DESCRIPTIVE ANALYSIS OF FINNISH EQUITY, BOND, AND MONEY MARKETS 1920-2004

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Work in process. Comments welcome.

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Abstract

This paper gathers together for the first time the longest available historical return series for the Finnish equity, bond, and money markets. The series are investigated in order to analyze the statistical characteristics of the returns investors would have received in these markets. We also survey the literature concerning the history of these markets and review the main developments to facilitate future research on long-term development of the Finnish markets. We find, using an approach similar to Mehra and Prescott (2003), that the equity premium for Finland 1920-2004 is 5.33 percent.

JEL-classification: G10, G11

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

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1 INTRODUCTION

The Finnish equity market is among the most closely researched of the small, developed markets (see, e.g., Hawawini, 1994). However, most of the studies have been conducted on relatively short data samples, typically from the late 1980s. Thus, there are hardly any studies using longer time series. This paper surveys the literature regarding the development of the Finnish financial markets and especially equity markets starting from the early 20th century. We also put together for the first time a comprehensive history of the markets in English. The purpose of this paper is to collect historical background information in one place in order to facilitate future research on the Finnish markets.[1]

In addition, we review the available data and provide an empirical analysis of the performance of the markets, i.e., of the returns investors would have received in Finland. This analysis also sheds light on the realized market risk premium in Finland during most of the 20th and early 21st century. Market risk premium is a central component of every risk and return model in finance. It is frequently used in academic research and business practice. Typically, most of the basic financial books recommend using something around four to five percent as the correct level for the equity risk premium. Empirical results have found the risk premium to be somewhat higher – even as high as eight percent on the US market. However, most of the results are from the USA and up until recent years only a few studies have been conducted on other markets.[2] This may be partly due to the lack of sufficiently long time series, as accurate estimates of the equity return require relatively long time series.

We review the longest available data series for the Finnish equity, bond and money markets and study the performance of these markets in Finland as a long-term investment. This is the first study to our knowledge to utilize such a long sample period from Finland for this type of analysis. The sample period is interesting in itself as the 20th century witnessed some major economic upturns and downturns partly due to global crisis and wars taking place around the world. It is also interesting to study Finland as it developed during this period from a relatively closed economy to an open one, and in later years it has become an integrated participant in the global economy. As a result, the whole Finnish economy has undergone changes, and the size and industries of the the companies listed on the stock exchange has changed considerably from the basic industrial companies into technology-oriented companies with Nokia-leading the way.

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1 There are only a few studies utilizing long time series from Finland. Liljeblom and Stenius (1997) are among these few. They use the equity series from 1920 to 1991.

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

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

2.1 History of the Finnish equity market

The first stock exchange in Finland was opened in Helsinki in November 1862 by a local stock association (Helsingfors börsförening).[3] 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. The trading activity remained, however, relatively low and the exchange lacked proper organization and regulation.[4]

The official birth of the Helsinki Stock Exchange can be said to have been on October 7, 1912, when a centralized market place was opened in Helsinki.[5] 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. The first decade of the stock exchange was quite indented as the stock exchange was closed during the First World War from August 1914 to March 1915 and also between July and August 1916. The Exchange was also closed between January and May 1918 during the Finnish Civil War that took place after Finland claimed independence from Russia in 1917. Tiderman (1937), Poutvaara (1996) and Stjernschantz (1987) review the early history of equity trading in Finland.

During the first couple of years in the history of the Helsinki Stock Exchange the exchange had not established itself as a central trading place and the general interest for trading appears to have

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2 In recent years there has been a growing interest in long-term returns on markets outside of the US. See Dimson, Marsh and Staunton (2002) where the authors analyze financial market returns 1900-2000 from sixteen countries.

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

4 Other exchanges were also set up at the same time in other cities. To read more of the stock exchanges' early history, see Björkvist (1953), Bruun (1956), Stjernschantz (1987), and Kock (2004).

5 The first stock and commodity exchanges were opened in the 13th century. However, the official history of the best-known stock exchanges can be traced back to the 17th century. For example, the London Stock Exchange

been low. For example, Tiderman (1937) notes that the total number of trades 1913 was only 898 with a nominal value of FIM 2.5 million (corresponds to approximately 8 mEUR in 2002 money). In 1920, the total value of trades during the year increased to FIM 686.2 million (1387.4 mFIM, 233 mEUR). This led some contemporary writers to describe the year 1920 and the next couple of years as the wild years of the Finnish stock market (see Figure 1 that illustrates the development of the monthly total trading volume on the exchange). The increase in the public interest was caused by raising stock prices. The rising interest in the stock market even forced the then-leading newspaper, Mercantor, to start publishing stock quotes.[6]

The first decades of the exchange appear to have been characterized by weakly informed investors and wild short-term speculation in share prices.[7] Stjernschantz (1987) notes, however, that the worsening economic conditions together with new taxation laws for security trading at the beginning of the 1920's led investors to consider a longer time-horizon in security valuation. The downward sloping trend in share prices that had started from early 1920s was reversed for a while when Finland was affected by the international economic upturn during 1926-1928 (see Figure 2). In 1927, there were already 65 companies listed on the stock exchange.[8]

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can trace its history to the 17th century. Similarly, the origin of NYSE can be traced to 1792. In Sweden, the Stockholm Stock Exchange was opened in 1863.

6 The earliest publication with stock market related information in Finland was Helsingfors Börsförenings tidning published in 1866-1867. It is nowadays available from the digitized Finnish Historical Newspaper Library 1771-1890 (http://digi.lib.helsinki.fi/).

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 already in 1926 (Jernström, 1926). Only a few years later, in 1929, Suomen Yhdys-Pankki (later Unitas) started to calculate their stock market index.

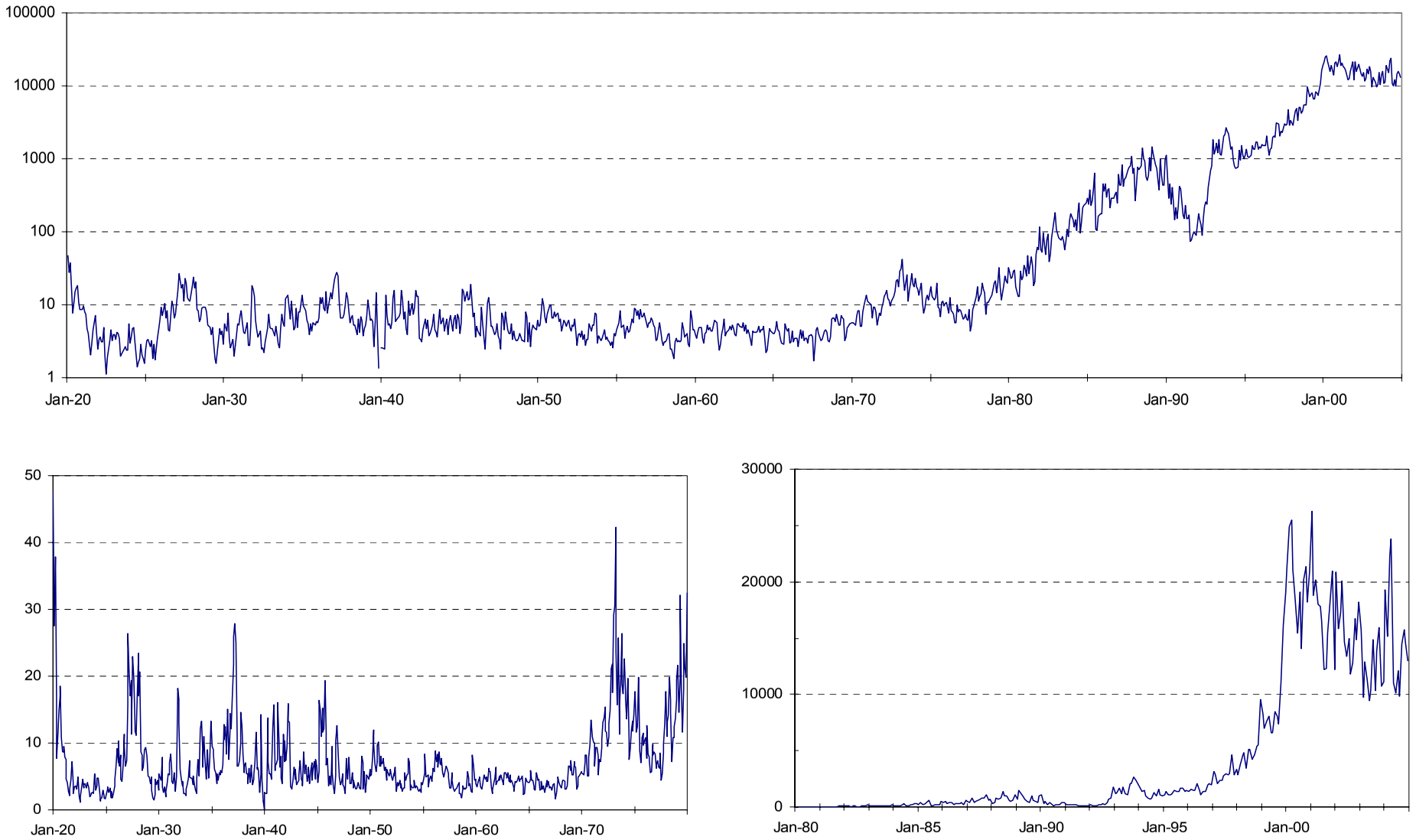

Figure 1: Monthly trading volume on the Helsinki Stock Exchange 1920-2004. These figures show the monthly, deflated (inflation-adjusted to 2004 money) trading volumes in million EUR. Note that the differences in the scale of the y-axis in different figures.

