Essays in Historical Finance

Daniel Waldenström

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STOCKHOLM SCHOOL OF ECONOMICS
EFI, THE ECONOMIC RESEARCH INSTITUTE

A Dissertation for the
Degree of Doctor of Philosophy
Stockholm School of Economics

Abstract:
This dissertation concentrates on the interplay between politics and financial markets using various empirical tools applied on historical financial statistics. The first essay examines the effect of stock transaction taxation on trading activity and asset prices, specifically focusing on the case of early 20th century Sweden. The main finding is that the tax substantially reduced trading as well as the level of asset prices.

In the second essay, modern *ex post* historical writing is contrasted with the *ex ante* views of contemporaries estimated from historical price data. The specific case study is the events around World War II related to the Nordic countries and Germany. The comparisons point out considerable differences between the assessments of historical events in the *ex post* and *ex ante* approaches. The third essay is an empirical study of price controls on asset price movements and how these controls affect asset returns. The study finds that the controls have large significant effects which even may influence estimates of the long-run equity premium. Altogether, this raises concerns about the use of century-long series of asset returns without correcting for the impact of institutional variation and market constraints.

Finally, the fourth essay examines the growth effects of international financial liberalization and integration are investigated using a large country- industry sample from the 1980s. The main result is that industries highly dependent on external financing do not experience higher value added growth in countries with liberalized financial markets. Liberalization does, however, increase the growth rates of both output and firm creation among externally dependent industries. These results are consistent both with increased competition and increased outsourcing.

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Acknowledgements

Before entering the graduate program, I heard two things about writing a Ph. D. thesis: first that it would probably be the loneliest thing I will ever do, and second, that the hardest part would begin after the completion of the thesis, when the search for something meaningful to do begins. Although these fears turned out to be relatively true, writing this thesis has been a highly fascinating and worthwhile journey, which introduced me to new, to me unknown, dimensions, places and even worlds. Looking back on these past years, I can only feel the deepest humbleness and gratitude for having been given the chance to make this journey, and finally also reach its destination.

There are a number of people that I am indebted to, who has contributed to this thesis in various ways making my writing less lonely. First of all, my advisor Professor *Magnus Henrekson* has assisted me actively from the very first moment and has helped me to focus on the essentials. Our many discussions on economic policy and the academic life in general have given me a number of eye-openers and also developed my way of "thinking economics". Thanks for all, Magnus!

My first three years at the school, however, were spent as a graduate student in economic history under the supervision of Professor *Håkan Lindgren* and also Professor *Hans Sjögren* (thanks, Hasse!). This work eventually resulted in a Licentiate thesis in economic history in the fall of 2000. Although thereafter I left the history discipline, the value of Håkan's experience, commitment and great personal warmth to my personal and academic progress can hardly be overestimated. I will always remember the summer evenings spent on the front porch of his summer cottage in By, discussing how to renovate timber cottages or making bargains at Swedish countryside auctions.

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I have also had the privilege to work together with Professor *Bruno S. Frey* at the University of Zurich. Bruno has impressed me by keeping up an extreme working tempo without losing stringency or analytical touch. He has, moreover, generously shared many of his profound economic insights with me and given me useful hints about how to write papers in economics.

The stimulation and friendship from all my fellow graduate students have also meant a lot to keep up my spirits during all these years. At times, these people were the only ones who could understand my problems with devious matrices whose elements are also matrices (scary!) or Mas-Colell's chapter 3. When I complained about having dreams about open balls, "chasing the Hessian" or Kakutani-mountains it was truly comforting to hear that they had nightmares about "being attacked by flying eigenvectors"! There are particularly some of these colleagues that have been important for me over these years: *Andreas Madestam*, with whom I shared the initial (and shocking) pain of learning mathematics and who has also become one of my dearest friends; *Erik "IV" Grönqvist*, who has serviced me with *Economist*-articles and who always was there when I needed someone to discuss the asymptotic behavior of estimators; *Nina Waldenström* (formerly Constantinescu...) always helped me when I got stuck with the mathematics (rather often, that is); *Niclas Damsgaard*, a great discussion partner in political economics issues who (himself being a politician) always also knew how economic policy worked in reality; *Magnus Andersson*, the central banker and prime table tennis partner at the top floor of the Swedish Riksbank who also tried to convince me that $i = i + 1$ (at least in the world of Matlab); my former roommate *John Ekberg* that showed me the virtues of SAS as well as downloading music from the internet; *Björn Lagerwall*, my prime supplier

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fundamental for my mental well-being and hence ability to keep up my research. My parents have offered their support and encouragement no matter what. Most important of all, however, was the love and support from my wife *Nina*, which gave me the energy I needed in order to complete the thesis. Thank you all!

Dissertation Summary

Essays in Historical Finance

This dissertation concentrates on the interplay between politics and financial markets. Three of the essays address how the taxation and regulation of financial markets influence the performance of financial markets and the real economy. A fourth essay makes a broader methodological inquiry into the structural discrepancy between retrospective and simultaneous analyses of the historical events. All papers are based on the same approach, which aims at applying theories and methods from modern economics and finance on new sets of historical financial data.

In Essay I, *Taxing Emerging Stock Markets: A Beneficial Policy? The Case of the Stockholm Stock Exchange, 1907–1939*, I analyze the pricing and trading distortions due to a stock transaction tax that was levied in Sweden in the pre-World War II era. Specifically, I estimate demand elasticities of trading volume with respect to the tax and its level and volatility-effects on the prices at the Stockholm Stock Exchange. The main results suggest several things. First, the empirical tests indicate strongly that taxes on emerging stock markets hamper the trading activity on these markets. The estimated tax elasticities are statistically significant and are larger than previous estimations on more mature stock markets. Secondly, asset prices fall immediately after an announced rise in taxes. Although volatility differs significantly across tax regimes, it seems to be dominated by changes in the real economy.

Altogether, the study raises doubt about the efficacy of setting high taxes on newly established and emerging stock markets. It is clear that transaction taxes cause both crowding out of trading and decreased asset prices on the stock market. More comparative research is, however, needed in order to capture the entire range of effects from financial market taxation. This study of an emerging market suggests that proponents of reducing excess volatility and speculation on financial markets

need to look at other measures to achieve their goals, without incurring the serious deadweight costs that seem to occur with transaction taxes.

Essay II, *Contrasting Ex Post with Ex Ante Assessments of Historical Events* (with Bruno S. Frey), examines how historians' *ex post* analyses of historical events differ from the *ex ante* assessments of the same events made simultaneously by contemporaries. Specifically, we test for the presence of structural breaks in secondary government bond prices of the Nordic countries and Germany around World War II and contrast the estimated break dates with the events that modern historical writing emphasizes as important to the contemporaries. This methodological approach was first proposed by Willard, Guinnane and Rosen (1996) and our study develops their approach further in a number of ways. Firstly, we make a more thorough evaluation of the historical writing in the light of the quantitative structural breaks estimates, which Willard et al. only discussed briefly. Secondly, we use a more robust structural breaks methodology (that of Bai and Perron (1998)) and furthermore present a way to systematically discriminate between sudden and gradual structural breaks, something which the previous literature has largely left untouched. Thirdly, we provide new evidence on sovereign debt prices of Denmark, Finland, Norway and Sweden and Germany, collected from the Stockholm Stock Exchange, one Europe's least regulated financial markets at this time.

The empirical analysis establishes large discrepancies between the *ex post* and *ex ante* versions of World War II. In particular, the atmosphere in the Nordic countries around the years before the war is quite differently described. The dating of the perceived turning points of the war is slightly more similar although considerable disagreement remains. We interpret these results as questioning the accuracy of traditional historical writing in assessing how contemporaries truly viewed risks and political changes, but before drawing any extensive conclusions, one should bear in mind that neither of the two history versions can claim to be objectively "true", as they are both representing estimates or interpretations of the data and sources that are at hand.

Our systematic distinction between sudden and gradual breaks proved to be useful for our understanding of the *ex ante* perceptions of historical events. Moreover, the trend-break specification allowed us to avoid estimating spurious mean-shift breaks in the case when the series were clearly trending. We therefore strongly encourage that this distinction is made, and also further developed, by others, in particular when analyzing *the ex* post versus *ex ante* approach to history.

Essay III, *The Effect of Price Controls on Financial Assets: the Case of World War II Sovereign Debt Yields*, examines the largely neglected issue of varying institutional constraints on financial markets and their effect on asset prices. Specific focus is put on a price control regime practiced on the Copenhagen Stock Exchange during World War II which prohibited asset prices to move outside certain regulated boundaries. The Copenhagen case is quite significative for the general situations at the time since practically every Western country imposed asset price controls on its financial markets. Surprisingly enough, there is little research on these experiences, which motivates this study. Specifically, I compare market yields on Danish government bonds that were traded simultaneously on the Copenhagen Stock Exchange and on the Stockholm Stock Exchange, which was basically unrestricted during the whole war. Hence, calculating the yield differentials, correcting for various macroeconomic factors, all determinants of the yields except the potential impact of the asset price controls are cancelled out.

The main empirical finding is that the controls reduced the yield level by roughly 5 percentage points. This result holds irrespective of using nominal or real differentials as well as the correction for exchange rate depreciation and national inflation rates. A somewhat surprising, and also puzzling, observation is that the Copenhagen secondary bond market continued to be active during the war, in spite of the measured effect from the controls. This could be explained by the fact that most Danish market institutions (payment settlements, information provision etc) were kept intact during the war which reduced some of the costs to investors due to the controls. Moreover, Danish wealth bearers did not have many alternative invest-

ment opportunities since the Danish government prohibited all cross-border flows of capital.

A supplementary finding of the study is that when the unrestricted (Stockholm) Danish government bond yields replace Copenhagen yields for the war years, the estimations of the Danish long-run equity premium over the entire 20th century are reduced by roughly 0.5 percentage points compared to the previous estimates in Nielsen and Risager (2001). Altogether, the large estimated effects of the Copenhagen asset price controls, although they are not easily interpreted when all facts are considered, raise serious concerns about examining century-long series of asset returns without taking the potential effect from varying institutional constraints into account.

In Essay IV, *International Financial Liberalization and Industry Growth* (with Jonas Vlachos), the real growth effects of international liberalization of capital accounts and stock markets are analyzed. Whereas previous work has mainly approached the topic by considering growth rates of country aggregates, we analyze growth effects at the industry level, using the well-known and widely used methodology and data from Rajan and Zingales (1998). We extend their analysis on financial development and growth by testing if industries highly dependent on external financing experience a faster growth in countries with liberalized capital accounts, liberalized equity markets, and that are well-integrated with global capital markets. Specifically, we look for growth effects in value added, production, and the number of establishments.

Our main finding is that industries highly dependent on external financing do not experience a higher growth in value added among countries with liberalized capital accounts or equity markets. The same result holds for countries more integrated with the international capital market in terms of actual capital flows and stocks. Although it is plausible that the growth effects of liberalization and integration differ between countries at different levels of financial development, we cannot draw any conclusions in this direction. We do, however, find significant positive effects

of liberalizing capital accounts and equity markets on the creation of new firms and growth in production – given that countries have relatively well developed financial markets. Hence, there may be growth effects of financial liberalization other than in value added. In a dynamic perspective, accelerated firm growth is important for a functioning creative destruction and thereby also for sustained long-run economic development.

Increased competition provides a straightforward explanation of these results. Financial liberalization stimulates firm creation, which increases competition and production. Value added, on the other hand, does not increase since the prices of final output fall. A second potential explanation is based on industrial vertical disintegration and corporate outsourcing. When the setting up of new plants is made less expensive by the liberalization of financial markets, firms become more inclined to outsource the parts of their production. Since outsourcing means breaking up value added chains, it could result in a pattern of increased firm creation, increased measured production and zero growth in value added. Some preliminary evidence points towards an explanation based on outsourcing rather than increased competition, but to fully analyze the question more research is needed.

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I

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Taxing Emerging Stock Markets: A Beneficial Policy? Evidence from the Stockholm Stock Exchange, 1907–1939[1]

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The question of whether financial markets should be taxed or not has been debated extensively. In this study, the gradual rise in public taxation of the Stockholm Stock Exchange during the first half of the 20th century is examined and evaluated. The empirical findings, focusing on trading volume and volatility, show that transaction taxes caused substantial crowding out of trading activity and led to lower asset prices. Hence, some support is given to the proponents of a more cautious policy of financial market taxation, especially in emerging stock markets. © 2001 Academic Press

INTRODUCTION

Financial markets in the Western world have been a target for taxation. One of the most common taxes has been the securities transaction tax (STT). Proponents for this tax argue that it reduces excess volatility and speculation and yields important state revenues. Tobin (1984) was among the first to propose the idea that increased transaction costs on financial markets would discourage short-sighted speculators and thereby enhance social welfare. More recently, Summers and Summers (1989) and Stiglitz (1989) have also argued that a transaction tax would be a relatively efficient source of government revenue while curbing excessive speculation. Most empirical work concerning transaction taxes have investigated their effect on mature markets in industrialized economies. The balance of this evidence has supported critics of transaction taxes who emphasize that they increase capital costs to firms, lead to thinner securities markets, and distort investors' portfolio allocations. Umlauf (1993) and Saporta and Kan (1997), for example, reported that transaction taxes tend to depress asset prices

[1] I thank Malin Adolfsson, Fredrik Bergström, Paolo Giordani, Lars Jonung, Håkan Lindgren, and Hans Sjögren for valuable comments. Also, participants at the Bank of Sweden Tercentenary Foundation Symposium on the "International Competitiveness of the Swedish Financial Industry," the European Public Choice Society 1999 annual meeting, and seminars at the Stockholm School of Economics; Eugene N. White; and two anonymous referees all have given useful input. Financial support from the Jacob Wallenberg Foundation is gratefully acknowledged.

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while having no effect on volatility. The same authors, as well as Lindgren and Westlund (1990) and Sun (1999), also have found that transaction costs reduce trading volume.

This article expands the scope of this literature by examining how a securities transaction tax affected one emerging stock market, the Stockholm Stock Exchange, during the pre-World War II period. At the time of the STT introduction in 1909, more than 80% of Swedish public revenues were derived from customs and excise duties on consumption goods. This structure was soon revised, and in less than 10 years, new taxes on labor and capital income were introduced, producing a political response from these newly taxed groups. To measure the effects of the STT, I estimate a linear regression model of the trading volume as a function of transaction taxes and commission fees, and I test for tax effects on asset prices in terms of level and volatility.

THE STT AND THE SWEDISH STOCK MARKET

The Stockholm Stock Exchange was founded in 1863, well before Sweden was industrialized and when there were only about 100 joint stock companies. Due to the undeveloped stock market, most new industrial corporations preferred debt to equity in their finance structure, relying on the developed commercial banking system. When industrialization finally took off at the end of the century, new needs for equity financing emerged. In 1901, the Stockholm Stock Exchange was thoroughly reorganized, substituting its old auction trading system for a continuous call market in which dealers could negotiate directly with each other. When commercial banks were allowed to become exchange members in 1907, the size and importance of the exchange increased considerably as trading volume grew 12-fold that year.

The growth of the financial market soon attracted the notice of the Swedish parliament with its fiscal interest. Furthermore, it became alarmed by a nationwide banking and financial crisis during 1907 and 1908. The Swedish tax system at that time consisted primarily of customs and stamp duties on alcohol and sugar. Inspired by other European countries, the Swedish legislature during the early 20th century started to levy taxes on capital gains and corporate profits. A securities transaction tax was introduced in 1909, designed after the German Stock Exchange tax. Although the desire to raise revenue was given as the reason behind the tax, the government was also concerned about curbing "speculative behavior" on the stock market.[2] The tax rate was set at 0.1% of the price of a transaction, to be equally shared by buyers and sellers for most types of Swedish and foreign securities. Bonds were taxed at a lower rate. In comparison to the STT rates in other countries, the Swedish stock transaction tax rate was substan-

[2] Government bill 1908:152, p. 15. There was one earlier attempt to impose a tax.

tially higher than the U.S. rate (0.02%), roughly equal to the German rate (effectively 0.09%), and lower than the British (0.5%) and French (0.7%) rates.[3]

When socialist parties, in particular the Social Democratic Party, began to enter the Swedish parliament during the 1910s, several new proposals for stock market regulations and taxation were launched.[4] In January 1913, a sharp increase of the STT rate to 0.5% was proposed, motivated ostensibly by the "insane" stock speculation and governmental funding requirements for an expensive pension reform scheme.[5] Financial market interest groups reacted strongly to the radical proposal. The Stockholm Stock Exchange Board and the Stockholm Chamber of Commerce submitted a critical report to the parliament emphasizing the negative effects from the tax on stock trading.[6] Little was heard from private investors. Although this resistance did not suffice to stop the increase, it reduced the new tax rate to 0.15%.

World War I forced Sweden off the international gold standard, raising inflation but also initiating an export boom.[7] This increased activity in the Swedish economy also was reflected in an increased volume of new equity issues. During the period from 1900 to 1930, new issues increased each decade from 170 million Swedish kronors during the 1900s to 694 million kronors during the 1910s and 1413 million kronors during the 1920s.[8] This increase and the rise in stock trading activity increased the importance of the Stockholm Stock Exchange in the financial system. The financial market boom was contrasted, however, by increasing poverty and unemployment in other parts of society during the war. Radical political movements emerged, calling for work and democracy and producing a constitutional reform in 1917 that gave all wage-earning men the right to vote for parliament.[9]

In January 1917, Social Democrats in parliament proposed a new STT increase, arguing that the wealthy groups in society should contribute more. In submitting this proposal, the liberal minister of finance drew support from the independent Stock Market Commission, charged with investigating changes in stock market regulation. The experts on the commission (including a stock broker and a banker) answered that "the current economic boom and the excessive stock market speculation" made it reasonable to impose a temporary but not a permanent tax increase like the one implemented in Denmark.[10] Supported by the commission and the "fiscal needs" of the war economy, the government proposed a 1-year tax increase to 0.3% that could be prolonged if considered necessary.

[3] Committee for the Study of Federal and State Stock Transfer Taxes (1940, pp. 13–80).

[4] Algott (1963, p. 64).

[5] Parliamentary member's proposal, AK 1913:133.

[6] Swedish parliament Tax Committee, 1913:36, pp. 6 f.

[7] See Haavisto and Jonung (1995) about the Swedish war economy and the subsequent postwar deflation crisis.

[8] Hägg (1980, p. 138).

[9] Rodriguez (1980, pp. 75 f).

[10] Report of December 27, 1916 (Ministry of Finance, konseljakt March 20, 1917, No. 14).

Between 1917 and 1920, a new joint Social Democratic and Liberal government came to power. In an extraordinary wartime session in late October 1918, the minister of finance proposed a doubling of the STT to 0.6%. It was argued that "the recent activity on the stock market required a higher STT" because real public expenditures had increased annually by an average 36% during the war.[11]

After the war, the worldwide economic depression reached Sweden during the early 1920s. A deflationary monetary policy accelerated the collapse, resulting in a fall in the Swedish industrial production by nearly 50% and a crisis for the commercial banking system.[12] The stock market also experienced hard times. During the period from 1918 to 1923, real stock returns decreased by more than 60% and the number of stock exchange brokers fell.[13] Despite this slump, the high transaction taxes remained in effect for more than a decade, with the Social Democratic Party strongly opposed to cutting the tax.[14] Tax opponents, on the other hand, stressed the effects of the tax on the secondary market and the problems of the corporate sector in raising new capital. This struggle continued until 1929, when the left-wing dominance in parliament was broken. A new Conservative administration cut the tax by half, based on arguments about the importance to have a well-functioning stock market for corporate sector growth.[15]

During the 1930s, the transaction tax remained unchanged in spite of the turbulent times. In September 1931, Great Britain left the gold standard, causing a financial crisis in Sweden. The discount rate was doubled in a few days, and the Stockholm Stock Exchange closed down for 3 weeks. In 1932, the largest Swedish industry conglomerate, Kreuger & Toll, failed in an enormous debt scandal, setting off a crisis for the entire Swedish stock market.[16]

Figure 1 reports the size of the Swedish STT revenue before World War II as a share of all national tax revenues. The tax was fiscally most important during the war when it represented between 0.5% and 1.2% of total taxes. Its importance decreased steadily into the 1930s. The Swedish STT revenues were low in comparison with other contemporary Western countries, keeping in mind that the national STTs were not always completely comparable.[17] By the late 1930s, the French bourse tax and the U.K. stamp duty represented about 2% and 1%,

[11] Rodriguez (1980, p. 75) and Statistics Sweden, *Statistical Yearbook.*

[12] See Haavisto and Jonung (1995).

[13] See Waldenström (2000, pp. 12–16).

[14] The interest group activity can be traced partly in the opinions written to the government and the Tax Committee as referring bodies to new tax changes. For a closer treatment of the political economy of the 20th-century STTs in Sweden, see Waldenström (2000).

[15] Government bill 1929:85, pp. 12 f.

[16] This was the famous "Kreuger Crash," named after the suicide on March 12, 1932, of the prime owner of the Kreuger & Toll corporation, Ivar Kreuger.

[17] The STT in France and the United Kingdom included both transfers in registered stock ownership and short-term stock trading on the stock exchange, albeit taxed at different rates. Other countries (e.g., the United States, Germany, Netherlands, Scandinavian countries) treated all changes in ownership as equal transactions, although the site of trading (outside or inside the stock exchange)

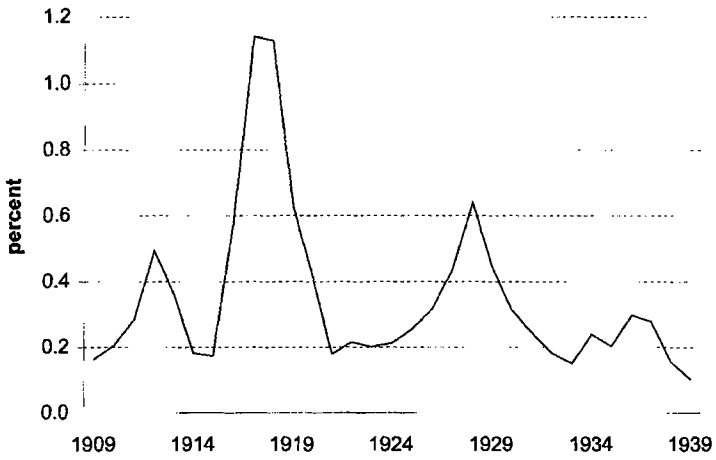

FIG. 1. Swedish STT revenue as share of total tax revenues, 1909–1939.

respectively, of national taxes. In the United States, federal and state STTs constituted about 0.3% of all revenues, whereas the Dutch stamp duty produced about 0.25% and the German stock exchange tax yielded only 0.1% of total revenues.

ANALYSIS OF TRADING VOLUME

In this section, the effects of the transaction tax on the stock trading activity on the Stockholm Stock Exchange are analyzed. Previous studies (Lindgren and Westlund, 1990; Sun, 1999) have used ordinary least squares (OLS) regressions to estimate the elasticity of trading volume with respect to the tax. This study follows a similar approach, using a semilog–linear regression model of stock market trading volume:

$$\ln TV_t = \beta_0 + \beta_1 \tau_t + \beta_2 \ln IP_t + \beta_3 \ln P_t + \beta_4 \ln V_{NYSE,t} + \beta_5 b_t + \beta_6 r_t + \beta_7 \ln TV_{t-1} + \delta_i D_{i,t} + e_t, \quad (1)$$

where TV denotes stock trading volume (total value traded shares divided by stock price). It is deflated to measure real activity.[18]

Figure 2 shows the monthly trading volume on the Stockholm Stock Exchange between 1907 and 1939. The growing time trend resembles that of most other Western exchanges, but the extraordinary high volumes during World War I were a unique feature of the Scandinavian stock markets because these countries were

or nationality of securities (domestic or foreign) mattered (see Committee for the Study of Federal and State Stock Transfer Taxes, 1940, pp. 13–80).

[18] The price data are weighted by capital and not by volume, which will cause a slight but probably negligible bias of the deflated series from the true real volume.

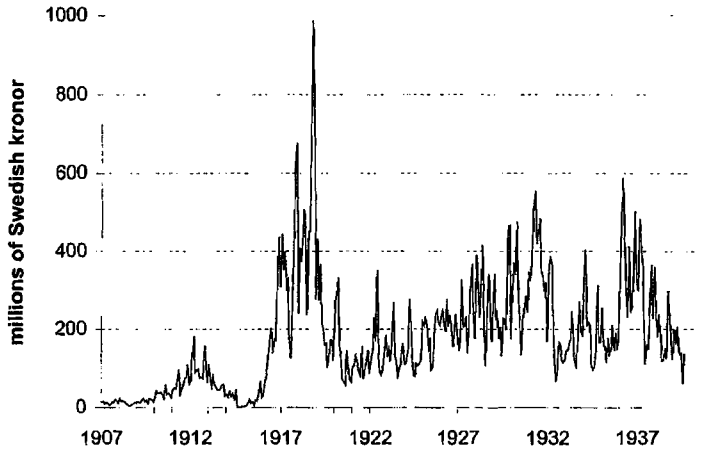

FIG. 2. Trading volume on the Stockholm Stock Exchange, 1907–1939.

not engaged in war.[19] The sample period carries from 1907 to 1939. The starting date is constrained by data availability (stock prices are not available before 1907, and industrial production is not available before 1913). The period ends in August 1939 with the outbreak of World War II.

Data on value of traded shares on the Stockholm Stock Exchange were published in the Swedish periodical *Ekonomiska Meddelanden.*[20] There are no continuous stock price indexes for Sweden until the 1920s. However, there were some short-lived price indexes. I have linked three shorter stock price indexes together into one long stock price sequence for the purpose of this study (see Fig. 3). For the period from 1907 to 1913, a price index in the contemporary publication *Kommersiella Meddelanden* is used. This index is constructed by calculating the market value of all shares on the Stockholm Stock Exchange "A list" and dividing by their aggregate book value. The A list contained the most traded shares within industry and banking, comprising about 50 companies. Östlind (1945) constructed an index for the period from 1913 to 1921. Although the index of *Kommersiella Meddelanden* existed until 1921, Östlind's index appropriately adjusts for the numerous new equity issues on the exchange during the war and, therefore, is used in this study.

For the remaining period from 1922 to 1939, I use the stock index *Affärsvärlden Generalindex* (AFGX), calculated and published by the financial chronicle

[19] See Algott (1963, p. 93), for short descriptions of other Scandinavian stock markets.

[20] Before 1927, monthly figures also include volume of traded bonds. This will not influence the estimates for two reasons. First, available yearly data show that the stock trade vastly exceeded the bond trade (Östlind, 1945, p. 259). Second, the estimated Eq. (2) stands in first differences and, hence, is mainly unaffected by changes in the level of the dependent variable, something that is also confirmed by test regressions with the trading volume adjusted for the estimated bond share from the annual data.

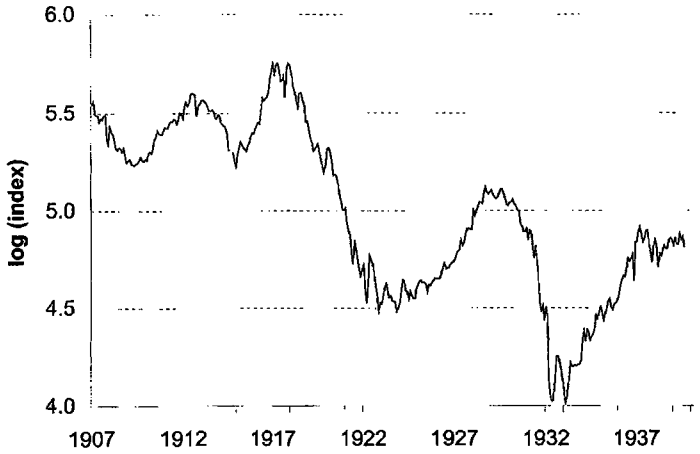

FIG. 3. Stockholm Stock Exchange price index, 1907–1939.

Affärsvärlden.[21] AFGX also uses the A-list companies but excludes banking companies. AFGX is merged with a pure banking stock price index (also published in *Affärsvärlden*) weighted by its capital.[22] This last adjusted stock price index is used because the trading volume includes all companies listed and banks. Neither of these indexes includes dividend yields properly, which means that the price index reflects only capital gains. The model also includes a one-period lag of the dependent variable (TV_{t-1}) to correct for autocorrelation in the trading volume.

The transaction cost τ associated with the trade is equal to the sum of the transaction tax and the fixed commission fee (Fig. 4).[23] A τ of 1% enters the data as 0.01.[24] By letting τ enter the equation untransformed, its estimated coefficient will be the *semi-elasticity* of trading volume with respect to τ, which can be interpreted as the percentage change in the dependent variable when the transaction costs are increased by 1%. Lindgren and Westlund (1990) used a log–linear model and obtained elasticities, whereas Sun (1999) calculated the elasticities out of the estimated semi-elasticities. Log–linear models assume constant

[21] This index is still today the most commonly used Swedish stock price index, and details on its construction can be found in *Affärsvärlden,* 1928, No. 50, pp. 668–669.

[22] Möller (1962) also constructed a total price index, albeit annual, where he also merged these two indexes. His weights for banking companies were 0.35 for 1922–1924, 0.30 for 1925–1927, 0.25 for 1928–1932, and 0.20 for 1933–1939.

[23] The commission fee was a fixed rate of the transacted value set by the Stockholm Stock Exchange Board in cooperation with the public control authorities. Transaction costs may also be defined to include the bid–ask spread, but because this does not reflect any direct act of taxation, we disregard it in the model.

[24] Sun (1999) let transaction cost be endogeous due to the fact that a revenue-maximizing government might adjust the tax rate according to changes in observed trading volume. However, the use of monthly data rules out this endogeneity given that the contemporaneous information standards were hardly sufficient for the government to calculate, legislate, and then politically implement new tax rates on a monthly basis.

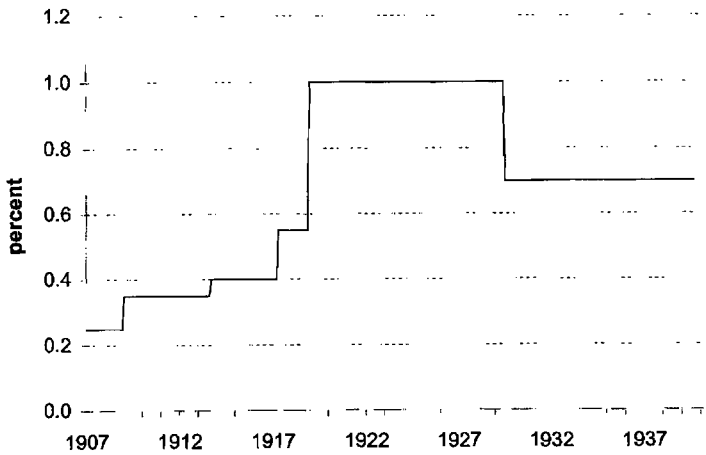

FIG. 4. Transaction costs (STT + commission fee) on the Swedish stock market, 1907–1939.

elasticity of the estimated variable, which implies that demand effects from tax changes are the same for increases from 0.1% to 0.2% as for increases from 10% to 20%. Hence, I use a semilog–linear model specification, although I calculate the ordinary elasticities from the estimates to get comparable estimates.[25]

The expected effects of transaction costs are that investors demand a higher rate of return on each investment, which in turn increases the average holding time of shares and thereby decreases trading activity. Elasticities estimated by Lindgren and Westlund (1990) lie between −0.85 and −1.35, whereas Sun (1999) reported estimates between −0.3 and −0.9. The theoretical priors and empirical evidence, thus, suggest a negative regression coefficient for τ.

IP is the Swedish real industrial production, used primarily as a proxy for real economic growth. Industry shares dominated the stock market at this time, and industrial production is also relevant to stock investors because it is linked to the profitability of the industry, which in turn determines future dividends. The expected coefficient sign, therefore, is positive. ln P_t is the monthly percentage change in stock prices, which is expected to have a positive impact on trading volume because it represents positive new information that signals possible future profits.

