EQUITY PREMIUM IN FINLAND AND LONG-TERM PERFORMANCE OF THE FINNISH EQUITY AND MONEY MARKETS

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Abstract

Using new monthly series collected together for the first time for Finland, this paper analyses the performance and development of the Finnish equity and money markets as well as the equity premium and inflation from 1912 to 2009. The series are analyzed and compared to similar series from Sweden and USA. Continuously compounded nominal returns in Finland have been high, 12.91 and 6.25 percent per annum for the stock and money markets, respectively. However, taking into account the high annual average inflation rate of 7.77, the Finnish market has provided clearly lower real returns than the US market. On the other hand, the equity premium, 10.14 percent per annum, is found to be comparable to that of the US (9.35%) and higher than that in Sweden (6.01%) using an approach similar to Mehra and Prescott (2003). Finally, our empirical evidence suggests that as the Finnish stock market has matured, it shows an increasing degree of informational efficiency while at the same time becoming more intertwined with international markets.

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Keywords: equity premium, stock market, money market, Helsinki Stock Exchange, NASDAQ OMX, Finland, Sweden, USA

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1. INTRODUCTION

In recent years, there has been a growing interest in the historical equity premium and overall development of the financial markets. The main puzzle for the researchers has been the size of the premium in the US market; it was found to be higher than justifiable by economic theory given the relatively low covariance of stock market returns with consumption growth (Mehra and Prescott 2003). One explanation for the puzzle has been country selection bias since most historical data is from the USA, and until recently, only a few studies had been conducted that focused on other markets (see, e.g., Dimson, Marsh, and Staunton 2002). This may partly be due to the lack of sufficiently long and of high quality time series, given that accurate estimates of an equity premium require relatively long and comprehensive time series.

The main purpose of this paper is to analyze the equity premium in Finland as well the long-term development of its financial markets. Our paper fills a gap in the literature because Finland is one of the countries for which there are hardly any studies available that use longer time series. Past empirical analyses have suffered from the unavailability of a stock market index that captures the total return on the Finnish market. However, using the stock market index by Nyberg and Vaihekoski (2010), the risk-free rate series and a new inflation series created for this study, we are now able for the first time to conduct comparable long-term analyses of the Finnish stock market.

Finland provides an interesting case for the study of the equity premium and financial market development. At the beginning of the sample period in 1912, Finland was a poor agrarian country lagging clearly behind other western countries in its economic development. GDP per capita was typically only 60 percent of the western European average (see Tiihonen, 2012). However, various factors, including a rapid production growth and changes in the industrial structure, led to economic convergence and Finland was able to catch up with other western countries – a convergence of such a strength that it makes it a rather rare event world-wide (for more information, see Kokkinen et al.,

2007). At the same time, Finland evolved from a relatively closed economy to an open, export-oriented economy. As a result, the size and industries of the companies listed on the stock exchange have changed considerably from the home-market oriented companies to internationally competitive technology-oriented companies, with Nokia leading the way.

We compare the performance of the Finnish equity market against markets in Sweden and the USA. Sweden is a natural benchmark for Finland as the countries have long historical ties and they have both emerged as top performing countries in many contemporary rankings. From a financial and an economic point of view they also underwent many similar developments (e.g., deep economic and banking crisis in the early 1990s, closely related exchange rate policies, just to name a few). However, in many ways, Sweden has led the development as it was clearly more developed than Finland in the early 1900s, and during the 20th and 21st centuries Finland has tried to catch up with its western neighbor. The US market, on the other hand, is selected as a benchmark for slightly different reasons. It is a global reference point in financial research and market development. As such, comparing Finland against the USA can provide potentially interesting results.

Our long time series of financial market returns combined with the peculiar development of Finland from a poor, closed economy in the periphery to a country comparable in economic fundamentals to the leading countries makes it convenient for us to compare our results with predictions derived from theory. Due to the relatively strong segmentation of the Finnish economy and its financial markets from international markets, we would expect the equity premium in Finland to be high compared to international standards (see, e.g., Stulz, 1999). Furthermore, considering the gradual development of trading activity, the gradual increase in market participants, and the shift from less informed to more informed speculative investors coinciding with the stock market liberalization, we would expect the informational efficiency of the Helsinki Stock Exchange to have increased over time (see, e.g. Grossman and Stiglitz, 1980). Finally, the gradual convergence of the Finnish economy with the world economy and the opening up of the Finnish stock market to foreign investors should be reflected in

increased comovements between Finnish market returns and international returns. Our empirical results are mostly consistent with these predictions.

The remainder of the paper is as follows: Section 2 reviews the history of the equity and money markets in Finland and surveys existing literature covering these markets. Section 3 reviews the data available for these markets. Section 4 gives a theoretical background to our analysis and shows the results from the empirical estimations. Section 5 concludes.

2. HISTORY OF FINNISH EQUITY AND MONEY MARKETS

2.1 Finnish stock market

The birth of the Helsinki Stock Exchange (HSE or the Exchange, currently known as Nasdaq OMX Helsinki) took place on October 7, 1912, when a centralized market place was opened for trading in Helsinki.[1] At the end of 1912, as many as 33 shares and most of the bonds that had been issued by municipalities and credit institutions were listed on the exchange. At the beginning, the members of the stock exchange could also trade commodities; during 1920-21 and 1924-26 they could also trade in foreign currencies. However, trading was halted after the outbreak of the First World War.

The Helsinki Stock Exchange did not immediately attract a lot of trading. Tiderman (1937) notes that the total number of trades in 1913 was only 898 with a nominal value of FIM 2.5 million (corresponding to approximately 9 million euros in 2009). Moreover, the stock exchange was closed during the First World War from August 1914 to March 1915 and from July to August 1916. The stock

[1] One has to remember that Finland was part of Russian Empire until 1917. The first Exchange in Russia was established in St. Petersburg already in the 18th century. Trading in stocks started later, in the 1830s (see Borodkin and Perelman 2011). Shares of some Finnish companies were traded there occasionally. The first stock exchange in Finland was opened in Helsinki in November 1862 by a local stock exchange association. The association was discontinued in 1869, but a new association was set up to continue its operations. Even though there was interest among the public, the trading activity remained relatively low and the exchange lacked proper organization and regulation. In Sweden, the Stockholm Stock Exchange was opened in 1863.

exchange was also closed between January and May 1918 during the Finnish Civil War that ensued after Finland claimed independence from Russia in December 1917.

However, towards the end of the 1910s, trading started to increase. In 1918, the total value of trades was already as much as FIM 922.9 million (approximately 300 million euros in 2009). This led some contemporary writers to describe the years surrounding 1920 as the wild years of the Finnish stock market. The increase in public interest was caused by rising stock prices. This also led to the establishment of a competing stock exchange in Helsinki (Helsingin Arvopaperi Osakeyhtiö) at the beginning of 1918. Stock exchanges were also opened in other cities, including Turku and Viipuri, which was at the time the second largest city in Finland.[2] All of these new stock exchanges were closed after a few years of operation.

The first decades of the exchange's existence appear to have been characterized by weakly informed investors and wild short-term speculation of share prices.[3] The downward sloping trend in share prices that started in the early 1920s was reversed when the international economic upturn in 1926 started to boost share prices (see Figure 1) and companies' desire to get listed on the stock exchange. In 1927, there were already 65 companies listed on the stock exchange.[4]

The 1930s began with a worldwide depression.[5] Great Britain left the gold standard in September 1931 and several countries, including Finland, followed in its trail. The Finnish currency was allowed to float and the Finnish Markka depreciated heavily. This stimulated certain parts of the industry and, together with the interest rate cuts made by the Finnish Central Bank, gradually led to improved profitability of the listed companies and higher share prices. The trading at the stock exchange also changed when a

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2 For example, the Turku Stock Exchange (Turun Arvopaperipörssi) was opened on March 13, 1919. The trading was very modest compared to the Helsinki Stock Exchange (e.g., FIM 7.97 million in 1919) and the exchange was closed after few years of operation in 1922.

3 This assertion is based on anecdotal evidence in Tiderman (1937) and Stjernschantz (1987).

4 In addition, it seems that a number of companies that were not officially listed had their shares traded unofficially (e.g. Talousmies newspaper quotes in September 1928 prices for close to 30 stocks that were not listed on the stock exchange).

5 In October 1929, the Nyberg-Vaihekoski index, that we use to proxy for the stock market returns 1912-1969, rose 1.70 per cent in nominal value. In November, it rose by approximately 2.8 percent. Thus, the Black Tuesday in New York does not appear to have affected the Finnish stock market to a large degree. One potential explanation is that the Finnish stock market had sunk approximately 22 per cent during the previous 12 months, whereas the Dow Jones index reached its highest value in September the same year (Siegel 1998).

mechanical trading system was taken into use 1935. However, at the end of the 1930s, the worsening political situation and uncertain world economy led to more pessimistic expectations. At the end of the decade, only 36 companies (38 stock series) were listed on the exchange. The low number of companies was partly due to the economic conditions that had prevailed but also due to the large number of mergers that had taken place during the decade.

In the 1940s, the Finnish stock market was heavily affected by the Second World War. This decade was also characterized by a high level of inflation that on average was approximately 20 per cent per annum. The market took a steep fall in 1948, and at the same time the market volatility increased significantly. It is possible that this occurred because of the market's uncertainty surrounding the Agreement of Friendship, Cooperation, and Mutual Assistance that was signed by Finland and the Soviet Union, and the economic and political consequences that it could have.

The 1950s began with rising share prices. Industrial production reached two peaks in 1951 and 1954. In 1951, 26 companies were listed on the A-list and 22 companies were listed on the B-list, which consisted of shares that were traded less frequently. On the other hand, the beginning of the 1960s offered lower returns to shareholders. Increasing labor costs affected profits in the industrial sector and Finland began to have difficulties with its balance of payments. However, in 1968 the Government abolished all index clauses on Government Bonds and deposit accounts, which had been extremely favorable to the investors; as a result, investors transferred money to the stock market. Moreover, there was a strong economic upturn that further strengthened the rise in share prices between 1968 and 1973. This upward trend was reversed in 1974 when the international Oil Crisis and the interest rate increases made by the Finnish Central Bank resulted in a fall in share prices. The downturn continued until 1978; a high level of inflation during this period furthered the negative development in real stock market values.

