4551	1.22	0.3017
2009-02-06	**E11**	**5.95**	**0.0001 ****	**7.82**	**0.0000 ****
2009-02-13	**E12**	**2.66**	**0.0310 ****	**2.29**	**0.0766 ***
2009-02-20	**E13**	1.80	0.1264	1.55	0.1984
2009-02-27	**E14**	**3.05**	**0.0162 ****	**2.80**	**0.0385 ****
2009-03-13	**E15**	**4.85**	**0.0007 ****	**6.44**	**0.0002 ****

(**) Hypothesis rejected on the 5% level (*) Hypothesis rejected on the 10% level

The results from the tests show that H_1 can be rejected for 8 events at the 10% level and 7 events at the 5% level. This implies that these events have significant impact for at least one of the banks. As stated above, if H_1 is not rejected it will be problematic to further examine the relationship between market response and the exposure level for the banks.

Therefore, we will only focus on the events that can be rejected in H_1. These events are marked in bold.

Furthermore, for all the events rejected in H_1, our results show that the hypothesis of equality among banks' price responses on the event day (H_2) can be rejected on at least the 10% level. This indicates that the price responses for these events were not uniform across banks.

4.3 Results for the event coefficients in equation system (2)

We next re-estimate the event parameter model and include the Baltic exposure level for each bank specified as in equation system (2). This is done since hypothesis 2 can be rejected for the events which had a significant effect on the Swedish banks. Therefore, we examine if the observed difference is due to the exposure to the Baltic region or not. *Table 5* shows the results from the re-estimation of the model. [2]

Table 5: Results from the estimation of equation system (2)

		Swedbank		SEB		Nordea		SHB	
Date	Event	λ	t-value	λ	t-value	λ	t-value	λ	t-value
2008-04-28	**E1**	-0.3887	-2.37 **	-0.0628	-0.28	-0.3943	-0.49	-6.3880	-0.36
2008-05-09	**E2**	0.0321	0.2	0.0561	0.25	-0.0250	-0.03	0.8481	0.05
2008-05-14	**E3**	-0.1887	-1.15	-0.4181	-1.86 *	-0.4946	-0.62	-2.3720	-0.13
2008-10-14	**E4**	-0.2936	-1.79 *	0.0807	0.36	-0.0430	-0.05	-3.6648	-0.21
2008-11-07	**E5**	-0.2037	-1.24	-0.3460	-1.54	-0.2584	-0.32	0.6724	0.04
2008-11-10	**E6**	-0.4981	-3.03 **	-0.6261	-2.78 **	-0.8234	-1.03	-10.3565	-0.58
2008-12-05	**E7**	-0.2553	-1.55	-1.1217	-4.97 **	-0.2172	-0.27	-2.7652	-0.16
2008-12-09	**E8**	-0.1354	-0.82	-0.7133	-3.17 **	-0.0849	-0.11	-11.3442	-0.64
2008-12-19	**E9**	-0.1956	-1.19	-0.0435	-0.19	-0.6073	-0.76	8.6391	0.49
2009-01-13	**E10**	-0.1414	-0.91	-0.2788	-1.24	-0.1974	-0.33	14.8366	0.84
2009-02-06	**E11**	-0.1297	-0.84	0.7391	3.27 **	0.5187	0.86	13.8732	0.78
2009-02-13	**E12**	-0.3935	-2.55 **	-0.1832	-0.81	-0.2423	-0.4	-30.8331	-1.74 *
2009-02-20	**E13**	-0.2328	-1.5	-0.0316	-0.14	-0.2086	-0.35	-31.1318	-1.75 *
2009-02-27	**E14**	-0.5234	-3.39 **	-0.3319	-1.48	-0.5615	-0.94	-13.6101	-0.77
2009-03-13	**E15**	-0.1614	-1.04	-0.8065	-3.59 **	-0.2037	-0.34	9.1666	0.52

(**) Significant on the 5% level (*) Significant on the 10% level

[2] The results from the estimations of equation system (1) and (2) are available from the authors on request.

The significance levels and signs for the events are the same as for the regressions without the exposure levels taken into account. The difference is that the coefficient λ_j is approximately equal to γ_j/EXP_j and is a measure of price response of bank *j* per unit of exposure as described in Smirlock and Kaufold (1987).