V_{NYSE} is the monthly volume of traded shares on the New York Stock Exchange (NYSE), which is used as a proxy for foreign financial market influence on the Stockholm Stock Exchange. Because the STT efficiency depends on how elastic the demand for the taxed activity is (i.e., how mobile stock investors are), the degree of international financial market integration becomes important. There are no satisfactory figures for the trading movement between exchanges during this period, but data for Swedish short-term capital suggest that

[25] In a semi-log model $\ln Y = \alpha + \beta X + \epsilon$, the semi-elasticity β equals $(1/Y)\ (dY/dX)$, and hence the elasticity can be achieved by multiplying this expression with X. When X is the transaction costs variable τ, elasticities can be calculated using the weighted average $\bar{\tau} = 0.007$.

the 1910s and 1920s movement was higher than during earlier periods.[26] Reading contemporary financial journals such as *Affärsvärlden* also lends support to the notion of growing international integration during this period. The pattern of the NYSE volume differs from that of the Stockholm Stock Exchange. When the Swedish market boomed during World War I, the activity on the NYSE was remarkably low. Both markets experienced growing volume during the 1920s, but the American exchange grew faster and soared during the boom and bust of 1929. The NYSE was selected because other Scandinavian stock exchanges all were much smaller markets that followed Stockholm rather than the other way around. The largest stock exchanges—London, Berlin, Paris and New York—all attracted significant attention from market participants in Sweden. However, data on monthly volume of trade for the entire period is available only for the NYSE.

The rate of return on alternative investments outside of the stock exchange is measured in two ways. The yield on Swedish government bonds (consols) is b, representing the risk-free rate of return on the market.[27] However, because monthly yield data exist only from December 1918, another proxy for opportunity investments was used, the official discount rate of the Swedish Riksbank, r, which determined the deposit rates of Swedish commercial banks during the period. $D_{i,t}$, $t = 1 \ldots, 1\ 1$, are untransformed monthly dummies (where 1 is observation month i and 0 otherwise) reflecting seasonal behavior of stock investors. There is no clear theoretical interpretation of trading volume seasonality. One previous study (Lindgren and Westlund, 1990) found seasonality to be important in explaining trading activity. Some efforts have tried to link seasonality to stock returns (Ramcharran, 1997) in the sense that the "January effect" or declaration of dividends affects investors. Another reason for trading seasonality on the early Stockholm Stock Exchange is that investors spent their holidays in the countryside or abroad and, thus, found it much more difficult to trade shares.

If inferences are to be made using OLS estimations, then the time-series properties of the variables must fulfill the requirement of stationarity. Indications from previous studies of trading volume show that it may carry some trend component, casting doubt over its assumed stationarity. After using the Augmented Dickey–Fuller (ADF) tests of unit roots,[28] unit roots cannot be rejected for any of the variables. When suspecting that the variables are nonstationary, a standard procedure is to take first differences of the nonstationary series to get rid of the stochastic trend component that is causing the unit roots.[29] Differencing the variables, however, requires that there is no significant cointegration between the

[26] See Lindahl *et al.* (1937), pp. 611–16. This conclusion is drawn from increasing fluctuations in in- and outflows between 1870 and 1930, which is the only statistics available.

[27] The data on bond yield is described in Frennberg and Hansson (1989) and generously supplied by the authors.

[28] Available from the author upon request.

[29] See Hamilton (1944), p. 444.

variables in the regression. Cointegration implies that although the time series are individually nonstationary there might exist some linear combination of them that is stationary. If cointegration is present, then the t distributions of the estimated coefficients are invalidated and might cause spurious regressions. Therefore, I have tested for the existence of cointegration in the model using one of the most common tests of cointegration, Johansen's cointegration test, and the test results reject cointegration at the 5% significance level.[30] Hence, the use of a differenced model is straightforward. Taking first differences of Eq. (1) give

$$\Delta \ln TV_t = \tilde{\beta}_0 + \tilde{\beta}_1 \Delta\tau_t + \tilde{\beta}_2 \Delta \ln IP_t + \tilde{\beta}_3 \Delta \ln P_t + \tilde{\beta}_4 \Delta \ln V_{NYSE,t} + \tilde{\beta}_5 \Delta b_t + \tilde{\beta}_6 \Delta r_t + \tilde{\beta}_6 \Delta \ln TV_{t-1} + \delta_i D_{i,t} + u_t. \quad (2)$$

Equation (2) is the econometric model to be estimated. All of the variables are the same as in Eq. (1) above, and the only new element is that all variables (expect for the dummies) are in first differences. Because the error term u_t might be carrying some serial correlation due to the differencing, an appropriate number of lags of the dependent variable (which in this case is one) is included. The interpretation of the elasticities will be the same, but now it is *changes* in taxes that explain simultaneous *changes* in trading volume (measured by the prime parameter of interest $\hat{\beta}_1$). One difference from previous studies is that finding a trend component (nonstationarity) in the trading volume does not allow calculation of what has been called the long-run elasticity.

Results of Estimating Trading Volume

Table 1 presents the estimation results of four variants of Eq. (2). Regression (1) estimates the unmodified model. Regression (2) adds a dummy variable (D_{WWI}) testing for the exogenous shock caused by World War I. Regression (3) estimates the model as in Regression (1) but excludes the index of industrial production in order to use the whole data sample from 1907 and include all tax regimes during the period. Regression (4) estimates the model using the government bond yield as opportunity investment on the period from 1922 to 1939 instead of the discount rate.

In all four regressions, standard residual tests of u_t indicate normality and reject any critical serial correlation. The estimated semi-elasticities of trading volume with respect to the transaction costs are statistically significant and negative, between -155 and -191, which corresponds to elasticities between -1.09 and -1.33. Thus, if the 1929 transaction tax cut had occurred during the beginning of the 1920s, then trading volume would have been about 45% higher. The results of the estimated parameter of interest confirm that transaction costs significantly reduce trading activity, as Lindgren and Westlund (1990) and Sun (1999) found on post-1970 data. My estimates, however, seem to be greater compared to those in previous studies, which might signal a larger vulnerability

[30] See Hamilton (1994), p. 645–650. Test results are available from the author upon request.

TABLE 1
Trading Volume Estimations (Coefficient Estimates)

Variable	(1) (1913–1939)	(2) (1913–1939)	(3) (1907–1939)	(4) (1922–1939)
$\Delta\tau$	−161.56	−191.57	−169.51	−155.47
	(−4.30)**	(−4.13)**	(−4.66)**	(−5.52)**
$\Delta \ln P$	2.01	1.94	2.15	1.41
	(4.40)**	(4.26)**	(4.90)**	(2.78)**
$\Delta \ln IP$	0.25	0.28		0.38
	(1.69)	(1.96)*		(1.79)
$\Delta \ln V_{NYSE}$	0.24	0.24	0.19	0.30
	(4.00)**	(3.95)**	(3.51)**	(4.86)**
Δr	−7.01	−8.05	−11.33	
	(−0.95)	(−1.07)	(−1.80)	
Δb				−0.17
				(0.63)
$\Delta \ln TV_{t-1}$	−0.25	−0.27	−0.27	−0.24
	(−4.57)**	(−5.10)**	(−5.40)**	(−3.73)**
D_{WWI}		0.16		
		(2.73)**		
Constant	−0.29	−0.31	−0.32	−0.15
	(−3.59)**	(−3.67)**	(−4.82)**	(−1.53)
D_1	0.54**	0.54**	0.55**	0.40**
D_2	0.40**	0.40**	0.46**	0.23**
D_3	0.41**	0.40**	0.43**	0.23*
D_4	0.22*	0.22*	0.28**	0.04
D_5	0.17	0.16	0.25**	0.03
D_6	−0.05	−0.06	−0.06	−0.22
D_7	0.13	0.11	0.15	−0.04
D_8	0.42**	0.42**	0.46**	0.29*
D_9	0.53**	0.52**	0.57**	0.32*
D_{10}	0.53**	0.53**	0.61**	0.34**
D_{11}	0.35**	0.34**	0.40**	0.12
Elasticity	−1.13**	−1.34**	−1.19**	−1.09**
T	314	314	385	212
R^2	0.39	0.42	0.40	0.39
F statistic	11.3	11.5	15.0	7.25
DW	2.14	2.18	2.14	2.26

Note. t statistics are in parentheses using White (1980) heteroskedastic consistent standard errors.
* Significant at 5% level.
** Significant at 1% level.

to transaction costs for emerging markets than seems to be the case for more mature ones.

The other exogenous variables are also important. Trading volume is driven by rising stock prices, which is similar to what Lindgren and Westlund (1990) and Sun (1999) found. Industrial production contributes positively to the stock trading. Another interesting result is that Swedish financial activity before World

TABLE 2
Stock Price Effects of Announced Transaction Cost Changes

Event	Date	Percentage change	$\|t\|$
Tax raise (0.1%)	March 1908	−1.0	(3.6)
Tax raise (0.15%)	May 1913	−1.9	(7.9)
Tax raise (0.3%)	April 1917	1.2	(6.6)
Tax raise (0.6%)	November 1918	−9.4	(40.3)
Commission raise (0.4%)	January 1919	−7.0	(15.7)
Tax cut (0.3%)	February 1929	−2.0	(7.9)

Note. The test is a hypothesis test of equality of mean for each point in time listed in the table, using the entire period 1907–1939 mean = −0.2%, standard deviation = 4.5, and $T = 392$.

War II can be significantly linked to international financial markets. Trading on the NYSE significantly induces trading on the Stockholm Stock Exchange during the period. However, the negative relationship between coefficient size and sample length (0.19 in Regression (3) starting from 1907 and 0.30 in Regression (4) starting from 1922) suggests that Swedish trading activity was increasingly affected by foreign capital markets.

The rates of return on alternative investments do not seem to have been a factor for trading activity, as shown by the insignificant coefficients of the bank deposit interests (r) and the bond yield (b). The estimations suggest seasonal patterns in stock trade similar to those reported previously. The dummy variable controlling for the exogenous shock of World War I enters significantly, but it does not change the result of any other estimates.

ANALYSIS OF THE LEVEL AND VOLATILITY OF STOCK RETURNS

Transaction taxes may also affect the level and variance of stock index returns. According to standard asset valuation theory, an increase in transaction taxes would cause asset price levels to decrease. By the same reasoning, when information about future tax increases becomes publicly known, it should be capitalized in current prices. Umlauf (1993) and Saporta and Kan (1997) found that this was the case for Swedish and British stock markets of the 1970s and 1980s. This prediction is tested by examining the monthly stock price behavior after public announcements of changes in the transaction tax or commission fee.

Some simple tests are reported in Table 2. They show that the announced transaction cost increases in 1908, 1913, 1918, and 1920 caused significant changes in asset prices on the Stockholm Stock Exchange. Exceptions are the price reactions to the 1917 tax raise and the 1929 tax cut. In spite of these anomalities, the results generally indicate that investors quickly capitalized forthcoming changes in transaction costs.

Interpreting these results, however, requires some caution. The analysis should ideally incorporate effects on Swedish prices that stem from world-wide stock market trends and domestic political events that may coincide. For

example, the sharp price movements during 1918 and 1919 took place at the same time as severe political turbulence with threats of countrywide strikes and revolutionary movements.[31] The use of monthly, instead of daily, price changes might also magnify the measurement difficulties. Still, the overall results are in line with earlier findings of a short-term negative price response to tax announcements.

The tax–volatility relationship is evaluated in three different ways.[32] First, I calculate volatility, measured ex post as a 12-month moving standard deviation of the log stock returns,[33] and examine whether the peaks can be related to some extraordinary political or economic event at those specific dates. Second, I compare the volatility across tax regimes by conducting a hypothesis test of equality in the variance of returns. Third, to adjust for fluctuations in fundamentals that could distort the measurable transaction tax effects on volatility, I compare the variance of returns on the Stockholm Stock Exchange to the variance of the Standard & Poor's monthly composite index.[34] One benchmark for interpreting this ratio is that it would equal unity when returns on both markets follow a random walk. In previous research, there have been conflicting conclusions as to how transaction taxes affect stock market volatility. Some scholars argue that taxes will curb speculative behavior and thereby dampen excessive volatility (Tobin, 1984; Summers and Summers, 1989; Stiglitz, 1989). Other empirical findings (Umlauf, 1993; Saporta and Kan, 1997) suggest that transaction taxes do not seem to have any significant and consistent effect on levels of volatility. Aggarwal, Inclan, and Leal (1999) showed, based on emerging market data from the 1990s, that the predominant exogenous variables influencing stock market volatility are country-specific economic, social, and political shocks such as hyperinflation, currency, and government crises.

In Fig. 5, one evident spike in volatility appears between late 1931 and mid-1932. This peak is about four times the average volatility for the period as a whole. This was a highly turbulent time. Sweden left the gold standard, and Sweden's largest industrial conglomerate, the Ivar Kreuger empire, collapsed. The corporations involved in the crash (L. M. Ericsson, Kreuger & Toll, and Tändsticksbolaget) dominated trading on the Stockholm Stock Exchange, representing about 60% to 80% of the total trading.[35] Another period of high recorded volatility was during the early 1920s, when the volatility was about twice the average level, reflecting the Swedish postwar depression. These observations are

[31] Affärsvärlden, No. 47, 1918, p. 4903.

[32] A similar test procedure was done by Umlauf (1993).

[33] One problem with this measure is that the overlapping procedure creates situations where an extreme observation in 1 month affects the volatility during a whole 12-month period, and when it falls out of the window it affects the volatility disproportionally during the period 6 months afterward.

[34] This index is taken from Robert Schiller's personal Web page. Due to data scarcity, no equivalent European stock index covering the same period has been found.

[35] Algott (1963, pp. 176 f.).

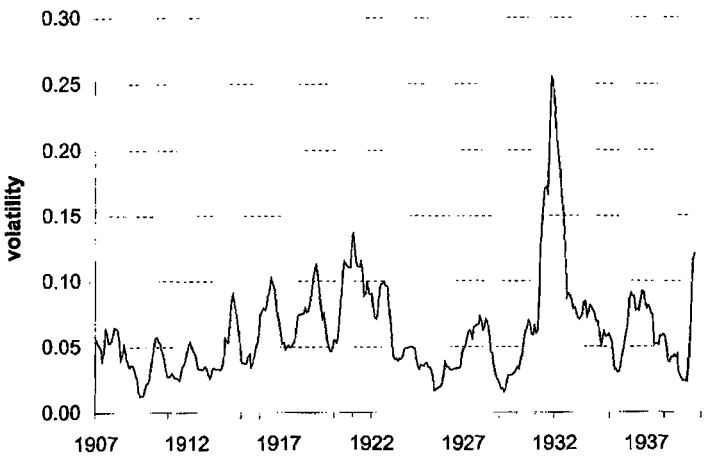

FIG. 5. Volatility on the Swedish Stock Exchange, 1907–1939.

in line with the findings of Aggarwal *et al.* (1999) that the largest recorded levels of stock market volatility can be traced to turbulent periods in the real economy.

In the two other volatility tests, volatility across different tax regimes is analyzed. Table 3 reports the Bartlett, Levene, and Brown–Forsythe test statistics of the null hypothesis of no difference. Volatility differs significantly across tax regimes during the periods, contrary to the findings of Umlauf (1993). However, there is no uniform relationship between tax rates and volatility level in these results. Both the highest and lowest volatility levels occurred under a 0.3% tax. Inspecting Fig. 4 during the 0.6% tax period, the high returns variance is generated by one period of high volatility (the depressed 1920s) followed by another period of low volatility (reflecting overall lower market activity of the second half of the 1920s). Some caution is required due to the low number of observations during all these tax periods, especially the first 0.3% tax period.

In Table 3, normalizing the Stockholm return variance with the Standard & Poor's return variance suggests a different picture of the tax effects. Although the variance ratios during the periods of a 0.1% and a 0.15% tax were high (4.50 and 2.25, respectively), the ratios during the post-World War I tax periods all were below unity. In other words, when adjusting the volatility for variance in fundamentals, there are indications that higher taxes might have had a negative effect on volatility. These results, however, are open for interpretation because variance in fundamentals is a function of economic development that is largely country specific. The Swedish stock market was still relatively undeveloped during the first two decades of the century but then underwent very rapid change compared to the more developed and stable New York stock market.[36] The low ratios from the post-World War I period can be explained by the aftermath of the

[36] See Davis and Cull (1994, pp. 66–67).

TABLE 3
Return Variances across Tax Regimes

	1909:01–1913:08	1913:09–1917:03	1917:04–1918:11	1918:12–1929:06	1929:07–1939:08
STT rate (percentage)	0.1	0.15	0.3	0.6	0.3
Standard deviation of stock prices	0.12	0.14	0.08	0.26	0.30
Average absolute mean difference	0.10	0.11	0.07	0.23	0.26
Average absolute median difference	0.10	0.11	0.07	0.22	0.25
Variance (Stockholm)/ Variance (NYSE)	4.50 [2.94, 6.89]	2.24 [1.19, 4.21]	0.90 [0.37, 2.21]	0.51 [0.36, 0.73]	0.61 [0.43, 0.87]
T	56	41	20	127	122
Bartlett $\chi^2(4)$ statistic	91.5**				
Levene $F(4,361)$ statistic	30.6**				
Brown–Forsythe $F(4,361)$ statistic	18.1**				

Note. Bartlett, Levene, and Brown–Forsythe statistics test the null hypothesis of equality of return variances across tax regimes. The variance ratio uses the Standard & Poor's composite price index, Robert Shiller's home page citation. Beneath each variance ratio, I report 95% confidence intervals using the F distribution. Because the F distribution rests on the questionable assumption that the two return distributions are independent, the intervals should be regarded as rough indications of the precision of the estimated variance ratios. Stockholm, Stockholm Stock Exchange; NYSE, New York Stock Exchange.

** Significant at 1% level.

Swedish economic depression during the early 1920s relative to the growing U.S. economy during the same period. Furthermore, although Sweden experienced turbulence during the early 1930s, its depression was less severe than the depression in the United States. In general, it is difficult to analyze the effects of taxes on volatility during this period given several large real shocks and institutional regime switches.

CONCLUSIONS

The aim of this study has been to examine the causal relationship between securities transaction taxation and the market performance on the Stockholm Stock Exchange during the period before World War II. The findings suggest several insights. First, the empirical tests indicate strongly that taxes on emerging stock markets hamper the trading activity on these markets. The estimated tax elasticities are statistically significant and are larger than previous estimations on more mature stock markets. Second, asset prices fall immediately after an announced raise in taxes. Although volatility differs significantly across tax regimes, it seems to be dominated by changes in the real economy.

Altogether, the study raises doubts about the efficacy of setting high taxes

on newly established and emerging stock markets. It is clear that transaction taxes cause both crowding out of trading and decreased asset prices on the stock market. More comparative research is needed, however, to capture the entire range of effects from financial market taxation. This study of an emerging market suggests that proponents of reducing excess volatility and speculation on financial markets need to look at other measures to achieve their goals without incurring the serious deadweight costs that seem to occur with transaction taxes.

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II

Contrasting *Ex Post* with *Ex Ante* Assessments of Historical Events.*

Daniel Waldenström† and Bruno S. Frey‡

May 6, 2003

Abstract

In this study we analyze two different ways of describing historical events and how they were perceived by contemporary actors. The first way is the historians' *ex post* analysis as represented in modern historical writing. The second way is the *ex ante* assessments of contemporary actors as reflected in financial price data collected from the time period in question. Specifically, we estimate structural breaks in government bond prices of the Nordic countries and Germany around World War II and contrast them with the events that historians claim were viewed as important by that period's contemporaries. We find large differences between the outputs of the two methods. For example, whereas historians describe the Scandinavians as feeling safe from the threat of war until a very late stage, the bond prices produce significant breaks signaling the opposite at a quite early stage. From a methodological point of view, we also introduce a systematic distinction between sudden and gradual structural breaks which provides an intuitive way of capturing peoples' responses to major political events.

JEL classification: C22, G14, N01, N44.

Keywords: Ex post history, Ex ante history, Sudden structural breaks, Gradual structural breaks, Sovereign debt, Capital markets, World War II.

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1 Introduction

In all analyses of historical events, there is a basic conflict between the retrospective analyses made by historians and the simultaneous analyses made by contemporaries. The historical writing, being typically explorative and descriptive in its character, has problems with handling this time inconsistency. The historical researcher that explicitly tries to alleviate these problems has also problems in evaluating how well they succeed since their approaches are founded on subjective assessments of various qualitative sources. It is the main purpose of this study to propose an alternative method for how such evaluation can be done. Specifically, we use historical financial statistics to estimate the ex ante views of the contemporary actors and then compare these with the traditional ex post version of history offered by modern historical writing. As a specific case study, we estimate structural breaks in sovereign debt prices of the Nordic countries and Germany during the 1930s and 40s which are then related with the major political events and turning points around World War II that historians emphasize. This methodology was first proposed by Willard, Guinnane and Rosen (1996) and our study is an attempt to develop their approach further.

When historians analyze historical events, they carefully assemble facts and written sources (correspondence, diaries, memoirs etc) and interpret them in the light of both the general knowledge of their own field and the particular circumstances prevailing at the time (see, e.g., Carr (1961) and Marwick (1970)). Their conclusions drawn are *ex post*, which means that they write the history of events after the consequent developments are known. This knowledge may bias the evaluation of the events, and may lead to "facts" being overlooked or over-emphasised, even though historians try to alleviate this by practicing source criticism and other validity checks (see, e.g., Jarrick and Söderberg (1993)). The historical events brought up by historians are of two completely different types. Firstly the events that the historians themselves regard as crucial to the subsequent development and secondly the events that historians claim that the contemporary people regarded as important for the subsequent development. The first type of events may thus not have been observed at all by the contemporaries, but only after some time and/or

after other complementary events have occurred.

In recent years, a new kind of historical writing, primarily complementary to the traditional one, has been proposed in the economics literature. It aims to conjecture the views and assessments of the contemporary actors by econometrically estimating them from, mostly, historical financial data. Since these estimates reflect the situation at each instant in time, they thereby reflect the *ex ante* assessments of actors, which is also what makes this method new relative to the traditional, historical method. The focus on financial market prices is advantageous in several respects. First of all, financial markets are widely considered as markets for the processing of information and as shown by, among others, Forsythe, Nelson, Neumann and Wright (1992), they usually exhibit a high predictive power due to so-called marginal traders who decide on a relatively unbiased basis, and carefully collect the relevant information. Moreover, asset prices represent the outcome of the interaction between many independent individuals that all incorporate the information available in order to make their valuations and forecasts as correctly as possible. Any deviation from this strategy, either deliberate or not, soon translates into capital losses which underlines the strong monetary, as opposed to, e.g., ideological, incentives that drive actors on these markets.

The ex ante approach to history just described was first suggested by Willard et al. (1996), who estimated unknown structural breaks in the market price of Greenbacks, a special currency issued by the Union during the U.S. Civil War, and linked these to the political and military events of the war. Frey and Kucher (2000*a*) used the same methodology on domestic and foreign government bond prices traded on the Zurich stock exchange during the 1930s and 1940s and could show that many important events before and during World War II were reflected in the bond prices. Similarly, Brown and Burdekin (2002) study German sovereign debt prices traded in London and Oosterlinck (2001) compares the prices of different French government bonds traded in France; both studies with focus on the World War II period. Sussman and Yafeh (2000) search for breaks in Japanese sovereign debt prices during 1870–1914 to inquire to what extent institutional reforms in Japan were reflected in the sovereign risk premium, and Mauro et al (2002)

compare the breaks in sovereign yield spreads of that period and of the 1990s.

In this study, we analyze the *ex post* and *ex ante* assessments of World War II using structural breaks estimations on sovereign debt prices of the Nordic countries' and Germany. Despite the similarities in time period and financial data, our study differs substantially from the previous literature in several respects. Firstly, we employ another structural breaks methodology, that of Bai and Perron (1998). This method is considerably more robust than the methods used previously since it takes both serial correlation and various heterogeneities in the errors and regressors across break regimes into account. Secondly, while previous studies have been primarily interested in the historical incidence from inspecting the timing of the breaks, we put considerable more focus on the comparison and, especially, evaluation of the modern historical writing in the light of our estimated structural breaks.[1] Thirdly, the study presents a new set of weekly bond price data from the Stockholm Stock Exchange during 1930–1947 covering bonds issued by the governments of Sweden, Norway, Denmark, Finland and Germany. Using Swedish data for this period is particularly advantageous, since the Stockholm Stock Exchange was practically unrestricted during the war. Hence, we expect these prices to be more efficient than those quoted on many other European markets, if they were open for trading at all.[2]

We also contribute in a methodological sense by systematically differentiate between sudden structural breaks, measured as breaks in the estimated means, and gradual structural breaks, measured as breaks in the estimated slopes of the trend and taking place over the period between the two breaks in the slope. This distinction has hardly been emphasized previously, which we find quite surprising based on the intuitive characters of both these kinds of breaks.

We analyze the prices of sovereign debt because we believe them to clearly reflect political events that have a significant effect on the debtor country and, in particular, its ability to service its outstanding debt. In the extreme case, a country completely

[1] Although this aspect of evaluation was clearly mentioned by Willard et al., it was for them merely a side issue whereas it is a main purpose of our study.

[2] The other Nordic stock exchanges were heavily restricted during the war, which most likely also was the case for most continental markets. For a more thorough description of the Swedish secondary bond market and how the financial asset price controls distorted the prices recorded on the Copenhagen exchange, see Waldenström (2003).

destroyed during the war is normally neither expected to service nor to pay back its debts at maturity. If traders do not believe that a country will reemerge, the value of the bond drops to zero. But in many cases even countries defeated and occupied by enemy forces may sometimes be expected to recover, so that the bond values do not drop to zero. Hence, political events are reflected in bond prices through the perceived risk of a sovereign default. Of course, this is not the only factor that affects the bond prices, but since most of these factors were constant throughout the period and since the estimated structural breaks are primarily related with fluctuations in the sovereign risk (either through political events or outright debt moratoria), we believe our method to be valid.[3]

The main empirical result of this study is that a quite significant discrepancy between what historians claim that the people of the 1930s and 40s regarded as important and what the structural break analysis finds in this respect. For example, historians broadly outline the people in Sweden, Denmark and Norway as being largely unconcerned about the threat of being exposed to a European war until late 1939 (Sweden) or April, 1940 (Denmark and Norway). Our bond price analysis shows, however, that Danish bonds started decreasing significantly already after Germany's annexation of Austria in March 1938 but more sharply after June 1939, when the Danish-German non-aggression pact was signed. Both the Norwegian and Swedish bonds started falling sharply in late May – early June 1939, which suggests that the bondholders perceived a significant increase in the threat of war at that early point in time. For Finland, there is more of agreement between the two approaches, although the Finnish bonds started to fall dramatically after the German-Russo pact in August 1939 whereas the historians do not describe the Finns as seriously worried for a Soviet attack until it came in late November. The German bond prices started to fall sharply in late October 1938 which, however, was two-three years after the Rhineland occupation, which have been forwarded as an important event which made the European public familiarized with thoughts of a new war. Regarding the major

[3] The other characteristics that affect bond prices are the coupon rate, time to maturity, tax status of the cash flow, redemption clauses and the size of the discount rate. These did not change much and regarding the changes in the yield curve, which could possibly be driven by inflation fluctuations (which were moderate), these have not been discussed or highlighted neither at that time nor subsequently.

turning points in the war, we also find quite apparent differences between the *ex post* and *ex ante* approaches. For Denmark, Sweden and Germany this discrepancy is considerable whereas for Finland and Norway, we find more of agreement between the two versions.

Moreover, we inquire whether the turning points stressed by historians as being important in a long-run perspective were perceived immediately as such by the contemporary actors. Examples of such breaks are the Rhineland occupation, the evacuation at Dunkerque and the German halt outside Moscow. For practically all events, however, we fail to show that this was the case. Finally, our distinction between sudden and gradual breaks prove to be highly useful both in capturing the gradual process of people's assessment of an event and to avoid finding spurious breaks which is the risk when a simple mean-model is regressed on a linear trend.

The study is organized as follows: Section II starts out with an overview of the Stockholm secondary bond market and then provides a thorough description of the government bond price data used in the empirical analysis. Section III presents the econometric methodology used for estimating structural breaks in the bond prices. In section IV and V, we report the main results of the study. First, section IV presents the results from the structural breaks estimations for all the five countries. Second, section V compares and contrasts the *ex post* with the *ex ante* assessments of the historical development around World War II. Finally, we offer concluding comments in section VI.

2 Institutional setting and data

2.1 The Stockholm bond market

Throughout the 20th century, the Stockholm Stock Exchange has been Sweden's prime arena for secondary trading and pricing of most kinds of securities, including domestic and foreign bonds. Sweden was during the interwar an active capital exporter, especially through imports of foreign high-yield government and corporate bonds, but the international financial crisis of 1931–33 set off a series of sovereign defaults which almost swept away the international capital markets. When World War II broke out in 1939, most

Western government imposed restrictions of their secondary bond markets. In the Nordic countries, the bond markets were either subject to strict price controls (Oslo and Copenhagen) or shut down completely (Helsinki). The exception was Stockholm's bond market that avoided being restricted throughout the war, apart from a short period of controls in 1939.[4] Swedish politicians kept a low profile towards restricting the financial markets, partly because the neutrality did not induce fears of servicing the debt of enemy states and partly because of the negative experiences from the market close-downs during World War I.

Since our analysis focuses on how contemporary actors made conjectures about actual and expected events, it is of great interest to identify who these actors were. Unfortunately, there exists little information about the identity of the traders or of the investors. According to an official list of the owners of Swedish government bonds, about 50 percent were public institutions, 34 percent financial institutions and 6 percent households, representing several thousands of individual bondholders. Complementary sources indicate that the share of individual bondholders were at least twice as big since the register had missed large amounts of bonds.[5] Foreign investors were probably also active on the Stockholm Stock Exchange up to the introduction of the currency regulations in 1940.

The information situation in Sweden during the war has been described as quite free and uncontrolled (see Weibull (1979)). The financial sector should thus have been quite well informed about the political and military events that took place in Europe and the rest of the world throughout the 1930s and 40s. This is also the impression one receives when reading issues of the Swedish financial chronicle *Affärsvärlden* from these years, with numerous references to both Nordic and international press such as *The Economist* and *The Wall Street Journal*.

[4] Between September 1, 1939 and January 2, 1940, the Stockholm Stock Exchange price controls prohibited bond prices to decrease more than between 5 and 10 percent in one day, which was a relatively mild constraint relative to the Danish control of maximally ± 1 percent in one day. According to Ohlin (1941, p. 140) it was primarily binding in December 1939 after the Soviet attack on Finland made the Finnish bond prices inefficient.

[5] Ohlin (1941, p. 32) and Nygren (1979, p. 206).

2.2 Bond price data

The bond price data used are weekly bid prices of sovereign debt traded on the Stockholm Stock Exchange between January 2, 1930 and March, 25 1947, collected from *Affärsvärlden*. In the analysis, we use the "clean" prices and hence abstract from the accrued interest because the bonds had the same coupon payment schemes (semiannual).[6] Moreover, the small accrued interest fraction would not influence the structural breaks we estimate.

Our country sample is restricted to the Nordic countries and Germany, which had the most actively traded loans on the Stockholm exchange throughout the 1930s and 40s. All loans (except one) were issued in Swedish kronors and were hence affected the same way by exchange rate and inflation fluctuations. For Denmark, we use the 30-year 5 percent loan of 1928 (listed until November 1937) and the 20-year 4.5 percent loan of 1936. Although it is not ideal to link together two loans with such different times to maturity, they were the only ones available. We linked them together using a loan size-weighted average yield for the period when they overlapped each other from which we calculated the continuous price series. In the case of Finland, we use the 6 percent 23-year U.S. dollar loan of 1928 (listed until November 1934) and the 5 percent 10-year loan of 1934.[7] For Norway, we use the 25-year 4 percent loan of 1935 listed during the entire period. In the case of Sweden, we use the 3 percent consols (the 1888 loan until 16 April 1934 and the 1934 loan thereafter) which were both highly liquid and regarded as bench marks for the Swedish long-term interest rates.[8] For Germany, we used the 5.5 (4.5) percent Young loan of 1930 for the whole period.[9] In December 1938, the German government unilaterally reduced the coupon rate from 5.5 to 4.5 percent which we adjust for by first calculating the yield

[6] See the *Swedsih Bond Catalogue* , various years, for details about the coupons.

[7] The 1934 was traded even after 1944 because the Finnish government prolonged its maturity indefinitely.

[8] See, e.g., Kock (1961). These loans were used by the Swedish National Debt Office in their published official long-term government bond rate although before November 1934, five other bond loans (all consols) with similar yields were also included in that rate. We also abstract from the conversion risk of the 1934 loan during 1938 and the first half of 1939, since Ohlin (1941, p. 127) argues that this should not notably have affected its yield.

[9] We disregard the six German "funding bonds", issued between 1936 and 1945 to finance the interest rate payments of the former debt. They were both of much smaller amounts and had unclear repayment conditions.

for the whole period and then again compute the bond price assuming a constant coupon rate.

