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Descriptive analysis of Finnish equity, bond and money market returns

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* Aalto University School of Economics, Department of Finance. PO Box 1210, 00101 Helsinki, Finland. E-mail: peter.nyberg@hse.fi.
** Turku School of Economics (TSE) and Lappeenranta University of Technology, School of Business. TSE, Department of Accounting and Finance, 20014 University of Turku, Finland. E-mail: mika.vaihekoski@tse.fi. Corresponding author.

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Descriptive analysis of Finnish equity, bond and money market returns

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Peter Nyberg – Mika Vaihekoski
Monetary Policy and Research Department

Abstract

This paper gathers the longest available historical monthly return series for the Finnish equity, bond and money markets as well as inflation. The series are analysed to calculate the statistical characteristics of the returns investors would have received in these markets. We also survey existing literature concerning the history of these markets and review the main developments to facilitate future research on the long-term development of the Finnish markets. Using a new total return stock market index for Finland in an approach similar to Mehra and Prescott (2003), we find the equity premium for Finland to be 10.14 per cent from 1913 to 2009.

Keywords: equity market, bond market, money market, risk premium, Finland, Helsinki Stock Exchange, performance

JEL classification numbers: G10, G11, N24

Suomen osake-, joukkolaina- ja rahamarkkinoiden tuottojen kuvaileva analyysi

Suomen Pankin keskustelualoitteita 14/2011

Peter Nyberg – Mika Vaihekoski
Rahapolitiikka- ja tutkimusosasto

Tiivistelmä

Tässä tutkimuksessa kerätään yhteen pisimmät mahdolliset Suomen osake-, joukkolaina- sekä rahamarkkinoita koskevat kuukausitason tuottojen aikasarjat sekä niitä vastaava inflaatiosarja. Tutkimuksessa analysoidaan kerättyjä sarjoja käyttäen sijoittajan saamien nimellisten ja reaalisten tuottojen suuruutta ja tilastollisia ominaisuuksia. Lisäksi tarkastellaan näiden markkinoiden historiallista kehitystä sekä pyritään tuomaan esille markkinoita aiemmin tarkastellutta kirjallisuutta. Uutta osakemarkkinaindeksiä sekä Mehran ja Prescottin (2003) tarkastelutapaa käyttäen Suomen osakemarkkinoiden riskipreemioksi saadaan 10–14 % vuodesta 1913 vuoteen 2009.

Avainsanat: osakemarkkinat, joukkolainamarkkinat, rahamarkkinat, riskipreemio, Suomi, Helsingin pörssi

JEL-luokittelu: G10, G11, N24

Contents

1 INTRODUCTION

In recent years, there has been a growing interest in the historical equity premium and overall development of the financial markets. However, 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 time series, given that accurate estimates of an equity premium require relatively long time series. Unfortunately, Finland is one of the countries for which there are hardly any studies available that use longer time series.[1]

The main purpose of this paper is to provide a descriptive analysis of the development of the equity, bond and money markets in Finland since the 20th century. We provide a statistical analysis of the long-term performance of the markets (i.e., what kind of returns investors have received in Finland over a long period of time). For the first time, this study collects several long-term time series to conduct this analysis. Another purpose of this paper is to facilitate future research on the Finnish markets.

Past empirical analyses of the Finnish stock market have suffered from the unavailability of a stock market index that captures the total return on the Finnish market. The realized total return realized on the Finnish stock market is not known prior to 1970. However, based on the work by Nyberg and Vaihekoski (2010), we now have available a set of total return stock market indices that covers the history of the Finnish stock market from October 1912 onward. Using their index we can also study the equity market premium in Finland.

The sample period used in this paper is interesting as the 20th century witnessed some major economic upturns and downturns due to a global crisis and wars taking place around the world. In addition, Finland evolved from a relatively closed economy to an open economy during this period. More recently, it has become an integrated participant in the global economy. As a result, the Finnish economy has undergone major changes; the size and industries of the companies listed on the stock exchange have changed considerably from the basic industrial companies to technology-oriented companies, with Nokia leading the way.

[1] There are only a few studies utilizing long time series from Finland. Sierimo and Virén (1995) as well as Liljeblom and Stenius (1997) are among these few. They both use stock market series from 1920 forward.

The remainder of the paper is as follows: Section 2 reviews the history of the equity, bond, and money markets in Finland and surveys existing literature covering these markets; Section 3 reviews the data available for these markets; Section 4 shows the results from the descriptive analysis of the data; and Section 5 concludes.

2 HISTORY OF THE FINNISH EQUITY, BOND, AND MONEY MARKETS

2.1 Finnish stock market

The first stock exchange in Finland was opened in Helsinki in November 1862 by a local stock exchange association (Helsingfors Börsförening).[2] Trading took place twice a week. In the beginning, only a few stocks, currencies and bonds were traded, but later more stocks were added to the list. The association was discontinued in 1869, but a new association was set up to continue its operations.[3] Even though there was interest among the public, the trading activity remained relatively low and the exchange lacked proper organization and regulation.

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.[4] 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.[5]

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 (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

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2 Note that Finland was a Grand Duchy of Russia during 1809-1917.

3 Helsingfors Börsförening also published a newspaper, Helsingfors Börsförenings tidning during 1866-67. It was the first newspaper in Finland with stock market specific information in Finland. It is nowadays available from the digitized Finnish Historical Newspaper Library 1771-1890 (http://digi.lib.helsinki.fi/).

4 In Sweden, the Stockholm Stock Exchange was opened in 1863. In general, even though the first stock and commodity exchanges in the world were opened as early as in the 13th century, the major stock exchanges can be said to be established in the 17th century. For example, the London Stock Exchange can trace its history to the 17th century. Similarly, the origin of NYSE can be traced to 1792.

5 Tiderman (1937), Björkvist (1953), Bruun (1956), Stjernschantz (1987), Poutvaara (1996), Kock (2004) and Nyberg and Vaihekoski (2010) review the early history of the stock markets in Finland.

exchange was also closed between January and May 1918 during the Finnish Civil War 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 (see Figure 1 for an illustration of the monthly total trading volume on the exchange). 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.[6] All of these 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.[7] However, Stjernschantz (1987) notes that the worsening economic conditions at the beginning of the 1920's, together with new taxation laws for security trading, led investors to consider a longer time horizon when valuing securities. 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 2) and companies' desire to get listed on the stock exchange. In 1927, there were already 65 companies listed on the stock exchange.[8]

The 1930s began with a worldwide depression.[9] 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

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6 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.

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

8 As the number of companies listed on the stock exchange increased, so did the public interest in the shares listed on the exchange. This can be seen, for example, by the fact that the first book on the listed companies was published in 1926 (Jernström, 1926). Only a few years later, in 1929, Suomen Yhdys-Pankki (later Unitas, currently part of Nordea) started to calculate their own stock market index. 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).

9 In October 1929, the Nyberg-Vaihekoski index, that we use to proxy for the stock market returns 1912-1969, rose 1.70 percent 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 percent during the previous 12 months, whereas the Dow Jones index reached its highest value in September the same year (Siegel 1998).

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 mechanical trading system was taken into use. 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 still listed on the exchange. The low number of companies was partly due to the large number of mergers that had taken place during the decade and partly due to the economic conditions that had prevailed.

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 percent per annum (see Table 4). The market took a steep fall in 1948, and at the same time the volatility in the market increased significantly (see Figure 6A). 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. However, 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 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, one could even hear 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 international process that started in the USA in 1974. 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 percent of total equity capital. In April 1987, the maximum unrestricted equity capital for Finnish firms was raised to 40 percent on condition that the amount of voting power on unrestricted shares could still not exceed 20 percent.

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[10] 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 percent of the total market capitalization value of the HSE. At the end of 1996, 71 companies were officially listed on the HSE, and 95 issues were separately quoted.[11] 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.[12] During 1997, a merger agreement between the Helsinki Stock Exchange and the Swedish OM (the Finnish options exchange) was 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

[10] As a minor detail, one should mention Suomen Arvopapereita Oy which was established in 1932 as 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.

[11] 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).

[12] For more information of the more recent history of the Helsinki Stock Exchange see Stjernschantz (1987), Suomen Pörssisäätiö (1987), Hedvall (1994), Kauko and Saukkonen (1996), and Vaihekoski (1997).

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 bond market

It is generally acknowledged that the Finnish bond market was relatively undeveloped during most of the 20th century, especially when it comes to the secondary market. In the private sector, banks and other credit institutions played a prominent role in offering capital to corporations and entrepreneurs; direct financing from the market was relatively uncommon. However, even though the secondary market for bonds was small, bonds did play an important role for individual investors to earn interest on their savings and for some companies and the government to finance their investments.[13]

The largest issuer in Finland was the government, followed by municipalities, banks and major corporations. The first government bonds were issued as early as 1841. At the beginning of the 1900s, banks and corporations also started to issue bonds, some of which were sold to international investors (most notably Paris, Stockholm, and New York). Ordinary citizens in Finland also bought these bonds. However, the secondary market for bonds remained unorganized until the HSE was established in 1912. In practice, the HSE became the main secondary market for trading in bonds. Bond trading was not very common at first; bond trades accounted for 2.57 percent of total trading at the HSE in 1914. Moreover, during 1917-1922 bonds were not traded on the Exchange at all.

Following the First World War, the government started to issue more bonds. During 1918-1922, FIM 1900 million worth of bonds were issued. Of this total, FIM 1600 million were issued by the government and 500 million were issued in foreign currency. The number and size of issues started to increase in the 1920s and most of the bonds were issued abroad following the international boom. For example, during 1921-1930, FIM 6550 million worth of bonds were issued, out of which only 805 million were issued in Finnish currency.

[13] Arola (2006) and Aalto (1996) review the early history.

The secondary market for bond trading on the HSE slowly started to pick up pace, and in the late 1920s and 1930s, trading on bonds accounted for approximately 5-10 percent of the total transaction value at the HSE. Starting from 1929 the Exchange listed separately a new type of bond instrument, namely participating debentures, which were issued by a small number of companies. These debentures typically paid a coupon rate but the payment was related to the dividend and company's profitability. In 1930s the Government also issued lottery bonds. However, despite the increased trading, the secondary market remained quite thinly traded. There were several reasons for this, one of which is related to the popularity of lottery bonds among the public, but not among institutional investors due to the difficulty in pricing them. After the outbreak of WWII, the trading on bonds was ultimately stopped from December 1938 until October 1946; however, a number of bonds were issued even during this period. The government started to issue inflation indexed bonds (first one in 1944) that proved to be valuable in the post-War inflation era. The bonds with an index clause were either entirely or partially tied to a price index and were therefore protected against inflation.[14] The index-linked bonds became gradually more important, and in 1960 most of the government-issued bonds had an index clause. However, due to the economic stabilization agreement signed by the government, all index clauses were removed in 1968.

In 1950, after the Second World War, the share of transaction volume accounted for by bonds had increased to 27 percent, with a nominal value of FIM 807 million. This large growth in the bond market was primarily due to large loans that the government had issued and other arrangements that were made to compensate people who had to move from the areas that Finland lost to the Soviet Union in the Second World War. In 1960, the nominal value of the bond transactions had fallen back to FIM 115 million, accounting for 4.5 percent of total volume.

A big change in the market took place in 1967 when the bond income became taxable (government bonds for half the income). Few years later the government bonds were again given the tax free treatment as the demand for taxable bonds almost dried up. In fact, for most of our sample period, government bonds and deposit accounts were generally tax-free for households to promote private saving and to provide some indirect protection against inflation. The relatively favorable tax treatment on deposit accounts can also be seen as one of the reasons banks played a major role in the Finnish economy (capital income from other sources was primarily taxable). Furthermore, because of taxation, debt was often a cheaper form of financing for corporations

[14] However, the tax status on the index-linked bonds varied between the loans and during the years, whereas the bonds that did not have an index clause were tax-free (Alhonsuo et al., 1989).

than equity.[15] Along with the financial liberation that took place in the late 1980s, the relative tax advantage of interest income was reduced in 1988, and, after 1991-1992 tax-free government bonds were no longer issued (Andersson, 1994).

The size and significance of the bond market in Finland grew steadily yet quite slowly from 1960 to the 1980s, when the bond market started to develop and gain significance. In 1986, the nominal value of fixed income securities transactions had climbed to FIM 6,479 million[16], accounting for 40 percent of the total volume (Stjernschantz, 1987). However, the secondary market remained in a rather underdeveloped state until the 1990s, primarily because of the relatively modest size of the outstanding bonds, heterogeneity of the terms applied, low interest on the liquidity of markets (from the part of the issuers), and rather low demand for the bonds.

The economic crisis together with large deficit government budgets caused the state to borrow increasingly more from the domestic and foreign capital markets to balance the budget. The government changed its policy and began to actively participate in and guide the bond markets. The benchmark bond system was also established for the government bonds. In addition, at the beginning of 1990, foreign investors were allowed (ban was established in 1985) once again to buy markka-denominated bonds with maturities longer than one year. This contributed to the development of more efficient government bond markets in the 1990s. The number and size of initial bond issues have also grown with the secondary market; the total value of outstanding markka bonds was 199.4 billion markka at the end of 1996.

Aside from growing rapidly and becoming more liquid, the bond market has also undergone some significant structural changes. First, physical bond ownership certificates were transferred to computerized book entry system starting from 1992. Bullet bonds became also the most popular form of amortizing the bonds. Second, the secondary market trading that previously took place primarily on the HSE moved to direct interbank trading between brokers. In addition, increased participation by the government caused government bonds to account for the major part of the outstanding value of bonds, whereas corporate bonds used to dominate the market.[17]

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15 The tax status on corporate bonds has been more heterogeneous than on government bonds, and a detailed description will not be given here. However, the terms applied have been fairly generous. (Alhonsuo et al., 1989)

16 Including debentures and other fixed income securities.

17 For more information on the Finnish bond markets, see, e.g., Valtonen (1996), and Niskanen (1996b).

2.3 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 percent 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.[18]

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 made multiple attempts to form a cartel to limit the costs of their funding (i.e., the deposit rates) but with limited success. 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.

[18] The early history of the money markets is reviewed in Autio (1996).

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 interest rates were unable to reflect the fluctuating financial situation.[19] 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. Nowadays, open-market operations are an essential part of the Central Bank. The bank operates by absorbing excess liquidity from the banking system. It does this by issuing its own one-month CDs through tenders. Conversely, the bank can increase liquidity through repo tenders.

Although money market rates are available prior to 1987, 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.[20] 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. Pricing is based on a standard [actual/365] convention for papers with maturities shorter than one year.[21] Interest rates are quoted on a per annum basis.[22] Starting in 1999, the Finnish currency, Markka, was tied to the Euro and Helibor interest rates were replaced by the Euribor interest rates.

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[19] 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.

[20] 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.

[21] I.e., price equals $100/(1 + r \cdot d/365)$, where r is the interest rate per annum and d is the running time for the security.

[22] For more information on the Finnish money markets see Lahdenperä (1995), Valtonen et al. (1996), and Niskanen (1996).

