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CHINESE CAPITAL MARKET:
AN EMPIRICAL OVERVIEW

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ABSTRACT

The Chinese capital market, despite its relative short history in its modern form, has experienced a tremendous growth and is now the second largest in the world. Due to China's tight capital controls, the development of its capital market has mostly been isolated from and hence not been well understood by the rest of the world. Yet, this state of isolation is bound to change substantially as China becomes more integrated into the global financial system. In this paper, we provide an empirical overview of the Chinese capital market: its historical development and main empirical characteristics.

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Along with its economy, China's capital market has experienced a fast growth in the past three decades. By market capitalization, it is now the second largest in the world. However, due to China's tight capital controls, the development of its capital market has mostly been isolated from and hence not been well understood by the rest of the world. But this state is quickly changing as China becomes more integrated into the global financial system and developments in its capital market are increasingly impacting global markets, either directly or indirectly.

In this paper, we provide a basic empirical review of the Chinese capital market: its developments, main empirical characteristics, and future challenges. The paper is organized as follows. In Section 1, we give a brief introduction to the Chinese capital market: its major components, their past growth, and their institutional context and structure. In Section 2, we report the return characteristics of major asset classes in their recent history, including government bonds, corporate credit bonds, large company stocks, and small company stocks. In Section 3, we examine the risk characteristics of these broad asset classes. In sections 4 and 5, we further examine the size, value and momentum effects in the Chinese stock market.

A few additional notes are in order. First, for terminology, such as those for instruments, markets, regulatory bodies, we follow the official English terminology used by Chinese regulators rather than a translation of their Chinese terminology, either literally or adaptively. This is mainly to avoid possible confusion if readers attempt to refer to official sources. The names of many instruments in the Chinese market may not exactly match those for their corresponding parts in other markets. Such a gap, although somewhat cumbersome and sometimes awkward, may well be warranted since substantial differences often exist between these instruments.

Second, the data used in this paper comes from multiple sources. Descriptive data are mostly from official sources, which are given in the paper. Derived data such as returns on securities are from the Chinese Capital Market Database, which is developed by the authors. Great effort has been devoted to development this database to correct errors in the raw data and more importantly compute the relevant quantities correctly.

Third, more details of the results presented in this paper can be found in 2017 Chinese Capital Market Yearbook (Wang, Hu, and Pan (2017)).

1 A Brief Introduction of the Chinese Capital Market

China had an active capital market in the 1920's. At that time, Shanghai Huashang Security Exchange, which was founded in 1921, ranked the top in east Asia, in terms of facility and size (see, for example, Zhang (2001)). However, the development of China's capital market suffered from wars, economic upheavals and political instability in 1930's and 40's. It was suspended as China adopted a planned economy in 1949, after the founding of the People's Republic. Capital allocation was controlled by the government through administrative means. Banks served mainly as a vehicle to facilitate payments and credit allocations, and interest rates were set by the central government. When China began to transform into a more market-oriented economy after economic reforms started in 1976, the Chinese capital market began its revival. Despite rapid changes in the economy during the reform, the initial growth of the capital market was slow and lagging. The re-birth of the stock market in 1990 marked the beginning of China's capital market in its contemporary form. The market of government and corporate bonds also re-emerged in the 1980s and gradually grew in the 1990s. By the end of 2016, these markets have reached to a size that is comparable with China's economy, ranked the second largest globally by market capitalization, next only to the United States.¹

The rapid growth of the Chinese capital market bears strong marks of "Chinese characteristics". In this introduction, we provide a brief overview of the market, including some important facts and characterizations. We focus primarily on common stocks, government bonds and corporate bonds, as they constitute the major parts of the market at this point.

1.1 Common Stocks

A The Emergence of Common Stocks

In May 1982, the State Commission for Restructuring the Economic Systems was established to reform China's economic system, whose initiatives included overhauling the state-owned enterprises (SOEs). The commission actively promoted the so-called joint-stock reform, which introduced non-state participation in (state-owned) firms. Ownership, or a claim on future earnings, by non-state entities including individuals was offered in exchange for capital or other

¹See, e.g., World Federation of Exchanges monthly report at Dec 2016- Equity - 1.1.

forms of economic contributions. Some small state-owned enterprises and collective enterprises then began to restructure themselves into joint-stock firms, which led to an early form of stocks. Particularly, several enterprises in Beijing, Shanghai and Guangzhou were formally chosen to restructure into joint-stock firms. After December 1986 when the State Council announced the “Regulations on Deepening Enterprise Reform and Enhancing the Vitality of Enterprises”, more enterprises, including some large state-owned enterprises, started to issue stocks, and the primary stock market began to emerge (see, e.g., “Twenty Years of China’s Capital Markets” by the China Securities Regulatory Commission).

In the early stage, most stocks had bond-like characteristics. For example, they had finite maturities, guaranteed par values and predetermined interests or dividends paid at maturity. In addition, most stocks were issued to employees and local citizens, and were self-issued without an underwriting process. Over time, the shares issued to the public took on a form similar to modern common stocks, with no fixed terms in maturity, par value or dividends. In addition, the pre-existing ownership of these firms, especially the SOEs, was regarded as a different form of shares from those issued to the public. This ambiguity or ambiguity in ownership rights led to the distinction between these two classes of shares, one was issued to the public and the other representing the pre-existing ownership, which often belongs to different parts of the government. The latter were often called government or legal-person shares. The co-existence of these two classes of shares is also referred to as the “split-share structure”, which still exists nowadays, although to a lesser extent.

B Two Major Exchanges

As the number of stocks and investors rose in late 1980s , the need for secondary trading of stocks also increased. Under such circumstances, the central government approved the establishment of the Shanghai Stock Exchange (SSE) and the Shenzhen Stock Exchange (SZSE) in 1990, for the listing, issuance and trading of stocks. Both exchanges began to operate in December 1990.

Currently, a number of regional security exchanges also exist. But they have played only a relatively minor role in China’s overall stock market both in terms of total market capitalization and trading volume. We therefore will focus our analysis exclusively on the two major exchanges: the Shanghai and Shenzhen stock exchanges.

Shares, issued by listed companies to the general public, form the basis of “floating shares”, which can be invested by domestic investors, individual and institutional. In general, the legal-person shares, not listed nor traded on the exchanges, form the basis of “non-floating” shares. They are traded over-the-counter but infrequently.

Shanghai Stock Exchange

The Shanghai Stock Exchange was founded on November 26, 1990, and formally started operation on December 19, 1990. Located in the Pudong New Area of Shanghai, it is directly administrated by the China Securities Regulatory Commission (CSRC). Today, it is the largest stock market in mainland China in terms of total market capitalization and trading volume. Trading in the Shanghai Stock Exchange is executed through a centralized electronic limit order book, based on the principle of price first and time first.

By the end of 2016, the total number of stocks listed on SSE reached 1,175, with only 102 stock newly listed in 2016. The total market capitalization of listed companies is CNY 28.5 trillion and that of floating shares is CNY 23.9 trillion.² The total number of shares and floating shares listed on the SSE are, respectively, 3.3 trillion and 2.9 trillion by the end of 2016.

Shenzhen Stock Exchange

Founded on December 1, 1990, the Shenzhen Stock Exchange is in the coastal city of Shenzhen, one of the designated Special Economic Zones meant to foster the opening of China’s economy in the 1980s. Since its founding, the Shenzhen Stock Exchange has quickly grown from a regional market to a nation-wide securities market. The Shenzhen Stock Exchange adopts a similar trading mechanism as the Shanghai Stock Exchange.

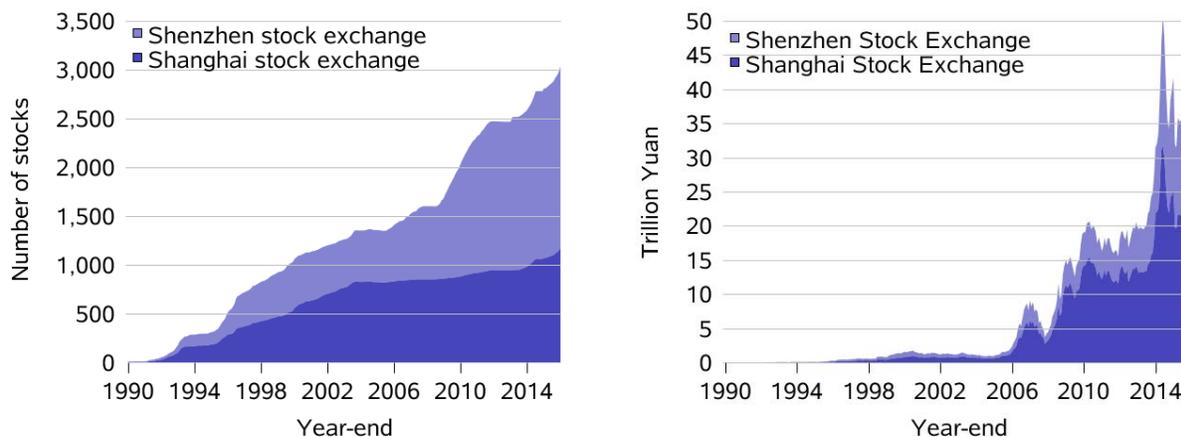
What distinguishes the Shenzhen Stock Exchange from Shanghai’s is its support for small enterprises. In May 2004, the Shenzhen Stock Exchange formally launched the Small and Medium Enterprises Board (SME Board) to list and trade shares of small- and medium-size firms. The firms listed on the SME Board typically have high growth and high profitability. In October 2009, to better support the financing of small enterprises, the Shenzhen Stock Exchange launched the Growth Enterprise Market. Compared with the Small and Medium

²The Chinese currency is Renminbi or RMB, denominated in Yuan, which is also denoted by CNY or ¥, as in this article. On December 31, 2016, the exchange rate between CNY and US Dollar is CNY 6.95/USD.

Enterprise Board, the Growth Enterprise Market focuses more on even smaller firms and high-tech firms. The Growth Enterprise Market also has different listing and trading rules from the Small and Medium Enterprise Board.

C Stock Market Growth

Figure 1.1(a) shows how the number of listed firms on the two major stock exchanges increased since 1990. The dark-blue band represents the Shanghai Stock Exchange and the light-blue the Shenzhen Stock Exchange. As seen in the figure, the growth of China’s stock market experienced several phases. From 1990 to 1992, the initial “experimental phase”, only eight stocks were listed in Shanghai, the so-called “old eight.” Six were listed in Shenzhen in 1991. By the end of 1992, there were 53 stocks listed on the two exchanges combined. From 1993 to 1997, the market experienced a robust growth. The number of firms listed on the two exchanges more than doubled in 1993, reaching 177 in by the end of the year. The total was 311 by the end of 1995, 514 by 1996, and 720 by 1997.



(a) Number of Listed Firms (Monthly) (b) Floating Market Capitalization (Monthly)

Figure 1.1: Size of the Stock Market (1990-2016)

It is worth noting that the number of stocks remained nearly unchanged from 1994 to early 1996. This was due to the IPO suspensions on three occasions, from July to December in 1994, from January to June in 1995, and from July 1995 to January 1996. After the suspension was lifted in 1996, IPO soared again, which is reflected in the figure. The growth, however, is not without glitches. In the early part of 2004, stock prices dropped substantially. After the market index plummeted 8.43% on July 28, 1994, the securities regulator halted new IPOs,

from July 30, 1994 to the middle of 1995. The growth resumed afterward but at a slightly slower pace, reaching 1,060 in 2000, and 1,353 in 2004, with 827 on the Shanghai exchange and 526 in Shenzhen. New listings then slowed down substantially, especially for Shanghai. The number of stocks listed in Shanghai almost stayed flat, ranging between 827 and 860 from 2004 to 2009. It started to grow slowly again in 2010, reaching 1,175 by the end of 2016.

Until 2004, the Shenzhen Stock Exchange had a similar growth path as Shanghai, with slightly fewer stocks and smaller sizes. However, after the launch of the Small and Medium Enterprise Board in 2004 and the Growth Enterprise Market in 2009, Shenzhen's growth picked up pace. The number of listed firms in Shenzhen has been increasing substantially since 2005 and more sharply since 2009. By the end of 2016, it has reached 1,859, significantly more than that in Shanghai.

A more important measure of a stock market's size is the total market capitalization. Figure 1.1(b) shows a direct comparison of the total floating market capitalization of the two exchanges. Although the Shenzhen Stock Exchange has several different boards now and a larger number of listed stocks in total, especially more recently, its market capitalization is still less than that of the Shanghai Stock Exchange.

D Stock Market Volatility and Turnover

Over the years, the Chinese stock market has experienced substantial volatility. Figure 1.2(a) shows the annualized volatility of the stock market, measured over one-month, three-month and one-year periods. Here, the cumulative square of daily percentage changes of the total market capitalization is used to estimate the market volatility over a given measurement period. Clearly, the stock market volatility was very high in the early 1990s. Afterward, the volatility subsided to an average level of around 20% in 1998 and stayed relatively low until 2006. However, because of a bull market in 2007 followed by a bear market in 2008, the one-year volatility index climbed up to more than 50% and the volatility indexes using the one- and three-month returns were even higher. After 2008, the indexes dropped back to around 20%. Towards the end of June 2015, at the onset of the recent Chinese stock market turbulence, the volatility spiked up again, with the volatility indexes using the one- and three-month returns rose well above 60%.

Figure 1.2(b) shows the monthly turnover of the whole stock market. Here, the market-

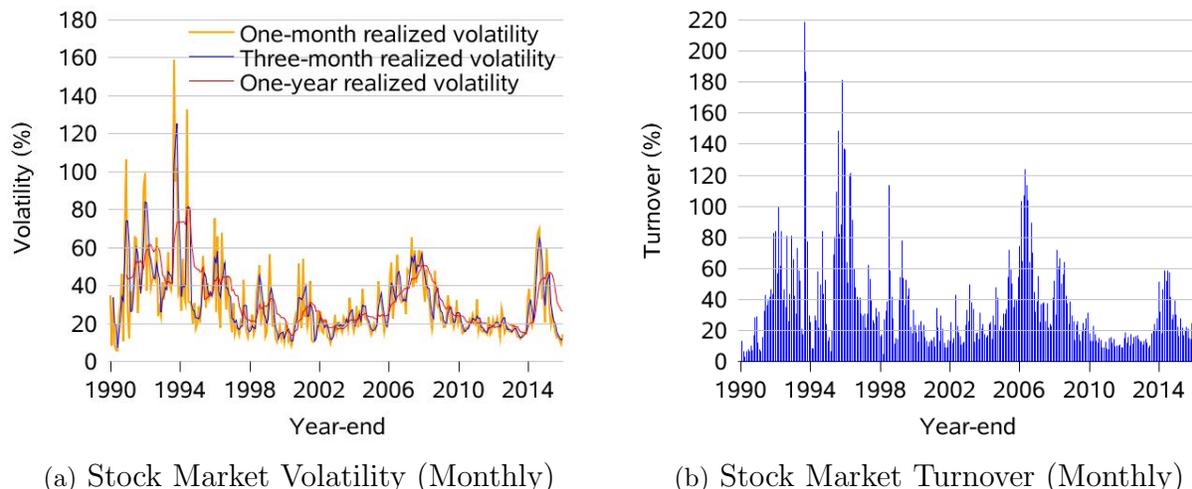


Figure 1.2: Volatility and Turnover of the Stock Market (1990-2016)

wide turnover is measured as the total number of shares traded divided by the total number of floating shares outstanding. Monthly turnover is simply the sum of daily turnover in a month. The high turnovers in the earlier years was mainly due to the limited number of stocks and the overwhelming enthusiasm in stock investment. The monthly turnover averaged around 20%, significantly higher than that in mature markets. In addition, the turnover exhibits substantial fluctuations over time, exceeding 120% in 1994, 1997 and 2007 while dropping below 10% in 2002, 2012 and 2013, but with no obvious time trend.