The degree of trading in the various is quite uncertain since we lack any compiled trading volume data on sovereign debt on the Stockholm Stock Exchange. We do know, however, that total turnover of all bonds (government and corporate) increased both in absolute number and as share of total securities trading on the exchange.[10] Moreover, we have manually collected a small sample of turnover figures for our government bonds during March, June, September and December every second year to get a rough picture of their liquidity in terms of volumes. The findings suggest that primarily Finnish bonds in the 1940s were quite illiquid, but all other loans were regularly traded during the period. Although non-liquidity is not desirable, it could reflect increased bid-ask spreads which does not imply that the bid prices we analyze are not valid.

2.2.1 Dealing with missing values in the data

All price series have dates for which no bid price was recorded in the official price lists. This is particularly the case during some of the war years related to periods of extreme political uncertainty or even declared moratoria from of the issuing governments (for example, Finland in February-August 1943). The share of missing values varies between 1.2 percent (Germany) and 9.8 percent (Norway and Sweden), as in Table 1.

Missing values create problems for the quantitative analysis, since the econometric techniques employed require the time series to be continuous. There are different ways to address this missing value-problem, one could either estimate the method on continuous subsamples (which, however, could give rise to problems of overfitting local breaks) or one could use interpolation to fill the gaps. We use the latter method and even interpolates in three different ways to make sure the functional form does not interfere with the results.[11] Since the original and interpolated data are drawn from completely different

[10] Algott (1963, pp. 246f).

[11] We will only report the results using the standard conversion method *cubic spline* (a piecewise cubic polynomial linked together so that the first and second derivatives in the respective segments are continuous), but the interpolations using *linear* and *step functions* produce equivalent results and are available upon request.

Table 1: Summary statistics of the bond price series (in logs), their missing values and a sensitivity analysis of the interpolation method.

Country	Denmark	Finland	Norway	Sweden	Germany
Mean	4.468	4.145	4.361	4.483	3.375
Variance	0.047	0.254	0.098	0.017	0.318
Coefficient of variance	1.049	6.120	2.250	0.384	9.413
# observations (original)	880	818	515	807	858
# observations (interpolated)	895	895	571	895	868
# missing values	15	77	56	88	10
Share of missing values	0.017	0.086	0.098	0.098	0.012
HHI (gap lengths)	0.182	0.180	0.194	0.024	0.360
Interpolation distortion	0.305	1.551	1.901	0.239	0.415

Note: Summary statistics of pt. The HHI is the sum of the squared gap-length shares of all the gaps, i.e., the relative concentration of long missing value gaps. The distortion measure is calculated by multiplying the share of missing values with the HHI $\times 100$.

data generating processes, great care will be needed when analyzing the test outputs. The degree of distortion from the interpolation varies, however, with the number and length of the missing data gaps as well as the price volatility in a neighborhood around the gap. Longer gaps and volatile price series potentially increase the distance between the interpolated data and the true value of the missing data. To get some notion about how the various countries in our study are exposed to this distortion, Table 1 reports the share of missing values of the full sample, the relative importance of long missing value gaps among all gaps (measured as a Herfindahl Hirshman Index (HHI), i.e., as the sum of squared gap-length shares) and the product of these two. The interpolated series of Norway and Finland appear to be associated with the largest distortions due to their long gaps of consecutive missing values and hence the most problematic to use in our study. This aspect will be important when discussing the timing of the breaks as a serious political shock that gives rise to a structural break might also give rise to missing values. Figures A1–A10 in the appendix show plots of the original and the interpolated series. Apart from the case of Norway in the spring and summer of 1940, inspecting the series does not suggest any flagrant misrepresentations.

3 Econometric methodology

The presence of structural breaks in many economic time series have in recent years given rise to a large literature on how they can be estimated and what their consequences to statistical inference are. A specific branch of this literature has been primarily interested in the information value of the breaks to various economic issues like dating regime switches in some policy issue or testing the long-term stability of economic relations. An important contribution in the applied research using structural breaks analysis, with particular attention to the historical literature, was Willard et al. They were among the first to estimate multiple unknown structural breaks by using a one-break model within narrow time windows that were sequentially moved across the full sample. What the Willard et al. method lacked, however, was formal asymptotics for the inference of the number of breaks and the exact break dates (which has been even fuzzier in some of its successor studies) as well as the possibility to control for non-spherical errors. These aspects are taken into account in the multiple structural breaks model of Bai and Perron (1998), which consistently estimates the number and date of the breaks and computes confidence intervals around each estimated break date, which enables a better evaluation and interpretation of the results.

3.1 The Bai and Perron (1998) multiple structural breaks method

In this paper, we employ the methodology of Bai and Perron (1998), for the estimation of unknown structural breaks in the government bonds one at a time.[12] It rests on least squares estimation of the following system of linear equations,

$$\begin{aligned} p_t &= \mu_1 + \beta_1 t + \varepsilon_t, \qquad t = 1, ..., T_1 \\ p_t &= \mu_2 + \beta_2 t + \varepsilon_t, \qquad t = T_1 + 1, ..., T_2 \\ &\vdots \\ p_t &= \mu_m + \beta_m t + \varepsilon_t, \qquad t = T_m + 1, ..., T \end{aligned} \tag{1}$$

[12] In the companion paper Bai and Perron (2001), the method is evaluated using simulations for which the GAUSS code containing the main program is made available by Pierre Perron.

where p_t is the log bond price at time period t, μ_j is the intercept and β_j the slope of the trend in regime j ($j = 1, \ldots, m+1$) and ε_t is an error term.[13] The parameters of interest are the number of breaks m, the dates at which they occur $(T_1, \ldots, T_m)$ and the regressor coefficients associated with each break, $\mu(T_1, \ldots, T_m)$ and $\beta(T_1, \ldots, T_m)$. As stated above, the model allows for serial correlation and heteroskedasticity in the errors. In our empirical estimations, we have chosen to denote "break date" as the date directly after the estimated break, i.e., T_{j+1}, since this date is actually the first date of the new regime and also the first one that reflects its impact. Since the model estimates structural breaks in both the mean and the slope of the trend, we can discriminate between sudden and gradual structural breaks along the specifications discussed below.

The estimation of the break dates is to estimate for each possible combination of break points $(T_1, \ldots, T_m)$, the coefficients $\hat{\mu}(T_1, \ldots, T_m)$ and $\hat{\beta}(T_1, \ldots, T_m)$ using least squares, i.e., by minimizing the sum of squared residuals $(S_T(\cdot))$

$$S_T(T_1, \ldots, T_m) = \sum_{i=1}^{m+1} \sum_{t=T_{i-1}+1}^{T_i} (p_t - \mu_j - \beta' t)^2. \tag{2}$$

Thereafter, we substitute in the coefficient estimates into the objective function (3) to attain the break date estimates $\hat{T}_1, \ldots, \hat{T}_m$, i.e., we have that

$$(\hat{T}_1, \ldots, \hat{T}_m) = \underset{T_1, \ldots, T_m}{\arg\min} S_T(T_1, \ldots, T_m) \tag{3}$$

In practice, Bai and Perron specify a dynamic programming algorithm that efficiently compares possible combinations of breaks that correspond to the smallest total sum of squared residuals. In order to ensure that the breaks are not located at the end points of the sample or too close to each other, which would mean that they are not "structural", the method imposes a minimum length h of each regime. This length depends on the choice of trimming value π through by the relation $h = \pi T$ and the breaks are hence

[13] We let $T_0 = 0$ and $T_{m+1} = T$. Here, we have redefined the original model setup of Bai and Perron, who estimate

$$y_t = x_t'\beta + z_t'\delta_j + \varepsilon_t, \quad t = T_{j-1} + 1, ..., T_j.$$

where y_t is the dependent variable, x_t is a $v \times 1$ vector of regressors never subject to (structural) parameter change and z_t is a $q \times 1$ vector of regressors that are subject to change. Hence, in our case $y_t = p_t, x_t = \emptyset, z_t = \{1, t\}$ and $\delta_j = [\mu_j, \beta_j]'$.

separated according to $T_{j+1} - T_j \geq h$. Choosing value of π is associated with a trade-off between having segments long enough to avoid capturing short-term price variations, causing an "overfit" of the models, and short enough to capture regime switches that lie close to each other in time.

When selecting the number of breaks, Bai and Perron suggest a two-step procedure which first tests whether there are any breaks present at all and then tests for the exact number of breaks in the series, given that there are any. Hence, first test the null hypothesis of no break against an alternative of $m = \ell$ breaks using a sup $F_T(\ell|0)$.[14] As a complement, the so-called double maximum tests, $UDmax$ and $WDmax$, test the no-break null against the alternative of an unknown number of breaks, i.e., $UDmax = \max_{1 \leq \ell \leq L} \sup F_T(\ell|0)$ (simply the biggest F-statistic obtained in the sup F_T tests up to some upper bound L), and $WDmax$ is a weighted variant of it.[15] The critical values of all the tests considered can be found in Bai and Perron (1998).

Second, selecting the exact number of breaks can be done either by using the Bayes Information Criterium (BIC) or by using the sequential method, also called the sup $F_T(\ell + 1|\ell)$ test. BIC was shown by Yao (1988) to consistently estimate the number of breaks by minimizing

$$BIC(\ell) = \ln \hat{\sigma}^2(\ell) + k\frac{\ln(T)}{T}$$

where $k = (\ell + 1)q + \ell + v$ and $\hat{\sigma}^2(\ell) = T^{-1}S_T(\hat{T}_1, \ldots, \hat{T}_m)$.[16] BIC hence estimates the number of breaks as $\hat{\ell}(BIC) = \min_{0 \leq \ell \leq L} \{BIC(\ell)\}$. In the sequential method, one starts one break and test for parameter consistency across the segments on each side of the break using the sup $F_T(\ell + 1|\ell)$ test where $\ell = 0$. If significant, another break is added (corresponding to the break date that, together with the first break, minimize the sum of squared errors) and the test is repeated until the sup $F_T(\ell + 1|\ell)$-statistic is no longer significant which defines the number of breaks slected by the method. In Bai and Perron (2001), these two tests are evaluated in terms of size and power of the test and coverage

[14] The special case $\ell = 1$ is basically the sup F test of Andrews (1993).

[15] $WDmax$ takes into account that the power of the sup F_T test decreases in m(see Bai and Perron (1998, p. 59).

[16] Recall that v was the vector dimension of the regressor that does not change its parameters after a break.

rate of the confidence intervals. Although the authors are inclined to prefer the sequential method, BIC perform similarly well, if not better, especially when breaks are present.[17]

3.2 Discriminating between sudden and gradual breaks

Our main motivation for the use of a combined mean- and trend-break model (in equation (1)) is that it allows us to make the distinction between sudden and gradual structural changes. We believe this distinction to be crucial for the understanding of contemporary actors' ex ante assessments of unexpected events in history since it emphasizes the role of uncertainty and imperfect (or asymmetric) information. To see what the distinction means, consider the following two different price responses to some exogenous shock which truly affects the value of a bond. If this effect is immediately capitalized in the bond price causing a significant mean-shift in the prices, we observe a sudden structural break. If the shock, on the other hand, is not considered as important but only understood after some other events have occurred (e.g., if the shock has a "domino effect"), people update their valuation of the bond stepwise, or gradually, which also makes prices moving gradually towards a new level and thereby create a gradual structural break. The gradual structural break can hence be viewed as a transitional period between two steady states.

More precisely, the mean- and trend-break model can either estimate a single shift in the mean (a sudden break), a single change in the slope of the trend (a gradual break), or a combined mean-shift and trend-change (both a sudden and a gradual break). Note that the first case is equivalent to the breaks estimated in the common mean-models in the special case $\beta_{j-1} = \beta_j = 0$. Moreover, when the sudden and the gradual break have different signs, it could reflect market overreactions to new information, which is a commonly observed phenomenon (see, e.g., De Bondt and Thaler (1985)).

In the empirical results, we present *break date*, *break size* (as percentage change) and *break type* (sudden or gradual or both). These are defined as follows. For an estimated

[17] Actually, BIC outperforms the sequential method in models with one and two breaks (Bai and Perron do not test for larger m), regardless of correction for serial correlation or heterogeneous regressor distributions across segments (see the working paper version of Bai and Perron (2001), tables 4, 5, 6, 7a and 7b).

break at time j, if the break is sudden it occurs at date $\hat{T}_{j+1}$ (recall our previous dating discussion) and if it is gradual it occurs over the time interval $\hat{T}_{j+1} - (\hat{T}_j + 1)$, i.e., from the period following upon the estimated break to the period of the next estimated break. The break size of the sudden break is $\hat{p}_{\hat{T}_j+1} - \hat{p}_{\hat{T}_j}$, i.e., the one-period change by the time of the break, and of the gradual break $\hat{p}_{\hat{T}_{j+1}} - \hat{p}_{\hat{T}_j+1}$, i.e., the difference in the fitted value between the start and end points of the break regime. All breaks are reported in the form of percentage change of the original price series which has been computed by anti-logging and subtraction by 1.[18] Since the Bai and Perron algorithm does not by itself distinguish between the two break types at each estimated break, it may be the case that only one of them is significant. We therefore impose rough significance criteria for the two breaks: the sudden break size must exceed two pre-break segment standard deviations and the gradual break must be associated by a significant slope coefficient in the regime following upon the break.

The distinction between sudden and gradual structural breaks is surprisingly enough not common in the previous literature. The estimation of structural breaks in both the mean and the slope of the trend have indeed been standard in the time series literature (e.g., Perron (1989); Banerejee, Lumsdaine and Stock (1992); Zivot and Andrews (1992); Lumsdaine and Papell (1997)), but these studies have mainly focused on the stationarity properties of the series rather than the economic interpretation of the breaks. Banerejee, Lazarova and Urga (2003) is a recent exception where finite-sample bootstrapping is used to detect multiple structural breaks in both mean and trend, without, however, making any systematic distinction between sudden and gradual breaks. Bai and Perron themselves do mention the difference between sudden and gradual breaks, but only by proposing the inclusion of a lagged dependent variable on the right hand side which makes the break gradual. We strongly disagree, since the timing of the breaks are still measured in the mean and it is practically impossible to understand in what way the lagged dependent variable works and affects the timing.

In the economic history literature analyzing historical events using structural break

[18] Recall that $\exp[\ln(x_{t+1}) - \ln(x_t)] - 1 = \exp[\ln(\frac{x_{t+1}}{x_t})] - 1 = \frac{x_{t+1}}{x_t} - 1 = \frac{x_{t+1} - x_t}{x_t}$.

estimations, there are only mean-models (often with lagged dependent variables) used and, moreover, pracitcally none that has used the method of Bai and Perron or other recent authors (see, e.g., Willard et al. (1996); Frey and Kucher (2000*a*, 2000*b*, 2001); Sussman and Yafeh (2000); Mauro, Sussman and Yafeh (2002); Brown and Burdekin (2002)). As a matter of fact, of all studies using Bai and Perron's method, there are not many that estimate mean- and trend-break models and even fewer with systematic distinctions between sudden and gradual breaks. One reason for this lack might be that Bai and Perron's theory formally raises concerns regarding trending regressors, although they argue that trending regressors in practice can be used. Despite this, since they neither mention the mean- and trend-model explicitly nor include it as in their computer package, we will be cautious and observant on the possibility of some (undeclared) problems with this model.

3.3 Additional estimation and testing issues

The Bai and Perron methodology requires careful choices of the trimming parameter π and how to correct for non-spherical disturbances and differing regressor distributions within or between regimes. As noted by Bai and Perron (2001, 2003), these decisions may be crucial for how well the method performs in terms of size and power of the tests. All regressions we estimate use the heteroskedasticity and autocorrelation consistent (HAC) variance-covariance matrix of Andrews (1991).[19] We choose a trimming value $\pi = 0.05$ and set the maximum number of breaks to 9. Although a higher number would be theoretically possible, this created computational problems to the algorithm.

The asymptotic theory of the method was designed for regressors without deterministic or stochastic trends (unit roots). This could be problematic in the financial context, as many financial time series contain high degrees of persistency, which also seems to be in our case.[20] Paye and Timmermann (2002) have shown using Monte Carlo simulations,

[19] In terms of the options available the GAUSS program, this means that we set $cor\_u = 1$. Note that the options have different names in the papers and in the program where $cor\_u \equiv robust$, $het\_z \equiv hetdat$, $het\_u \equiv hetvar$.

[20] Although there are no critical values for unit root testing of series with more than two breaks (ours have 9 breaks), tentative evidence indicate that most price series are indeed $I(1)$.

however, that the method performs well also in the case of very high persistency (i.e., unit roots), especially for large sample sizes (in their case, if $T \geq 200$ while we use $T \approx 900$). For trending regressors, Bai and Perron refer to simulation evidence suggesting that their critical values can be safely used even in the case when data is trending. Hence, the structural breaks estimated in our study are robust to both the use of trending regressors and when errors are $I(1)$.

4 Structural breaks estimations

This section presents the structural breaks estimations for the government bond prices of Denmark, Finland, Norway, Sweden and Germany. Since each break is associated with a type, date, sign and size, they inform us about how the contemporary bondholders and financial market investors, by the time of the break, updated their beliefs about each country's likelihood of a sovereign default. Although we make short reviews of what was written, if anything, in the contemporary financial press in connection to the break dates to give some qualitative body to the results, it is should be noted that we cannot verify any causal relationship between these opinions and the structural breaks but merely see them as suggestive.

We first report the test statistics that determine the number of breaks in each country's bond prices in Table 2 both for the sequential method and BIC. As noted by Bai and Perron, the sequential method breaks down at a low number of breaks (due to insignificant sup $F_T(\ell+1|\ell)$ test), we have chosen to give preference to the BIC output.[21] Note, however, that for three of the five countries the two methods pick the same number of breaks and in the other two the sequential tests produce a significant sup $F_T(\ell+1|\ell)$ statistic for the number of breaks chosen by BIC. As for the number of breaks estimated by the models, all countries had 9 breaks.

[21] One could indeed criticize Bai and Perron's choice of preferring their sequential method especially as BIC was equally good, if not better, to pick the right number of breaks in their own simulation study. Moreover, they primarily mention breakdowns of the sup $F_T(1|0)$ test, whereas we have encountered similar problems at higher ℓ:s as well. Also, for Denmark, Table 2 reveals inconsistencies between the number of breaks picked by the sequential method and the sequential test statistics.

Table 2: Structural break tests and number of breaks selected.

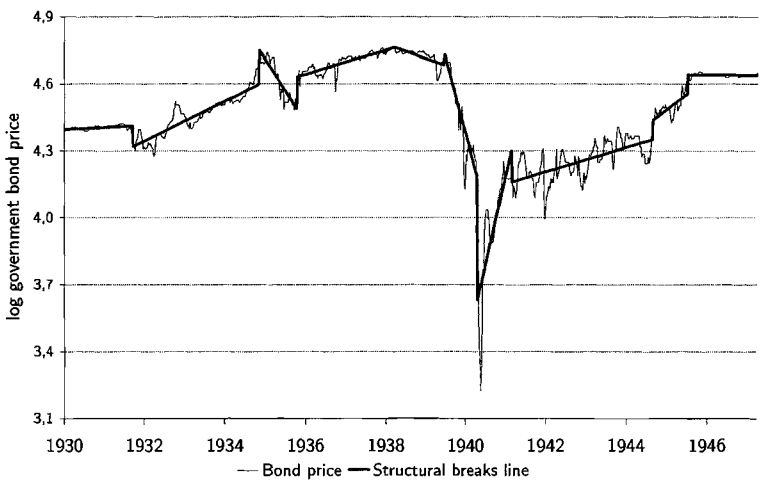
	Denmark	Finland	Norway	Sweden	Germany
$\sup F_T(1\|0)$	1514.10*	52.65*	95.51*	170.18*	9.86
$\sup F_T(2\|0)$	225.75*	140.67*	1109.45*	765.44*	37.31*
$\sup F_T(3\|0)$	312.27*	99.09*	1009.88*	974.11*	41.32*
$\sup F_T(4\|0)$	398.71*	325.71*	1359.63*	1592.08*	44.69*
$\sup F_T(5\|0)$	331.59*	918.18*	3133.37*	438.80*	49.75*
$\sup F_T(6\|0)$	286.49*	979.69*	1998.29*	464.80*	48.04*
$\sup F_T(7\|0)$	306.31*	2262.41*	2016.63*	563.19*	68.83*
$\sup F_T(8\|0)$	310.69*	1946.82*	3111.50*	841.48*	79.29*
$\sup F_T(9\|0)$	946.82*	2553.61*	3961.81*	866.80*	79.32*
$UDmax(\ell)$	1514.10 (1)	2553.61 (9)	3961.81 (9)	1592.08 (4)	79.32 (9)
$WDmax$	1635.99*	4412.34*	6845.54*	2113.49*	137.05*
$\sup F_T(2\|1)$	46.91*	221.55*	153.13*	238.04*	43.09*
$\sup F_T(3\|2)$	85.45*	134.06*	142.86*	174.36*	69.39*
$\sup F_T(4\|3)$	84.28*	575.57*	89.64*	172.92*	69.35*
$\sup F_T(5\|4)$	79.10*	575.57*	87.81*	163.53*	69.35*
$\sup F_T(6\|5)$	68.81*	74.46*	87.81*	755.24*	51.60*
$\sup F_T(7\|6)$	54.57*	146.84*	80.31*	61.81*	67.27*
$\sup F_T(8\|7)$	48.53*	146.84*	108.82*	61.81*	67.27*
$\sup F_T(9\|8)$	48.53*	146.84*	108.82*	61.81*	79.44*
$BIC(0)$	–3.067	–1.774	–2.339	–4.506	–3.041
$BIC(1)$	–4.641	–2.452	–3.996	–5.574	–3.186
$BIC(2)$	–5.101	–2.926	–5.034	–6.060	–3.404
$BIC(3)$	–5.311	–3.227	–5.322	–6.497	–3.501
$BIC(4)$	–5.415	–3.669	–5.520	–6.951	–3.640
$BIC(5)$	–5.523	–4.079	–5.647	–7.247	–3.765
$BIC(6)$	–5.607	–4.328	–5.735	–7.515	–3.948
$BIC(7)$	–5.681	–4.561	–5.833	–7.603	–4.046
$BIC(8)$	–5.736	–4.612	–5.892	–7.724	–4.102
$BIC(9)$	–5.769	–4.667	–5.915	–7.835	–4.120
# Breaks chosen:					
Sequential	4 (9)	9	9	9	0 (9)
BIC	**9**	**9**	**9**	**9**	**9**

Note: The 5%-critical values for the $\sup F_T(\ell|0)$ test, $\ell = 1, ..., 9, q = 2$ (i.e., two variables change across segments), 12.89, 11.60, 10.46, 9.71, 9.12, 8.65, 8.19, 7.79, 7.46. The WDmax 5%-critical value is 10.91. The 10%-critical values for the $\sup F_T(\ell|0)$ test, $\ell = 1, ..., 9$, are 11.02, 12.79, 13.72, 14.45, 14.9, 15.35, 15.81, 16.12 and 16.44. * denotes significance at the level for which we have reported critical values. When the number of breaks chosen by the sequential method has two numbers, there is a discrepancy between the direct output (which breaks down at the first $\sup F_T$-test) and the correct output in parentheses (when the first test is ignored). When both methods choose the same number, we chose the one with the lowest sum of squared residuals (not reported).

A recurrent problem in the estimations that is due to the methodology is that the minimum length requirement of the segments sometimes interferes with the dating of the breaks, particularly so when the significant events lie closer together than the minimum length (normally about 45 weeks). Since this might flaw the dating of breaks we are careful to always consult the calculated confidence intervals, as well as the figures with both the prices and the fitted regression lines, before drawing conclusions about the timing of the breaks.

4.1 Danish structural breaks, 1930-1947

Figure 1: Danish bond price and the fitted regression line.



As seen in Table 3 and Figure 1, which show the results and fitted regression line of the structural breaks estimations, the first break in the Danish bonds occurred on *September 21, 1931.* This break can be related to the international financial turmoil which peaked at this time and Denmark's retreat from the gold standard only one week later. According to a number of positive gradual breaks, the prices then gradually recovered and increased further for several years, except for a pair of jointly offsetting breaks around 1935.[22] On

[22] The +16.7 percent sudden break of November 1934 most likely reflects a general bull market as

Table 3: Structural breaks in Danish government bonds, 1930-47.

	Coef.		Type	Date	Size	Major event
$\hat{\mu}_1$	4.39					
	(0.00)					
$\hat{\beta}_1$	0.00					
	(0.02)					
$\hat{\mu}_2$	4.16	$\hat{T}_1$:	Sudden:	31.09.21	–8.9%	International financial crisis.
	(0.02)			[31.09.15,31.09.29]		Denmark leaves gold standard.
$\hat{\beta}_2$	0.17		Gradual:	31.09.21–34.10.30	+31.8%	
	(0.01)					
$\hat{\mu}_3$	6.13	$\hat{T}_2$:	Sudden:	34.11.06	+16.7%	Danish economic boom. Bullish
	(0.19)			[34.10.30,34.11.13]		bond market.
$\hat{\beta}_3$	–0.54		Gradual:	34.11.06–35.10.01	–23.1%	–
	(0.05)					
$\hat{\mu}_4$	4.31	$\hat{T}_3$:	Gradual:	35.10.08–38.03.08	+14.0%	–
	(0.04)			[35.09.24,35.11.26]		
$\hat{\beta}_4$	0.11					
	(0.01)					
$\hat{\mu}_5$	5.29	$\hat{T}_4$:	Gradual:	38.03.15–39.05.30	–7.4%	German annexation of Austria.
	(0.17)			[38.01.11,38.03.29]		
$\hat{\beta}_5$	–0.12					
	(0.03)					
$\hat{\mu}_6$	10.95	$\hat{T}_5$:	Gradual:	39.06.06–40.04.09	–41.3%	Danish-German non-aggression
	(0.66)			[39.05.30,39.06.13]		pact.
$\hat{\beta}_6$	–1.27					
	(0.06)					
$\hat{\mu}_7$	–4.50	$\hat{T}_6$:	Sudden:	40.04.16	–41.8%	Germany occupies Denmark.
	1.37			[40.04.09,40.04.23]		
$\hat{\beta}_7$	1.52		Gradual:	40.04.16–41.02.18	+94.9%	Germany allows extensive
	(0.00)					Danish self-governance.
$\hat{\mu}_8$	3.54	$\hat{T}_7$:	Gradual:	41.02.25–44.08.15	+21.0%	
	(0.16)			[41.02.11,41.05.06]		
$\hat{\beta}_8$	0.11					
	(0.01)					
$\hat{\mu}_9$	2.41	$\hat{T}_8$:	Gradual:	44.08.22–45.06.25	+12.4%	News about Ally triumphs.
	(0.56)			[44.07.18,45.02.27]		British postwar investments.
$\hat{\beta}_9$	0.27					
	(0.06)					
$\hat{\mu}_{10}$	4.66	$\hat{T}_9$:	Sudden:	45.07.02	+9.0%	
	(0.05)			[45.06.26,45.07.10]		
$\hat{\beta}_{10}$	–0.00					
	(0.02)					
R^2	0.95					
SSR	2.28					
T, m, h	895,9,45					

Note: Robust standard errors (according to Andrews (1991)) are in parenthesis and 95% confidence intervals in brackets. All $\hat{\beta}$:s and their standard errors are multiplied by 100. "Sudden:" reports a sudden (S) break date and "Gradual:" a gradual (G) break date (in interval form). * indicates significance of the sudden or gradual break. SSR is the sum of squared residuals, T is the number of observations, m is the number of breaks allowed and h is the minimum segment length. Size are reported in percentage form (see text for details) and are defined as $\hat{p}_{\hat{T}_j+1} - \hat{p}_{\hat{T}_j}$ (sudden) or $\hat{p}_{\hat{T}_{j+1}} - \hat{p}_{\hat{T}_j+1}$ (gradual).

March 15, 1938, they started to decrease estimated by the negative gradual break of –7.4 percent, which was surely a response to the German annexation of Austria.[23] On *June 6, 1939*, only a week after the surprising German-Danish non-aggression pact, a new gradual break with much sharper falling prices is estimated, covering, and reflecting, the outbreak of the war and the Soviet attack on Finland. The next break is an estimated sudden decrease of 41.8 percent on *April 16, 1940*, which is clearly associated with the strong reactions to the German attack on Denmark. Quite shortly thereafter, however, it stood clear that the physical damage had been small and that considerable Danish self-governance was allowed, which made Danish prices start increasing sharply, as recorded by the gradual break +94.9 percent (until February 1941). These offsetting fluctuations are evidence on how new information is disseminated on the financial market and how the extreme uncertainty directly connected to the attack was resolved to the better, which was capitalized in the prices.

During the occupation, the Danish bond prices fluctuated considerably and we only estimate one long weakly positive gradual break, from early 1941. On *August 22, 1944*, the prices started growing at a higher pace, coinciding with reports both about Ally victories in France and about large British postwar investments in Denmark.[24] The war triumphs of the Allies did hence translate into higher likelihood of a Danish liberalization. This growth rate was kept intact until mid-1945 when prices leveled out after the peace.[25]

4.2 Finnish structural breaks, 1930–1947

Table 4 and Figure 2 show the estimated structural breaks in the Finnish government bonds. The first one occurred on *September 21, 1931*, at the time for the international crisis which also affected Finland. Thereafter, Finnish prices started growing significantly until late 1934, reflecting improved Finnish economic conditions. After a long period of

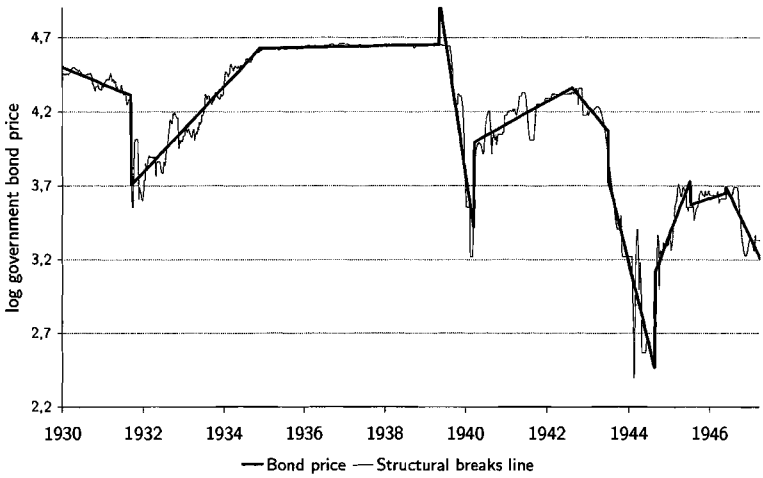
well as reports of positive Danish economic performance (*Affärsvärlden*, 11 Nov. 1934, No. 46, p 484; 29 Nov. 1934, No. 48, p. 522). The following gradual decrease and the October 1935 break could be responses to this.

[23] The Austrian annexation strongly affected the value of Danish loans according to *Affärsvärlden*, 6 Apr, 1939, No. 14, p. 400).

[24] *Affärsvärlden*, 10 Aug. 1944, No. 32, p. 596 and 7 Sep. 1944, No. 36, p. 672.

[25] The break in July 1945 is merely the delayed effect of the liberalization in early May.

Figure 2: Finnish bond price and the fitted regression line.



stable prices lying around par level, we estimate a strongly negative gradual break of −78.1 on May 5, 1939 until *March 13, 1940*, when they suddenly started increasing until 1942. This price fall is probably falsely dated (due to the minimum length requirement) and the actual price falls did not begin until late August, most likely reflecting the increased uncertainty related with the surprising German-Russo agreement and the subsequent war with the Soviet Union. The turning point in March is directly associated to the Moscow Peace on March 13, which carried positive prospects for a lasting peace. In the following years, there is a positive gradual break revealing no valuation setback due to the Finnish agreement with Germany in August 1940 or even the new war with the Soviet Union. In *August, 1942*, however, prices turned downward , coinciding with reports telling about severe Finnish economic problems that eventually led to a partial debt default in November.[26] Somewhere around mid-1943 (the date is quite uncertain due to a long sequence of missing values) prices fell uncontrollably, initially caused by fears for an extended moratorium but later on more as a consequence of the exaggerated Finnish-

[26] The default did though exclude the bond loan of 1934 which is analyzed in this study (*Affärsvärlden*, 20 Aug. 1942, No. 33, p. 641 and 26 Nov. 1942, No. 47, pp. 904ff).

Table 4: Structural breaks in Finnish government bonds, 1930-47.