4.4 Testing hypothesis H_3

With the third hypothesis the equality of price responses adjusted for the banks exposure for each event is tested. The results from these tests are shown in *Table 6* under headline hypothesis 3.[3]

Table 6: Results from the test of H_3 (including the results from tests of H_1 and H_2)

Date	Event	Hypothesis 1 (γ1 = γ2 = γ3 = γ4 = 0)		Hypothesis 2 (γ1 = γ2 = γ3 = γ4)		Hypothesis 3 (λ1 = λ2 = λ3 = λ4)	
		F-statistic	P-value	F-statistic	P-value	F-statistic	P-value
2008-04-28	E1	**1.98**	**0.0944 ***	**2.18**	**0.0883 ***	1.38	0.2477
2008-05-09	E2	0.02	0.9991	0.03	0.9943	0.01	0.9984
2008-05-14	E3	0.96	0.4273	1.10	0.3490	0.57	0.6345
2008-10-14	E4	1.69	0.1494	2.09	0.0993 *	1.67	0.1717
2008-11-07	E5	0.73	0.5701	0.88	0.4508	0.24	0.8711
2008-11-10	E6	**2.69**	**0.0295 ****	**2.53**	**0.0559 ***	0.22	0.8860
2008-12-05	E7	**8.23**	**0.0000 ****	**10.79**	**0.0000 ****	**8.49**	**0.0000 ****
2008-12-09	E8	**3.31**	**0.0103 ****	**4.26**	**0.0053 ****	**3.69**	**0.0115 ****
2008-12-19	E9	0.74	0.5614	0.92	0.4312	0.56	0.6447
2009-01-13	E10	0.91	0.4551	1.22	0.3017	0.66	0.5773
2009-02-06	E11	**5.95**	**0.0001 ****	**7.82**	**0.0000 ****	**7.92**	**0.0000 ****
2009-02-13	E12	**2.66**	**0.0310 ****	**2.29**	**0.0766 ***	**2.25**	**0.0804 ***
2009-02-20	E13	1.80	0.1264	1.55	0.1984	2.12	0.0955 *
2009-02-27	E14	**3.05**	**0.0162 ****	**2.80**	**0.0385 ****	0.80	0.4915
2009-03-13	E15	**4.85**	**0.0007 ****	**6.44**	**0.0002 ****	**5.35**	**0.0011 ****

(**) Hypothesis rejected on the 5% level (*) Hypothesis rejected on the 10% level

[3] Note: in the literature, a second approach is used to test the equality of price response parameters adjusted for exposure. This is done in Cornell and Shapiro (1986), Bruner and Simms (1987) and Musumeci and Sinkey (1990) using an OLS framework. They estimate the following equation

$$AR_i = \alpha + \beta EXP_i + \varepsilon_i$$

Where AR_i is the abnormal return on the event day and EXP_i is the exposure variable for bank *i.* If the beta coefficient is significant the authors argue that there is evidence for rational pricing. However, this framework cannot be applied in our study, since we have too few abnormal returns per event to obtain reliable results.

The results for these tests show that 5 out of the 8 events rejected under hypothesis 2, are also rejected under hypothesis 3. These events are marked in bold. *Table 7* summarizes the outcomes for the hypotheses that had an impact on the Swedish banks i.e. rejected under hypothesis 1.

Table 7: Summarized results for the events that had an impact on the Swedish banks

Date	Event	Description	H1	H2	H3
2008-04-28	**E1**	Q1 2008 GDP growth eases to 6,4% y/y in Lithuania.	*	*	
2008-11-10	**E6**	Nationalization of Parex bank in Latvia.	**	*	
2008-12-05	**E7**	Moody's report that Lithuanian bank credit outlook is negative.	**	**	**
2008-12-09	**E8**	Largest drop in Estonian GDP y/y rate in 14 years.	**	**	**
2009-02-06	**E11**	Lithuania launches economic stimulus plan.	**	**	**
2009-02-13	**E12**	GDP collapse in Estonia down 9,4% y/y.	**	*	*
2009-02-27	**E14**	The Riksbank lends to the Estonian central bank.	**	**	
2009-03-13	**E15**	EIB lends 1,15b € to lithuania to support SME's.	**	**	**

(**) Hypothesis rejected on the 5% level (*) Hypothesis rejected on the 10% level

5 Analysis

In this part we will analyze the results from the previous section. Our main goal has been to examine if the list of selected events form the Baltic States have had an impact on Swedish banks' stock prices. If they had an impact, the relationship between price response and exposure level was further investigated.