E Stock Market Organization

Different Types of Shares

The Chinese stock market is characterized by the co-existence of various types of shares, summarized briefly as follows.

- **A Shares** represent the shares listed on the two main stock exchanges that are denominated in Renminbi (RMB). In the following discussion of China's stock market, we will mainly focus on A shares, which comprise approximately 96% of all shares traded.
- **B Shares** were established in 1992 in both Shanghai and Shenzhen. Initially, the participants were exclusively foreign investors. Since February 19, 2001, however, this market was opened to domestic individual investors. On the Shanghai Stock Exchange, prices are denominated in U.S. dollars while on the Shenzhen Stock Exchange prices are

denominated in Hong Kong dollars. By the end of 2016, there are 100 listed companies with B shares traded on the two exchanges, accounting for only a tiny proportion of the total market.³

- **H Shares** refer to shares of companies registered in mainland China but listed and traded on the Hong Kong Exchanges. Many companies issue their shares simultaneously on the Hong Kong Exchanges and one of the two stock exchanges in mainland China. Many empirical studies have shown that there are often substantial price discrepancies between H shares and their A-share counterparts issued by the same company. A shares are generally traded at a premium to H shares. Domestic investors are restricted from investing abroad and foreign investors are also restricted from investing in the A-share market in mainland China.

Stock Investors

There are four major classes of investors in China's stock market:

- Domestic individual investors
- Financial intermediaries and financial service providers, including brokers, integrated securities companies, investment banks, and trust companies
- Domestic institutional investors
- Qualified foreign institutional investors (QFII).

In mainland China, commercial banks are forbidden by law from participating in security underwriting or investing business, except for QFIIs. Nor can banks lend funds to their clients for securities business. Insurance companies are permitted to invest in common stocks only indirectly, through asset management products operated by funds institutions.

Regulation

The main regulator of the securities industry in China is the China Securities Regulatory Commission (CSRC). In October 1992, the State Council Securities Committee and its executive branch, the CSRC, were established to regulate China's stock and futures markets. In 1998,

³See Monthly Statistical Report of CSDC, 2016-12.

the State Council Securities Committee ceased operation and its functions were transferred to the CSRC, which became the sole regulator supervising nationwide securities and futures markets. Currently, the CSRC is a sub-institution of the State Council.

China's Securities Law, the nation's first comprehensive securities legislation, which took effective on July 1, 1999, grants the CSRC authority to manage a centralized and unified regulation of the nationwide securities market to ensure their lawful operation. The CSRC oversees China's nationwide centralized securities supervisory system, with the power to regulate and supervise securities issuers, as well as to investigate, and impose penalties to illegal activities related to stock and futures markets. The CSRC is empowered to issue Opinions or Guideline Opinions, non-legally binding guidance for publicly traded companies.

F Special Features of China's Stock Market

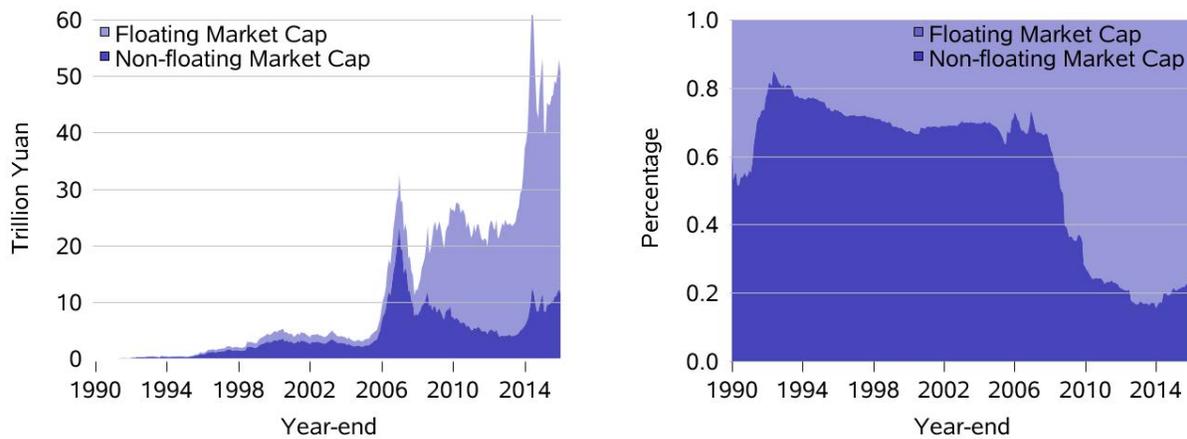
The Split-Share Structure and Its Reform

The presence of both floating and non-floating shares, i.e., the split-share structure, is unique to China's stock market. The origin and evolution of non-floating shares can be divided into the following three phases:

- **Phase I:** In the early days of China's securities market, the ownership of state-owned enterprises (SOEs) was transformed into equity shares, held by different government and semi-government entities. These shares form the basis of non-floating shares. They are different from the floating shares issued to the general public, which are listed and traded on exchanges. The non-floating shares were traded between government and semi-government entities and later other legal entities through negotiations, typically at book value. The presence of these two classes of shares reflects certain ambiguity in their respective ownership rights.
- **Phase II:** Attempts to reform the split-share structure were made to meet the needs of state-owned enterprises for funds, liquidity, better governance, and re-organization. From the second half of 1998 to the first half of 1999, the Chinese government started to reduce state-ownership in most SOEs and shift them toward a more market driven environment. However, due to the gap between the market expectation on the value of non-floating shares and their actual realization, the pilot program was soon suspended.

- **Phase III:** On January 31, 2004, the State Council announced its intent to “actively address the problem of split-share structure.” On April 29, 2005, CSRC launched the Split Share Structure Reform. Through terms negotiated with the owners of floating shares, the non-floating shares were gradually converted into floating shares.

Figure 1.3(a) describes the total market capitalization of floating shares (light blue) and non-floating shares (dark blue). It is worth noting that here the value of non-floating shares is based on book value, while that of floating shares is based on market value. The total market capitalization of both floating and non-floating shares remained stable around CNY 4 trillion between 2000 and 2006, and abruptly climbed up in 2007 to around CNY 30 trillion. In the same year, the Shanghai Composite Index reached its historical high of 6124.04 point. Shortly after, as a result of the global financial crises, the market capitalization shrunk to only about one-third of its peak value. Since early 2009, the market capitalization of non-floating shares continued declining while that of floating shares reversed back to over CNY 20 trillion and remained relatively stable until the more recent stock market turbulence. From mid-2014 to early 2015, the market capitalization of floating shares increased rapidly from CNY 20 trillion to CNY 60 trillion and then crashed to around CNY 40 trillion in mid-2015. Similar pattern can be observed for the non-floating shares, although the rise and fall were not as dramatic.



(a) Market Capitalization (Monthly)

(b) Share in Market Capitalization (Monthly)

Figure 1.3: Floating versus Non-Floating Shares (1990-2016)

Figure 1.3(b) shows the relative proportion of the total market capitalization of floating and non-floating shares across the two exchanges. Although the split-share structure reform

started from 2005, the total market capitalization peaked in 2009, which was reflected as the sharp increase in the market capitalization of floating shares. By the end of 2016, the proportion of the market capitalization of non-floating shares dropped to around 20% from the peak of near 80% in early 1990's.

Trading Restrictions

Daily Price Limit A price limit is the maximum amount the price of stock is allowed to increase or decrease in any single trading day from the previous day's settlement price. In the early years of China's stock market, there were no daily price limits. Since December 26 of 1996, both the SSE and SZSE started to impose a daily price limit of 10%. The following circumstances, however, are exempted from this rule:

1. The IPO date.
2. The first trading date after the stock split-structure reform.
3. The first trading date after seasonal offerings.
4. The first trading date after material assets restructuring.
5. The first re-listing date of de-listed stocks.

T+1 The T+1 rule refers to a trading restriction which means that stocks bought on day t is settled on day $t + 1$ and can therefore be sold on day $t + 1$ at the earliest. In Shanghai and Shenzhen Stock Exchange, the trading of stocks and mutual fund products all adopt the T+1 rule.

Special Treatment (ST)

Special Treatment or ST status refers to a listed company, which is faced with financial abnormality. Since April 22 of 1998, Shanghai and Shenzhen Stock Exchange announced that firms with financial abnormality will undergo special treatment with "ST" being added as prefix to its stock name.

According to the China Securities Regulatory Commission (CSRC), there are four types of ST stocks. ST refers to firms with losses for two consecutive years, *ST refers to firms with losses for three consecutive years, SST refers to firms with losses for two consecutive years

and the stock split-structure reform not completed, and S*ST refers to firms with losses for three consecutive years and the stock split-structure reform not completed.

For ST stocks, the daily price limit is 5%, only half of that for normal stocks.

Taxes

Securities Investment Income Tax Typically, taxes on returns from security investments take two forms: the capital gains tax and the dividend income tax. In China, there is no tax on capital gains on stock investments. However, tax is levied on dividend income. The tax rate was initially set at 20%, then reduced to 10% in June 2005. Since January 2016, a new differential dividend income tax policy has been applied. Under the new policy, dividend income tax varies with the time period that the dividend distributing security has been held. Specifically, if the security has been held for more than one year, the tax rate is 5%; for one month to one year, it is 10%; for less than one month, it is 20%. This policy is intended to lower the tax rate for long-term investors and restrain speculation on securities with high dividend income.

Stamp Tax on Stock Trading Another tax feature of China's stock market is the transactions tax, which is also referred as the stamp tax. Although the stamp tax has been recently reduced to a fairly low level, of 0.1% on the seller, it was rather high in the early days of the stock market compared with other markets.

Table 1.1: Stamp Tax on Stock Trading

Date	Change
1991/10/10	0.6% to 0.3%
1997/05/10	0.3% to 0.5%
1998/06/12	0.5% to 0.4%
2001/11/16	0.4% to 0.2%
2005/01/24	0.2% to 0.1%
2007/05/30	0.1% to 0.3%
2008/04/24	0.3% to 0.1%

On July 1, 1990, Shenzhen Stock Exchange started charging 0.6% stamp tax on the sell side of the traded value. On November 1990, it started charging 0.6% stamp tax on the buy side as well. Shenzhen Stock Exchange reduced the stamp tax to 0.3% on October, 1991.

On October 3, 1991, Shanghai Stock Exchange also started charging 0.3% stamp tax on both the sell side and buy side. The stamp tax on both stock exchanges was then raised to 0.5% on May 10, 1997, and dropped to 0.4% on June 12, 1998. The stamp tax rate was further reduced to 0.2% on November 16, 2001, and 0.1% on Jan 24, 2005. On the night of May 29, 2007, the Ministry of Finance announced the increase of stamp tax to 0.3%; the stock market plunged sharply on the next day in response to this unforeseen rise in transaction cost. On April 24, 2008, the stamp tax was reduced back to 0.1%. Starting from September 19, 2008, the stamp tax is charged on the sell side only while before that the stamp tax was charged on both the buy and sell side. Table 1.1 exhibits changes in the stamp tax.

1.2 Government Bonds

A History and Development

Since the founding of the People's Republic of China, the history of China's government bond market can be divided into two periods: the first period is in the 1950s, during which the government bonds were issued six times, and the second period is since 1980. From 1959 to 1978, the issuance of government bonds was completely halted. After the reopening of the government bond market in 1981, the market has went through a period of fast growth, with significant improvements in market structure, trading mechanism, regulation, and supervision.

Depending on the issuing body, the Chinese government bonds take two main forms: Treasury bonds which are issued by the Ministry of Finance of the central government, and local government bonds which are issued by local governments. Before 2009, all government bonds issued in China were Treasury bonds. The total issuance amount of Treasury bonds increased from CNY 5 billion in 1981 to to CNY 1.4 trillion in 2009, and recently to CNY 2.9 trillion in 2016. The first local government bonds was issued in April 2009 by Xinjiang Uyghur Autonomous Region. Since then, the local government bond market has experienced tremendous growth, the issuance size has quickly increased from only CNY 200 billion in 2009 to CNY 6.0 trillion in 2016. By the end of 2016, the total government bonds deposited at China Central Depository & Clearing Co. (CCDC) reached CNY 22.1 trillion, of which CNY 11.4 trillion are Treasury bonds and CNY 10.6 trillion are local government bonds.⁴ Due to the short

⁴See Monthly Statistical Report of CCDC, 2016-12: <http://www.chinabond.com.cn/jsp/include/EJB/tjyb->

history of the local government bonds, our discussion in this paper will focus primarily on the Treasury bonds.

The Treasury bonds in China takes three forms: book-entry bonds, savings bonds and bearer-form bonds. Treasury bonds were mostly issued in the form of bearer-form bonds during the early years, and were gradually switched to book-entry bonds and savings bonds. Since 1998, no bearer-form bonds have been issued, and the Treasury bonds are issued in the form of either book-entry bonds or savings bonds. With book-entry bonds, ownership of bonds is recorded electronically and under general depository of the CCDC. Investors of book-entry Treasury bonds were used to be limited to commercial banks and individual investors. Now, insurance companies, security firms and funds institutions also play an important role in this market. In addition, the market liquidity has improved significantly over time. With the implementation of a centralized market making and clearing system, the trading cost decreased while the market depth increased.

Savings bonds are issued to individual investors through commercial bank counters. Savings bonds have an important feature that they can only be held to maturity or be redeemed earlier, and can not be circulated in the secondary market. Saving bonds are issued either in the form of certificates or electronically, in which the electronic savings bonds are under general depository of the CCDC. Compared with book-entry bonds, the market size of savings bonds is relatively small. In 2016, the total issuance of electronic savings bonds is CNY 199 billion, only around 10% of the total CNY 2.7 trillion issuance of Treasury bonds in book entry forms.

In the early years, the maturity of Treasury bonds was limited to three to five years. In more recent years, the maturity expanded to 15, 20, 30 and even 50 years. In what follows, we will refer to bonds with maturities no greater than one year as short-term, bonds with maturity between two and five years as medium-term, and bonds with maturity more than five years as long-term. In terms of both the number of bonds and the amount outstanding, the medium- and long-term Treasury bonds dominate the current Treasury bond market.

more.jsp. Most of the data on Chinese bond markets for the rest of this section are from the monthly statistical report of CCDC.

