# Does Sovereign Risk Differ for Domestic and Foreign Investors? Historical Evidence from Scandinavian Bond Markets[*]

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**Abstract**

This paper shows that geographical investor heterogeneity strongly influences sovereign risk. While standard sovereign debt models mainly attribute the absence of sovereign defaults to foreign creditor retaliation, a new theoretical literature argues that domestic creditors also affect borrowing governments' default decisions through channels of domestic politics. This paper examines this controversy using a newly assembled dataset on cross-listed Scandinavian sovereign yields traded at markets that abruptly went from integration to segmentation by capital controls and World War II. The results strongly suggest that domestic and foreign bond investors assessed different sovereign risks whereas more standard explanations based on macroeconomic factors, portfolio choice or risk aversion added little explanatory value. The study also documents large effects on recorded asset prices from institutional trading constraints (e.g., price limits), an issue largely neglected by previous research in historical long-run asset returns.

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## 1 Introduction

This paper shows that investor heterogeneity across markets strongly influences sovereign risk assessments. Standard economic models of sovereign debt mainly focus on how the actions of foreign creditors influence the default decision of borrowing sovereigns through either increased reputational costs on international capital markets (e.g., Eaton and Gersovitz, 1981; Wright, 2002) or trade sanctions launched by foreign creditor countries (e.g., Bulow and Rogoff, 1989). Contrasting this one-sided geographical focus, a new theoretical literature points at the ability of domestic creditors in credibly threaten to punish the sovereign in case of a default on its domestic debt. For example, Drazen (1998) argues that since domestic creditors belong to the sovereign's constituency they can punish the defaulting government by refusing reelection, evading taxation etc, which foreign creditors cannot do. This creates a gap in the expected default costs to the sovereign and hence a differential in its propensity to default on the domestic vs. the foreign debt. Other studies proposing a similar political-economic effect on sovereign risk from different investor populations are, e.g., Roubini (2001), Harms (2002); Brandauer (2003) and Di Gioacchino et al. (2004).

Previous empirical research has largely focused on the traditional framework and hence the role of foreign debt and the results are not uniform. While some studies are mainly supportive (e.g., Tomz, 2001; Rose and Spiegel, 2003) others come to the conclusion that additional mechanisms are needed to fully understand the behavior of borrowing sovereigns (e.g., Obstfeld and Taylor, 2003; Mitchener and Weidenmier, 2004). Tomz (2004) is one of the few previous attempts to study the political-economic dimensions of domestic versus foreign sovereign risk. He analyzes large surveys of Argentine residents in the 1980's and early 2000's finding that these are highly responsive to the distributional effects of a sovereign debt default and especially if foreigners fare better than themselves.

This paper is a direct test of these issues drawing on a unique historical situation in Scandinavia during World War II when capital controls abruptly segmented national bond markets that were previously fully integrated. While arbitrage and buybacks were ruled out the pricing of assets changed overnight from being "globally" to locally determined and in effect the regime switch offers a unique opportunity to test the effect of investor heterogeneity on sovereign risk according to the mechanisms of Drazen (1998) and others.

As a working hypothesis, if yields are significantly larger when markets are segmented than when they are integrated, controlling for other potential yield influences, this would signal that the new approach adds explanatory value to the traditional sovereign debt models.

The basic dataset used consists of newly assembled secondary market yields of Danish long-term government bonds that were traded in Denmark and Sweden throughout the 1930's and 40's. Sweden was the only Nordic country listing and trading foreign assets, which means that these data are uniquely allowing for comparative studies like this one. A complementary bond dataset and the relevant macroeconomic variables are also considered. The empirical analysis departs from a simple model of bond yields and a derivation of the variables driving cross-market yield spreads. Several contrasting hypotheses explaining yield spreads such as macroeconomic fluctuations, differences in portfolio choice or risk aversion are also examined.

A special contribution of the paper is that it explicitly accounts for the considerable market regulations that were common in all Western Europe during World War II, and indeed also in Scandinavia and especially Denmark.[1] Luttmer (1996) and others have shown (on more modern data) that even moderate levels of trading frictions could significantly bias statistical inference on asset returns.[2] Despite this there are almost none of the past historical asset pricing studies that have tried to address this issue.[3] My paper hence not only presents new descriptive material on the Danish and Swedish bond market institutions and microstructure in the interwar and wartime period, but it also empirically analyzes their implications on recorded asset prices.

The rest of the paper is structured as follows. Section 2 contains a description of the most important Danish and Swedish bond market institutions and microstructure during the 1930's and 40's. Section 3 presents the empirical methodology used and section 4 presents the data. In section 5, the results are presented and section 6 concludes.

[1] Common frictions during WWII were price limits, trading halts, listing disruptions, special wartime transaction taxes and dividend restrictions. Denmark practiced all of these but Sweden only the last one.
[2] Examples of studies of price limits are Kim and Rhee (1997), Charemza and Majerowska (2000) and Evans and Mahoney (1997) and of short-sale constraints and margin requirements Jones and Lamont (2002).
[3] For example, Dimson *et al*. (2003) do not mention these issues at all while Obstfeld and Taylor (2003) simply omit the WWII period from the sample.

## 2 The Copenhagen and Stockholm bond markets around WWII

Table 1 presents an overview of some of the most important characteristics of Danish and Swedish bond market institutions in the 1930's and 40's. In general, there is not much detailed information about these markets why some of the descriptive statistics should be treated with caution. The Danish bond market had been well-developed for decades with a large number of issues both by the government and by several different non-government actors, especially credit and mortgage associations. The organized secondary market at the Copenhagen Stock Exchange was accordingly relatively large, with more listed issues and larger trading volumes than the stock market.[4] In contrast, the Swedish bond market was smaller both in numbers of issues and traded volumes, at least this is true for the organized trading at the Stockholm Stock Exchange where bonds were regularly traded only in the late 1920's. One thing that Stockholm but not Copenhagen did, however, was listing and trading a number of foreign bond loans, mainly issued in the 1920's and 30's by governments in the other Nordic and northern European countries.

Information about the identity of traders and investors in both Denmark and Sweden is scarce. Some general descriptions of these markets indicate that holders of Danish government debt were both large financial institutions (central and commercial banks, insurance companies etc) as well as private households. Perhaps most interesting is the identity of the marginal traders on both markets, and the most qualified guess would there be the ones working with institutional investors.

It is also important to get a picture of the liquidity in the analyzed bonds as this concerns the reliability of the recorded market yields used. Unfortunately there are little disaggregated data on bond trading, but the other evidence collected for this study allows for some tentative conclusions shown in Table 1.[5] The exchange recorded bond trading in Copenhagen and Stockholm was fairly continuous and significant throughout the period although Stockholm had both smaller volumes and almost no trading in Danish loans during 1940–42. When also including the trading in the over-the-counter (OTC) markets, however, it seems like the exchange numbers vastly understate the total volumes underlying the quoted bond prices. Based on evidence from the mandatory Swedish transaction tax re-

[4] The sources are Statistical Yearbook of Denmark, table "Omsætningen af Værdipapirer ved den off. Notering paa Københavns Børs", various years and the stock exchange lists published in *Finanstidende*.
[5] Data on Copenhagen trading is based on the daily data described below. For Stockholm I collected a sample of trading during one month each quarter, every second year during 1938–1948.

ceipts which enables estimates of the total bond trading in the economy and the relative shares of the OTC and the exchange, Table 1 indicates that the OTC volumes were between four and fifteen times larger.[6] Hence, the liquidity underlying the Swedish prices should be sufficient at least for our purposes.