3 DATA

For the statistical analysis, we collected the longest available monthly time series for the equity, bond, and money markets as well as for inflation. Our main interest is 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. For a closer examination we selected a sub-period from 1970 to 2009. We use continuously compounded asset returns throughout the paper, but we also calculate percentage returns to derive estimates of the equity premium.

3.1 Money market rates

Because the money market developed quite late in Finland, real money market rates are not available before the beginning of 1987. In this study, we use the Finnish Helibor one-month rate from 1987 to 1998. After 1999, Euribor rates replaced Helibor rates in the market; we therefore used Euribor rates thereafter. It is difficult to determine a suitable rate to reflect the short-term money market rates prior to 1987 because no real money market rates are available. As a result, the money market rate series has to be constructed from different series. In Appendix A we present a short review of the money market rate series available prior to 1987.

We chose 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 really invest or borrow using that rate; however, we believe that it provides an indication of the returns on short-term savings as banks' highest offers on savings rates closely followed the Base Rate (see Autio, 1996).

From January 1972 to December 1986, we could also use the money market rate series derived in Malkamäki (1993). In January 1972, the Bank of Finland created a market for US dollar forwards where the shortest maturity traded was a three-month forward contract. Malkamäki calculates end-of-the-month time series for a three-month interest rate series using the following covered interest rate parity rule:

$$R_d = \frac{F}{S}(1 + R_f) - 1 \tag{1}$$

where R_d and R_f are the domestic (Finnish) and the US dollar interest rates, respectively, S is the spot exchange rate between the USD and FIM, and F is the forward rate. The data is taken from the Eurodollar market. For this analysis, one could assume as Malkamäki did that the interest rate yield curve is flat between one and three month maturities. As a result, Malkamäki's series could act as a proxy for the one-month return.

Figure 3 shows the time series development of the proxies for the money market rates that we use in this study. It illustrates that the implied three-month rate was very volatile during the 1970s at the time of the oil crisis, and it reflected expectations of the inflation rate that on average was around 10 percent per annum during the decade. The markka was devalued twice in 1977 and once more in February 1978, which appears to have reduced the volatility in the interest rates (Malkamäki, 1993). However, in the end we chose to use the Base Rate as a proxy because we believe that it more realistically reflects the returns achievable for institutional investors during that time period.

3.2 Bond market data

The long-term series on government bond returns is the hardest to come by as there is no Finnish bond return index available for most of the 20th century. In addition, even the price or the yield data as well as the documentation of the collection and/or calculation principles are often inadequate. Moreover, most of the available series are calculated only for a short period of time (see Appendix A for a review of the series). The first available government bond index is calculated by Nordea bank and has a starting period of January 1991.[23] It includes all taxable government benchmark bonds with a mean duration of about four years. This index is calculated from the daily quotas on the Reuters screen of the Finnish government taxable bonds of all different maturities. The monthly return on this index is used in our analysis for the period after 1991.

However, prior to 1991, one has to consider alternative sources of data. The best data available prior to 1991 are the monthly values of issue coupon rates (IOBL) and effective yields to maturity (ROBL) for five-year tax-free government bonds in Alhonsuo et al. (1989). Their data

[23] Postipankki (later Leonia Bank, currently Sampo Bank which is part of Danske Bank Group) also publishes a government bond index. It is available from the end of 1991. They have also calculated a money market index covering the same period. Some other bond indices are also available for Finland, but with shorter samples. Unitas also calculated a bond index during the 1930s. Values from 1931 to the mid-1939 are available but the construction methodology is not exactly known.

covers the period from January 1948 to the end of 1986. Yields to maturity are calculated on the basis of the month-end clean prices quoted on the Helsinki Stock Exchange, with the exception of monthly values calculated by the Bank of Finland that are averages of the weekly yields.[24] Prices are adjusted for accrued interest and for a one percent transaction fee before calculating the yield. To cover the years between 1987 and 1990, the ROBL series is augmented with the yields at issue for publicly issued tax-free (1987-1989) and taxable (1990) bonds. The IOBL series is augmented with market yields for publicly issued taxable bonds (1987) and government bonds (1988-1990). The series are taken from the Bank of Finland Bulletin, IMF database (whose original source is the Bank of Finland), and Etlatieto database (whose original source is Statistics Finland).

In addition, the quarterly Unitas publication lists the yields to maturity on a monthly basis from October 1933 until June 1939[25], and the yearly averages for 1930-1933 are provided. Yields are calculated on the basis of unspecified government bonds listed on the stock exchange. Finally, Unitas (1932) provides monthly yields to maturity for a group of sixteen bonds (government, municipal, corporate, financial) from January 1926 to June 1931. The average yield is within 0.1 percentage points from the average yield for government bonds during 1931. Thus, we chose to combine the yield series to obtain the best series available for the period from 1926 to mid-1939. To calculate returns prior to 1926, we use the quarterly yields calculated in Arola (2006) for 1862-1938 using month-end prices abroad for Finnish bonds. During the period around the Second World War (1939-1947) we assume that the yield stays at the same level as the last available pre-war yield, adjusted for the changes in the Base Rate.[26]

There are a number of ways to construct (approximate) return series from the yield series. The first method uses the issue yields (i.e., coupon rates) as a basis and assumes that new bonds are issued at par value so that the coupon is approximately the yield to maturity. If a new bond is issued the next month with another coupon rate (still at par value), the old bond is priced using the yield to maturity of the new bond (and with a month shorter time to maturity). The capital return is consequently defined as the relationship between the new and old values of the bond

[24] Unfortunately, it seems that there are no public sources that would consistently offer data available that would cover the period from the beginning of the 1987 to the end of 1990.

[25] Unitas does not provide the methodology for calculating the yields except noting that they are true yields based on prices at the stock exchange. It is also evident, when comparing the coupon rates of the government bonds issued at the time, that the yields cannot be issue yields.

[26] Contrary to expectations, the issue yield did not seem to increase during the Second World War. Judging by the coupon rates offered in the few issues during the wartime (as mentioned in the Bank of Finland Bulletin), the rates basically stayed the same as prior to the war.

issued earlier. The coupon return for the series is calculated as a 12-month moving average of the coupons of the new bond and the bond issued earlier.

The following example clarifies the main principles of the coupon returns. The monthly return for a given month t, in the case where there have been no new issues with a new coupon rate during the months t-1 and t, is calculated as $r_t = D_{b1}/12$, where D_{b1} is the yearly coupon rate for the bond in the portfolio. If a new bond is issued at t+1 with a coupon rate D_{b2}, and if $D_{b2} \neq D_{b1}$, the capital return for the bond issued earlier is calculated by pricing the bond with D_{b2} as the new yield to maturity and using the relative difference of its new and old prices as the capital return. The coupon return for the same month, t+1, is given by $(11/12)D_{b1}/12+(1/12)D_{b2}/12$. In the next month, t+2, if there are no new issues during the period, the yield to maturity remains the same, and the return is given by an average of the coupons, defined as $(10/12)D_{b1}/12+(2/12)D_{b2}/12$. Thus, bonds that are issued earlier remain in the portfolio with declining weights for 11 months after a new bond with a new coupon rate has been issued. This method presents a problem that if no new bonds are issued, the changes in the overall market yield accumulate, and their impact is realized in the return series only when a new bond is issued.

The second method uses market yield to maturity series to estimate the returns. However, because we do not know the real coupon rate, we have assumed that the bond is issued at par and that the new price is based on the new yield to maturity. The return to investors is the percentage difference in the prices adjusted for the shorter time to maturity. The benefit of this method is that it reacts quickly to the changes in the market yields.

Both yield series also allow the use of duration approximation to get the return series. There are at least two duration approximation techniques used in existing literature. The first one (D1) uses the fact that multiplying the modified duration with the change in the yield gives us an approximation of the (percentage) change in the value of the bond. The second (D2) approach uses loglinear approximation (see Campbell et al., 1997):

$$R_{n,t+1} \approx \exp\left(D_{nt}\left(1+Y_{nt}\right)-\left(D_{nt}-1\right)\left(1+Y_{n-1,t+1}\right)\right)-1 \qquad (2)$$

where $R_{n,t+1}$ is the monthly percentage rate of return, D_{nt} is the approximate duration of the bond (measured in months), and Y_{nt} ($Y_{n\text{-}1,t+1}$) is the bond yield per month (i.e., annual rate divided by twelve).

Here we chose to use all of these methods to calculate the return series for the periods prior to 1991. In our calculation, we have assumed that the bonds are bullet bonds and that they have a maturity of five years. When using the first method, we have augmented the IOBL series with the series from the Unitas publication.[27] The second approach is based on the ROBL series instead of the IOBL. The third approach uses the loglinear approach where $Y_{n-1,t+1}$ is approximated by the $Y_{n,t+1}$ as in Campbell and Viceira (2002). Ultimately, after carefully comparing the series, we chose to use the last approach using market yields. We believe that this series best represents the true returns acquired by the investors.[28]

These returns provide us with an approximation of realized returns in absence of a better measure. Overall, we believe that this approximation gives a picture of the level and variability of bond returns during the early periods that we study. [29] However, we note that our bond return series are calculated from bonds that did not have the index clause mentioned earlier. If we assume market rationality, it can be argued that if there is to be demand for newly issued bonds that are not protected for inflation and therefore have riskier real cash flows than inflation-protected bonds, these bonds should offer higher expected returns to investors. This does not imply for an ex-post analysis that bonds without the index clause would have yielded comparable returns to index-linked bonds if the rate of inflation had been higher than expected. Thus, our results for 1953-1968 must be interpreted with caution because they do not necessarily give a valid picture of the average returns on bond investments during this period; they are more suitable for illustrating the returns to investors who only invested in non-protected bonds during this period.

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[27] It also happens that a similar time series from January 1930 to the end of 1990 has been available at Hanken School of Economics in Finland for some time now. However, the origin, calculation method, and the author(s) of the series are unknown. During the construction of our series we discovered that the series is based on Unitas data from 1930 forward (yearly averages used for 1930-September 1933) and the IOBL series from Alhonsuo et al. (1986). It seems, however, that the author(s) did not use IOBL series as such as it is provided with only one decimal whereas the yields used are based on two (e.g. 6.25% instead of using 6.3%). There are also some other minor differences (e.g. no adjustment for the yield of a partly taxable bond issued in 1967). We were able to match the series exactly except for the months were the yield has changed. For those months, the duration approximation method D1 gave the closest values with a difference typically less than one percent.

[28] We removed few outliers borne from combining market yields series from different sources.

[29] Another alternative would have been to directly use the historical yields on Government bonds which have been approximated e.g. by Alhonsuo et al. (1989) and Autio (1996) as the realized returns to investors. However, there are problems associated with such a strategy because the yield to maturity is equal to the realized return only when the bond is held until maturity and the coupons can be reinvested at the same interest rate. Furthermore, since the yields on Government bonds tend to move in the same direction as the rate of inflation, the returns for long-term investors especially in times of high inflation would tend to be overstated using this alternative proxy for monthly bond returns.

3.3 Stock market trading volume data

To study the trading turnover on the HSE, a variety of different sources were collected and compared. We have hand-collected annual and monthly trading volumes as accurately as possible (in some cases down to one FIM) from the best public sources available. During the data collection process, we discovered that the origin and details of the aggregate monthly trading volume time series used by most prior studies have been somewhat forgotten. Analysis revealed that the series used were actually the total trading volume on the HSE (instead of trading volume of stocks, for example), and the data seems to have been taken from the Bank of Finland Bulletin for January 1913 to October 1955 and from the Unitas publication for after October 1955 (both cite the Stock Exchange committee as the original source). The accuracy of the volume varied through years, but it was mostly given in millions of local currency with one decimal.

To improve accuracy and to get a breakdown of the volume, we use the annual statements of the HSE. The Exchange's statements offer exact monthly trading volume from October 1912 to December 1963. Trading volume is further broken down into trading on stocks, equity issue rights / warrants, participating debentures, co-operative certificates, and obligations (bonds). For most years, trading on stocks is further broken down into banks, insurance, industry, etc. If available, we have also recorded the breakdown of the bond trading into government, municipal, financial, and other.[30] These values are listed in Appendix B (available from the authors).

During 1964-1986 the annual statements only include annual trading volume. Unfortunately, there are no public sources (as far as we know) that provide exact information on the monthly trading for each security class during this period. However, for 1964-1966, the daily newspaper Kauppalehti provides the figures in thousands in the first paper of the year. The total monthly trading volume on the HSE is available for the whole period (with varying accuracy, but mostly in 1/10 of a million FIM); unfortunately, the source is unknown, but it is most likely the HSE.[31] The breakdown of the total trading volume is unavailable before 1980. Etlatieto Ltd offers monthly trading figures for bond and stock (including equity rights and warrants) trading in millions of euros from January 1980 forward. The source cited is the HSE.

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[30] Participating debentures are basically bonds with coupon payments tied to the success of the company. They traded between 1929-40 and 1960-64. Co-operative certificates were issued by the government established company called Holding Concern. They entitled the owner to receive certain dividend and amortizing payment on the capital invested. They were hugely popular among investors and they were listed at the HSE from 1946 to 1956.

[31] The data series has been used by researchers in Finland. We compared the figures with those available from public sources and they match giving confidence in their correctness.

Beginning in 1987, the monthly trading numbers are again available from the annual statements (1987-1994) and HSE's Fact Books (1995 Market review), which replaced the annual statements as the main publication for HSE's statistical information on trading. The monthly trading volume, though, was only given for two categories: stocks (including equity rights and warrants) and bonds (including debentures and corporate bonds). The accuracy, however, dropped down to 1/10 million FIM. The last Fact Book published covered the year 2002. From then on, the monthly trading figures are available on public databases (e.g., NASDAQ OMX offers monthly figures at their web-site starting from December 1998).

Annual trading volumes are collected from the HSE's annual statements. From 1912 to 1963, the breakdown of the trading between different asset classes and the accuracy of the figures is the best. Beginning in 1964, the classification of the bond trading on the HSE changed following amendments in legislation. Bonds were classified either as obligations (with collateral; typically issued by the government or mortgage banks) and corporate debentures (basically bonds without explicit collateral). Starting in 1981, certain bonds were classified into a group called "other bonds" which included bonds with warrants and convertible loans. After 1997, the HSE has reported only total bond trading without any breakdown. Annual figures from 1990 until the present are also available on the NASDAQ OMX website.

The annual trading figures from 1912 to 2009 are provided in Appendix C. The accuracy of the figures has varied throughout the years.[32] Moreover, one has to keep in mind that comparison of the trading figures across different sources is somewhat complicated because different sources categorize assets slightly differently. For example, the stock trading volume provided by the HSE only includes trading on stocks listed on the Main List prior to 1997. Some sources also include OTC trading and trading on ETFs (available since 2003) in the trading volume.

3.4 Stock market index

To track the stock market development, we use the value-weighted total return stock market indices constructed by Nyberg and Vaihekoski (2010) 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

[32] We have also used other sources to improve the accuracy of the figures and to check for potential typos. Note that in practice, most of the bond trading takes place outside the HSE.