The stock market developed substantially during the 1980s. The economic recession was ending, and many companies were issuing new shares. From 1980 to 1990, the number of companies listed on the

main stock exchange increased from approximately 50 to 80. The trading volume doubled several years in a row at the beginning of the 1980s, and at the end of the decade it was 122 times larger in nominal value than at the beginning. As wealth started to accumulate and information became more accessible, investing in stock started to become more popular among wealthy people. At times, there were even radio broadcasts where stock prices were read aloud.

In the 1980s, there was a gradual abolishment of restrictions set on the free capital movements to and from Finland, following the globalization process that started in the USA after the oil crisis in the early 1970s. This process was mostly guided by legislation and restrictions set by the Bank of Finland. Foreign investors also started to pay attention to Finnish securities in the early 1980s. Some Finnish companies issued stock directly to international investors (e.g., Instrumentarium and Nokia), and some companies decided to dual-list abroad (e.g., Kone 1982 on the Stockholm Stock Exchange and Wärtsilä and Amer 1984 on the London Stock Exchange).

However, as fear increased that foreign investors would buy Finnish companies, the Finnish government decided to limit foreign ownership. Foreigners were only allowed to buy unrestricted shares and in 1984 the exchange started to quote foreigners' prices separately. In 1985, the degree of foreign ownership in Finnish shares was restricted to 20 per cent of total equity capital. In April 1987, the maximum unrestricted equity capital for Finnish firms was raised to 40 per cent on condition that the amount of voting power on unrestricted shares could still not exceed 20 per cent (see Vaihekoski 2004).

On the other hand, prior to 1986 it was almost impossible for Finnish investors to buy foreign securities, with the exception of those foreign companies who had become dual-listed in the HSE (e.g., Sweden's AGA AB, the first one in 1985). After 1986, Finnish brokerage firms were allowed to sell foreign shares (and other securities) from their own portfolios to Finnish investors. Since then, most of the restrictions on foreign investments have been gradually removed. Beginning in 1990, Finnish investors were able to invest freely abroad and hence diversify their portfolios internationally. The final

step of this liberalization process took place when all restrictions on foreign ownership were removed at the beginning of 1993.

Market capitalization and trading turnover developed favorably during the 1970s and 1980s, to the extent that there was an initiative to open a competing stock exchange in Turku 1988. Brokers at the HSE started to quote stocks of companies not officially listed on the exchange on a so-called "brokers' list" (from 1981 forward) and "OTC-list" (from the end of 1984 forward). Both lists were transferred to the Exchange's official responsibility in 1996. A number of new instruments became available to the investors (e.g. mutual funds that were first established in 1987[6] after legislation regarding them was established), and in most cases they were listed on the Exchange. These include e.g. bonds with warrants in 1986 and convertible bonds in 1988.

The 1990s began with a deep economic recession; stock prices and trading volume dropped. This negative trend in the stock market continued until mid-1993, after which stock prices rose rapidly and surpassed the pre-depression level. This was partly due to the success of Nokia Corporation, which at times accounted for more than 70 per cent of the total market capitalization value of the HSE. At the end of 1996, 71 companies were officially listed on the HSE, but 95 stocks were separately quoted.[7] More than ten of the listed companies were also listed on foreign stock exchanges.

After the early 1990s, a number of major changes took place at the HSE. First, the structure and ownership of the Exchange changed. The Exchange was originally organized as a nonprofit cooperative, but it was reorganized in November 1995 as a Limited Liability Company.[8] During 1997, a merger agreement between the Helsinki Stock Exchange and SOM (the Finnish options exchange) was

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6 As a minor detail, one could mention Suomen Arvopapereita Oy which was established in 1932. It resembled in a number of ways present day ETFs. Investors were able to buy the participating certificates freely from the market; prices for the certificates were commonly quoted in daily newspapers. If the price of the certificate deviated too much from the underlying assets (portfolio of selected listed stocks), more certificates were issued.

7 The number of listed stock series is higher than the number of companies since several companies have two common stock classes listed – the ordinary and the preference share series. They differ typically by their amount of voting rights and/or rights to monetary distributions. The maximum difference in voting rights is set by the company law and it is currently 1:20 (see Vaihekoski, 2004, for more details).

8 For more information of the more recent history of the Helsinki Stock Exchange see, e.g., Stjernschantz (1987) and Vaihekoski (1997).

announced. They joined their operations to create a new exchange called HEX Ltd., Helsinki Security and Derivatives Exchange, Clearing House. In 2003, the Swedish OM bought the majority of HEX; they merged and the new company was ultimately renamed as OMX Ab. The OMX exchange expanded its operations and it became the main exchange operator in the Nordic and Baltic area. The OMX later merged with NASDAQ in 2008 to form the NASDAQ OMX group.

Second, technological advances have changed trading, settlement and depository systems considerably, and financial innovations have provided new assets to be traded. Fully automatized electronic trading started in 1989. The book entry system, where physical securities were replaced by book entries, was introduced in 1992 and within the next few years all companies were transferred over to the system. Trading on short selling contracts (LEX) started officially in 1995. HEX and Eurex signed a cooperation agreement in 1999 and part of the derivatives trading moved to Eurex. Trading on covered warrants and Exchange Traded Funds began in December 2000 and February 2002, respectively. Several other derivatives were also traded for a short period of time over the years (e.g., swaps, other interest rate derivatives and temperature-based derivatives).

2.2 Finnish money market

The history of the Finnish money market is closely related to the history of the Bank of Finland. The Bank of Finland is one of the oldest central banks in the world. In connection with Finland's separation from Sweden and transfer to the jurisdiction of Russia in 1809, the decision was made to overhaul Finland's monetary framework. In 1811, Tsar Alexander I decreed the establishment of a bank that was later developed into the Bank of Finland. In 1819, the bank was moved to Helsinki. The Bank of Finland began to operate as a true central bank in the 1860s when Finland obtained its own currency and commercial banks were established. This gave birth to a more organized credit market in Finland.

The first couple of decades of the credit markets' existence were characterized by strong regulation. There was a six per cent upper limit on loans to prevent loan sharking, for historical and religious

reasons. On the other hand, banks were keen to set up cartels to limit the costs of their funding. Some of the agreements were short-lived, but they affected the overall interest rate levels until the gold standard was abandoned at the end of 1914.[9]

The upper interest rate limit for lending was removed in 1920. This led to an immediate increase in the amount of both lending and deposits, as there were several banks competing for market share. Ultimately, this led to major difficulties for the banks; as a result, the banks again tried to form a cartel to limit the costs of their funding (i.e., the deposit rates) but with limited success despite multiple attempts. Interest rates increased sharply after the international recession in 1929, reflecting the cash shortage of companies. This led to a mutual agreement between the banks in 1931 that set an upper limit on deposit rates to lower the costs of their financing. This agreement lasted until 1938.

During the Second World War, banks were more or less forced to direct their lending to the government. As a result, lending rates were close to the Bank of Finland's base rate, and it was in the banks' interest to also keep deposit rates low even without a formal agreement. Lending rates were kept stable under a voluntary agreement made in 1941. After the war, the Bank of Finland started to regulate the competition more tightly as a result of political pressure to control the market. Lending rates were generally based on the Base Rate set by a Parliamentary banking committee. Interest rate regulation was slightly relaxed in 1960 when banks were allowed to use different rates for different loans as long as the average lending rate was within a pre-specified limit.

In 1975, the Bank of Finland founded the call money market in which commercial banks could lend money to fund deficits in their liquidity. The call money rate became the most important source of central bank funding and was the first step towards a real money market rate in Finland (Tarkka, 1988). The financial situation became more turbulent later in the 1980s; it became obvious that the static

9 The early history of the money markets is reviewed in Autio (1996).

interest rates were unable to reflect the fluctuating financial situation.[10] This led to a deregulation of banks' lending rates and the banking sector in general. The deregulation began gradually in 1982 when foreign banks were allowed to operate in Finland. During the same year, Finnish banks received permission to issue certificates of deposits (CDs).

However, a properly functioning secondary market for the CDs did not emerge until the beginning of 1987. In March 1987, the Bank of Finland introduced open market operations and began to participate in the Interbank markets. The Interbank markets quickly became the most important short-term money markets in Finland. Beginning in 1988, floating rates were allowed for all loans.

The Central Bank started to calculate and officially publish the money market rates beginning in May 1987. These rates, called Helibor rates (Helsinki Interbank Offered Rate), are the averages of the bid rates for CDs quoted by the five largest banks each day at 1 p.m.[11] Rates are calculated for one, two, three, six, nine and twelve months. Trading on the securities happens over the phone and on the Reuters screen. Starting in 1999, the Finnish currency, Markka, was tied to the Euro and Helibor interest rates were replaced by the Euribor interest rates.[12]

3. DATA

For the statistical analysis, we collected the longest available monthly time series for the equity and money markets as well as for inflation from Finland, Sweden, and USA. Our main interest is the equity premium in Finland and the time period from the establishment of the Helsinki Stock Exchange in October 1912 through December 2009. Thus, our market sample covers more than 97 years, or 1167 months, of data. Throughout the paper, we use continuously compounded asset returns calculated

[10] In addition, there were already market-born attempts to evade the regulation and restrictions on loan rates. Banks set up financial companies to loan money on more flexible terms. The size of the unregulated money market also started to increase. The largest companies were also able to resort to European money markets.

[11] From 1994 onwards the rates are calculated as the average of the quotations excluding the highest and the lowest given by the five largest banks.

[12] For more information on the Finnish money markets see Niskanen (1996).

from month-end to the next, but we also calculate percentage returns to derive estimates of the equity premium. More details of the series are provided in the Appendix.

3.1 Money market rates

As a proxy for the risk-free rate in Finland, we use the Finnish Helibor one-month rate from 1987 to the end of 1998 after which we use the Euribor one-month rate. However, because the money market developed quite late in Finland, money market rates are not available before the beginning of 1987. As a result, we have to use a proxy for the short-term risk-free returns that (institutional) investors could have obtained.

We choose to use the Bank of Finland's Base Rate as an approximation of the money market rate from 1912 to 1986. Naturally, the Base Rate does not represent a real market-determined rate as investors could not directly invest or borrow using that rate; however, we believe that it provides a reasonable proxy for the return on short-term savings as Finnish banks' highest offers on common short-term savings accounts closely followed the Base Rate, or course with a margin deducted (see Autio 1996). As a result, we believe that the returns achievable for institutional investors could hardly exceed the base rate.