Market regulations developed radically during the period of investigation and after September 1939 most European financial markets experienced severe restrictions. The Copenhagen exchange was closed between September 1 and 11 by the Department of Commerce and when it reopened, new price limits prohibiting prices below two percentage points under the bid price of August 31 could were imposed. Two weeks later the limits were altered to prohibiting daily price falls beyond 1 percentage point, which was a regime that lasted until February 23, 1946 when all limits were removed.[7] On top of the initial trading halt, the Copenhagen exchange stopped its trading also after Germany invaded Denmark (between April and May 1940) and when the war ended (in May 1945).

In Stockholm, by contrast, there were fewer regulatory changes related to the war. Trading continued and for pure neutrality reasons all bonds issued by foreign governments (including German, Belgian and the Nordic countries) remained listed and traded without restrictions. The single important intervention occurred when price limits were imposed in late 1939, launched by the Board of the Exchange. These limits were quite loose, however, allowing between five and ten times larger variations than the Copenhagen ones and some evidence suggests that they were never binding on Danish bond prices.[8]

One important regulatory change affecting both Denmark and Sweden was the capital controls stopping cross-border investments from early 1940 onwards (see Table 1). The Danish controls came in January and April 1940 and the Swedish ones in February 1940.[9] Both countries prohibited all transfers of currency, securities or capital goods unless they were approved by each country's central bank. Figure 1 shows clearly how they stopped

[6] The data for 1926 come from the Banking Inspection survey published in a government proposal Prop. 1927:56 p. 13 and for 1948 (onwards) from the Banking Inspection recurrent official publication "Uppgifter om bankerna samt uppgifter om fondkommissionärerna och fondbörs".
[7] On all these events, see the Danish financial weekly *Finanstidende* 6 Sep. 1939, p. 1020; 27 Sep. 1939, p. 1077 and 27 Feb. 1946, p. 430.
[8] The official limit of maximum –5 percentage points per day was never strictly enforced and Algott (1963, pp. 182ff) argues that the Board allowed much larger price falls, up to 10 percentage points per day. The period when the limits were said to bind the most was December 1939 and then mainly for Finnish bonds.
[9] The Danish capital controls are described in *Finanstidende* 10 Apr. 1940, p. 589, and the Swedish ones in Valutakommittén (1980), SOU 1980:51, chapter 1.

all portfolio flows between the two countries from 1940 onwards. The spikes in 1936, 1938 and 1947 reflect direct placements of Danish government loans.

## 3 Estimation methodology

This section develops tests to analyze the main questions of the study. The starting point is to characterize a nominal bond yield on market $i$ as a function of the following determinants:[10] *a)* the term premium $T$, which is the effect on the return by variation in time to maturity; *b)* the default risk $DR_i$ which in the standard view is borrower-specific and hence should have no subscript $i$, whereas Drazen (1998) and others suggest it to be dependent on geographical location and therefore have a subscript; *c)* market-specific institutional constraints $\theta$ such as taxes on cash flows, commission fees, market liquidity, price limits, trading halts etc. For example, minimum price limits tend to on average increase prices and decrease returns (see Charemza and Majerowska, 2000) whereas Silber (1991) and Longstaff (2004) show that illiquidity discounts may be substantial in cases of insignificant liquidity; *d)* macroeconomic conditions $\Omega$ such as inflation rates, market interest rates, the exchange rates (to account for international trading) and alternative investment opportunities as embodied in the market portfolio return. Altogether, the bond yield $y$ at market $i$ can be characterized as

$$(1) \qquad y_i = y(DR_i, T, \theta_i, \Omega_i).$$

The next step is to separate out the loan- and borrower specific yield determinants, which is done by subtracting the yield in market $j$ from that in market $i$. This cancels out all loan- and borrower-specific factors shared across markets if $y(\cdot)$ is linear:

$$(2) \qquad \begin{aligned} y_i - y_j &= y(DR_i, T, \theta_i, \Omega_i) - y(DR_j, T, \theta_j, \Omega_j) \\ &= y(DR_i - DR_j, \theta_i - \theta_j, \Omega_i - \Omega_j). \end{aligned}$$

Controlling for the macroeconomic and portfolio factors $\Omega_i - \Omega_j$ makes the yield spread a function solely of the differences in default risk across markets $DR_i - DR_j$ and in institutional constraints $\theta_i - \theta_j$:

[10] This setup is stylized but basically valid (see, e.g., Cuthbertson, 1996, ch. 9).

(3) $$y_i - y_j \,|_{\Omega i - \Omega j} \;=\; y(DR_i - DR_j,\, \theta_i - \theta_j)$$

The challenge to empirically estimate equation (3) is to find appropriate variables that account for the macroeconomic and portfolio influences on yields. One way to do this goes through international macroeconomics and portfolio theory. For example, the uncovered interest rate parity (UIP) asserts that nominal bond yields should be equal across countries once expected exchange rate changes are taken into account, which hence suggests a way to deal with the exchange rate effects across markets. In a similar way, the real interest rate parity (RIP) shows how expected inflation relates to yields, using the UIP and the relative purchasing power parity (PPP), which states that expected depreciation explains the difference in expected inflation. The RIP then shows that real yields should be equal across markets, at least in the "long run". These concepts are admittedly stylized and theoretical, but they have been widely used to examine market integration and the behavior of long-run interest rate differentials and represent useful benchmarks for the clean macroeconomic influence on nominal and real sovereign yields (see, e.g., Jackson and Lothian, 1993; Lothian, 2001).

The following variables are used in the estimations. $y_{itn}$ is the nominal yield on Danish government bonds traded on market $i$ (Copenhagen or Stockholm) in month $t$ (in 1938:01–1948:12) having $n$ months left to maturity (descending from 252 to about 120); $r_{itn} = y_{itn} - \pi_{it+n}$ is the equivalent real yield when inflation expectation $\pi_{it+n}$ is subtracted from the nominal yield, and $s_t$ is the log exchange rate defining number of units of Danish currency per unit of Swedish currency since the bonds were issued in local currencies. Depreciation expectations over $n$ periods $s^e_{t+n}$ are measured using the common technique (see, e.g., Jackson and Lothian) of *ex post* forward rate, $s_{t+n} = s^e_{t+n} + u_t$, where $s_{t+n}$ is the actual log exchange rate at period $t + n$ and $u_t$ a random error (since expectations are assumed rational). Similarly, the expected inflation differentials across markets $i$ and $j$ in RIP are measured as *ex post* forward rates $\pi_{it+n} - \pi_{jt+n} = (\pi^e_{it+n} - \pi^e_{it+n}) + \varepsilon_t$, for random error $\varepsilon_t$. Another influence on bond yields is the interest-rate risk incorporating the cost of holding fixed-income securities when market interests fluctuate, measured as the market interest rate differentials in both nominal $rf_{it} - rf_{jt}$ (for UIP) and real $rf^{real}_{it} - rf^{real}_{jt}$ (for RIP) terms. Finally, since investors diversify across assets one must also account market portfolio returns differentials $R^m_{it} - R^m_{jt}$ (UIP) and $R^{m,real}_{it} - R^{m,real}_{jt}$ (RIP).

Estimating the impact of default risk and institutional constraints differences is mainly done through the use of time dummy variables in the UIP and RIP equations. The period is split to capture variation over time due to exogenous regulatory changes and historical events. Accordingly, the first dummy, $C_{39:09–40:03}$, covers the initial war period when the circuit breakers were used but Denmark was still a neutral country. $C_{40:04–43:08}$ is the initial period of the German occupation when Denmark was kept as a "protectorate" with considerable political and economic autonomy.[11] $C_{43:09–44:05}$ is the period when Germany imposed martial law and severely sharpened its control while $C_{44:06–45:05}$ is the period with both martial laws and Allied victories at Normandy and elsewhere, one of the important turning points in the war. Finally, $C_{45:06–46:02}$ is the only fully peaceful period when price limits were still in place. All other effects on yield differentials stemming from omitted institutional differences (taxes on cash flows, market liquidity, commission fees etc) should enter the constants given that they did not change during the period. This in turn implies that the constants might well differ from zero despite the theoretical predictions of UIP and RIP.

