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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.

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

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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)

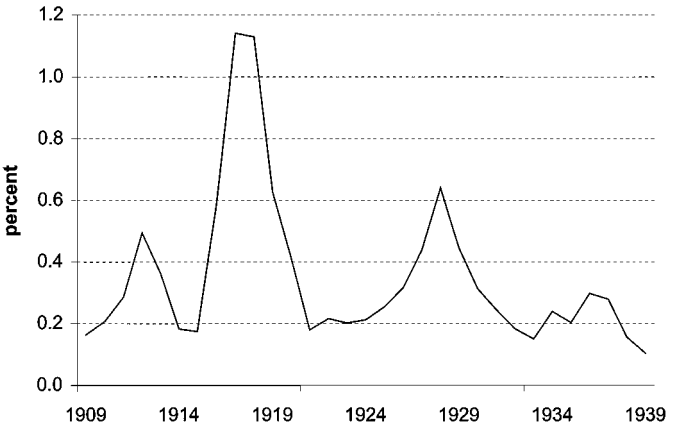

FIG. 1. Swedish STT revenue as share of total tax revenues, 1909–1939.

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.

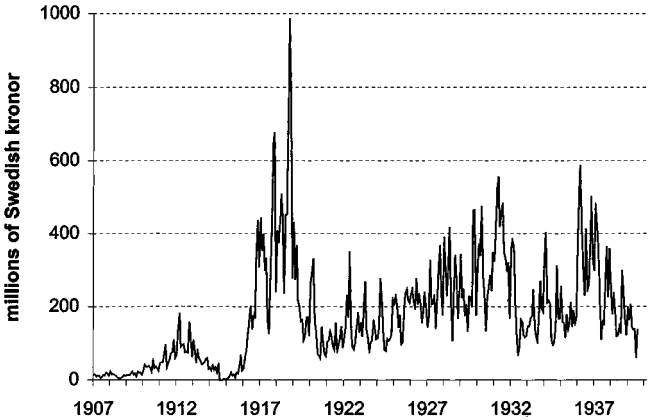

FIG. 2. Trading volume on the Stockholm Stock Exchange, 1907–1939.

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.

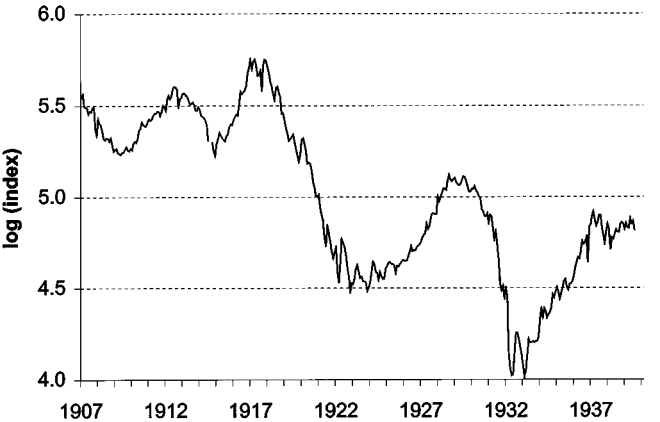

FIG. 3. Stockholm Stock Exchange price index, 1907–1939.

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.

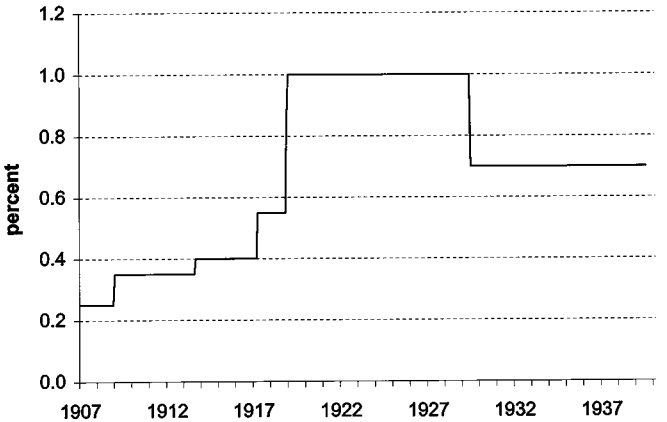

FIG. 4. Transaction costs (STT + commission fee) on the Swedish stock market, 1907–1939.

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.).

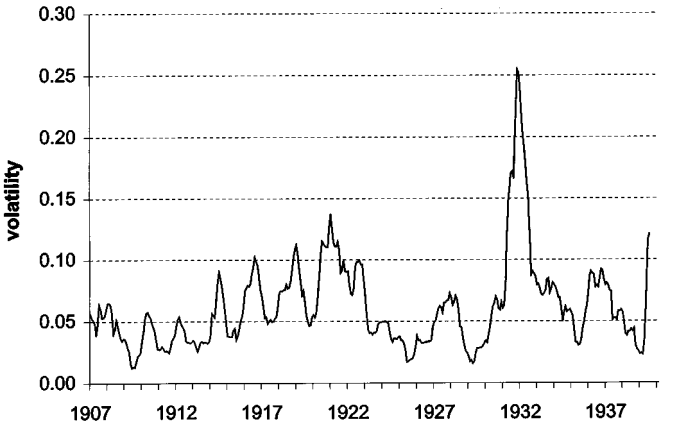

FIG. 5. Volatility on the Swedish Stock Exchange, 1907–1939.

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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