For Sweden, we use the monthly short-run yield series until the end of 2006 provided on the Riksbank's (Bank of Sweden) website after which we use 30 day T-bill rates taken from Datastream. The data for 1912-1981 is the discount rate of the Riksbank. Thereafter, the data consists of yields on Swedish 30-day Treasury bills (Statsskuldsväxlar). For the USA, we use the risk-free return series based on the US Treasury Bills. The series are available since 1926 and taken from Ibbotson SBBI (2009). For the period prior to 1926, we utilize the call money rate taken from FRED.

3.2 Stock market returns

To track the stock market development in Finland, we use value-weighted and equally weighted stock market indices. The value-weighted index is constructed by using the Nyberg and Vaihekoski (2010) total return index from October 1912 to December 1969. From 1970 to the end of 1990, we use monthly total returns for the WI-index calculated by the Department of Finance and Statistics at the HANKEN School of Economics. After 1990, we use the HEX yield-index calculated by the Helsinki Stock Exchange.[13] The equally weighted index, constructed by the authors, is calculated similarly but with equal weights on all listed stocks.

Similar to the Nyberg-Vaihekoski index, both the WI and HEX indices are also survivorship bias free, value-weighted and corrected for cash dividends, splits, stock dividends and new issues. All these indices include all stocks listed on the official list of the stock exchange. The main difference between the WI index and the HEX index is in how dividends are handled. In the WI index, dividends are reinvested in the particular stock, whereas in the HEX index, dividends are reinvested in the market. Other smaller differences include, among others, what price is used when no transaction price is available (for more information, see Nyberg and Vaihekoski 2010).

For Sweden, we use monthly total return indices from the Bank of Sweden website augmented with the official indices after 2006. Note that the period 1912-1917 excludes dividends. For the USA, we use the Standard and Poor's composite index as a proxy for the market index from 1912 to June 1926 after which we have used the CRSP value-weighted index.

3.3 Inflation

In long-horizon studies it is customary to analyze real returns. For this purpose, we also collect and calculate monthly inflation values for Finland from 1912 onward. The official monthly Cost of Living

[13] Since the merger of the HEX and Swedish OMX in 2004 the index has been called the OMX Helsinki (OMXH) index. See Nyberg and Vaihekoski (2010) for more detailed discussion of the indices.

index has been available from January 1921 forward. The period before 1921 is more problematic, but here we use an unofficial index calculated by the Research Office of the Ministry for Social Affairs for 1920-1921 on a monthly basis, and on a quarterly basis for the period from 1914 to the end of 1919. We use this quarterly index to calculate monthly inflation rates under the assumption of a constant rate of inflation during the intervening months. For the period prior to 1914, index values for the cost of living are only available on a yearly basis. Therefore, for 1912-1913 we have used yearly values of the cost of living index published in Hjerppe (1989) and again transformed annual inflation rates into monthly rates.[14]

Swedish inflation is calculated using the CPI index provided in Frennberg and Hansson (1992) for the period 1919-1989 after which we the official CPI index by Statistics Sweden. For 1912-1916 we calculate monthly rates of inflation using the annual inflation index provided by the Riksbanken. For 1917-1918 we use the quarterly CPI index by Statistics Sweden. US inflation is calculated from the official CPI index.

3.4 Notes on Finnish transaction costs and taxes

In this paper we study the total return before taxes and transactions costs due to the many potential tax clienteles and negotiability of transaction costs. However, it is important to note their potential effect on the returns. During most of the sample period, there are two types of direct transaction costs: (i) the trading fee taken by the broker; and (ii) the stamp duty collected by the government. The broker's fee was typically set by the Exchange to, or at below, 1 per cent (at times less for bonds) until September 1986 when the minimum level was removed. The stamp duty changed a bit more during the sample period. For example, beginning in 1930, the duty was increased to 1.0 and 1.20 per cent on trades at and outside of the Exchange, respectively, and 2.0 per cent for shares issued by the company. In January 1993, the stamp duty (then set at 1.60 percent) was removed on trades conducted at the Exchange. It had already been removed in 1984 from trades where both parties were foreign and in

[14] More details can be found from the Appendix.

1968 from trades of equity issues. Overall, one can say the trading costs primarily affected those trading in the secondary equity markets, but the effect diminishes over a long period of time for buy and hold investors.

The evaluation of the effects of taxes on the returns is complicated because there are many issues and changes that need to be taken into account. A full survey of the changes in taxation is beyond this study. In general, it can be said that taxation treated individuals and institutional investors in Finland differently. For example, individuals had to pay tax on the basis of their wealth in excess of a minimum level from 1920 until 2004, but generally interest bearing instruments (bonds and bank accounts) were excluded from total wealth for purposes of taxation. In addition, taxation of capital gains versus coupon cash flow has also varied over the sample period and across different tax clienteles. Overall, one can say that until 1992 equity investments were taxed the most and bank accounts the least, with bonds being in the middle; in 1992, taxation on all forms of capital income was more or less equalized.

4. EMPIRICAL RESULTS

4.1 Interpreting the empirical evidence on Finnish capital market development

As discussed in our historical review, the Finnish capital markets remained relatively undeveloped and to a large degree segmented from international capital markets during most of the 20th century. Prior to 1986 it was almost impossible for Finnish investors to buy foreign securities and diversify internationally. Furthermore, it was only in the beginning of the 1980s when foreign investors started to enter the Finnish capital markets in larger numbers: at the beginning of the 1980s less than 10 percent of the market value of Finnish listed companies were owned by foreigners. However, in year 2000, the fraction of foreign ownership had reached 70 percent (see Ylä-Anttila et al., 2004).

Our explorative analysis is guided by financial theory that makes predictions of what we should expect to see in the data when studying the development of Finnish markets. First, there are theoretical reasons to believe that the historical equity risk premium should be high in countries, such as Finland, that have had strong constraints on inward and outward foreign equity investment (see, e.g., Stulz, 1999, and Bekaert and Harvey, 2003 for a review of theory). In closed capital markets, local investors have to bear all the risks related to the country's economic activities: they cannot diversify their holdings internationally and foreign investors cannot participate in bearing some of the risks related to the country's economy. Due to the high amount of undiversifiable risk that local investors have to bear, equity prices will be depressed and expected stock market returns (the equity premium) will be high as a compensation for the local market risk.[15]

Second, there are reasons to believe that the informational efficiency of the Finnish stock market has increased over time. The early decades of the Helsinki Stock Exchange were characterized by low liquidity and thin trading. The low liquidity gave opportunities for big market players to collude and potentially affect market prices. It would take until 1989 when the first insider trading laws were written into the legislation. In addition, the sophistication of Finnish market participants has likely increased over time: in 1958, more than 50 percent of Finnish listed equity capital was owned by households and the rest by institutional investors (Ylä-Anttila et al., 2004), whereas in 2011 the fraction of household ownership had decreased to 20 percent. The opening of Finnish markets to international investors and the ensuing increases in market participants and competition should also have led to more efficient information processing and to less predictability in short-term stock returns (see, e.g. Grossman and Stiglitz, 1980).

Third, we would expect to see patterns in how the stock market returns on the Finnish market comove with international markets. The fact that capital market liberalizations have a tendency to increase the

[15] See, for example, Henry (2000) and Bekaert and Harvey (2000) who present empirical evidence that the equity premium tends to decrease *after* financial market liberalizations.

correlation between a local market and world market returns has been documented in literature (see e.g., Bekaert and Harvey, 1997). Thus, we would expect the interdependence between the Finnish and the US markets to have increased significantly during the latter part of our sample period. Furthermore, even in segmented capital markets, comovements in financial returns across countries may arise due to comovements in economic variables. As hypothesized by Bracker et al. (1999), changing macro-economic conditions in one country should have a stronger effect on the stock market in the other country the stronger the bi-lateral trading relationships are between the countries. Considering the close geographic proximity and the similar industry structures of Finland and Sweden, and their history of bilateral trades, we would expect there to be interdependencies between the equity markets in these two countries even in the early part of the sample.

4.2 Average nominal and real stock market returns

Table 1 shows, for Finland, Sweden and USA, descriptive statistics for the continuously compounded nominal returns on equity and money markets from October 1912 to the end of 2009. The table also shows statistics for logarithmic changes in the inflation indices. Monthly means and standard deviations have been annualized by multiplying them with 12 and the square root of 12, respectively. The average value-weighted continuously compounded Finnish stock market return for the full sample from 1912 to 2009 is 12.91 percent. During the same period, the average returns in the USA and in Sweden were 10.65 and 9.03 percent, respectively. Thus, in nominal terms Finnish stock market has developed quite favorably in comparison to the stock markets in the other countries. This can also be seen from Figure 1A.

However, the situation changes when inflation is taken into account. The average inflation rate in Finland during the sample period was high, 7.77 percent per annum, compared to Sweden (3.90%) and the USA (3.18%). Analyzing the series shows (see Figure 2) that the Finnish inflation rate was high especially after the World Wars while the same kind of inflationary development did not occur in

Sweden and the USA. As a result, the real stock market return in Finland is, on average, 5.14 percent which is clearly lower than in the USA (7.47%) but on par with Sweden (5.13%).

Using the inflation series, we can adjust the nominal stock market indices to show the development in real terms (Figure 1B). There are a number of interesting observations that can be made from the figure. First, the Finnish and Swedish stock markets show a surprisingly similar development in real terms. Second, both markets visibly lose to the US market during the sample period, although the Great Depression clearly had a more negative effect on the US market. However, the US market starts to pull ahead again in the mid-1930s – especially against Finland whose stock market was hurt by the WWII.[16] The positive market development lasted in the USA until mid-1960s. After the oil crisis in the early 1970s, the Finnish and Swedish stock markets started to catch up with the USA, and more so after they started to recover from the deep economic and banking crisis in the early 1990s which also led to the decision to float their currencies in 1992.[17]

4.3 Volatility and long-run risk

Table 1 also shows the annualized standard deviations for the time series over the entire sample period. The volatility of the Finnish stock market has been quite high, 20.76 percent per annum; somewhat surprisingly it is not that much higher than in the US (18.07 percent) or in Sweden (16.87 percent). The Finnish inflation rate, on the other hand, shows much higher volatility, 7.29 percent, than the inflation rates in other countries (2.32 and 3.11 percent for USA and Sweden, respectively). Money market returns are much less volatile in all countries (in Finland: 0.73 percent), as expected.

Stock market volatility has varied greatly over the years. Figure 3 shows the dynamic behavior of annualized standard deviations during the sample period in Finland, Sweden, and the USA. The

[16] At the end of the 1940's, real Finnish equity values were approximately only 36 per cent of their corresponding values from the beginning of the decade. In comparison, equity values in Germany declined to 28 per cent and equity values in Japan declined to 5 per cent of earlier values (Jorion and Goetzmann 1999).