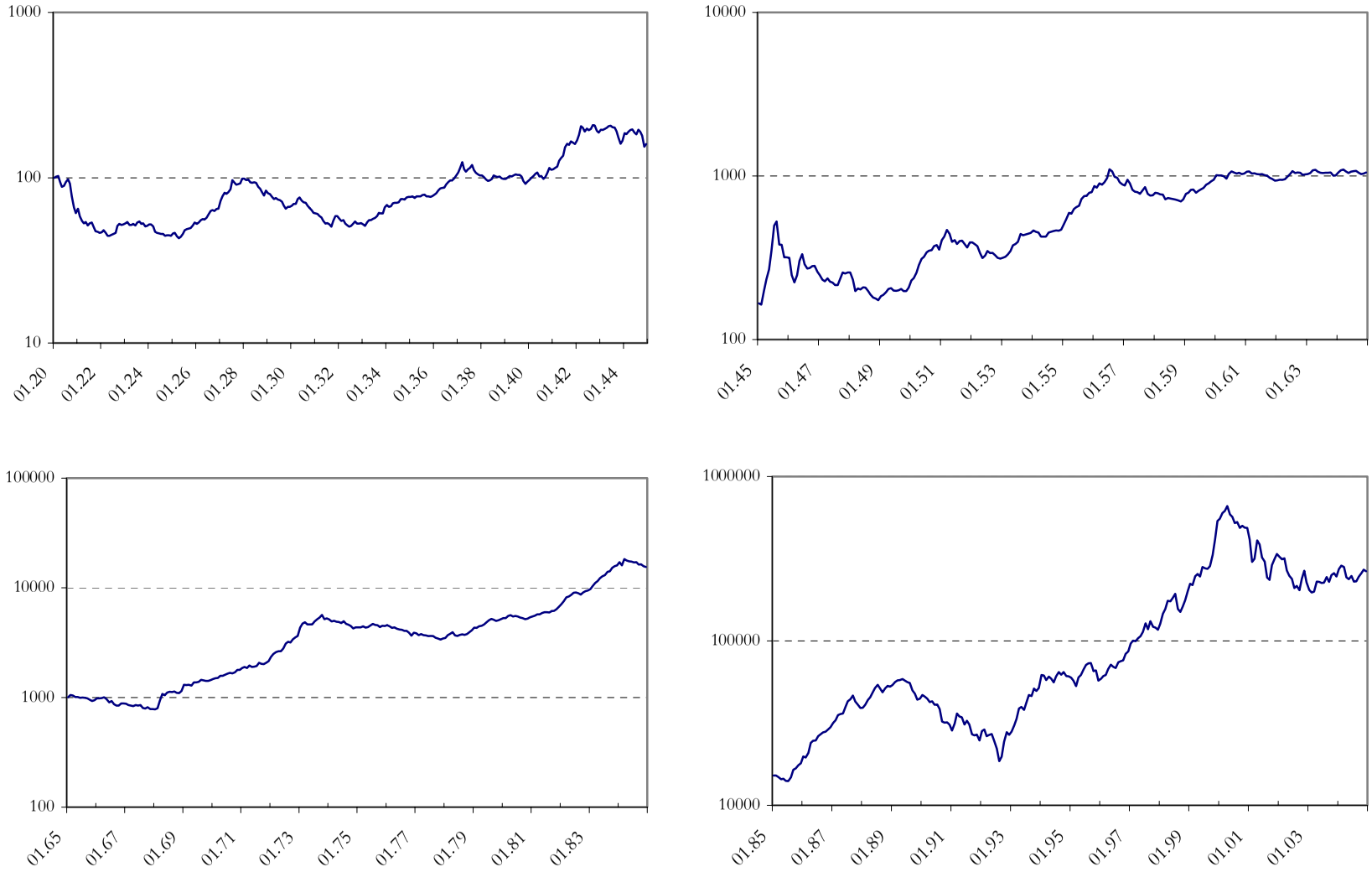

Figure 2: Development of the Finnish equity market prices 1920-2004. Nominal price and total return indices. Unitas price index is used until 1969, WI-index from 1970 to 1989, HEX-index thereafter. Logarithmic scale (January 1920 = 100). Note the differences in the scale of the y-axis in different figures. The stock market index for 1920-1969 does not include dividends and measures only the capital gain.

The 1930s began with a worldwide depression.[9] The Great Britain left the gold standard in September 1931 and several countries, including Finland, followed its trail. The currency was allowed to float and the Finnish Markka depreciated heavily. This stimulated certain parts of the industry, which together with the interest rate cuts by the Finnish Central Bank gradually led to an increase in share prices. But at the end of the 1930s the worsening political situation and the uncertain world economy led to more pessimistic expectations. At the end of the decade, only 34 companies remained listed on the exchange. This low number may, however, reflect more the large number of mergers that took place during the decade than the economic conditions that had prevailed.

The Finnish stock market was heavily affected by the Second World War. A large part of the period 1940-1949 was characterized by a high level of inflation that on average was around 20 per cent p.a. Furthermore, the market took a steep fall in 1948. It is possible that this price reduction was in part brought forward by the market's uncertainty concerning the Agreement of Friendship, Cooperation, and Mutual Assistance that was signed with the Soviet Union, and the economic and political consequences that it could have.

The 1950s began with rising share prices. The industrial production reached two peaks in 1951 and 1954. In 1951, 26 companies were listed on the A-list and 22 companies on the B-list that consisted of shares that were less-frequently traded. But the beginning of the 1960s offered lower returns to shareholders. Increasing labor costs affected the profits of 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, and new money started flowing to the stock market. On top of that, there was a strong economic upturn that further strengthened the rise in share prices between 1968 and 1973. This rising trend was reversed in 1974 when the international Oil Crisis and the interest rate increases by the Central Bank resulted in a fall in share prices. The downturn continued until around 1978, and the negative development was elevated further in real stock market values by the high level of inflation during this period.

The stock market developed substantially during the 1980s. The economic recession was passing by, and many companies issued new shares. From 1980 to 1990 the number of companies listed

[9] In October 1929, the Unitas-index that we use to proxy for the stock market returns 1920-1969 sank 4 percent in nominal value. In November, it rose by approximately 2 percent. Thus, the Black Tuesday in New York doesn't appear to have affected the Finnish stock market to a large degree. One potential explanation is that the Unitas-index had sunk approximately 20 percent during the previous 12 months, whereas the Dow Jones index reached its highest value in September the same year (Siegel 1998).

on the main list increased from around 50 to around 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.

In the 1980s started also the gradual abolishment of the restrictions set on the free capital movements to and from Finland. This process was mostly guided by the legislation and the restrictions set by the Bank of Finland. Prior to 1986, it was almost impossible for Finnish investors to buy foreign securities. After 1986, Finnish brokerage firms were allowed to sell foreign shares (and other securities) from their own portfolios to Finnish investors. After that most of the restrictions on foreign investments have been gradually removed. Eventually, beginning from 1990, Finnish investors have been able to invest freely abroad and hence diversify their portfolios internationally.