Department of Finance and Statistics at the HANKEN Swedish School of Economics (see Berglund, Wahlroos, and Grandell, 1983, for documentation).

After 1990, we use the HEX yield-index calculated by the Helsinki Stock Exchange.[33] Similar to the Nyberg-Vaihekoski index, both the WI and HEX indices are also value-weighted and corrected for cash dividends, splits, stock dividends and new issues. 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.

3.5 Inflation

In long-horizon studies it is customary to analyze real returns. For this purpose, we decided to also calculate monthly inflation values from 1912 forward. The official monthly Cost of Living index has been available from January 1921 forward. 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).[34] The reference period was set to be the first half of 1914 (i.e., 1914/1-6=100). The index was calculated until the end of 1936.

In 1936 and 1937, a meeting between economic statisticians from Nordic countries was held in Copenhagen. The countries decided to harmonize their indices and as a result, 1935 was set as the 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 official quarterly index (1935/1-12=100) was published at the same place as before, but the Bank of Finland also calculated unofficial values for the intervening months using the mentioned monthly sub-indices. The Bank published the index values in their Monthly Bulletin publication.[35] These index values are used in this study.

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[33] Since the merger of the HEX and Swedish OMX in 2004 the index has been called the OMX Helsinki (OMXH) index.

[34] 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.

[35] Issue 6 from 1937 discusses the construction in details.

From August 1939 forward, the monthly Cost of Living index can be easily derived from electronic databases through Statistics Finland. An index that covers the period from August 1939 until the present can be constructed by splicing two indices with reference periods 1938/8–1939/7=100 and 1951/10=100.

The period before 1921 is the most problematic from a researcher's point of view. For 1920, one can use an unofficial monthly 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 unofficial index did not take into account changes in taxes, but it is available for 1920-1921 on a monthly basis. In addition, it was also calculated on a quarterly basis for the period from 1914 to the end of 1919.[36] 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 1912-1914 we have used yearly values of the cost of living index published in Hjerppe (1989) and again transformed annual inflation rates into monthly rates.[37]

3.6 Notes on 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 at or below 1 percent (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 percent on trades at and outside the Exchange, respectively, and 2.0 percent 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

[36] Somewhat mysteriously, the quarterly index has been published only in the Statistical Yearbook 1921 as far as we know. Index values during 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.

[37] The annual series is originally based on indices by Heikkinen et al. (1983) and Modeen (1952). For a discussion on the index construction, see also Hjerppe (1996). Unitas Bank also published (Unitas 1/1933) an index covering years 1913-1932 but their values for certain years differs completely from the others.

from trades where both parties were foreign and in 1968 from trades of equity issues. Overall, one can say the trading costs primarily affected those trading in the secondary bond and 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 so many issues and changes that one needs to take into account. A full survey of the changes in taxation is beyond this study. In general, it can be said that taxation has treated individuals and institutional investors 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 Descriptive statistics for the full sample

Table 1 shows descriptive statistics for the change in the logarithm of inflation, as well as continuously compounded nominal returns on equity, bond, and money markets (using the longest available sample periods from 1912 to the end of 2009). The only exception is the equally weighted stock market returns, which we could only calculate to the end of 2007 due to lack of data. Table 2 presents corresponding inflation-adjusted numbers. Monthly means and standard deviations have been annualized by multiplying them by 12 and the square root of 12, respectively.

The average inflation rate during the sample period is 7.77 percent per annum. Figure 4A shows the development of the inflation rate during the sample period. Figure 4B shows the monthly change in the logarithm of the Consumer Price Index. One can see that the inflation rate was clearly higher in the early part of the sample period. The effect of the World Wars on prices can also be seen in Figure 4B.

The average value-weighted continuously compounded stock return for the full sample from 1912 to 2009 is 12.91 percent (5.14 percent in real terms). During the same period, the return in the USA was 10.6 percent.[38] The volatility in the Finnish stock market has been quite high (20.76 percent per annum), but somewhat surprisingly not that much higher than in the US equity market (18.07 percent). To give an indication of the cross section of stock returns, we also examine the returns on an equal-weighted portfolio constructed of all shares listed on the Helsinki Stock Exchange. The portfolio weights are updated monthly. The mean equal-weighted stock market return is considerably higher than the value-weighted return, at 17.28 percent in nominal terms; however, the sample period is two years shorter.

The average continuously compounded bond market return is 7.74 percent (-0.03 percent in real terms). Our numbers for the bond market returns appear to be in line with results from other countries.[39] The mean continuously compounded money market rate is 6.25 percent (-1.51 percent in real terms) during 1912-2009. Bond returns and inflation rates show similar variability (7.39 and 7.29 percent, respectively), whereas the money market returns show the lowest volatility (0.55 percent), as expected. Analyzing the other aspects of the return series, we can see that all return series, except those of bond returns, show non-normality and autocorrelation.

Using the average equity and money market rate we can calculate an estimate for the historical equity premium. The result is 6.66 percent continuously compounded. This result can be compared to the equity premium of 5.149 percent in the US from 1891 to 1998 (Campbell, 2003).[40] Using arithmetic averages (simple, not continuously compounded returns), Mehra and Prescott (2003) report that the US equity premium from 1889 to 2000 was 6.92 percent.[41] Using a similar approach, our estimate of the annual real Finnish equity market return for 1912-2009 is 9.99 percent, whereas the real return on short-term money market assets is -0.15 percent. Thus, the equity premium is 10.14 percent (see Table 4). The Finnish equity premium appears to be at

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38 We use the Standard and Poor's composite index as a proxy for the US market from 1912 to 1926 after which we have used CRSP value-weighted index.

39 See for example Eijgenhuijsen and Buckley (1999) for results from several countries during a shorter time period than in our study, and Dimson and Marsh (2001) for longer time series from other countries. During the same time periods as in these studies, Finnish government bonds appear to have offered comparable returns. For example Siegel (1998) reports that the returns on US bonds 1946-1997 have been 1.1% (Finland: 2.5 %), 1966-1997: 2.5 % (3.64 %), 1966-1981: -4.2 % (-0.6%), and 1982-1997: 9.6 % (7.9 %).

40 We have used values from Table 1 in Campbell (2003) in order to provide a number that is comparable to our results.

41 Note that when working with continuously compounded returns it is important to keep in mind that Jensen's inequality implies that $E[lnR\text{-}lnR_f]$ is not equal to $ln\ E[R - R_f]$. Specifically, for a lognormally distributed variable it holds that $\ln(E_t[X])=E_t[\ln(X)]+0.5\sigma^2\ln(X)$.

least on the same level as that of the USA, supporting the equity premium puzzle originally identified by Mehra and Prescott (1985).

4.2 Sub-period analysis

Tables 2, 3, and 4 present the descriptive analysis for the real equity market returns for different sub-periods during 1912 to 2009. Tables 2 and 3 look at continuously compounded monthly returns that have been scaled to a 12-month basis. Table 3 analyses in more detail a time period from 1970 to 2009. Table 4, on the other hand, analyses simple average percentage returns for holding periods of one calendar year from 1913 to 2009.

The results show that there have been large differences in average stock returns between the decades. This can also be seen in Figure 5, which shows a 12-month moving average of continuously compounded real returns during the sample period of 1912-2009. As mentioned earlier, the Second World War appears to have been devastating for the stock market. At the end of the 1940's, real equity values were approximately only 36 percent of their corresponding values from the beginning of the decade. In comparison, equity values in Germany declined to 28 percent and equity values in Japan declined to 5 percent of earlier values (Jorion and Goetzmann, 1999).

Figure 6 below shows a forward-looking annualized moving average of the continuously compounded equity premium for holding periods of five, ten, twenty and thirty years. The equity premium is calculated as the logarithm of the difference between value-weighted stock returns and money market returns. For example, the point "1913" on the x-axis in the first graph shows the average five-year excess return over the money market return that someone who invested in the stock market in January 1913 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 returns are negative.

Panel C in both Tables 2 and 4 presents the sub-period analysis for the real bond market returns from 1912 to 2009. The relatively low real returns across the whole sample can in part be due to higher inflation than expected during some decades (see panel D of the corresponding tables), which punished long-term investments in bonds. For example, in the 1940s bonds do not appear

to have provided protection against inflation and instead led to large negative real returns for the investors. If this decade was excluded from our study, the mean of the continuously compounded real returns on bonds would rise to 1.74 percent, a significant increase from the current value of -0.03 percent. The high returns in the 1990s and in the early 21st century (6.21 percent continuously compounded) are explained by low inflation and decreasing interest rates, which yielded capital gains to bond investors.

Next, we examine the period from 1970 to 2009 more closely; Table 3 shows the results. The mean continuously compounded return on the value-weighted stock market index is 13.63 percent (8.46 percent real return), whereas the mean money market return is 6.58 percent (1.41 percent real return). The corresponding equity premium is 7.05 percent; for calendar year returns, the premium is as high as 14.8 percent. The excess return on bonds over money market instruments is 1.99 percent.

During the late 1990s and early 21st century, the Finnish stock market was characterized by a very high level of concentration. At the end of 2000, two of the largest companies, Nokia and Sonera (nowadays Telia-Sonera), accounted for 75 percent of the total market capitalization; Nokia alone contributed up to 70 percent of the total market value (see Vaihekoski, 2004). Given that the composition of the value-weighted index was at times dominated by a few influential shares, and taking into account the remarkable success of Nokia Corporation, one might ask if: (i) our stock market returns in the later sub-period mostly describe the performance of some highly successful companies; and (ii) if investors who opted to hold better diversified portfolios would have also received these high rewards for their risky investments.[42]

Consequently, we also analyze the difference between returns on equally weighted and value-weighted portfolios. The results for the equal-weighted (EW) portfolio are presented in Table 3. The mean real return on the EW portfolio is 13.45 percent, which is actually higher than the mean real return of 10.25 percent on the value-weighted (VW) portfolio for the same period

[42] 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 percent of the whole market value, whereas the three largest companies accounted for approximately 35 percent. At the beginning of 1990, the largest company accounted for 8 percent of the total value, and the three largest companies for 20 percent.

(1970-2007). Thus, the high Finnish stock returns after 1970 appear to be a market-wide phenomenon and not just the result of a few larger companies' success.[43]

4.3 Cross-correlations

Table 5 shows the cross-sectional correlation matrix between the continuously compounded nominal monthly returns and inflation series for the time periods 1912-2009 (panel A) and 1970-2009 (panel B). Looking first at the correlations between nominal equity returns and inflation, we note that during the longer sample period equity returns and inflation appear to be slightly positively correlated, whereas they are negatively correlated for the shorter sub-period. The positive correlation during 1912-2009 appears to be somewhat in contrast with results from other countries that tend to show that stock returns are negatively correlated with ex-post inflation (for cross-country evidence, see e.g. Barnes et al., 1999). Bond returns show a small negative correlation with inflation during both time periods. As for money market rates, there is a considerable increase in their correlation with inflation during the later period, which is not surprising given that interest rates in the later period were more or less market determined, and earlier interest rates were based on the Bank of Finland's base rate.

4.4 Stock market volatility

Table 1 indicates that the annualized standard deviation for the stock market over the entire sample period is 20.76 percent. However, the volatility has varied greatly over the years. Figure 7 shows the dynamic behavior of annualized standard deviations during the sample period in Finland and in the USA. The standard deviations are calculated from continuously compounded nominal equity market returns using a rolling window of 24 months.

Figure 7A shows that 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. Comparing Finnish market volatility to US market volatility (Figure 7B), we can see that the Great Depression in the 1930s crated much higher volatility in the US

[43] The fact that the equally-weighted returns are higher for the whole sample may to some degree reflect the strong small-firm effect that has been documented on the Finnish market prior to 1990. See e.g. Berglund (1986). From 1970 to 1992, the continuously compounded mean real return on EW was 10.96 percent. For VW it was 4.74 percent. However, for 1993-2003 the returns have been 17.42 percent for EW, 18.67 percent for VW. For 1995-2000 the returns were 15.49 for EW, and 33.08 for VW.

stock market than in the Finnish stock market. On the other hand, the end of WWII did not cause the same kind of increase in volatility in the USA 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 both markets.

In the early 1990s, Finland experienced a banking crisis and a deep economic depression that was also reflected in the stock market. Another increase in volatility came after the mid-1990s, following 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 had a big influence in the index. Thus, in Figure 7A we contrast the standard deviations of the value-weighted portfolio with those of an equal-weighted portfolio that is constructed of all shares listed on the stock exchange. 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.

4.5 Correlation with the US market

It has been argued that due to the worldwide economic integration that has taken place during the last few decades, the interdependence between national stock markets has increased. Even though the purpose of this paper is not to study the links between the Finnish market and foreign markets over time, we present for descriptive purposes a plot of the correlation between the Finnish and the US market through time.

Figure 8 shows the correlation between the two markets. The correlations are calculated with a moving window of 36 months. The figure indicates that the correlation is not stable and fluctuates strongly over time.[44] For the period 1912-1980, the correlation does not appear to have a clear trend and it fluctuates around 0.09 (the correlation for the whole sample is 0.17). However, during the financial liberation in Finland in the mid-1980s, and especially after all restrictions on foreign ownership were removed in 1993, the correlation between the two

[44] Similar findings for other markets have been reported in the literature. See e.g. Longin and Solnik (1995) and Solnik et al. (1996). The time-varying correlation between the Nordic stock markets and international stock markets from 1974 to 1998 is studied in Liljeblom and Löflund (1999).

markets shows a clear upward trend.[45] The fact that capital market liberalizations have a tendency to increase the correlation between a local market and world market returns has been documented in literature (see e.g., Bekaert and Harvey, 1997)).

5 CONCLUSIONS

For this paper, we have collected the longest available historical monthly return series for the Finnish equity, bond, and money markets from the early 20th century to the present. In addition, we have collected monthly inflation rate series as well as stock market trading volumes for the corresponding period. We also surveyed existing literature concerning the history of these markets and reviewed the main developments to facilitate future research on the long-term development of the Finnish markets.

Finally, we conducted an empirical analysis of the returns on these markets using the data series from 1912 to 2009. The results show that the Finnish stock market has given an investor a continuously compounded return of 12.91 percent (5.14 in real terms) with a standard deviation of 20.76 percent. Using an approach similar to Mehra and Prescott (2003), the equity premium for Finland from 1912 to 2009 is 10.14 percent per annum, which is somewhat higher than the US equity premium of 6.92 percent from 1889 to 2000.

Having a number of long time series collected together for the first time allows one to study further a number of issues. It would be interesting to examine, for example, the role of the stock market in the economy, correlation to other markets, or the behavior of the trading volume over time. Furthermore, it would be also interesting to construct additional times series for more detailed analysis (e.g. dividend yield series, market capitalization to the GDP ratio). These questions are left for future research.