Adding up, the UIP equation based on nominal yield spreads $y_{itn} - y_{jtn}$ to estimate is

$$(4) \quad y_{itn} - y_{jtn} = \beta_0 + \beta_1(C_{39:09–40:03}) + \beta_2(C_{40:04–43:08}) + \beta_3(C_{43:09–44:05}) + \beta_4(C_{44:06–45:05}) + \\ + \beta_5(C_{45:06–46:02}) + \beta_6(s_t + s_{t+n}) + \beta_7(rf_{it} - rf_{jt}) + \beta_8(R^m{}_{it} - R^m{}_{jt}) + u_t,$$

while the equivalent RIP equation based on real yield spreads $r_{itn} - r_{jtn}$ is

$$(5) \quad r_{itn} - r_{jtn} = \gamma_0 + \gamma_1(C_{39:09–40:03}) + \gamma_2(C_{40:04–43:08}) + \gamma_3(C_{43:09–44:05}) + \gamma_4(C_{44:06–45:05}) + \\ + \gamma_5(C_{45:06–46:02}) + \gamma_6(rf^{real}{}_{it} - rf^{real}{}_{jt}) + \gamma_7(R^{m,real}{}_{it} - R^{m,real}{}_{jt}) + \varepsilon_t.$$

Both equations will be estimated with OLS since the yield spreads are stationary by construction. However, the overlapping observations in the *ex post* forward rates introduce serial correlation and therefore Newey and West (1987) standard errors are used.

According to the theoretical equation (3) and the empirical representations (4) and (5), the parameters $\beta_1 - \beta_6$ and $\gamma_1 - \gamma_6$ do not disentangle the individual effects of sovereign risk and institutional differentials. To do this, I use complementary daily bond market data (de-

[11] For more details on the Danish economy and politics during the war, see Johansen (1986), ch. 5.

scribed in the data section below) to analyze the price limits effect in more detail and see whether they persist to the monthly level. If they were not, this will be taken as evidence in support of the sovereign risk explanation.

One alternative explanation besides sovereign risk for high sovereign yield spreads is suggested by Roubini (2000). He points at high risk aversion of foreign investors as the reason for why recent emerging markets experience high spreads despite nearly default-free credit histories. I test this alternative hypothesis on the Scandinavian World War II case estimating variants of a single-asset time series CAPM, with both monthly sovereign yields and holding period returns as returns measure.[12] Although the Nordic markets were only partly integrated during this period, I control for potential cross-border diversification (as suggested by Karolyi and Stulz, 2003) by using two alternative portfolios: the local one and an equally-weighted "Nordic" portfolio based on the Copenhagen and Stockholm returns converted into home currencies (i.e., everything in DKK when estimated for Danish investors and SEK for Swedish investors). The local and "Nordic" CAPM:s are then estimated as follows,

(6a) $$z_{it} = \alpha_{ik} + z^{L}_{it}\beta_{ik} + v_{it}, \quad \text{k = Full, Prewar, War, Postwar,}$$

(6b) $$z_{it} = \alpha_{ik} + z^{N}_{it}\beta_{ik} + v_{it}, \quad \text{k = Full, Prewar, War, Postwar,}$$

where $z_{it} \equiv h_{it} - rf_{it}$ is the excess return on Danish government bonds in market $i$, $z^{L}_{it} \equiv R^{m}_{it} - rf_{it}$ the excess market return on the local portfolio, $z^{N}_{it} \equiv R^{m}_{(i+j)/2,t} - rf_{it}$ the excess Nordic market return, $\alpha_{ik}$ constants and $\beta_{ik}$ the beta for periods $k$ = "Full" (1938:01–1948:12), "Prewar" (1938:01–1939:08), "War" (1939:09–1945:05) and "Postwar" (1945:06–1948:12) and $v_{it}$ a random error.

In all cases, I fit robust regressions since outlier influence is obvious and clearly indicated as both heteroskedasticity and non-normality of the residuals.[13] To account for the potential inference problems implied by the small sample sizes, I use bootstrapped standard er-

[12] Monthly holding period returns are included since they may be better to capture short-term variations relative to the fluctuations in the stock market portfolio. They are defined as $h_t = (C_t + P_t - P_{t-1})/P_{t-1}$, where $C_t$ is the monthly accrued coupon interest and $P_t$ the bond price at month $t$. Although zero-beta CAPM tests are not common for bonds and "Cuthbertson (1996, p. 248) discusses some previous attempts.

[13] Robust regressions (command *rreg* in STATA) basically eliminate gross outliers and then compute Huber-biweight iterations in order to weight observations more evenly in the loss function.

rors (calculated with 2000 replications) for each sub-period. It should also be noted that single-asset CAPM regressions are inherently noisy, which means that the overall poor goodness of fit will be relatively low.

## 4 Data

The basic data are yields calculated from end-of-month bid prices at the Copenhagen and Stockholm Stock Exchanges during 1938–1948 collected from the Statistical Yearbook of Denmark (for Copenhagen) and the Swedish financial chronicle *Affärsvärlden*.[14] To get as similar Danish bonds as possible from each market, the 4% 25-year loan of 1934 from Copenhagen and the 4% 20-year loan of 1936 from Stockholm were selected (see figure 2).[15] Both loans were semi-annual and both issued and paid coupons in local currencies. As noted by Statistics Denmark (1967, p. 226), the 1934 loan was prematurely redeemed in July 1950 but I have not found any indications or announcements of this in the financial chronicle *Finanstidende* in the years preceding the event and hence disregard this early call in the yield calculations. Available official documentation and financial press in both countries suggest that all bondholders, both home and abroad, received coupon payments throughout the period.[16] A complementary dataset with daily prices and volumes at Copenhagen were collected from the newspaper *Berlingske Tidende* for the shorter period 7/1/39–6/30/40. The period was chosen for its many institutional changes but restricted in size due to time considerations. Three bonds were covered: the 1934 government bond described above and two 4% bonds issued by two regional credit associations: *Copenhagen* and *Østifterne*.[17]

Data on market interest rate and also risk-free rates are measured as the central bank discount rates (or inter-bank rate) of both countries. Market returns are measured as monthly stock market capital gains ($(P_t - P_{t-1})/P_{t-1}$), collected from both countries' statistical yearbooks. These variables are all shown in Figure 3. Monthly spot exchange rates were col-

[14] For Denmark, see the table "Københavns Børskurs (Køber) for Obligationer". For the period in April-May 1940 when the exchange was closed but prices still quoted they were probably collected from the off-exchange market arranged by the large brokerage firms, as discussed by *Finanstidende* 22 May 1940, p. 700.
[15] The results are robust to choice of yield concept (current yield and yield to average life were tried without affecting the basic results) and also bond loan (the Copenhagen-traded 3.5% consol of 1888 and Stockholm-traded 3.5% 20-year loan of 1938 were used with no seeming effect).
[16] For Sweden, the Bond Catalogues of the Swedish Banker's Association as well as *Affärsvärlden* were closely searched for any notes about halted or stopped debt service. *Finanstidende* 12 Jun. 1940, p. 761 actually explicitly reports how the Danish government sustained its debt service to foreign creditors.
[17] These two loans were selected as they were described as the most "popular" among Danish investors, and hence an upper bound on trading volumes. In the bond lists they were denoted as follows: *Kjøbenhavns Kreditforening* (1933–2007, 9 S.) and *Østifternes Kreditforening* (1934–2009, 14 S.)