B Market Structure

The secondary market for Treasury bonds consists of three components: the exchange market, the interbank market and the commercial bank over-the-counter (OTC) market. In this multi-part market structure, the interbank bond market is the largest in size, the exchange market is the most active in trading, and the commercial bank OTC market is only supplementary. Figure 1.4 illustrates the structure of the secondary market for government bonds:

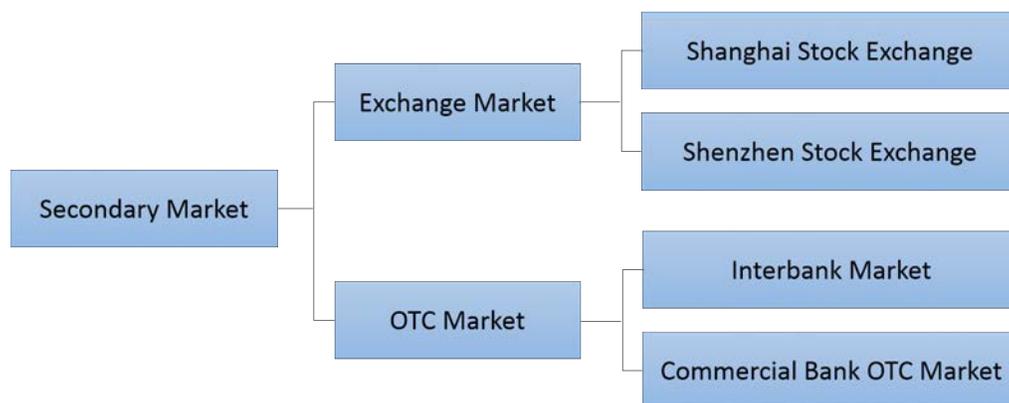


Figure 1.4: Structure of Secondary Bond Market

The interbank bond market uses the primary depository structure, while the exchange bond market and commercial bank OTC market use the two-level depository structure. CCDC is responsible for the overall bond depository in all bond markets and the primary depository in the interbank market. In the exchange bond market and the commercial bank OTC markets, CCDC is the primary depository and the China Security Depository and Clearing Co. (CSDC) and commercial banks themselves are the secondary depository, respectively.

Exchange Market

A subset of book-entry Treasury bonds are listed and traded on the two main stock exchanges, in Shanghai and Shenzhen. Currently, the transaction volume of Treasury bonds on the Shanghai Stock Exchange far exceeds that on the Shenzhen exchange. Saving bonds, which are target for individual investors at the commercial bank OTC market, can not be listed or traded in the exchange market.

By the end of 2016, the par amount of book-entry Treasury bonds listed on the exchange market reached CNY 635 billion, making up 5.89% of the total amount outstanding (par

value) of book-entry Treasury bonds. In 2016, the issuance size of book-entry Treasury bonds on the two exchanges was merely CNY 173 billion, making up 6.30% of the total issuance size of book-entry Treasury bonds in the year.

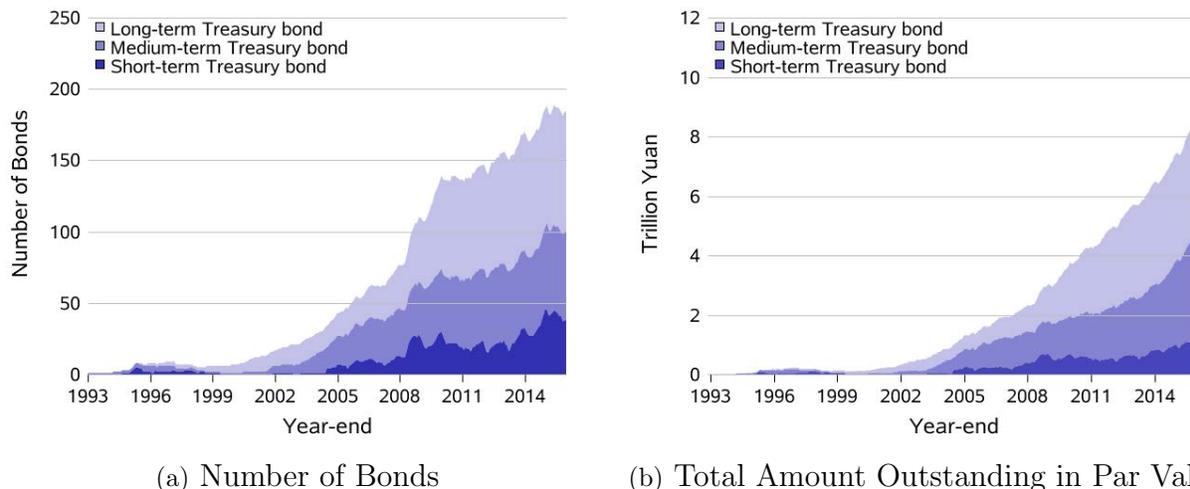


Figure 1.5: Treasury Bonds on the Shanghai Stock Exchange

Figure 1.5 (a) shows the number of Treasury bonds traded on the Shanghai Stock Exchange and Figure 1.5 (b) shows the bonds total amount outstanding in par value for different maturities. Since many Treasury bonds listed on the Exchange are often traded in multiple markets, the amount outstanding in Figure 1.5 (b) measures their total amount outstanding in par-value across all markets, including exchanges, inter-bank market and the commercial bank OTC market.⁵ The number of Treasury bonds remained stable between 1993 and 2001, and began to increase since 2003. From 2003 to 2007, Treasury bond issuance increased at a high pace and the number of bonds listed on Shanghai reached above 50 by the end of 2007. After a stimulus package was released during the global financial crisis in 2008, a large amount of Treasury bonds were issued, which is reflected in both figures. The total number of bonds listed on Shanghai reached 110 by the end of 2009. Overall, the number of medium-term and long-term Treasury bonds exceeds that of short-term Treasury bonds. The Treasury bonds listed on the exchanges enjoy high levels of trading frequency and turnover.

⁵The data for the Treasury bonds traded on the exchanges is from WIND.

Interbank Market

The interbank bond market is a typical over-the-counter market. In 1997, the People's Bank of China (PBOC) banned spot and repo transactions in Treasury bonds by all commercial banks on stock exchanges. Instead, they were permitted to use bonds deposited at CSDC, such as Treasury bonds, Central bank bills, and policy bank bonds, to conduct spot and repo transactions through the trading system of the National Interbank Funding Center, which later became the interbank bond market.

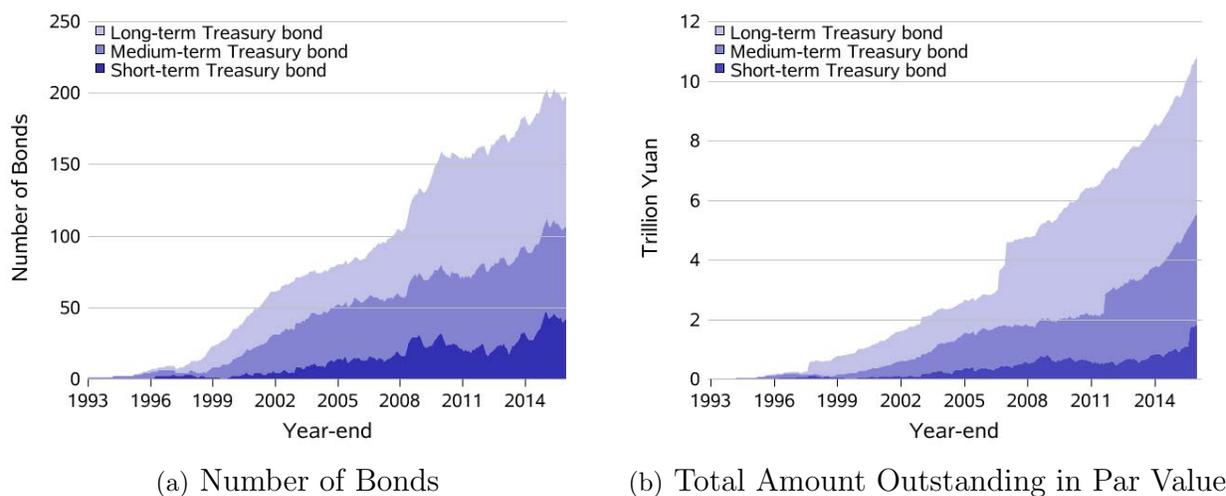


Figure 1.6: Size of Interbank Market for Treasury Bonds

By the end of 2016, book-entry Treasury bonds deposited at the interbank bond market reached CNY 10.1 trillion, making up 94.08% of the total amount outstanding of all book-entry Treasury bonds. The new issuance size of book-entry Treasury bonds in the interbank market was CNY 2.6 trillion in 2016, making up 93.70% of the total issuance amount of book-entry Treasury bonds in the year. Saving bonds, which are target for individual investors at the commercial bank OTC market, can not be listed or traded in the interbank bond market.

Figure 1.6 (a) shows the number of book-entry Treasury bonds traded in the interbank market and Figure 1.6 (b) shows their outstanding amount in par value, by different maturity ranges.⁶ Shortly after the interbank market was established, the number of Treasury bonds deposited at the interbank bond market was far less than that on the exchanges. However, it started to increase sharply since 1999. By the end of 2009, the number of short-term Treasury

⁶The data for the Treasury bonds traded in the interbank market is from WIND.

bonds reached around 30, and that of long- and medium-term Treasury bonds reached over 100 in total. The number of Treasury bonds soared since 2009 and reached to approximately 200 by the end of 2016. It is also worth noting that the amount outstanding of the Treasury bonds abruptly increased at the second half year of 2007, from CNY 3 trillion to nearly CNY 4.5 trillion, largely due to the issuance of special government bonds in 2007.

Figure 1.7 shows the time to maturity of Treasury bonds traded in the interbank bond market and on the Shanghai Stock Exchange. Here, only the equally-weighted average maturity for all the bonds outstanding is presented. The average maturity when weighted by total amount outstanding exhibits a similar pattern.

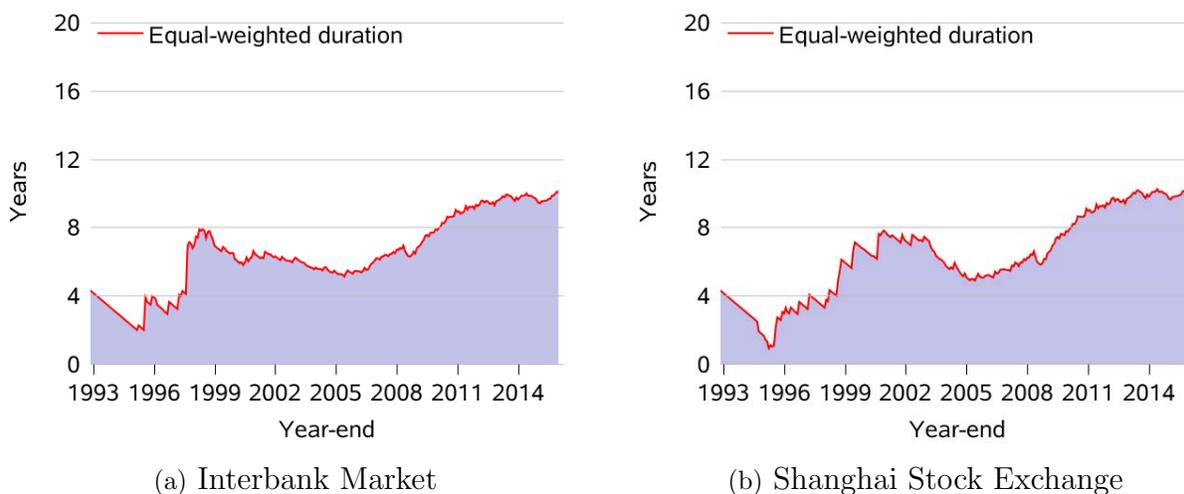


Figure 1.7: Maturity of Treasury Bonds

Apparently, the average maturity for Treasury bonds traded in the interbank market grew overall during the sample period, from the beginning of 1994 to the end of 2016. Up until 1999, the average maturity rarely exceeded four years. It then increased to close to eight years and stayed around six years until 2003. After dropping below five years in 2006, the average maturity of government bonds started to climb again above eight years in 2011 and reached above nine years in 2016. The maturity structure for the Treasury bonds traded on the Shanghai Stock Exchange experienced a similar evolution.

Commercial Bank OTC Market

The commercial bank OTC market is another type of OTC market for government bonds, and the main participants are individual investors, who can trade Treasury bonds with commercial

banks at their branches.

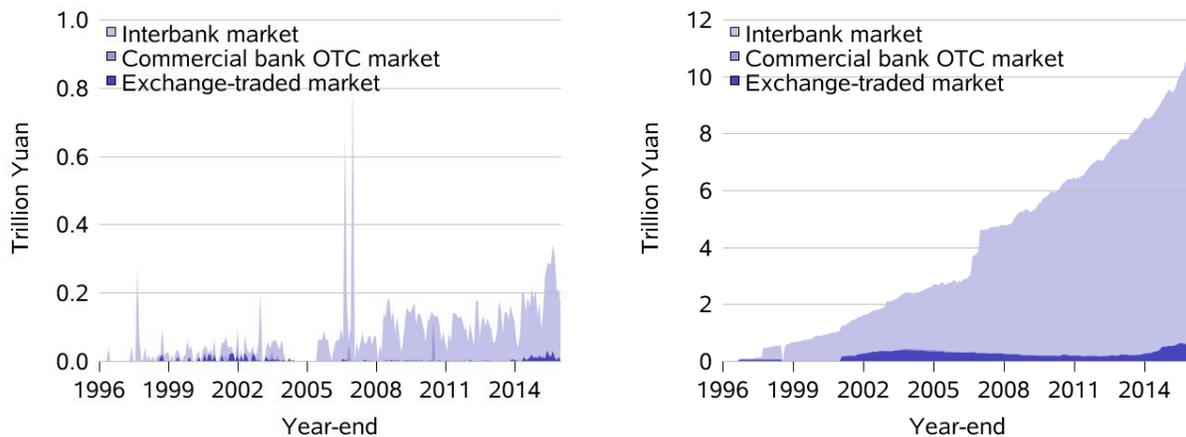
The market began in 2002, when the four state-owned commercial banks - the Agricultural Bank of China (ABC), the Industrial and Commercial Bank of China (ICBC), the Bank of China (BOC) and the Construction Bank of China (CBC) - were allowed to sell Treasury bonds at their branches. Later, they were also allowed to buy back these bonds. Now, it is only an extension of the interbank bond market to individual investors and small and medium size institutional investors. The salient feature of this market is that participants are allowed to trade only with banks.

Majority of the bonds traded in the commercial bank OTC market are savings bonds. In the year 2015, the issuance size of book-entry Treasury bonds in the commercial bank OTC market was only CNY 0.1 billion, making up 0.01% of the total issuance of book-entry Treasury bonds in the year. In the year 2016, no book-entry treasury bond is issued in the commercial bank OTC market. By comparison, all of the CNY 199 billion savings bonds (in electronic form) are issued at the commercial bank OTC market. By the end of 2016, the book-entry Treasury bonds deposited at the commercial bank OTC market is merely CNY 2.6 billion, taking up only 0.02% of the total amount outstanding of all book-entry Treasury bonds. By comparison, all of the CNY 0.7 trillion savings bonds (in electronic form) are deposited at the commercial bank OTC market.

The Fortunes of the Three Markets

Figure 1.8 (a) shows the monthly issuance size and Figure 1.8 (b) shows the total amount outstanding in par value of all Treasury bonds, including both book-entry Treasury bonds and Savings bonds, by the three markets from early 1997 to the end of 2016.

There are four peaks in Treasury bond issuance before 2008. The first occurred in the first half of 1998, when special Treasury bonds of CNY 270 billion were issued to raise capital for the four state-owned commercial banks, an amount high enough to meet the capital adequacy ratio required by Basel II. The second spike happened in 2003, when the funds raised were mainly used to stimulate the weak economy as a result of the crisis surrounding the outbreak of Severe Acute Respiratory Syndrome (SARS). The last two spikes appeared in the second half year of 2007, when two special Treasury bonds, with total issuance size of CNY 1.5 trillion, were issued by the Ministry of Finance to fund the China Investment Corporation, making the



(a) Monthly Issuance Size

(b) Total Amount Outstanding in Par Value

Figure 1.8: Monthly Issuance Size and Total Amount Outstanding of Treasury Bonds

total amount outstanding jump from approximately CNY 3 trillion to approximately CNY 4.5 trillion. To deal with the financial crisis at the end of 2008, the Chinese government started a *stimulus package* of CNY 4 trillion. As a result, the monthly issuance size of Treasury bonds often exceeded CNY 100 billion, showing periodic peaks.