[17] Reinhart and Rogoff (2009) provide an international comparison on the effects of banking crisis on the stock market; the Finnish stock market suffered clearly more than the historical average of the cases analyzed. Kuusterä and Tarkka (2012) provide more detailed information on the banking crisis in Finland. Antell and Vaihekoski (2012) review the history of Finnish and Swedish currency regimes since the Bretton Woods agreement.

standard deviations are calculated from continuously compounded nominal equity market returns using a rolling window of 24 months. In Finland, the most turbulent periods were after the First World War and the Second World War (1945-1948); since then, the volatility appears to have been relatively stable until the early 1990s (c.f., Figure 3A).

Comparing the Finnish stock market volatility to the US market volatility (Figure 3B), we can see that the Great Depression in the 1930s created much higher volatility in the US stock market than in the Finnish or Swedish stock markets. On the other hand, the end of WWII did not trigger the same kind of increase in volatility in the USA or in Sweden as it did in Finland. Some similarities can also be found; for example, the oil crisis in the 1970s seems to have had an impact on all markets.

In the early 1990s, Finland experienced a banking crisis and a deep economic depression that also had an impact on stock market volatility. Another increase in volatility came after the late 1990s, during the technological boom. During this time, the Finnish stock market shows almost twice the volatility of the US market. This could be because the value-weighted market portfolio was not well-diversified; Nokia and other high tech had a major influence in the index. To study this we contrast the standard deviation of the value-weighted portfolio with that of an equal-weighted portfolio that is constructed of all shares listed on the stock exchange. The series is also shown in Figure 3A. Prior to the mid-1990s, the standard deviations of the value-weighted and equal-weighted portfolios tracked each other closely; however, their paths started to diverge around 1995 when Nokia and other information technology/telecom companies started to gain dominance in the value-weighted index.

Analyzing other aspects of the return series, we can see that all return series show evidence of autocorrelation. A related issue is the question whether stocks are less risky in the long run. To study this we calculate variance ratios for the return series (variance of N-period returns divided by N times the variance of one-period returns). If returns follow a random walk, the variance ratio is equal to one, and the variance does not proportionally decrease or increase during longer holding periods. Earlier studies (e.g., Pástor and Stambaugh 2012) have documented ratios lower than one using annual returns

suggesting that stocks are less risky on the long run. To study this, we estimate variance ratios using continuously compounded returns from 1913 to 2009. We use the approach of Lo and MacKinlay (1988) where returns are assumed under the null to follow a random walk process, $r_t = \mu + \epsilon_t$, where ϵ_t is allowed to show conditional time-varying heteroscedasticity. The results are shown in Table 2.[18]

The results for annual returns using N=2 to N=20 show that the variance ratios decrease for Finland and for the USA as the holding period becomes longer, but the ratio decreases more rapidly for Finland than for the USA (see also to Figure 9 in Pástor and Stambaugh 2012). Maybe surprisingly, the variance ratios do not decrease for Sweden -- in fact, the variance ratios show an increasing pattern as the holding period is extended. However, in general, the null hypothesis of variance ratios equal to one cannot be rejected for Sweden or the USA, and the null hypothesis is only marginally (at the ten percent level) rejected for Finland for periods of two and ten to fifteen years. Overall, the results suggest that, *ex post*, Finnish stocks have been less risky in the long run in nominal terms, and even more markedly so than in the USA, although the sample length does not allow us to make any statistically clear conclusions.

We also calculate the variance ratios using monthly data for N=2 to N=60 (see Table 2). For all three countries, the ratio stays above one for all values of N (as suggested by positive autocorrelation in monthly returns), but in the USA, the ratio is fairly constant and not statistically significantly different from one, whereas for Finland and Sweden, the ratio is significant for most values of N, and it increases quite steeply (reaching values close to two) after which it starts to decrease (Finland) or stays put (Sweden).

4.4 Equity premium

Our main interest in this paper is the equity premium in Finland. The continuously compounded risk-free return in Finland is estimated to be 6.44 percent per annum on average, which is again fairly high

[18] More detailed results are available upon request.

compared to Sweden (5.43%) and US (3.70%) in nominal terms, but not in real terms (-1.33 percent) as Sweden (1.53%) and US (0.52%) both show positive real rates for their money markets. Now, using the difference in the continuously compounded equity and money market return series, we can calculate our estimate for the average historical Finnish equity premium. The result is 6.47 percent. It can be compared against the equity premium estimates of 6.95 and 3.59 percent in the US and Sweden, respectively.[19] Statistically, though, the Finnish equity premium is not significantly different from either one (*p*-values for the heteroskedastic t-test of equality of means are 0.856 and 0.276 against the US and Sweden, respectively).

To study the equity premium further, we also analyze sub-periods. To provide a comparison to other studies, we utilize annual simple percentage (i.e. not continuously compounded) returns in the analysis. Table 3 presents the mean and volatility of annual real percentage returns for 1913-2009 and for individual decades. Using arithmetic averages of simple returns, Mehra and Prescott (2003) report that the US equity premium from 1889 to 2000 was 6.92 percent. Using a similar approach, our estimates for the annual real Finnish equity and money market returns for 1913-2009 are 9.99 and -0.15 percent, respectively.[20] Thus, the equity premium is 10.14 percent. Similarly, for Sweden we estimate the premium to be 6.01 percent and for the USA 9.35 percent. The Finnish equity premium appears to be slightly higher than in the USA, and clearly higher than in Sweden.

On the other hand, the results show that there have been large differences in average stock returns between the decades in all three countries. For example, the effect of the WWII is reflected clearly as a negative realized risk premium in the Finnish stock market during the 1940s. The same did not happen in Sweden that stayed out the war. We can also observe the post-war optimism in the 1950s in all of the markets. Finally, the technology boom in the 1990s can also be clearly seen in all of the markets, and

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19 The results differs slightly what Dimson et al. (2010) estimated from 1910 to 2009. Using their equity premium index, one can estimate the equity premium to be 5.57% for Finland, 4.83% for the USA, and 3.65% for Sweden.

20 The mean values in Table 1 differ from those reported here due to the well-known relationship between the lognormal distribution (percentage returns) and the normal distribution (continuously compounded returns) which implies, for example, that the arithmetic average of percentage returns exceeds the average continuously compounded rate by $0.5\sigma^2$. Note also that annualized volatility (Table 1) typically differs from volatility of annual returns due to autocorrelation in returns. Note also that the annual money market returns are proxied as the average of the one month returns.

especially in Finland where the stock market experienced almost an unparalleled development in western countries due to Nokia and other technologically oriented companies.

Finally, we analyze the effect that the investment horizon has on the realized equity premium in Finland. Figure 4 shows a backward-looking annualized moving average of the continuously compounded monthly equity premium for holding periods of five, ten, twenty and thirty years. For example, the point "1917" on the x-axis for the line labeled '5 years' shows the average five-year excess return over the money market return that someone who invested in the stock market in October 1912 and held his investment for five years would have received. We see that as the investment horizon grows longer, the probability that the equity premium is positive during the holding period increases. In fact, for investment periods of 20 and 30 years, none of the average holding period premiums are negative.

4.5 Stock market interactions and return predictability

4.5.1 VAR-analysis

Having quantified the historical equity premium in Finland, we now estimate a vector autoregressive (VAR) system for the three stock markets. Our aim is to analyze the interactions between the markets as well as the predictability in stock returns. Based on our discussion in subsection 4.1, we are especially interested in how these patterns have evolved over time as a function of the development and internationalization of the Finnish stock market.

Using the standard VAR methodology and nominal monthly stock market returns for all three countries, we first estimate the optimal number of lags in the model. The Akaike, Schwartz, and Hannan-Quinn information criteria support the use of one lag. This supports our decision to use a VAR process of order one in the estimation. In the second estimation, we add two restrictions on the model, namely that the US stock market returns are not explained by the lagged returns in Sweden or Finland. Finally, we also estimate a system where we have contemporaneous returns for other markets

included in the model (except for the US) to see more direct interactions between the markets. The results for the last system using the seemingly unrelated regression (SUR) method are reported in Table 4 (results for other systems are available upon request).

We estimate the system first using the full sample (Panel A), and then for three subsamples, where the first sub-period ranges from 1912 to 1969 (Panel B), the second covers the years 1970-1989 (Panel C) and the third is from 1990 to 2009 (Panel D). The time period before 1970 was mostly characterized by segmented stock markets and a more or less fixed currency system in all countries. Market integration started to increase slowly in the 1970s gaining more speed in the 1980s. Finally, in 1993, all restrictions on foreign ownership were removed in Finland.

Due to the close geographic proximity of Finland and Sweden, their hypothesized sensitivity to the same macroeconomic shocks and their history of bilateral trades, our expectation is that there are, during the whole sample period, contemporary cross-country effects between the two Nordic countries. We also expect cross-country effects from the US market to Finland and Sweden, especially in the later part of the sample when capital markets became more integrated. However, the US influence is likely to be more significant for Sweden than for Finland as the Swedish stock market was more developed and internationalized than the Finnish counterpart during most of the 20th century. Finally, we expect to see short-term predictability in returns, but this predictability should have decreased over time as the increased number and sophistication of market participants, and the increased stock market liquidity might have made value-relevant information processing more efficient.

The results are mostly consistent with our expectations. First, Sweden and Finland have contemporary cross-effects on each other during all sub-samples, and the interdependency of these markets increases monotonically in time. Second, somewhat contrary to our expectation, the US market is not found to influence Finland directly, even though the strength of the US influence reaches its highest level in the most recent sub-sample (albeit it does not reach statistical significance). On the other hand, the US

market plays a major role for the Swedish market, as expected. Third, there is evidence of AR(1)-type of predictability in local returns, but the effect tends to decrease and become insignificant over time for the Nordic countries.

4.5.2 Cross-country correlations

To present a more complete picture of the dynamic behavior of stock market interactions we calculate rolling correlation coefficients between Finland and the two other markets. The correlations are calculated with a moving window of 36 months, and the results are presented in Figure 5.

The Figure indicates that the correlations are not stable and they fluctuate strongly over time. However, there are some discernible patterns of interest. First, as we would expect, the correlation that the Finnish stock market has historically displayed with Sweden is higher than the one displayed with the US market. For the whole sample period, the average correlation between Finland and Sweden (USA) is 0.28 (0.17).[21] Second, there appears to be a positive time-trend in the correlations. During the sub-periods, the average correlations between Finland and Sweden (USA) are: 1912-1969: 0.14 (0.05), 1970-1989: 0.24 (0.12) and 1990-2009: 0.69 (0.55). Third, the financial liberalization that started in Finland in the mid-1980s, and the gradual removal of restrictions on foreign ownership that came thereafter, appear to coincide with a strong upward shift in the correlations.