lected from the Swedish central bank that posted daily offerings to buy and sell foreign currency. Inflation data is based on the cost of living indexes, *CLI*, published by Statistics Sweden and Statistics Denmark. A potential caveat in using the official price statistics is that both countries practiced price controls during the war and the resulting rationing might have made price unrepresentative. There is little previous research on these issues and the inflation proxies used here are the same as have been used in basically all previous studies of historical Nordic price levels. However, using nominal stock market returns implies that the "real" underlying inflation should have been incorporated which means that at least in some estimations this problem is partly alleviated. *Ex post* forward rates of inflation are measured as $\pi_{t+n} = [(CLI_{t+n} - CLI_t)/CLI_t]^{12/n}$ for $n$ being the period (in number of months) over which the inflation is expected and the ratio in the exponent annualizes the inflation rate. *CLI* is the cost of living index collected from the each country's Statistical Yearbooks and interpolated from quarterly to monthly frequency using cubic splines. Many studies choose $n = 12$ to get a straightforward measure of annual inflation expectations, but since the bonds are assumed to be held until maturity date (as in "yield to maturity"), $n$ should be larger if the bonds are "long"-term. Here this means that for the period 1938–1948 $n$ descends from 252 (21 years) to 120 (10 years). To avoid selection problems, however, I use both $n = 12$ and $n = [120,252]$ (see Figure 4).

## 5 Econometric results

In this section, the yield spreads are analyzed in two steps. First, the baseline models with nominal (UIP) and real (RIP) yield spreads are estimated, offering a first-pass estimate of how yields respond to either different risk assessments or trading constraints. Thereafter these two effects are traced out using the complementary data and specifications discussed above.

### 5.1 The determinants of the yield spreads

Table 2 presents the results from estimating equations (4) and (5). Basically all cases show time dummies $C$ producing large and significantly negative estimates, regardless of whether inflation rates (both short- and long-term horizons), exchange rate fluctuations or differences in risk-free rates and market returns are included. Overall, this means that the period of segmentation implied highly distinct equilibrium yields in the two markets.

In the initial war period, $C_{39:09–40:03}$ is significantly negative but varies in size, possibly due to the large variances of some of the variables such as the yield spread, the short-horizon

inflation expectations and the risk-free rate in this sub-period. The three following periods $C_{40:04–43:08}$ $C_{43:09–44:05}$ and $C_{44:06–45:05}$ also yield negative estimates at highly significant levels. Interestingly enough, the size in the spread decrease over time from roughly –570 basis points (–5.7%) to –400 basis points and –290 basis point in each period, respectively. These magnitudes are remarkable and it should be noted that they persist regardless of including the various control variables. Finally, for the brief postwar period when price limits were still in place, $C_{45:06–46:02}$ is significant and –100 basis points large in all cases except for when short-horizon inflation rates are used. Although this could suggest an independent price limit effect, one should not that capital controls remained in place after the war and the Danish fiscal uncertainty was potentially significant even after the German occupation ended.

Expected depreciation enters negatively, which rejects UIP but goes in line with most previous studies of UIP over relatively short periods (Lothian and Liu, 2003). Interestingly, all regression intercepts are negative and, with a couple of exceptions, highly significant. This suggests that there are some additional institutional differences across the markets that influenced the yields above from the ones modeled. One such factor could be the mentioned liquidity gap in the Danish loans, i.e., that Danish loans in Stockholm were structurally less illiquid than in Copenhagen and that this induced an illiquidity discount. Moreover, transfers of foreign bonds were taxed in Stockholm with 0.15% which also could explain part of the difference.

Finally, the difference in market interests enters positively as expected, but only in the real yield spread estimations. The market return differentials are insignificant throughout, possibly because of their relatively high variances as shown in Figure 3.

### 5.2 Institutional constraints effects

The complementary daily bond prices and volumes in Figures 5, 6 and 7 suggest that prices of all the three bonds fell 10%–15% from the war outbreak to April 1940 and then quickly recovered after the second trading halt in late May. If price limits would have been strictly binding, one would have expected prices to decrease stepwise 1% per day until they converged to the lower Stockholm prices (and with higher yields). This is not shown in the data. Hence, the daily observations suggest that the daily price limits did not influence yields on a monthly basis, hence they do not explain the results found previously.

The price limits could have affected trading volumes, however, in the form of crowding out to other markets or instruments as found by Evans and Mahoney (1997) for modern U.S. futures markets. Aggregate bond trading data from Statistics Denmark, however, show no decrease in trading on the Copenhagen Stock Exchange but instead large increases in trading during the war. Indeed, volumes vanished under the initial price limit regime when a price floor regulated prices, but as soon as the limits changed to bound daily movements volumes returned gradually within a short period.[18] Testing for crowding out using statistical test for difference in average volumes between days when bid prices decreased less than 1% and when they decreased exactly 1% (i.e., when the limit was presumably binding), there is some evidence for crowding out as shown in Table 3. Since the bounds were only hit 20%–25% of the days when prices were falling, however, this still only suggests a weak effect. Interestingly, only non-governmental loans contain significant volume differences, which indicate that whenever government bond prices were falling sharply supportive buying actions by large market actors were triggered. Qualitative sources confirm that the central bank (*Nationalbanken*) and large commercial banks openly intervened in the markets the government bonds in the market to keep its prices superficially high.[19] This kind of influence hence is another channel through which institutional constraint affect the recorded yields. Altogether, however, the price limits had little long-run impact on yields in Copenhagen and were mainly binding on shorter terms in bear markets.

### 5.3 Investor heterogeneity effects

This section performs some additional tests of the investor heterogeneity explanation of the yield spreads. First I evaluate the suggestion by Roubini (2000) that high yield spreads may reflect high risk aversion of foreign investors. Then the overall robustness of the investor heterogeneity explanation is checked against the historical and contextual background.

Testing the degree of risk aversion is performed by estimating single-asset time-series CAPM (equations (6a) and (6b)) using robust regressions to control for observed outlier

[18] Contemporary sources confirms that crowding out was present during the first regime (see *Finanstidende* 20 Sep. 1939, p. 1058; *Obligationstidende* 27 Sep. 1939) and that trading returns thereafter (*Obligationstidende* 5 Jun. 1940, p. 17).

[19] The Central Bank's intervention is noted in early October Stated by the banking firm L. Palsby in "Fondsbørsen og Krigen", *Berlingske Tidende*, Jan. 1 1941, p. 8.

influences.[20] The estimated beta coefficients displayed in Table 4 give no indications of large differences in risk aversion between domestic and foreign investors, regardless of CAPM models or returns concepts used. In particular, there do not seem to be any consistent variation in betas across time periods or countries although the Danish betas are surprisingly often higher than the Swedish ones. As expected the models perform quite badly (especially when sovereign yields are used), why the results should be treated with some caution.