It is also clear that most of the growth occurred in the interbank market, which dominated in terms of market size. The exchange market experienced modest growth until 2004, when it started to shrink in size. The commercial bank OTC market remained small until 2007, but has started a modest growth since 2008.

Although the three markets are mostly segregated by types of bonds and investors, there is limited space for cross-market depository transfer. For example, investors could transfer certain Treasury bonds originally deposited in the interbank bond market to exchanges or the commercial bank OTC market and vice versa. However, such transfers remain restricted to a given set of bonds.

C Organization of Treasury Bond Market

Treasury Bond Investors

The investors of government bonds vary across the three markets.

- **Exchange Market:** The participants in the exchange market are mainly medium and small size investors, including individual investors, non-financial firms as well as security

firms, funds institutions and insurance companies.

- **Interbank Bond Market:** The participants in the interbank bond market are all large institutional investors, such as commercial banks, credit cooperatives, security firms, insurance companies and funds institutions.
- **Commercial Bank OTC Market:** In this market, the participants are mostly individual investors who trade with commercial banks.

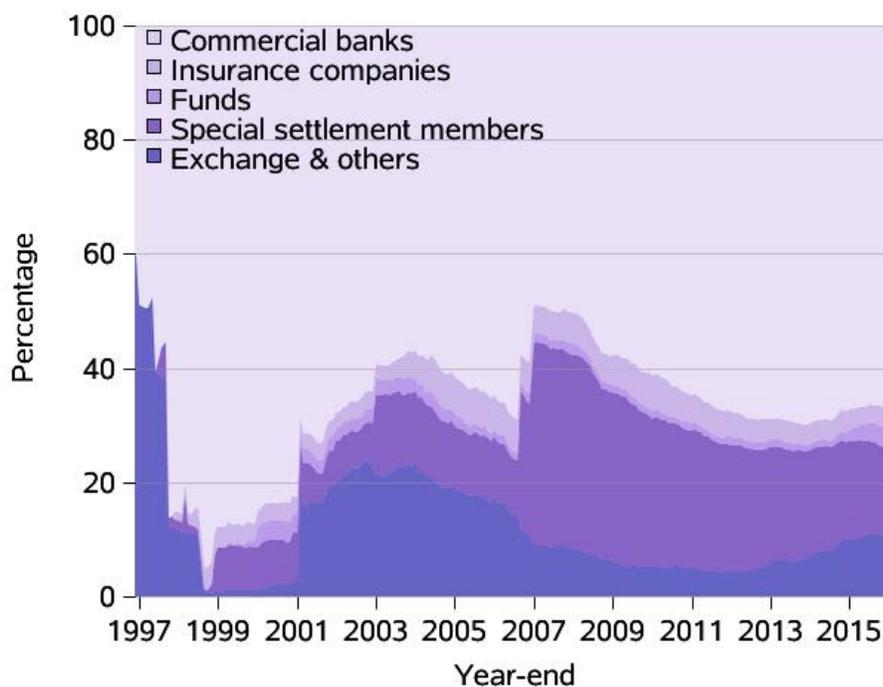


Figure 1.9: Treasury Bond Holdings

Figure 1.9 shows the breakdown of different classes of investors holding Treasury bonds, covering Treasuries with all maturities, depositories and markets, from late 1997 to the end of 2016. At the end of 2016, of CNY 10.8 trillion Treasury bonds, commercial banks held 67.07%, special settlement members held 15.09% and insurance companies held 3.23%.⁷ It is clear that the main holders of Treasury bonds are commercial banks, which typically hold over 60% of bonds, but the weight has varied substantially over time. At the beginning of our sample period, in late 1997, commercial banks held slightly below 50% of Treasury bonds,

⁷The special settlement members include PBOC, the Ministry of Finance, policy banks, exchanges, CCDC and CSDC. They hold government bonds mainly for liquidity management purposes.

while the other half was deposited on exchanges. The holdings of commercial banks began to gain weight after 1998, half a year after the interbank market was established. It peaked over 90% in 1999, then steadily dropped to around 60% in 2004. At the same time, special settlement members took on more weight and reached nearly 40% at the end of 2007. The decline in holdings of commercial banks continued to about 50% in 2008 before it started to increase again until 2016.

Started in 1998, special settlement members increased their Treasury bond holdings, from close to zero to around 10% of the total market. The category stayed around that level until 2007 when it sharply increased holdings to more than 30%. It decreased slowly thereafter. But by the end of 2016, special settlement members still hold about 20% of the whole market.

Shown in the figure, Treasury bond holdings exhibit some abrupt changes, which are largely a result of institutional shifts. For example, at the end of 1997, right after the establishment of the interbank bond market, with commercial banks banned from exchanges, most of the Treasury bond holdings moved out of the exchanges.

Another important trend is the volatility and the significant decline in market share of the exchange market in recent years. In 1998, the market share was about 50% and dropped nearly to zero in 1999, because of the shift to the interbank market; it bounced back to more than 20% in 2003, then declined to over 2% by the end of 2012 and climbed up slightly in 2016. It is also worth noting that mutual funds held only a very small fraction of the government bonds, no greater than a few percentages, which in part reflects the low level of participation of individual investors in this market.

Trading Mechanism

The exchange market and the interbank market also differ by trading mechanisms.

- **Exchange Market:** The exchange market for Treasury bonds is an order-driven market, similar to stock trading. As mentioned before, the China Securities Depository and Clearing Corporation (CSDC) oversees bond registration, depository, and clearing for bonds traded on the stock exchanges. The exchange bond market adopts a system of centralized registration, two-level depository and net-clearing.

- **Interbank Market:** Compared with the exchange market, the interbank market is a wholesale, quote driven market. China Central Depository and Clearing (CCDC) oversees registration, depository and clearing for the interbank bond market. Different from the exchange market, all members of the interbank market directly open bond trading accounts with CCDC, which is directly involved in bond depository and clearing.

Regulation

The regulatory framework consists of two parts: market regulation and institution supervision. The People’s Bank of China (PBOC) and China Securities Regulatory Commission (CSRC) are responsible for market regulation, covering the interbank market and the exchange market, respectively. For institution supervision, the China Banking Regulatory Commission (CBRC) supervises commercial banks and credit cooperatives; the China Securities Regulatory Commission (CSRC) handles security firms and funds institutions; and China Insurance Regulatory Commission (CIRC) oversees insurance companies.

1.3 Corporate Credit Bonds

A History and Development

The corporate credit bonds in China have four main categories: enterprise bonds, corporate bonds, short-term commercial papers, and medium-term notes.⁸ Though these four type of bonds are all issued by entities with corporate credit, they are under different regulatory authorities and are issued and traded in different markets. The issuance of enterprise bonds are approved by the National Development and Reform Commission (NDRC), which is a successor of the State Planning Commission (SPC). Enterprise bonds are issued and traded in both the interbank bond market and the exchange markets, and are under general depository of CCDC. Corporate bonds are regulated by the China Security Regulatory Commission (CSRC). Corporate bonds are issued and traded in the exchange bond market only and under depository of CSDC. Short-term commercial paper and medium-term notes are regulated by the National Association of Financial Market Institutional Investors (NAFMII), which is a self-

⁸Other corporate credit bonds include super-short-term commercial paper, perpetual medium-term notes, collective notes of SMEs, private placement note, asset back notes, project revenue notes, convertible corporate bond, private placement bond of SMEs. Since these bonds are less common, we focus primarily on the four main categories in this paper.

regulatory non-profit association of institutional investors in the inter-bank market in China with delegated power from and under the supervision of the People's Bank of China (PBOC). Short-term commercial paper and medium-term notes are issued and traded in the interbank bond market and under the depository of Shanghai Clearing House (SHCH). Enterprise bonds and corporate bonds are long-term bonds; short-term commercial papers are within one year maturity; and medium-term notes are with maturity ranging from one to ten years.

Enterprise Bonds

The enterprise bonds are issued by enterprises, which include government agencies, enterprises under collective ownership, and state-owned enterprises, etc. During the early years, enterprises needed to first apply for the approval of SPC, and SPC then needed to submit the application to the State Council for review and approval. The redundancy and complexity of the process had curbed the growth of the enterprise bond market. In 2006 and 2007, only CNY 66 billion and CNY 172 billion of enterprise bond were issued, respectively. The issuance process was then significantly simplified in 2008, which led to the liberalization of the enterprise bond market. In 2008 and 2016, the issuance amount increased to CNY 237 billion and CNY 593 billion, respectively.

Corporate Bonds

Corporate bonds are long-term bonds issued by listed companies and non-listed companies. Compared with enterprise bonds, the history of corporate bonds is rather short. Although the Company Act stated that listed companies are allowed to issue debt, it was never carried out until August 2007, when the CSRC starts approving issuance of two corporate bonds with total size of CNY 5 billion. Despite its short history, the corporate bond market has expanded quickly, especially after the CSRC adopted new regulations in 2015. Under the new policy, the issuing body of corporate bonds were expanded from only listed companies to include both listed and non-listed companies. In addition, the corporate bonds were also allowed to be privately placed, as well as public offering. As a result, the total issuance of corporate bonds jumped to 472 number of bonds with total size of CNY 1.0 trillion in 2015, a sharp increase from only 184 number of bonds with total size of CNY 282 billion in 2014. In 2016, the corporate bond market continues to grow fast, 975 number of bonds with total size of

CNY 1.5 trillion are issued during the year.

Short-Term Commercial Papers

Short-term commercial papers are issued by non-financial enterprises with legal person status. This instrument, similar to commercial papers in the U.S., is a direct financing tool with maturity not exceeding one year. Short-term commercial paper first appeared in China in 1989. During the early years, the issuance of short-term commercial paper were highly regulated and needed approval from the PBOC. Nevertheless, a number of scandals occurred, leading to the eventual halt of issuance of short-term commercial papers in 1997. It was until 2005 when the new regulation policy reopened the market. Under the new policy, the issuance of short-term commercial paper switched from the old approval system to the new registration system. In 2016, CNY 608.3 billion of short-term commercial papers were issued and the total deposit amount reached CNY 602.2 billion.⁹

Medium-Term Notes

Medium-term notes, with maturity ranging from 2 to 10 years, fill in the gap between short-term commercial papers and enterprise/corporate bonds. Similar to the short-term commercial papers, medium-term notes are also issued by non-financial enterprises with legal person status, and traded in the interbank bond market.

The first issuance of medium-term notes occurred on April 15, 2008, when the Ministry of Railways and other six companies issued CNY 119 billion of medium-term notes in total. Medium-term notes were used to be issued and deposited at the CCDC before June 17, 2013. Afterward, the newly issued medium-term notes are under depository of SHCH. In 2016, 890 medium-term notes were issued, with a total issuance value of CNY 1.1 trillion.

B Market Structure

China's corporate credit bond market, similar to the government bond market, consists of the exchange market and the interbank market. The issuance of corporate credit bonds in the commercial bank OTC market does occur but is quite rare compared with the other two markets. The total amount outstanding in par value is also small.

⁹Data source: the monthly statistics report (2016-12) provided by the Shanghai Clearing House.

Exchange Market

The exchange market includes the Shanghai Stock Exchange and the Shenzhen Stock Exchange, with the CSDC responsible for bond registration, depository and clearing and the CSRC for market regulation and supervision. Of the four types of corporate credit bonds that we discussed earlier, enterprise bonds and corporate bonds can be traded in the exchange market, while short-term commercial paper and medium-term notes can only be traded in the interbank market.

In 2016, the issuance size in the exchange market was CNY 66.1 billion, making up merely 11.16% of the total issuance of enterprise bond in the year. By the end of 2016, enterprise bond deposited in the exchange market had reached CNY 945 billion, taking up about 26.68% of the total amount outstanding of enterprise bond.

For corporate bonds, the issuance size was CNY 1.5 trillion at the exchange market in 2016; while by the end of year, 2,807 bonds were deposited at the exchange market, with the total par value of CNY 4.3 trillion.¹⁰

Interbank Market

The interbank market for corporate credit bonds is regulated and supervised by the People's Bank of China (PBOC), while the CCDC is in charge of bond registration, depository and clearing. Of the four types of corporate credit bonds, enterprise bonds, short-term commercial papers and medium-term notes can be traded in the interbank market, while corporate bonds can only be traded in the exchange market.

- Enterprise Bond: In 2016, the issuance size in the interbank market was CNY 526.5 billion, 88.84% of the total issuance size of enterprise bond. By the end of 2016, the total amount of enterprise bond deposited in the interbank market reached CNY 2.6 trillion, making up 73.03% of the total amount outstanding for enterprise bond.
- Short-term commercial papers: In 2016, CNY 608.3 billion of short-term commercial paper were issued in the interbank market. The total outstanding amount of short-term commercial paper is CNY 602.2 billion at the end of 2016.

¹⁰Data Source: the 2016 annual report of China Securities Depository and Clearing Corporation.

- Medium-Term Notes: In 2016, 890 number of medium-term notes were issued in the interbank market, with the total par value amount of CNY 1.1 trillion. By the end of 2016, the total amount of medium-term notes deposited in the interbank bond market reached CNY 4.5 trillion, with CNY 3.4 trillion deposited at the Shanghai Clearing House and CNY 1.0 trillion deposited at the China Central Depository & Clearing.

Among the four type of bonds in the category of corporate credit bonds, enterprise bond is the one with the largest size and the longest history. Our discussion below will focus primary on the enterprise bonds. Figure 1.10(a) shows the number of enterprise bonds across all maturities traded in the exchange and interbank markets, from late 1998 to the end of 2016. For enterprise bonds listed on Shanghai Stock Exchange, after a moderate growth initially, the number of bonds reached 50 by the end of 2006 but then decreased. Growth started again at the end of 2008, and its pace sped up in 2012, but dropped in 2015 and then increased slightly in late 2016. The interbank market, however, enjoyed a more robust growth. The number of bonds exceeded 50 in 2005. The pace of growth picked up markedly in 2006, with the number of bonds doubling in less than a year. By the end of 2016, the total number of enterprise bonds reached around 250. Figure 1.10(b) shows that the total market capitalization of enterprise bonds in two markets generally follow the same growth pattern. The sharper increase in market value after 2008 is in part due to an interest rate decrease and a stimulus package that was aimed at rebooting the economy after the global financial crisis.