[45] One might wonder to what extent this increase in correlation during the 1990s is explained by Nokia's high weight in the value-weighted index. As mentioned earlier, during this period Nokia developed into a truly international company with most of its sales taking place outside of Finland, and since mid 1990s it has been listed on the New York Stock Exchange. However, the correlation between the equally-weighted Finnish stock returns and the S&P index (results not shown here) shows the same pattern as in Figure 7.

REFERENCES

Alhonsuo, Sampo – Söderlund, Kjell Peter – Tarkka, Juha (1989): Joukkovelkakirjalainojen tuotto Suomessa 1948-1986. Helsinki: Bank of Finland, Discussion paper 10/89.

Andersson, Edward (1994): Pääomatulon verotus. Helsinki: Lakimiesliiton kustannus. 2. edition.

Arola, Mika (2006): Foreign capital and Finland. Helsinki: Bank of Finland, Scientific Monographs E: 37.

Autio, Jaakko (1996): Korot Suomessa 1862-1952 [Interest rates in Finland]. Bank of Finland, Discussion paper 7/1996.

Barnes, Michelle – Boyd, John – Smith, Bruce (1999): Inflation and Asset Returns. European Economic Review, 43, 737-754

Bekaert, Geert – Harvey, Campbell (1997): Emerging equity market volatility. Journal of Financial Economics, 1997, 43, 29-77

Berglund, Tom (1986): Anomalies on a thin security market. Publications of the Swedish School of Economics and Business Administration, 37. Doctoral dissertation.

Berglund, Tom – Wahlroos, Björn – Grandell, L. (1983): The KOP and the UNITAS indexes for the Helsinki Stock Exchange in the light of a New Value Weighted Index. Finnish Journal of Business Economics, 32, 30-41.

Björkqvist, Heimer (1953): Helsingfors Börsförening på 1860-talet. Historisk Tidskrift för Finland, no. 1, 97-130.

Bruun, Otto: Helsingin kaupungin kauppayhdistys 1868-1954. Helsinki 1956.

Campbell, John Y. – Lettau, Martin – Malkiel, Burton – Xu, Yexiao (2001): Have individual stocks become more volatile? An empirical exploration of idiosyncratic risk. Journal of Finance, 56, 1-43.

Campbell, John Y. – Viceira, Luis M. (2002): Strategic Asset Allocation. USA: Oxford University Press.

Campbell, John Y. (2003): Consumption-Based Asset Pricing. In Constantinides, George and Harris, Milton, and Stulz, René (Eds.): Handbook of the Economics of Finance. Volume 1B. Financial Markets and Asset Pricing. North Holland: Amsterdam.

Dimson, Elroy. – Marsh, Paul (2001): U.K. Financial Market Returns, 1955-2000. Journal of Business, 74, 1-32.

Dimson, Elroy – Marsh, Paul – Staunton, Mike (2002): Triumph of the Optimists: 101 Years of Global Investment Returns. New Jersey: Princeton University Press

Eijgenhuijsen, H. – Buckely, A. (1999): An overview of returns in Europe. The European Journal of Finance, 5, 276-297.

Graflund, Andreas (2002): Empirical Probability Distributions of Real Return from Swedish Stock and Bond Portfolios. Lund University: Unpublished working paper. EFMA 2002 London Meetings. http://ssrn.com/abstract=313926

Hawawini, Gabriel (1994): Equity Price Behavior: Some Evidence from Markets around the World. Journal of Banking and Finance, 18, 4, 603-620.

Heikkinen, Sakari – Kortteinen, Timo – Soikkanen, Hannu – Soininen, Arvo M. (1983): Palkat, toimeentulo ja sosiaalinen rakenne Suomessa 1850–1913 (Wages, Livelihood and Social Structure in Finland 1980–1913). Helsinki: Helsingin yliopiston talous- ja sosiaalihistorian laitoksen tiedonantoja, nro 13.

Hernesniemi, Hannu (1990): HEX-indeksi [The Helsinki Stock Exchange Index]. Helsinki: Elinkeinoelämän tutkimuslaitos, B 68.

Hjerppe, Riitta (1989): The Finnish economy 1860–1985. Growth and structural change. Helsinki: Bank of Finland Publications. Studies on Finland's Economic Growth XIII.

Hjerppe, Riitta (1996): Finland's historical national accounts 1860–1994. Calculation methods and statistical tables. Jyväskylän yliopisto, Suomen historian julkaisuja 24.

Jernström, Harald: Osakkeenomistajan kirja pörssilistalla olevista osakkeista. Helsinki: 1926-1931.
Jorion, P. – Goetzmann, W. (1999): Global Stock Markets in the Twentieth Century. Journal of Finance, 54, 3, 953-980.
Kock, Gunhard (2004): Helsingin Pörssiyhdistys. Unpublished, available from internet: http://www.porssitieto.fi/1862porssi.html
Liljeblom, Eva – Löflund, Anders (1999): The Euro and Portfolio Choices: A Nordic Perspective. Swedish Economic Policy Review, 6, 1, 41-82
Liljeblom, Eva – Stenius, Marianne (1997): Macroeconomic volatility and stock market volatility: Empirical evidence on Finnish data. Applied Financial Economics, 7, 4, 419-426.
Linnamo, J. (1958): Rahamarkkinain indeksiehtojärjestelmä. Kansallis-Osake-Pankin Taloudellinen Katsaus, No. 2.
Longin, Francois – Solnik, Bruno (1995): Is the correlation in international equity returns constant: 1960-1990? The Journal of International Money and Finance, 14, 3-26.
Malkamäki, Markku (1993): Essays on Conditional Pricing of Finnish Stocks. Bank of Finland Publications, Series B:48.
Mehra, R. – Prescott, E. (1985): The Equity Premium: a Puzzle. Journal of Monetary Economics, 15, 145-161.
Mehra, R. – Prescott, E. (2003): The Equity Premium in Retrospect. In Constantinides, George and Harris, Milton, and Stulz, René (Eds.): Handbook of the Economics of Finance. Volume 1B. Financial Markets and Asset Pricing. North Holland: Amsterdam.
Modeen, Gunnar (1952): Elinkustannusindeksi (Cost of living index). Helsinki: Työväen kirjapaino.
Niskanen, Mikko (1996a): The money and foreign exchange markets. Bank of Finland Bulletin, Special Issue.
Niskanen, Mikko (1996b): The bond market. Bank of Finland Bulletin, Special Issue.
Nyberg, Peter – Vaihekoski, Mika (2010): A new value-weighted index for the Finnish stock market. Research in International Business and Finance, 24 (3), 267-283. doi: 10.1016/j.ribaf.2009.12.006.
Poutvaara, Panu (1996): Pörssikurssien kehitys Suomessa 1896-1929: Uudet indeksisarjat ja niiden tulkinta. (A new stock index for Helsinki Stock Exchange and time before it for years 1896 - 1929). Bank of Finland, Discussion Papers 25/1996.
Schwert, G. William (1989): Why does stock market volatility change over time? Journal of Finance, 44, 1115-1153.
Siegel, J. (1998): Stocks for the Long Run. New York: McGraw-Hill.
Sierimo, Carolina – Virén, Matti (1995): Financial factors and the macroeconomy. Bank of Finland, Discussion Papers 34/95.
Solnik, Bruno – Boucrelle, Cyril – Le Fur, Yann (1996): International market correlation and volatility. Financial Analysts Journal, 52, 5, 17-34.
Suomen Pörssisäätiö (1987): Pörssikirja. Helsingin Arvopaperipörssi 75 vuotta [The Helsinki Stock Exchange 75 years]. Helsinki: Suomen Pörssisäätiö.
Stjernschantz, Göran (1987): På Börsens Berg- och Dalbana. Helsinki: Helsinki Stock Exchange.
Tarkka, Juha (1988): Kahlitun rahan aika – Suomen rahoitusmarkkinoiden säännöstelyn vuosikymmenet. In Honkapohja, Seppo and Suvanto, Antti (Eds.): Raha, inflaatio ja talouspolitiikka. Helsinki.
Tiderman, F. (1937): Helsingfors börs 1912-1937. Helsingfors: J. Simelii Arvingars Boktryckeri Ab.
Valtonen, Erik (1996): A guide to the Finnish Bond and Money Market. Helsinki: Handelsbanken Markets.
Vaihekoski, Mika (2004). Portfolio Construction for Tests of Asset Pricing Models. Financial Markets, Institutions & Instruments, 13, 1, 1-39.

Vaihekoski, Mika (1997): The Finnish Stock Market: Recent Trends and Important Events. Finnish Journal of Business Economics, 46, 4, 526-543.

Appendix A: Historical money and bond market data for Finland

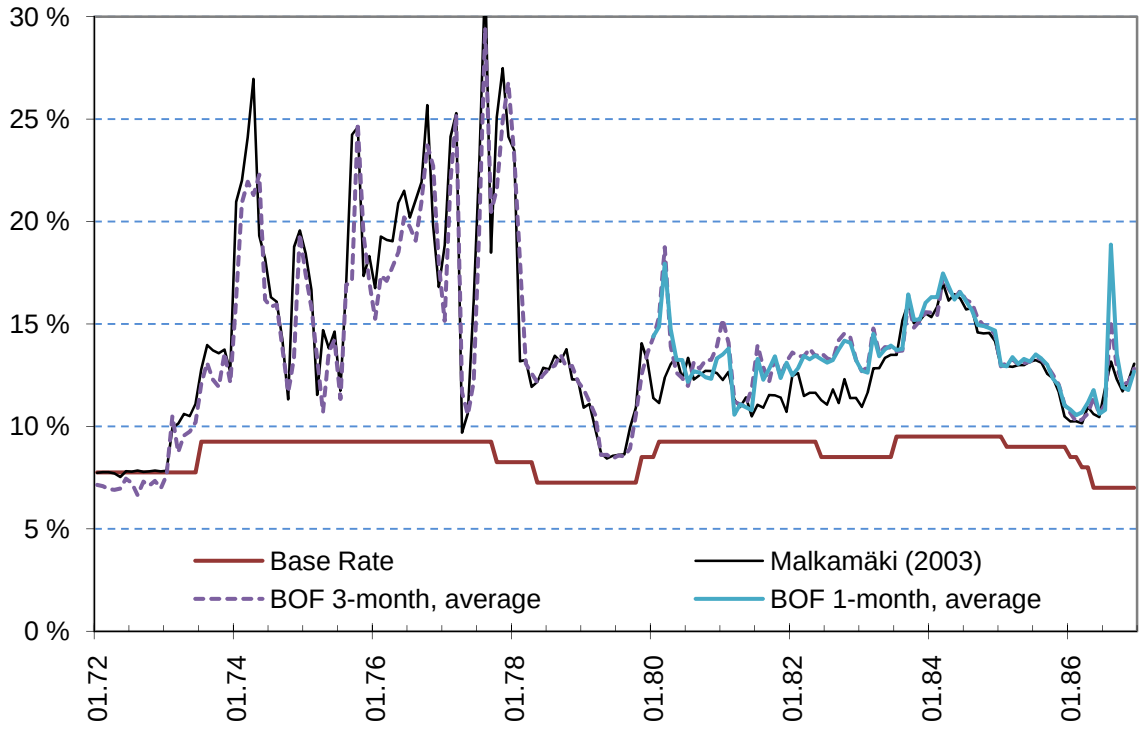
Money market

The Bank of Finland base-rate and the date when it has been changed are available from the beginning of 1867. In addition, Autio (1996) provides a number of short-term and long-term interest rate series from 1862 to 1952. Provided series are year-end values. He notes that monthly values are available for some of the series, but unfortunately they seem to have been lost as they cannot be found (despite our efforts).

Päivi Valkama calculated monthly short-term corporate money rates as well as bond yields for her licentiate thesis. Short-term rates are calculated on the basis of discounts recorded for the three month corporate papers (vekseli in Finnish) at the Bank of Finland. Her series is available for a period from 1921:7 to 1938:12 (provided below).

Several time series databases also include one and three month money market rates for Finland that start from January 1972 (January 1980 for the one month rate). Series are shown below. Original source of the data indicated in the databases is the Bank of Finland. Unfortunately, the rates are monthly averages and it is not known if the daily observations (or weekly) used to calculate monthly averages are still available. Furthermore, the documentation of the series is

typically missing and it is not known who has calculated the series and how, nor on what information they are based on.

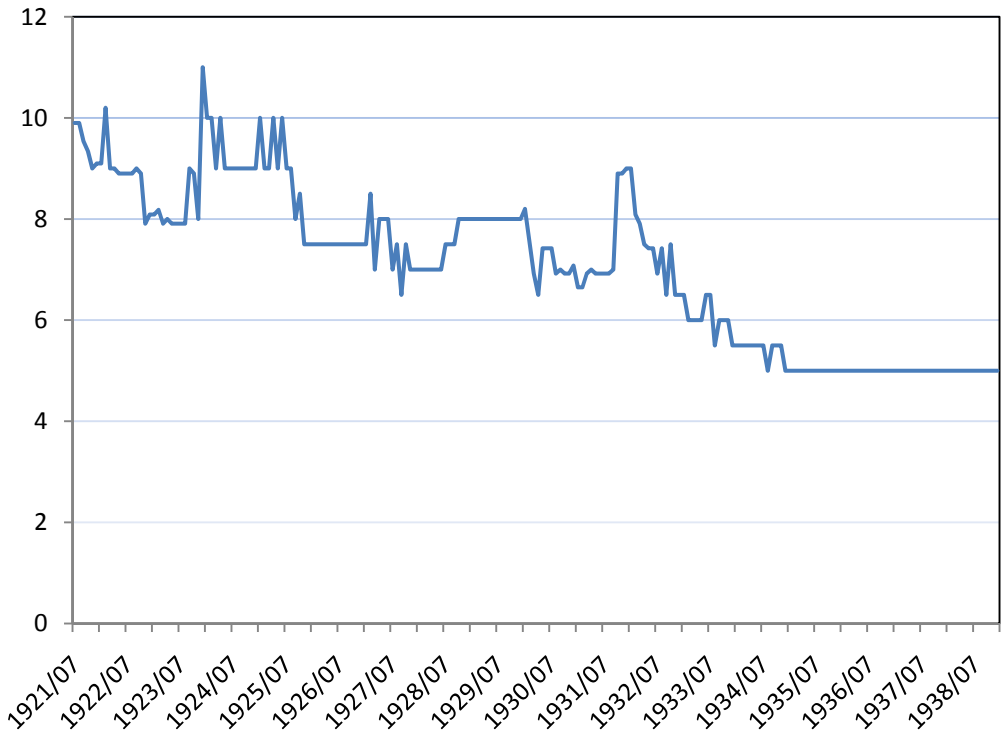


Bond market

As far as the bond market rates go, Arola (2006) provides end-of-quarterly market yields for the Finnish government bonds listed abroad. He uses true market price data to derive the yields from 1863Q1 to 1938Q4.