Looking at the historical sources describing political and economic events in the region before and during the war, a clear correspondence between the investor heterogeneity hypothesis and the historical evidence emerges. Prior to the war, the Danish government had a default-free track record (Eichengreen and Portes, 1989) and all Nordic investors anticipated the risk of a Danish sovereign default to be low, which produced insignificant yield spreads. When the war broke out, however, most Danish overseas trade routes and domestic economic activities were severely disrupted (Johansen 1986, p. 72). The yield spreads also increased by 250 basis points (recall Table 2) during the initial war period, which reflects that the foreigners felt more concerned about a default when observing the economic and fiscal pressure of Denmark. Contemporary Danish financial magazines also describes how the residents kept track of the government's public debt management, by expressing concerns over the inflationary pressure, governmentally induced or not.[21] When Germany occupied Denmark, a notorious defaulter-country took control which made yield spreads diverge dramatically. The historical descriptions in Johansen (1986, pp. 70ff) again support the investor heterogeneity explanation by the descriptions of Germany as a power that regarded it as important that Denmark functioned well economically and fiscally since this sustained the bilateral trade between the two countries (and probably also regarding future expropriation plans). The Danish residents did not experience a particular default threat, as reflected in the relatively low domestic yields, whereas Swedish creditors felt considerably more worried and seemed to have expected at least a partial default by the Germans.[22] When Germany introduced martial law in late August 1943 the German goodwill towards the Danes became clearly less pronounced, which accordingly lowered yield spreads as Swedish yields remained high but Danish yields increased.[23] By the end of the war, Allied

[20] The residuals in basic OLS regressions were both clearly heteroskedastic and non-normal.
[21] See, e.g., *Finanstidende* Mar. 13, 1940, pp. 484f.
[22] *Affärsvärlden* 4 May 1940, p. 396.
[23] On the fiscal policy changes around 1943, see Johansen (1986, p. 87).

war successes pointed at a German defeat and the decrease in risk assessments was on the margin most pronounced in Stockholm. Hence, despite that Germany was still formally in control, investors expected Denmark to be back on its default-free track as soon as the war ended.[24] This situation resembles the Soviet repudiation experiences on the Paris Bourse after World War I, where investors kept paying high prices for the repudiated Tsarist bonds since they believed in a coming political settlement and hence full reimbursement (see Oosterlinck and Szafarz, 2004). However, unlike in their case there were no signs of a Swedish bailout policy to rescue Swedish holders of Danish debt.[25]

## 6 Concluding remarks

This paper empirically examines how sovereign risk depends on the location of trade and the nationality of investors as suggested by a recent strand in the sovereign debt literature. Unlike the standard of sovereign debt models that use foreign creditor retaliation to explain why borrowing countries deter from defaulting, the newer models emphasize that the political influence and punishment ability of domestic creditors also force sovereigns to reconsider default. The analysis rests on a unique historical episode in Scandinavian bond markets, when World War II implied that the previously integrated markets became abruptly segmented by capital controls and war. Despite this, the interwar debt listed across border remained traded throughout the 1930's and 40's, allowing for direct investigations of the impact of investor heterogeneity on sovereign risk.

Several important findings come out of the analysis. The main result is that geographical differences in default risk expectations are important determinants of observed yield spreads across markets whereas changes in macroeconomic factors, portfolio choice or risk aversion have only marginal influence. This finding lends support the recent theoretical studies by Drazen (1998), Di Gioacchino *et al*. (2004) and others emphasizing that sovereigns strategically default at home and/or abroad based on the total political and economic costs this involves and that market actors simultaneously anticipate this decision process.

[24] In early 1944 the Danish creditworthiness was firmly acknowledged with reference to the "happy and complete restoration after the currently burdensome situation" (*Affärsvärlden* 9 Mar 1944, p. 191). See also the article "Denmark after the Occupation" from 14 Sep 1944, p. 9.

[25] In contrast, an article in one of the Swedish financial quarterly reviews stated the poor payoffs of foreign investments of Swedish investors in the 1930's and 40's were bygones ("Värdepappersmarknaden under kriget", *Skandinaviska Bankens Kvartalstidskrift*, January 1946, pp. 25f.)

Another contribution of the study is that it conducts one of the first systematic analyses of the effect on asset pricing from the profound institutional trading constraints that almost every Western government imposed on financial markets during World War II. In particular, it is found that despite the restrictiveness of the Copenhagen price limits their effect on long-run market yields was limited. However, signs of instantaneous price distortions and crowding out of trading activities were found, which is also what studies of more recent trading circuits experiences have observed.

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**Table 1: Danish and Swedish bond market microstructure around World War II**

| | Copenhagen/Denmark | Stockholm/Sweden |
|---|---|---|
| *Bond market features:* | | |
| Main organized market | Copenhagen Stock Exchange | Stockholm Stock Exchange |
| Number and types of bonds listed | ≈250 bonds, 20 governmental. All domestic and DKK-denominated. | ≈60 bonds, 15 governmental, 10 foreign. All SEK-denominated. |
| Reporting frequency | Daily | Biweekly (domestic), weekly (foreign) |
| Monthly average trading volumes on exchange, 1938–1948. | All bonds: 470 million DKK<br>All stocks: 62 million DKK<br>Danish government bond in the study: 0.14 million DKK (≈ 0.03% of total bond trading) | All bonds: 164 million SEK<br>All stocks: 205 million SEK<br>Danish government bond in the study: 0.04 million SEK (≈ 0.02% of total bond trading) |
| Estimated total bond trading (OTC + exchange) | n.a. | Jan.-Jun. 1926: 179.1 million SEK, with OTC 134.1 (75%) and exchange 45 (25%).<br>1948: 1,714 million SEK, with OTC 1,356 (79%) and exchange 358 (21%).<br>1949–1952 (average): 7,421.1 million SEK, with OTC 6,934.4 (93%) and exchange 486.7 (7%). |
| *Rules and regulations:* | | |
| Price limits | 1. 9/1/39–9/22/39: Min. 2% below prices of 8/31/39.<br>2. 9/23/39–2/23/46: ≥-1% per day. | 9/1/39–1/2/40: ≥-5% (–10%) per day. |
| Trading halts | 1. 9/1/39–9/11/39<br>2. 4/9/40–5/27/40<br>3. 5/8/45–5/18/45 | No trading halts. |
| Capital controls | Currency transfers restricted from Jan. 1940. Capital in- and outflows stopped from Apr. 1940. | All capital and currency in- and outflows without approval of the Bank of Sweden stopped from Feb. 1940. |

*Sources:* See text.