	Coef.		Type	Date	Size	Major event
$\hat{\mu}_1$	4.50					
	(0.01)					
$\hat{\beta}_1$	–0.21					
	(0.03)					
$\hat{\mu}_2$	3.21	$\hat{T}_1$:	Sudden:	31.09.21	–43.1%	International financial crisis.
	(0.04)			[31.09.15,31.09.29]		
$\hat{\beta}_2$	0.56		Gradual:	31.09.21–34.11.20		
	(0.02)					
$\hat{\mu}_3$	4.60	$\hat{T}_2$:		34.11.27		
	(0.02)			[34.11.13,34.12.04]		
$\hat{\beta}_3$	0.01					
	(0.01)					
$\hat{\mu}_4$	21.75	$\hat{T}_3$:	Gradual:	39.05.05–40.03.12	–78.1%	Soviet diplomatic pressure.
	2.27			[39.04.29,39.05.05]		Outbreak of Finnish-Soviet war.
$\hat{\beta}_4$	–3.45					
	(0.45)					
$\hat{\mu}_5$	2.42	$\hat{T}_4$:	Sudden:	40.03.19	+77.3%	Peace treaty in Moscow.
	(0.16)			[40.03.05,40.04.30]		
$\hat{\beta}_5$	0.30		Gradual:	40.03.19–42.08.04	+43.9%	Finnish-German cooperation.
	(0.03)					War with the Soviet Union.
$\hat{\mu}_6$	8.74	$\hat{T}_5$:	Gradual:	42.08.11–43.06.22	–25.4%	Finnish economic problems.
	(0.72)			[42.07.21,42.08.18]		German setbacks in war.
$\hat{\beta}_6$	–0.67					
	(0.11)					
$\hat{\mu}_7$	18.78	$\hat{T}_6$:	Sudden:	43.06.29	–28.2%	Finnish moratorium.
	(0.91)			[43.06.15,43.07.13]		
$\hat{\beta}_7$	–2.15		Gradual:	43.06.29–44.08.22	–71.8%	Finnish moratorium. Crisis
	(0.13)					in peace negotiations.
$\hat{\mu}_8$	-7.42	$\hat{T}_7$:	Sudden:	44.08.22	+91.5%	Finnish-Soviet cease-fire.
	1.85			[44.08.08,44.08.29]		
$\hat{\beta}_8$	1.39		Gradual:	44.08.22–45.06.26	+83.9%	Finland switches side in war.
	(0.24)					
$\hat{\mu}_9$	2.12	$\hat{T}_8$:	Sudden:	45.07.03	–14.6%	Finnish devaluation and central
	(0.81)			[45.06.19,45.08.14]		bank turbulence.
$\hat{\beta}_9$	0.18					
	(0.10)					
$\hat{\mu}_{10}$	12.91	$\hat{T}_9$:	Gradual:	46.05.21–47.03.25	–37.9%	Finnish economic problems.
	(1.07)			[46.05.07,45.05.28]		
$\hat{\beta}_{10}$	–1.08					
	(0.12)					
R^2	0.97					
SSR	6.85					
T, m, h	895,9,45					

Note: Robust standard errors (according to Andrews (1991)) are in parenthesis and 95% confidence intervals in brackets. All $\hat{\beta}$:s and their standard errors are multiplied by 100. "Sudden:" reports a sudden (S) break date and "Gradual:" a gradual (G) break date (in interval form). * indicates significance of the sudden or gradual break. SSR is the sum of squared residuals, T is the number of observations, m is the number of breaks allowed and h is the minimum segment length. Size are reported in percentage form (see text for details) and are defined as $\hat{p}_{\hat{T}_j+1} - \hat{p}_{\hat{T}_j}$ (sudden) or $\hat{p}_{\hat{T}_{j+1}} - \hat{p}_{\hat{T}_j+1}$ (gradual).

Soviet conflict in 1944. There where fears at this time that Finland would cease to exist as a nation, and in March-April 1944 the Finnish government chose between a peace most likely triggering a German retaliation and a continued war with the Soviet Union which could even lead to the end of Finland as sovereign nation.[27] The government chose the latter alternative.

The estimated turning point for Finland came on *August 22, 1944*, estimated as a sudden break of +91.5 percent and a gradual break of +83.9 percent. It came soon after Finland received a new President who opened up for a less pro-German policy and increased the prospects for peace.[28] Two weeks later, the fighting stopped and after another two weeks, on September 19, a cease-fire agreement was signed. After the war had ended, the Finnish economy faced severe problems and a 40 percent devaluation escorted by the resignation of the president of Finland's central bank on *July 3, 1945*, made markets react negatively by a negative gradual break.[29]

4.3 Norwegian structural breaks, 1935-1947

As shown in Table 5 and Figure 3, the first estimated break in the Norwegian bonds was on *June 6, 1939*, directly after Norway had declined the offered non-aggression pact with Germany. This negative gradual break also reflects the outbreak of the wars in Poland and in Finland, which hence also put pressure on the Norwegian bond prices. The German occupation gave rise to a negative sudden break dated on *April 30, 1940*. Unlike in Denmark, the Norwegian government bond prices continued to fall after the occupation, which could reflect the Norwegian resistance and the overall rougher treatment of the occupation authorities. Due to the high concentration of missing values during 1940 and 1941 (recall Figures A5–A6 and Table 1), the significance and timing of the two estimated breaks in 1941 cannot be considered valid, although the negative overall trend seems quite plausible.

[27] *Affärsvärlden*, 9 Mar. 1944, No. 10, p. 194, 23 Mar. 1944, No. 12, p. 242 and 6 Jul. 1944, No. 27–28, p. 536.

[28] *Affärsvärlden*, 10 Aug. 1944, No. 32, p. 596.

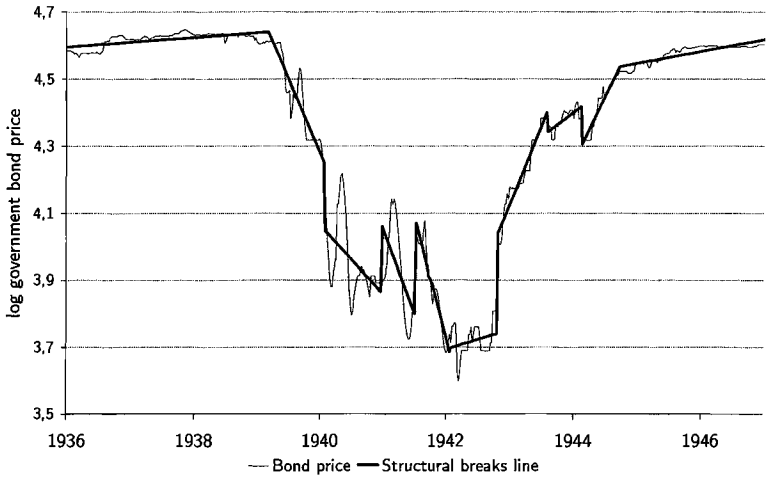
[29] *Affärsvärlden*, 7 Jun. 1945, No. 23, p. 540, 543.

Table 5: Structural breaks in Norwegian government bonds, 1936-47.

	Coef.		Type	Date	Size	Major event
$\hat{\mu}_1$	4.60					
	(0.01)					
$\hat{\beta}_1$	0.03					
	(0.01)					
$\hat{\mu}_2$	6.03	$\hat{T}_1$:	Gradual:	39.06.06–40.04.23	–31.9%	Norway declines German pact.
	(0.04)			[39.05.23,39.06.13]		Outbreak of war. Finnish war.
$\hat{\beta}_2$	–0.83					
	(0.02)					
$\hat{\mu}_3$	4.90	$\hat{T}_2$:	Sudden:	40.04.30	–18.3%	Germany occupies Norway.
	(0.17)			[40.04.23,40.05.07]		
$\hat{\beta}_3$	–0.40		Gradual:	40.04.30–41.03.19	–16.7%	Norway under German
	(0.07)					administration.
$\hat{\mu}_4$	6.58	$\hat{T}_3$:	Sudden:	41.03.26	+21.6	–
	(0.93)			[41.03.19,41.04.01]		
$\hat{\beta}_4$	–0.97		Gradual:	41.03.26–41.09.30	–22.9%	–
	(0.34)					
$\hat{\mu}_5$	8.18	$\hat{T}_4$:	Sudden:	41.10.07	+.31.0%	–
	(0.43)			[41.09.30,41.10.14]		
$\hat{\beta}_5$	–1.42		Gradual:	41.10.07–42.04.21	–31.9%	–
	(0.14)					
$\hat{\mu}_6$	3.34	$\hat{T}_5$:		42.04.28		
	(0.31)			[42.04.14,42.05.05]		
$\hat{\beta}_6$	0.11					
	(0.09)					
$\hat{\mu}_7$	(0.80)	$\hat{T}_6$:	Sudden:	43.01.26	+35.3%	German surrender at Stalingrad.
	(0.21)			[43.01.12,43.02.02]		
$\hat{\beta}_7$	0.91		Gradual:		+42.8%	Reports about German defeat.
	(0.05)					
$\hat{\mu}_8$	3.22	$\hat{T}_7$:	Sudden:	43.11.02	–5.6%	–
	(0.29)			[43.10.19,43.11.30]		
$\hat{\beta}_8$	0.28		Gradual:	43.11.02–44.05.08	+8.0%	–
	(0.07)					
$\hat{\mu}_9$	1.11	$\hat{T}_8$:	Sudden:	44.05.15	–10.6%	–
	(0.27)			[44.05.09,44.05.23]		
$\hat{\beta}_9$	0.76		Gradual:	44.05.15–44.12.05	+24.5%	Successful invasion of France.
	(0.06)					
$\hat{\mu}_{10}$	4.22	$\hat{T}_9$:	Gradual:	44.12.12–47.03.25	+8.9%	Soviet troops enter
	(0.07)			[44.12.05,45.01.02]		northern Norway.
$\hat{\beta}_{10}$	0.07					
	(0.01)					
R^2	0.95					
SSR	11.43					
T, m, h	868,9,28					

Note: Robust standard errors (according to Andrews (1991)) are in parenthesis and 95% confidence intervals in brackets. All $\hat{\beta}$:s and their standard errors are multiplied by 100. "Sudden:" reports a sudden (S) break date and "Gradual:" a gradual (G) break date (in interval form). * indicates significance of the sudden or gradual break. SSR is the sum of squared residuals, T is the number of observations, m is the number of breaks allowed and h is the minimum segment length. Size are reported in percentage form (see text for details) and are defined as $\hat{p}_{\hat{T}_{j+1}} - \hat{p}_{\hat{T}_j}$ (sudden) or $\hat{p}_{\hat{T}_{j+1}} - \hat{p}_{\hat{T}_{j+1}}$ (gradual).

Figure 3: Norwegian bond price and the fitted regression line.

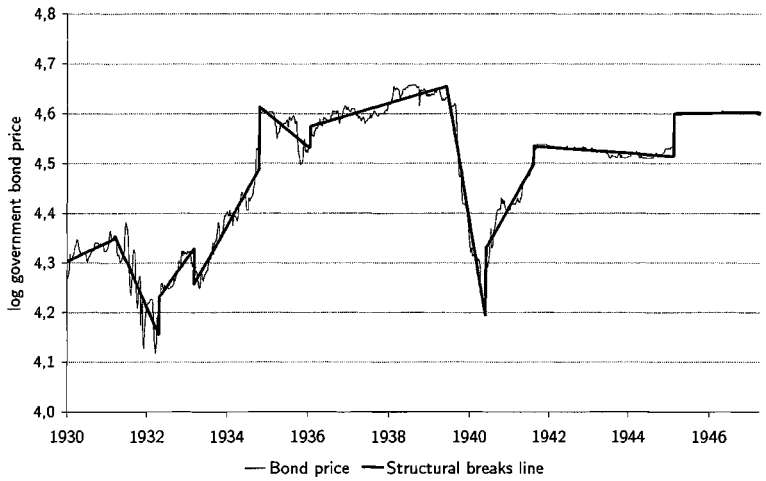


The estimated Norwegian turning point came on *January 31, 1943*, directly associated with the German surrender at Stalingrad. The break is both sudden (on +35.3 percent) and gradual (of +42.8 percent) lasting until November 1943. Hence, the defeat of the occupier was perceived as a significantly decreased risk of Norwegian sovereign default, but there remained considerable uncertainty about how and when Norway would be liberalized, reflected by the gradual aspect of the break. The growth rate was moderated by late 1943 but accelerated again in the latter half of 1944, coinciding with the Soviet intrusion into northern Norway and successes for the Allies in France.

4.4 Swedish structural breaks, 1930-1947

Table 6 and Figure 4 report the Swedish structural breaks. Note is that the sizes of the Swedish structural breaks are quite moderate relative the other countries. Although Figure 4 might suggest rather drastic swings in the prices, they are far less volatile in absolute numbers than for the other countries. The first estimated structural break was a negative gradual break between *March 1931* and April 1932. It is clearly related with the

Figure 4: Swedish bond price and the fitted regression line.



international financial crisis (Sweden left the gold standard in late September) although the relatively early timing could be due to market concerns about the worsened financial status of the Swedish dominant industrialist firm, the huge Kreuger Corporation.[30] From the end of *April 1932* and for several years ahead, Swedish bond prices increased gradually driven by a higher demand for Swedish bonds when investors turned to domestic investments during the international crisis and by a savings boom among the Swedish households.[31] The positive sudden break estimated in late October 1934 is related to the international bull market which also induced Swedish investors to speculate.[32]

In *late May 1939*, a sharply negative gradual break is estimated but this is actually three months' pre-dating the true break which occurred in early September and lasted until June, 1940. This break coincides with the German invasion of Poland, the Finnish-Soviet war and the occupations of Denmark and Norway. In early June, 1940, we estimate a large sudden break and a subsequent gradual break until August 1941. At this time,

[30] Kock (1961, p. 94).

[31] Ohlin (1941, pp. 110f).

[32] The bond prices were at this point "abnormal" according to *Affärsvärlden*, 1 Nov. 1934, No. 44, p. 420.

Table 6: Structural breaks in Swedish government bonds, 1930-47.

	Coef.		Type	Date	Size	Major event
$\hat{\mu}_1$	4.30					
	(0.01)					
$\hat{\beta}_1$	0.07					
	(0.02)					
$\hat{\mu}_2$	4.58	$\hat{T}_1$:	Gradual:	31.03.17–32.04.19	–18.0%	International financial crisis.
	(0.03)			[31.02.24,31.03.25]		Sweden leaves gold standard.
$\hat{\beta}_2$	–0.35					
	(0.01)					
$\hat{\mu}_3$	3.96	$\hat{T}_2$:	Gradual:	32.04.26–33.02.28	+10.2%	Domestic savings boom.
	(0.04)			[32.04.12,32.05.10]		
$\hat{\beta}_3$	0.22					
	(0.01)					
$\hat{\mu}_4$	3.80	$\hat{T}_3$:	Sudden:	33.03.07	–6.8%	–
	(0.03)			[33.02.07,33.03.14]		
$\hat{\beta}_4$	0.27		Gradual:	33.03.07–34.10.16	+25.9%	Savings boom and surge
	(0.01)					for Swedish bonds.
$\hat{\mu}_5$	4.94	$\hat{T}_4$:	Sudden:	34.10.23	+13.3%	Bullish bond market.
	(0.06)			[34.10.16,34.10.30]		
$\hat{\beta}_5$	–0.13		Gradual:	34.10.23–36.01.14	–7.8%	Economic stagnation
	(0.11)					and reduced exports.
$\hat{\mu}_6$	4.43	$\hat{T}_5$:	Sudden:	36.01.21	+4.4%	–
	(0.03)			[35.12.27,36.02.18]		
$\hat{\beta}_6$	0.05		Gradual:	36.01.21–39.05.23	+8.3%	Savings boom.
	(0.01)					
$\hat{\mu}_7$	8.98	$\hat{T}_6$:	Gradual:	39.05.30–40.05.28	–36.7%	Outbreak of war. Invasions
	(0.24)			[39.05.15,39.06.06]		of the other Nordic countries.
$\hat{\beta}_7$	–0.90					
	(0.00)					
$\hat{\mu}_8$	2.94	$\hat{T}_7$:	Sudden:	40.06.04	+14.5%	New government bond loan.
	(0.20)			[40.05.21,40.06.11]		Decreased war threat.
$\hat{\beta}_8$	0.27		Gradual:	40.06.04–41.07.29	+18.0%	
	(0.01)					
$\hat{\mu}_9$	4.60	$\hat{T}_8$:	Gradual:	41.08.05–45.02.06	–2.0%	
	(0.02)			[41.07.22,41.08.26]		
$\hat{\beta}_9$	–0.01					
	(0.00)					
$\hat{\mu}_{10}$	4.58	$\hat{T}_9$:	Sudden:	45.02.13	–8.9%	Raised Swedish minimum
	(0.02)			[45.01.30,45.02.20]		lending rate.
$\hat{\beta}_{10}$	0.00					
	(0.00)					
R^2	0.98					
SSR	0.29					
T, m, h	895,9,45					

Note: Robust standard errors (according to Andrews (1991)) are in parenthesis and 95% confidence intervals in brackets. All $\hat{\beta}$:s and their standard errors are multiplied by 100. "Sudden:" reports a sudden (S) break date and "Gradual:" a gradual (G) break date (in interval form). * indicates significance of the sudden or gradual break. SSR is the sum of squared residuals, T is the number of observations, m is the number of breaks allowed and h is the minimum segment length. Size are reported in percentage form (see text for details) and are defined as $\hat{p}_{\hat{T}_{j+1}} - \hat{p}_{\hat{T}_j}$ (sudden) or $\hat{p}_{\hat{T}_{j+1}} - \hat{p}_{\hat{T}_j+1}$ (gradual).

the Swedish government issued a large underpriced low-coupon bond loan partly with the aim to drive down the interest rates, which also succeeded by indulgent patriotic banks who took capital losses when they underwrote this loan. The effect on Swedish investors was, however, positive in that the bond prices started to increase on all Swedish bonds.[33] By August 1941, the price increases stopped and reached a stable level which was kept until *February 13, 1945*, when prices jumped up by 8.9 percent. This increase was caused by a widely noticed reduction of the Riksbank's minimum lending rate (on the 9th).[34] Hence, this suggests that Swedish investors had not changed their estimation of the default likelihood of Swedish long-term government bonds since the beginning of August, 1941.

4.5 German structural breaks, 1930-1947

Figure 5: German bond price and the fitted regression line.

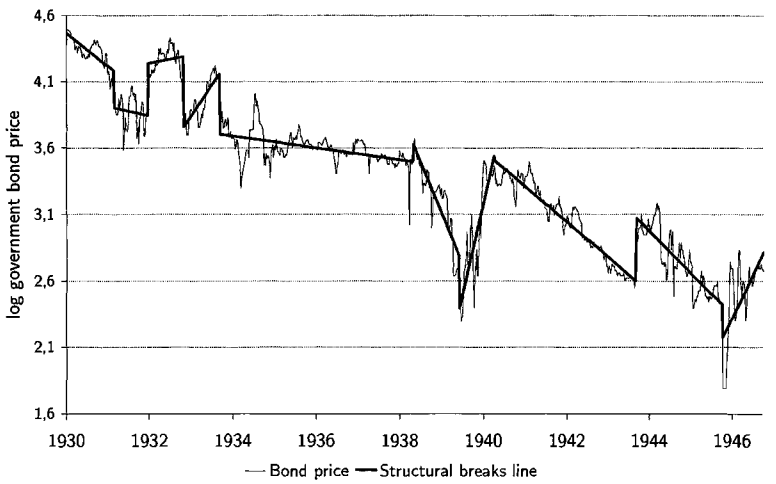


Table 7 and Figure 5 display the estimated German structural breaks. In the early

[33] *Affärsvärlden*, 25 Apr. 1940, p. 374; Nygren (1979, pp. 178f.).

[34] At the same time on the international arena, Great Britain, the United States and the Soviet Union met in Yalta between the 4th and 11th, but nobady referes to this event as affecting the bond prices.

1930s, German bond prices fluctuated heavily along the series of drastic moratoria that they presented to the world. The first negative sudden break occurred on *September 1, 1931*, coinciding with the international crisis and a serious diplomatic debt repayment conflict.[35] The positive break of *June 12, 1932* was related to the Lausanne Conference, where combined efforts managed to avoid the one-sided German moratorium.[36] New German threats causing price cuts came in *May 1933*, this time to start paying for their coupons with a new deflated currency (so-called "Sperrmark") and, finally, the Schacht moratorium speech in *March 1934* also gave rise to a sharply negative sudden break.[37]

For the next four years, the German bond price decreased constantly but at a slow pace. On *October 25, 1938*, a new negative gradual break with a more drastic fall in was recorded. This break occurred right after the Munich Conference and the German annexation of the Sudetenland, two events that in the financial press were interpreted as having increased the "immediate danger of war".[38] On *December 5, 1939*, shortly after the Soviet attack on Finland, a negative sudden break is estimated and the Young loan reached its lowest price so far. Then, the German bond price started a significant recovery of in total 213.7 percent until mid-1940, which could well reflect the remarkable triumphs of the campaigns in the North and the West. By *October 1, 1940*, however, a long negative gradual break lasting until early 1944 measuring–60 percent is recorded, evidently reflecting a series of events of which none produced any single break. In early March 1944, a positive sudden break occurred but we, as well as the contemporary financial press, have problems explaining it from either a political, military or financial viewpoint.[39] The negative price trend continued, however, and not until a negative sudden break in April 1946 coincides with a highlighted conflict between the victorious nations about how to split the German remains to compensate their war expenses, prices turned upwards.[40]

[35] See *Affärsvärlden*, 23 Jul, 1931, No. 29, pp. 88ff, 27 Aug. 1931, No. 34, pp. 205f and Kock (1961, p. 96).

[36] *Affärsvärlden*, 14 Jul, 1932, No. 28, p. 44.

[37] *Affärsvärlden*, 1 Jun. 1933, No. 22, pp. 616f and 22 Mar. 1934, No. 12, p. 316. The final agreement in September 1934 implied extensive debt relieves, though excluding the Young loan (*Affärsvärlden*, 6 Sep. 1934, No. 36, pp. 238f).

[38] *Affärsvärlden*, 29 Sep. 1938, No. 39, p. 1012 and 13 Oct. 1938, No. 41, p. 1068.

[39] *Affärsvärlden*, 27 Apr. 1944, No. 17, p. 350.

[40] *Affärsvärlden*, 23 May 1946, No. 21, p. 444.

Table 7: Structural breaks in German government bonds, 1930-47.

	Coef.		Type	Date	Size	Major event
$\hat{\mu}_1$	4.47					
	(0.03)					
$\hat{\beta}_1$	–0.49					
	(0.09)					
$\hat{\mu}_2$	3.98	$\hat{T}_1$:	Sudden:	31.09.01	–24.5%	International financial crisis.
	(0.09)			[31.06.09,31.09.15]		
$\hat{\beta}_2$	–0.13					
	(0.14)					
$\hat{\mu}_3$	4.12	$\hat{T}_2$:	Sudden:	32.06.28	+48.0%	Lausanne Conference.
	(0.28)			[32.06.14,32.07.26]		
$\hat{\beta}_3$	0.11					
	(0.14)					
$\hat{\mu}_4$	2.44	$\hat{T}_3$:	Sudden:	33.05.02	–41.0%	German moratorium threats.
	(0.24)			[33.04.04,33.05.09]		
$\hat{\beta}_4$	0.90		Gradual:	33.05.02–34.03.06	+48.6%	–
	(0.13)					
$\hat{\mu}_5$	3.87	$\hat{T}_4$:	Sudden:	34.03.13	–36.4%	German moratorium threats.
	(0.10)			[34.02.27,34.04.24]		
$\hat{\beta}_5$	–0.09		Gradual:	34.03.13–38.10.18	–18.7%	Political turbulence.
	(0.01)					
$\hat{\mu}_6$	9.98	$\hat{T}_5$:	Gradual:	38.10.25–39.11.28	–56.1%	Munich Conference. Sudet and
	(0.98)			[38.10.18,38.11.01]		Czech annexations. Outbreak
$\hat{\beta}_6$	–1.47					of the war.
	(0.09)					
$\hat{\mu}_7$	–10.94	$\hat{T}_6$:	Sudden:	39.12.05	–32.6%	Soviet enters the war.
	1.28			[39.11.14,39.12.12]		
$\hat{\beta}_7$	2.72		Gradual:	39.12.05–40.09.24	+213.7%	German "Blitzkrieg" successes
	(0.14)					
$\hat{\mu}_8$	6.24	$\hat{T}_7$:	Gradual:	40.10.01–44.02.29	–59.5%	German military setbacks
	(0.26)			[40.09.17,40.10.15]		
$\hat{\beta}_8$	–0.51					
	(0.02)					
$\hat{\mu}_9$	7.36	$\hat{T}_8$:	Sudden:	44.03.07	+60.2%	Speculative bubble?
	(0.53)			[44.02.01,44.03.28]		
$\hat{\beta}_9$	–0.60		Gradual:	44.03.07–46.04.02	–47.6%	
	(0.04)					
$\hat{\mu}_{10}$	–8.35	$\hat{T}_9$:	Sudden:	46.04.09	–22.5%	Conflict about German war
	3.16			[46.02.22,46.04.16]		debts
$\hat{\beta}_{10}$	1.29		Gradual:	46.04.09–47.03.27	+90.2%	
	(0.11)					
R^2	0.95					
SSR	11.43					
T, m, h	868,9,28					

Note: Robust standard errors (according to Andrews (1991)) are in parenthesis and 95% confidence intervals in brackets. All $\hat{\beta}$:s and their standard errors are multiplied by 100. "Sudden:" reports a sudden (S) break date and "Gradual:" a gradual (G) break date (in interval form). * indicates significance of the sudden or gradual break. SSR is the sum of squared residuals, T is the number of observations, m is the number of breaks allowed and h is the minimum segment length. Size are reported in percentage form (see text for details) and are defined as $\hat{p}_{\hat{T}_j+1} - \hat{p}_{\hat{T}_j}$ (sudden) or $\hat{p}_{\hat{T}_{j+1}} - \hat{p}_{\hat{T}_j+1}$ (gradual).

5 Contrasting the *ex post* and *ex ante* versions of history.

After having presented the estimated structural breaks, we will now compare and evaluate the *ex post* oriented historical writing with the *ex ante* views of contemporary actors conjectured from these breaks. Specifically, we make a careful reading of how modern historical writing portray the historical circumstances around World War II and relate it to the story told by the bond prices. Even if this is done countrywise, it is important to note that the contemporary actors we refer to are the *Swedish* contemporaries, since they were the ones active on the Stockholm Stock Exchange, dominantly in the 1930s and exclusively in the 1940s.

Historians emphasize two different types of historical events that mattered. First, the events that they claim were recognized and interpreted as important by the contemporaries. These events should then be evident in the bond prices with small or no time lags if that could be expected. Second, the type of events that historians emphasize although they do not claim them to have been perceived as such at the time for their occurrence. Instead, these events are the results of historical syntheses and interpretations resting on many sources like diaries, auto-biographies and the work of other historians. The first type of events can be contrasted with the structural breaks since both "claim" to reflect the views of contemporaries. Note, however, that there may be some discrepancy about exactly these are, since historians do not always specify which kind of people they refer to (the public opinion, the government etc.) whereas the bond prices are always reflecting the views of the traders and investors on the market. In our reading, we have, been aware of this and only used statements that we interpreted as truly expressing what was not by the general public. Regarding the second type of events, however, we are restricted to comparative analysis of how historical and instant analyses differ from each other.

We will concentrate on the writings of Nordic historians. In addition to their comparative advantage in writing the history of their own countries, this selection is motivated by our exclusive use of financial data collected from one of the Nordic financial markets.

Our main historical references have been Norborg (1970) for the descriptions of Denmark, Norway and Finland, Norborg (1981) for Sweden and Johansson (2002*a*) for Germany. Complementary literature on the Nordic countries is Bojerud (2002), Johansson (2002*b*), Åberg (1992), Weibull (1991), and Skodvin (1979). An inquiry into the military strategies and the main war events is found in Johansson (2002*a*). All these texts are written by well-known and recognized Scandinavian historians and are in many cases standard references in Swedish academic history programs.

5.1 Events and turning points perceived by the contemporaries

In the following, we will go through for each country the events that significantly increase the threat of war and the events that were regarded as turning points of the war as they are described by both the historians and the structural breaks (see Table 8 below). We deliberately leave out all events that are related with repayment details of the bond loans (e.g., the crisis of 1931 and the various German and Finnish moratoria), since these are of a different character than the purely political and military events that the historians focus on.

5.1.1 Denmark

Since Denmark declared itself neutral both throughout the 1930s and after Germany invaded Poland, the Danes never felt significantly worried for being attacked in the war. This in spite of Denmark's exposed location near Germany and the obviously German-oriented policy of the 1930s with which the Danes hoped to quiet the German expansionary ambitions especially towards the North.[41] The bond prices tell quite another story. Already at the time for Germany's annexation of Austria did Danish bonds start to decrease, and directly after the Danish-German pact of 1939 they began falling sharply. The German occupation in April 1940 did nevertheless give rise to a significant sudden break, indicat-

[41] See Weibull (1991) and Norborg (1970, p. 202) on how Denmark supported Germany when the League of Nations protested against the German rearmament and about the Danish-German non-aggression pact May 31, 1939. See Norborg (1970, p. 211) and Åberg (1992, p. 522) about how the Danish government did not fear a German attack, not even after having received Swedish intelligence reports about German troop movements on April 4, 1940.

ing that the market had not fully calculated with an attack. As for the major turning point in the war, historians point out the German setbacks in late 1942 and early 1943 since they boosted the active Danish resistance movement and eventually also the German repression from August 1943.[42] According to the recorded bond prices, however, the Danish bonds experienced a gradual increase from early 1941 until August 1944, when a sharply positive gradual break is recorded, clearly marking the road to a new era.

5.1.2 Finland

For Finland, historians stress that Finland in the latter half of 1930s was under obvious and hard pressure from the Soviet Union which wanted Finland to collaborate militarily. The German-Russo pact of August 1939 is described as severely worsening Finland's strategic position. Despite this situation, the Finnish government and many Finns did not believe in a Soviet attack.[43] The bond prices partly agree with this picture. The period before August 1939 reveals nothing of the mentioned political risks related with the Soviet pressure, but directly after the pact in late August (incorrectly dated as May) a sharp negative gradual break was recorded suggesting that markets perceived a significantly increased threat of war. For the early war period, there is agreement between the historians and the bond prices concerning the descriptions of the Moscow Peace and the subsequent Finnish-German collaboration, which were clearly interpreted as positive for Finland as Germany was seen as a shelter from a new Soviet attack.[44]

Of the turning points, Skodvin (1979) argues that when the focus of the war moved to the Black Sea and Africa away from the Finnish front, people started to hope for Finland to escape the war.[45] We record a negative gradual break from August 1942 and sharply negative sudden break around mid-1943, which does not lend its support to Skodvin although these events were partly driven by fears for a Finnish moratorium. Moreover,

[42] Skodvin (1979, pp. 63ff); Norborg (1970, p. 223).

[43] According to Norborg (1970, pp. 205f), Finland resisted the Soviet demands for military collaboration partly because they thought Soviet would attack and partly as they hoped for and believed in a Swedish military support after having observed the strongly pro-Finnish Swedish public opinion at a large meeting in Stockholm in October 18-19. See also Åberg (1992, p. 521) and Norborg (1981, p. 249).

[44] Norborg (1970, pp. 214f). See also Johansson (2002*b*, pp. 81f.).

[45] Skodvin (1979, pp. 56f).

historians and bond prices disagree to some extent about how the cease-fire in September 1944 was recognized by the contemporaries. Whereas historians primarily describe it as exceptionally hard for Finland, with many territorial and financial losses accompanied with a substantial fear of Finland being incorporated into the Soviet Union, the bond prices reveal great optimism on Finland's behalf as showed by a large positive sudden break of 91.5 percent and a positive gradual break until July 1945 of 83.9 percent.[46]

5.1.3 Norway

The historical writing establishes that Norway during the interwar period felt completely militarily safe from being by anyone. The only potential threat, Germany, had insufficient naval potentials and the sea neighbor Great Britain was a close commercial and political partner to Norway. Not even after the "Altmark incident" in February 1942 when British troops on Norwegian territorial waters boarded the German ship Altmark did the Norwegians feel afraid of being drawn into the war.[47] The bond prices produce a large negative gradual break already from June 1939, which was shortly after the Czechoslovak crisis (which caused a negative spike) and directly related to Norway's refusal to enter a non-aggression pact with Germany. Hence, the bond prices state that contemporaries clearly projected an increased risk of war for Norway well before the German occupation, which, however, was still not expected by the markets indicated by a sudden negative break.