Valkama provides end-of-month market yields calculated on the basis of quoted price of one single 30-year government bond quoted at the Helsinki Stock Market. Her series is available from 1921:7 to 1934:7 (provided below).[46]

[46] Sierimo and Virén (1995) use in their study four to five year government bond yields from January 1920 forward. Comparing the graph provided in the study against Valkama's times series, it seems that their series is based on Alhonsuo et al. data (1986) from 1948 forward (with minor changes, see footnote 26) and Valkama's short-term corporate money market rates.



Unitas has also calculated and published in their quarterly Unitas publication a number of obligation and bond related time series. A monthly obligation index is available from 1931:03 to 1939:7 with base years set to 1926 (two different versions) and 1935. It is argued to be based on prices observed at the HSE. In addition, Unitas provides obligation yield series for a period from 1926:1 to 1931:6 and then again from 1933:10 to 1939:6. They also seems to be based on price observations at the HSE. Provided series is based on sixteen bonds (government, municipal, corporate, and financial) and it is probably an equally weighted average.

Appendix C: Yearly trading volumes

Series are taken from the HSE's annual reports and Nasdaq OMX's web-site (1990). Volumes are shown as provided by the source i.e. in old Finnish markkas prior to 1963, in new Finnish markkas 1963 (one new markka equals to 100 old markkas) and in euros after 1999.

					Obligations (bonds)			
	Stocks	Equity rights & Warrants	Co-op particip. certificates	Total	Government	Municipal	Financial	Other
Year	(1)	(2)	(3)	(1-3)	(4)	(5)	(6)	(7)
1912	1 599 451	0	0	1 599 451	0	3 340	0	0
1913	2 537 028	0	0	2 537 028	0	16 215	0	0
1914	1 995 109	0	0	1 995 109	0	52 530	0	0
1915	4 164 147	0	0	4 164 147	0	17 039	0	0
1916	190 161 195	0	0	190 161 195	0	2 144	0	0
1917	294 252 663	0	0	294 252 663	0	0	0	0
1918	922 965 358	0	0	922 965 358	0	0	0	0
1919	663 988 979	0	0	663 988 979	0	0	0	0
1920	686 250 623	0	0	686 250 623	0	0	0	0
1921	208 946 938	0	0	208 946 938	0	0	0	0
1922	118 332 237	0	0	118 332 237	0	0	0	0
1923	131 202 418	0	0	131 202 418	6 110 241	173 600	0	722 180
1924	112 284 412	0	0	112 284 412	5 217 231	559 600	29 500	976 620
1925	129 187 742	0	0	129 187 742	13 368 748	1 924 500	56 000	961 960
1926	302 342 959	0	0	302 342 959	27 196 587	5 883 303	2 836 755	3 136 718
1927	727 401 936	0	0	727 401 936	29 932 226	10 621 690	1 776 528	6 626 230
1928	477 789 450	0	0	477 789 450	23 494 926	1 656 228	1 311 565	1 174 900
1929	153 681 150	130 166	0	153 811 316	8 913 659	996 003	2 633 250	924 035
1930	171 397 154	0	0	171 397 154	6 965 943	546 300	1 110 737	344 190
1931	298 506 026	0	0	298 506 026	6 851 428	434 676	175 240	0
1932	150 771 232	0	0	150 771 232	6 865 145	1 856 815	2 849 801	11 200
1933	177 022 260	0	0	177 022 260	12 347 036	163 310	5 670 415	26 900
1934	263 094 162	776 502	0	263 870 664	19 335 339	547 090	22 044 102	39 730
1935	199 703 245	2 011 678	0	201 714 923	27 243 719	2 338 200	1 601 512	83 675
1936	386 884 003	185 141	0	387 069 144	35 981 508	404 425	10 426 678	50 750
1937	517 593 414	27 329 925	0	544 923 339	20 454 957	267 150	19 366 427	0
1938	190 650 699	5 826 107	0	196 476 806	24 455 946	40 650	607 055	0
1939	213 613 445	6 762 258	0	220 375 703	21 969 757	204 950	2 684 674	29 600
1940	326 820 259	1 795 128	0	328 615 387	0	0	0	0
1941	486 969 419	14 476 020	0	501 445 439	0	0	0	0
1942	495 515 247	26 371 716	0	521 886 963	0	0	0	0
1943	389 432 756	35 703 375	0	425 136 131	0	0	0	0
1944	486 840 235	876 340	0	487 716 575	0	0	0	0
1945	1 295 422 237	34 519 179	0	1 329 941 416	0	0	0	0

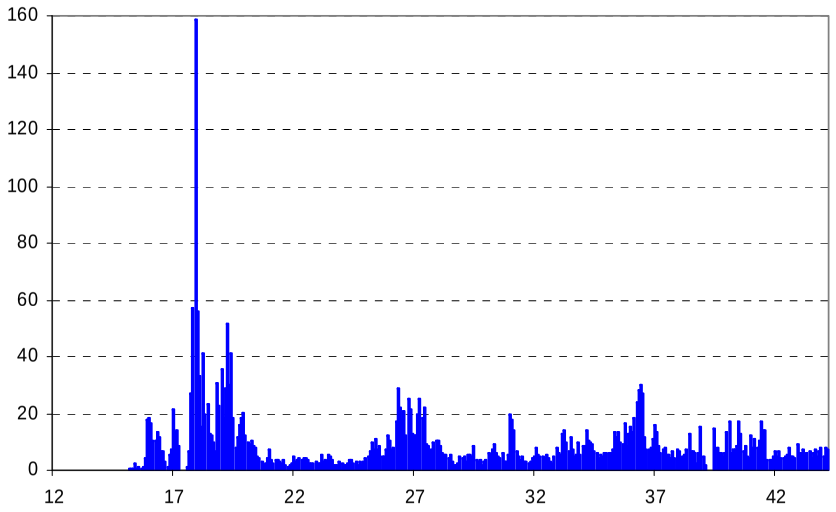
1946	933 256 774	110 853 294	71 345 700	1 115 455 768	147 570 039	0	0	0
1947	703 826 434	4 321 989	188 194 360	896 342 783	352 777 155	0	0	0
1948	567 760 196	7 807 792	152 779 750	728 347 738	547 573 522	0	0	0
1949	808 173 615	28 640 163	331 549 350	1 168 363 128	448 593 940	0	0	0
1950	1 415 818 314	143 237 602	590 335 100	2 149 391 016	807 007 565	0	0	0
1951	1 542 144 132	93 023 790	548 727 100	2 183 895 022	597 005 272	0	0	0
1952	1 229 339 283	113 367 531	269 015 550	1 611 722 364	372 152 688	0	0	0
1953	1 578 370 520	22 943 415	243 206 750	1 844 520 685	288 298 486	1 119 000	0	0
1954	1 271 602 579	77 775 816	69 878 300	1 419 256 695	148 350 101	294 500	0	990 000
1955	2 052 230 774	73 084 738	43 627 650	2 168 943 162	143 447 420	49 000	0	0
1956	2 906 128 454	428 137 466	22 199 200	3 356 465 120	196 156 885	0	0	0
1957	2 332 002 022	238 500	0	2 332 240 522	315 482 938	0	0	0
1958	1 663 906 157	23 423 310	0	1 687 329 467	149 082 245	0	0	168 000
1959	2 289 100 729	293 651 109	0	2 582 751 838	126 518 769	0	0	1 538 800
1960	2 367 380 378	145 346 562	0	2 512 726 940	115 691 513	0	0	85 000
1961	2 508 142 183	175 046 028	0	2 683 188 211	166 188 821	75 200	0	338 300
1962	2 665 213 776	170 204 685	0	2 835 418 461	277 363 475	66 500	0	528 000
1963	25 600 832,97	689 815,05	0	26 290 648	2 979 274	4 128,00	0	20 897,50
1964	25 647 474,09	563 609,99	0	26 211 084	Break-down no longer available;			4 806 029
1965	24 212 402,23	4 813 511,15	0	29 025 913	column (8) is the total trading volume			5 261 160
1966	21 362 442,51	1 683 975,00	0	23 046 418	for all obligations.			5 397 980
1967	18 465 959,03	967 707,62	0	19 433 667				8 500 268
1968	27 823 430,00	4 827 854,00	0	32 651 284				6 942 862
1969	36 750 868,01	5 336 830,96	0	42 087 699				8 341 418
1970	53 158 487,27	9 243 368,14	0	62 401 855				12 943 824
1971	66 109 400,92	5 641 673,04	0	71 751 074				18 345 402
1972	109 464 892,30	36 539 276,64	0	146 004 169				16 500 015
1973	204 002 782,35	61 373 078,67	0	265 375 861				19 496 330
1974	147 045 176,00	42 668 129,00	0	189 713 305				16 072 491
1975	143 080 966,94	48 682 680,40	0	191 763 647				13 445 916
1976	136 876 651,00	16 417 970,04	0	153 294 621				16 063 406
1977	125 523 979,21	1 798 286,59	0	127 322 266				56 808 848
1978	153 672 546,96	19 124 971,40	0	172 797 518				138 992 907
1979	259 790 269,05	46 451 598,34	0	306 241 867				224 908 353
1980	307 953 856,92	55 470 341,05	0	363 424 198				303 112 615
1981	342 676 460,09	12 222 869,03	0	354 899 329				1 000 925 005
1982	566 829 792,86	96 693 256,27	0	663 523 049				2 201 794 911
1983	1 241 391 179,00	148 114 203,00	0	1 389 505 382				1 623 747 391
1984	2 109 871 000,00	397 652 000,00	0	2 507 523 000				1 894 600 000
1985	3 009 299 000,00	104 599 000,00	0	3 113 898 000				2 906 177 000
1986	9 184 649 000,00	303 659 000,00	0	9 488 308 000				1 801 134 000
1987	25 623 706 000,00	1 017 212 000,00	0	26 640 918 000				2 214 361 000
1988	29 726 136 000,00	2 008 002 000,00	0	31 734 138 000				1 418 931 000
1989	31 719 819 000,00	1 440 575 000,00	0	33 160 394 000				1 553 669 000

1990	15 343 616 576,70	177 125 550,13	0	15 520 742 127	1 321 577 000
1991	6 318 203 210,88	21 175 003,91	0	6 339 378 215	477 700 000
1992	10 272 580 032,70	4 143 793,52	0	10 276 723 826	6 558 256 000
1993	45 229 819 212,22	1 107 055 659,86	0	46 336 874 872	36 745 249 000
1994	68 423 165 862,89	497 767 121,35	0	68 920 932 984	1 089 859 000
1995	82 992 835 157,16	25 689 662,68	0	83 018 524 820	391 080 000
1996	101 146 475 301,02	118 846 787,70	0	101 265 322 089	51 974 000
1997	180 320 199 320,62	57 633 401,74	0	180 377 832 722	13 779 000
1998	306 559 620 145,08	210 369 156,90	0	306 769 989 302	13 779 000
1999	103 571 874 701,00	1 272 728 593,00	0	104 844 603 294	
2000	225 833 795 641,18	1 407 154 177,09	0	227 240 949 818	
2001	201 462 013 779,80	1 158 154 771,17	0	202 620 168 551	
2002	187 220 798 653,90	925 363 182,00	0	188 146 161 836	
2003	144 708 473 467,26	316 131 883,91	0	145 024 605 351	
2004	179 897 071 323,50	508 993 023,50	0	180 406 064 347	
2005	223 431 047 411,67	655 635 682,59	0	224 086 683 094	
2006	287 940 584 132,00	800 061 708,00	0	288 740 645 840	
2007	394 481 496 230,00	637 504 792,00	0	395 119 001 022	
2008	269 165 835 250,00	125 494 298,00	0	269 291 329 548	
2009	130 711 023 105,00	261 135 815,00	0	130 972 158 920	

Year	"Particip. Debentures" (8)	Debentures Corporations (9)	Other bonds Misc (10)	Bonds Total (4-10)	Total
1912	0	0	0	3 340	1 602 791
1913	0	0	0	16 215	2 553 244
1914	0	0	0	52 530	2 047 639
1915	0	0	0	17 039	4 181 186
1916	0	0	0	2 144	190 163 339
1917	0	0	0	0	294 252 663
1918	0	0	0	0	922 965 358
1919	0	0	0	0	663 988 979
1920	0	0	0	0	686 250 623
1921	0	0	0	0	208 946 938
1922	0	0	0	0	118 332 237
1923	0	0	0	7 006 021	138 208 438
1924	0	0	0	6 782 951	119 067 362
1925	0	0	0	16 311 208	145 498 950
1926	0	0	0	39 053 362	341 396 320
1927	0	0	0	48 956 673	776 358 609
1928	0	0	0	27 637 619	505 427 068
1929	1 036 910	0	0	14 503 857	168 315 173

1930	32 100	0	0	8 999 270	180 396 424
1931	75 000	0	0	7 536 343	306 042 369
1932	17 000	0	0	11 599 961	162 371 193
1933	431 760	0	0	18 639 420	195 661 680
1934	1 176 500	0	0	43 142 761	307 013 425
1935	1 757 290	0	0	33 024 396	234 739 319
1936	2 413 870	0	0	49 277 231	436 346 375
1937	2 801 400	0	0	42 889 934	587 813 273
1938	182 300	0	0	25 285 951	221 762 757
1939	51 000	0	0	24 939 981	245 315 684
1940	1 789 404	0	0	1 789 404	330 404 791
1941	0	0	0	0	501 445 439
1942	0	0	0	0	521 886 963
1943	0	0	0	0	425 136 131
1944	0	0	0	0	487 716 575
1945	0	0	0	0	1 329 941 416
1946	0	0	0	147 570 039	1 263 025 807
1947	0	0	0	352 777 155	1 249 119 938
1948	0	0	0	547 573 522	1 275 921 260
1949	0	0	0	448 593 940	1 616 957 068
1950	0	0	0	807 007 565	2 956 398 581
1951	0	0	0	597 005 272	2 780 900 294
1952	0	0	0	372 152 688	1 983 875 052
1953	0	0	0	289 417 486	2 133 938 171
1954	0	0	0	149 634 601	1 568 891 296
1955	0	0	0	143 496 420	2 312 439 582
1956	0	0	0	196 156 885	3 552 622 005
1957	0	0	0	315 482 938	2 647 723 460
1958	0	0	0	149 250 245	1 836 579 712
1959	0	0	0	128 057 569	2 710 809 407
1960	267 500	0	0	116 044 013	2 628 770 953
1961	5 148 740	0	0	171 751 061	2 854 939 272
1962	18 913 584	0	0	296 871 559	3 132 290 020
1963	60 579,95	0	0	3 064 879,28	29 355 527,30
1964	0	103 833,52	0	4 909 863,01	31 120 947,09
1965	0	544 122,44	0	5 805 282,55	34 831 195,93
1966	0	769 229,99	0	6 167 209,89	29 213 627,40
1967	0	3 264 102,39	0	11 764 369,90	31 198 036,55
1968	0	4 195 939,00	0	11 138 801,00	43 790 085,00
1969	0	3 278 037,20	0	11 619 455,29	53 707 154,26
1970	0	1 925 109,55	0	14 868 933,98	77 270 789,39
1971	0	2 396 302,30	0	20 741 704,03	92 492 777,99
1972	0	4 389 037,75	0	20 889 052,96	166 893 221,90
1973	0	6 167 940,50	0	25 664 270,60	291 040 131,62