**Table 2: Explaining the yield differentials across markets, 1938–1948.**

| Equation: | (4) | (4) | (4) | (5) | (5) | (5) | (5) | (5) | (5) |
|---|---|---|---|---|---|---|---|---|---|
| Spreads: | nominal | nominal | nominal | real | real | real | real | real | real |
| $C_{39:09–40:03}$ | –0.027*** | –0.003 | –0.030*** | –0.144*** | –0.037*** | –0.037*** | –0.021*** | –0.030** | –0.042*** |
| | (0.003) | (0.015) | (0.007) | (0.013) | (0.005) | (0.005) | (0.004) | (0.012) | (0.012) |
| $C_{40:04–43:08}$ | –0.063*** | –0.068*** | –0.057*** | –0.053*** | –0.057*** | –0.052*** | –0.058*** | –0.058*** | –0.050*** |
| | (0.008) | (0.010) | (0.006) | (0.017) | (0.008) | (0.004) | (0.008) | (0.008) | (0.005) |
| $C_{43:09–44:05}$ | –0.045*** | –0.050*** | –0.042*** | –0.042*** | –0.035*** | –0.035*** | –0.040*** | –0.036*** | –0.035*** |
| | (0.004) | (0.007) | (0.004) | (0.011) | (0.002) | (0.002) | (0.003) | (0.003) | (0.003) |
| $C_{44:06–45:05}$ | –0.034*** | –0.036*** | –0.032*** | –0.027** | –0.027*** | –0.026*** | –0.028*** | –0.027*** | –0.028*** |
| | (0.005) | (0.008) | (0.005) | (0.013) | (0.003) | (0.003) | (0.004) | (0.004) | (0.003) |
| $C_{45:06–46:02}$ | –0.013*** | –0.011*** | –0.011*** | 0.012 | –0.008*** | –0.008*** | –0.008*** | –0.008*** | –0.012*** |
| | (0.004) | (0.004) | (0.002) | (0.011) | (0.001) | (0.001) | (0.003) | (0.002) | (0.003) |
| $s_{t+n} - s_t$ | –0.088** | –0.120** | –0.063** | | | | | | |
| | (0.034) | (0.053) | (0.029) | | | | | | |
| $rf_{Cop,t} -$ $rf_{Sto,t}$ | | –1.813 | 0.232 | | | | | | |
| | | (1.253) | (0.559) | | | | | | |
| $R^m_{Cop,t} -$ $R^m_{Sto,t}$ | | | 0.019 | | | | | | |
| | | | (0.023) | | | | | | |
| $rf^{real}_{Cop,t} -$ $rf^{real}_{Sto,t}$ | | | | | 1.025*** | 1.023*** | | 0.470 | 1.252*** |
| | | | | | (0.048) | (0.046) | | (0.692) | (0.163) |
| $R^{m,real}_{Cop,t} -$ $R^{m,real}_{Sto,t}$ | | | | | | 0.032 | | | 0.025 |
| | | | | | | (0.018) | | | (0.027) |
| *Constant* | –0.010*** | –0.009 | –0.010*** | –0.008 | –0.015*** | –0.015*** | –0.008*** | –0.011** | –0.016*** |
| | (0.002) | (0.012) | (0.005) | (0.011) | (0.001) | (0.001) | (0.003) | (0.005) | (0.001) |
| *n*, inflation | | | | 12 | 12 | 12 | (120,252) | (120,252) | (120,252) |
| # obs. | 132 | 132 | 129 | 132 | 132 | 129 | 132 | 132 | 129 |
| *F*-statistic | 93.6 | 61.2 | 96.6 | 343.3 | 551.45 | 563.4 | 68.0 | 69.9.5 | 134.5 |
| $R^2$ | 0.77 | 0.79 | 0.88 | 0.34 | 0.90 | 0.96 | 0.72 | 0.73 | 0.87 |

*Note:* Dependent variables are nominal yield spreads $y_{Cop,t} - y_{Sto,t}$ as in equation (4) and real yield spreads $r_{Cop,t} - r_{Sto,t}$ as in equation real of Danish government bonds across the Copenhagen and Stockholm Stock Exchanges. *C* denote time dummies explained in the text. $s_{t+n} - s_t$ is the ex post depreciation between the Danish and Swedish currencies, where $s$ = DKK/SEK. $rf_{Cop,t} - rf_{Sto,t}$ and $rf^{real}_{Cop,t} - rf^{real}_{Sto,t}$ are the nominal and real market differentials of central bank discount rates and $R^m_{Cop,t} - R^m_{Sto,t}$ and $R^{m,real}_{Cop,t} - R^{m,real}_{Sto,t}$ the same for stock market returns. *n* is inflation horizon 12 (annual) or 120–252 (10–21 years). ***, ** and * denote statistical significance at the 1%-, 5%- and 10%-levels, respectively. Newey and West (1987) heteroskedasticity and autocorrelation consistent standard errors with maximum 6 lags stand in parentheses.

**Table 3: Mean differences in daily trading volume in three bonds traded at the Copenhagen Stock Exchange between July 1939 and June 1940.**

| | Trading volume (DKK 1000's) at days when prices changed... | | | |
|---|---|---|---|---|
| | $0\% < \Delta P < -1\%$ | $\Delta P \leq -1\%$ | Mean difference | $H_0$: Mean diff. > 0 |
| **Government 4% loan of 1934** | | | | |
| Mean | 11.33 | 5.20 | 6.13 | *t*-stat: 1.27 |
| Standard error | (3.74) | (3.04) | (4.82) | Pr. > *t*: 0.105 |
| Observations | 42 | 10 | | |
| **Copenhagen Credit Association 4% loan of 1933** | | | | |
| Mean | 34.32 | 9.50 | 24.82** | *t*-stat: 1.74 |
| Standard error | (14.02) | (2.73) | (14.29) | Pr. > *t*: 0.044 |
| Observations | 57 | 16 | | |
| **Østifternes Credit Association 4% loan of 1934** | | | | |
| Mean | 18.41 | 8.86 | 9.56*** | *t*-stat: 2.41 |
| Standard error | (2.79) | (2.82) | (3.97) | Pr. > *t*: 0.010 |
| Observations | 63 | 14 | | |

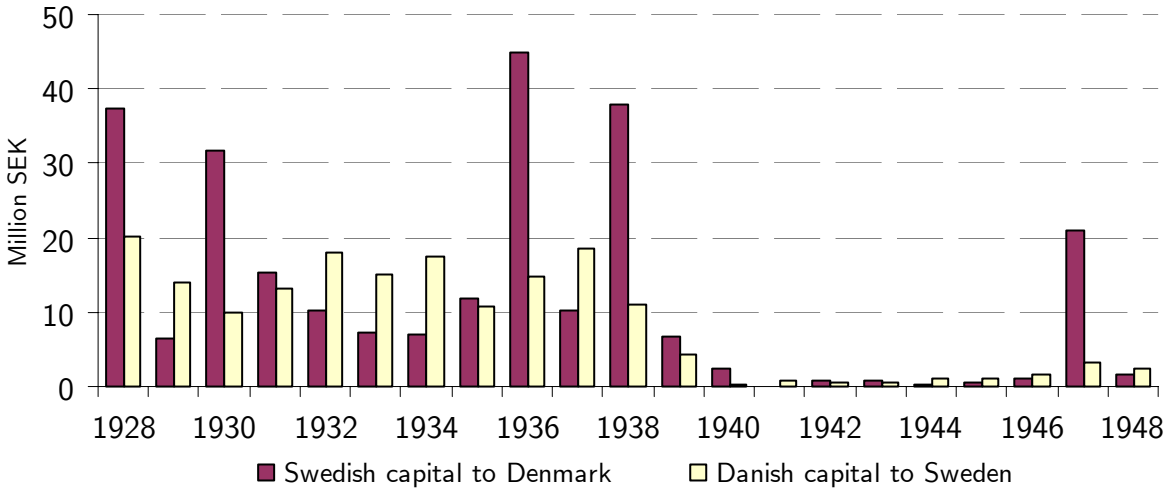
*Notes and sources*: The bonds and their sources are described in the text. One extreme outlier observation of the Copenhagen Credit Association sample has been removed (abnormally large trading on June 5 when bid prices dropped 1% but trading was done at higher prices). The t-tests assume unequal variances according to Welch's approximation technique.