Regarding the turning point for Norway, the historical writing disagrees on when to date this. While Norborg (1970) links the turning point to the liberalization in October 1944, Skodvin (1979) emphasizes that the likelihood of liberalization was inversely related with the German war experiences, hence suggesting a gradually increased likelihood after 1942 and 1943.[48] The bond price analysis clearly assign the major turning point to the Battle of Stalingrad which both coincided with a sudden break of +35.3 percent and a subsequent gradual break of +42.8 percent. Still, in mid-May 1944 a new positive

[46] Norborg (1970, pp. 214f).

[47] On the general Norwegian optimism to stay out of war, see, e.g., Weibull (1991); Skodvin (1979, pp. 49f), and on its non-reactions to the Altmark incident, see Norborg (1970, pp. 210f)..

[48] See Norborg (1970, p. 221) and Skodvin (1979, p. 53).

gradual break is recorded coinciding with the Allied invasion of France and potentially also reflecting the Soviet invasion from the North. Hence, the bond prices to a large extent agree with the historians in these respects.

5.1.4 Sweden

The Swedish war history differs quite strikingly from all the other countries that were at war. This is clearly reflected both the historical writing and the estimated structural breaks. According to the historians, Sweden never really worried about getting involved in the war although the pressure increased after the Soviet invasion of Finland and especially the German occupations of Denmark and Norway. Norborg (1981) even argues that the Swedish non-mobilization after April 9, 1940 was based on a rational analysis stating that Germany would never want to attack Sweden.[49] According to the bond prices, however, we estimate a negative gradual break between late May 1939 and June 1940 on –36.7 percent, which suggests that the contemporary market actors recognized the threat of war on Sweden as both large and increasing. Apart from this episode, there were predominantly domestic fiscal and monetary events that are reflected in the Swedish bond prices according to the structural breaks analysis. This stands in sharp contrast with the conventional historical writing which emphasizes two events associated with the imminent threat of war and as the turning points in the war for Sweden. The first was the government crisis in June 1941 (the "Midsummer crisis") caused by a German request to transfer troops and material across Swedish territory. The second was the "February crisis" in February 1942 when Sweden, after having cracked German secret messages containing plans for an attack on Sweden, mobilized on a large scale near the Norwegian border in the north.[50] Neither of these events gave rise to structural breaks and not even to temporary reductions in the Swedish bond price.

[49] Åberg (1992, p. 522); Norborg (1981, pp. 249ff).

[50] Norborg (1981, p. 255) argues that the Midsummer crisis marked the beginning of a new, more prudent, phase in the Swedish-German relations. Johansson (2002*b*) estimates, based on diary notes and other historical sources, the risk for a German attack if Sweden had refused Germany to ship their troops across Sweden as being quite low.

5.1.5 Germany

The historical writing on the German interwar and war period is, of course, quite extensive and full of events and crucial turning points of which the major ones are not easily selected. Johansson (2002*a*) argues that the Rhineland occupation in March 1936 and the wars in Abyssinia and Spain significantly strengthened Germany's political position relative the rest of Europe but also made the European public opinion "gradually accustomed" with the thought of a new large-scale war.[51] Åberg (1992) emphasizes the German annexations of Austria and the Sudetenland in March and October 1938 as the point when, from the Swedish horizon, a new World War seemed inevitable.[52] As for the bond prices, the long weakly negative gradual break estimated between March 1934 and October 1938 does not suggest any changed views on Germany's risk being in involved in a war. The gradual break in late October, however, does so and thereby supports Åberg's version. The estimated price increase in the first half of 1940 clearly corresponds to what historians describe as a row of successful occupations from Norway to France.

Of the turning points for Germany that historians emphasize such as the battles of El Alamein and Stalingrad and the Invasion at Normandy, they were all were included in a long negative gradual break that was estimated between 1940 and 1944.[53] Hence, the investors were not instantly surprised by any of these events regarding the repayment ability of Germany. As seen in Figure 5, this break seems quite robust and strongly stresses the value of estimating structural breaks in a gradual fashion. If we, by contrast, had used a simple mean-model, this long downward trend would have produced a "staircase" containing a number of steps that each represented a break date corresponding to some excessive short-term fluctuation, i.e., spurious breaks.

[51] Johansson (2002*a*, p. 270).
[52] Åberg (1992, p. 519).
[53] See, e.g., Johansson (2002*a*, p. 345) and Skodvin (1979, p. 52).

Table 8: Comparison between how historians and structural breaks in the bond prices date when the contemporaries, for each country, perceived i) a significantly increased threat of war and ii) the major turning point(s) of the war.

	Date according to...	
	Historians	Bond prices
i) Significantly increased threat of war:		
Denmark	April 9, 1940	June 6, 1939 (March 15, 1938)
Finland	November 30, 1939 (August 23, 1939)	September 1939*
Norway	April 9, 1940	June 6, 1939
Sweden	November 30, 1939	May 30, 1939
Germany	March 1935–1936[a] March–October 1938[b]	October 25, 1938
ii) Turning point in the war:		
Denmark	January 31, 1943	August 22, 1944
Finland	September 5, 1944	August 22, 1944
Norway	Oct. 1942 – Jan. 1943[c] October 1944[d]	January 31, 1943
Sweden	February 23, 1942 (June 25, 1941)	August 5, 1941
Germany	January 31, 1943	Aug. 1940 – Mar. 1944

Note: Dates in parenthesis are weaker breaks with similar interpretation. [a] means according to Johansson (2002*a*), [b] to Åberg (1992), [c] to Skodvin (1979) and [d] to Norborg (1970). * signals the true timing of the break which the model dated as May, solely because of the minimum length of segment requirement.

5.2 Major turning points not claimed to have been perceived by contemporaries

The other kind of historical events and turning points emphasized in the historical writing are those that only retrospectively turned out to be important, which means that they were not necessarily recognized by contemporaries. The comparison with the estimated structural breaks should therefore only give insight in a complementary sense, e.g., to ask whether the contemporaries in general are capable of assigning the "right" weight to various events as defined by the posterity.

Of the events leading up to the war, Johansson (2002*a*) argues that the passive policy of the Western democracies towards Italy during the Abyssinian war in 1935 fundamentally undermined the League of Nations and was "the first great act of appeasement", i.e., the policy that allowed Hitler to gradually pave his way into Eastern Europe. Moreover, the Rhineland occupation was perhaps the most important.[54] As we have seen, for none of the five countries there are structural breaks until at least two or three years after these two episodes. Regarding the turning points of the war, Johansson (2002*a*) points out a set of events: the miracle at Dunkerque in late May 1940 which was a fatal blow to Hitler's war on the U.K.; early December 1941, when both the German lightning war tactics failed outside Moscow forcing Germany to run a war of attrition which it was doomed to lose and the time for the U.S. entry into the war; January 1943 at Stalingrad where Germany lost the strategic initiative in the war.[55] Out of these events, we have observed a break in the Norwegian bonds coinciding with the German defeat at Stalingrad and in both the Norwegian and Danish bonds for the time of the Ally invasion of Normandy in June 1944.

This apparent discrepancy between what historical researchers find to be crucial historical events and how these were perceived by the contemporary actors is quite interesting. In particular, it has something to say about our own time and how we assign weight to various events in front of others.

[54] Johansson (2002*a*, p. 270).

[55] Johansson (2002*a*, pp. 317, 329, 341). Skodvin (1979) emphasizes December 1941 as the point of time after which Germany could no longer win the war.

6 Conclusions

In this paper, we have analyzed structural breaks in the prices of sovereign debt during the 1930s and 40s which are compared with the historical events around World War II pointed out in modern historical writing. The crucial aspect of this comparison is that while the first version of history reflects the *ex ante* assessments of contemporary actors, mirrored in the bond prices, the second version represents the result of careful analysis made by historians *ex post*. This type of *ex post* versus *ex ante* analysis was originally introduced by Willard et al. (1996) and our study develops this approach further in several ways. First, we actually *evaluate* the historians' writing in the light of the quantitative structural breaks estimates, an issue that was only briefly discussed by Willard et al. Second, we use a new and more robust structural breaks methodology (Bai and Perron (1998)) and furthermore present a way to systematically discriminate between *sudden* and *gradual* structural changes, which has not been done in the same methodical way before. Third, we present new high-frequency evidence for Denmark, Finland, Norway and Sweden and Germany, collected from the Stockholm Stock Exchange which at this time was one Europe's least regulated financial markets.

Our main finding is that there are large discrepancies between the *ex post* and *ex ante* assessments of how the contemporaries viewed the events around World War II. For example, historians generally claim that the people in Sweden, Denmark and Norway not until late 1939 (Sweden) or April, 1940 (Denmark and Norway) became concerned about the threat of being exposed to a European war. According to the bond prices, however, the Danish bond prices report significant worries among market actors already after Germany's annexation of Austria in March 1938 and more acutely so from June 1939, right after the annexation of Czechoslovakia and the Danish-German non-aggression pact. The Norwegian and Swedish bond prices started to fall sharply in late May – early June 1939, signaling perceived increases in sovereign risk of both these countries according to the bond markets. For Finland, there is more of agreement between the two approaches, although the Finnish bonds started to fall dramatically after the German-Russo pact in August 1939 whereas the historians do not describe the Finns as seriously worried about

a Soviet attack until it came in late November. The German bond prices started to fall sharply by late October 1938 which, however, was two-three years after the German rearmament and the Rhineland occupation, which have been forwarded as events where the European public became familiarized with thoughts of a new war.

Also regarding the dating of major turning points of the war as, again as conceived by the contemporaries, we find significant differences between historians and the bond prices, although not as uniformly as for the events leading up to the war. For Denmark, Sweden and Germany there is a quite considerable disagreement between the points in time when historians argue that the public opinion started to believe in a final German defeat and the dates of the estimated structural breaks confirming this. The Finnish and Norwegian break points are, however, more in line with the historians' versions. As for the events emphasized by historians but not claimed to having been perceived by the contemporary actors, such as the Rhineland occupation, the Dunkerque evacuation and the German halt outside Moscow, we find little correspondence with bond prices. It turns out that practically none of these "hidden" turning points were recognized as crucial at the time of their occurrence, which lends some insight to how likely it is that contemporary analysts are successful in picking the crucial events and turning points of other developments, something which would deserve further inquiry.

We interpret these results as questioning the accuracy of traditional historical writing in assessing how contemporaries truly viewed risks and political changes. Before drawing any extensive conclusions, however, it should be stressed that the estimated structural breaks are not the true picture of what people in those days considered being important. The breaks are merely estimates (as is the historians' analyses) and the financial market we refer to is not perfectly equivalent to the entire population. Moreover, our particular data set contains problems of missing values and periods of low liquidity. Still, resting on the robustness of our findings, one could argue the thousands of bond investors (recall that domestic and foreign government bonds were widely popular among ordinary people in the 1930s) to be at least as representative for the perceptions and views of the public opinion as are the few individuals whose correspondence, auto-biographies, newspapers

articles or other kinds of writings form the basis of the qualitative inference made by historians.

Our methodological contribution of discriminating between sudden and gradual breaks has proven to be quite useful for gaining deeper understanding of how historical events are perceived. Since the mean- and trend-break model both allows for the standard form of structural breaks (as in the simple mean-model) and to a large extent avoids the spurious fitting of several consecutive mean-shifts in a clearly trending time series, we strongly recommend that it is used and elaborated further in future studies estimating structural breaks and, especially, the *ex post* versus *ex ante* approach to history.

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Appendix: Original and interpolated government bond prices, 1930-47 (in logs).

Fig. A1: Denmark (original)

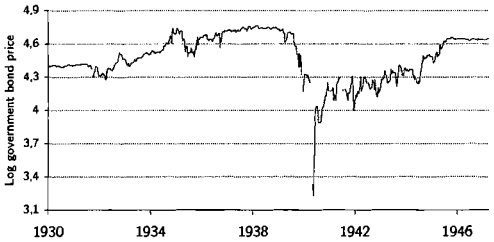


Fig. A1: Denmark (interpolated)

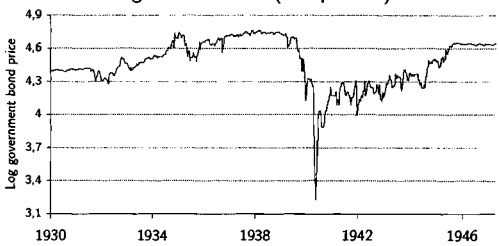


Fig. A3: Finland (original)

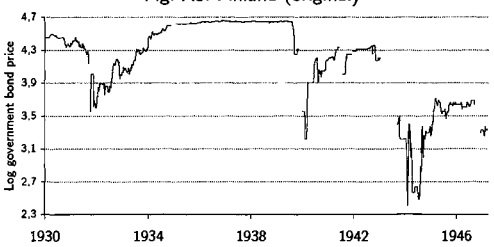


Fig. A4: Finland (interpolated)

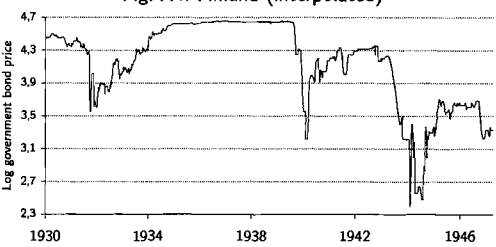


Fig. A5: Norway (original)

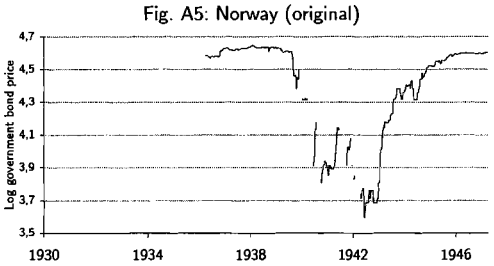


Fig. A6: Norway (interpolated)

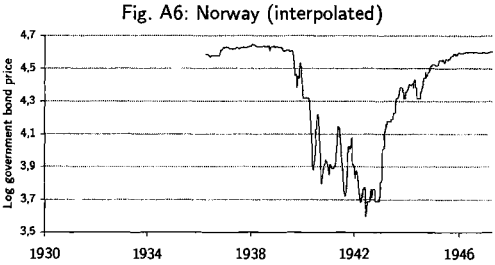


Fig. A7: Sweden (original)

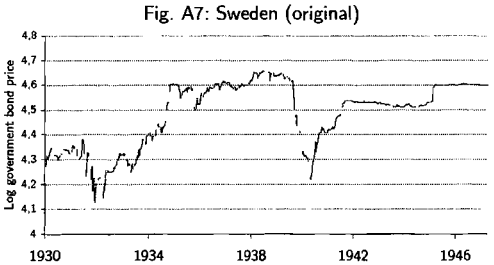


Fig. A8: Sweden (interpolated)

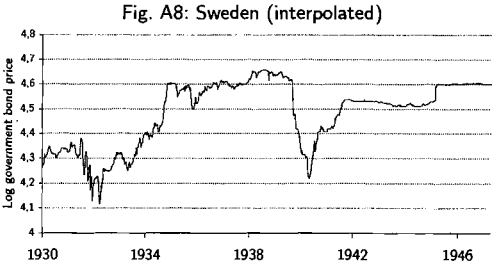


Fig. A9: Germany (original)

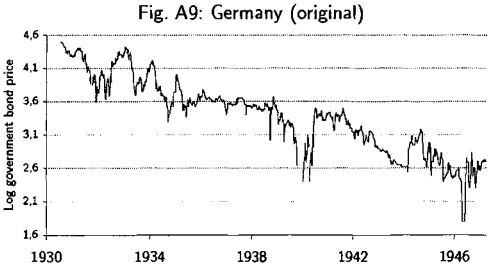
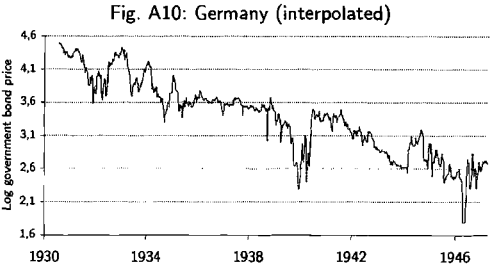


Fig. A10: Germany (interpolated)



III

The Effect of Price Controls on Financial Assets: The Case of World War II Sovereign Debt Yields.*

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Abstract

This paper examines the impact of price controls on financial asset prices. Specifically, it is found that the controls on asset price movements practiced on the Copenhagen Stock Exchange during World War II affected the market yields on Danish sovereign debt downwards by between four and six percentage points in relation to the same yields traded on the unregulated Stockholm Stock Exchange. Moreover, when using the Stockholm yields in calculating a long-run Danish equity premium, the new estimates suggest that previous figures overestimated the premium by roughly half a percentage point. These findings raise serious concerns about examining century-long series of asset returns without taking the effect from varying institutional constraints into account.

JEL classification: G14, G18, N24, N44.
Keywords: Asset price controls, Institutional constraints, Sovereign debt, Capital market integration, Financial history.

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1 Introduction

In recent years, the compilation of new and extended historical financial statistics with century-long time series have offered researchers unique opportunities to examine asset returns and equity premiums over extensive time periods (see, e.g., Jorion and Goetzmann (1999) or Dimson, Marsh and Staunton (2000)). This largely explorative field of research is both promising and exciting, but its use of continuous long-run price data collected from periods of highly differing institutional market settings imposes new methodological constraints that so far have not been sufficiently addressed. Western financial markets have periodically during the 20th century been subject to extensive restrictions with potentially significant effect on their performance.Of all these periods, the most restrictive one was World War II when practically every government in the Western world imposed severe restrictions on their domestic financial markets. A common intervention was the introduction of price controls on asset price movements, i.e., that explicit boundaries restricted prices to change beynd certain levels.

Despite this serious kind of interference with the free markets, there is practically no research on these asset price controls or their effect on market performance for any country or time period. Based on the results of Luttmer (1996) and others showing that even relatively small trading frictions may severely bias statistical inference based on asset returns, the study of past asset price controls experiences should be highly motivated and of particular concern to the studies that use continuous series of long-term asset returns without considering the effects of these institutional variations.[1]

This study is aimed at alleviating some of this apparent knowledge deficit regarding the effects of the asset price controls, with particular focus on the ones practiced during World War II on the Copenhagen Stock Exchange. These controls are especially well suited for analysis because the Copenhagen exchange listed securities that were simultaneously traded in other markets, not subject to controls. Hence, by comparing the returns on these securites across markets, correcting for various market-specific macroeconomic factors, it

[1] One exception is Obstfeld and Taylor (2002) who study long-run capital market integration but explicitly leave out World War II data due to the risk of being biased.

is possible to analyze the impact of the price controls. Specifically, I will analyze the yields on Danish long-term government bonds traded in Copenhagen and on the Stockholm Stock Exchange, which was not subject to controls.

An important feature of the World War II period to bear in mind was that both Denmark and Sweden closed their borders to all kinds of capital movements. For Denmark, this implied that the Danish economy, and even more its capital market, became highly suscetible to national macroeconomic conditions. Another effect was that any cross-country arbitrage trading that normally would have offset significant price differentials of cross-listed securities, was precluded. In the analysis below, I explicitly address this complete market segmentation between Denmark and Sweden by correcting for both fluctuations in the exchange rate of the Swedish and Danish currencies and national *ex post* inflation expectations, calculated with two different assumed time horizons of investors.

Another issue related to the price control analysis is the how this constraint affected long-term Danish stock and bond returns and the estimated equity premium. Using both long-run Danish stock an bond returns data of Nielsen and Risager (2001), exculsively based on data from the Copenhagen Stock Exchange, I simply test whether the long-run equity premium changes if instead the Danish government bond yields from the Stockholm Stock Exchange were to be used. While such a test may not fully revise the picture of Danish investors's risk aversion, it can still give an indication of what happens when long-run asset price relations are explicitly exposed to the effects of differing market constraints.

2 The effects of financial asset price controls

How do price controls on financial assets work and what kind of specific effects on asset returns should they give rise to? As already mentioned, there is a general lack of research on these phenomena. Widely more highlighted is the past incidence of commodity price controls, most likely because they applied economy-wide and had significant effects on inflation, which has been shown in the World War II case by Capie and Wood (2002). According to standard microeconomic analysis, a politically decided price gives rise costs

associated with the excesses of either supply or demand resulting from the disequilibrium price (see, e.g., Scott Morton (2001)). In the model of Charemza and Majerowska (2000), which is one of the few models that look at price controls on financial assets, the main focus is put on their effect on the portfolio decisions of investors. They modify the capital asset pricing model with a price control constraint and show that the reduced price volatility this creates make portfolios more correlated with each other and increases their risk level since they cannot be diversified to the same extent as for a higher degree of volatility. Charemza and Majerowska also empirically evaluate the price controls practiced in the 1990s on the Warsaw Stock Exchange. They find that although the effects of the controls were moderate, they generated quite significant quantity spillovers of trading to other non-restricted markets and did not shelter the restricted securities from boom-bust events.

Financial asset price controls can either be constructed as a prohibition on prices to be quoted above or below a certain price level, similar to the structure of commodity price controls, or as the more commonly used form of specific upper and lower bounds daily price changes. In the latter case, one can expect the restricted assets on average to be less volatile than non-restricted assets and have lower returns because of this. On the other hand, the set of tradable prices for the restricted assets is smaller which increases the holding costs to their owners who accordingly should require a premium for this imposed illiquidity, i.e., higher returns. When price controls are sufficiently extreme, they could even crowd out all trading to other markets or instruments with less restrictions and in those cases, the quoted market prices may be poor signals of how investors asses the risk and returns prospects of the respective assets.

How distortive the price controls are is, however, contingent on several factors. Clearly, tighter bounds result in a smaller set of potential prices and thus on average larger distortive effects. Times of considerable market volatility due to system-wide crises like wars should also result in larger distortive effects on the market pricing given a certain price control level. Imposing price controls under a high degree of market integration and low cross-market transaction costs will be highly ineffective becasue of arbitrage trading.

As shown by Froot and Dabora (1999), however, even in the case of highly developed and integrated markets as those of the 1990s could anomalies such as persisting risk-free arbitrage opportunities prevail.

3 Institutional setting and Data

3.1 The Danish and Swedish secondary bond markets

The Danish secondary bond market during the 1930s and 40s was the dominant part of the trading on the Copenhagen Stock Exchange representing roughly 90 percent of the total securities trading.[2] All the bond loans listed on the exchange were issued by domestic lenders. The Swedish secondary bond market took place on the Stockholm Stock Exchange but was not as important as in Copenhagen, neither absolutely nor relatively. During World War II, however, its share of total trading peaked with about 50 percent. Unlike in Copenhagen, there were several foreign loans listed in Stockholm at this time and a couple of them were issued by the Danish government, which is the motive for the present study. There is no detailed evidence on trading volumes in individual bond loans in either Copenhagen or Stockholm, but a examination in Waldenström and Frey (2003) suggests that the Danish bonds were regularly traded throughout the 1930s and 40s. Regarding the degree of integration of the Danish and Swedish capital markets, Kock (1961) argues that the cross-border flows largely broke down after the international financial crisis in 1931 but that there were some transactions especially between the Nordic countries in the 1930s, which is otherwise commonly described as a period of low capital market integration (see, e.g., Obstfeld and Taylor (2002)).[3]

When the war broke out on September 1, 1939, the trading on the Copenhagen Stock Exchange was stopped by the Danish Department of Commerce. On September 12, the exchange was reopened but this time accompanied with new price controls on asset price movements applying on all listed securities. Specifically, bonds were prohibited

[2] See the *Statistical Yearbook of Denmark*, the table named *Omsætningen af Værdipapirer ved den off. Notering paa Københavns Børs*, various years.

[3] Kock (1961, pp. 146f).

to fall more than two percentage points below the bid prices recorded on August 31, i.e., a level restriction of the prices. After only a few weeks, however, the controls were relaxed to prohibiting daily bond price decreases of more than 1 percentage point. When Germany occupied Denmark on April 9, 1940, Denmarks was thrown into the war and the Copenhagen Stock Exchange was closed once again by the Danish government. This second trading halt lasted until May 28 the same year and when it reopened the price controls were kept intact. After this event, the price controls remained in place until February 23, 1946, when they were finally abolished.[4]

Also on the Stockholm Stock Exchange, the outbreak of war set off a period of price controls decided by the Board of the Exchange. They only lasted between September 1, 1939 and January 2, 1940, however, and were substantially less restrictive than the one practiced in Copenhagen. Foreign government bonds were allowed to fall at most 5 percentage points per day, but the Board clearly stated that these boundaries were not strictly binding and larger decreases were allowed.[5] Apart from this intervention, there were no other war-related price or trading restrictions on the Stockholm bond market. Moreover, the exchange never closed down or changed its listing requirements during the war and all foreign securities, including Danish government bonds, were freely traded for the whole period.[6]

During the war, both Denmark and Sweden also introduced sharp currency regulations, restricting all kinds of cross-border flows of capital and securities. In Denmark, they were imposed from January 1940 and were further extended in April that year.[7] In Sweden, from February 1940s Swedes were prohibited to purchase foreign securities (hence stopping capital outflows) from 1944 to sell securities to foreigners (stopping capital inflows). Foreigners in Sweden were from 1940 obliged to temporarily deposit their funds on a blocked account at the Swedish Riksbank. After the war, the Swedish regulations were kept intact and Kock (1961) describes them continuously restrictive on imports and

[4] On all these events, see the Danish financial weekly *Finanstidene* 6 Sep. 1939, p. 1020; 27 Sep. 1939, p. 1077 and 27 Feb. 1946, p. 430.

[5] See Algott (1963, pp. 182ff.).

[6] See also Waldenström and Frey (2003) for a description of the Swedish interwar government bond market.

[7] For details, see *Finanstidene*, 10 Apr. 1940, p. 589.

Table 1: Individual Danish government bonds analyzed in the study.

Stock Exchange	Year issued	Maturity	Coupon	Dates listed	Loan size
Stockholm:	1936	1956	4%	1937–48	20 MSEK
	1938	1958	3.5%	1939–48	30 MSEK
Copenhagen:	1934	1959	4%	1938–48	31 MDKR

Note: MSEK = million Swedish kronor, MDKR = million Danish kronor. *Source:* *Swedish Bond Catalogue* and Statistics Denmark (1969, p. 226).

exports of capital.[8]

The other capital market institutions that affected secondary bond markets were the imposed costs of buying, selling and holding securities, i.e., commission fees and taxes on transactions and capital gains. In the Swedish case, these were stable throughout the 1930s and 40s and there is no indication of anything else in the case of Denmark.[9]

3.2 Data

The data employed in this study are secondary market yields of long-term Danish government bonds assembled from the price lists of the Copenhagen and Stockholm Stock Exchanges during 1937–1948. The data are published as end-of-month bid quotes in *Statistical Yearbook of Denmark* (for Copenhagen) and the Swedish financial publication *Affärsvärlden.*[10] Table 1 lists the individual bond loans from the two markets used. Evidently, there were two Danish bonds traded in Stockholm during these years and both are used by weighting together their yields by their loan size.[11]

In Copenhagen there were several Danish government bonds traded at the same time, but the 25-year loan of 1934 was the one most similar to the loans traded in Stockholm

[8] Kock (1961, p. 536.).

[9] On the Swedish transaction costs during this period, see Waldenström (2002*a*); Waldenström (2002*b*). In the Danish case, the war saw extra transaction taxes on stock trading (see Gejl (1989, pp. 287ff)), but I have not been able to trace any reports on changes of commission fees or taxes in the issues of *Finanstidene* over these years.

[10] For the Danish statistics, see the table *Københavns Børskurs (Køber) for Obligationer* for various years. For the period in April-May 1940 when the exchange was closed, these prices were probably collected from the off-exchange market that was arranged by the large brokerage firms, as noted by *Finanstidene*, 22 May 1940, p. 700.

[11] The correlation between the two yields is 0.98 and it makes no difference whether the individual yields or a mean between them is used.

in terms of coupon rate and time to maturity and is therefore used. However, all the results in the study have been replicated instead using the yield of the 1888 consol with a 3.5 percent coupon from the Copenhagen exchange, without encountering any significant differences. All loans paid their coupons semi-annually in local currencies, i.e. Danish kronor for the 1934 loan and Swedish kronor for the 1936 and 1938 loans. As noted in Statistics Denmark (1969, p. 226), the 1934 loan was prematurely redeemed in July 1950 but since I have not found any indications or announcements of this in *Finanstidene* in the years preceding this event, this will not be taken into account in the yield calculations. It is assumed that all bonds experienced no cuts in their stream of coupon payments, which seems reasonable as for the bonds traded in Sweden the Swedish bond catalogue did not report any troubles with this and *Finanstidene* even noticed that the Danish government were anxious about doing so.[12]

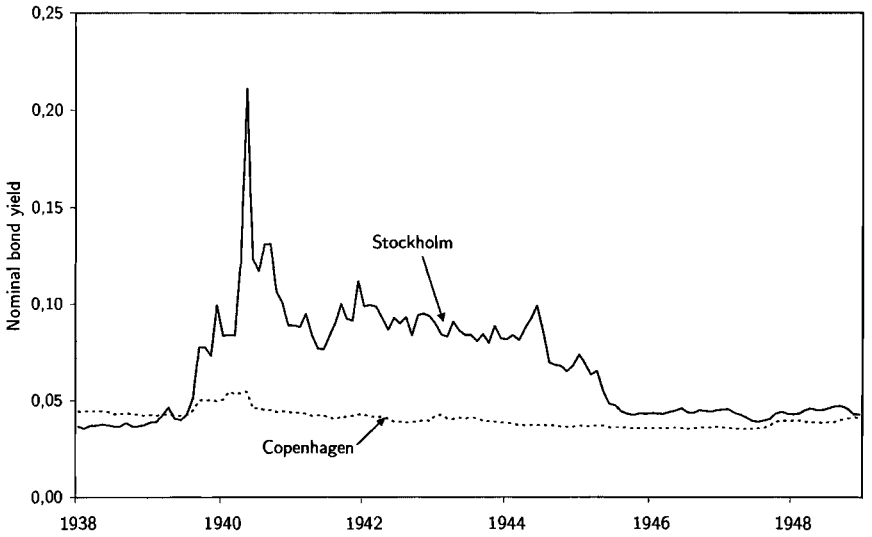
All yields are calculated using yields to maturity, which is a commonly used measure and also the one used by Nielsen and Risager (2001) whose results are replicated in this study.[13] It is also called the "buy and hold" return since it equals the annual average rate of return on a bond that is held to maturity when it is finally repaid. The yield to maturity contains some well-known problems, for example its underlying assumption that all coupon payments are reinvested at a flat rate equal to the yield itself. Figure 1 displays the nominal bond yields of Danish government bonds recorded from the stock exchanges in Copenhagen and Stockholm.

To account for macroeconomic effects on the yields (see the following section), data on monthly spot exchange rates are collected from the *Yearbook of the Swedish Riksbank*. As proxy for inflation expectations in Denmark and Sweden, I use the *ex post* n-month forward rate of change of prices, $\pi_{t+n} = [(P_{t+n} - P_t)/P_t]^{12/n}$, where the ratio in the exponent gives the annualized inflation rate. The monthly price P is the cost of living index, published on a quarterly level in the Statistical Yearbooks of Denmark and Sweden

[12] *Finanstidene*, 12 Jun. 1940, p. 761.

[13] I have also checked the results using other yield measures, e.g., the *current yield* (flat yield), abstracting from everything affecting the cash flows but the coupon income, and the *yield to average life*, which accounts for that bonds are sometimes routinely retired during the life of the issue. Neither of these variants, however, affect the basic message of the findings.

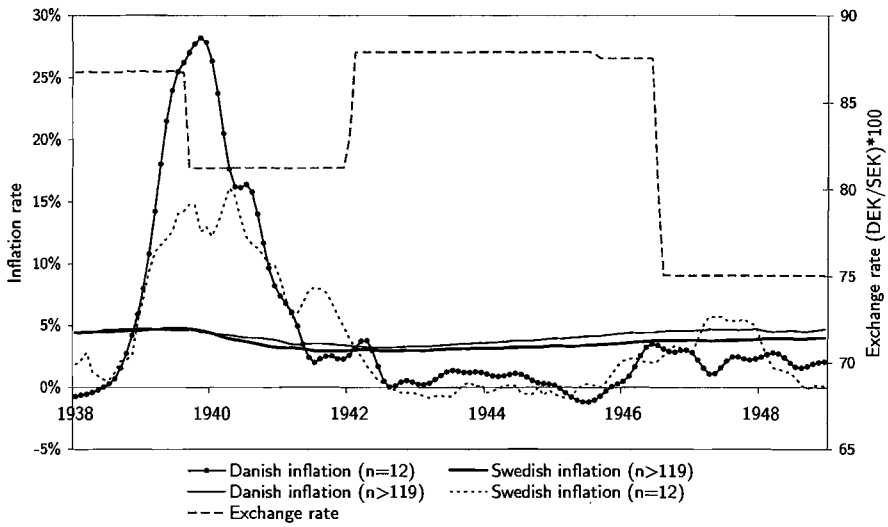
Figure 1: Danish government bond yields in Copenhagen and Stockholm, 1938-1948.



and interpolated to monthly frequency using standard cubic spline interpolation. The choice of n is related to the length of the bond's holding period and if it should correspond to the yield measured used, which assumes a holding period until the maturity date, n would be descending from 252 (21 years) to 120 (10 years) during the period 1938–1948. Several studies have disregarded this fact that the yield to maturity measure assumes bonds to be held until maturity and instead simply chosen $n = 12$ to get "short-horizon" annual inflation rates, despite the fact that it is used to calcualte real yields with a longer time to maturity (see, e.g., Obstfeld and Taylor (2002); Jackson and Lothian (1993)). Although the 12-month rolling inflation window gives more conventional spot inflation rates, it does thus not match the holding period of long-term bonds. To make sure my results are not driven by the choice of either of these *ex post* inflation rates, both measures will be used, i.e., both $n = 12$ and $n = [120, 252]$.