Eleven out of the fifteen events selected are significant for at least one bank at the 10% level. This finding supports our hypothesis that events from the Baltic States indeed affect Swedish banks. However, the distribution of significant events among the banks is quite surprising. Only one out of fifteen events is significant for SEB and Swedbank simultaneously. Our expectation was that SEB and Swedbank would follow a more similar pattern, since these are the two most exposed banks to the Baltic region. Furthermore, it is notable that Nordea is not affected by any event, while SHB is significantly affected by two. If Nordea is used as a proxy, we find no reason to believe that any other major events affect the Swedish banking system during the selected events, since it is the only bank without significant abnormal returns.

We now focus on the events for which we can reject the hypothesis that the dummy coefficients are simultaneously equal to zero (H_1). The rejection of this hypothesis enables us to further examine the relationship between market response and exposure level. As argued in Smirlock and Kaufold (1987) it is important to note that the inability to reject this hypothesis does not directly imply that the market was unaware of the exposure level for each bank. Instead, the event may have too small impact on the banks stock prices relative to noise in our model and thus abnormal returns cannot be revealed.

The first event where the dummy coefficients are not simultaneously equal to zero is the GDP estimate for 2008-Q1 in Lithuania (E1). This implies that some banks exhibited negative abnormal returns significantly different than zero, indicating that the first quarter GDP estimate for Lithuania was worse than expected. Further, hypothesis 2 can also be rejected, which means that the abnormal returns are not equal among the Swedish banks. However, when we test if the abnormal returns are proportional to the banks exposure level as specified in *Section 4*, the equality of λs across banks cannot be rejected. This suggests that the response is proportional to the banks exposure levels i.e. support for the *rational pricing* hypothesis.

The nationalization of Parex Bank (E6) is the only event that shows evidence of significant abnormal returns for both SEB and Swedbank. The event is a signal of a weakening of the financial system in the Baltic's and had a clear negative impact for these two banks. The results from testing the two first hypotheses confirm that the event had an effect and that the abnormal returns are not equal across all banks. In addition, investors were able to discriminate among the Swedish banks' exposure levels.

Moody's report concerning the expected rise in problem loans in Lithuania (E7) causes abnormal returns and these are not equal across the examined banks. The difference between this event and the previous ones is that the equality of the exposure adjusted dummy coefficients can be rejected. The result can be interpreted as support for the hypothesis of *contagion* effects. One reason why the market does not distinguish between the banks can be that the event has a signaling effect of lower asset quality for the banks in the region. This may be associated with a rise in credit losses and affect the Swedish banking system as a whole, since it is highly inter-connected.

Regarding the large drops in Estonia's GDP (E8 and E12), both events have a significant negative and unequal impact on the banks. After adjusting for exposure, the hypothesis of *rational pricing* can be rejected. Thus, these events have an impact on the banks and the price responses are not equal even after considering exposure. Signs of a hard-landing in the region seem to affect the Swedish banks irrespective of their exposure and suggest that the drops in GDP were larger than expected.

The stimulus plan in Lithuania (E11) with the aim to dampen the economic downturn is the only event that had a significant positive effect for one of the banks. For this event all three hypotheses can be rejected and as stated earlier it means that the government intervention indeed yield abnormal returns. However, these are not equal among banks even after the exposure level is considered i.e. support for the contagion effect hypothesis.

The agreement between Sweden and Estonia, that the Riksbank will support the Estonian central bank ("Eesti Pank") (E14), caused negative abnormal returns for the four banks. For this event both H_1 and H_2 can be rejected. However, when considering exposure in the model H_3 cannot be rejected. This precautionary agreement can be viewed as an act of support in order to secure stability in the financial system, by providing liquidity under a currency board arrangement. The market did however respond negatively and the response suggests that it views this news as a sign of instability in the financial system. Since hypothesis 3 is not rejected, the market was able to discriminate between the banks respective exposure levels. Thus, the results from this international agreement are in support for the *rational pricing* hypothesis.

The loan from EIB to support Lithuanian small and middle sized firms (E15) follows the same pattern as for the agreement between the Riksbank and Eesti Pank i.e. a significant negative market reaction for an act of support. The difference between this event and the previous is that we have indications of contagion effects rather than rational pricing.

We can now conclude that for all events that had an impact on the Swedish banks, the abnormal returns were unequal. However, after regarding the banks exposure levels the results are quite different. Five events give support for the hypothesis of *contagion* effects whilst three events support *rational pricing*. As argued in Rime (2003), these mixed results point out that even if the market partially separated between banks according to their Baltic exposure, we cannot exclude a contagion effect in the banking system for some of the selected events.