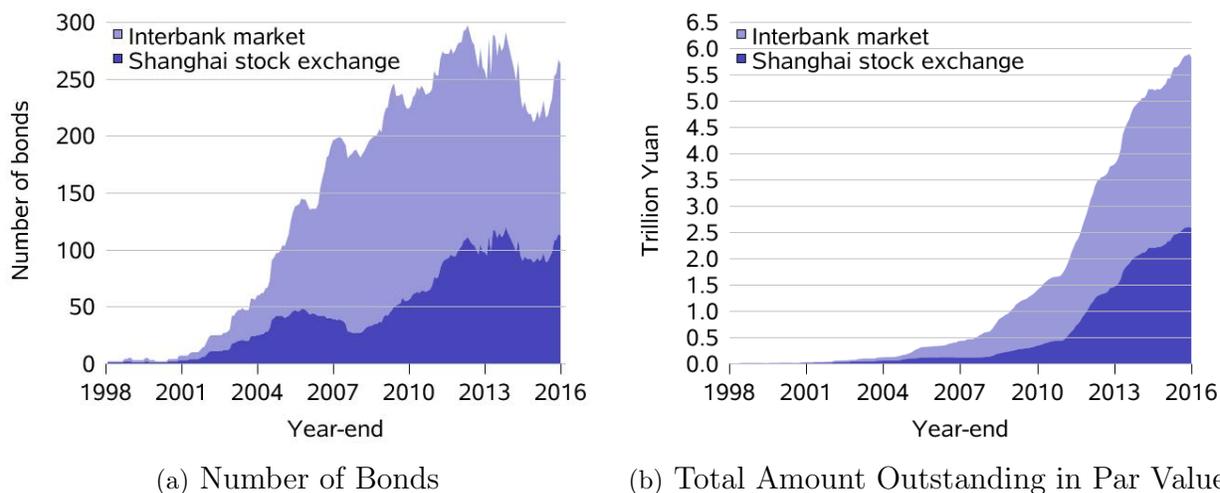


Figure 1.10: Number of Bonds and Total Market Capitalization of Enterprise Bonds

Figure 1.11(a) illustrates the monthly issuance size of enterprise bonds in the three markets from 1997 to 2016. Figure 1.11(b) depicts the total amount outstanding in par value of enterprise over the same period.¹¹ Before 2007, the monthly issuance size was quite small, mostly less than CNY 20 billion. However, since late 2007, it nearly tripled in average. The sharp increase largely resulted from the relaxation on administrative approval of enterprise bonds.

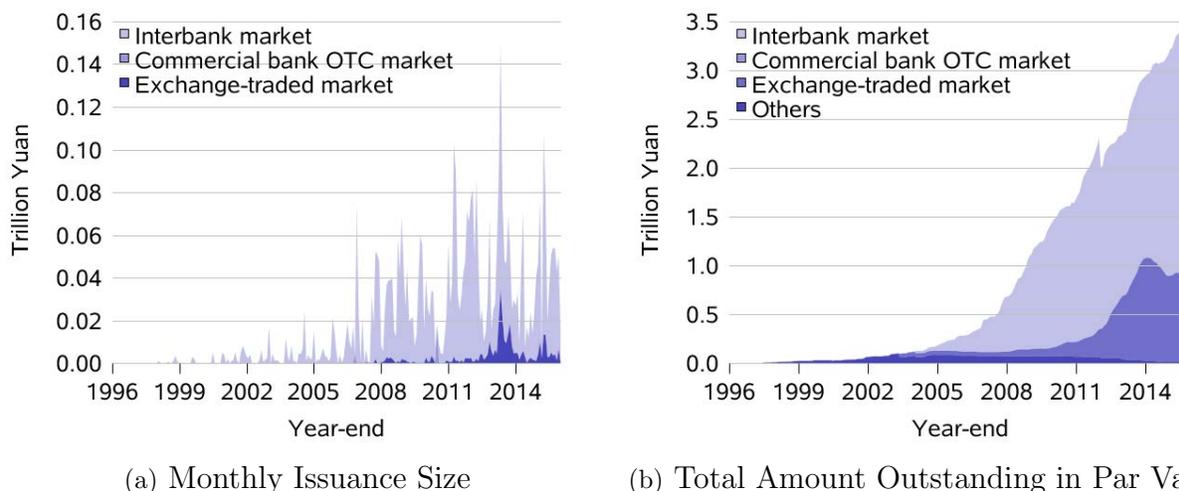


Figure 1.11: Monthly Issuance Size and Total Amount Outstanding of Enterprise Bonds

Figure 1.12 shows the time to maturity of long-term enterprise bonds traded in the interbank bond market and on the Shanghai Stock Exchange.¹² For enterprise bonds in the interbank market, the average maturity stayed around eight years until 2008 and then started a steady decline. By the end of 2016, it has dropped to around four years. For enterprise in the exchange market, the average maturity was quite short initially, less than two years in 2000. It gradually increased to above eight years after 2003, but then started to decline in 2007. By the end of 2016, the average maturity for enterprise bonds in the exchange market fell to around four years.

C The Organization of the Corporate Credit Bond Market

Corporate Credit Bond Investors

The investors of enterprise bonds vary across markets.

¹¹ *Others* stands for enterprise bonds deposited in commercial banks. It was common before 2005.

¹² The data source for the maturity of enterprise bonds is from WIND.

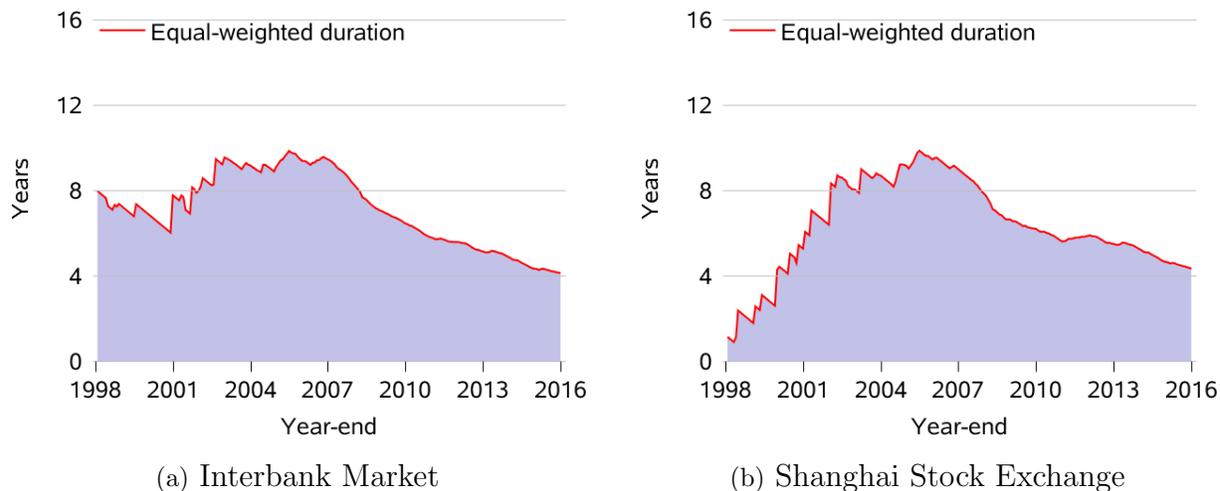


Figure 1.12: Average Maturity of Long-Term Enterprise Bonds

- **Exchange Market:** The participants in the exchange market are mainly small and medium-size investors, including individual investors, non-financial firms as well as security firms, funds institutions and insurance companies.
- **Interbank Market:** Investors in the interbank bond market are mainly large institutions. For enterprise bond, of the total amount outstanding of CNY 3.5 trillion at the end of 2016, commercial banks held CNY 516 billion, insurance companies held CNY 174 billion, and funds institutions held CNY 1.7 trillion. For medium-term notes, of the total amount of CNY 1.0 trillion deposited at China Central Depository& Clearing (CCDC), commercial banks held CNY 361 billion, insurance companies held CNY 95 billion and fund institutions held CNY 478 billion; of the total amount of CNY 3.4 trillion deposited at Shanghai Clearing House (SHCH), commercial banks held CNY 1.0 trillion, insurance companies held CNY 1.3 trillion and fund institutions held CNY 2.1 trillion. For corporate bonds and short-term commercial papers, we don't have detailed data on their investors' holdings.

Figure 1.13 shows the structure of investors in enterprise bonds for all maturities, depositories and markets, from late 2002 to the end of 2016. We observe several changes over time. First, enterprise bonds held through exchanges experienced a drastic decline, from almost 100% in 2003 to below 20% in 2010, which was because of the fast development of the interbank bond market. It had a modest climb back in 2012 and 2016, exceeding 30% by the

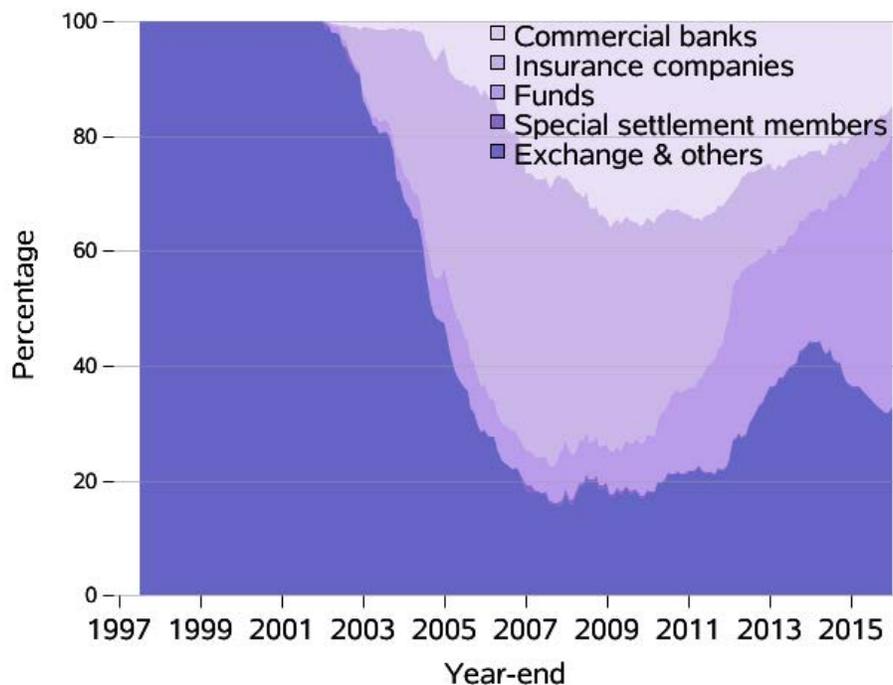


Figure 1.13: Enterprise Bonds Holding

year end. Another major shift is the holding of enterprise bonds by commercial banks. The figure was close to zero at the beginning of the period, i.e., in 2003, but increased to more than 30% in 2009. It stayed at that level since with a slight drop towards 2016. Enterprise bond holdings by mutual funds experienced a large variation during this period. Negligible in 2003, it increased to more about 50% in the middle of 2008 and then dropped steadily to about 20% by the end of 2016. It is also worth noting that special settlement members have increased their enterprise bond holdings steadily during this period, starting from close to zero in 2003 and ending about 20% by 2016. To the extent that enterprise bond holdings through the exchange market are dominated by individual investors, Figure 1.13 clearly shows a shift towards institutional investors in enterprise bond holdings.

1.4 Other Types of Bonds

Beside government bonds and corporate credit bonds described above, there are other types of bonds traded in China's bond market. We briefly introduce two major ones: PBOC bills and financial bonds.

A PBOC bills

PBOC bills are short-term debt certificates issued by the People’s Bank of China to commercial banks, with maturity ranging from three months to three years. In June 2002, to expand the open market operation tools and enhance the efficiency of implementing monetary policy, especially to cope with the fluctuation in foreign exchange reserves, PBOC started issuing bills in the interbank bond market. By the end of 2002, the total amount outstanding reached CNY 14 billion.

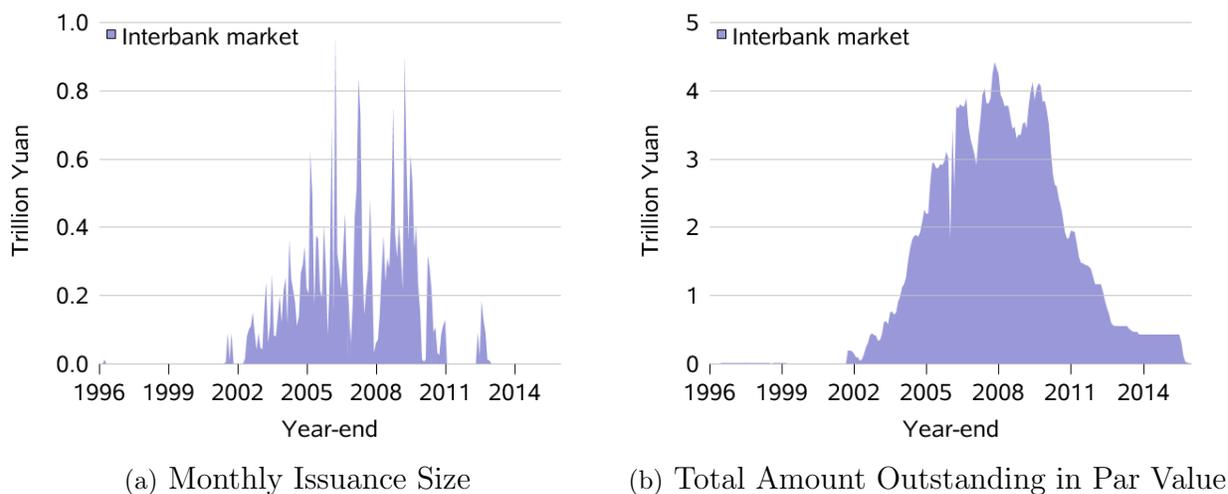


Figure 1.14: Monthly Issuance Size and Total Amount Outstanding of PBOC bills

Figure 1.14(a) shows the monthly issuance size of PBOC bills and Figure 1.14(b) shows the total amount outstanding in par value, from 1997 to 2016. Clearly, this market experienced a fast growth from 2004 to 2010, from CNY 1 trillion to over CNY 4 trillion. However, it began to shrink during 2010 and has dropped to zero by the end of 2016.

B Financial Bonds

Financial bonds refer to bonds issued by policy banks, commercial banks and other financial institutions.

Development

Policy Financial Bonds Policy financial bonds are issued by three policy banks, the China Development Bank (CDB), the Export-Import Bank of China, and the Agricultural Development Bank of China. The three policy banks were established in 1994 as an innovation in

the financial reform, to separate policy banking functions from commercial banks. Initially, lacking nationwide branches as existing commercial banks, the policy banks received their funds mainly from the PBOC and the Ministry of Finance, which were far from sufficient. To make up for the shortage, since 1998 the three policy banks began issuing policy bonds to the four largest state-owned commercial banks and other participants in the interbank bond market. As the policy banks grew in size, so did the policy bond market. By the end of 2016, the total amount outstanding reached CNY 12.4 trillion, making it comparable to the size of the government bond market, which is CNY 22.1 trillion. Within the same year, the issuance size of policy financial bonds is CNY 3.3 trillion, exceeding the total issuance size of all other types of non-government bonds.

Figure 1.15(a) shows the monthly issuance size and Figure 1.15(b) shows the total amount outstanding in par value, from 1997 to 2016. This market has enjoyed a robust growth since its birth. Among the three types of financial bonds, policy financial bonds rank at the top in both issuance size and total amount outstanding.