On the other hand, Finnish securities started to draw attention from foreign investors and at the end of the 1980s some foreign banks established subsidiaries in Finland. The relatively high interest rate levels also attracted foreign investments to Finland. Foreign investors were allowed to invest in Finnish companies quoted on the stock exchange already beginning 1982. However, they were allowed to buy only unrestricted shares. In 1985, the degree of foreign ownership in Finnish shares was restricted to 20 per cent of the total equity capital. In April 1987, the maximum of unrestricted equity capital for Finnish firms was raised to 40 per cent on condition that the amount of voting power on unrestricted shares could still not exceed 20 per cent. 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 early 1980s. Then came the deep economic recession and stock prices and trading dropped. The negative trend in the stock market continued until mid-1993 after which the stock prices rose rapidly and surpassed the pre-depression level. This was partly due to the success of Nokia Corporation, which accounted solely for more than 70 per cent of the total market capitalization value of the HSE at times. At the end of 1996, the number of companies listed on the official list of the HSE was 71 and the number of separately quoted issues was 95.[10] More than ten of the listed companies were also listed on foreign stock exchanges.

[10] 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.

The Exchange was originally organized as a nonprofit cooperative but was reorganized in November 1995 as a Limited Liability Company.[11] During 1997, a merger agreement between the Helsinki Stock Exchange and SOM (Finnish options exchange) was announced. They joined their operations to a new exchange called HEX Ltd., Helsinki Security and Derivatives Exchange, Clearing House. In 2003, the Swedish OMX bought the majority of HEX, and HEX merged with OMX, and the Helsinki Stock Exchange is now part of the OMX Exchanges division within OMX.

2.2 History of the Finnish bond market

It is generally acknowledged that the Finnish bond markets were relatively undeveloped during most of the 20th century. In the private sector, banks and other credit institutions played a prominent role in offering capital to corporations and entrepreneurs, and direct financing from the market was relatively uncommon. Bonds were mostly issued by the government. However, even though the market for bonds was not large, bonds did play an important role for individual investors as a way of earning interest on their savings.[12]

The secondary market for bonds at the Helsinki Stock Exchange has also suffered from illiquidity and thin trading. Trading with bonds constituted for a long time only a fraction of the total transaction volume. In 1930, bonds amounted to 5 % of the total transaction value with a nominal value of 8.9 million FIM. After the Second World War, in 1950, their share of the transaction volume had increased to 27 % with a nominal value of 807 million FIM. This large growth in the bond market had its roots in the large loans that the government had issued and in other arrangements that were made in order to compensate those 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 transactions had fallen back to 115 million FIM with a share of 4.5 % of total volume.

The size and significance of the bond market in Finland grew steadily yet quite slowly since then. But it would take until the 1980s when the bond market started to develop and gain significance. In 1986, the nominal value of the transaction volume of fixed income securities had climbed to

[11] 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).

[12] Aalto (1996) reviews the early history.

6 479 million FIM[13], accounting for 40% of the total volume (Stjernschantz, 1987). However, the secondary market remained in a rather underdeveloped state until the 1990s. There are several reasons behind this, the main reasons being still the relatively modest size of the outstanding bonds, the 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.

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

After 1970, the market yield has varied considerably. In the 1970s and in the 1980s, the yield was almost all the time higher than ten percent, at times even as high as 20 percent. After the floating decision in 1991, the long term yields started to come down (see Figure 3).

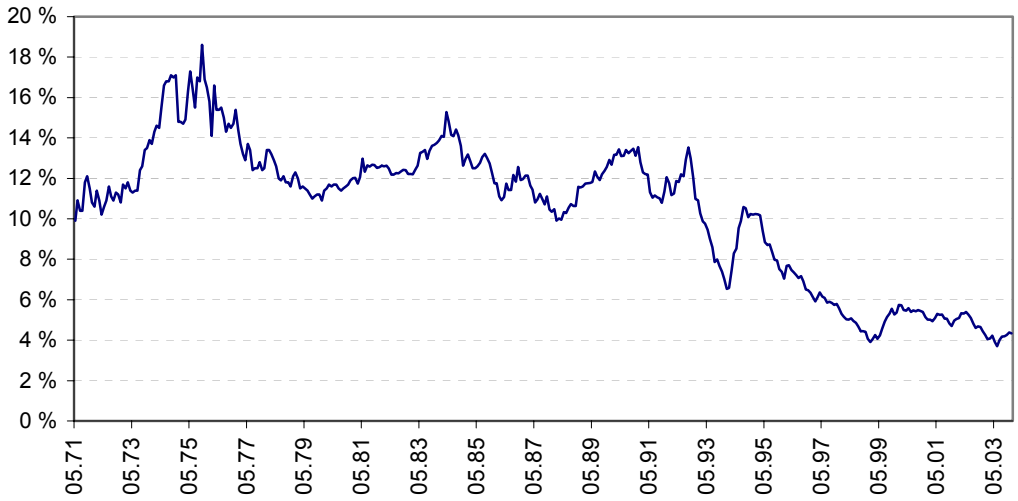

Figure 3: Government bond yield 1971-2003. Yield on 10-year government bonds. Monthly observations. Source: Bank of Finland

The bond market, besides growing rapidly and becoming more liquid, has also undergone some significant structural changes. Firstly, the secondary market trading that earlier took mainly place

[13] Including debentures and other fixed income securities.

in the HSE has moved to the direct interbank trading between the brokers. In addition, the increased participation of the government has caused that government bonds account at the moment for the major part of the outstanding value of the bonds, whereas the market was previously dominated by corporation bonds.[14]

There are two other characteristics of the Finnish government bond market during our sample period that deserve to be mentioned. The first concerns taxation. For most of our sample, government bonds and deposit accounts have generally been tax-free for households. The motivations cited for this have been that the tax-free status of deposits would promote private saving and also provide some indirect protection against inflation. The relatively favorable tax treatment on deposit accounts can also be regarded as one reason for the major role played by banks in the Finnish economy, since capital income from other sources was primarily taxable. Furthermore, because of taxation, debt was often a cheaper form of financing for corporations than equity financing.[15] Along with the financial liberation that took place in late 1980s, the relative tax advantage of interest income was reduced in 1988 and after 1991-1992 tax free government bonds have no longer been issued. (Andersson, 1994).

Another characteristic for the period are the index clauses that were applied to some government bonds from 1953 onward.[16] The bonds having an index clause were either entirely or partially tied to a price index and were protected against inflation.[17] 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 by the government all index clauses were removed in 1968.

2.3 History of the 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

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

[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] After the Second World War, several countries started applying index clauses on their capital and money markets. Index clauses were most widely applied in Finland, Israel and France, and also to some degree in China, Chile and Iceland. (Linnamo, 1958)

[17] 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).

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 were characterized by strong regulation, as there was an upper limit on loans (six percent) mostly due to historical, and partly due to religious reasons to prevent loan sharking. 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 both in the amount of lending and deposits, as there were several banks competing for the market shares. Ultimately, this led to major difficulties for the banks. As a result, the banks made multiple tries to form a cartel to limit the costs of their funding (i.e., the deposit rates) but with only limited success. After the international recession in 1929, interest rates increased again sharply reflecting the cash shortage of the companies. This finally led to a mutual agreement between the banks in 1931 that set an upper limit on the deposit rates in order to lower the costs of their financing. This agreement lasted until 1938.

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

In 1975, the Bank of Finland founded the call money market, where 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 it 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

situations.[19] This led to a deregulation of banks' lending rates and the banking sector. It 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 started to participate in the Interbank markets. The Interbank markets shortly 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 the central tool of the central bank. The bank operates by absorbing excess liquidity from the banking system by issuing its own one-month CDs through tenders. Conversely, the bank can increase liquidity through repo tenders.

Although money market rates are available from some time before 1987, the Central bank started to calculate and publish the money market rates officially beginning in May 1987. These so-called Helibor-rates (Helsinki Interbank Offered Rate) are averages of the bid rates for certificates of deposits 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 a maturity shorter than one year.[21] Interest rates are quoted on a per annum basis.[22] Starting 1999, the Finnish currency, Markka, was tied to the Euro and Helibor interest rates were replaced by the Euribor interest rates.

3 DATA

For the statistical analysis, we utilize the longest available time series for each of the markets presented earlier. Our longest sample period is for the equity returns and short-term money rates. It covers 85 years i.e. 1020 months of data from January 1920 to December 2004. The bond market sample starts ten years later in January 1930. For a closer examination we select a sub-

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

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).

period from 1970 to 2004 due to the availability of total return equity market data and more or less market-based money market rates. We use continuously compounded asset returns throughout the paper, but we also calculate percentage returns to arrive at estimates of the equity premium.