4.6 Robustness analysis

The high equity premium for Finland is, however, slightly surprising given its weaker real stock market performance compared to the US. The obvious question is whether the use of the Central Bank's base rate as our proxy for the risk-free rate of return for the early part of the period biases the results. However, as stated earlier, there were no real money markets in Finland until mid-1980s, and the Central Bank's base rate was actually used by law as the reference rate to savings accounts (and loans).

[21] The average correlation between Sweden and USA (not displayed in the figure) is 0.36 during the sample period, that is, more than double the correlation between Finland and USA.

As a result, one could argue that the governments forced the short-term (risk-free) savings rates to be artificially low. On the other hand, the reality was that investors had a hard time achieving even risk-free rates of return matching the base rate; especially since the savings rates offered by the banks, even for the wealthy clients, were typically clearly below the base rate, often by the margin set by the government. Overall, we believe that the high equity premium in Finland (and most likely in many other European countries as well) is partly caused by the government's interest rates control to keep rates low during most of the 20th century. In the end, low interest rates were a reflection of the reality investors were faced with. Moreover, it is evident that short-term interest rates were surprisingly low also in the USA during mid-part of the sample period (see Figure 6).

Another potential driver behind the results could be the fact that in the late 1990s and early 21st century, the Finnish stock market was characterized by a very high level of concentration. At the end of year 2000, two of the largest companies, Nokia and Sonera (that later became a part of TeliaSonera), accounted for 75 per cent of the total market capitalization (and thus of our value-weighted market index); Nokia alone contributed up to 70 per cent of the total market value (see Vaihekoski 2004). As a result, one might ask: (i) if Finnish stock market returns only describe the performance of some highly successful companies, especially in the late 1990s, and not the market in general; and (ii) if investors who opted to hold better diversified portfolios were also able to obtain these high rewards for their risky investments.[22]

Therefore, we first calculate the average returns for an equally weighted stock market index. The mean equal-weighted stock market return is considerably higher than the value-weighted return, at 16.89 percent in nominal terms, indicating the success of smaller companies (similar results have been shown e.g. for the Belgian market in Annaert et al. 2012). Second, we examine the period from 1991 to 2009 more closely using the NasdaqOMX Helsinki Cap Index which has a ten percent upper weight limit on

[22] It must, however, be noted that this extreme level of concentration mentioned here is a peculiarity of the later years in our sample and is not characteristic for the whole time period. For example at the beginning of 1975, the largest company made up approximately 12 per cent of the total stock market value, whereas the three largest companies accounted for approximately 35 per cent of total market value. At the beginning of 1990, the largest company accounted for 8 per cent of the total value, and the three largest companies for 20 percent.

all companies. The mean continuously compounded return on the index is 10.52 percent per annum which is two percentage points below the mean return of the uncapped value-weighted index (12.51 percent). Thus, the results are partly mixed. But on the other hand, the average equity premium over the same period (8.59 percent) was still more than two and a half percent higher than in the USA over the same period (5.95 percent).

Over the long period, the high returns on Finnish stocks appear to be a market-wide phenomenon and not just the result of a few larger companies' success, even though the "Nokia-effect" has clearly increased the equity premium, especially if estimated over the recent history. Overall, we believe, it is fair to say that the Finnish stock market has been able to provide a high equity premium over the last century in an international comparison.

5. CONCLUSIONS

For this paper, we have collected the longest available historical monthly return series for the Finnish equity and money markets from the early 20th century to the present day. In addition, we have collected similar series for Sweden and the USA together with the monthly inflation rate series to facilitate cross-country comparisons.

Using the data series from 1912 to 2009, the Finnish stock market has provided excellent returns in nominal terms when compared to the USA and Sweden, but in real terms, the US market excels in comparison to Finland and Sweden. The results show that the Finnish stock market has offered investors a continuously compounded return of 12.91 percent per annum (5.14 percent in real terms) with a standard deviation of 20.76 percent. The random walk hypothesis is rejected for Finland and Sweden, but not for the USA using variance ratio tests on monthly returns. Using annual returns, the variance ratios decrease for longer holding periods both for Finland and for the USA, but surprisingly not for Sweden.

Using an approach similar to Mehra and Prescott (2003), the equity premium for Finland from 1913 to 2009 is 10.14 percent per annum, which is slightly higher than in the US (9.35 percent) and clearly higher than in Sweden (6.01 percent). This high equity premium in Finland cannot be explained by the impact that Nokia with its extreme performance at the end of the 20th century has on the results. On the other hand, the result is partly driven by the low interest rates during the sample period. Low interest rates were the result of government's control over interest rates, both in Finland and Sweden, until the 1980s which kept investors' returns on short-term (risk-free) investments artificially low.

Having a number of long time series collected together from Finland for the first time allows one to study further a number of issues. It would be interesting to examine, for example, the role that the stock market plays in economic development (as in, e.g., Van Niuwerburgh et al. 2006), and to study long-term dependencies and risk transmission mechanisms in cross-country relationships. Furthermore, it would also be interesting to construct additional times series (for example, dividend yield series or market capitalization to the GDP ratios) to enable us to do additional analysis, e.g. by decomposing the sources of the returns. These questions are left for future research.

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APPENDIX. CONSTRUCTION OF THE TIME SERIES.

Finland

The money market (risk-free) rate of return for month t is calculated using the following equation: $r_t = 100(P_{t-1})^{-1}$, where $P_{t-1} = 100(1 + i \times d)^{-1}$. The money market rate, i, is either one month Helibor rate (31.12.1986-31.12.1998) or Euribor rate (31.1.1999–) observed at the end of the previous month. The parameter d is the real number of days between from the month-end t–1 to t divided either by 365 (Helibor) or 360 (Euribor). For the period before 1987, Bank of Finland's Base Rate is used. The approach used to derive monthly rates of return from the Helibor rates is also applied to the Base Rate.

The value-weighted total return index in Nyberg and Vaihekoski (2010) has been used to calculate value and equally weighted stock market returns from 1912 to March 1970. Few errors have been corrected in the original index but the impact is minuscule. Both the old and the new index are available at the author's website.

Inflation series is calculated using the official monthly Cost of Living index that is available from January 1921 onward. At first the index was calculated by the Research Office of the Ministry for Social Affairs and published in Sosiaalinen Aikakauskirja (Journal of Social Issues).[23] The reference period was initially set to the first half of 1914 (i.e., 1914/1-6=100). The index as such was calculated officially until the end of 1936.

In 1936 and 1937, a meeting between economic statisticians from Nordic countries was held in Copenhagen. The participating countries decided to harmonize their indices and, as a result, 1935 was set as the new reference period for a number of indices, including the Cost of Living index. At the same time, a decision was made that the index will only be calculated quarterly, during the first month of each quarter. However, sub-indices for food, heating and lighting would still be calculated on a monthly basis. The new officially quarterly index (1935/1-12=100) was published in the Journal as before, but the Bank of Finland also calculated unofficial values for the intervening months using the above-mentioned monthly sub-indices. The Bank published the index values in their Monthly Bulletin publication.[24] These index values are used in this study.

From August 1939 onward, the Cost of Living index has been available at the monthly level. It can be easily derived from the electronic databases e.g. through Statistics Finland. For this study, an index that covers the period from August 1939 until the present day was constructed by splicing two indices with reference periods 1938/8–1939/7=100 and 1951/10=100.

The period before 1921 is more problematic from a researcher's point of view as most sources provide only annual values for the index. However, one can use an unofficial index calculated by the Research Office of the Ministry for Social Affairs. They calculated two indices for living costs, both of which had the same reference period (1914/1-6=100), but they differed in how they handled taxes. The one used here did not take into account changes in taxes, but it is available for 1920-1921 on a monthly basis. In addition, it is also available on a quarterly basis for the period from 1914 to the end of 1919.[25] For the period prior to 1914, index values for the cost of living are only available on a yearly basis. Therefore,

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23 The index was also published in the Statistical Yearbook for Finland (accurate index values given) and Bank of Finland Monthly Bulletin (rounded index values given), among others.

24 Issue 6 from 1937 discusses the construction in details.

25 Somewhat mysteriously, the quarterly index has been published only in the Statistical Yearbook 1921 as far as we know. Index values for 1917-1919 are given using marginal prices as well as prices from the black market as the basis for the index construction. The latter one is used in this study.

for 1912-1913 we have used yearly values of the cost of living index published in Hjerppe (1989). Quarterly and annual changes in index values are transformed into monthly inflation rates under the assumption of a constant rate of inflation during the intervening months. In other words, we calculate the monthly rate corresponding to effective (compounded) quarterly (annual) rate of changes.

Sweden

The risk-free rate of return proxy for Sweden is calculated using the monthly short-run yield series provided at the Riksbank's (Bank of Sweden) website. Values are provided to the end of 2006 after which we use 30 day T-bill rates taken from Datastream. The values for 1912-1981 is the discount rate (corresponding to Finnish Base Rate) of the Riksbank and Swedish 30-day Treasury bills (Statsskuldsväxlar) market yields thereafter. The data provided by the Riksbank differs occasionally slightly from Frennberg and Hansson (1992) but for the most part the values are identical. Monthly returns are calculated similar to Finland, but using the real/360 day counting convention throughout the period.

Swedish stock market returns are calculated using stock market index provided at the Riksbank's website. It seems that their data for 1918-1989 is originally by Frennberg and Hansson (1992) and for 1912-1917 by Waldenström (2007). Note that period 1912-1917 excludes dividends. For the period after 2006 we augment first with the general index by Affärsvärlden (year 2007) and then with the Stock Exchange's own index OMXS (2008-). Both total return indices are taken from Datastream.

Swedish inflation is calculated using the CPI index provided in Frennberg and Hansson (1992) for period 1919-1989 after which we the official CPI index by Statistics Sweden. For 1912-1916 we calculate the monthly inflation using the annual inflation index provided by the Riksbanken. For 1917-1918 we use the quarterly CPI index by Statistics Sweden. Monthly rates are calculated as for Finland.