**Table 4: Robust Local and Nordic CAPM:s with Bootstrapped Standard Errors.**

| Market (*i*), Period (*k*) | CAPM | Sovereign yields $\hat{\alpha}_{ik}$ | Sovereign yields $\hat{\beta}_{ik}$ | Sovereign yields *Pr.>F* | Holding period returns $\hat{\alpha}_{ik}$ | Holding period returns $\hat{\beta}_{ik}$ | Holding period returns *Pr.>F* | # obs. |
|---|---|---|---|---|---|---|---|---|
| *k* = Full (1/1938–12/1948) | | | | | | | | |
| *i* = Copenhagen | Local | 0.001*** | 0.024*** | 0.004 | 0.001** | 0.082*** | 0.000 | 129 |
| | | (0.000) | (0.008) | | (0.000) | (0.022) | | |
| | Nordic | 0.001* | 0.015* | 0.064 | 0.001* | 0.074*** | 0.001 | 129 |
| | | (0.000) | (0.021) | | (0.000) | (0.021) | | |
| *i* = Stockholm | Local | 0.002*** | 0.005 | 0.319 | 0.006* | 0.062 | 0.475 | 132 |
| | | (0.000) | (0.005) | | (0.003) | (0.086) | | |
| | Nordic | 0.002* | 0.019** | 0.0153 | 0.005* | –0.012 | 0.926 | 129 |
| | | (0.000) | (0.132) | | (0.003) | (0.132) | | |
| *k* = Prewar (1/1938–8/1939) | | | | | | | | |
| *i* = Copenhagen | Local | –0.000 | –0.002 | 0.214 | 0.002 | 0.128 | 0.167 | 20 |
| | | (0.000) | (0.007) | | (0.002) | (0.110) | | |
| | Nordic | –0.001*** | –0.000 | 0.680 | 0.002 | 0.114 | 0.064 | 20 |
| | | (0.000) | (0.007) | | (0.002) | (0.099) | | |
| *i* = Stockholm | Local | 0.001*** | –0.000 | 0.903 | –0.004 | 0.161 | 0.176 | 20 |
| | | (0.000) | (0.003) | | (0.006) | (0.378) | | |
| | Nordic | 0.001*** | –0.000 | 0.969 | –0.002 | 0.313 | 0.077 | 20 |
| | | (0.000) | (0.004) | | (0.002) | (0.531) | | |
| *k* = War (9/1939–5/1945) | | | | | | | | |
| *i* = Copenhagen | Local | 0.003*** | 0.009 | 0.233 | 0.002*** | 0.086*** | 0.016 | 66 |
| | | (0.000) | (0.010) | | (0.001) | (0.036) | | |
| | Nordic | 0.003*** | 0.008 | 0.303 | 0.002** | 0.073 | 0.046 | 66 |
| | | (0.000) | (0.009) | | (0.001) | (0.047) | | |
| *i* = Stockholm | Local | 0.004*** | 0.002 | 0.630 | 0.020* | 0.025 | 0.909 | 69 |
| | | (0.012) | (0.007) | | (0.012) | (0.445) | | |
| | Nordic | 0.004*** | 0.007 | 0.303 | 0.020* | 0.090 | 0.795 | 66 |
| | | (0.000) | (0.007) | | (0.011) | (0.635) | | |
| *k* = Postwar (6/1945–12/1948) | | | | | | | | |
| *i* = Copenhagen | Local | –0.000*** | 0.002 | 0.294 | –0.000 | 0.029 | 0.387 | 43 |
| | | (0.000) | (0.002) | | (0.000) | (0.039) | | |
| | Nordic | –0.000*** | 0.001 | 0.286 | –0.000** | 0.015 | 0.597 | 43 |
| | | (0.001) | (0.001) | | (0.001) | (0.050) | | |
| *i* = Stockholm | Local | 0.001* | 0.001 | 0.162 | 0.002 | 0.067 | 0.212 | 43 |
| | | (0.001) | (0.001) | | (0.001) | (0.043) | | |
| | Nordic | 0.001*** | 0.002 | 0.202 | 0.001 | –0.008 | 0.922 | 43 |
| | | (0.000) | (0.001) | | (0.001) | (0.065) | | |

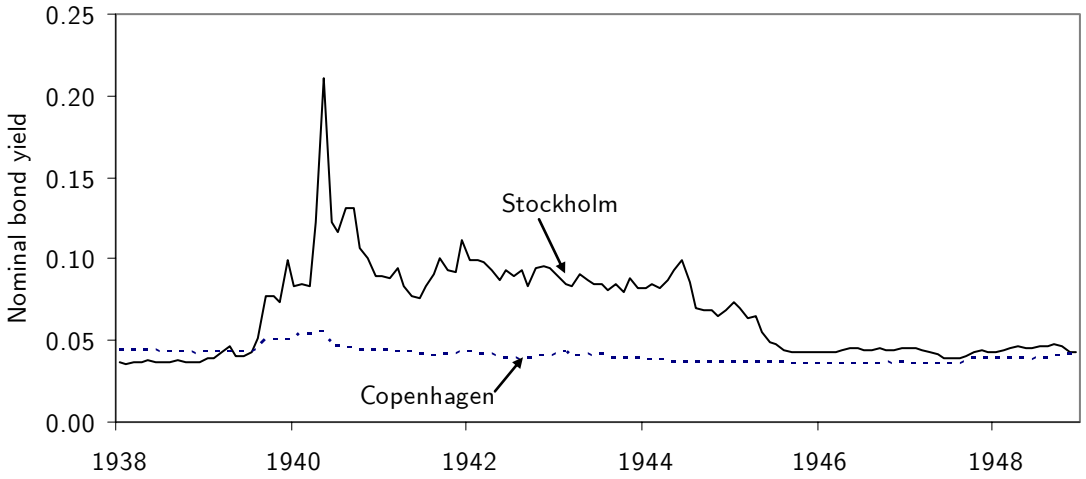
*Note*: Huber-Biweight robust CAPM regressions (6a) and (6b) with bootstrapped standard errors (with 2000 replications) for all sub-periods. Dependent variable is excess return (either sovereign yields or holding period returns) on Danish sovereign debt over the risk-free rate. "Local" and "Nordic" CAPM refer to the use of either a local portfolio or an equally-weighted Copenhagen-Stockholm portfolio. Subscript *i* is market place and *k* is periods "Full", "Prewar", "War" and "Postwar". *, ** and *** denote significance at the 10%-, 5%- and 1%-levels, respectively.

**Figure 1: Intermediated portfolio flows between Sweden and Denmark, 1928–1948.**



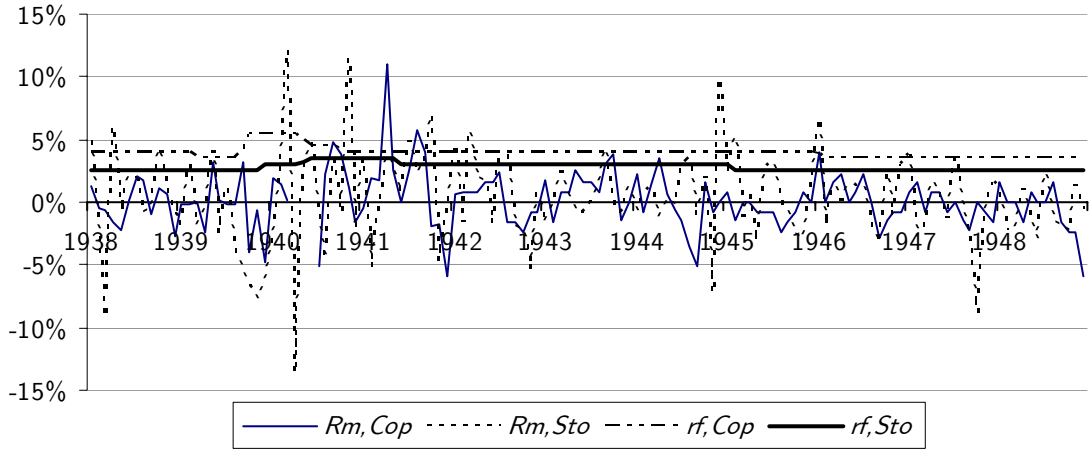

*Source:* The Swedish Banking inspection: "Bankbolags och vissa fondmäklares värdepappersaffärer med utlandet" published in *Ekonomiska Meddelanden*, various years.