3.1.1 Money market rates

Finding a suitable rate to reflect the short-term money market rates for Finland is a well-know problem for researchers since no real money market rates are available prior to 1987. As a result, the money market rate series has to be constructed from many different series. From 1920 to 1971 we use the Bank of Finland's Base Rate as an approximation of the money market rate. Naturally, the Base Rate cannot be said to represent a real market-determined rate as investors could not really invest or borrow using that rate, but we do believe that it can provide some indication of the returns on short-term savings. Moreover, it serves as a reference series for the other two markets.

From January 1972 to December 1986, we use Malkamäki's (1993) money market rate series. 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 calculated 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, 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 the analysis here, we assume similar to Malkamäki that the interest rate yield curve is flat between the one and three month maturities. As a result, Malkamäki's series acts as a proxy for the one month return.

Beginning from 1987 real money market rates are available. Helibor one-month rate is used from 1987 to 1998. After 1999, Euribor rates replaced Helibor rates and the one-month rate is used. Figure 4 shows the time series development of the proxies for the money market rates that we use in this study. It can be seen that the implied 3-month rate was very volatile during the 1970s at the time of the oil crisis, and it also reflected expectations of the rate of inflation that on average was around 10 % per annum during the decade. In 1977, the markka was devalued two

times, and once more in February 1978, which appears to have reduced the volatility in the interest rates. (Malkamäki, 1993)

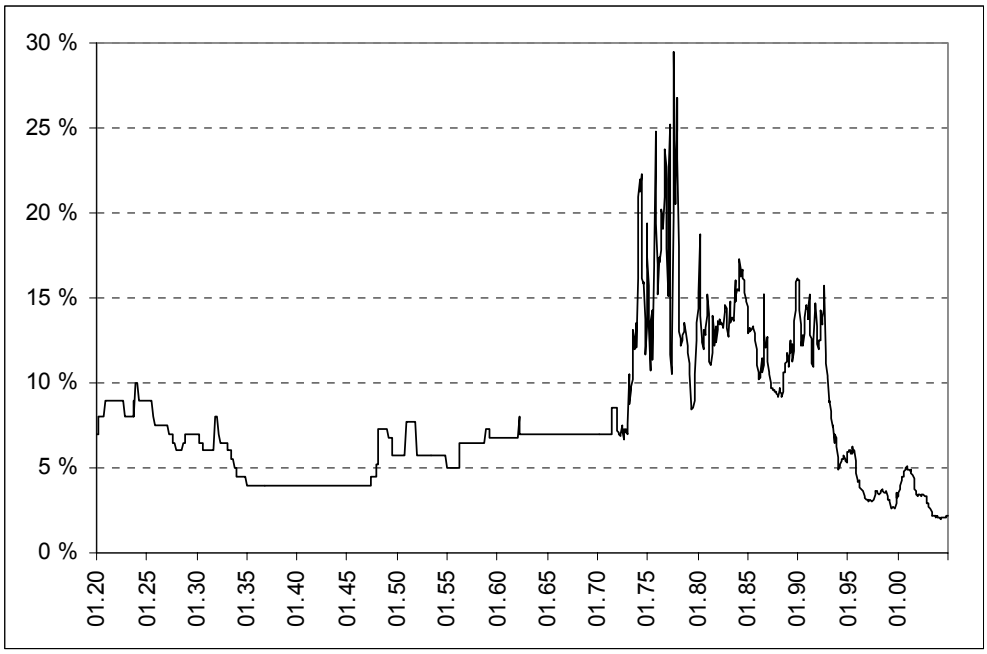

Figure 4: Money market rates 1920-2004. For 1920-1971 the base rate set by the Bank of Finland is used, 1972-1986 the implicit Markka interest rate calculated from the Eurodollar rates is used, 1987-1998 one-month Helibor rate is used, and from 1999 forward one-month Euribor rate.

3.1.2 Bond market data

Unfortunately there is no bond return index available for most of the 20th century. In this paper we use a data series constructed from 5-year Government bonds that can be seen as a proxy for the monthly bond market returns. This series starts in January 1930 and measures the total returns consisting of capital returns resulting from changes in the interest rate level and of coupon returns. When constructing these returns it has been assumed that new bonds are issued at par value so that the coupon is as large as 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. The capital return is consequently defined as the relationship between the new and old values of the bond 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 bonds issued earlier.

The following example clarifies the main principles of the series. 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 where $D_{b2} \neq D_{b1}$, the capital return for the bond issued earlier is calculated by pricing this bond with D_{b2} as the new yield to maturity, and using the relative price difference of its new and old values 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 have been 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 stay in the portfolio with declining weights for 11 months after a new bond having a new coupon rate has been issued.

These returns provide us an approximation of realized returns in absence of a better measure. Overall, we believe that this approximation can give a picture of the level and variability of bond returns during the early periods that we study. [23] We note, however, that our bond return series are calculated from bonds that did not have the index clause mentioned earlier. However, 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 which therefore have riskier real cash flows than inflation-protected bonds, these bonds should offer higher expected returns to investors. But this does naturally not imply for an ex post analysis that bonds that did not have the index clause would have yielded comparable returns to index-linked bonds if the rate of inflation has been higher than expected. Thus, our results for 1953-1968 must be interpreted with caution since they do not necessarily give a valid picture of the average returns on bond investments during this period, and they are more suitable for illustrating the returns to investors who only invested in non-protected bonds during the period.

This series ends in December 1990. From then on we use returns from the Nordea bank's Government bond index that starts in January 1991.[24] It includes all taxable government benchmark bonds with a mean duration around four years. This index is calculated from the daily quotas of the Finnish government taxable bonds of different maturities at the Reuters screen.

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[23] 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.

[24] Postipankki (later Leonia Bank, currently Sampo Bank) also publishes a government bond index. It is available from 31.12.1991. They have also calculated a Money market index covering the same period.

3.1.3 Equity market data

From January 1920 to December 1969 we calculate monthly returns from the SYP stock market index (also known as Unitas index) which is the best available series for the period.[25] The index was published for the first time in 1929 by Pohjoismaiden Yhdyspankki (later Suomen Yhdyspankki, then Unitas; nowadays a part of Nordea) with a base year corresponding to 1926.[26] During the period 1929-1969, the base year has been updated to 1935 and thereafter to 1948, and the old index-series have been linked together in order to obtain a continuous series reaching back to 1920.

The original index from 1929 represented the prices of 14 well-representative shares quoted on the Finnish stock market with weights corresponding to these shares' average market values during 1926.[27] The monthly index values are calculated as the monthly arithmetic averages of the bids. The index is adjusted for dividends by subtracting each month after the dividend payment from the current price an amount of $(n/12)\times D_{it}$, where n refers to the number of months since the last dividend payment and D_{it} is the last dividend payment for company i. That is, it is assumed that the future dividends cumulate during the year so that the unadjusted share price reflects each month $n/12$ of the last period's dividend.

Consequently, the Unitas index and thereby our stock market returns for 1920-1969 measure only the capital gain to investors and do not include the dividend return. For further details and for information on how splits and share offers are handled, see Poutvaara (1996) and Unitas (1971). From January 1970 onwards, a better, total return equity market index is available for Finland. Before 1990, the Department of Finance and Statistics at the Swedish School of Economics and Business Administration has calculated this so-called WI-index (see Berglund, Wahlroos, and Grandell, 1983, for documentation).[28]

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[25] Poutvaara (1996) extends the index back to the year 1912 when the Helsinki Stock Exchange was established. We choose, however, not to include these early returns in our sample since the stock exchange was closed several times during the 1910s and we would have several missing values that would affect our estimates of yearly returns and standard deviations.

[26] The earlier-mentioned Mercantor-newspaper had published an index of its own before the Unitas-index became available.

[27] For the base year 1948, the index included 13 companies. In 1960, five companies were added to the index.

[28] Note that SYP continued calculation of its index until 1990. For the same period also a similar market index calculated by SYP's biggest rival bank, KOP, is available.

After 1990, we use the HEX yield-index calculated by the Helsinki Stock Exchange.[29] Both the WI and HEX indices are 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 how the dividends are handled. In the WI-index the dividends are reinvested in the particular stock, whereas in the HEX-index the dividends are reinvested in the market. Other smaller differences include, among others, what price is used when no transaction price is available (see, Hernesniemi, 1990, for more detailed information).

3.1.4 Inflation

In long-horizon studies it is customary to analyze real returns. For this purpose we have also collected the monthly inflation values from 1920 to 2004. From 1939, the Finnish consumer price inflation is measured as the monthly change in the Cost of Living Index obtained from Statistics Finland through ETLA's database. Unfortunately, prior to 1939, the figures are not available from the database. Therefore, we have hand-collected the monthly values of the Cost of Living Index for 1920-1939 from the yearly publications of the Statistics Finland and calculated a monthly inflation series from the index.