Figure 2 provides plots of the the two inflation measures as well as the exchange rate (also measured *ex post*). Clearly, the 12-month inflation rate is more volatile than the implied annual inflation rate for the longer holding holding period. The spot exchange

Figure 2: Inflation and exchange rates in Denmark and Sweden, 1938-1948.



rate (right scale) is defined as the amount of Swedish kronor received for 100 Danish kronor. Although the study uses exchange rate data until 1959 (not displayed), the rate remained at about 75 kronor during that entire period.

4 Estimation specification

The analysis of the price controls is based on the comparison between the Danish government bond yields in Copenhagen and Stockholm.[14] Since the bonds had similar coupons and time to maturity, subtracting one of the yields from the other gives that all determinants of the yields that are not market-specific cancel out. To see this, note that the basic determinants of nominal bond yields are the following:[15] the default risk, denoted

[14] Charemza and Majerowska (2000) focuses on the estimation of the relative risk (the CAPM beta-coefficeint) using both traditional linear regressions and maximum likelihood estimations where the censored features of the observed returns are exploited. Hanousek and Nemecek (2002) analyze how differing stock exchange institutions within a fully integrated national market give rise to signficant arbitrage activities.

[15] Although this setup is slightly stylized it is still valid (see, e.g., Brown (1998) or Campbell, Lo and MacKinlay (1997, pp. 401ff)).

DR, which is the borrower-specific likelihood that the debt will not be serviced properly; the time to maturity T which is loan-specific; institutional factors θ that reflect market-specific features like price controls, tax status of cash flows, market liquidity etc.; and finally market-specific macroeconomic conditions Ψ such as the exchange rate and inflation rates that are relevant since the loans traded in Copenhagen and Stockholm were denominated in local currencies. Altogether, the yield on Danish sovereign debt traded on market i can then, somewhat stylized, be expressed as a function of the mentioned determinants,

$$y_i = y(DR, T, \theta_i, \Psi_i).$$

Taking the the yield differential across markets i and j by subtracting the yield on market j from that on market i, the loan- or borrower-specific yield determinants such as default risk, coupon and time to maturity that enter the expressions the same way in both markets, cancel out (when $y(\cdot)$ is linear), i.e.,

$$\begin{aligned} y_i - y_j &= y(DR, T, \theta_i, \Psi_i) - y(DR, T, \theta_j, \Psi_j) \\ &= y(\theta_i - \theta_j, \Psi_i - \Psi_j). \end{aligned} \tag{1}$$

When correcting for the macroeconomic factors in (1) and abstracting away the linear function, the differential it becomes a function of the institutional divergence only,

$$(y_i - y_j)|_{(\Psi_i - \Psi_j)} = \theta_i - \theta_j. \tag{2}$$

The previous section argued that most market specific factors like taxes or liquidity were similar in Copenhagen and Stockholm, which means that the institutional divergence $\theta_i - \theta_j$ primarily reflects the asset price controls. The aim of the empirical analysis will thus be to estimate (2) accounting for the macroeconomic factors $\Psi_i - \Psi_j$. This is done in two ways, the first focusing on the exchange rate effects through the well-known uncovered interest rate parity (UIP), which asserts that the nominal interest rates, or yields, should be equal once expected exchange rates are taken into account. The second way employs the relative purchasing power parity (PPP), which states that the real bond yield differential between the two markets should be equal to the nominal yield differential

less the expected inflation differential.[16] These two parity conditions are mostly employed in the context of measuring capital market integration, which is quite related to this study.

Formally, let y_{itn} denote the nominal Danish government bond yield recorded on market i at period t with n months to maturity, s_t the log exchange rate defining number of units of Danish currency per unit of Swedish currency and E_t a standard expectations operator. UIP can then be written as

$$y_{itn} - y_{jtn} = E_t s_{t+n} - s_t. \tag{3}$$

Since people's expectations at time t about future depreciation realized at time $t+n$, $E_t s_{t+n}$, cannot be measured directly I follow the convention of using the *ex post* rate of depreciation, s_{t+n}, which is the observed exchange rate at the time of maturity for the bonds in the study (the late 1950s according to Table 1). Using this *ex post* simplification introduces an error term $u_t = E_t s_{t+n} - s_{t+n}$ which is inserted in (3). In the estimation I use dummy variables to account for the price control effect, which hence enters in as a level-effect. The nominal yield differential equation (based on UIP) using (2) is then

$$y_{itn} - y_{jtn} = \alpha + \beta(s_{t+n} - s_t) + \delta D_k + \gamma P_{40:05} + u_t, \tag{4}$$

where α is the intercept, expected to be zero from the UIP and $s_{t+n} - s_t$ is the *ex post* exchange rate depreciation. Moreover, D_k is the dummy variable measuring the effect of the price control regime, i.e., $\theta_i - \theta_j$, taking the value 1 from September 1939 to either May 1945 (when the war ended, $k = 39{:}09 - 45{:}05$) or to February 1946 (when the price controls were lifted, $k = 39{:}09 - 46{:}02$) and 0 elsewhere. This temporal distinction is made to allow for inference of the price control effect conditional on the war. Hence, I am exploiting the fact there are almost two years of observations both before and after the price controls were in place. $P_{40:05}$ is a "peak" dummy included in order to correct for the extreme observation in May 1940 (see Figure 1) associated with the German occupation, which may otherwise drive some of the results.

In the PPP-based test, let the *ex ante* real yield be ρ and define the real bond yield

[16] This second approach is based on Jackson and Lothian (1993).

differential as

$$\rho_{itn} - \rho_{jtn} = [(y_{itn} - y_{jtn}) - (E_t s_{t+n} - s_t)] + [(E_t s_{t+n} - s_t) - (E_t \pi_{it+n} - E_t \pi_{jt+n})]. \quad (5)$$

Equation (5) is hence a combination of the UIP (the first term on the right hand side) and PPP (the second term), and $E_t \pi_{it+n} - E_t \pi_{jt+n}$ is the difference between the anticipated inflation rates of the two regions. Since the *ex post* exchange rate depreciation cancels out in (5) and the *ex post* inflation expectations differential gives rise to the error term $\varepsilon_t = (E_t \pi_{it+n} - \pi_{it+n}) - (E_t \pi_{jt+n} - \pi_{jt+n})$, the *ex post* real yield differential becomes $y^r_{itn} - y^r_{jtn} = (\rho_{itn} - \rho_{jtn}) + \varepsilon_t$, where y^r_t is measured as nominal yields minus the national rate of inflation (defined above). The relative PPP hence suggests that real yields should be equal across regions (at least in the long run), which suggests the following estimation equation (based on both UIP and PPP)

$$y^r_{itn} - y^r_{jtn} = \alpha + \delta D_k + \gamma P_{40:05} + \varepsilon_t, \quad (6)$$

where the constant term α captures the UIP and PPP effects and the dummies are the same as in equation (4).

All empirical estimations can straightforwardly be estimated using ordinary least squares since the differentials are all $I(0)$ stationary, both practically by construction (the loans have the same issuer) and as suggested by unit root tests.[17] Because the ex post approximations of the different expected inflation and exchange rate depreciations give rise to overlapping observations, all estimations use Newey and West (1987) estimated variance-covariance matrix to account for serially correlated residuals.

5 Results

5.1 Estimating the effect of the asset price controls

The empirical investigation focuses on whether the price controls had any isolated effect on the level of Danish government bond yields, holding all other yield determining factors

[17] Augmented Dickey-Fuller tests are run with inclusion of a dummy for World War II and the results are available from the author upon request.

Table 2: Test for a price control effect on bond yield differentials, 1938-1948

Dep. variable:	$y_{Sto,t} - y_{Cop,t}$ (nominal yields)		$y^r_{Sto,t} - y^r_{Cop,t}$ (real yields)			
	(A)	(B)	(C)	(D)	(E)	(F)
Intercept	0.011	0.003	0.001	0.000	0.007	0.009
	(0.002)	(0.005)	(0.001)	(0.001)	(0.009)	(0.010)
$(s_{t+n} - s_t)$	0.068***	0.114***				
	(0.025)	(0.033)				
$D_{39:09-45:05}$	0.053***		0.051***		0.062***	
	(0.009)		(0.004)		(0.013)	
$D_{39:09-46:02}$		0.053***		0.046***		0.052***
		(0.005)		(0.005)		(0.014)
$P_{40:05}$	0.183***	0.185***	0.187***	0.192***	0.180***	0.188***
	(0.004)	(0.005)	(0.004)	(0.005)	(0.011)	(0.011)
n (inflation)			[120,252]	[120,252]	12	12
Observations	131	131	131	131	131	131
F-statistic	266.0	145.0	369.0	170.3	48.9	31.6
Adjusted R^2	0.86	0.77	0.88	0.72	0.42	0.32

Note: $y_{Sto,t} - y_{Cop,t}$ is the *ex post* nominal Danish sovereign debt yield differential between the Stockholm and Copenhagen Stock Exchanges. $y^r_{Sto,t} - y^r_{Cop,t}$ is the equivalent differential in real terms. n displays the choice of inflation measure based on either the convention $n = 12$ or the holding period $n = [120, 252]$. The F-statistic represents the test of the joint significance of all coefficients and the adjusted R^2 shows how large a share of the observed variation the model can explain. *** represents statistical significance on 1-per cent level. Newey and West (1987) standard errors in parenthesis.

constant along the lines of equation (2). Table 2 presents the results from the estimations of equations (4) (shown in regressions A-B) and (6) (regressions C-F).

The main finding is that the asset price controls in Copenhagen significantly reduced the yields of Danish government bonds by between 4.6 and 6.2 percentage points, i.e., that the yields would be twice as large in Copenhagen if there were no price controls. This result is robust to using either nominal or real yield differentials as well as to the choice of dummy variable, which means that both the war dummy ($D_{39:09-45:05}$) and the price control dummy ($D_{39:09-46:02}$) are associated with a significant coefficient estimate. The second of these is somewhat smaller which reflects the reduced Danish sovereign risk at the end of and after the war as perceived by the traders in Stockholm. The control variable for the German occupation ($P_{40:05}$) also produces a large and significant estimates in all regressions. The constant term is zero for all regressions except one,

which renders support for the theoretical parity conditions but in particular as well for the robustness of the estimated price control effects as it rules out significant impact from liquidity premiums or other institutional differences that are not captured in the included regressors. The positive intercept in estimation B could be explained by the mismatch of the war dummy and the continued practice of the price controls.

The two different inflation measures (by n) do not affect the results which could be explained by the fact that they are highly correlated (0.88 in the 12-month case and 0.84 in the 120-250-month case) and therefore cancel out in the estimations. They have a different impact on the overall goodness of fit, however, since the 12-month measure is considerably more volatile (as seen in Figure 2).

Interpreting these results in the light of the continuous bond trade on the Copenhagen Stock Exchange throughout the war as mentioned above could, though, lead to a revised picture of the price controls. The first variant of the price controls did indeed break down the entire market, which was clearly observed by the market actors and noted in the financial press, but when the controls were relaxed on September 25, the trading came back to the exchange.[18] One explanation for this seeming contradiction could be that because of the complete isolation of the Danish capital market, opportunity costs to bond investments were low as most alternatives yielded smaller rates of returns such as bank deposits. Stock investments were also subject to price controls but, in excess of that, moreover subject to transaction taxes that had been launched especially for the wartime conditions.[19] On the other hand, as was indicated previously, the postwar period in Denmark and Sweden did not automatically imply full market integration but still the differentials for this period were considerably smaller and practically zero.

[18] On how the first restrictive period was experienced by the market, see, e.g., *Finanstidene*, 20 Sep. 1939, p. 1058 and *Obligationstidene*, 27 Sep. 1939, No. 12. On the following more active period, see, e.g., Gejl (1989, p. 288).

[19] Finanstidene, 27 Sep. 1939, p. 1075.

5.2 Asset price controls and the equity premium

As was mentioned in the introduction of this paper, many studies that utilize long-term asset return data compute estimates of the so-called equity premium, i.e., the average excess return on stocks over bonds. These are interesting both to academics for testing basic postulates of economic theory (e.g., the the equity premium puzzle) as well as to practioners for, e.g., the design of appropriate investment portfolios over varying time horizons. Among the stylized facts associated with 20th century equity premiums is the finding that they are mostly quite significant, which means somewhere between four and eight percent (see, e.g., Dimson et al. (2000)). Recently, Nielsen and Risager (2001) presented new evidence on Danish long-term stock and bond returns as well as estimates of the equity premium. They compute their estimates using end-of-year prices from the Copenhagen Stock Exchange between 1922 and 1999. Using 1-year government bond yields as proxy for the risk-free rate of return, they get a nominal equity premium of 4.1 percentage points. In an international comparison, the Danish premium is hence relatively low.

The purpose of this section is to inquire whether the equity premium estimated are sensitive to the inclusion of the Danish government bond yields taken from the Stockholm market. Specifically, the data of Nielsen and Risager is reexamined, using their stock returns data and their 10-year government bond yield, with the slight adjustment that for the war years 1939-1945 I swap their Copenhagen yields with the Stockholm yields reported above. Due to the difference in time to maturity, this yield swap is not ideal but as the nominal yield differentials correspond well to the levels encountered in the empirical estimations previously with an average of 5.1 percentage points during 1939-44 and 0.57 percentage points for 1945 (based on end-of-year prices). A potential problems is that for the years prior to the war they are quite negative, suggesting cautious interpretation of the results. Since Nielsen and Risager do not report the exact bond loans they use and, moreover, that their 10-year yield actually varies between 6 years and 9 months and 14 years and 5 months in different periods, the time to maturity mismatch could be even larger.

Table 3: Estimates of Danish equity premium (per cent)

	Stock return	Bond yield	Equity premium
Period : 1922–1999			
Stockholm yields	11.72	8.56	3.16
Nielsen and Risager (2001)	11.72	8.15	3.57
Difference		0.41	–0.41
Period : 1922–1982			
Stockholm yields	9.60	8.37	1.23
Nielsen and Risager (2001)	9.60	7.86	1.74
Difference		0.51	–0.52

Note: The stock return is the Copenhagen average annual return, reported in Nielsen and Risager (2001).

Table 4 reports the new equity premium estimates and the difference from the Nielsen and Risager (2001) results. Note that they only report the equity premiums where they used the 1-year yield whereas I used their 10-year yields. The calculation method is, however, identical. The equity premium is computed as the average stock return minus the average government bond yield (which follows Nielsen and Risager).

As clearly suggested by the table, the Stockholm yields produce an equity premium about one-half percentage point below the one based on purely Copenhagen yields. When the entire sample is used, i.e., 1922-99, the use of Stockholm yields decreases the premium from 3.57 to 3.16 percentage points and for the shorter period, 1922-82, it decreases from 1.75 to around 1.23 percentage points. The division into two time periods follows Nielsen and Risager, who argue that 1982 was a turning point for the Danish economy and the subsequent years differed in several respects, in particular by containing substantially higher stock returns.

Since this exercise has not taken into account that the Danish stock returns were also subject to price controls, the new equity premium probably overstates the difference between the two premiums. On the other hand, as none of the previous studies of Danish long-term returns data do not correct for either stock or bond returns with respect to the controls, the findings here are still valid.

Altogether, Table 4 suggests that time-varying institutional financial constraints can have substantial effects on the calculations of equity premiums, also when estimated over very long periods such as 60 or almost 80 years. In the case of Denmark, the already

internationally low Danish 20th century equity premium may in fact be even lower than suggested by Nielsen and Risager (2001).

6 Concluding remarks

This paper analyzes the impact of price controls on financial asset prices, with application on the historical case of Copenhagen Stock Exchange during World War II. The analytical approach has been to compare the market yields on Danish government bonds traded simultaneously on the Copenhagen Stock Exchange and on the unrestricted Stockholm Stock Exchange and calculate yield differentials which cancel out all determinants of the yields except for the price controls.[20]

I find that the asset price controls significantly reduced the yields by between 4 and 6 percentage points. This result is robust to both using nominal and real differentials as well as correcting for exchange rate depreciation and national inflation rates. Whether these results are reasonable is not easy to answer, but since Germany occupied Denmark during most of war which naturally put the pre-war sovereign debt at risk, one could even consider this estimated differential as low. Unfortunately, however, there are few other studies of these phenomena that can be used for reference and the issue is therefore left open for future inquires.

A somewhat surprising, and also puzzling, observation is that the Danish secondary bond market continued to function during the war, despite this restrictive price controls bounding all asset prices. One explanation for this seeming anomaly is that the Danish market, being completely isolated from the rest of the world due to harsh capital flow regulations, still kept up most of its other institutions (market clearing, information provision etc) which helped to maintain the investors' confidence in the market and alleviate some of the costs imposed by the price restrictions. Moreover, the closed borders gave Danish bondholders few opportunity investments, which may have contributed in inducing them to keep their wealth in the bonds. In other words, the combination of a quite

[20] The Stockholm Stock Exchange was subject to a relatively moderate price control regime at the end of 1939, as mentioned in the text.

significant negative level-effect on the price controls and the maintained bond market activity points at the importance of the complete market segmentation during most of this period. Since integrated markets would have sooner or later observed this risk-free arbitrage, these results may be taken as evidence of extremely low levels of capital market integration between Denmark and Sweden from the late 1930s onwards.

The other finding of the study is that when these new Danish government bond yields based on the Stockholm prices are substituted into the long-term series of Danish stock and bond returns and used to estimate a new Danish equity premium, the result is a reduction by roughly 0.5 percentage points compared previous estimates in Nielsen and Risager (2001) who only use Copenhagen yields. Considering that these estimates are based on long-run financial data spanning 60 to 80 years, a half-percent cut is significant. The overall contribution of Nielsen and Risager remains of course intact and the findings in this study are merely a complement to the full picture of Danish long-run stock and bond returns.

Altogether, even if the large estimated effects of the Copenhagen asset price controls are not easily interpreted when all facts are taken into consideration, they do, however, raise serious concerns about examining century-long series of asset prices without taking the effect from varying institutional constraints into account.

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IV

International Financial Liberalization and Industry Growth*

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Abstract

The growth effects of international financial liberalization and integration are investigated using the methodology and data developed by Rajan and Zingales (1998). The main result is that industries highly dependent on external financing do not experience higher growth in value added in countries with liberalized financial markets. Liberalization does, however, increase the growth rates of both output and firm creation among externally dependent industries – given that the countries have reached a relatively high level of financial development. These results are consistent both with increased competition and increased outsourcing. Some tentative evidence points toward the latter explanation.

JEL Classification: F3, G1, O4

Keywords: Financial Liberalization, Financial Integration, Economic Growth, Outsourcing.

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1. Introduction

The real growth effects of international financial liberalization and integration have been under theoretical and empirical scrutiny for quite some time. Despite substantial research efforts, it is fair to say that a consensus remains to be reached.[1] Whereas previous empirical work has mainly approached the issue by considering growth rates of country aggregates, this paper analyzes growth effects at the industry level, using the well-known methodology and data from Rajan and Zingales (1998). While these authors investigate the growth effects of financial development, we extend their analysis by testing if industries highly dependent on external finance experience faster growth in countries with liberalized capital accounts, liberalized equity markets, and that are well-integrated with global capital markets.[2] This approach allows us to test if liberalized financial markets disproportionately benefit the industries that, a priori, are expected be the most favored by a lower cost of capital and eased credit constraints.

The main result is that growth in value added is unrelated to all the investigated dimensions of financial liberalization and integration. However, both growth in the number of establishments and output is higher when financial markets are liberalized – given that countries have reached a relatively high level of financial development. These results are consistent with two explanations, a competition effect and an outsourcing effect. If financial liberalization stimulates firm creation, this can lead to increased competition and output. Markups, and eventually profits, should, however, fall as a result of these changes in the market structure. Hence, while there may be more firms and higher output in a market, the margins for each firm shrink and industry value-added may therefore be unaffected or even decrease. Outsourcing, on the other hand, would mean breaking up value added chains. A pattern of constant value added, a larger number of firms, and a higher level of (measured) output can therefore emerge. Some tentative and indirect evidence points toward the latter explanation. To our knowledge, these links between international financial liberalization, outsourcing and competition have not previously been analyzed and this paper is a first attempt to draw attention to these issues.

The literature on the real effects of financial liberalization and integration that this paper relates to is so large that only a partial list can be given here. In a widely cited study, Rodrik (1998) finds no effect of liberalized capital accounts, either on per capita GDP growth rates or the investment to GDP ratio. Using a somewhat different indicator of capital account liberali-

[1] See, for example, the surveys by Eichengreen, 2001, Arteta et al., 2001, and Edison et al., 2002a.
[2] We consider, in turn, the growth rates of real value added, real output, and the number of establishments.

zation, as well as different econometric techniques, both Quinn (1997) and Edwards (2001) find positive growth effects. Edwards qualifies his finding by noting that a certain level of economic development must be reached before an open capital account has positive growth effects. The controversy between Rodrik and Edwards is discussed by Arteta et al. (2001), who argue that it is largely due to the use of different indicators of capital account liberalization. While Rodrik uses the IMF binary indicator, Edwards uses a multi-level index of Quinn (1997) which, according to Arteta et al., also seems to be the more comprehensive of the two. In a recent study, Edison et al. (2002b) use similar set of indicators of international financial liberalization and integration as in our study, and fail to find any effects on aggregate economic growth.

Another branch of the literature focuses on the effects on capital constraints and growth by liberalizing equity markets. Henry (2000a,b) applies an event study approach to his careful classification of economic reforms in eleven developing countries and finds a temporary increase in stock prices and investments following stock market liberalization. Bekaert and Harvey (2000) use a similar approach and find the cost of capital to be somewhat reduced after a stock market liberalization. Using firm level evidence, Chari and Henry (2001) document an increase in firms' capital stocks post liberalization, but cannot confirm that this is due to a lower cost of capital. Using a different methodology to classify liberalization events, Bekaert et al. (2000, 2001) find a temporary increase in per capita growth rates following equity market liberalization. Finally, Harrison et al. (2002) combine firm level and macroeconomic data and find that foreign direct investments ease firms' credit constraints, while capital account restrictions make these constraints more severe. Although this last paper is close in sprit to ours, it uses a completely different methodology. While we assume the industry dependence on external funds to be equal across countries, Harrison et al. calculate a proxy for firm level financial constraints using Euler equations. Although their proxy gives a more precise estimate of a firm's financial position than our indicator of external dependence, it is also subject to more severe endogeneity problems. Hence, the two approaches should be seen as complements rather than substitutes.

2. The Basic Methodology

When countries liberalize their capital accounts and stock markets, the costs of capital to industrial firms are reduced. As shown by Henry (2003), this effect is theoretically based on two

mechanisms: First, investors can after liberalization improve the diversification of their assets by investing in other countries which thereby lowers their required risk premium on the stock of national firms. This effect works through the standard observation that the returns volatility on a national market is higher than the covariance between the national and the world returns. Second, firms can after liberalization attain funding at the lowest interest rates internationally rather than only the lowest rates nationally. At the empirical level, Henry (2000a,b) give ample evidence on that financial liberalization actually reduces the capital costs of industrial firms. Moreover, he shows that this has significantly positive effects on the level of investment and of output growth.

In this study, we exploit the negative relation between financial liberalization and capital costs of firms to analyze the specific question whether industries that are highly dependent on external capital raising grow faster in countries with more liberalized capital accounts and stock markets or, similarly, are more integrated with international capital markets. Rajan and Zingales (1998) ask the related question if industries highly dependent on external financing grow faster in countries with relatively developed financial markets. As the methodology Rajan and Zingales can easily be extended to our focus on the real growth effects of financial liberalization, we employ both their test methodology and basic data set.

The growth definitions in our study are divided on the three different variables: real value added, real output and number of establishments, all measured on industry level. Whereas growth of real value added or of real output are two standard representations of economic growth, growth in number of establishments is less common. It is though highly motivated as the creation of new firms is by many considered to be a crucial source of economic growth and its relation to the cost of capital is also straightforward. Hence, we estimate the following empirical growth relationship,

$$\begin{aligned}(2.1)\quad Growth_{ij} = {} & \beta_1 \left(External\ dependence_i \times Liberalization_j \text{ (or) } Integration_j\right) + \\ & \beta_2 \left(External\ dependence_i \times Financial\ development_j\right) + \\ & \beta_3\ Industry\ share\ in\ 1980_{ij} + \Sigma\ \beta_{4,i}\ D_i + \Sigma\ \beta_{5,j}\ D_j + \varepsilon_{ij},\end{aligned}$$

where i is the industry and j the country subscript. $Growth_{ij}$ is the average annual growth rate over the period 1980–1990 of real value added, the number of establishments or real output. In the analysis below, we examine these three measures separately. *Industry share in 1980*$_{ij}$ is

industry i's share of total value added in manufacturing in country j in 1980, D_i is a set of industry dummies, and D_j a set of country dummies. Our primary variable of interest is the interaction variable between different financial liberalization or integration indicators and the proxies of *external dependence*, an industry measure created by Rajan and Zingales. The liberalization and integration indicators belong to three classes: rule-based indicators on capital account liberalization; rule-based indicators of equity market liberalization; and actual capital market integration as measured by flows and stocks of foreign direct and portfolio investments. The time period of the study, 1980-90, is determined by the measure of external dependence being calculated using 1980's data. Although we would have liked to include data from the 1990s in our analysis, we are aware of the fact external dependence measure, on which the entire approach crucially hinges, seems quite variable over time and hence needs to be updated as often as possible without creating serious inconsistencies in the results.[3] To account for the effect from financial development found by Rajan and Zingales, we also include an interaction variable between the external dependency of industries and the level of *financial development*, measured either as the total amount of stock market capital and credits (total capitalization) or the standard of the account system of each country.

The specification (2.1) means that we are looking for a growth effect of financial liberalization and integration on top of the growth effect of financial development. This is important to keep in mind since a possible channel through which international financial integration can affect growth is by enhancing the performance of the domestic financial sector (see, e.g., Levine and Zervos, 1998, Klein and Olivei, 1999, and Levine, 2001). Throughout the analysis we also split the country sample according to the level of financial development, having one group of countries above and one group below the median level of financial development. The background is the recent findings (e.g., Laeven, 2000; Edwards, 2001) that the impact of financial liberalization on growth may depend on the level of financial development in a country.[4] Basically, this is mainly due to the fact that developed economies are better able to make productive use of new capital inflows than are emerging market economies. There is, however, no broad consensus along these lines and few studies have actually examined this impact.

[3] Rajan and Zingales (1998) compute external dependency measures for 1970 and 1980 and report a correlation between these of approximately 0.75.

[4] Edwards (2001) actually uses income rather than financial development when dividing the sample of countries into high- and low levels. We argue, however, that financial development is a more relevant dimension, since what really counts is the ability to allocate the capital to producers in the economy and not whether the country in general is rich.

As is common in the growth regression framework, there may be potential concerns about the endogeneity of the regressors. It is possible that countries where externally dependent industries were expected to grow rapidly during the 1980s were more prone to liberalize capital movements at the beginning of the decade. Therefore, besides the ordinary least squares, we will also run two-stage regressions in order to instrument for the liberalization indicators. The instruments are described in the following section.

3. Data

Except for data on capital account liberalization, equity market liberalization, international financial integration and industry level output, all other data is thoroughly described by Rajan and Zingales (1998). For this reason, the discussion of these variables and their sources will be kept brief here. The period under consideration is the 1980's, and the data covers a maximum of 42 countries (for the country coverage among different sub-samples, see Table A1).

3.1. Financial dependence

Rajan and Zingales' indicator of industry dependence on external financing is based on the assumptions that there are underlying technological reasons why industries differ in their use of external funds, and that these persist across countries. Furthermore, they note that when financial markets work relatively frictionless, the supply of external financing will be very elastic. Differences in the actual use of external financing in such an economy will hence mainly reflect differences in demand for this type of funding. Arguing that the U.S. financial markets are the most advanced in the world, Rajan and Zingales use data on the actual external financing pattern of U.S. firms to calculate their measure of external dependence. More precisely, their measure is defined as capital expenditures minus the cash flow from operations, divided by capital expenditures. To smooth fluctuations, they use data on the firm's external financing and capital expenditure over a 10-year period. The median value of this calculation is then used to indicate the external dependency for each respective industry.[5]

[5] According to this indicator, drugs and medicines (ISIC 3522) constitute the most externally dependent industry, while the tobacco industry (ISIC 314) is the least so.

3.2. Financial development

Following much of the literature on the impact of the financial sector on growth, we use two different proxies for financial development. Our first indicator is the *total capitalization* measured as the sum of domestic credits and stock market capitalization over GDP. Data on domestic credit is from the IMF *International Financial Statistics* (IFS), and stock market capitalization from IFC's *Emerging Stock Markets Factbook*. In addition, we use the *accounting standards* of a country.[6] This index is constructed by the Center for International Financial Analysis and Research, and rates the annual reports of firms across countries. Focusing on information disclosure, this index proxies for the potential to obtain financing, rather than the actual outcome.

3.3. Liberalization data

As we incorporate indicators of capital account liberalization, equity market liberalization, and actual flows and stocks of international capital flows, we employ data from a variety of sources described below, which all use somewhat different methodologies when calculating their indicators. Here, all rule-based indicators are normalized between zero and one, where zero implies full restriction and one full liberalization according to the respective index. In Table 1, summary statistics and the correlates between the different indices are shown. As can been seen, these correlates are generally quite high.

[Table 1]

3.3.1. Capital account liberalization

The most commonly used indicator of capital account liberalization is based on data from the IMF *Exchange Arrangements and Exchange Restrictions*, which is a qualitative yearly review of the laws that limit the ability of private citizens either to pay or receive payment for economic exchanges with nonresidents. In its simplest form, this indicator can be transformed into a dummy variable reflecting either presence (dummy = 0) or absence (dummy = 1) of restrictions on payments by residents of capital account obligations. Although this is a very crude measure, it will be used for the year 1980 (IMF80) as a starting point for our analysis. If the interaction term between external dependence and IMF80 is positive, this shows that industries highly dependent on external financing experienced a faster subsequent growth in countries where the capital account was open in 1980. As an alternative, this indicator is aver-

[6] The results using accounting standards are available in the appendix.

aged over the 1980's (IMF8090), which means that it measures the proportion of years during the 1980's when the capital account has been classified as open by the IMF.[7] While the IMF-indicators tell us whether a restriction is in place, they have little to say about how severe these restrictions actually are. In an attempt to correct for this shortcoming, Quinn (1997) has constructed an index for several years and a wide cross-section of countries, based on how strict the imposed regulations actually are.[8] Specifically, he discriminates between the severity of taxes or other forms of multiple currency rules regarding cross-border transactions, whether there are laws, such as licenses, with specific quantitative restrictions and to which extent the exchange is associated with the need for authority approval or not. Here, we use the Quinn-index from 1982 (QCAP82) as well as the average between the values from 1982 and 1988 (QCAP8288). The Quinn-indices overlap with the rest of the data for 39 countries.

Which of these indices to use is not evident as Rodrik (1998), using the IMF index, and Edwards (2001), using the Quinn indices, actually reach different conclusions. Arteta et al. (2001) try to evaluate this controversy by testing the quality and consistency of the two indices. They find that the Quinn indices seem more useful and coherent than those of the IMF, although the latter contain a larger sample of countries. All the same, we use both indicators because the underlying issue remains unsolved. As will be seen, our results are basically consistent across these indices.