1974	0	3 180 810,00	0	19 253 301,00	208 966 606,00
1975	0	2 713 015,75	0	16 158 931,68	207 922 579,02
1976	0	2 772 989,75	0	18 836 395,89	172 131 016,93
1977	0	7 342 773,25	0	64 151 621,25	191 473 887,05
1978	0	15 442 898,95	0	154 435 805,95	327 233 324,31
1979	0	25 600 130,75	0	250 508 483,75	556 750 351,14
1980	0	32 309 957,05	incl. in oblig./~0	335 422 572,05	698 846 770,02
1981	0	62 944 282,88	43 861 683,75	1 107 730 971,17	1 462 630 300,29
1982	0	125 641 094	93 794 222	2 421 230 226,48	3 084 753 275,61
1983	0	546 656 395	185 773 446	2 356 177 232,00	3 745 682 614,00
1984	0	1 133 083 000	1 979 689 000	5 007 423 000,00	7 514 946 000,00
1985	0	1 343 506 000	4 796 383 000	9 046 067 000,00	12 159 965 000,00
1986	0	549 433 000	4 128 710 000	6 479 276 000,00	15 967 584 000,00
1987	0	188 510 000	2 201 061 000	4 603 933 000,00	31 244 851 000,00
1988	0	924 340 000	3 374 545 000	5 717 816 000,00	37 451 954 000,00
1989	0	1 251 173 000	4 570 428 000	7 375 270 000,00	40 535 664 000,00
1990	0	206 921 000	3 021 593 000	4 550 088 517,53	20 070 830 644,36
1991	0	11 991 000	825 529 000	1 315 219 734,95	7 654 597 949,74
1992	0	22 219 000	8 796 370 000	15 376 845 764,58	25 653 569 590,80
1993	0	105 795 000	23 125 864 000	59 976 908 336,95	106 313 783 209,03
1994	0	13 892 000	1 057 331 000	2 161 082 283,94	71 082 015 268,18
1995	0	11 831 000	672 392 000	1 075 302 179,15	84 093 826 998,99
1996	0	33 653 000	455 187 000	540 813 727,70	101 806 135 816,42
1997	0	27 163 000	447 444 000	488 386 222,06	180 866 218 944,42
1998	Break-down no longer available; col. (11) is the total trading volume for all bonds.			521 804 607,78	180 866 218 944,42
1999				30 763 134	104 875 366 428,00
2000				8 164 912	227 249 114 730,27
2001				18 487 730	202 638 656 280,97
2002				14 520 368	188 160 682 203,90
2003				41 815 702	145 066 421 053,17
2004				22 444 417	180 428 508 764,00
2005				41 032 779	224 127 715 873,26
2006				30 684 087	288 771 329 927,00
2007				74 965 321	395 193 966 343,00
2008				64 830 412	269 356 159 960,00
2009				42 970 963	131 015 129 883,00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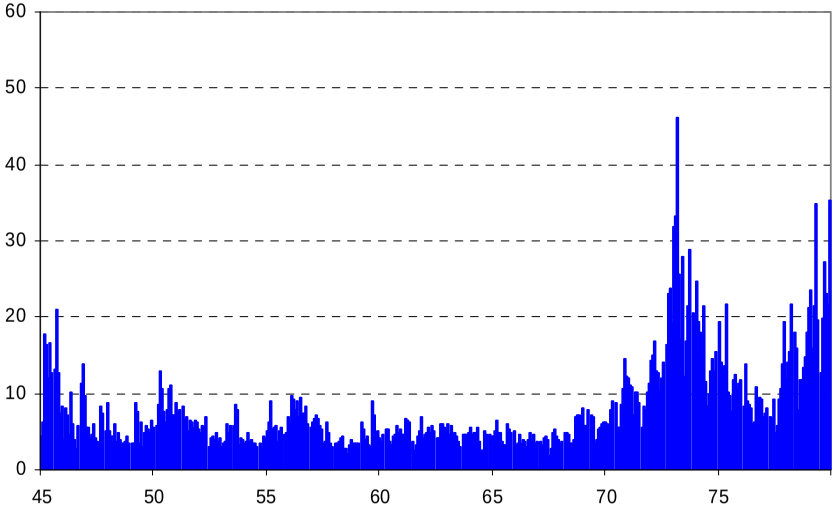
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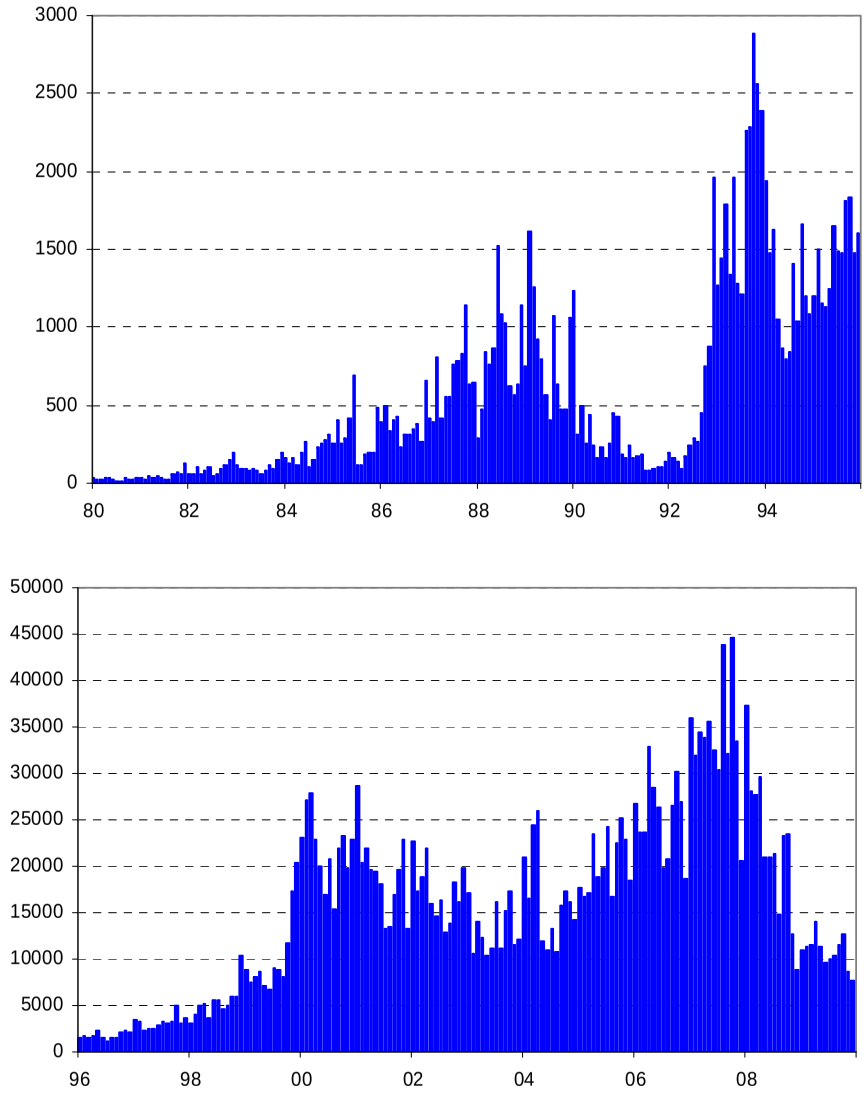


Figure 1: Monthly trading volume of the Helsinki Stock Exchange 1912-2009. These figures show the monthly, real (inflation-adjusted) total trading volume (including stocks, subscription rights, and bonds) at the Helsinki Stock Exchange in million euros (per December 2009). Note the differences in the scale of the y-axis in different figures.

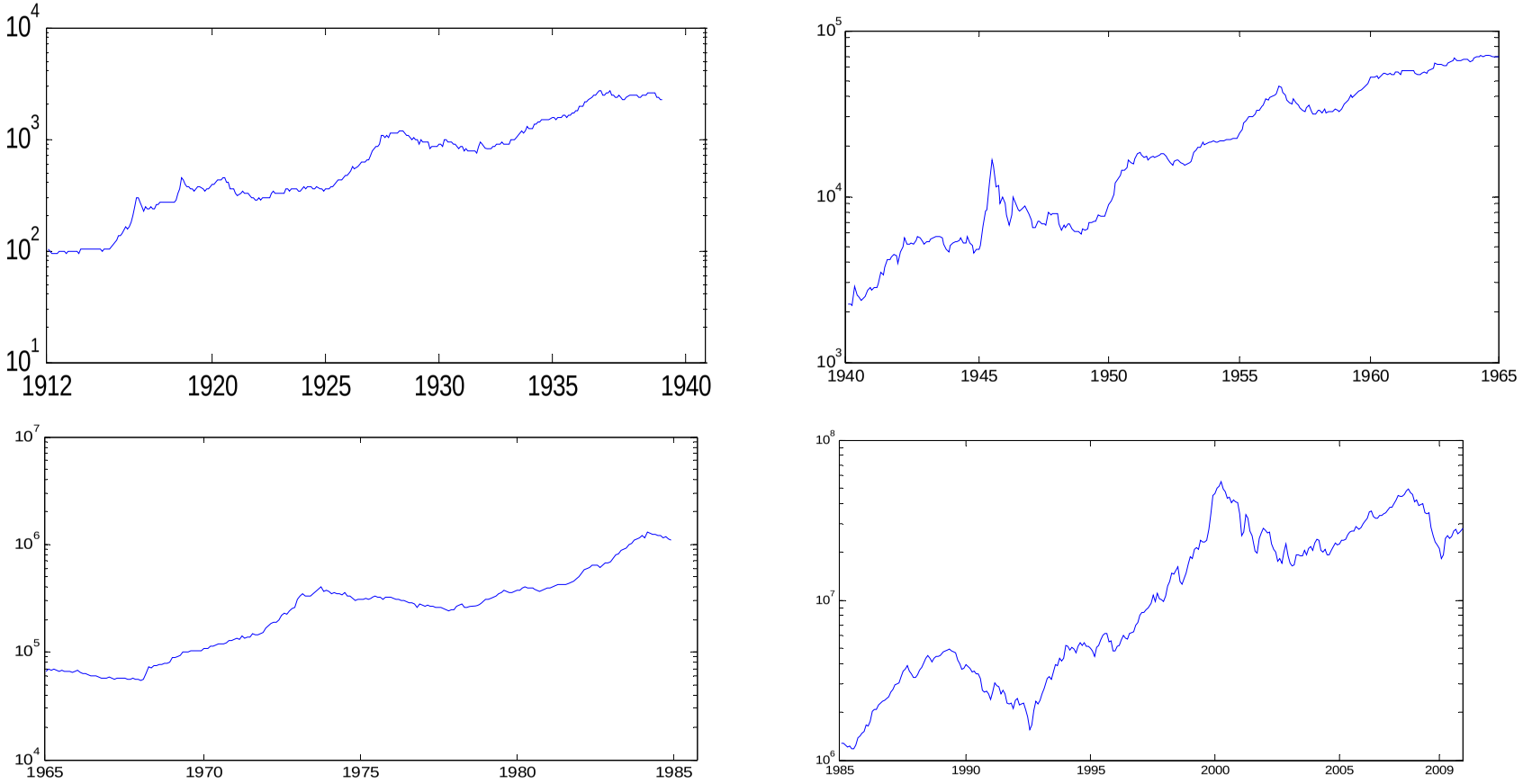


Figure 2: Development of the Finnish equity market 1912-2009. Nominal total return indices. The Nyberg-Vaihekoski index is used until 1969, the WI-index from 1970 to 1989 and the HEX-index thereafter. Logarithmic scale (November 1912 = 100). Note the differences in the scale of the y-axis in different figures.

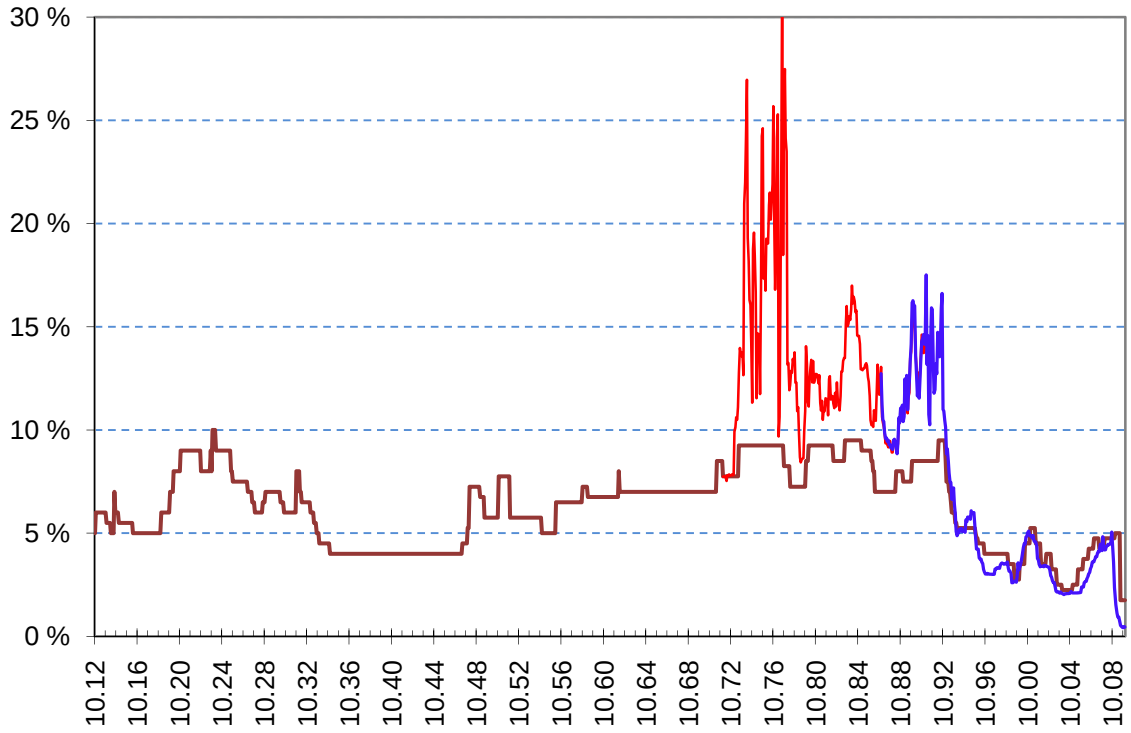


Figure 3: Monthly short-term risk-free rate rates per annum 1912-2009. The solid brown line shows the Bank of Finland's base rate throughout the sample period from October 1912 to December 2009. The red line shows the implied markka three-month interest rate calculated in Malkamäki (2003) from the Eurodollar rates for 1972-1986. The blue line shows the one-month Helibor (Euribor 1999-) interest rate.

Figure 4A.