USA

For the USA, we use the risk-free return series based on the US Treasury Bills. The series is available since 1926 and taken from Ibbotson SBBI. For a period prior to 1926, the selection of the risk-free rate of return is more problematic as there were no T-Bills (see, e.g., Mehra and Prescott, 2003, for discussion). Here we utilize call money yields taken from FRED. To derive monthly returns from the yields, we have used the same approach as before, but the pricing equation used is taken from SBBI, i.e., $P_{t-1} = 100(1 - i \times d)^{-1}$. Real/360 day counting convention is used. To derive implied money market yields for Figure 5, we have used the pricing equation backwards.

US stock market returns have been calculated using the Standard and Poor's composite index (dividends added separately) as a proxy for the market index from 1912 to June 1926 after which we have used CRSP value-weighted index. Series have been taken from Professors Robert J. Shiller's and Kenneth R. French's websites.

US inflation is calculated using the official CPI index (All Urban Consumers). Monthly values are available from January 1913 forward from FRED. Values for 1912 are taken from Professors Robert J. Shiller's web-site. His values for 1913-2005 match the values from FRED with minor differences in 2005.

Figure 1A.

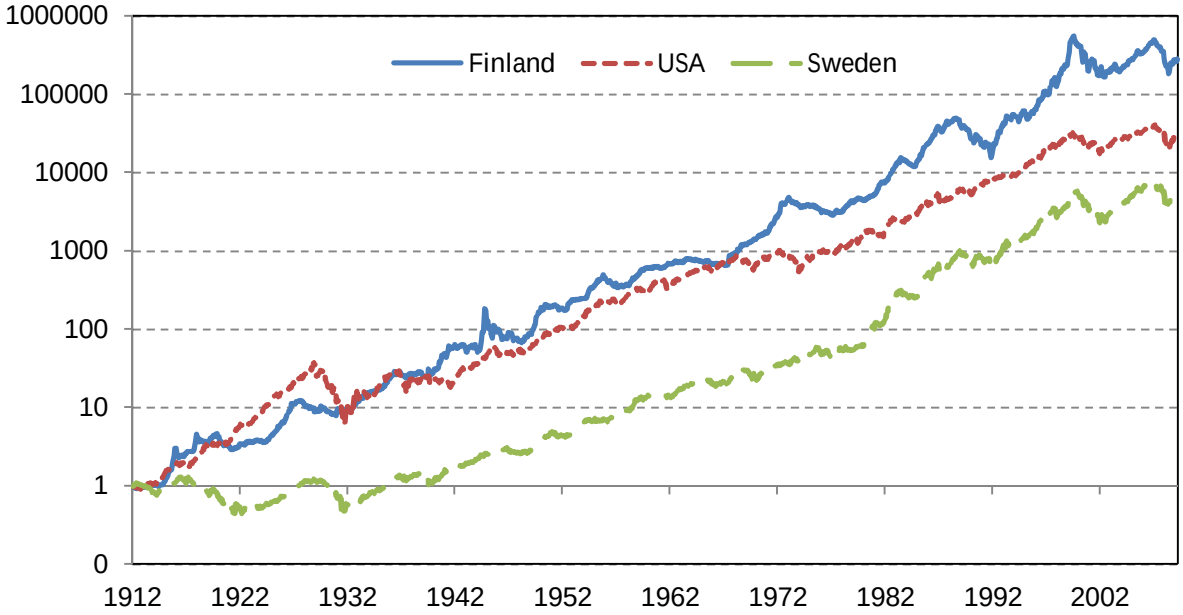

Figure 1B.

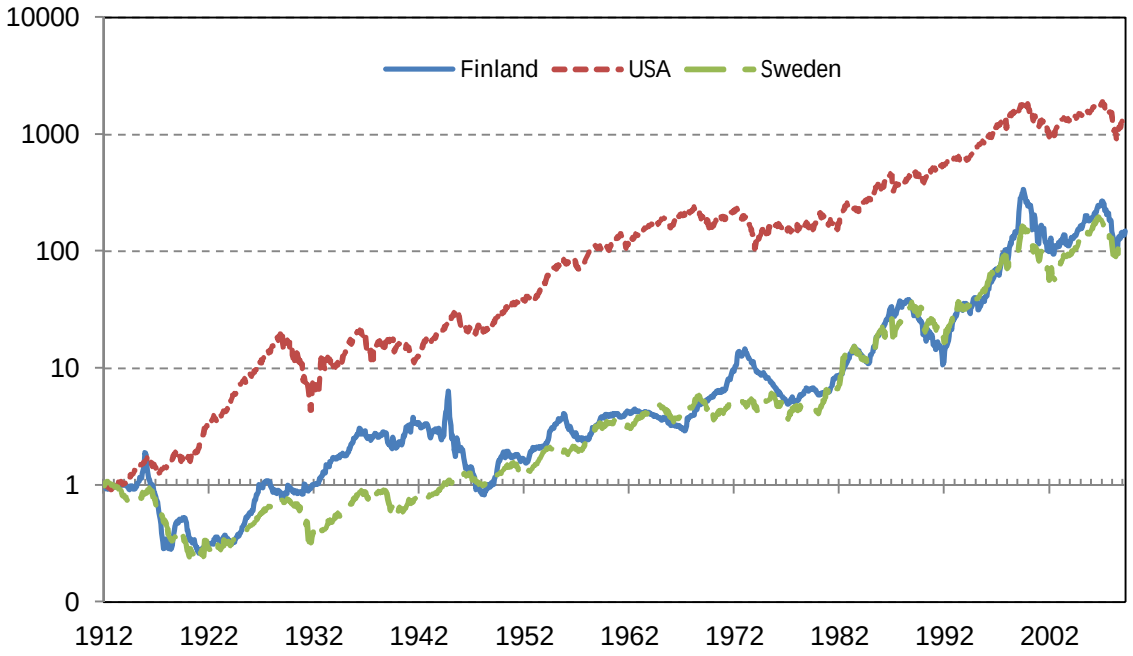

Figure 1: Development of the nominal (1A) and real (1B) stock market indices for the Finnish, Swedish, and US equity markets 1912/10-2009/12. See Appendix for data sources. Logarithmic scale (October 1912 = 1).

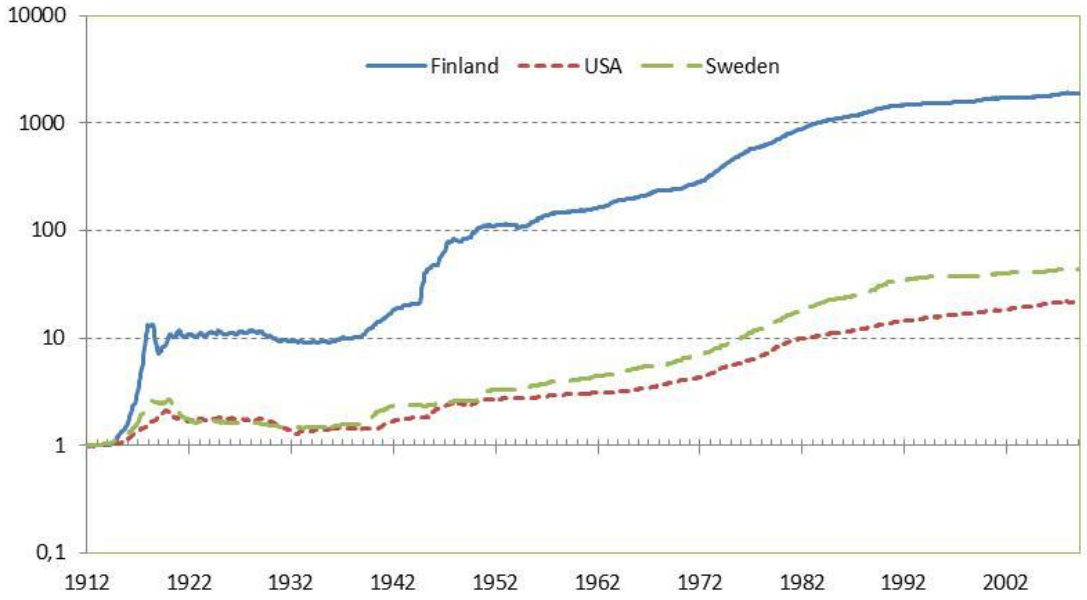

Figure 2: Development of the inflation indices in Finland, Sweden, and the US 1912/10-2009/12. See Appendix for data sources. Logarithmic scale (October 1912 = 1).

Figure 3A.

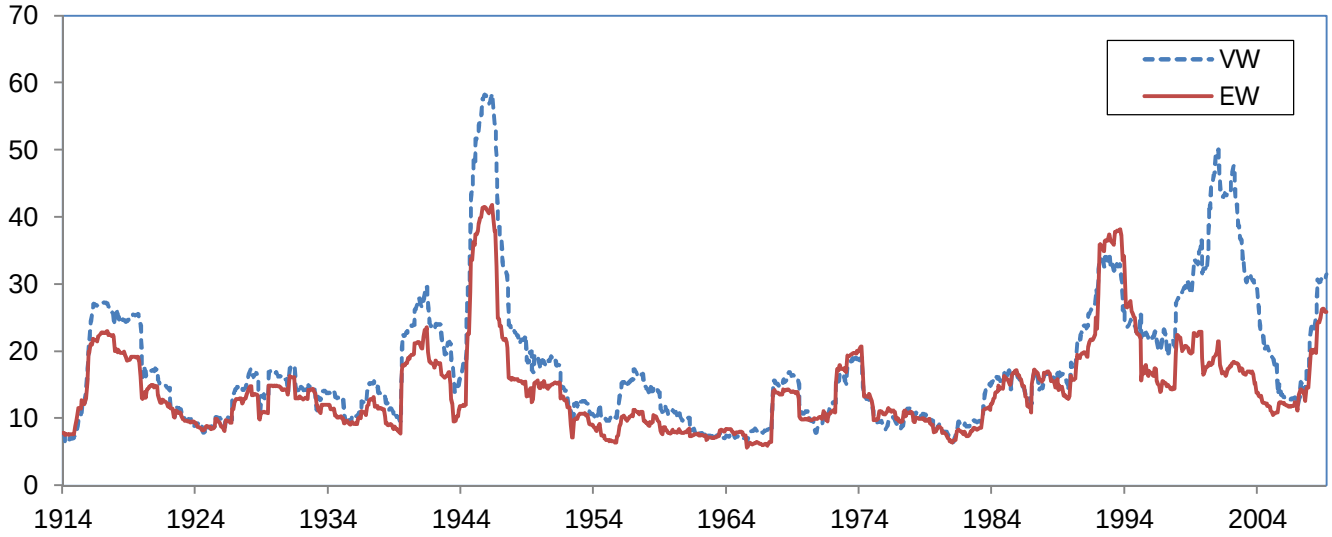

Figure 3B.