3.3.2. Equity market liberalization

In order to measure equity market liberalization, we first follow the classification in Bekaert et al. (2001). This indicator takes the value of one if equity markets are officially liberalized for foreign investors at a certain date, and zero otherwise. BHL80 thus indicates the policies in place in 1980, while BHL8090 is the proportion of years between 1980 and 1990 that equity markets were officially liberalized. These indicators are available for our full set of countries. Our second indicator is from Kaminsky and Schmukler (2001), who have constructed a database that attempts to take into account both different aspects of the liberalization process and the severity of the restrictions in place. Here, we use their index of stock market liberalization (KSSTOCK80 and KSSTOCK8090) which relates to the acquisition of shares in the

[7] Similar indicators have been used by, for example Alesina et al. (1994) in a study of the determinants of capital controls, and Rodrik (1998) in a study on how capital controls affect growth, inflation and investments.
[8] Using the Quinn index of capital account restrictions, Edwards (2001) finds that an open capital account spurs aggregate economics growth.

domestic market by foreigners, the repatriation of capital, and the repatriation of interest and dividends. Unfortunately, these indices only overlap with the rest of the data for 22 countries.

3.3.3. Integration data

Measuring capital market integration is a well-known difficulty and several candidate measures are proposed in the literature, all carrying specific pros and cons. In this study, we consider capital flows and stocks relative to the GDP of each country. The focus is mainly on the effects of capital flows but Lane and Milesi-Feretti (2001) argue that stocks of capital constitute a measure alleviating some of the problems often associated with flow data, such as sharp fluctuations across short periods. Recognizing this point, we include both estimates of capital stocks (with the variable name CAPSTOCK) and flows (CAPFLOW) to achieve as complete a picture as possible. Specifically, we use stocks and flows of inward and outward direct investments and portfolio assets and liabilities as a share of GDP, calculated as annual averages over the period 1980-90 and using data from Lane and Milesi-Feretti (2001) for stock and the IFS for flows. As always when using data on cross-country investments, the measures should be treated with great caution since the choice of calculation methods may be important.[9]

3.3.4. Instruments

As reported above, we will run instrumental variables (IV) estimations parallel to the ordinary least squares regressions in order to check for the potential reversed causality. As the instruments should be highly correlated with the exogenous variables but not with the endogenous variable, we take lagged index values for the various liberalization indexes. Specifically, for IMF80, we use the IMF indicator value of 1970 and the QCAP of the years 1958 and 1973. Similarly, QCAP82 is instrumented with its lagged values from 1958 and 1973 and BHL80 and KSSTOCK80 are both instrumented with the Quinn capital account indexes from 1958 and 1973 as well as the Quinn (1997) indicator of both capital and current account regulation from the years 1958 and 1973. CAPSTOCK and CAPFLOW are instrumented with the country area (in square kilometers), population size in §1980, total trade in 1975 and government spending in 1975, respectively, as shares of GDP. These data are from the World Bank's *World Development Indicators* (World Bank).

[9] For example, it could be of importance whether the investments are counted at market or book value, at which time of the year this is done, and in which of the two countries the valuation is done.

3.5. Industry data

The industry data is from the UN's *Industrial Statistics Yearbook* and covers manufacturing firms at the three- or four-digit ISIC-level. From Rajan and Zingales's data set, we get data on growth in value added and the number of establishments, or firm creation.[10] As a complementtary measure of economic growth, we introduce growth in real output published in the *Industrial Statistics Yearbook* (and the more recent *International Yearbook of Industrial Statistics*) as output in nominal producer prices. To deflate the output, we follow the procedures of Rajan and Zingales (1998) to make the data comparable. This means that the Producer Price Index (PPI) is the prime deflator and for countries where no such index is available, an effective deflator is computed by dividing the growth in nominal output for the entire manufacturing industry (ISIC 300) by the index of industrial production, taken from the IFS statistics. For Jamaica and Turkey neither an index of production nor a PPI are available and we have thus used the Consumer Price Index to deflate the nominal output growth. In the case of Brazil, none of these procedures could produce a satisfactory deflator, mainly due to the extreme inflation and a large number of devaluations in Brazil during the 1980s.

4. Results

The results are presented using *total capitalization* as the measure of financial development. In the Appendix, however, we present all the parallel regressions where *accounting standards* have instead been used. On the whole, the results are stronger when we use total capitalization, although the other measure does not contradict the presented findings. We do not report the results for the indicators representing multi-year averages (IMF8090, QCAP8288, BHL8090 and KSSTOCK8090), since they produce practically identical result as the respective initial year indices. Throughout, OLS-estimates and IV-estimates are reported, together with a set of diagnostic tests. First, a Hausman test of exogeneity tests whether the IV and OLS estimates differ significantly and hence if instrumenting would be necessary in the first place.[11] Second, an F-test shows whether the instruments explain a great deal of the variation in the instrumented variable, which is desirable. Finally, a Sargan-test of overidentifying restrictions shows whether the instruments have an impact of their own on the dependent variable, which is not desirable.

[10] Establishments can principally be treated as firms, although in some cases the collected data underlying the ISY variable was not sufficiently legally strictly defined to eliminate the possibility that establishments are not "plants within one firm".

[11] To be precise, our version of the Hausman test was actually proposed by Davidson-MacKinnon (1993).

4.1. Effects on growth in value added

Here, we analyze how the liberalization of international capital movements and the integration of capital markets affect industry growth in value added, i.e. the industry-level equivalent to GDP growth, according to equation (2.1).

[Table 2]

Table 2 reports the first set of our results. Liberalizing capital accounts does not seem to have any direct effects on industry growth in value added. None of the liberalization and integration indicators, interacted with the external dependency measure, produce significant results in either the OLS or the IV regressions. This is also true for the indicators of equity market liberalization and capital market integration.[12] Another finding is that the strong connection between the level of financial development and growth in value-added, originally suggested by Rajan and Zingales (1998), is robust to controlling for financial liberalization and integration, as shown by the positive and significant coefficients of the interaction between external dependency and financial development.

In table 3, we test the hypothesis that the level of financial development is of importance for the effect of liberalization and integration on growth. This is done by splitting the sample of countries with respect to the median value of the two measures of financial development.[13] Once more, there seem to be practically no growth effects of financial liberalization or capital market integration except in one single case (KSSTOCK80).[14] The results hence contradict the evidence of Laeven (2000), suggesting a positive correlation between financial liberalization and growth, given a relatively high level of financial development.

[Table 3 here]

[12] The possible exception is the IV result of BHL80, which is weakly significant at the 10-percent level.

[13] As an alternative approach, we have run regressions with dummy variables for low, medium, and high financial development interacted with the interaction term between financial liberalization and external dependence. The results from this exercise are similar to those presented here.

[14] CAPSTOCK has a positive significant sign in the OLS regression, but an insignificant sign in the IV and since the Hausman test indicates endogeneity, we focus on the IV-results.

4.2. Effects on firm creation

Table 4 reports the results of our tests for a link between financial liberalization as well as financial integration and growth in the number of firms, or firm creation, within industries highly dependent on external financing. Neither liberalization nor integration categories produce significant coefficient estimates consistent across both the OLS and IV specifications. For IMF80 and the two integrations measures, CAPSTOCK and CAPFLOW, the OLS estimates are positive and significant, but the IV estimates are not. According to the diagnostic tests reported, the IV-estimates should be followed.

[Table 4]

In table 5, we have split the sample into two groups of countries, either above or below the median level of financial development. The picture is now somewhat different. In countries with a "high" level of financial development there are strong effects on firm creation within industries dependent on external financing. This result holds for most liberalization indicators across both the OLS and the IV specifications. The integration variables only produce positive significant coefficients in the OLS regressions, but since the diagnostic tests (especially Hausman) do not suggest any statistical endogeneity, these results can be accepted all the same. Some potential concerns could be raised when the Sargan tests of overidentifying restrictions are checked, but since the Hausman tests do not indicate that IV regressions are necessary, the positive and significant OLS estimators should suffice for the results to be consistent.

The results seem to stand out clearer when total capitalization rather than accounting standards is used as a proxy for financial development. One interpretation of this diversity is that the different dimensions of financial development really do measure different aspects of the financial system. Whereas accounting standards primarily reflect the quality of information disclosure and investor protection, total capitalization directly corresponds to the size of markets for equity and bank borrowing. To make new foreign capital inflows help new projects and startups overcome some financing constraints, a well-established system of corporate financing might hence be required.

In a more general sense, these findings suggest that more accessible foreign funding helps cash-constrained entrepreneurs active in industries relatively dependent on external financing

to establish new firms. Naturally, we cannot tell whether they use the foreign funding directly or that the domestic creditors become keener on investing in new firms, but the final effect is the same. In essence, this result confirms the findings of Laeven (2000) that small firms benefited more from financial liberalization than did large firms since the latter had access to preferential credit already in the closed system due to favoritism and personal connections.

[Table 5]

4.3. Effects on growth in output

In the final set of regressions, reported in tables 6 and 7, we test whether financial liberalization and integration have any effect on real growth in output in externally dependent industries. As before, the full sample results (reported in table 6) contain no significant coefficients for our parameter of interest, except in the case of BHL80, which is positive and significant. There may hence prevail some positive effects on production after liberalizing equity markets, but not after capital account liberalization or as a result of being integrated in global capital markets.

[Table 6]

When splitting the sample into two according to the level of financial development, as reported in table 7, we once more obtain different results than in the full sample case. It is clear that the growth in real output is boosted by the financial liberalization in countries with relatively well-developed financial markets, regardless if this is measured by accounting standards or total capitalization or whether OLS or IV estimators are used. BHL80 once more fails to generate significant positive results for the high-development group. The effect on total output – also a relevant welfare indicator – can be linked to the expansion in the number of firms.

[Table 7]

4.4. Summing up: a competition or an outsourcing effect?

Altogether, considering the results reported in Tables 2-7, it seems that for countries at a relatively high level of financial development, there is a clear firm-creation effect from international financial liberalization (Table 5), that translates into a growth effect in output (Table 7),

but not into any such effects on the growth of real value added (Table 3). We have not seen any results in previous research pointing in this direction and thus, they are somewhat unexpected and our interpretations are preliminary and tentative.

One explanation consistent with the results presented here is a *competition effect*. Financial liberalization spurs firm creation. Basic IO-theory teaches us that when new firms enter a market this generally means an increase in competition and aggregate output. Markups, and eventually profits, can decrease for incumbent firms on that market. Hence, while there may be more firms on a market, the margins for each firm shrink and industry value-added may be unaffected or even decrease.[15]

Our findings could also be interpreted from the perspective of industrial vertical disintegration and corporate *outsourcing*. The basic argument would then be as follows. When financial markets become more liberalized, this reduces the costs for firms and entrepreneurs of finding financiers. These reduced capital costs for start-ups and corporate expansions, in turn, influence the choices of existing firms when it comes to considering outsourcing parts of their production to other units. Outsourcing has become less costly and, *ceteris paribus*, therefore more likely. Outsourcing can yield the observed pattern by breaking up value added chains.

To make the outsourcing argument more clear, consider the following two-period example. In period 1, an industry consists of a single firm producing 100 units of final goods. For this purpose, it first produces 50 intermediate inputs, using zero inputs, and then 100 units of final goods, using these intermediate inputs. For the industry, the firm hence creates a value-added of 100. In the second period, this firm decides to outsource its intermediate production to another firm. A subsidiary firm is set up to produce the 50 units of intermediate inputs that are delivered to the final good producer for its production of the 100 units of final goods. The final good producer has a production of 100 units of final goods but only a value-added of 50, since it uses 50 units of "external" inputs. The subsidiary produces 50 units, which is also its value-added. The growth in value-added between period 1 and 2 is therefore zero, but the growth in (measured) output is 50. Further, there is a growth in number of firms. Hence, this simple outsourcing example closely replicates our findings.[16]

[15] Rajan and Zingales (2003) propose an "interest group" theory of financial development where incumbents oppose financial development and deregulation because it breeds competition. The theory predicts that the incumbents' opposition will be weaker when an economy allows both cross-border trade and capital flows.
[16] Note that outsourcing only yields our pattern of results if it mainly takes place *within* an industry.

Given the data at our disposal, we cannot perform a direct test that discriminates between the two hypotheses put forward here. If, however, price increases are relatively low in sectors where firm creation is high, this yields some, albeit weak, support for the competition hypotheses. In order to recover industry level price series, we need data on value added (or output) in both current and constant prices. These data are not available in the UN *ISY*-database, but do exist for a subset of countries in the *STAN*-database from the OECD (OECD, 1998).[17] To compute the change in producer prices between 1980 and 1990 for each ISIC industry we extract industry price series by dividing value added in current prices by value added in constant prices. The price changes for the 1980's (in percent) are then regressed on the growth rates of firm creation and a set of industry and country dummies.

As can be seen in column 1 of Table 8, there is a positive and statistically significant partial correlation between firm creation and price increases. Since firm creation and increasing prices are expected to go hand in hand if, for example, demand is increasing, we control for growth in value added in the second column. This does not affect the result. In columns 3 and 4, only countries with above median values of total capitalization are included. When not controlling for growth in value added, the positive correlation remains in this subsample, but firm creation is insignificant in the final specification.

[Table 8]

The results in Table 8 point towards an explanation based on outsourcing rather than increased competition. It is important to note, however, that this is an interpretation based on an indirect test at the industry-level. Actual outsourcing decisions are carried out on the firm-level. To fully analyze the question, we would need more detailed data.

Much of the previous research on explaining the observed increase in global outsourcing in recent decades has primarily focused on technology enhancements and improved contracting environments (see, e.g., Carlsson, 1999; Grossman and Helpman, 2002). Our finding on improved financing opportunities through international financial liberalization hence suggests a

[17] The countries for which the data overlaps are Austria, Canada, Finland, France, Germany, Greece, Italy, Korea, Mexico, Netherlands, Norway, Portugal, Spain, Sweden, UK, USA. The positive growth effects on output holds in some and the positive growth effects on firm creation holds in most specifications for this sample of countries when total capitalization is above the median value (results available upon request).

partly new research agenda on the links between international financial liberalization and economic development.

6. Conclusions

This paper investigates the growth effects of international financial liberalization and integration. While previous work has mainly approached this problem by considering aggregate growth rates, our paper analyzes the growth effects at the industry level, using the data and methodology developed by Rajan and Zingales (1998).

The results are both interesting and somewhat puzzling. The main result is that industries highly dependent on external financing do not experience a higher growth in value added among countries with liberalized capital accounts or equity markets. The same result holds for countries more integrated with the international capital market in terms of actual capital flows and stocks. Although it is plausible that the growth effects of financial liberalization and integration differ between countries at different levels of financial development, we cannot find any results pointing in this direction. We do, however, find significant positive effects of liberalizing capital accounts and equity markets on the creation of new firms and growth in output – given that countries have relatively well developed financial markets.[18] Hence, there may be growth effects of financial liberalization other than in value added. In a dynamic perspective, accelerated firm growth is important for a functioning creative destruction and thereby also for sustained long run economic development.

Increased competition provides a straightforward explanation of this pattern of results. Financial liberalization stimulates firm creation, which increases competition and output. Value added, on the other hand, does not necessarily increase since the prices of final goods fall. A second potential explanation is based on outsourcing. If the setting up of new plants is made less expensive by the liberalization of financial markets, firms become more inclined to outsource the parts of their production. Since outsourcing means breaking up value added chains, it could result in a pattern of increased firm creation, increased measured output and zero growth in value added. The results on an outsourcing and/or competition effect following financial liberalization and integration open up a new research agenda. Some tentative evidence

[18] It should be noted that the results are somewhat dependent on how financial development is measured. The results using *accounting standards* are weaker than when *total capitalization* is used.

point towards an explanation based on outsourcing rather than increased competition, but to fully analyze the question more research is needed.

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Table 1. Summary statistics and correlates

	IMF-80	IMF-8090	QCAP-82	QCAP-8288	BHL-80	BHL-8090	KSSTOCK-80	KSSTOCK-8090	CAPSTOCK	CAPFLOW	TOTCAP	ACCSTAN
IMF8090	0.82	1										
	(0.00)											
QCAP82	0.53	0.68	1									
	(0.00)	(0.00)										
QCAP8288	0.44	0.66	0.96	1								
	(0.00)	(0.00)	(0.00)									
BHL80	0.20	0.39	0.71	0.76	1							
	(0.00)	(0.00)	(0.00)	(0.00)								
BHL8090	0.24	0.47	0.74	0.82	0.94	1						
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)							
KSSTOCK80	0.15	0.27	0.74	0.76	0.63	0.62	1					
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)						
KSSTOCK8090	0.16	0.35	0.74	0.80	0.64	0.72	0.95	1				
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)					
CAPSTOCK	0.28	0.35	0.41	0.42	0.44	0.37	0.34	0.31	1			
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)				
CAPFLOW	0.46	0.63	0.67	0.69	0.61	0.65	0.47	0.59	0.56	1		
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)			
TOTCAP	0.18	0.36	0.46	0.49	0.36	0.46	0.42	0.62	0.02	0.55	1	
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.48)	(0.00)		
ACCSTAN	0.13	0.39	0.42	0.50	0.56	0.58	0.40	0.47	0.21	0.47	0.41	1
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	
# Obs	42	42	39	39	42	42	22	22	39	41	41	33
Mean	0.31	0.28	0.52	0.56	0.31	0.38	0.47	0.56	0.76	0.03	0.72	61.44
Std. Dev.	0.46	0.41	0.23	0.24	0.46	0.44	0.46	0.40	0.50	0.03	0.37	13.44

Note and source: IMF80 and IMF8090 are the IMF indicators of an open capital account, for 1980 and the average between 1980-1990. QCAP82 and QCAP8288 are the Quinn (1997) indicators of financial liberalization in the year 1982, and the average of the 1982 and 1988 values. BHL80 and BHL 8090 and KSSTOCK80 and KSSTOCK8090 are, respectively, the Bekeart et al. (2001) and Kaminsky and Schumkler (2001) indicators of equity market liberalization. CAPSTOCK is the average of the sum of the stock of inward and outward direct investment and the stock of portfolio equity and portfolio debt assets and liabilities, as share of GDP over the period 1980-90, taken from Lane and Milesi-Feretti (2001). CAPFLOW are the equivalent figures but on flows instead of stocks, collected from the IFS. ACCSTAN = Accounting standards, an index of the quality of each country's information disclosure rules. TOTCAP = Total capitalization, the sum of domestic credits and stock market capitalization, divided by GDP. P-values are in parentheses.

Table 2: Growth in value added, measures of financial liberalization and integration. Full sample.

	Capital account liberalization measured as:				Stock market liberalization measured as:				Capital market integration measured as:			
	IMF80		QCAP82		BHL80		KSSTOCK		CAPSTOCK		CAPFLOW	
	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Industry share	–0.952***	–0.580***	–0.584***	–0.577***	–0.963***	–0.606***	–0.622***	–0.625**	–0.585***	–0.587***	–0.951***	–0.959***
	(0.251)	(0.149)	(0.151)	(0.146)	(0.250)	(0.148)	(0.290)	(0.278)	(0.155)	(0.154)	(0.230)	(0.254)
Ext. Dep. ×	0.071***	0.051***	0.049**	0.053*	0.066***	0.044**	0.040**	0.038*	0.052***	0.052***	0.065**	0.060**
Total capitalization.	(0.024)	(0.019)	(0.025)	(0.029)	(0.025)	(0.016)	(0.020)	(0.020)	(0.018)	(0.018)	(0.029)	(0.026)
Ext. Dep. × IMF80	0.006	0.002										
	(0.014)	(0.014)										
Ext. Dep. × QCAP82			0.010	–0.003								
			(0.034)	(0.053)								
Ext. Dep. × BHL80					0.017	0.023*						
					(0.013)	(0.013)						
Ext. Dep. × KSSTOCK							0.007	0.011				
							(0.011)	(0.016)				
Ext. Dep. × CAPSTOCK									0.009	0.011		
									(0.008)	(0.029)		
Ext. Dep. × CAPFLOW											0.167	0.296
											(0.321)	(0.456)
F-test (p-value)		419 (0.00)		371 (0.00)		368 (0.00)		188 (0.00)		36 (0.00)		79 (0.00)
Sargan-test (p-value)		0.27 (0.87)		0.12 (0.73)		2.20 (0.53)		6.37 (0.09)		3.69 (0.30)		4.98 (0.17)
Hausman-test (p-value)		0.01 (0.90)		0.13 (0.72)		1.13 (0.29)		0.10 (0.75)		0.01 (0.94)		0.05 (0.82)
No. of observations	1152	1106	1106	1106	1152	1106	666	666	1106	1106	1116	1116
R^2	0.29	0.33	0.33	0.33	0.29	0.33	0.40	0.41	0.33	0.33	0.28	0.28

Note: *** indicates significance at the 1-percent level, ** at the 5-percent level, * at the 10-percent level. The dependent variable is the annual compounded growth rate in real value added for the period 1980–90 for each ISIC industry in each country. "Industry share" is each industry's share of total value added in manufacturing within each country in 1980. "Ext. Dep." is a proxy for external financial dependence from Rajan and Zingales (1998), described in the text. The other variables are described in Table 1 and instruments used in the IV-estimations are reported in the text. Country- and industry fixed effects are not included in the table. F-test of excluded instruments, Sargan-test of overidentifying restrictions and Hausman (or Davidson-MacKinnon) test of exogeneity of the regressors. Heteroskedasticity robust standard errors are in parentheses.

Table 3: Growth in value added, financial liberalization and integration. Split sample.

Indicator of Fin.lib. or integration	Level of Fin.dev.	Model	Industry share	Ext.dep × Fin.dev.	Ext.dep × Fin.lib.or integration	Diagnostic tests: Haus-man	F	Sargan	N	R^2
IMF80	High	OLS	–0.434** (0.191)	0.064** (0.033)	0.008 (0.018)				622	0.31
		IV	–0.450** (0.181)	0.056 (0.034)	0.019 (0.023)	0.78 (0.38)	137 (0.00)	1.71 (0.43)	622	0.31
	Low	OLS	–1.417*** (0.363)	0.230* (0.119)	0.010 (0.029)				530	0.34
		IV	–0.850*** (0.250)	0.110 (0.070)	–0.011 (0.025)	0.01 (0.94)	663 (0.00)	0.41 (0.93)	484	0.39
QCAP82	High	OLS	–0.434** (0.187)	0.068** (0.029)	0.011 (0.047)				622	0.31
		IV	–0.451*** (0.175)	0.065** (0.030)	0.032 (0.076)	0.22 (0.64)	203 (0.00)	0.55 (0.46)	622	0.31
	Low	OLS	–0.861*** (0.271)	0.119* (0.065)	0.039 (0.048)				484	0.39
		IV	–0.846*** (0.252)	0.126** (0.061)	–0.025 (0.084)	0.75 (0.39)	195 (0.00)	0.11 (0.74)	484	0.39
BHL80	High	OLS	–0.431** (0.192)	0.070*** (0.025)	0.003 (0.015)				622	0.31
		IV	–0.457** (0.190)	0.072*** (0.025)	0.016 (0.011)	1.34 (0.25)	340 (0.00)	6.15 (0.10)	622	0.31
	Low	OLS	–1.427*** (0.362)	0.046*** (0.015)	0.038 (0.023)				530	0.34
		IV	–0.868*** (0.252)	0.074 (0.080)	0.039 (0.032)	0.03 (0.87)	147 (0.00)	2.86 (0.41)	484	0.40
KS-STOCK80	High	OLS	–0.416** (0.206)	0.051* (0.031)	0.030** (0.012)				368	0.49
		IV	–0.418** (0.192)	0.052* (0.031)	0.031** (0.014)	0.02 (0.90)	171 (0.00)	3.86 (0.28)	368	0.49
	Low	OLS	–1.067* (0.578)	0.204*** (0.071)	–0.007 (0.025)				298	0.43
		IV	–1.076** (0.531)	0.204*** (0.066)	–0.007 (0.033)	0.00 (0.98)	932 (0.00)	0.28 (0.96)	298	0.43

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Table 3 (continued)

Indicator of Fin.lib. or integration	Level of Fin.dev.	Model	Industry share	Ext.dep × Fin.dev.	Ext.dep × Fin.lib.or integration	Diagnostic tests: Haus-man	F	Sargan	N	R^2
CAP-STOCK	High	OLS	−0.450** (0.204)	0.080*** (0.029)	0.017* (0.009)				622	0.32
		IV	−0.400** (0.189)	0.058** (0.025)	−0.017 (0.016)	3.85 (0.05)	81 (0.00)	2.03 (0.57)	622	0.30
	Low	OLS	−0.850*** (0.266)	0.132** (0.066)	−0.017 (0.037)				484	0.39
		IV	−0.100 (0.162)	0.185*** (0.057)	0.027 (0.020)	0.93 (0.34)	140 (0.00)	3.62 (0.16)		0.48
CAP-FLOW	High	OLS	−0.420** (0.188)	0.071** (0.022)	−0.037 (0.345)				622	0.31
		IV	−0.403** (0.189)	0.058** (0.024)	−0.017 (0.026)	0.31 (0.58)	208 (0.00)	2.69 (0.44)	622	0.31
	Low	OLS	−1.446*** (0.391)	0.201** (0.101)	0.571 (0.582)				494	0.21
		IV	−1.463*** (0.371)	0.118 (0.074)	2.274 (1.642)	1.47 (0.23)	72 (0.00)	2.59 (0.46)	494	0.33

Note: *** indicates significance at the 1-percent level, ** at the 5-percent level, * at the 10-percent level. The dependent variable is the annual compounded growth rate in the number of establishments for the period 1980–90 for each ISIC industry in each country. "Fin.lib." represents the liberalization-indicator of either the capital account or the stock market. "Fin.dev." is financial development as measured by total capitalization. See Table 2 for a description of the rest of the variables. "High" ("Low") financial development refers to countries with above (below) median total capitalization. Heteroskedasticity robust standard errors are in parentheses, except for the diagnostic tests where p-values are reported.

Table 4: Firm creation, measures of financial liberalization and integration, Full sample.

	Capital account liberalization measured as:				Stock market liberalization measured as:				Capital market integration measured as:			
	IMF80		QCAP82		BHL80		KSSTOCK		CAPSTOCK		CAPFLOW	
	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Industry share	–0.264*	–0.374***	–0.380***	–0.384***	–0.257*	–0.378***	–0.192	–0.198	–0.365**	–0.356***	–0.268*	–0.226
	(0.152)	(0.139)	(0.189)	(0.142)	(0.153)	(0.139)	(0.151)	(0.143)	(0.144)	(0.138)	(0.161)	(0.151)
Ext. Dep. ×	0.022*	0.022*	0.015	0.013	0.027**	0.020	0.042**	0.038*	0.025**	0.029**	0.014	0.052*
Total capitalization.	(0.016)	(0.012)	(0.014)	(0.015)	(0.013)	(0.013)	(0.020)	(0.018)	(0.012)	(0.012)	(0.015)	(0.029)
Ext. Dep. × IMF80	0.021**	0.013										
	(0.010)	(0.012)										
Ext. Dep. × QCAP82			0.034	0.042								
			(0.021)	(0.034)								
Ext. Dep. × BHL80					0.009	0.016						
					(0.009)	(0.012)						
Ext. Dep. × KSSTOCK							0.003	0.015				
							(0.010)	(0.014)				
Ext. Dep. × CAPSTOCK									0.013*	–0.032		
									(0.007)	(0.021)		
Ext. Dep. × CAPFLOW											0.333**	–0.441
											(0.166)	(0.445)
F-test (p-value)		322 (0.00)		300 (0.00)		304 (0.00)		157 (0.00)		30 (0.00)		52 (0.00)
Sargan-test (p-value)		0.54 (0.76)		0.01 (0.91)		3.63 (0.30)		3.92 (0.27)		8.34 (0.04)		5.52 (0.14)
Hausman-test (p-value)		1.09 (0.30)		0.06 (0.81)		0.31 (0.58)		0.80 (0.37)		3.55 (0.06)		2.72 (0.10)
No. of observations	1034	986	986	986	1034	732	598	598	986	986	998	998
R^2	0.46	0.47	0.47	0.47	0.45	0.47	0.47	0.47	0.47	0.46	0.46	0.45

Note: *** indicates significance at the 1-percent level, ** at the 5-percent level, * at the 10-percent level.The dependent variable is the annual compounded growth rate in real output for the period 1980–90 for each ISIC industry in each country. See Table 2 for a description of the rest of the variables. Heteroskedasticity robust standard errors are in parentheses, except for the diagnostic tests where p-values are reported.

Table 5: Firm creation, financial liberalization and integration. Split sample.

Indicator of Fin.lib. or integration	Level of Fin.dev.	Model	Industry share	Ext.dep × Fin.dev.	Ext.dep × Fin.lib.or integration	Diagnostic tests: Haus-man	F	Sargan	N	R^2
IMF80	High	OLS	–0.388	0.006	0.039***				530	0.33
			(0.264)	(0.018)	(0.013)					
		IV	–0.410	–0.010	0.057***	2.49	112	5.91	530	0.33
			(0.253)	(0.020)	(0.019)	(0.11)	(0.00)	(0.05)		
	Low	OLS	–0.100	0.185***	0.027				504	0.54
			(0.162)	(0.057)	(0.020)					
		IV	–0.273**	0.207***	0.042	1.62	394	7.85	456	0.57
			(0.136)	(0.063)	(0.027)	(0.20)	(0.00)	(0.02)		
QCAP82	High	OLS	–0.404	0.025	0.065**				530	0.32
			(0.274)	(0.018)	(0.029)					
		IV	–0.506*	0.003	0.173***	4.31	115	2.64	530	0.31
			(0.265)	(0.018)	(0.055)	(0.04)	(0.00)	(0.10)		
	Low	OLS	–0.268*	0.146***	0.003				456	0.57
			(0.153)	(0.047)	(0.034)					
		IV	–0.272**	0.143***	0.012	0.15	333	7.88	456	0.57
			(0.136)	(0.045)	(0.045)	(0.70)	(0.00)	(0.01)		
BHL80	High	OLS	–0.366	0.039**	0.012				530	0.32
			(0.271)	(0.016)	(0.011)					
		IV	–0.388	0.039**	0.023**	1.44	257	7.49	530	0.32
			(0.252)	(0.016)	(0.011)	(0.23)	(0.00)	(0.06)		
	Low	OLS	–0.098	0.168***	–0.008				504	0.54
			(0.161)	(0.053)	(0.015)					
		IV	–0.235*	0.219***	–0.063*	4.52	141	5.06	456	0.56
			(0.133)	(0.073)	(0.033)	(0.03)	(0.00)	(0.16)		
KS-STOCK80	High	OLS	0.188	0.057	0.036***				312	0.47
			(0.248)	(0.038)	(0.014)					
		IV	0.175	0.059	0.042***	0.60	176	1.41	312	0.47
			(0.228)	(0.036)	(0.017)	(0.44)	(0.00)	(0.70)		
	Low	OLS	–0.286	0.146***	–0.044*				286	0.49
			(0.226)	(0.051)	(0.026)					
		IV	–0.286	0.147***	–0.043*	0.01	1091	6.55	286	0.49
			(0.207)	(0.046)	(0.022)	(0.92)	(0.00)	(0.09)		

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Table 5 (continued)

Indicator of Fin.lib. or integration	Level of Fin.dev.	Model	Industry share	Ext.dep × Fin.dev.	Ext.dep × Fin.lib.or integration	Diagnostic tests: Haus-man	F	Sargan	N	R^2
CAP-STOCK	High	OLS	–0.358 (0.263)	0.047*** (0.016)	0.014** (0.007)				530	0.32
		IV	–0.352 (0.253)	0.044*** (0.014)	0.010 (0.012)	0.29 (0.59)	95 (0.00)	1.67 (0.64)	530	0.32
	Low	OLS	–0.269 (0.143)	0.130 (0.046)	0.027 (0.023)				456	0.57
		IV	–0.269** (0.134)	0.129*** (0.044)	0.029 (0.024)	0.02 (0.88)	333 (0.00)	8.71 (0.04)	456	0.57
CAP-FLOW	High	OLS	–0.392 (0.274)	0.018 (0.021)	0.389* (0.212)				530	0.32
		IV	–0.357 (0.259)	0.033 (0.023)	0.116 (0.244)	2.28 (0.13)	153 (0.00)	1.98 (0.58)	530	0.32
	Low	OLS	–0.073 (0.168)	0.160*** (0.050)	0.036 (0.346)				468	0.54
		IV	–0.081 (0.162)	0.119** (0.049)	0.733 (0.644)	1.88 (0.17)	85 (0.00)	8.81 (0.03)	468	0.54

Note: *** indicates significance at the 1-percent level, ** at the 5-percent level, * at the 10-percent level. The dependent variable is the annual compounded growth rate in the number of establishments for the period 1980–90 for each ISIC industry in each country. See Tables 2 and 3 for a description of the other variables. "High" ("Low") financial development refers to countries with above (below) median total capitalization. Heteroskedasticity robust standard errors are in parentheses, except for the diagnostic tests where p-values are reported.