**Figure 2: Danish sovereign yields in Copenhagen and Stockholm, 1938–1948.**



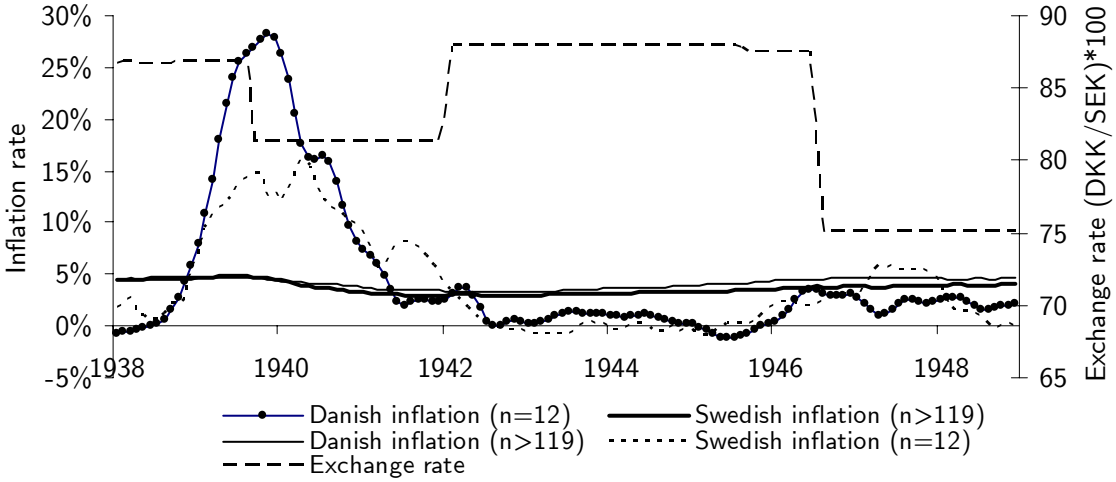

*Sources:* See text.

**Figure 3: Risk-free rates and market returns in Copenhagen and Stockholm, 1938-1948.**



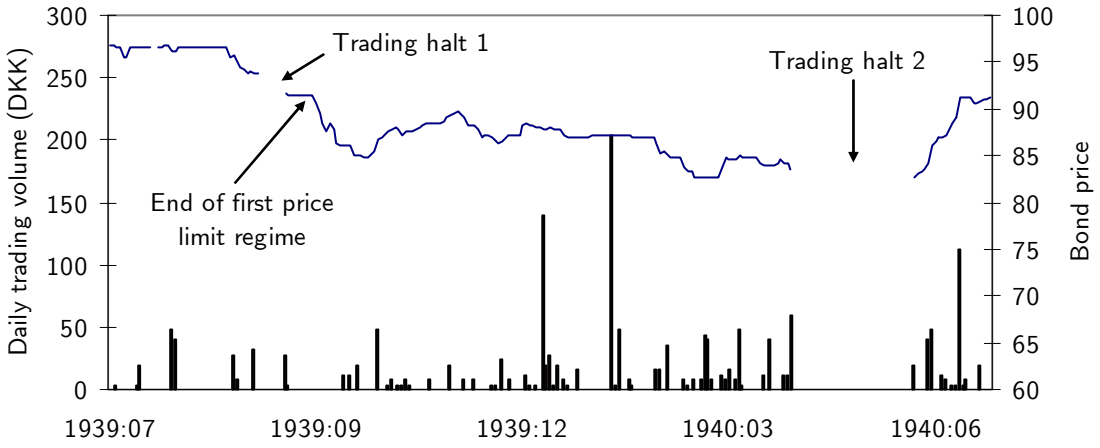

*Notes: Rm,Cop* and *Rm,Sto* are capital gains on the composite stock market indexes in Copenhagen and Stockholm, respectively. *rf,Cop* and *rf,Sto* are discount rates of the respective central banks.
*Sources:* See text.

**Figure 4: Inflation and exchange rates in Sweden and Denmark, 1938–1948.**



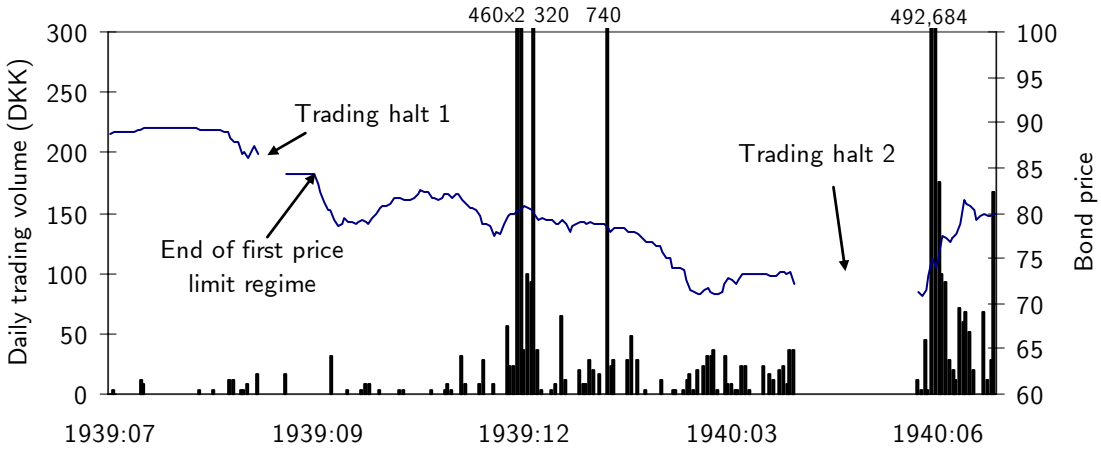

*Sources:* See text.

**Figure 5: Daily bond price and volume, 4% Government loan of 1934, 1939–1940.**



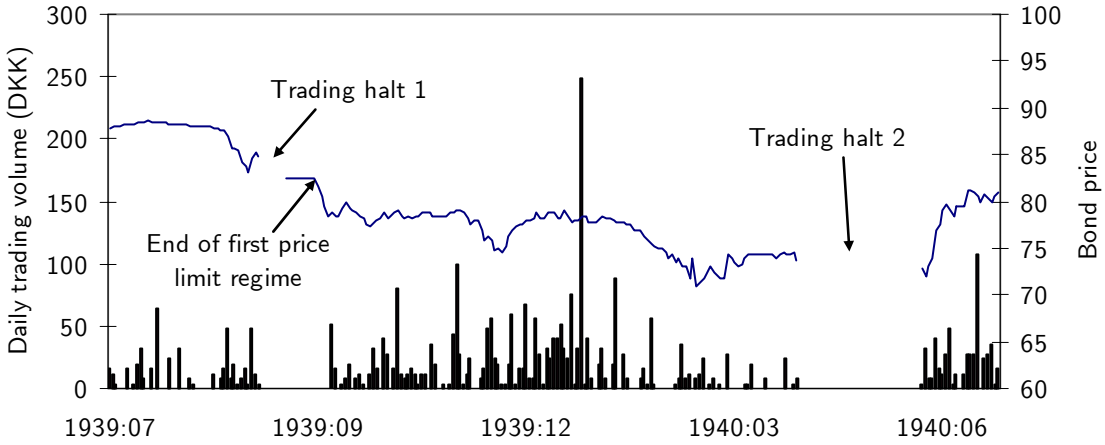

*Source:* Daily market reports in the newspaper *Berlingske Tidende*.

**Figure 6: Daily bond price and volume, 4% Copenhagen Credit Ass., 1939–1940.**




*Source:* Daily market reports in the newspaper *Berlingske Tidende*.

**Figure 7: Daily bond price and volume, 4% Østifternes Credit Ass., 1939–1940.**




*Source:* Daily market reports in the newspaper *Berlingske Tidende*.