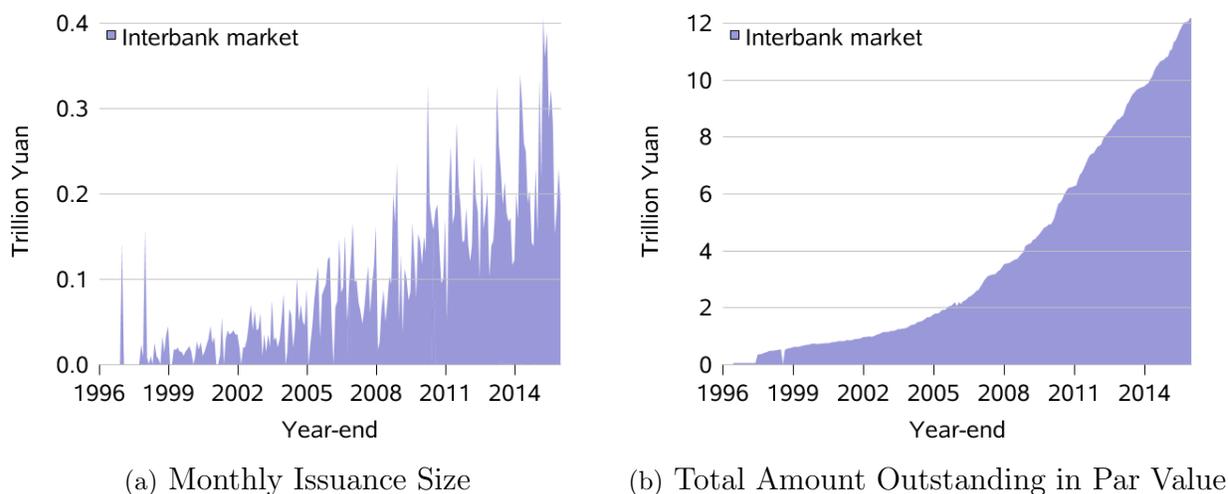


Figure 1.15: Monthly Issuance Size and Total Amount Outstanding of Policy Financial Bonds

Commercial Bank Bonds Three types of bonds are issued by commercial banks: general financial bonds, which are used for daily liquidity needs, subordinated bonds, and hybrid capital bonds. By the end of 2016, the total amount outstanding reached CNY 1.6 trillion, while within that year, CNY 365.7 billion of commercial bank bonds were issued.

Non-Bank Financial Bonds The issuance size and the total amount outstanding of non-banking financial bonds are comparatively small. For 2016, the issuance size was CNY 90.5 billion and the total amount outstanding was merely CNY 209.8 billion by the year end.

Features

Issuance Mechanism When financial bonds emerged, the stock exchanges dominated both the primary and secondary market. The issuance of financial bonds was apportioned to state-owned commercial banks under the instruction of the PBOC. With the establishment of the interbank bond market, which is an OTC market dominated by institutional investors, the market-based mechanism for bond issuance also was also established. Since 1998, the issuance process followed the typical underwriting procedure with book-building and bidding. The interest rates are then determined by the market supply and demand.

High Credit Rating The issuers of financial bonds are usually financial institutions with high credit standing, enabling the financial bonds to enjoy high credit ratings, especially policy financial bonds, which are backed by the central government. Currently, the credit ratings of all financial bonds are above AA.

Long Maturity In general, financial bonds issued by the policy banks are used to support long-term infrastructure projects. The subordinated and hybrid capital bonds issued by commercial banks are supplements of capital, with maturity of no less than five years, while the normal financial bonds are for short term liquidity, with maturity no longer than three years.

2 Historical Returns on Stocks and Bonds

China's capital market has experienced a phenomenal growth since its revival in the early 1990s. A study of its history can reveal the basic relationship between risk and return of the different asset classes in the market. It can also help shed light on how, over a relatively short period of time, it has become one of the most important capital markets in the world. Although what happened in this period are quite unique, given the political, economic and regulatory environment, we can still make useful inferences about the market and its future evolution. The goal of our study is to document the risk and return characteristics of the major asset classes in China's capital market and its evolution over time, including the capital

markets' responses to major events such as regulatory changes, market cycles, inflation and other factors that could affect asset returns.

2.1 Basic Return Series

In the remainder of this paper, we study the statistical properties of basic return series on seven asset classes, namely, large company stocks, small company stocks, long-term Treasury bonds, medium-term Treasury bonds, short-term Treasury bonds, long-term enterprise bonds and a hypothetical asset returning the inflation rate.

Before we present the basic return and risk characteristics of different asset classes, we first provide the definitions of the basic return series of the assets and how they are constructed.

A Large Company Stocks and Small Company Stocks

At the end of each year, from 1992 to 2015, we sort all A-share stocks listed on the main boards of Shanghai Stock Exchange and the Shenzhen Stock Exchange into ten equally populated groups or deciles, according to their floating market values. The stocks listed on the Shenzhen Small and Medium Enterprises Board and the Growth Enterprise Market are then assigned to the appropriate deciles according to their floating market capitalization in relation to the main board breakpoints. Our way of constructing the breakpoints avoid the potential bias that the small size deciles are too dominated by the stocks listed on the Small and Medium Enterprise board and the Growth Enterprise Market, which usually have tiny market capitalization compared with those listed on the main boards. The Large Company Portfolio and the Small Company Portfolio are the first decile and the last decile, respectively.

The portfolios are reformed at the end of each year, and use only stocks with valid market capitalization which is the product of the total floating A-shares and the close prices on the last trading day of the two exchanges during the year. Only floating A-shares are used to compute the total market value or market capitalization of a listed company, for two reasons. First, only floating A-shares are investable for general domestic investors, while non-floating shares or other types of floating shares such as B and H are not. Second, non-floating shares are not actively traded, and their transaction prices are not determined in the open market but through private negotiations, typically benchmarked against book value.

Section 4 contains more details on the construction of size portfolios and their returns.

B Long-term Treasury Bonds

The annual returns on long-term Treasury bonds from 1997 to 2016 are constructed with data on Treasury bonds traded on the Shanghai Stock Exchange. Despite the fact that the total amount outstanding is relatively small on the exchange, trading frequency is much higher than that in the interbank market, providing more reliable market prices. To the greatest extent possible, a one-bond portfolio with remaining maturity of nearly 10 years and a reasonable current coupon is constructed each year. The bond is “held” for the calendar year and the return is computed accordingly.

C Medium-term Treasury Bonds

The annual returns on medium-term Treasury bonds from 1997 to 2016 are calculated with data on Treasury bonds traded on the Shanghai Stock Exchange. Similar to long-term Treasury bonds, one-bond portfolios are constructed to measure the medium-term Treasury bond returns. The bond selected each year is the noncallable bond with maturity of no less than but closest to five years, and is “held” for a whole calendar year.

D Short-term Treasury Bonds

The annual returns on short-term Treasury bonds from 1997 to 2016 are calculated with data on Treasury bonds traded on the Shanghai Stock Exchange. Prior to selecting the short-term benchmark bonds, we construct a monthly trading activity index that indicates the trading frequency of each bond. The trading frequency in each month is computed as the percentage of trading days with positive trading volume within that month. In each month a one-bond portfolio is constructed by selecting a bond with trading frequency greater than 20% in the previous month and remaining maturity closest to one year. To compute holding period returns of the portfolio, we use the bond’s closing prices on the last trading day in the previous and current months. The annual return in a given year is the compounded monthly returns.

Traditionally, the return on short term Treasury bonds is regarded as a risk-free return for the corresponding horizon. However, because the Ministry of Finance rarely issues short-term Treasury bonds, we use the long- or medium-term Treasury bonds with the remaining

maturity closest to one year instead.¹³

E Long-term Enterprise Bonds

The annual returns on long-term enterprise bonds from 2000 to 2016 are constructed with data on enterprise bonds listed on the Shanghai Stock Exchange. At the beginning of each year, a portfolio is constructed with all AAA- and AA-rated enterprise bonds with maturity of no less than seven years. Each bond in the portfolio is “held” for the calendar year and the portfolio return is calculated as the weighted average of individual bond returns in the portfolio. The portfolio weight of each bond is proportional to its issuance size.

F Inflation

The Consumer Price Index for All Urban Consumers, without seasonal adjustment, is used to measure inflation, which is the rate of change of consumer good prices. We use the monthly CPI to compute the hypothetical rate of change of consumer good prices. Monthly changes are then compounded to obtain the yearly CPI change. We will also treat inflation as an asset class, assuming a hypothetical investment that yields a return equal to the inflation rate.

G Wealth Indexes

We consider a hypothetical investment of CNY 1.00 at the beginning of a period in a given asset class. We then compute the cumulative investment return over the given period, which gives us a wealth index associated with that asset class. Thus, the cumulative returns on the seven classes give us the time series of seven wealth indexes.

2.2 Historical Returns on Stocks, Bonds, and Inflation

Figures 2.1, 2.2, and 2.3 present the wealth indexes, i.e., the growth of CNY 1.00 invested in the seven asset classes from the beginning of 1993, 1997 and 2000 to the end of 2016. The reason that three graphs are displayed is that the starting point of data is different across the asset classes. For example, because stock data was available only after 1992, the starting point for large company stocks and small company stocks is January 1, 1993. The transaction data of

¹³An alternative is to use central bank bills with maturity of one year. This will give a risk-free return, at least in nominal terms. However, this choice has two drawbacks. First, central bank bills are mostly issued to commercial banks, not the general public. Second, they have an even shorter history. In addition, they have more volatile issuance patterns, which may lead to additional shocks to their prices.

Treasury bonds with satisfactory quality are not available until 1997. Thus, the starting point for Treasury bond returns is January 1, 1997. As for enterprise bonds, available data started from 2000. Therefore, different asset classes have different time spans. To make different asset classes comparable, returns are shown in three separate figures and the corresponding indexes are adjusted for the same time span.

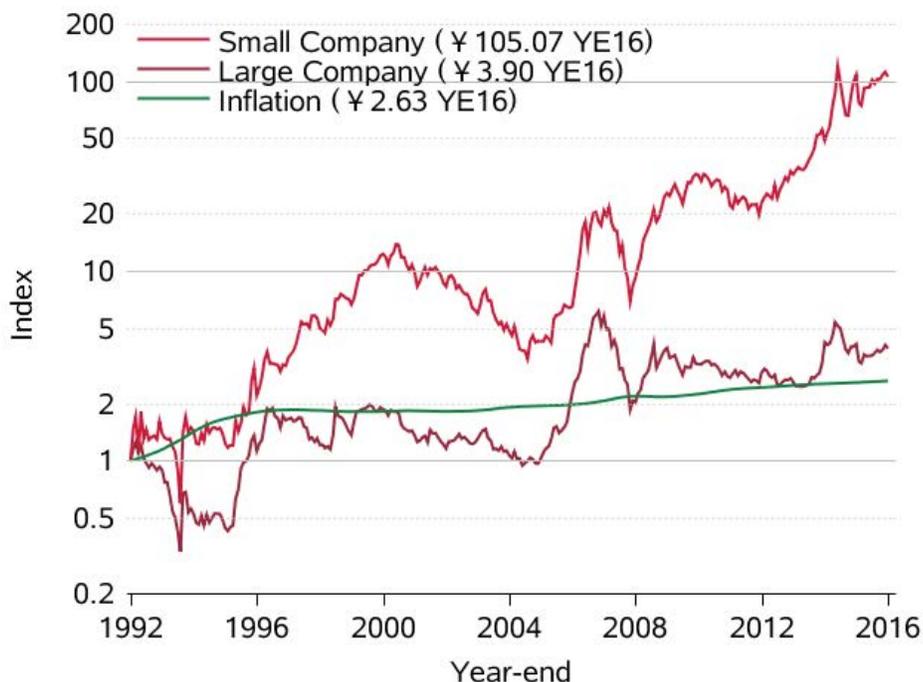


Figure 2.1: Wealth indexes of Investments in the Chinese Capital Market (Year-End 1992 = CNY 1.00)

Figure 2.1 displays the growth of CNY 1.00 invested in large company stocks, small company stocks, and a hypothetical asset that grows at the inflation rate over the period from the beginning of 1993 to the end of 2016. For CNY 1.00 invested in the small stock portfolio at the end of 1992, it will become CNY 105.07 by the end of 2016, while investment in the large stock portfolio will only yield CNY 3.90. Over the same period, if CNY 1.00 is invested in the inflation index, it will turn into CNY 2.63. It is also worth noting that over the 24 years from 1993 to 2016, the growth rate of the large company stock portfolio only narrowly beat the inflation.

In Figure 2.1, we find a significant co-movement between the value of a large-stock portfolio and that of a small-stock portfolio. Both series dropped in the middle of 1994. In the early

1990s, market reforms had significantly improved the life quality of average households. In the meantime, exuberant consumption demand pushed up the prices, resulting in high inflation. In October 1994, CPI increased by 27.5% on year-to-year basis, reaching the historical high point, which is also reflected in the inflation series. The one-year deposit rate climbing up to 10.98% at the same time. Investments were diverted out of the stock market, prompting a decline in the stock index from 833 point to 400 point in 1994. After struggling for nearly two years, large and small company indexes increase sharply during the second half of 1996, leading to the first bullish period in the history of China's stock market. Stimulated by the great enthusiasm of individual investors and pro-growth fiscal policy, the Shanghai Composite Index increased by 65.14% and the Shenzhen Component Index increased by 225.75% in 1996. To ease the market overreaction, the central government introduced several policies, including the increase on transactions tax, to cool down the market, which is reflected in the decrease in both indexes in 1997. Shortly afterward, the small company index bounced back and continued to increase till 2001 when it reached its first all time high. For CNY 1.00 invested in the small stock portfolio at the end of 1992, it would return approximately CNY 9.88 by 2001. After 2001, the stock market turned bearish. In 2005 and 2006, the small stock portfolio declined over 60% from its first peak. After reaching its lowest value in 2005, the small stock portfolio began to recover gradually. In 2007, the small-company index reached its second peak, around CNY 20.77, and the large-company index reached its first historical high. In the same year, the Shanghai Composite Index soared up to 6124, the highest level in history. However, only half a year later, a huge plunge came as a result of the global financial crisis, wiping off nearly all the returns from the previous period. In 2010, the small stock portfolio reached its third peak in history. The large stock portfolio followed a similar pattern in return, except that after the market drop in 2007 and 2008, it recovered only partially, still far away from its highest level in 2007. In the period of 2014 to 2015, the stock market experienced another cycle, running up substantially, especially the small stocks, until the midyear of 2015 and then dropped substantially. From this figure, we also see that the small stock portfolio outperformed the large stock portfolio almost throughout the history of China's stock market.

Figure 2.2 illustrates the growth path of CNY 1.00 invested in large company stocks, small company stocks, long-term Treasury bonds, short-term Treasury bonds and a hypothetical

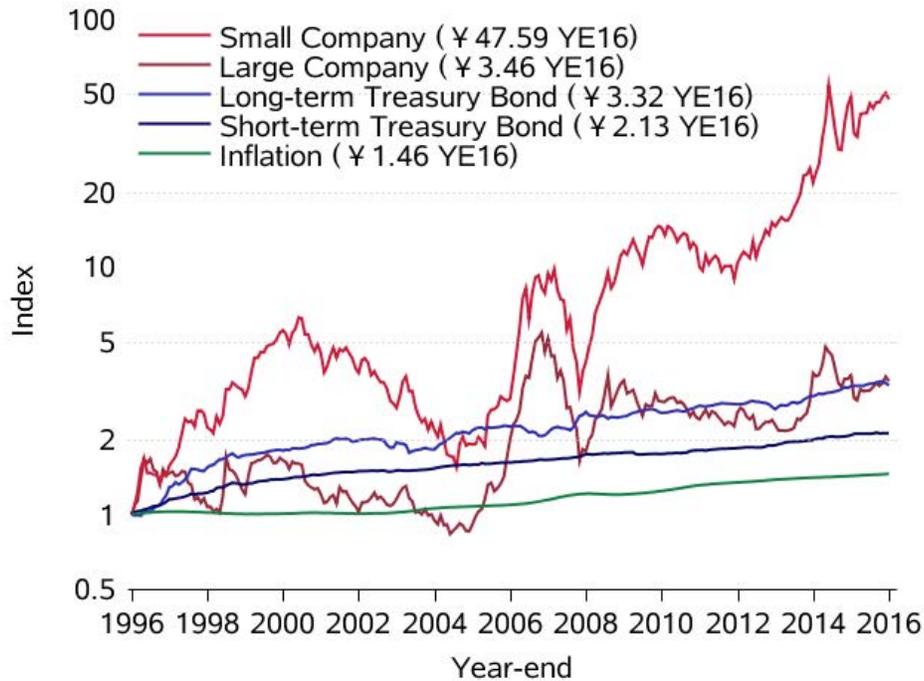


Figure 2.2: Wealth indexes of Investments in the Chinese Capital Market (Year-End 1996 = CNY 1.00)

asset that grows at the inflation rate from the beginning of 1997 to the end of 2016. Different from Figure 2.1, Figure 2.2 has included two more asset classes, the long-term Treasury bonds and the short-term Treasury bonds. The starting year of Figure 2.2 is 1997, instead of 1993 in Figure 2.1. The reason is that before 1997, the number of Treasury bonds was quite small and the quality of data was poor. To make different asset classes comparable, we choose the same time span for all asset classes in Figure 2.2, from 1997 to 2016.