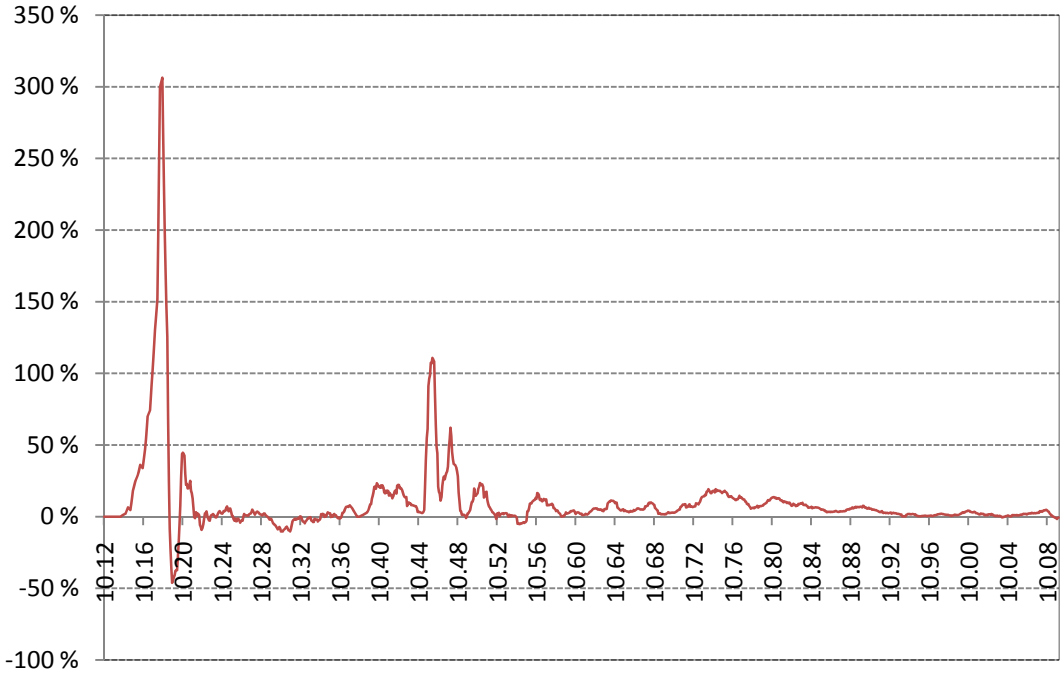


Figure 4B.

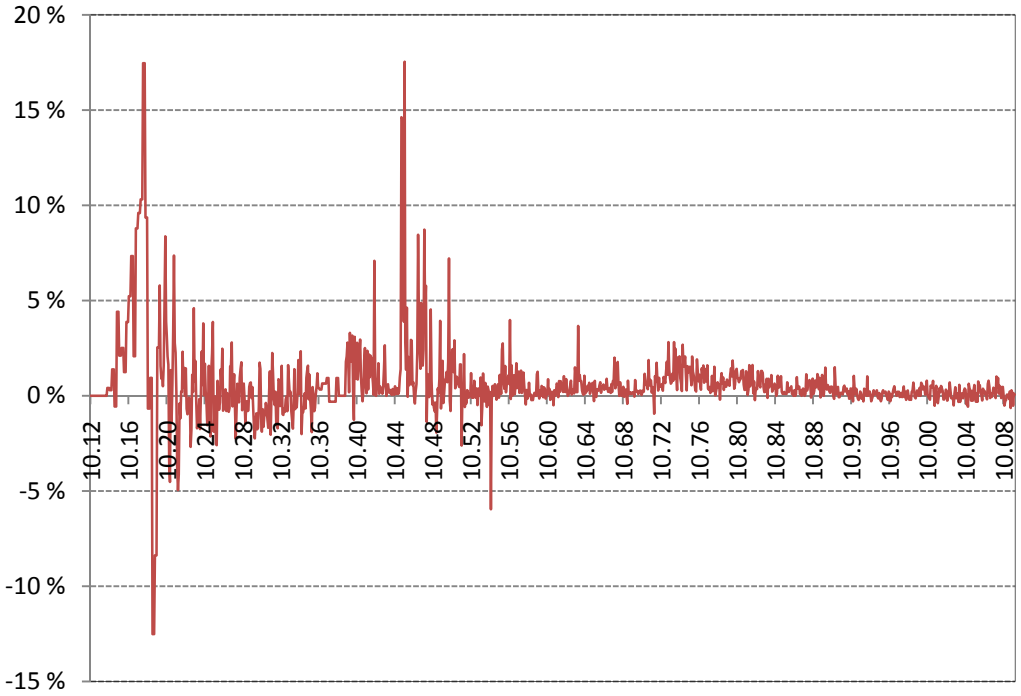


Figure 4: Monthly inflation from October 1912 to December 2009. Figure A shows the yearly inflation rate (cumulative sum of monthly changes). Figure B shows the monthly percentage change in the CPI index.

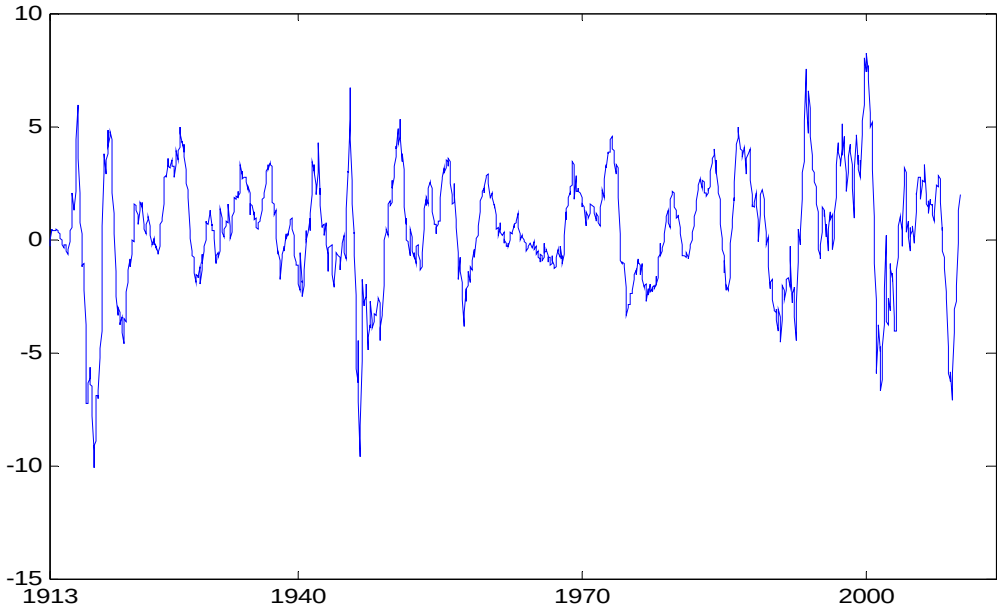


Figure 5: One-year moving average of real, inflation-adjusted monthly stock market returns 1912-2009. Monthly continuously compounded returns 1912-1969 are calculated from the Nyberg-Vaihekoski index (1912-1969), and from the WI (1970-90) and the HEX/OMHEX-indices (1991-2009).

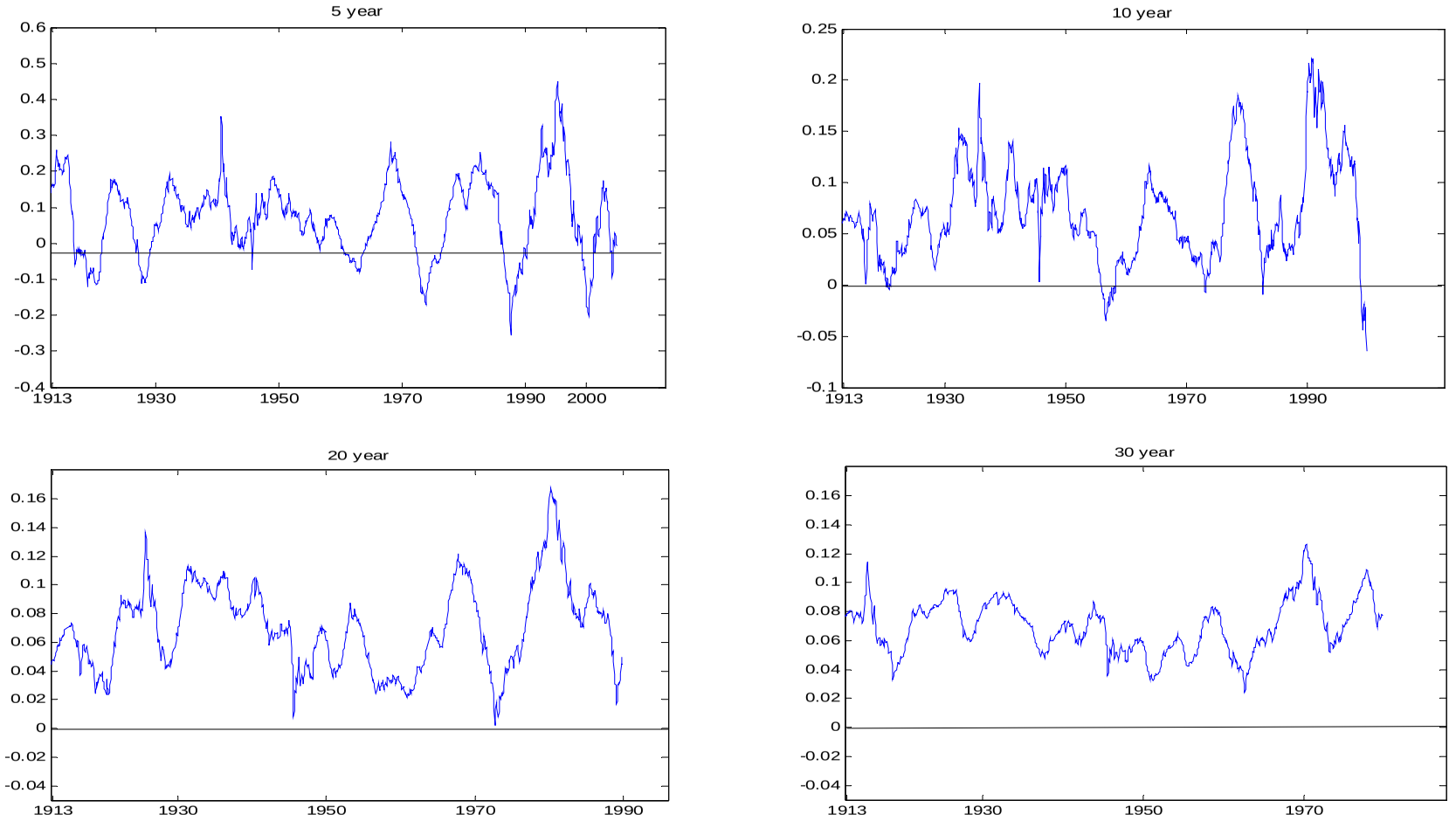


Figure 6: The equity premium under different investment horizons. This figure shows a forward-looking moving average of the monthly continuously compounded return differences between value-weighted stock market and money market returns. From left to right and top to bottom, the graphs show the equity premiums for investment horizons of 5, 10, 20 and 30 years, respectively. The values are multiplied by 12 to arrive at annual averages. Note the different scales on the y-axis in the graphs.

Figure 7A.

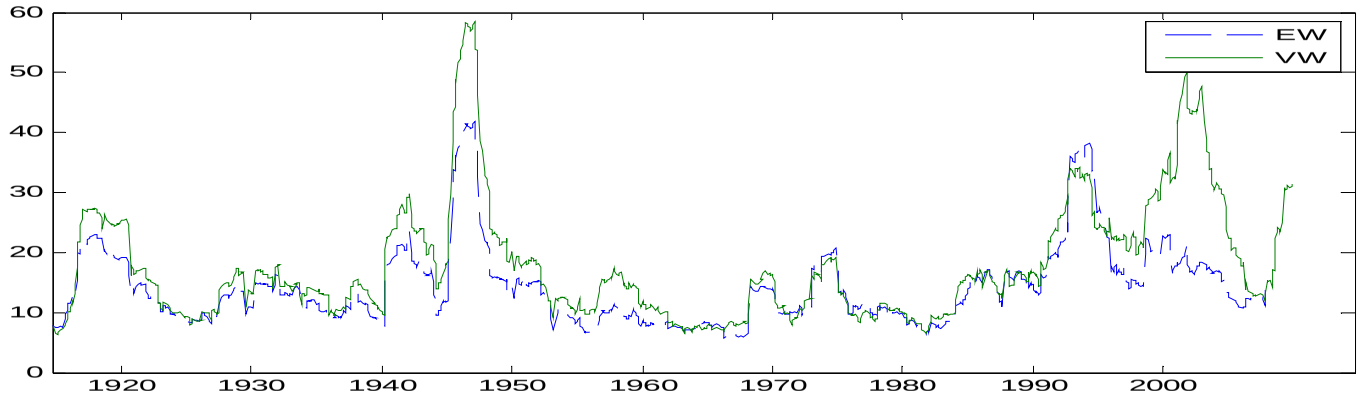
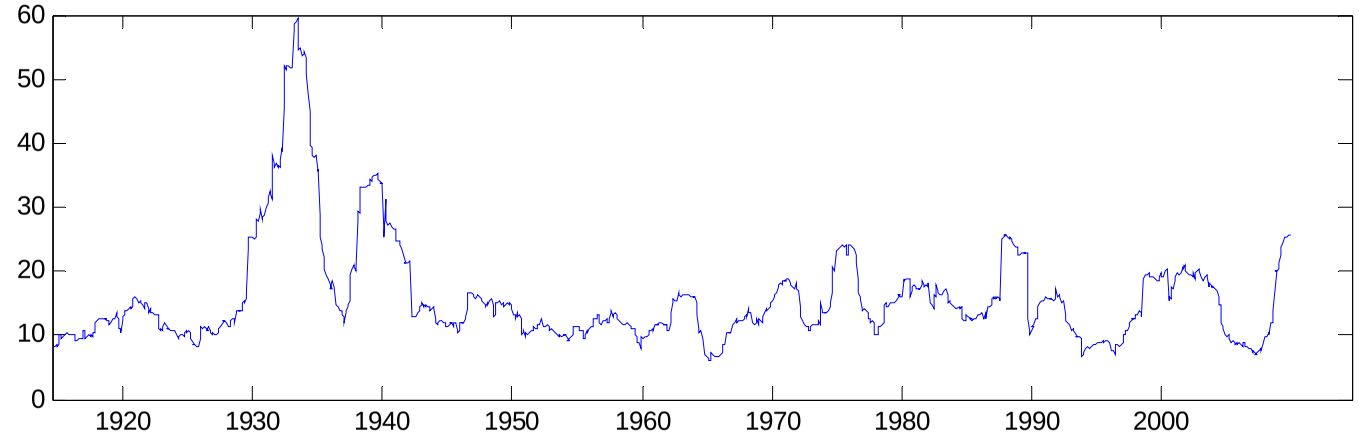


Figure 7B.