As the events affecting the Swedish banks, show support for both the *rational pricing* and the *contagion* effect hypotheses, it is important to note that when rejecting the third hypothesis we have signs of contagion effects across banks. However, it is not certain. As argued in Unal *et al.* (1993), such a finding propose that other factors than exposure to the Baltic region could be influential in explaining the impact of the event. Furthermore, our exposure variables are only approximations to the region as a whole and do not capture country specific exposure. This means that the banks' exposure levels to each country are assumed to be the same. In reality this is not true instead the banks are exposed differently between the countries. Therefore, considering the Baltic States as one region may provide different results than if each country would have been investigated separately. However, if conducting the study for each Baltic State, it would be difficult to control for contagion effects between the countries. We believe that this would cause more problems and is the reason why we chose to treat the Baltic States as one region.

Notably, when observing the events with no significant abnormal return, we find one surprising result, the agreement between Latvia and IMF of the rescue package. This agreement is one of the most widely known events during our period of interest and the absence of reaction for this event can possibly be interpreted as the market had already anticipated the rescue package and therefore no response can be observed on the event day. Similar arguments regarding key events without market reactions are made by Rime (2003) for events during the Russian crisis.

6 Robustness of our findings

The main purpose of an event study is to test for the existence of an information effect i.e. impact of an event on firm value. The relatively simple framework has made the use of event studies very popular. However, the event methodology is obviously not perfect and several problems can arise. With this said, our results based on the method and models used raise concerns that are worth discussing.

First of all, the choice of events is of great importance when conducting event studies. In the literature regarding financial crises, the selection of events are often based on surveys explaining the crisis development and pointing out the main events. One reason why our study yields mixed results, could be that it is based on an ongoing crisis and the selected events may not be perceived by the market as the most important ones. When the event(s) of interest has been selected it is important to determine when it took place. The timing of the event is of great importance and in many cases it may seem obvious, however it is not. The issue is not when an event took place, instead when investors in the market could have anticipated it. In our study we have an example of this issue, in form of the agreement between the IMF and Latvia. Usually this problem is addressed by expanding the event window. However, even if there is a cost associated with a longer event window, in some cases it is worth bearing instead of facing the risk of missing the effects of an event (MacKinlay 1997). With our specification, using a multivariate regression with some events close in time, we believe it is reasonable to have a short event window. We tried to minimize the problem by controlling the timing of the events i.e. if an announcement occurred after the closure of the stock exchange we used the next day as the event day. Furthermore, another possible bias that can arise when conducting event studies is the non-trading or non-synchronous trading effect as discussed in MacKinlay (1997). An example of this is when using closing prices to compute daily returns. In this case we implicitly and incorrectly assume that the returns are equally spaced at 24-hour intervals. Moreover, we disregard the possibility of price adjustments during the day when the event occurred and this problem will be more prominent if a larger event window is used.

In addition, as argued in Kilic *et al.* (2000), results from event studies are sensitive to the choice of estimation period. To control for this in our event parameter models, we re-estimate equation system (1) and (2) with shorter estimation period. Instead of using data for 2007 we now estimate from the first of January 2008. The results are reasonably similar to the first estimations. The difference is that the events which had an impact on the banks at the 10% level are no longer significant. This means that our previous findings are relatively robust irrespective of the choice of estimation period.[4]

The issues presented above are meant to highlight possible difficulties associated with the event study methodology. The discussion above should not be interpreted as arguments for not using the event study methodology. It is a simple and functional design which works under less than perfect conditions. However, to get reliable results the framework used must be thoughtfully specified.

[4] The results from the re-estimation of the models with shorter estimation period are available from the authors on request.

7 Conclusions

In this paper, we have studied how events from the financial crisis in the Baltic countries affect Swedish banks' valuation and if the reactions were in proportion to the banks' Baltic exposure. In a first step, using stock price event analysis in a multivariate regression framework, we tried to determine which events that had an impact for the banks. We can conclude that the majority of the events had an impact on the banks but the distribution among them where surprising. Only one event out of fifteen was simultaneously significant for the two most exposed banks, SEB and Swedbank. Furthermore, approximately half of the selected events had a significant impact on the banks as a group. Our interpretation is that the events with no significant impact were not a surprise for investors.

In a second step, the hypothesis of *rational pricing* and *contagion* effects were investigated by including a firm specific exposure variable in the model. Here we cannot draw any general conclusions, since on this issue our results are mixed. This points out that the market only partially separated between the banks according to their exposure.

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