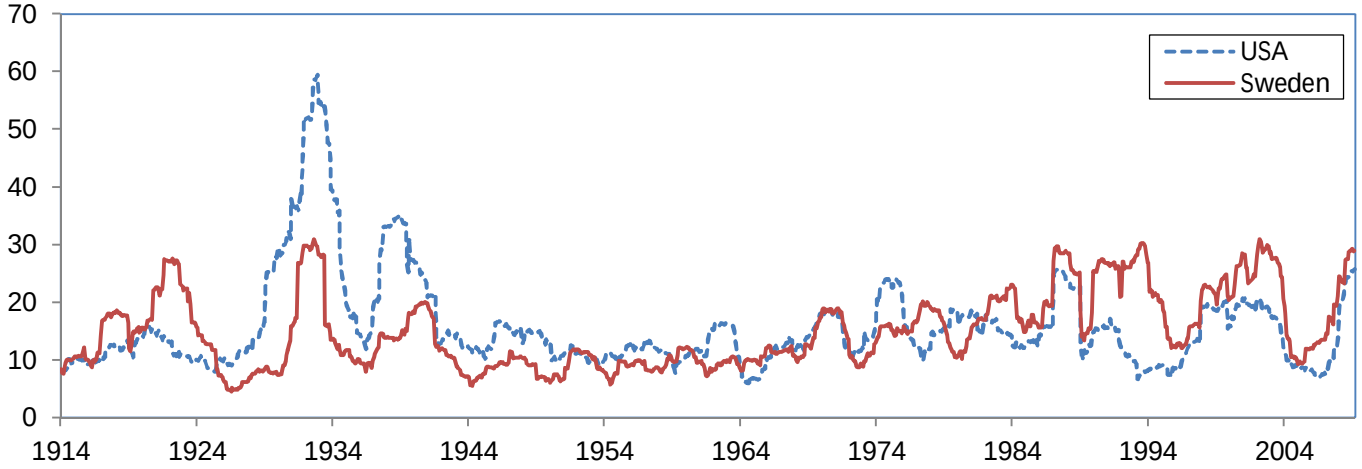

Figure 3: 24-month backward-looking rolling standard deviations. Annualised 24-month rolling standard deviation of continuously compounded, nominal stock market returns are shown for Finland (3A) as well as for Sweden and USA (3B) from November 1912 to December 2009. Figure 3A shows the standard deviations both for a value-weighted stock market index (VW) and for an equally-weighted portfolio (EW) of all shares on the market.

Figure 4.

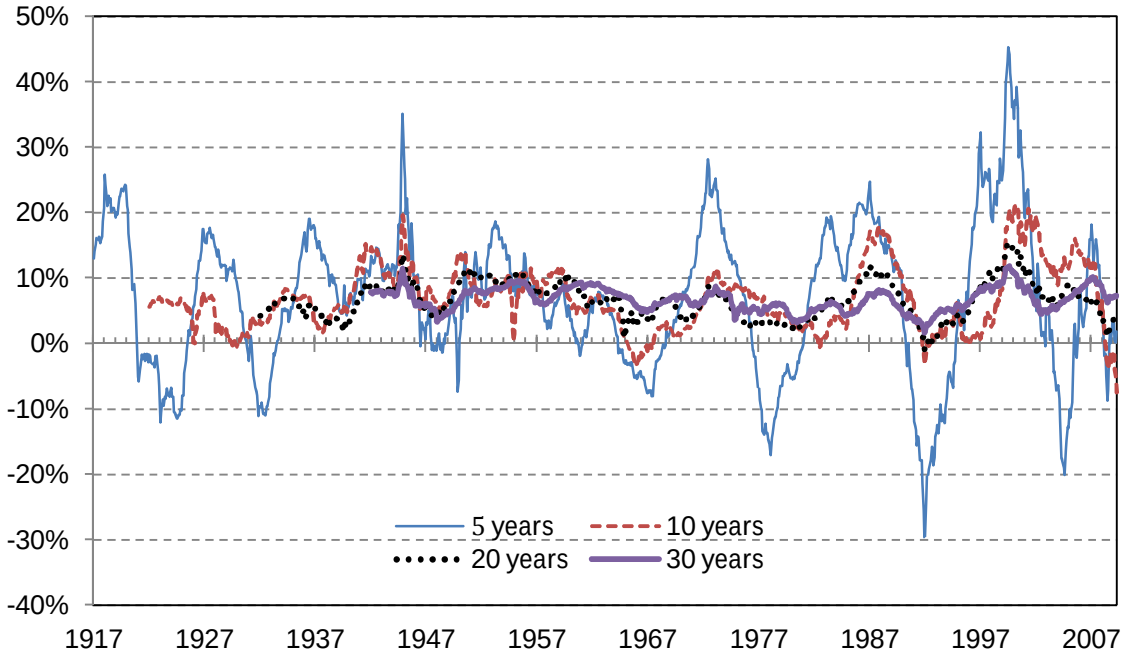

Figure 4: The equity premium in Finland under different investment horizons. Figure 4 shows a backward-looking moving average of the monthly continuously compounded return differences between value-weighted stock market and money market returns (i.e. the equity premium). All values are multiplied by 12 to arrive at annual averages. Per annum average equity premiums are calculated for investment horizons of 5, 10, 20 and 30 years.

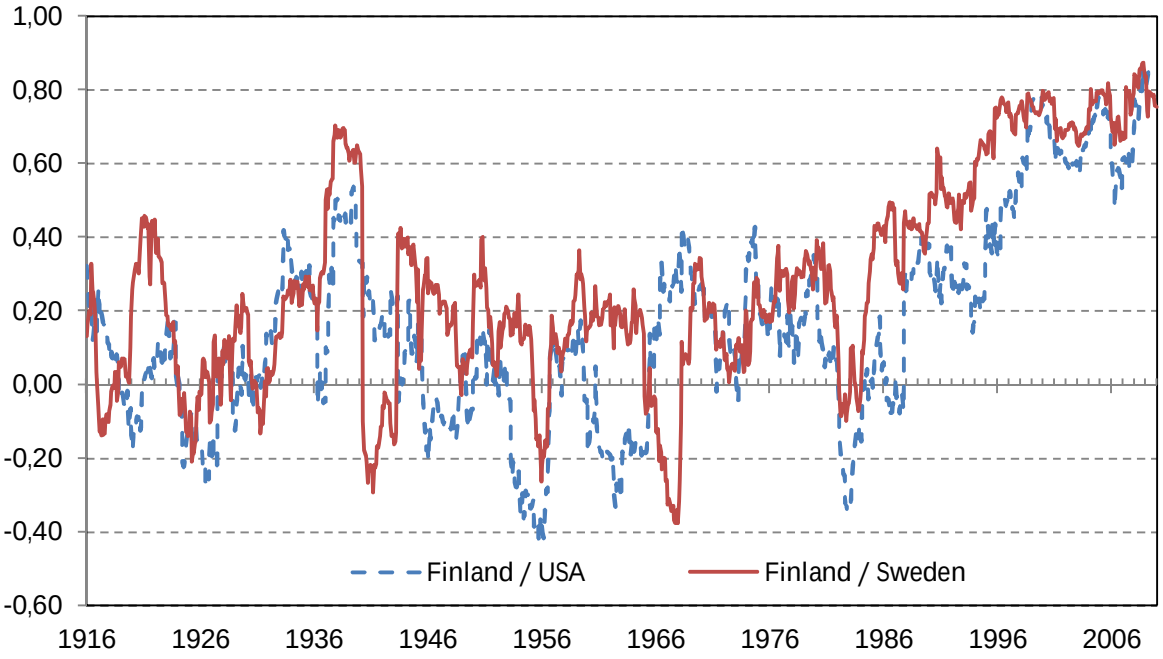

Figure 5: 36-month correlation coefficient between monthly stock market returns 1912/10-2009/12.

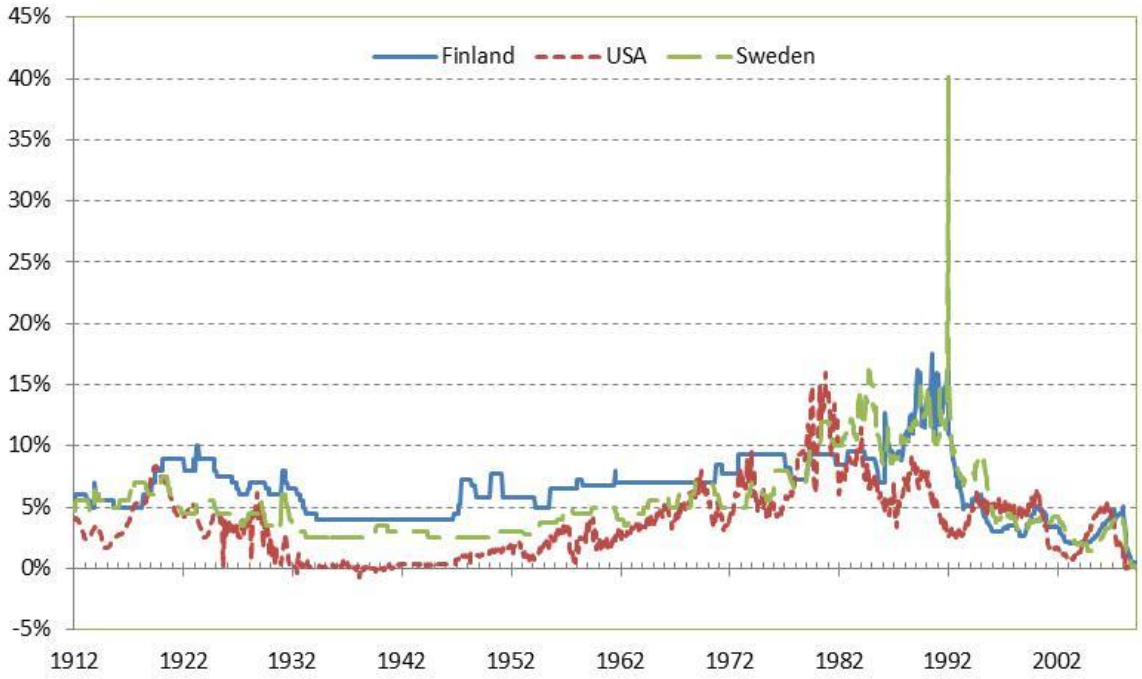

Figure 6: Monthly short-term money market rates per annum in Finland, Sweden, and the US 1912/10-2009/12. See the Appendix for details and data sources.