4 EMPIRICAL RESULTS

4.1 Descriptive statistics for the full sample

Table 1 presents descriptive statistics for the continuously compounded nominal returns on equity, bond, and money markets using the longest available sample periods. The monthly means and standard deviations have been annualized by multiplying them with 12 and the square root of 12, respectively. The average continuously compounded stock return for the full sample 1920-2004 is 9.28 percent (2.94 percent in real terms).[30] The average continuously compounded bond market return is 7.62 percent (0.87 percent in real terms) for the sample 1930-2004. Our numbers for the bond market returns appear to be in line with results from other countries.[31]

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[29] Since the merger of the HEX and Swedish OMX in 2004 the index has been called the OMX-index.

[30] Again, it is important to keep in mind that the sub-period 1920-1969 does not include dividends and our return series only measure the capital return. Thus, these numbers are downward biased estimates of the actual stock market returns during the sample.

[31] 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: 1.3 %), 1966-1997: 2.5 % (2.8 %), 1966-1981: -4.2 % (-0.7%), and 1982-1997: 9.6 % (6.3 %).

The mean continuously compounded money market rate has been 7.64 percent (1.3 percent in real terms) during 1920-2004. To compare the money market and bond market returns over matched samples, we calculate the nominal money market return for 1930-2004. The average is 7.61% (real return 0.86%). Thus, the bond and money market returns have been roughly the same in our sample. Using the average money market rate we can calculate an estimate for the historical equity premium. The result is 1.64 percent. Since the dividends are not included from 1920 to 1969, this estimate should be considered as the lower limit on the equity premium in Finland. The results can be compared to the equity premium of 5.149 percent in the US from 1891 to 1998 (Campbell, 2003).[32]

Also note that when working with continuously compounded returns it is important to keep in mind that Jensen's inequality implies that $E[\ln(R)-\ln(R_f)]$ is not equal to $\ln(E[R-R_f])$.[33] Using arithmetic averages (percentage returns), Mehra and Prescott (2003) report that the US equity premium 1889-2000 was 6.92 percent. Using similar calculations, our estimate of the annual (real) Finnish equity market return for 1920-2004 is 7.14 percent, whereas the money market return is 1.815 percent. Thus, the equity premium is 5.33 percent (see Table 4). The Finnish equity premium appears to be on the same level as in the USA supporting the equity premium puzzle originally identified by Mehra and Prescott (1985).

It is, however, worth pointing out that even in such long samples of 85 years of stock market data, a few extreme observations can drastically affect the reported results. A striking example of this is the first year of our data, 1920, when the real wealth reduction was approximately 55% p.a. If we had started our study from 1922 (instead of starting it from 1920), the average real percentage return for the whole sample had been 8.3 percent, more than a one percent increase from our current estimate of 7.1 percent.

4.2 Sub-period analysis

Tables 2, 3 and 4 present the sub-period analysis for the real equity market returns from 1920 to 2004. Tables 2 and 3 look at monthly continuously compounded returns that have been scaled to 12-month levels, whereas Table 4 contains percentage returns for holding periods of one calendar year. Specifically, Table 3 presents descriptive statistics for 1970-2004, a time period for which total return equity data are available.

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

[33] Specifically, for a lognormally distributed variable it holds that $\ln(E_t[X])=E_t[\ln(X)]+0.5\sigma^2\ln(X)$.

The results show that there have been large differences in stock returns between the decades. This can also be seen from Figure 5 which shows a 12-month moving average of continuously compounded real returns during the sample period 1920-2004.

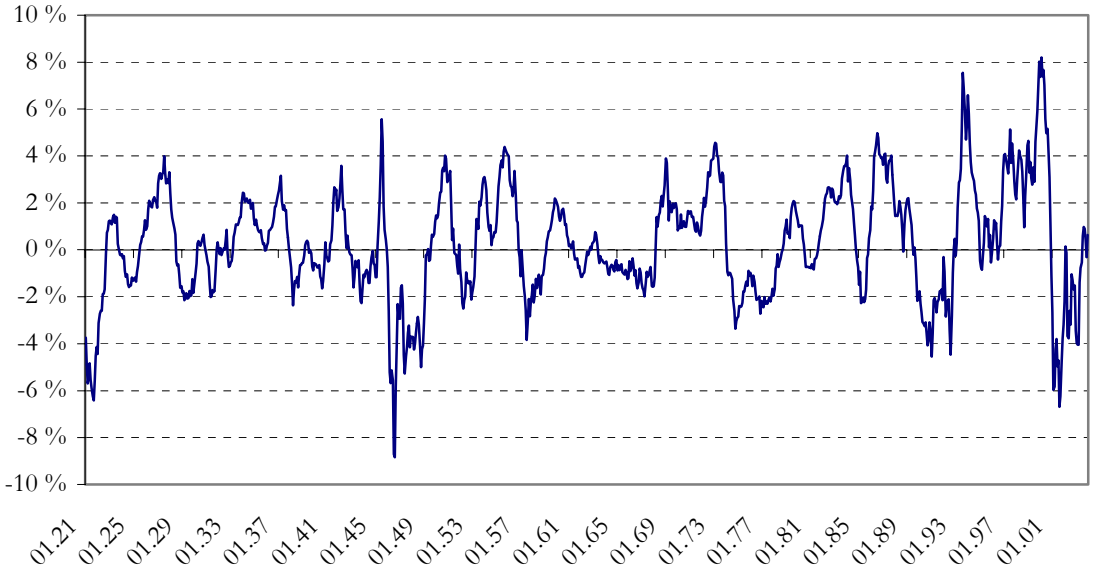

Figure 5: One-year moving average of real, inflation-adjusted monthly stock market returns 1921-2004. Monthly continuously compounded returns 1920-1969 are calculated from the Unitas-index, 1970-1989 from the WI-index and 1990-2004 from the HEX/OMHEX-index. The stock market returns 1920-1969 do not include dividends and measure only the capital gain.

Before 1970, the continuously compounded capital return has been negative during three decades (1920s, 1940s and 1960s), and especially the turbulent 1940s are characterized by large real wealth reductions for investors. The yearly average percentage return during this period was approximately -9 percent.

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 25 percent of their corresponding values from the beginning of the decade. This can be compared to Germany, where equity values had declined to 28 percent and Japan where the real values were only 5 percent of the earlier values (Jorion and Goetzmann, 1999).

Panels C of tables 2 and 4 present the sub-period analysis for the real bond market returns from 1930 to 2004. The explanation for the relatively low real returns for the whole sample can in part be found in the level of inflation that appears to have been higher than expected during some

decades (see panel D of the corresponding tables) and which therefore has punished long-term investments in bonds. An example of this are the 1940s when 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 3.5 percent, a clear increase from the current value of 0.9 percent. The high returns in the 1990s and in the early 21st century (7.2 percent continuously compounded) are explained by the low level of inflation and the decreasing interest rate level that has yielded capital gains to bond investors.

Since we have a value-weighted total return stock market index available from 1970 onwards, we take a period from 1970 to 2004 into closer examination. Table 3 shows the results. The mean continuously compounded return on the value weighted stock market index is 14.9 percent (9.2 percent real return), whereas the money market return is 9.8 percent (4.2 percent real return). The corresponding equity premium is 5.1 percent (for percentage calendar year returns the premium is as high as 11.2 percent). The excess return on bonds over money market instruments is negative, with a value of -1.2 percent. This can partly be due to the proxy that we have used for the money market returns 1972-1986, as the rates calculated from the covered interest rate parity do not reflect real investment opportunities for a representative investor, but a general impression is that the short-term interest rates in Finland appear to have been high in an international comparison.

During the late 90s and early 21st century, the Finnish stock market was characterized by a very high level of concentration. At the end of the year 2000, two of the largest companies, Nokia and Sonera (nowadays Telia-Sonera), accounted for 75 percent of the total market capitalization, with Nokia alone contributing up to 70 percent to the total market value. Considering 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 our stock market returns in the later subperiod mostly describe the performance of some highly successful companies, and if investors who opted to hold better diversified portfolios would also have received these high rewards for their risky investments?[34]

[34] 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.