During this period, CNY 1.00 invested in long-term Treasury bonds at the beginning of 1997 grew to CNY 3.32 by the end of 2016, while CNY 1.00 invested in short-term Treasury bonds grew to CNY 2.13. During the same period, such investment in large company stocks and small company stocks grew to CNY 3.46 and CNY 47.59, respectively. Apparently, large company stocks underperformed long-term Treasury bonds in this period. Furthermore, investment in these four asset classes all beat the inflation index in this period, which reached CNY 1.46. As Figure 2.1 shows, large and small company stocks experienced three bullish periods in 1996, 2007, and 2009, and two bearish periods in 2004 and 2008. Compared with the volatile stock indexes, both long- and short-term Treasury bond indexes followed a rather

smooth growth path.

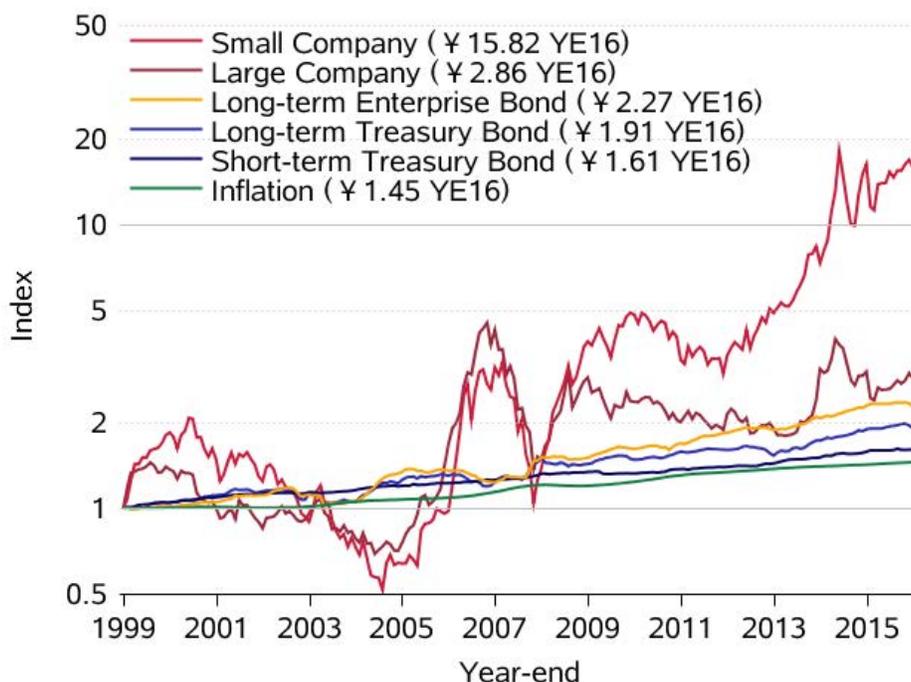


Figure 2.3: Wealth indexes of Investments in the Chinese Capital Market (Year-End 1999 = CNY 1.00)

Figure 2.3 presents the growth of CNY 1.00 invested in large company stocks, small company stocks, long-term Treasury bonds, short-term Treasury bonds, long-term enterprise bonds and a hypothetical asset growing inflation from the beginning of 2000 to the end of 2016. Here, we have added long-term enterprise bonds and shortened the period to start in 2000, which is the first year of available enterprise bond data.

During this period, CNY 1.00 invested in short-term and long-term Treasury bonds at the end of 1999 grew to CNY 1.61 and CNY 1.91, respectively, by the end of 2016. CNY 1.00 invested in long-term enterprise bonds returned CNY 2.27, outperforming Treasury bonds. The growth for investments in large company stocks and small company stocks over the same period were CNY 2.86 and CNY 15.82, respectively, higher than enterprise and Treasury bonds. Furthermore, all of the above five asset classes outperformed inflation during this period, which reached CNY 1.45 by the end of 2016.

All the results above assume that reinvestment of dividends on stocks or coupons on bonds and taxes are exempted. In addition, transactions cost is not considered.

Returns on Large- and Small-Company Stocks

As illustrated in Figure 2.1, the large company stock index, constructed on January 1, 1993, at CNY 1.00, grew to 3.90 by the end of 2016, yielding a compounded annual return of 5.83%. During the same period, the final value of inflation index is CNY 2.63. The inflation-adjusted gross return on large stocks from 1993 to 2016 is then CNY 1.48, reflecting a compounded real return of merely 1.65% per year.

Over these 24 years, small company stocks surpassed large company stocks and other assets. An CNY 1.00 investment in the small stock portfolio on January 1, 1993, increased to CNY 105.07 by the end of 2016, yielding a compounded annual return of 21.40%. Adjusted for inflation during this period, the gross real return on small stocks is CNY 39.95, reflecting a compounded real return of 16.61% per year.

Returns on Short-Term Treasury Bonds

A CNY 1.00 investment in short-term Treasury bonds at the beginning of 1997, which is the starting point of our data on Treasury bonds, would return CNY 2.13 by the end of 2016, yielding a compounded annual return of 3.86%. Adjusted for inflation during this period, the terminal value of this investment amounts to CNY 1.46, reflecting a compounded real return of 1.91% per year from 1997 to 2016.

Over the same period, the large and small stocks grew from CNY 1.00 to CNY 3.46 and CNY 47.59, yielding 6.40% and 21.30% per year, respectively. The inflation-adjusted real returns on large and small stocks in the corresponding period are 4.41% and 19.03%, respectively. Clearly, from 1997 to 2016, stocks outperformed the short-term Treasury bonds.

Returns on Long-Term and medium-Term Treasury Bonds

We now look at long-term and medium-term Treasury bonds, starting from CNY 1.00 at the beginning of 1997. The total return index for long-term Treasury bonds, constructed with bonds with maturity of 10 years, reached CNY 3.32 at the end of 2016. The compounded annual return for long-term Treasury bonds over the 20-year period is 6.18%. Adjusted for inflation, the annualized real return on long-term Treasury bonds over this period is 4.19%.

CNY 1.00 invested in medium-term Treasury bonds at the end of 1996 grew to CNY 2.99, a bit lower than CNY 3.32 for long-term Treasury bonds. The compounded annual total

return for medium-term Treasury bonds is 5.62%, close to the realized return of long-term Treasury bonds. The real return on medium-term Treasury bonds over this period averaged to 3.64%.

Compared with the performance of stocks over the same period, the returns on long- and medium-term Treasury bonds are substantially below that of small stocks and only slightly lower than that of large stocks.

Returns on Long-Term Enterprise Bonds

Long-term enterprise bonds outperformed both long- and short-term Treasury bonds from 2000 to 2016, with a compounded annual growth rate of 4.94%. CNY 1.00 invested in the long-term enterprise bond index at the beginning of 2000 led to CNY 2.27 by the end of 2016. Over the same period, an initial investment of CNY 1.00 returned CNY 15.82 on small stocks, with compounded annual returns for the period of 17.64%; CNY 2.86 on large stocks, with 6.38%; CNY 1.91 on long-term Treasury bonds, with 3.87%; CNY 1.61 on short-term Treasury bonds, with 2.83%; and CNY 1.45 on inflation index, with compounded annual returns of 2.22%. Clearly, long-term enterprise bonds underperformed large and small stocks over this period, but outperformed Treasury bonds and inflation. Because almost all long-term enterprise bonds examined here are issued by state and local government-owned enterprises or agencies, the default risk is negligible. In addition, it is obvious that the stock indexes are far more volatile than fixed-income and inflation indexes, while the latter group generally follows a smoother upward trend.

Inflation

The compounded annual inflation rate from 1993 to 2016 was 4.11%. The inflation index, starting from CNY 1.00 at the beginning of 1992, increased to CNY 2.63 by the end of 2016. It is worth noting that from 1993 to 1996, China went through a high inflation period, with the CPI for urban residents growing by 16% each year with a total increase of 80.5% during this period. However, since the late 1990s, China experienced two periods of moderate deflation, from 1998 to 2000 and 2001 to 2003, with relatively low and stable inflation in other periods in the 2000s.

2.3 Summary Statistics of Total Returns

Table 2.1 lists the summary statistics of annual returns on each of the seven asset classes from 1993 to 2016. Due to data availability, the actual time span for each asset class is different. The set of data for large and small stocks as well as inflation spans 24 years, from 1993 to 2016; data on Treasury bonds have a time span of 20 years, from 1997 to 2016; and data on enterprise bonds spans only 17 years, from 2000 to 2016. The statistics reported are based on the available data.

Table 2.1 reports the arithmetic and geometric means of annual returns on seven asset classes as well as their standard deviation. Obviously, the arithmetic means for stock and bond returns are always greater than or equal to their geometric means. Since the difference between the arithmetic mean and the geometric mean is related to the standard deviation of the series, implied by Jensen's inequality, the difference reflects the volatility of returns to a large extent.

The ranking of the arithmetic mean returns is also in line with the volatility of asset returns. In particular, the small stock index had an annual volatility of 66.44%, the large stock index had a slightly lower volatility of 59.12%. Both the long-term Treasury and enterprise bonds experienced substantial volatility, of 9.94% and 8.93%, respectively, but lower than the stocks. Medium- and short-term Treasury bonds had the lowest volatility of 6.34% and 3.45%, respectively. Due to the high inflation rate in the early sample period, the overall volatility of inflation is quite substantial, reaching 6.16%.

Given the high volatility of wealth indexes, especially for stocks, their geometric means are substantially lower than their arithmetic counterparts. For small stocks, the geometric mean return is 21.40%, while for large stocks it is only 5.83%, which clearly shows the negative impact of high volatility on long-term stock investors over this period.

The statistics reported in Table 2.1 summarizes the performance of seven asset classes over the whole sample period from 1993 to 2016 whenever data is available, while in Table 2.2, we report statistics for the seven asset classes over different sub-periods. The left panel covers the period from 1997 to 2016 and the right panel from 2000 to 2016, when data on all seven asset classes are available. The basic pattern of returns and standard deviation is similar over these different periods. One significant difference is that average inflation is substantially

Table 2.1: Summary Statistics of Yearly Returns (%) (1993 – 2016)

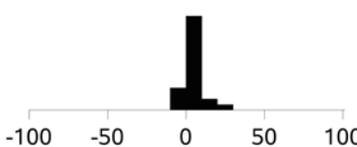
	Geometric Mean	Arithmetic Mean	Standard Deviation	Distribution (%)
Large Company Stocks	5.83	17.79	59.12	
Small Company Stocks	21.40	34.83	66.44	
Long-Term Enterprise Bonds	4.94	5.28	8.93	
Long-Term Treasury Bonds	6.18	6.61	9.94	
Medium-Term Treasury Bonds	5.62	5.80	6.34	
Short-Term Treasury Bonds	3.86	3.91	3.45	
Inflation	4.12	4.28	6.16	

Table 2.2: Summary Statistics of Sub-period Yearly Returns

	1997-2016			2000-2016		
	Geometric Mean	Arithmetic Mean	Standard Deviation	Geometric Mean	Arithmetic Mean	Standard Deviation
Large Company Stocks	6.75	16.82	52.96	6.78	17.81	55.95
Small Company Stocks	19.05	33.84	70.35	15.28	32.03	76.03
Long-Term Enterprise Bonds	4.57	4.90	8.81	4.57	4.90	8.81
Long-Term Treasury Bonds	5.79	6.21	9.86	3.56	3.84	7.99
Medium-Term Treasury Bonds	5.23	5.42	6.42	3.72	3.84	5.21
Short-Term Treasury Bonds	3.69	3.74	3.45	2.70	2.71	1.77
Inflation	1.91	1.93	2.07	2.22	2.24	1.94

lower over these later periods. Another observation is that realized annual returns on large stocks (the geometric mean return) over these two later periods remain comparable to those from long-term Treasury and enterprise bonds.

2.4 Inflation-Adjusted Returns on Stocks and Bonds

The wealth indexes presented in Figures 2.1, 2.2, and 2.3 are nominal. They do not adjust for the change in purchasing power along with the growth of nominal wealth. Figures 2.4, 2.5, and 2.6 present the inflation-adjusted wealth indexes, i.e., the growth of CNY 1.00 invested in the seven asset classes from the beginning of 1993, 1997, and 2000 to the end of 2016, adjusted for inflation during the same period.

Figure 2.4 plots the inflation-adjusted growth of CNY 1.00 invested at the beginning of 1993 in large and small company stocks, respectively, until the end of 2016. Over this 24-year period, the small company stocks experienced substantial growth in real terms. As mentioned before, CNY 1.00 invested in small company stocks at the beginning of 1993 grew to CNY 39.95 by the end of 2016 in real terms, i.e., in 1993 yuan (RMB). In comparison, large company stocks performed poorly – CNY 1.00 grew only to CNY 1.48 by the end of 2016 in real terms, yielding a total return of merely 1.65% over 24 years. It is also observed that



Figure 2.4: Inflation-adjusted wealth indexes of Investments in the Chinese Capital Market (Year-End 1992 = CNY 1.00)

similar to the nominal returns in large and small company stocks, their inflation-adjusted returns also experienced large up and down swings. In particular, the magnitude of these swings is quite similar for large and small company stocks, indicating similar risks for these two asset classes.

Figure 2.5 plots the inflation-adjusted growth of CNY 1.00 invested in large company stocks, small company stocks, long-term Treasury bonds and short-term Treasury bonds from 1997 to 2016. We omitted the real growth of medium-term Treasury bonds as before since it is very close to that of long-term Treasury bonds. Over this period of 20 years, CNY 1.00 invested in the short- and long-term Treasury bonds at the beginning of 1997 grew to CNY 1.46 and CNY 2.27, respectively, by the end of 2016 in real terms. Over the same period, CNY 1.00 invested in the large- and small-company stocks grew to CNY 2.37 and CNY 32.58, respectively, in real terms.