Table 1. Descriptive statistics for monthly continuously compounded nominal returns 1912-2009

Descriptive statistics are calculated for the monthly continuously compounded asset returns. See the Appendix for details on the data series. The mean and standard deviation of the returns in the table are multiplied by 12 and the square root of 12, respectively. The *p*-value for the Jarque-Bera test statistic of the null hypothesis of normal distribution is provided in the table. The full sample size is 1166 monthly observations from November 1912 to December 2009.

Asset return series	Mean (% p.a.)	Std. dev. (% p.a.)	Skewness	Excess Kurtosis	Normality (p-value)	Autocorrelation[a] r_1	r_2	r_3	r_{12}	Q(12)[b]
Panel A: Finland										
Equity market	12.91	20.76	0.343	4.991	<0.001	0.218*	0.024	0.060*	0.091*	<0.001
Money market	6.44	0.73	0.732	-2.268	<0.001	0.972*	0.960*	0.944*	0.844*	<0.001
Inflation	7.77	7.29	2.617	24.602	<0.001	0.711*	0.589*	0.497*	0.044	<0.001
Panel B: Sweden										
Equity market	9.03	16.87	-0.502	3.986	<0.001	0.164*	0.000	0.078	0.050	<0.001
Money market	5.43	0.90	2.259	14.362	<0.001	0.929*	0.911*	0.897*	0.806*	<0.001
Inflation	3.90	3.11	-0.301	11.896	<0.001	0.485*	0.380*	0.345*	0.293*	<0.001
Panel C: USA										
Equity market	10.65	18.06	-0.625	7.115	<0.001	0.123*	-0.009	-0.078	0.016	<0.001
Money market	3.70	0.83	0.955	1.318	<0.001	0.971*	0.957*	0.947*	0.842*	<0.001
Inflation	3.18	2.32	0.661	7.978	<0.001	0.462*	0.370*	0.326*	0.255*	<0.001

[a] Autocorrelation coefficients significantly (5%) different from zero are marked with an asterisk (*).

[b] The *p*-value for the Ljung and Box (1978) test statistic for the null that autocorrelation coefficients up to 12 lags are zero.

Table 2. Variance ratios using monthly and yearly returns 1913-2009

Variance ratios are reported for various period lengths (N) using yearly and monthly continuously compounded returns. The variance ratio is defined as $VR(N)=Var[r_t(N)](N\times Var[r_t])^{-1}$. *P*-values are reported below the variance ratio estimates. Heteroscedasticity robust standard errors are used to calculate *p*-values. Values statistically different from the null hypothesis of one are marked with an asterisk (** indicates significance at the 5% confidence level, * at the 10% level).

	Yearly returns				Monthly returns		
N	Finland	USA	Sweden	*N*	Finland	USA	Sweden
2	1.180*	1.088	1.156	2	1.219**	1.124**	1.165**
	0.078	0.479	0.136		<0.001	0.016	<0.001
3	1.128	1.028	1.170	6	1.488**	1.166	1.377**
	0.403	0.879	0.273		<0.001	0.180	<0.001
4	0.989	1.033	1.156	8	1.568**	1.206	1.466**
	0.954	0.881	0.423		<0.001	0.160	<0.001
5	0.851	1.015	1.151	10	1.618**	1.259	1.551**
	0.514	0.953	0.507		<0.001	0.118	<0.001
6	0.755	0.956	1.146	12	1.699**	1.308*	1.651**
	0.340	0.876	0.568		<0.001	0.093	<0.001
7	0.686	0.927	1.156	14	1.792**	1.347*	1.745**
	0.266	0.814	0.578		<0.001	0.083	<0.001
8	0.600	0.918	1.165	16	1.854**	1.355*	1.797**
	0.191	0.805	0.588		<0.001	0.099	<0.001
9	0.496	0.914	1.198	18	1.893**	1.362	1.829**
	0.124	0.809	0.542		<0.001	0.115	<0.001
10	0.371*	0.912	1.168	20	1.912**	1.379	1.850**
	0.071	0.816	0.626		<0.001	0.118	<0.001
15	0.248*	0.772	1.382	40	1.732**	1.315	1.927**
	0.088	0.622	0.374		0.018	0.345	<0.001
20	0.310	0.496	1.677	60	1.374	1.284	1.929**
	0.177	0.340	0.172		0.299	0.468	0.002

Table 3. Descriptive statistics for real percentage calendar year returns 1913-2009

This table presents the means and standard deviations for annual percentage (i.e. not continuously compounded) real asset returns and percentage change in the inflation indices. Annual money market returns are calculated on the basis of the monthly observations. See the Appendix for details on the data series. The holding period is one calendar year. The full sample size is 97 annual observations from 1913 to 2009.

	Equity		Money market		Inflation	
	Mean (%)	Std. dev. (%)	Mean (%)	Std. dev. (%)	Mean (%)	Std. dev. (%)
Panel A: Finland						
1913-1919	1.53	46.23	-10.59	47.77	51.72	83.83
1920-1929	8.55	31.20	4.76	10.57	4.55	13.62
1930-1939	12.32	20.02	5.50	6.74	-0.07	5.32
1940-1949	-3.81	24.28	-13.14	15.67	25.20	29.61
1950-1959	15.01	28.09	0.70	6.82	6.10	7.55
1960-1969	4.62	14.93	2.25	2.41	4.88	2.55
1970-1979	5.84	27.34	-1.84	3.66	10.81	4.94
1980-1989	18.50	26.87	2.58	3.19	7.19	3.13
1990-1999	36.27	59.17	5.55	3.96	1.99	1.41
2000-2009	-1.42	29.67	1.52	0.62	1.71	1.32
1913-2009	9.99	32.98	-0.15	14.92	10.16	27.11
Panel B: Sweden						
1913-1919	-13.94	22.41	-7.50	11.20	16.26	16.02
1920-1929	9.25	14.38	10.62	9.83	-4.22	7.41
1930-1939	2.07	23.22	3.07	3.36	0.15	2.56
1940-1949	6.43	9.05	-1.13	4.80	4.30	5.47
1950-1959	13.04	19.91	-0.60	4.46	4.43	4.91
1960-1969	5.48	17.25	1.44	1.49	3.78	1.44
1970-1979	-0.58	15.45	-1.70	1.39	8.57	1.91
1980-1989	25.12	24.62	3.64	3.10	7.93	3.08
1990-1999	18.66	29.91	5.33	3.22	3.28	3.77
2000-2009	5.40	32.36	1.44	0.70	1.51	1.13
1913-2009	7.74	22.99	1.74	6.58	4.24	7.33
Panel C: USA						
1913-1919	10.89	22.87	-5.50	6.27	10.25	8.12
1920-1929	25.70	23.30	5.73	5.10	-0.86	4.05
1930-1939	6.69	32.86	2.80	6.00	-1.92	5.01
1940-1949	5.59	19.04	-4.56	5.28	5.51	5.93
1950-1959	17.05	19.20	-0.32	2.23	2.24	2.26
1960-1969	6.67	15.63	1.33	0.63	2.53	1.80
1970-1979	0.93	20.29	-0.97	1.60	7.41	3.45
1980-1989	11.37	12.33	3.63	2.38	5.14	3.22
1990-1999	14.95	14.65	1.95	1.11	2.94	1.24
2000-2009	0.08	22.02	0.25	1.83	2.53	1.15
1913-2009	9.96	21.25	0.62	4.78	3.37	5.05

Table 4. Results from the restricted VAR(1) system

Parameter estimates from a restricted VAR(1) system with contemporaneous cross-country returns are reported in the Table. Omitted values indicate restrictions in the system. System is estimated using seemingly unrelated regression method on monthly continuously compounded returns for the stock markets from Finland, Sweden, and the USA. Parameter estimates (c) are given for the full sample, and three subsamples with t-values next to estimates. Values statistically different from zero are marked with an asterisk (** indicates significance at the 5% confidence level, * at the 10% level).

	FINLAND		SWEDEN		USA	
	c	t-value	c	t-value	c	t-value
Panel A: Full sample						
C_0	0.005**	2.823	-0.000	-0.134	0.008**	5.070
$R_{fin,t}$			0.421**	20.469		
$R_{swe,t}$	0.714**	20.469				
$R_{usa,t}$	-0.012	-0.367	0.256**	10.514		
$R_{fin,t-1}$	0.136**	4.676	0.013	0.591		
$R_{swe,t-1}$	-0.026	-0.682	0.053*	1.823		
$R_{usa,t-1}$	-0.044	-1.311	0.034	1.325	0.123**	4.217
Adj. R^2	11.278%		20.594%		1.419%	
Panel B: 1912-1969						
C_0	0.007**	3.265	0.001	0.497	0.008**	3.945
$R_{fin,t}$			0.126**	4.845		
$R_{swe,t}$	0.268**	4.845				
$R_{usa,t}$	0.021	0.548	0.202**	7.906		
$R_{fin,t-1}$	0.163**	4.330	0.041	1.555		
$R_{swe,t-1}$	0.063	1.127	0.099**	2.600		
$R_{usa,t-1}$	-0.008	-0.196	-0.001	-0.041	0.128**	3.384
Adj. R^2	4.026%		11.493%		1.500%	
Panel C: 1970-1989						
C_0	0.006**	2.317	0.003	0.900	0.008**	2.533
$R_{fin,t}$			0.584**	7.701		
$R_{swe,t}$	0.374**	7.701				
$R_{usa,t}$	-0.057	-1.077	0.352**	5.694		
$R_{fin,t-1}$	0.217**	3.482	-0.103	-1.290		
$R_{swe,t-1}$	0.049	0.953	0.033	0.512		
$R_{usa,t-1}$	-0.050	-0.942	0.112*	1.689	0.087	1.359
Adj. R^2	8.403%		17.294%		0.346%	
Panel D: 1990-2009						
C_0	0.000	0.050	0.000	0.082	0.006**	1.995
$R_{fin,t}$			0.540**	14.372		
$R_{swe,t}$	1.049**	14.372				
$R_{usa,t}$	0.136	1.257	0.328**	4.460		
$R_{fin,t-1}$	0.083	1.270	0.037	0.788		
$R_{swe,t-1}$	-0.021	-0.235	-0.066	-1.049		
$R_{usa,t-1}$	-0.241**	-2.077	0. 187**	2.245	0.136**	2.137
Adj. R^2	46.455%		53.775%		1.455%	