In order to give an indication of the cross section of stock returns we also examine the returns on an equally-weighted portfolio constructed of all shares listed on the Helsinki Stock Exchange. The portfolio weights are updated monthly, and the sample is from March 1970 to December 2003. The results are presented in table 3, Row 2 of panels A and B. We see that the mean return on the equally-weighted (EW) portfolio (13.1 percent real return) has in fact been higher than the mean return on the value- weighted (VW) portfolio (9.2 percent). Since the samples are not exactly the same for these two return series, we look at the returns from 1970:3 to 2003:12 on the value-weighted portfolio in order to compare the VW and EW series in a matched sample. The mean return for VW is approximately 9.3 percent. Thus, the high Finnish stock returns after 1970 appear to be a market-wide phenomenon.[35]

4.3 Dividends

The high stock returns after 1970 reflect also to some degree the inclusion of dividends in the return calculations. For the subperiod 1920-1969 for which we are only able to include the capital appreciation, the continuously compounded mean return is in fact negative, -1.5 percent. Table 4, panel A shows that the returns during all the decades for which dividends are included were at a very high level as compared to the earlier decades. In a comprehensive cross-country study, Jorion and Goetzmann (1999) report that out of a sample of 39 countries, they were able to find only six countries for which dividend data was available for the period around 1920-1995. Their results indicate that the dividend return had a tendency to be higher in the early part of the sample and decreased during the later periods. The real dividend return that was added to the part of returns stemming from capital appreciation was on average 4.20 percentage units for these six countries (the mean capital appreciation for these countries during the sample was 2.27 percent, and thus the total return was 6.47 percent).

Instead of adding some ad hoc estimates of the dividend return to our return series, we only note at this point that our estimates of the stock market returns from 1920 to 1969 are likely to be downward biased by a degree of several percentage units, a fact that most be taken into account when interpreting the results.

[35] 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, 33.08 for VW.

4.4 Cross-correlations

Table 5 shows the cross-sectional correlation matrix between the continuously compounded nominal monthly returns and inflation series for the time periods 1930-2004 (panel A) and 1970-2004 (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 the correlation is of the opposite sign for the later subperiod. The positive correlation for 1930-2004 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).[36] Bond returns, on the other hand, show a negative correlation with inflation during both time periods. As for money market rates, the considerable increase in their correlation with inflation during the later period is not surprising given that the interest rates in the later period were more or less market determined, whereas the earlier rates were based on the Bank of Finland's base rate.[37]

4.5 Rolling standard deviations

Figure 6 shows the dynamic behavior of standard deviations during the sample period. The standard deviations are calculated from continuously compounded nominal equity market returns using a rolling window of 24 months.

Table 1 indicated that the annualized standard deviation for the whole sample is 20.3 percent. Figure 6A shows that if we disregard the turbulent period after the Second World War (1945-1948), the standard deviations appear to have been fluctuating around a relatively stable level prior to 1980. However, after mid-1980s, there appears to be an upward sloping trend in market volatility, and beginning from the 1990s the standard deviations have consistently been higher than 20 percent.

One reason for the apparent increase in volatility during the 1990s can be found in the fact that our market portfolio (that we proxy by the value-weighted HEX/OMXH-index) was not well-diversified. As mentioned earlier, at certain points of our sample the shares of Nokia corporation

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[36] A negative correlation is troubling, since the Fisher hypothesis states that there should be a positive correspondence between the expected nominal rate of return and expected inflation. A regression of continuously compounded equity returns on a constant and the realized inflation during the same time period leads to a point estimate of 0.48 for the inflation coefficient in our data. The null hypothesis of $\beta=1$ implied by the Fisher hypothesis can be rejected at a 10 percent level of significance.

[37] Untabulated results show that the correlation between inflation and money market rates 1930-1969 was -0.2. The correlation between bond returns and inflation was -0.075, a value that appears to have been relatively stable during the whole sample.

accounted for more than 70 % of the total value of the market portfolio. Thus, in figure 6B we contrast the standard deviations of the value-weighted portfolio to those of an equally-weighted portfolio that is constructed of all shares listed on the stock exchange. The figure shows a clear pattern. Prior to mid-90s, the standard deviations of the value-weighted and equally-weighted portfolios tracked each other closely, whereas their paths diverged around 1995 when Nokia started to gain dominance in the value-weighted index. During the time of the financial liberation of the Finnish stock market and the economic crisis in the early 90s, the volatility of the equally-weighted portfolio appears to have been high, but during the late 90's the standard deviation fell back towards a level at which the market on average had been during the whole sample 1920-2004.

Using daily return data and a sample from 1970 to 2001, Maukonen (2004) finds that the Finnish market volatility does not exhibit a clear trend during his sample period. Instead, it appears to decrease during 1970-1985 and increase during 1986-2001, a result that is also supported by our plots in figure 6B. If we compare our results to those from the US market, Schwert (1989) and more recently Campbell et al. (2001) find that the US market volatility has not had a systematic tendency to increase during the 20th century. Our results indicate that notwithstanding a possible short-term increase in volatility during the 90s, this appears to be generally true also for the Finnish market, as long as we consider the returns on a well-diversified portfolio in our analysis.[38]

[38] That is, the standard deviation of the equally-weighted portfolio does not appear to be significantly or systematically higher during the 90s than the standard deviations during other volatile periods in the history of the Helsinki Stock Exchange.

Figure 6A.

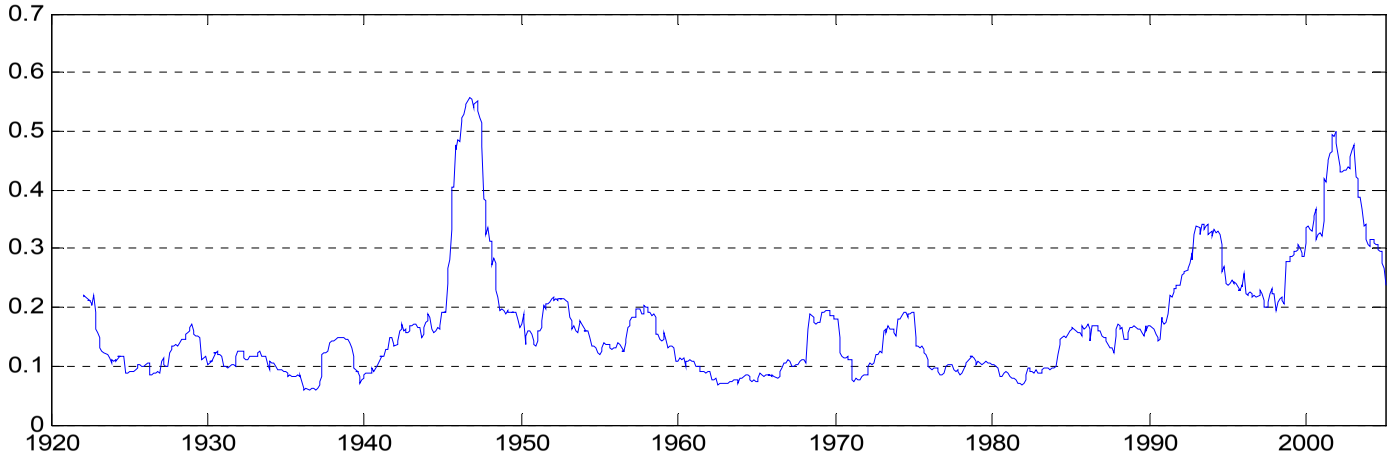
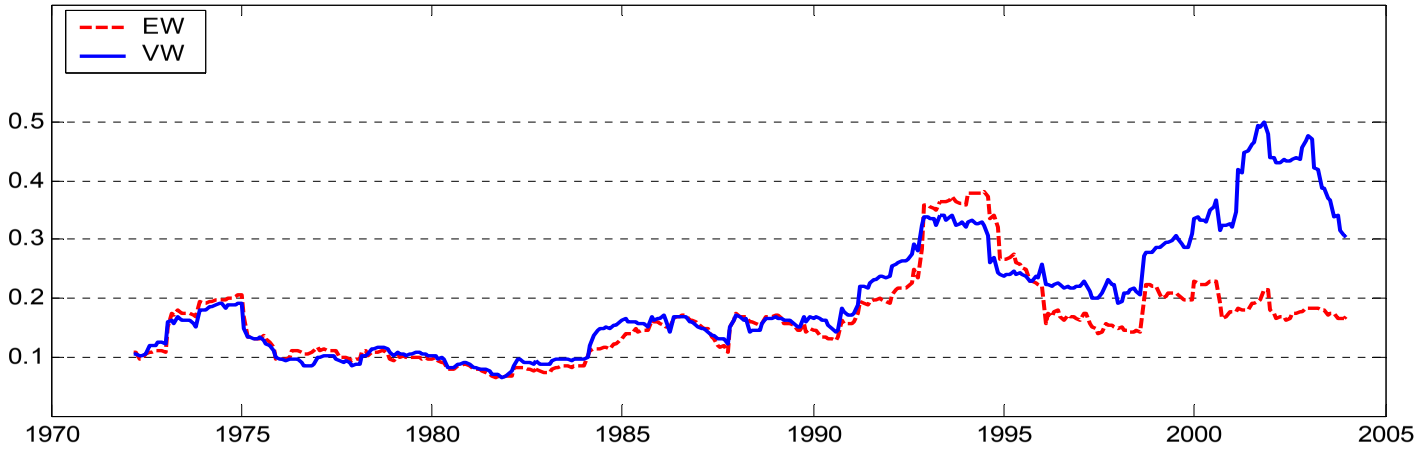


Figure 6B.