Table 6: Growth in output, financial liberalization and integration. Full sample.

	Capital account liberalization measured as:				Stock market liberalization measured as:				Capital market integration measured as:			
	IMF80		QCAP82		BHL80		KSSTOCK		CAPSTOCK		CAPFLOW	
	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Industry share	–0.328***	–0.356***	–0.359***	–0.365***	–0.330***	–0.365***	–0.416***	–0.421***	–0.346***	–0.343***	–0.332***	–0.324***
	(0.173)	(0.075)	(0.077)	(0.076)	(0.072)	(0.976)	(0.124)	(0.121)	(0.079)	(0.073)	(0.074)	(0.072)
Ext. Dep. ×	0.045***	0.053***	0.049***	0.040***	0.044***	0.045***	0.067***	0.061***	0.052***	0.054***	0.037***	0.057***
Total capitalization.	(0.013)	(0.012)	(0.014)	(0.013)	(0.014)	(0.012)	(0.021)	(0.018)	(0.013)	(0.012)	(0.014)	(0.018)
Ext. Dep. × IMF80	0.005	0.003										
	(0.009)	(0.010)										
Ext. Dep. × QCAP82			0.057	0.049								
			(0.020)	(0.031)								
Ext. Dep. × BHL80					0.005	0.022**						
					(0.009)	(0.011)						
Ext. Dep. × KSSTOCK							0.011	0.024				
							(0.010)	(0.016)				
Ext. Dep. × CAPSTOCK									0.003	–0.019		
									(0.006)	(0.015)		
Ext. Dep. × CAPFLOW											0.222*	–0.212
											(0.135)	(0.290)
F-test (p-value)		444 (0.00)		420 (0.00)		361 (0.00)		159 (0.00)		82 (0.00)		92 (0.00)
Sargan-test (p-value)		4.79 (0.09)		1.98 (0.16)		5.12 (0.16)		12.5 (0.01)		2.01 (0.57)		2.78 (0.42)
Hausman-test (p-value)		0.31 (0.57)		1.38 (0.24)		3.23 (0.07)		3.23 (0.07)		2.91 (0.08)		2.83 (0.09)
No. of observations	1223	1154	1154	1154	1223	1154	674	674	1165	1165	1187	1187
R^2	0.44	0.50	0.50	0.50	0.44	0.50	0.60	0.60	0.50	0.50	0.44	0.44

Note: *** indicates significance at the 1-percent level, ** at the 5-percent level, * at the 10-percent level. The dependent variable is the annual compounded growth rate in real output for the period 1980–90 for each ISIC industry in each country. See Table 2 for a description of the other variables. Heteroskedasticity robust standard errors are in parentheses, except for the diagnostic tests where p-values are reported.

Table 7: Growth in output, financial liberalization and integration. Split sample.

Indicator of Fin.lib. or integration	Level of Fin.dev.	Model	Industry share	Ext.dep × Fin.dev.	Ext.dep × Fin.lib.or integration	Diagnostic tests: Haus-man	F	Sargan	N	R^2
IMF80	High	OLS	–0.511*** (0.131)	0.046** (0.019)	0.034*** (0.013)				635	0.43
		IV	–0.514*** (0.215)	0.039** (0.018)	0.044*** (0.017)	0.93 (0.34)	140 (0.00)	3.62 (0.16)	635	0.43
	Low	OLS	–0.264*** (0.080)	0.121** (0.060)	–0.015 (0.017)				588	0.47
		IV	–0.283 (0.084)	0.177*** (0.055)	–0.003 (0.016)	0.00 (0.99)	583 (0.00)	2.34 (0.31)	519	0.57
QCAP82	High	OLS	–0.520*** (0.131)	0.065*** (0.019)	0.045* (0.025)				635	0.43
		IV	–0.554** (0.131)	0.055*** (0.018)	0.120*** (0.044)	2.52 (0.11)	186 (0.00)	0.50 (0.48)	635	0.42
	Low	OLS	–0.286*** (0.089)	0.184*** (0.050)	0.036 (0.038)				519	0.57
		IV	–0.288*** (0.084)	0.186*** (0.048)	0.060 (0.051)	0.37 (0.54)	233 (0.00)	0.93 (0.33)	519	0.57
BHL80	High	OLS	–0.520*** (0.131)	0.071*** (0.019)	0.002 (0.011)				635	0.42
		IV	–0.520*** (0.127)	0.074*** (0.019)	0.016 (0.010)	2.61 (0.11)	349 (0.00)	6.57 (0.09)	635	0.42
	Low	OLS	–0.267*** (0.080)	0.111* (0.058)	0.026 (0.019)				588	0.47
		IV	–0.285*** (0.083)	0.136*** (0.052)	0.043* (0.024)	1.34 (0.25)	180 (0.00)	1.33 (0.73)	519	0.57
KS-STOCK80	High	OLS	–0.519** (0.214)	0.111*** (0.043)	0.036*** (0.013)				366	0.50
		IV	–0.524*** (0.202)	0.112*** (0.042)	0.041*** (0.015)	0.25 (0.62)	167 (0.00)	2.68 (0.44)	366	0.50
	Low	OLS	–0.434** (0.172)	0.215*** (0.058)	0.009 (0.018)				308	0.70
		IV	–0.433*** (0.159)	0.214*** (0.053)	0.019 (0.025)	0.28 (0.59)	155 (0.00)	0.99 (0.80)	308	0.70

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Table 7 (continued)

Indicator of Fin.lib. or integration	Level of Fin.dev.	Model	Industry share	Ext.dep × Fin.dev.	Ext.dep × Fin.lib.or integration	Diagnostic tests: Haus-man	F	Sargan	N	R^2
CAP-STOCK	High	OLS	–0.505*** (0.131)	0.077*** (0.020)	0.010 (0.007)				635	0.42
		IV	–0.505*** (0.125)	0.077*** (0.019)	0.009 (0.014)	95 (0.00)	2.84 (0.42)	0.01 (0.92)	635	0.43
	Low	OLS	–0.273*** (0.085)	0.199*** (0.055)	–0.027 (0.022)				530	0.57
		IV	–0.274*** (0.080)	0.201*** (0.053)	–0.030 (0.030)	157 (0.00)	1.87 (0.60)	0.01 (0.91)	530	0.57
CAP-FLOW	High	OLS	–0.511*** (0.132)	0.060*** (0.020)	0.257* (0.146)				635	0.43
		IV	–0.506*** (0.126)	0.066*** (0.021)	0.121 (0.216)	209 (0.00)	3.01 (0.39)	0.63 (0.43)	635	0.43
	Low	OLS	–0.263*** (0.085)	0.129** (0.058)	0.149 (0.425)				552	0.47
		IV	–0.255*** (0.081)	0.203*** (0.068)	–1.200 (1.181)	58 (0.00)	1.95 (0.58)	1.56 (0.21)	552	0.46

Note: *** indicates significance at the 1-percent level, ** at the 5-percent level, * at the 10-percent level. The dependent variable is the annual compounded growth rate in the number of establishments for the period 1980–90 for each ISIC industry in each country. See Tables 2 and 3 for a description of the other variables. "High" ("Low") financial development refers to countries with above (below) median total capitalization. Heteroskedasticity robust standard errors are in parentheses, except for the diagnostic tests where p-values are reported.

Table 8. Explaining changes in price levels

	Dependent variable is the percentage change in industry price levels between 1980 and 1990.			
Growth in number of establishments 1980-1990	1.644***	1.282**	2.097***	0.205
	(0.552)	(0.542)	(0.682)	(0.914)
Growth in value added 1980-1990		1.201***		3.375***
		(0.449)		(1.322)
No. of observations	324	323	230	229
R^2	0.91	0.91	0.80	0.81

Note: *** indicates significance at the 1-percent level, ** at the 5-percent level, * at the 10-percent level. The dependent variable is the percentage change in price levels between 1980 and 1990 for each ISIC industry in each country. Country- and industry fixed effects are included but not shown. Heteroskedasticity robust standard errors are in parentheses.

Table A1. Indicators of liberalization

Country	IMF80	QCAP82	BHL80	KSSTOCK80	CAPSTOCK	CAPFLOW
Australia	0	.5	1	.	.742694	.0562806
Austria	0	.75	1	.	1.172527	.0383822
Bangladesh	0	.	0	.	.	.0000203
Brazil	0	.375	0	.5	.4665384	.0083611
Canada	1	.75	1	1	1.1765	.0572943
Chile	0	.5	0	0	1.031781	.0228369
Columbia	0	.375	0	0	.5325444	.0147017
Costa Rica	1	.375	0	.	1.21825	.0235035
Egypt	0	.375	0	.	1.274474	.0262076
Finland	0	.5	1	.5	.6951951	.0392009
France	0	.625	1	1	.8920823	.0359365
Germany	1	1	1	1	.7598786	.0354987
Greece	0	.5	0	.	.0488642	.0115876
India	0	.25	0	.	.1782569	.
Indonesia	1	.625	0	0	.4505696	.005563
Israel	0	.5	0	.	.0612123	.0266216
Italy	0	.75	1	1	.5622534	.0168005
Jamaica	0	.	0	.	1.255333	.0095036
Japan	1	.625	0	0	.4995376	.0504401
Jordan	0	.375	0	.	1.004601	.0109161
Kenya	0	.	0	.	.	.0062992
Korea	0	.5	0	0	.4965836	.0109355
Malaysia	1	.5	0	.5	.5231221	.0537342
Mexico	1	.375	0	0	.5225904	.0200498
Morocco	0	.125	0	.	.9217592	.0039101
Netherlands	1	.75	1	.	1.947572	.0912627
New Zeeland	0	.625	0	.	1.236027	.0484484
Nigeria	0	.25	0	.	.	.0184015
Norway	0	.5	1	0	.8998007	.0466735
Pakistan	0	.25	0	.	.470136	.0053546
Peru	1	.375	0	0	.6959333	.0020136
Philippines	0	.25	0	0	.7374972	.0080224
Portugal	0	.375	0	0	.1630504	.0261469
Sri Lanka	0	.125	0	.	.6738331	.0074351
Singapore	1	1	1	.	.8321908	.1469173
South Africa	0	.375	0	.	.0678706	.011975
Spain	0	.5	0	1	.4833221	.024915
Sweden	0	.75	1	1	.916338	.0437282
Turkey	0	.25	0	.	.3829049	.0056955
UK	1	1	1	1	2.664083	.1067
USA	1	1	1	1	.5350813	.0265935
Venezuela	1	.75	0	1	.6150251	.0474498

IMF80 is the IMF indicator of an open capital account for 1980. QCAP82 is the Quinn (1997) indicator of capital account liberalization in the year 1982. BHL80 and KSSTOCK80 are the Bekeart et al. (2001) and Kaminsky and Schumkler (2001) indicators of equity market liberalization. CAPSTOCK is the average of the sum of the stock of inward and outward direct investment, and the stock of portfolio equity and portfolio debt assets and liabilities, as a share of GDP over the period 1980-90, taken from Lane and Milesi-Feretti (2001). CAPFLOW constitute the equivalent figures, but on flows instead of stocks, collected from the IFS.

Table A2: Growth in value added, measures of financial liberalization and integration, Full sample.

	Capital account liberalization measured as:				Stock market liberalization measured as:				Capital market integration measured as:			
	IMF80		QCAP82		BHL80		KSSTOCK80		CAPSTOCK		CAPFLOW	
	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Industry share	–0.691***	–0.688***	–0.701***	–0.708***	–0.678**	–0.687***	–0.638**	–0.643**	–0.439**	–0.438***	–0.660***	–0.672***
	(0.217)	(0.211)	(0.220)	(0.215)	(0.215)	(0.210)	(0.282)	(0.272)	(0.139)	(0.134)	(0.224)	(0.216)
Ext. Dep. ×	0.150***	0.151***	0.126***	0.119***	0.142***	0.117**	0.168***	0.160***	0.147***	0.149***	0.136***	0.123***
Accounting standards	(0.034)	(0.032)	(0.037)	(0.037)	(0.043)	(0.049)	(0.044)	(0.039)	(0.035)	(0.040)	(0.038)	(0.043)
Ext. Dep. × IMF80	0.015	0.013										
	(0.011)	(0.015)										
Ext. Dep. × QCAP82			0.049*	0.061								
			(0.029)	(0.040)								
Ext. Dep. × BHL80					0.007	0.019						
					(0.012)	(0.019)						
Ext. Dep. × KSSTOCK							–0.004	0.002				
							(0.012)	(0.016)				
Ext. Dep. × CAPSTOCK									–0.004	–0.006		
									(0.006)	(0.026)		
Ext. Dep. × CAPFLOW											0.185	0.315
											(0.198)	(0.297)
Hausman-test (p-value)		0.10 (0.75)		0.15 (0.70)		0.63 (0.43)		0.19 (0.66)		0.01 (0.94)		0.35 (0.56)
F-test (p-value)		332 (0.00)		400 (0.00)		224 (0.00)		187 (0.00)		28 (0.00)		170 (0.00)
Sargan-test (p-value)		2.26 (0.32)		0.39 (0.53)		4.21 (0.24)		0.07 (1.00)		7.16 (0.07)		6.82 (0.08)
No. of observations	1020	1020	1020	1020	1020	1020	666	666	995	995	984	984
R^2	0.35	0.43	0.35	0.43	0.35	0.43	0.41	0.48	0.42	0.52	0.34	0.42

Note: *** indicates significance at the 1-percent level, ** at the 5-percent level, * at the 10-percent level. The dependent variable is the annual compounded growth rate in real output for the period 1980–90 for each ISIC industry in each country. See Table 2 for a description of the rest of the variables. Heteroskedasticity robust standard errors are in parentheses, except for the diagnostic tests where p-values are reported.

Table A3: Growth in value added, financial liberalization and integration. Split sample.

Indicator of Fin.lib. or integration	Level of Fin.dev.	Model	Industry share	Ext.dep × Fin.dev.	Ext.dep × Fin.lib.or integration	Diagnostic tests: Haus-man	F	Sargan	N	R^2
IMF80	High	OLS	–0.523**	0.244**	0.021				413	0.45
			(0.245)	(0.106)	(0.013)					
		IV	–0.368***	0.164*	0.036*	0.21	92	7.30	419	0.51
			(0.142)	(0.098)	(0.021)	(0.65)	(0.00)	(0.03)		
	Low	OLS	–0.887***	0.161***	0.011				607	0.35
			(0.303)	(0.062)	(0.018)					
		IV	–0.796***	0.175***	–0.007	0.12	486	4.82	595	0.47
			(0.202)	(0.061)	(0.015)	(0.73)	(0.00)	(0.09)		
QCAP82	High	OLS	–0.487**	0.219*	0.011				413	0.44
			(0.247)	(0.113)	(0.034)					
		IV	–0.410***	–0.159	0.164*	1.79	41	5.46	419	0.48
			(0.154)	(0.163)	(0.095)	(0.18)	(0.00)	(0.02)		
	Low	OLS	–0.907***	0.130*	0.068				607	0.35
			(0.307)	(0.067)	(0.042)					
		IV	–0.796***	0.177***	–0.031	0.04	371	1.29	595	0.47
			(0.205)	(0.063)	(0.043)	(0.83)	(0.00)	(0.26)		
BHL80	High	OLS	–0.471*	0.332**	–0.016				413	0.44
			(0.249)	(0.165)	(0.022)					
		IV	–0.341**	0.391*	–0.043	0.24	98	7.95	419	0.50
			(0.141)	(0.215)	(0.030)	(0.62)	(0.00)	(0.05)		
	Low	OLS	–0.903***	0.139**	0.023				607	0.35
			(0.306)	(0.066)	(0.017)					
		IV	–0.801***	0.170***	0.007	1.94	194	2.87	595	0.47
			(0.205)	(0.061)	(0.024)	(0.16)	(0.00)	(0.41)		
KS-STOCK80	High	OLS	–0.847**	0.278**	–0.013				307	0.52
			(0.336)	(0.124)	(0.014)					
		IV	–0.414***	–0.007	0.022	2.17	92	1.86	303	0.57
			(0.152)	(0.121)	(0.023)	(0.14)	(0.00)	(0.60)		
	Low	OLS	–0.732*	0.196**	–0.002				359	0.43
			(0.432)	(0.090)	(0.018)					
		IV	–0.390**	0.239***	0.010	0.03	212	2.64	339	0.65
			(0.166)	(0.070)	(0.017)	(0.85)	(0.00)	(0.45)		

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Table A3 (continued)

Indicator of Fin.lib. or integration	Level of Fin.dev.	Model	Industry share	Ext.dep × Fin.dev.	Ext.dep × Fin.lib.or integration	Diagnostic tests: Haus-man	F	Sargan	N	R^2
CAP-STOCK	High	OLS	–0.475*	0.266**	–0.006				413	0.44
			(0.284)	(0.115)	(0.008)					
		IV	–0.341**	0.140	–0.001	2.31	245	8.98	419	0.50
			(0.142)	(0.102)	(0.008)	(0.13)	(0.00)	(0.03)		
	Low	OLS	–0.528***	0.195***	0.006				582	0.43
			(0.189)	(0.059)	(0.014)					
		IV	–0.542***	0.161***	0.004	0.68	74	1.43	569	0.58
			(0.132)	(0.060)	(0.020)	(0.41)	(0.00)	(0.70)		
CAP-FLOW	High	OLS	–0.510**	0.196*	0.166				413	0.44
			(0.252)	(0.108)	(0.212)					
		IV	–0.365***	0.060	0.319*	2.68	594	7.56	419	0.50
			(0.139)	(0.100)	(0.187)	(0.10)	(0.00)	(0.06)		
	Low	OLS	–0.837***	0.159**	0.286				571	0.34
			(0.384)	(0.162)	(0.485)					
		IV	–0.809***	0.169***	0.364	1.30	82	3.93	559	0.58
			(0.211)	(0.061)	(0.565)	(0.25)	(0.00)	(0.27)		

Note: *** indicates significance at the 1-percent level, ** at the 5-percent level, * at the 10-percent level. The dependent variable is the annual compounded growth rate in value added for the period 1980–90 for each ISIC industry in each country. See Tables 2 and 3 for a description of the other variables. "High" ("Low") financial development refers to countries with above (below) median accounting standards. Heteroskedasticity robust standard errors are in parentheses except, for the diagnostic tests where p-values are reported.

Table A4: Firm creation, measures of financial liberalization and integration, Full sample.

	Capital account liberalization measured as:				Stock market liberalization measured as:				Capital market integration measured as:			
	IMF80		QCAP82		BHL80		KSSTOCK		CAPSTOCK		CAPFLOW	
	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Industry share	–0.378**	–0.376**	–0.377**	–0.388**	–0.350**	–0.354**	–0.198	–0.204	–0.163*	–0.165*	–0.384**	–0.370**
	(0.165)	(0.162)	(0.170)	(0.165)	(0.165)	(0.160)	(0.148)	(0.141)	(0.095)	(0.092)	(0.180)	(0.170)
Ext. Dep. × Accounting standards	0.077***	0.078***	0.052*	0.039	0.083**	0.059	0.127***	0.103***	0.071***	0.088***	0.054*	0.070**
	(0.025)	(0.024)	(0.029)	(0.030)	(0.035)	(0.040)	(0.035)	(0.028)	(0.026)	(0.033)	(0.028)	(0.035)
Ext. Dep. × IMF80	0.026***	0.024*										
	(0.010)	(0.014)										
Ext. Dep. × QCAP82			0.057**	0.078**								
			(0.028)	(0.039)								
Ext. Dep. × BHL80					0.002	0.015						
					(0.012)	(0.018)						
Ext. Dep. × KSSTOCK							–0.006	0.013				
							(0.010)	(0.014)				
Ext. Dep. × CAPSTOCK									0.010	–0.010		
									(0.007)	(0.020)		
Ext. Dep. × CAPFLOW											0.322*	0.169
											(0.178)	(0.206)
Hausman-test (p-value)		0.04 (0.85)		0.39 (0.53)		0.56 (0.45)		1.48 (0.22)		0.76 (0.38)		0.40 (0.53)
F-test (p-value)		317 (0.00)		317 (0.00)		196 (0.00)		146 (0.00)		26 (0.00)		154 (0.00)
Sargan-test (p-value)		1.48 (0.47)		0.01 (0.93)		4.29 (0.23)		1.60 (0.66)		8.57 (0.04)		6.02 (0.11)
No. of observations	936	936	936	936	936	936	598	598	905	905	900	900
R^2	0.32	0.32	0.32	0.32	0.31	0.31	0.48	0.48	0.42	0.42	0.32	0.32

Note: *** indicates significance at the 1-percent level, ** at the 5-percent level, * at the 10-percent level. The dependent variable is the annual compounded growth rate in real output for the period 1980–90 for each ISIC industry in each country. See Table 2 for a description of the rest of the variables. Heteroskedasticity robust standard errors are in parentheses, except for the diagnostic tests where p-values are reported.

Table A5: Firm creation, financial liberalization and integration. Split sample.

Indicator of Fin.lib. or integration	Level of Fin.dev.	Model	Industry share	Ext.dep × Fin.dev.	Ext.dep × Fin.lib.or integration	Diagnostic tests: Haus-man	F	Sargan	N	R^2
IMF80	High	OLS	–0.093	0.138	0.023*				376	0.48
			(0.208)	(0.098)	(0.013)					
		IV	–0.108	–0.141	0.028*	0.29	214	0.91	376	0.48
			(0.195)	(0.094)	(0.017)	(0.59)	(0.00)	(0.64)		
	Low	OLS	–0.646**	0.060	0.024				560	0.26
			(0.218)	(0.050)	(0.017)					
		IV	–0.646**	0.057	0.020	0.32	562	1.55	560	0.26
			(0.247)	(0.048)	(0.021)	(0.57)	(0.00)	(0.46)		
QCAP82	High	OLS	–0.052	0.079	0.024				376	0.47
			(0.221)	(0.111)	(0.037)					
		IV	–0.192	–0.136	0.137	1.22	26	1.21	376	0.48
			(0.220)	(0.182)	(0.095)	(0.27)	(0.00)	(0.27)		
	Low	OLS	–0.655**	0.028	0.071*				560	0.26
			(0.284)	(0.050)	(0.038)					
		IV	–0.652**	0.032	0.055	0.28	348	0.02	560	0.26
			(0.270)	(0.046)	(0.042)	(0.59)	(0.00)	(0.88)		
BHL80	High	OLS	–0.013	0.374*	–0.038				376	0.48
			(0.208)	(0.201)	(0.026)					
		IV	–0.010	0.458**	–0.051*	1.39	147	3.43	376	0.48
			(0.192)	(0.097)	(0.027)	(0.30)	(0.00)	(0.33)		
	Low	OLS	–0.652**	0.035	0.022				560	0.26
			(0.283)	(0.048)	(0.016)					
		IV	–0.655**	0.031	0.031	0.09	151	0.93	560	0.26
			(0.271)	(0.044)	(0.030)	(0.77)	(0.00)	(0.82)		
KS-STOCK80	High	OLS	0.152	0.175	–0.007				279	0.49
			(0.294)	(0.152)	(0.018)					
		IV	0.171	–0.134	0.047	2.35	45	2.80	279	0.48
			(0.273)	(0.193)	(0.034)	(0.13)	(0.00)	(0.42)		
	Low	OLS	–0.070	0.128*	–0.009				396	0.47
			(0.220)	(0.072)	(0.016)					
		IV	–0.085	0.112*	0.005	0.98	196	0.24	319	0.45
			(0.207)	(0.062)	(0.014)	(0.32)	(0.00)	(0.97)		

...table continues on next page.

Table A5 (continued)

Indicator of Fin.lib. or integration	Level of Fin.dev.	Model	Industry share	Ext.dep × Fin.dev.	Ext.dep × Fin.lib.or integration	Diagnostic tests: Haus-man	F	Sargan	N	R^2
CAP-STOCK	High	OLS	–0.020	0.102	0.007				376	0.47
			(0.214)	(0.100)	(0.010)					
		IV	–0.017	0.082	0.013	1.24	436	4.31	376	0.47
			(0.201)	(0.089)	(0.010)	(0.27)	(0.00)	(0.23)		
	Low	OLS	–0.268*	0.079*	0.015				529	0.38
			(0.137)	(0.045)	(0.013)					
		IV	–0.282**	–0.046	–0.080	1.67	7	5.22	529	0.35
			(0.135)	(0.108)	(0.067)	(0.20)	(0.00)	(0.15)		
CAP-FLOW	High	OLS	–0.015	0.100	0.104				376	0.47
			(0.224)	(0.096)	(0.167)					
		IV	–0.078	0.070	0.233	3.46	1143	3.72	376	0.47
			(0.208)	(0.094)	(0.177)	(0.06)	(0.00)	(0.29)		
	Low	OLS	–0.660**	0.050	0.645				524	0.26
			(0.313)	(0.046)	(0.430)					
		IV	–0.704**	0.072	3.534**	4.03	30	4.23	524	0.23
			(0.302)	(0.051)	(1.65)	(0.05)	(0.00)	(0.24)		

Note: *** indicates significance at the 1-percent level, ** at the 5-percent level, * at the 10-percent level. The dependent variable is the annual compounded growth rate for the number of establishments for the period 1980–90 for each ISIC industry in each country. See Tables 2 and 3 for a description of the other variables. "High" ("Low") financial development refers to countries with above (below) median accounting standards. Heteroskedasticity robust standard errors are in parentheses, except for the diagnostic tests where p-values are reported.

Table A6: Growth in output, measures of financial liberalization and integration, Full sample.

	Capital account liberalization measured as:				Stock market liberalization measured as:				Capital market integration measured as:			
	IMF80		QCAP82		BHL80		KSSTOCK		CAPSTOCK		CAPFLOW	
	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Industry share	–0.329***	–0.577***	–0.359***	–0.587***	–0.330***	–0.577***	–0.416***	–0.333***	–0.400***	–0.400***	–0.589***	–0.601***
	(0.073)	(0.141)	(0.078)	(0.142)	(0.072)	(0.141)	(0.124)	(0.118)	(0.100)	(0.097)	(0.150)	(0.144)
Ext. Dep. ×	0.045***	0.162***	0.049***	0.139***	0.044***	0.165	0.067***	0.188***	0.160***	0.153***	0.150***	0.111**
Total capitalization.	(0.013)	(0.036)	(0.014)	(0.038)	(0.014)	(0.053)	(0.021)	(0.040)	(0.042)	(0.043)	(0.043)	(0.045)
Ext. Dep. × IMF80	0.005	–0.001										
	(0.009)	(0.012)										
Ext. Dep. × QCAP82			0.016	0.038								
			(0.020)	(0.037)								
Ext. Dep. × BHL80					0.005	–0.002						
					(0.009)	(0.017)						
Ext. Dep. × KSSTOCK							0.011	0.016				
							(0.010)	(0.017)				
Ext. Dep. × CAPSTOCK									–0.007	0.001		
									(0.007)	(0.018)		
Ext. Dep. × CAPFLOW											0.120	0.525**
											(0.172)	(0.252)
Hausman-test (p-value)		3.02 (0.08)		1.24 (0.27)		2.22 (0.14)		1.76 (0.18)		0.30 (0.58)		6.53 (0.01)
F-test (p-value)		321 (0.00)		345 (0.00)		211 (0.00)		174 (0.00)		70 (0.00)		256 (0.00)
Sargan-test (p-value)		3.68 (0.16)		2.76 (0.10)		4.05 (0.41)		1.37 (0.71)		8.81 (0.03)		9.73 (0.02)
No. of observations	1223	1014	1154	1014	1223	1014	674	642	988	988	978	978
R^2	0.44	0.44	0.50	0.44	0.44	0.44	0.60	0.58	0.52	0.52	0.43	0.43

Note: *** indicates significance at the 1-percent level, ** at the 5-percent level, * at the 10-percent level. The dependent variable is the annual compounded growth rate in real output for the period 1980–90 for each ISIC industry in each country. See Table 2 for a description of the rest of the variables. Heteroskedasticity robust standard errors are in parentheses, except for the diagnostic tests where p-values are reported.

Table A7: Growth in output, financial liberalization and integration. Split sample.

Indicator of Fin.lib. or integration	Level of Fin.dev.	Model	Industry share	Ext.dep × Fin.dev.	Ext.dep × Fin.lib.or integration	Diagnostic tests: Haus-man	F	Sargan	N	R^2
IMF80	High	OLS	–0.364**	0.161	0.031**				419	0.51
			(0.150)	(0.100)	(0.015)					
		IV	–0.368***	0.165*	0.036*	0.21	92	7.30	419	0.51
			(0.121)	(0.098)	(0.021)	(0.65)	(0.00)	(0.03)		
	Low	OLS	–0.796***	0.175***	–0.004				595	0.47
			(0.252)	(0.064)	(0.014)					
		IV	–0.796***	0.175***	–0.007	0.12	486	4.82	595	0.47
			(0.202)	(0.061)	(0.015)	(0.73)	(0.00)	(0.09)		
QCAP82	High	OLS	–0.350**	0.099	0.021				419	0.50
			(0.149)	(0.199)	(0.033)					
		IV	–0.410***	–0.159	0.164*	1.79	41	5.46	419	0.48
			(0.155)	(0.163)	(0.095)	(0.18)	(0.00)	(0.02)		
	Low	OLS	–0.794***	0.180***	–0.009				595	0.47
			(0.214)	(0.066)	(0.039)					
		IV	–0.796***	0.177***	–0.003	0.04	595	1.29	595	0.47
			(0.205)	(0.063)	(0.043)	(0.84)	(0.00)	(0.26)		
BHL80	High	OLS	–0.341**	0.348	–0.036				419	0.50
			(0.150)	(0.217)	(0.028)					
		IV	–0.341**	0.392*	–0.043	0.24	98	7.95	419	0.50
			(0.1141)	(0.019)	(0.030)	(0.62)	(0.00)	(0.05)		
	Low	OLS	–0.788***	0.188***	–0.013				595	0.47
			(0.215)	(0.067)	(0.019)					
		IV	–0.801***	0.170***	0.007	1.94	194	2.87	595	0.47
			(0.205)	(0.065)	(0.024)	(0.16)	(0.00)	(0.41)		
KS-STOCK80	High	OLS	–0.400**	0.183	–0.016				303	0.57
			(0.160)	(0.141)	(0.017)					
		IV	–0.414***	–0.007	0.022	2.17	92	1.86	303	0.57
			(0.152)	(0.121)	(0.023)	(0.14)	(0.00)	(0.60)		
	Low	OLS	–0.389**	0.242***	0.008				339	0.65
			(0.178)	(0.077)	(0.015)					
		IV	–0.390**	0.239***	0.010	0.03	213	2.65	339	0.65
			(0.166)	(0.070)	(0.017)	(0.85)	(0.00)	(0.45)		

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Table A7 (continued)

Indicator of Fin.lib. or integration	Level of Fin.dev.	Model	Industry share	Ext.dep × Fin.dev.	Ext.dep × Fin.lib.or integration	Diagnostic tests: Haus-man	F	Sargan	N	R^2
CAP-STOCK	High	OLS	–0.340** (0.151)	0.168 (0.113)	–0.008 (0.009)				419	0.50
		IV	–0.341** (0.142)	0.140 (0.102)	–0.001 (0.008)	2.32 (0.13)	245 (0.00)	8.98 (0.03)	419	0.50
	Low	OLS	–0.539*** (0.139)	0.153** (0.064)	–0.007 (0.014)				569	0.58
		IV	–0.542*** (0.133)	0.161*** (0.060)	0.004 (0.020)	0.68 (0.41)	74 (0.00)	1.43 (0.70)	569	0.58
CAP-FLOW	High	OLS	–0.356** (0.150)	0.090 (0.103)	0.197 (0.167)				419	0.50
		IV	–0.365*** (0.139)	0.060 (0.100)	0.319* (0.187)	2.68 (0.10)	594 (0.00)	1.86 (0.60)	303	0.57
	Low	OLS	–0.804*** (0.222)	0.174** (0.064)	–0.110 (0.395)				559	0.46
		IV	–0.809*** (0.211)	0.169*** (0.061)	0.364 (0.565)	1.31 (0.25)	82 (0.00)	3.93 (0.27)	559	0.58

Note: *** indicates significance at the 1-percent level, ** at the 5-percent level, * at the 10-percent level. The dependent variable is the annual compounded growth rate in real output for the period 1980–90 for each ISIC industry in each country. See Tables 2 and 3 for a description of the other variables. "High" ("Low") financial development refers to countries with above (below) median accounting standards. Heteroskedasticity robust standard errors are in parentheses, except for the diagnostic tests where p-values are reported.

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