Figures 7A and 7B: 24-month backward-looking rolling standard deviations. These figures show a 24-month rolling standard deviation of continuously compounded, nominal stock market returns for Finland (7A) and USA (7B) from 1912 to 2009. Figure 7A 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 7B is based on S&P and CRSP indices.

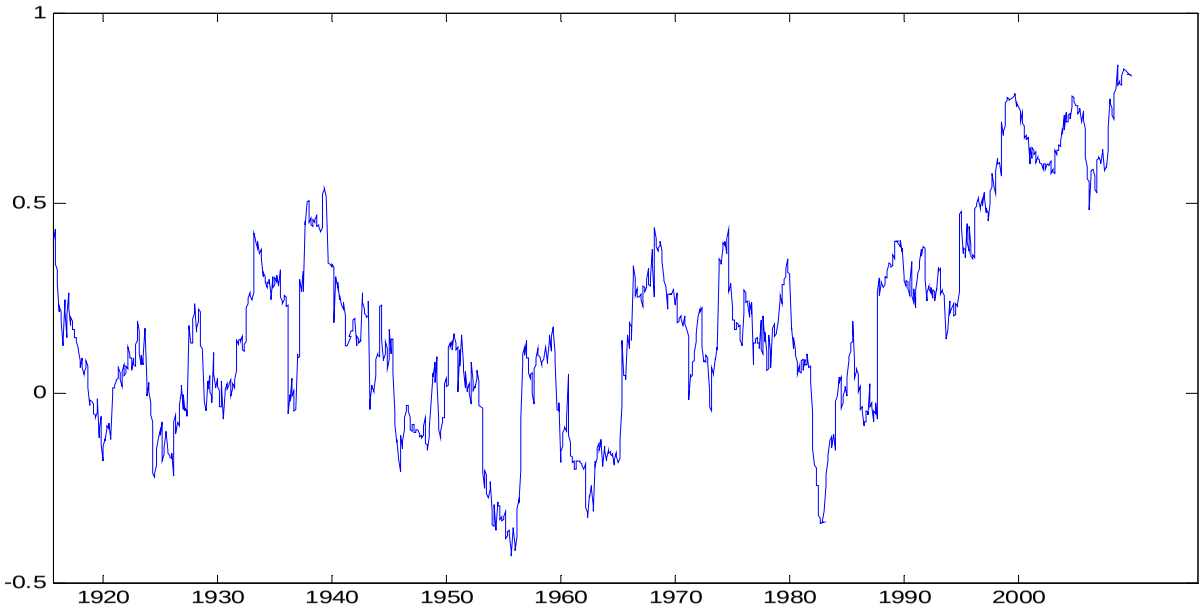


Figure 8. 36-month backward-looking moving correlation between the Finnish and US equity markets 1912-2009. This figure plots the correlations between the Finnish and US markets. For Finland we use the value-weighted Nyberg-Vaihekoski, WI and HEX/OMHEX indices. As a proxy for the US market we use the S&P composite index (1912-1925) and the CRSP value-weighted index (1926-2009). The correlations are calculated from nominal continuously compounded returns measured in local currencies.

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

Descriptive statistics are calculated for the monthly continuously compounded asset returns. The value-weighted equity market portfolio is proxied by the index created by Nyberg and Vaihekoski (2010) for the time period 1912-1969, the WI-index (1970-1989) and HEX/OMXH index (1990-2009). The equal-weighted equity market portfolio is based on the index created by Nyberg and Vaihekoski (2010) and on the calculations of the authors. The bond portfolio returns (1912-1990) are calculated by the authors. After 1991, Nordea's government bond index is used. Inflation is measured using the Cost of Living Index (Statistics Finland). 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	**Period**	**Mean** (% p.a.)	**Std. dev.** (% p.a.)	**Skewness**	**Excess Kurtosis**	**Normality** (p-value)	**Autocorrelation** [a] ρ_1	ρ_2	ρ_3	ρ_{12}	**Q(12)**[b]
Equity market portfolio (VW)	1912-2009	12.91	20.76	0.343	4.991	<0.001	0.218*	0.024	0.060*	0.091*	<0.001
Equity market portfolio (EW)	1912-2007	17.28	16.10	0.967	5.271	<0.001	0.260*	0.091*	0.104*	0.140*	<0.001
Bond portfolio return	1912-2009	7.74	7.39	0.041	13.681	<0.001	-0.043	0.065*	-0.078*	0.104	<0.001
Base rate/money market return	1912-2009	6.25	0.55	-0.041	-0.953	<0.001	0.987*	0.976*	0.963*	0.865*	<0.001
Inflation	1912-2009	7.77	7.29	2.617	24.602	<0.001	0.711*	0.589*	0.497*	0.044	<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. Descriptive statistics for monthly inflation and continuously compounded real equity, bond, and money market returns 1912-2009

Descriptive statistics are calculated for the monthly continuously compounded real asset returns. The mean and standard deviations are annualized (multiplied with 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.

		Mean	Std. dev.		Excess	Normality	Autocorrelation [a]				
	Period	(% p.a.)	(% p.a.)	Skewness	Kurtosis	(p-value)	ρ_1	ρ_2	ρ_3	ρ_{12}	Q(12)[b]
Panel A: Equity returns											
Full sample	1912-2009	5.14	21.32	-0.103	3.383	<0.001	0.269*	0.076*	0.094*	0.100*	<0.001
Sub-samples	1912-1939	2.97	18.25	-0.122	2.003	<0.001	0.365*	0.255*	0.189*	0.078*	<0.001
	1940-1959	2.22	25.01	-0.044	3.041	<0.001	0.255*	0.054	0.020	0.095	<0.001
	1960-1989	6.98	13.13	0.457	1.536	<0.001	0.234*	0.188*	0.193*	0.146*	<0.001
	1990-2009	8.27	29.60	-0.196	1.080	0.007	0.238*	-0.037	0.064	0.079	0.016
	1912-1969	2.83	19.89	-0.051	4.032	<0.001	0.289*	0.132*	0.094*	0.092*	<0.001
	1970-1986	8.76	13.63	0.501	1.233	<0.001	0.242*	0.252*	0.248’	0.139	<0.001
	1987-2009	8.23	28.29	-0.211	1.295	<0.001	0.247*	-0.027	0.063	0.093	0.002
Panel B: Money market returns											
Full sample	1912-2009	-1.51	7.34	-2.659	24.631	<0.001	0.716*	0.595*	0.504*	0.055*	<0.001
Sub-samples	1912-1939	-2.63	11.58	-1.210	8.102	<0.001	0.819*	0.682*	0.560*	0.018	<0.001
	1940-1959	-7.69	8.26	-3.611	18.784	<0.001	0.463*	0.365*	0.339*	0.048	<0.001
	1960-1989	0.59	1.86	-1.464	4.413	<0.001	0.236*	0.248*	0.215*	0.310*	<0.001
	1990-2009	3.02	1.15	-0.374	0.298	0.038	0.212*	0.074	0.073	0.443*	<0.001
	1912-1969	-3.56	9.43	-1.948	13.753	<0.001	0.721*	0.598*	0.505*	0.037	<0.001
	1970-1986	-0.59	1.98	-0.877	1.424	<0.001	0.261*	0.273*	0.161*	0.373*	<0.001
	1987-2009	2.89	1.17	-0.390	0.131	0.031	0.188*	0.027	0.106	0.436*	<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. *Continued*

Descriptive statistics are calculated for the monthly continuously compounded asset returns. The mean and standard deviations are annualized (multiplied with 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.

	Period	Mean (% p.a.)	Std. dev. (% p.a.)	Skewness	Excess Kurtosis	Normality (p-value)	Autocorrelation [a] ρ_1	ρ_2	ρ_3	ρ_{12}	Q(12)[b]
Panel C: Bond returns											
Full sample	1912-2009	-0.03	10.55	-0.920	8.452	<0.001	0.368*	0.361*	0.213*	0.075*	<0.001
Sub-samples	1912-1939	-2.64	13.46	-1.057	4.560	<0.001	0.555*	0.592*	0.395*	0.026	<0.001
	1940-1959	-5.64	11.07	-1.056	7.872	<0.001	0.394*	0.253*	0.146*	0.055	<0.001
	1960-1989	1.91	9.90	0.313	8.453	<0.001	0.004	0.056	-0.064	0.131*	<0.001
	1990-2009	6.21	4.33	0.241	1.110	0.006	0.362*	0.185*	0.139*	-0.118	<0.001
	1912-1969	-2.43	13.02	-0.684	5.133	<0.001	0.377*	0.374*	0.219*	0.068	<0.001
	1970-1986	-0.15	6.04	-0.291	2.219	<0.001	0.126	0.177*	0.032	0.142*	<0.001
	1987-2009	6.02	4.22	0.197	1.152	0.003	0.362*	0.176*	0.145*	-0.096	<0.001
Panel D: Inflation											
Full sample	1912-2009	7.77	7.29	2.617	24.602	<0.001	0.711*	0.589*	0.497*	0.044	<0.001
Sub-samples	1912-1939	8.82	11.51	1.201	8.170	<0.001	0.816*	0.677*	0.555*	0.006	<0.001
	1940-1959	13.05	8.16	3.661	19.187	<0.001	0.449*	0.350*	0.325*	0.034	<0.001
	1960-1989	7.27	1.95	1.382	3.510	<0.001	0.308*	0.317*	0.290*	0.359*	<0.001
	1990-2009	1.80	1.12	0.707	1.870	<0.001	0.150*	0.006	0.001	0.421*	<0.001
	1912-1969	9.58	9.34	1.948	13.959	<0.001	0.716*	0.590*	0.496*	0.021	<0.001
	1970-1986	9.10	2.03	0.870	1.216	<0.001	0.305*	0.311*	0.206*	0.374*	<0.001
	1987-2009	2.27	1.19	0.691	1.199	<0.001	0.211*	0.057	0.132*	0.474*	<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 3. Descriptive statistics for monthly continuously compounded returns 1970-2009.

Descriptive statistics are calculated for the monthly continuously compounded real and nominal asset returns. The mean and standard deviation of the returns in the table are multiplied by 12 and the square root of 12, respectively. The descriptive statistics for the equity market are presented both for a value weighted market portfolio (VW) and for an equally weighted portfolio (EW) of all stocks on the market. The *p*-value for the Jarque-Bera test statistic of the null hypothesis of normal distribution is provided in the table. The sample size is 480 monthly observations from January 1970 to December 2009 (2007 for EW).

Asset return series	**Mean** (%)	**Std. dev.** (%)	**Skewness**	**Excess Kurtosis**	**Normality** (p-value)	**Autocorrelation** [a] ρ_1	ρ_2	ρ_3	ρ_{12}	**Q(12)**[b]
Panel A: Real ln-returns										
Equity market portfolio (VW)	8.46	23.20	-0.18	2.659	<0.001	0.247*	0.015	0.091*	0.104*	<0.001
Equity market portfolio (EW)	13.45	17.64	0.54	3.721	<0.001	0.298*	0.083	0.092*	0.103*	<0.001
Bond portfolio return	3.40	5.14	-0.32	2.653	<0.001	0.243*	0.201*	0.106*	0.083	<0.001
Money market return	1.41	1.64	-1.16	2.827	<0.001	0.307*	0.268*	0.225*	0.464*	<0.001
Panel B: Nominal ln-returns										
Equity market portfolio (VW)	13.63	23.05	-0.26	2.774	<0.001	0.247*	0.014	0.078	0.103*	<0.001
Equity market portfolio (EW)	18.82	17.48	0.47	3.816	<0.001	0.298*	0.083	0.077	0.101*	<0.001
Bond portfolio return	8.57	4.67	-0.05	3.510	<0.001	0.146*	0.152*	0.036	0.000	<0.001
Money market return	6.58	0.68	-0.36	-1.283	<0.001	0.988*	0.976*	0.964*	0.877*	<0.001
Excess equity market return	7.05	23.09	-0.22	2.737	<0.001	0.249*	0.017	0.081	0.103*	<0.001
Excess bond market return	1.99	4.63	-0.18	3.641	<0.001	0.131*	0.140*	0.021	-0.007	<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 4. Descriptive statistics for real percentage calendar year returns 1913-2009

Mean and standard deviation for annual percentage, real asset returns. The holding period is one calendar year. The full sample size is 97 annual observations from 1913 to 2009.

Asset return series	**Mean** (%)	**Std. dev.** (%)	Asset return series	**Mean** (%)	**Std. dev.** (%)
Panel A: Equity returns			**Panel C: Bond returns**		
1913-1919	1.53	46.23	1913-1919	-13.66	43.08
1920-1929	8.55	31.20	1920-1929	4.93	15.93
1930-1939	12.32	20.02	1930-1939	7.86	9.38
1940-1949	-3.81	24.28	1940-1949	-12.46	18.20
1950-1959	15.01	28.09	1950-1959	4.87	11.03
1960-1969	4.62	14.93	1960-1969	5.15	10.65
1970-1979	5.84	27.34	1970-1979	-2.11	10.16
1980-1989	18.50	26.87	1980-1989	4.04	6.81
1990-1999	36.27	59.17	1990-1999	9.64	9.99
2000-2009	-1.42	29.67	2000-2009	3.18	2.80
1913-2009	**9.99**	**32.98**	**1913-2009**	**1.66**	**16.72**
Panel B: Money market			**Panel D: Inflation**		
1913-1919	-10.59	47.77	1913-1919	51.72	83.83
1920-1929	4.75	10.57	1920-1929	4.55	13.62
1930-1939	5.50	6.74	1930-1939	-0.07	5.32
1940-1949	-13.14	15.67	1940-1949	25.20	29.61
1950-1959	0.70	6.82	1950-1959	6.10	7.55
1960-1969	2.25	2.41	1960-1969	4.88	2.55
1970-1979	-1.85	3.66	1970-1979	10.81	4.94
1980-1989	1.55	2.48	1980-1989	7.19	3.13
1990-1999	4.04	1.74	1990-1999	1.99	1.41
2000-2009	1.95	1.05	2000-2009	1.71	1.32
1913-2009	**-0.15**	**14.92**	**1913-2009**	**10.16**	**27.11**

Table 5. Cross-correlation matrix

Cross-correlation matrix of the nominal continuously compounded return and inflation series. The sample size is 1166 monthly observations from November 1912 to December 2009 (Panel A) and 480 monthly observations from January 1970 to December 2009 (Panel B).

Asset return series	Equity	Bond	Money	Inflation
Panel A: 1912-2009				
Equity market portfolio (VW)	1.000			
Bond portfolio return	0.052	1.000		
Money market return	-0.043	0.079	1.000	
Inflation	0.098	-0.032	-0.060	1.000
Panel B: 1970-2009				
Equity market portfolio (VW)	1.000			
Bond portfolio return	0.042	1.000		
Money market return	-0.037	0.135	1.000	
Inflation	-0.037	-0.063	0.503	1.000

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Suomen Pankki
Bank of Finland
P.O.Box 160
FI-00101 HELSINKI
Finland

. 2343