Figures 6 A and B: 24-month backward-looking rolling standard deviations. These figures show a 24-month rolling standard deviation of continuously compounded, nominal stock market returns. The monthly standard deviations are multiplied by the square root of 12. Figure 5A shows the standard deviations from 1920 to 2004. The stock market returns 1920-1969 do not include dividends and measure only the capital gain. Figure 5B shows the standard deviations 1970-2003 both for a value-weighted stock market index (WI-index and HEX/OMHEX-index) and for an equally-weighted portfolio of all shares on the market.

4.6 Correlation with the US market

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

Figure 7 shows the correlation between the two markets. The correlations are calculated with a moving window of 36 months, and we use the Standard and Poor's composite index as a proxy for the US market.[39] The figure indicates that the correlation is not stable and fluctuates strongly over time.[40] For the period 1920-1980, the correlation does not appear to have a trend and fluctuates around the unconditional correlation for this whole subperiod that is 0.11 (for the whole sample the correlation is 0.22). However, during the financial liberation in Finland in mid-80s, and especially after all restrictions on foreign ownership were removed in 1993, the correlation between the two markets shows a clear upward trend.[41] That capital market liberalizations have a tendency to increase the correlation between the local market and world market returns has been documented in the literature, see e.g. Bekaert and Harvey (1997).

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[39] From January 1920 to December 1969 we use monthly data on the S&P index from Robert Shiller's online database available at http://www.econ.yale.edu/~shiller/data.htm. From January 1970 to December 2004 we use monthly values of the S&P 500 index obtained from Datastream.

[40] 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).

[41] 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 operations outside of Finland, and since mid 1990s it has been listed on the New York Stock Exchange. However, the correlations between the equally-weighted Finnish stock returns and the S&P index (results not shown here) show the same pattern as in figure 7.

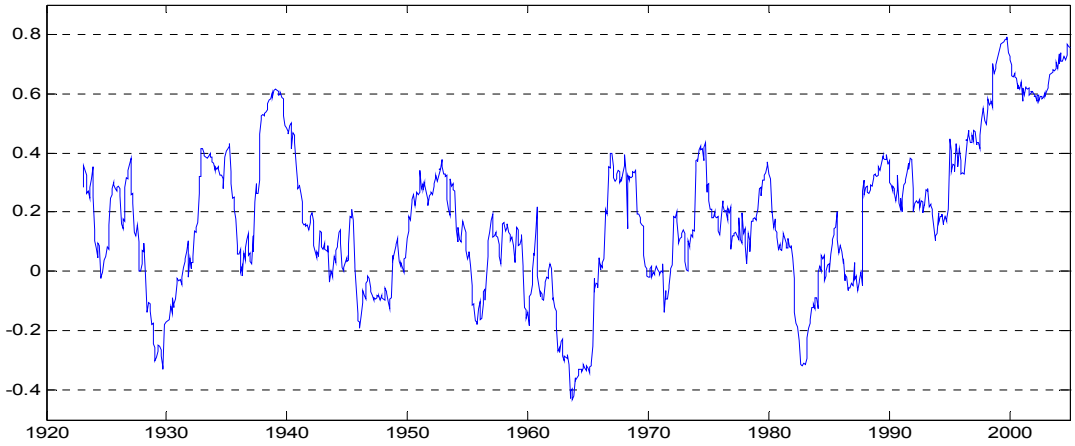

Figure 7. 36-month backward-looking moving correlation between the Finnish and US equity markets 1920-2004. This figure shows a plot of the correlations between the Finnish and US markets. For Finland we use the Unitas-index and the value-weighted WI- and HEX/OMHEX-indices. As a proxy for the US market we use the S&P composite index. The correlations are calculated from nominal continuously compounded returns measured in local currencies.

5 CONCLUSIONS

In this paper we present a short survey of the development of Finnish equity, bond, and money markets from the early 20th century to the present day. At the same time we also survey the literature covering these markets. In addition, we present and discuss what kind of data is available in Finland for these markets in order to facilitate future research on the Finnish markets. Finally, we conduct an empirical analysis of the returns on these markets using the longest available data series from 1920 to 2004. The results show, using an approach similar to Mehra and Prescott (2003), that the equity premium for Finland 1920-2004 is 5.33 % which is in line with the US equity premium during 1889-2000 (6.92 percent).

A natural extension to this study would be to develop total return indices for the Finnish equity and bond markets that also cover the periods before 1970 and 1991, respectively. Similarly, it would be interesting to analyze the liquidity (i.e., volume and spread) over the whole sample period. However, the collection of the required data and construction of the indices are left to further studies. A further extension to the present study would be to analyze the results of different investment strategies.

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Table 1. Descriptive statistics for monthly continuously compounded nominal returns 1920-2004.

Descriptive statistics are calculated for the monthly continuously compounded asset returns. The equity market portfolio is proxied by the Unitas price index (1920-1969), the WI-index (1970-1989) and HEX/OMXH index (1990-2004). Equity market returns 1920-1969 measure only the capital gain and do not include dividends. The bond portfolio returns are calculated by NN (20xx). 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 Bera-Jarque test statistic of the null hypothesis of normal distribution is provided in the table. The full sample size is 1019 monthly observations from February 1920 to December 2004.

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	1920-2004	9.28	20.27	-0.024	5.159	<0.001	0.280*	0.023	0.035	0.101*	<0.001
Bond portfolio return	1930-2004	7.62	3.34	-0.418	21.459	<0.001	0.196*	0.118*	0.114*	-0.058	<0.001
Base rate/money market return	1920-2004	7.64	1.20	1.711	3.979	<0.001	0.955*	0.919*	0.898*	0.813*	<0.001
Inflation	1920-2004	6.34	5.10	4.279	39.342	<0.001	0.487*	0.354*	0.289*	0.231*	<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, Panels A and B. Descriptive statistics for monthly continuously compounded real equity and money market returns 1920-2004

Descriptive statistics are calculated for the monthly continuously compounded asset returns. Equity market returns 1920-1969 measure only the capital gain and do not include dividends. The mean and standard deviations are annualized (multiplied with 12 and the square root of 12, respectively). The *p*-value for the Bera-Jarque test statistic of the null hypothesis of normal distribution is provided in the table. The full sample size is 1019 monthly observations from February 1920 to December 2004.

	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 A: Equity returns											
Full sample	1920-2004	2.939	20.410	-0.343	4.363	<0.001	0.298*	0.043	0.053	0.114*	<0.001
Sub-samples	1920-1939	-1.900	14.392	-0.713	3.534	<0.001	0.377*	0.099	0.110	0.104	<0.001
	1940-1959	-1.514	23.336	-0.790	4.300	<0.001	0.375*	0.053	-0.004	0.107	<0.001
	1960-1989	5.561	13.479	0.552	1.661	<0.001	0.267*	0.190*	0.166*	0.108	<0.001
	1990-2004	10.057	31.497	-0.199	0.785	0.055	0.223*	-0.042	0.029	0.097	0.054
	1920-1969	-1.475	18.100	-0.736	6.285	<0.001	0.360*	0.060	0.026	0.097*	<0.001
	1970-1986	8.731	13.600	0.510	1.340	<0.001	0.246*	0.254*	0.248’	0.136	<0.001
	1987-2004	9.710	29.593	-0.211	1.084	<0.001	0.235*	-0.029	0.030	0.113	<0.001
Panel B: Money market returns											
Full sample	1920-2004	1.300	5.204	-4.329	39.381	<0.001	0.505*	0.375*	0.310*	0.250*	<0.001
Sub-samples	1920-1939	4.832	5.572	-0.692	4.342	<0.001	0.491*	0.227*	0.050	0.429*	<0.001
	1940-1959	-7.687	8.260	-3.633	19.205	<0.001	0.462*	0.365*	0.339*	0.048	<0.001
	1960-1989	3.518	1.968	-0.704	4.199	<0.001	0.287*	0.254*	0.198*	0.275*	<0.001
	1990-2004	4.154	1.392	0.325	-0.120	0.195	0.521*	0.375*	0.403*	0.575*	<0.001
	1920-1969	-0.712	6.557	-3.442	24.439	<0.001	0.503*	0.367*	0.301*	0.227*	<0.001
	1970-1986	3.990	2.177	-0.124	0.717	0.087	0.344*	0.293*	0.169*	0.347*	<0.001
	1987-2004	4.337	1.374	0.237	-0.244	0.277	0.459*	0.301*	0.400*	0.561*	<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, Panels C and D. Descriptive statistics for monthly continuously compounded real bond returns 1930-2004 and inflation 1920-2004.

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 Bera-Jarque test statistic of the null hypothesis of normal distribution is provided in the table. The full sample size is 1019 monthly observations from February 1920 to December 2004.

	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	1930-2004	0.867	6.027	-3.086	25.839	<0.001	0.445*	0.343*	0.342*	0.105*	<0.001
Sub-samples	1930-1939	7.431	4.207	0.693	1.518	<0.001	0.429*	0.185	0.145	0.315*	<0.001
	1940-1959	-6.975	9.257	-2.638	13.169	<0.001	0.462*	0.333*	0.340*	0.018	<0.001
	1960-1989	0.720	3.347	-0.792	7.419	<0.001	0.133*	0.255*	0.265*	0.184*	<0.001
	1990-2004	7.241	4.594	0.118	1.037	0.014	0.345*	0.165*	0.128	-0.200*	<0.001
	1930-1969	-0.942	7.237	-3.212	21.593	<0.001	0.478*	0.359*	0.359*	0.111	<0.001
	1970-1986	0.031	3.582	-0.781	8.307	<0.001	0.218*	0.322*	0.329*	0.256*	<0.001
	1987-2004	5.677	4.528	0.208	1.026	<0.001	0.315*	0.177*	0.166*	-0.135	<0.001
Panel D: Inflation											
Full sample	1920-2004	6.340	5.10	4.279	39.342	<0.001	0.487*	0.354*	0.289*	0.231*	<0.001
Sub-samples	1920-1939	1.610	5.556	0.899	4.698	<0.001	0.487*	0.222*	0.045	0.426*	<0.001
	1940-1959	13.051	8.155	3.684	19.616	<0.001	0.449*	0.350*	0.325*	0.034	<0.001
	1960-1989	7.274	1.951	1.388	3.576	<0.001	0.308*	0.317*	0.290*	0.359*	<0.001
	1990-2004	1.823	1.073	1.043	3.053	<0.001	0.178*	-0.058	0.057	0.439*	<0.001
	1920-1969	6.820	6.459	3.514	24.828	<0.001	0.487*	0.348*	0.281*	0.209*	<0.001
	1970-1986	9.100	2.027	0.877	1.276	<0.001	0.305*	0.311*	0.206*	0.374*	<0.001
	1987-2004	2.418	1.168	0.926	1.628	<0.001	0.244*	0.020	0.208*	0.501*	<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 1970-2004.

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 Bera-Jarque test statistic of the null hypothesis of normal distribution is provided in the table. The sample size is 420 monthly observations from January 1970 to December 2004 (for the equally weighted portfolio 406 observations from March 1970 to December 2003).

Asset return series	**Mean** (%)	**Std. dev.** (%)	**Skewness**	**Excess Kurtosis**	**Normality** (p-value)	**Autocorrelation** [a]				**Q(12)**[b]
						ρ_1	ρ_2	ρ_3	ρ_{12}	
Panel A: Real ln-returns										
Equity market portfolio (VW)	9.235	23.215	-0.162	2.733	<0.01	0.237*	0.019	0.068	0.121*	<0.001
Equity market portfolio (EW) [c]	13.062	18.195	0.592	3.662	<0.01	0.306*	0.081	0.091	0.107	<0.001
Bond portfolio return	2.935	4.171	0.027	3.301	<0.01	0.306*	0.260*	0.257*	0.041	<0.001
Money market return	4.168	1.807	-0.087	1.249	<0.01	0.377*	0.295*	0.238*	0.421*	<0.001
Panel B: Nominal ln-returns										
Equity market portfolio (VW)	14.898	23.039	-0.255	2.897	<0.01	0.235*	0.017	0.052	0.118*	<0.001
Equity market portfolio (EW) [c]	18.877	18.031	0.518	3.738	<0.01	0.305*	0.083	0.076	0.107	<0.01
Bond portfolio return	8.598	3.575	-0.073	4.462	<0.01	0.236*	0.156*	0.161*	-0.129*	<0.001
Money market return	9.832	1.586	0.656	0.411	<0.01	0.938*	0.888*	0.859*	0.741*	<0.001
Excess equity market return	5.066	23.254	-0.157	2.678	<0.01	0.250*	0.036	0.070	0.125*	<0.001
Excess bond market return	-1.234	3.848	-0.231	4.231	<0.01	0.311*	0.231*	0.225*	-0.35	<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.

c) Sample for the equally weighted portfolio is from March 1970 to December 2003.

Table 4, Panels A and B. Descriptive statistics for percentage calendar year returns 1920-2004.

Descriptive statistics are calculated for percentage, real asset returns. The holding period is one calendar year. Equity market returns 1920-1969 measure only the capital gain and do not include dividends .The *p*-value for the Bera-Jarque test statistic of the null hypothesis of normal distribution is provided in the table. The full sample size is 85 annual observations from 1920 to 2004.

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: Equity returns										
1920-1929	-2.715	29.000								
1930-1939	4.515	15.342								
1940-1949	-9.509	21.021								
1950-1959	13.341	29.492								
1960-1969	0.747	17.933								
1970-1979	5.776	27.304								
1980-1989	18.502	26.873								
1990-2004	20.025	54.213								
1920-2004	7.141	32.210	1.589	5.054	<0.01	0.279*	-0.068	-0.067	-0.009	0.164
Panel B: Money market returns										
1920-1929	5.159	9.346								
1930-1939	5.339	7.008								
1940-1949	-13.142	15.667								
1950-1959	0.698	6.822								
1960-1969	2.247	2.411								
1970-1979	3.374	4.453								
1980-1989	5.302	3.230								
1990-2004	4.300	3.678								
1920-2004	1.815	9.191	-2.643	13.416	<0.01	0.415*	0.446*	0.321*	-0.168	<0.01

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, Panels C and D. Descriptive statistics for percentage calendar year returns 1920-2004.

Descriptive statistics are calculated for percentage, real asset returns. The holding period is one calendar year. .The *p*-value for the Bera-Jarque test statistic of the null hypothesis of normal distribution is provided in the table. The full sample size is 85 annual observations from 1920 to 2004 (for bonds, 75 observations from 1930 to 2004).

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 C: Bond returns										
1930-1939	7.994	8.216								
1940-1949	-13.156	16.282								
1950-1959	2.479	9.984								
1960-1969	2.864	4.146								
1970-1979	-1.855	6.953								
1980-1989	1.689	6.289								
1990-2004	7.814	8.444								
1930-2004	1.565	11.116	-1.301	4.476	<0.01	0.356*	0.366*	0.341*	-0.253	<0.01
Panel D: Inflation										
1920-1929	3.750	11.136								
1930-1939	0.118	5.681								
1940-1949	25.200	29.607								
1950-1959	6.097	7.547								
1960-1969	4.877	2.554								
1970-1979	10.813	4.939								
1980-1989	7.195	3.129								
1990-2004	1.848	1.315								
1920-2004	7.156	13.222	4.586	26.966	<0.01	0.205	0.389*	0.203	-0.164	<0.01

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 5. Cross-correlation matrix

Cross-correlation matrix of the nominal continuously compounded return and inflation series. The sample size is 900 monthly observations from January 1930 to December 2004 (panel A) and 420 monthly observations from January 1970 to December 2004 (panel B).

Asset return series	Equity	Bond	Money	Inflation
Panel A: 1930-2004				
Equity market portfolio	1.000			
Bond portfolio return	0.054	1.000		
Money market return	-0.050	0.081	1.00	
Inflation	0.111	-0.068	0.036	1.000
Panel B: 1970-2004				
Equity market portfolio	1.000			
Bond portfolio return	0.080	1.000		
Money market return	-0.102	0.043	1.00	
Inflation	-0.051	-0.073	0.475	1.000