Figure 2.6 presents the inflation-adjusted growth of CNY 1.00 invested in large company stocks, small company stocks, long-term Treasury bonds, short-term Treasury bonds, and long-term enterprise bonds from the beginning of 2000 to the end of 2016. Over this 17-



Figure 2.5: Inflation-adjusted wealth indexes of Investments in the Chinese Capital Market (Year-End 1996 = CNY 1.00)

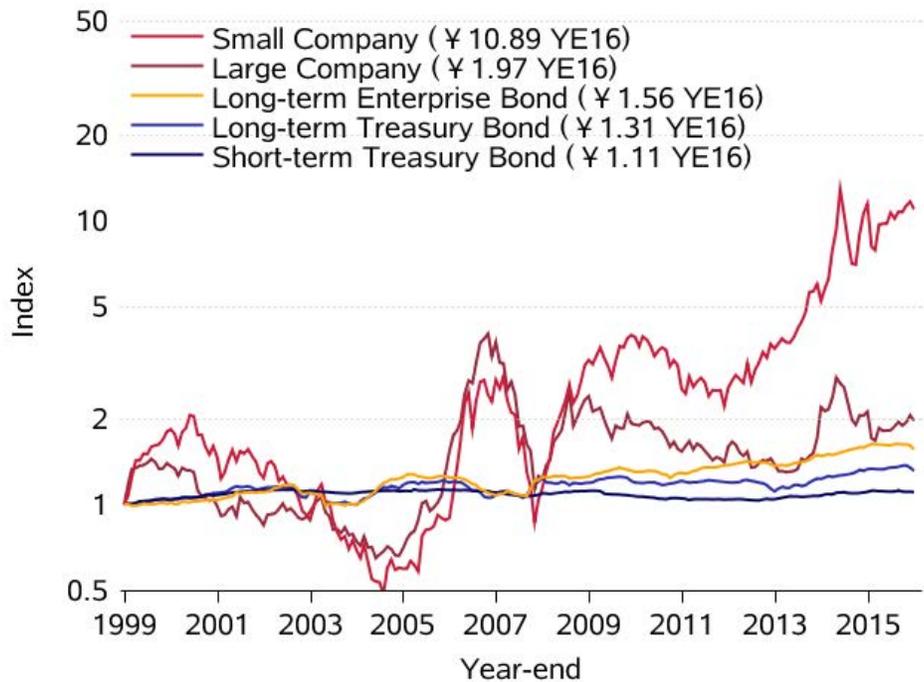


Figure 2.6: Inflation-adjusted wealth indexes of Investments in the Chinese Capital Market (Year-End 1999 = CNY 1.00)

year period, CNY 1.00 invested in the short- and long-term Treasury bonds and long-term enterprise bonds at the beginning of 2000 grew to CNY 1.11, CNY 1.31 and CNY 1.56, respectively, by the end of 2016, in real terms. Over the same period, CNY 1.00 invested in the large and small company stocks grew to CNY 1.97 and CNY 10.89, respectively, in real terms.

Table 2.3 summarizes the inflation-adjusted returns or real returns on the six basic asset classes, over the periods where data is available. Compared with nominal returns described in Table 3.1, the real returns all have lower means. The differences are close to the average inflation rate. Although inflation does vary from year to year, it is in general relatively smooth over short horizons. Under this circumstance, its impact on the return volatility is limited. From the table we see that volatility of inflation-adjusted returns is similar in magnitude to the unadjusted returns.

Table 2.3: Summary Statistics of Yearly Real Returns

	Geometric Mean	Arithmetic Mean	Standard Deviation
Large Company Stocks	1.64	13.75	57.37
Small Company Stocks	16.60	30.22	65.79
Long-Term Enterprise Bonds	2.66	3.00	8.66
Long-Term Treasury Bonds	4.19	4.63	9.97
Medium-Term Treasury Bonds	3.64	3.84	6.67
Short-Term Treasury Bonds	1.91	1.99	4.13

In terms of the long-run performance, from 1993 to 2016, small company stocks did the best, yielding an average inflation-adjusted return of 16.60% per year (the geometric mean return). The large company stocks, however, only yielded an average inflation-adjusted return of 1.64% per year. This even lower than the average return from short-term Treasury bonds, which is 1.91%, which is from 1997 to 2016. Over the same period, medium- and long-term Treasury bonds yielded an average annual, inflation-adjusted return of 3.64% and 4.19%, respectively. Long-term enterprise bonds only yielded an average inflation-adjusted return of 2.66% per year, from 2000 to 2016.

In terms of average yearly returns (arithmetic mean), inflation-adjusted, small company stocks have the highest value of 30.22%, followed by large company stocks at 13.75%. The

substantial difference between arithmetic and geometric mean returns for stocks is due to their high volatility. For bonds, their average yearly inflation-adjusted returns range from 1.99% for the short-term Treasury bonds to 3.84% and 4.63% for medium- and long-term Treasury bonds, respectively, and 3.00% for long-term enterprise bonds.

We also note that for large- and small- company stocks, the standard deviations become slightly lower after adjusting for inflation. On bond returns, inflation has a limited impact of their volatility with the exception of short-term Treasury bonds, for which return volatility increases after adjusting for inflation.

The volatility of inflation-adjusted returns for the six asset classes exhibits similar patterns and magnitudes as for their nominal returns. For the small- and large company stocks, their yearly real returns have a volatility of 65.79% and 57.37%, respectively, which are very close. For short-, medium- and long-term Treasury bonds, the volatility of their yearly inflation-adjusted returns are 4.13%, 6.67% and 9.97%, respectively. For long-term enterprise bonds, their yearly real returns have a volatility of 8.66%.

2.5 Rolling Period Returns

The maximum and minimum annual returns on the basic return series, are shown for one-, five-, and ten-year holding periods in Table 2.4. The table also gives the number of years in which an asset had positive returns, and the number of years that an asset's return was the highest among all those studied. The number of years with a positive/highest return is compared with the total number of observations.

For one-year holding period returns, listed in the top panel, the best year for large stocks was in 1996, while that for small stocks was in 2007. Both had their worst year in 2008. Long-term enterprise bonds received the highest return in 2005 and the lowest return in 2007. Treasury bonds tend to move together, earning the highest returns, ranging from 15.56% to 29.34%, in 1997. Short-term Treasury bonds had their lowest return in 2010; medium-term term Treasury bonds had their lowest return in 2013; and the long-term Treasury bonds had their lowest returns in 2004. In over half of the sample periods, Treasury bonds had positive returns. Small stocks had more positive returns and large stocks had more years with the negative returns.

Table 2.4: Basic Series Maximum and Minimum Values of Returns for 1-, 5-, 10-Year Holding Periods Compound Annual Returns (%) (1993 – 2016)

Yearly Returns	Maximum Return	and Year	Minimum Return	and Year	Times Positive (out of 24 years)	Times Highest Return
Large Company Stocks	155.14	1996	-64.83	2008	10	4
Small Company Stocks	220.25	2007	-55.84	2008	15	10
Long-Term Enterprise Bonds	26.49	2005	-9.23	2007	13	4
Long-Term Treasury Bonds	29.34	1997	-6.48	2004	15	1
Medium-Term Treasury Bonds	19.47	1997	-3.24	2013	16	1
Short-Term Treasury Bonds	15.56	1997	-1.27	2010	19	0
Inflation	24.10	1994	-1.40	1999	20	4

5-year Rolling Period Returns	Maximum Return	and Years	Minimum Return	and Years	(20 overlapping 5-year periods)	Times Highest Return
Large Company Stocks	37.91	2003-2007	-12.76	2008-2012	16	3
Small Company Stocks	58.28	1996-2000	-19.11	2001-2005	17	13
Long-Term Enterprise Bonds	8.43	2008-2012	0.38	1996-2000	17	2
Long-Term Treasury Bonds	14.06	1997-2001	0.49	2009-2013	20	0
Medium-Term Treasury Bonds	10.86	1997-2001	1.62	2009-2013	20	1
Short-Term Treasury Bonds	7.70	1997-2001	1.67	2009-2013	20	1
Inflation	13.16	1993-1997	-0.38	1998-2002	19	0

10-year Rolling Period Returns	Maximum Return	and Years	Minimum Return	and Years	(15 overlapping 10-year periods)	Times Highest Return
Large Company Stocks	14.90	2006-2015	1.48	1993-2002	15	0
Small Company Stocks	38.17	2006-2015	6.31	1999-2008	15	15
Long-Term Enterprise Bonds	6.96	2005-2014	0.58	1995-2004	15	0
Long-Term Treasury Bonds	8.52	1997-2006	3.13	2004-2013	15	0
Medium-Term Treasury Bonds	7.35	1997-2006	3.34	2004-2013	15	0
Short-Term Treasury Bonds	4.96	1997-2006	2.16	2003-2012	15	0
Inflation	6.17	1993-2002	0.92	1997-2006	15	0

For returns on a five-year rolling period, in over 80% of the 20 (overlapping) sample periods, all assets had positive returns. Small stocks had 13 highest five-year returns out of 20. The returns on the ten-year period, exhibited in the bottom panel, have a similar pattern. Given the relative short time period, 15 years in total, the results for ten-year returns are subject to small sample problems.

3 Volatility and Correlations

Statistical analysis of historical asset returns reflects characteristics that include the average return, risk as measured by return volatility, co-movement in asset returns. This section mainly examines the standard deviation, time series and cross section correlation of returns on the seven asset classes.

3.1 Volatility of the Market

Figure 3.1 depicts the volatility of monthly returns of large-company stocks and long-term Treasury bonds. The history of large-company stocks is longer than that of long-term Treasury bonds. In the history of these two assets, in general, the return of large company stocks is much more volatile than that of long-term Treasury bonds. The volatility of large-company stocks was extremely high in the first few years, when only a small number of stocks were traded and there was no daily price change limit. It peaked at the end of 1994. During 2000 and 2004, the volatility is relatively moderate, while from 2006 to 2010, the volatility increased, but was still below the extreme level in early years.

The volatility of the bond market is generally milder. Long-term Treasury bonds were very volatile in 1997 and early 1998. Since 1999, however, the bond market was stable and volatility remained low. In the bearish period from 2008 to 2009, capital redirected to the bond market, resulting in more volatility during that period.

To calculate the monthly return of the whole market, we first calculate the return of individual stocks in each month, and then calculate the portfolio return according to the weight of each stock within the portfolio.

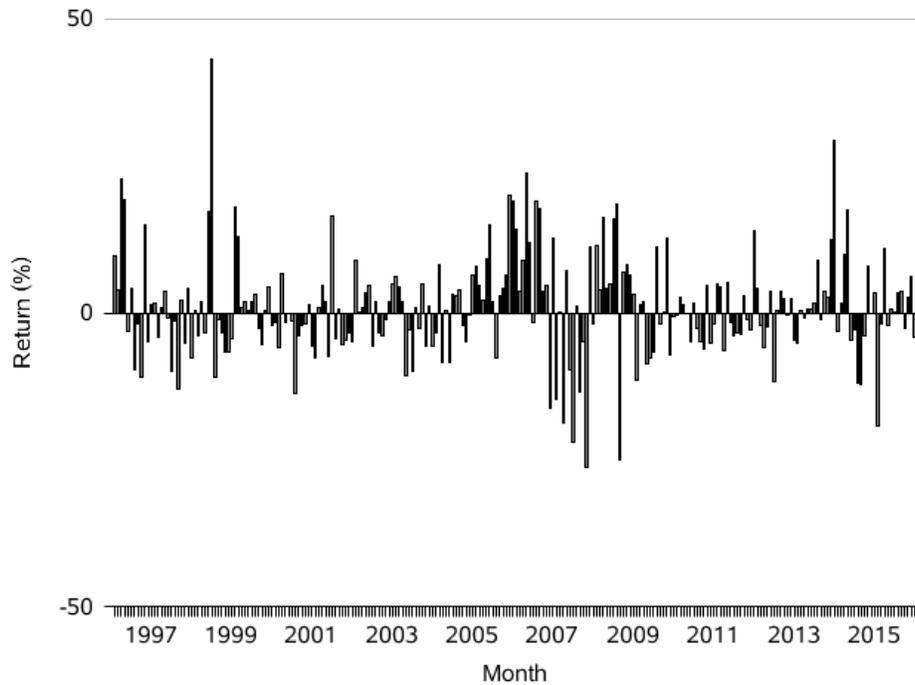
3.2 Serial Correlations

The predictability of an asset return series, classified as random, unpredictable, or subject to a certain trend and periodicity, can be reflected by its serial correlations or autocorrelations. From a theoretical perspective, a highly auto-correlated sequence, with the autocorrelation coefficient equal to 1, can be fully predicted, whereas a sequence with coefficients close to 0 is nearly random and cannot be predicted.

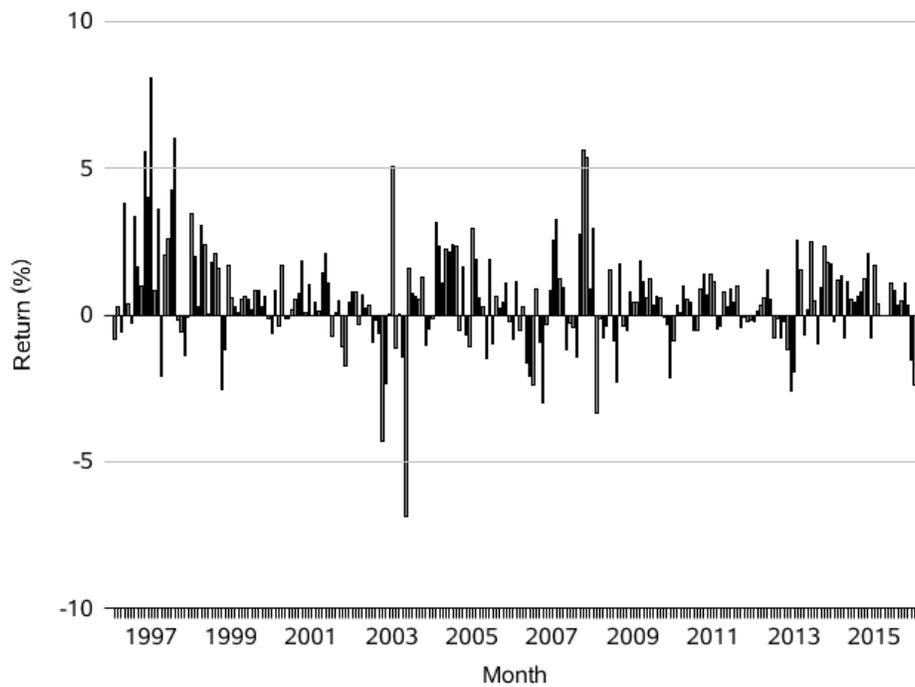
3.3 Summary Statistics of Basic Series

Table 3.1 summarizes the statistical characteristics of annual returns on the seven basic asset classes. For certain assets, total returns include both income and capital appreciation, which are also presented separately.

Table 3.1 shows that from 1993 to 2016, large-company stocks exhibited tremendous risk, with standard deviation of annual returns reaching 59.12%. Their return was unimpressive,



(a) Large Company Stocks



(b) Long-Term Treasury Bonds

Figure 3.1: Month-by-Month Returns on Stocks and Bonds (%)

yielding only 5.83% per year for long-term investors. It consists of 1.53% from income and 4.11% from capital appreciation. We also note that annual returns on large company stocks

Table 3.1: Total Returns, Income Returns, and Capital Appreciation of the Basic Asset Classes: Summary Statistics of Annual Returns

Series	Geometric Mean	Arithmetic Mean	Standard Deviation	Serial Correlation
Large Company Stocks				
Total Returns	5.8	17.8	59.1	-0.06
Income	1.5	1.5	0.8	0.47
Capital Appreciation	4.1	15.9	58.4	-0.06
Small Company Stocks (Total Returns)				
	21.4	34.8	66.4	-0.19
Long-Term Enterprise Bonds (Total Returns)				
	4.9	5.3	8.9	-0.47
Long-Term Treasury Bonds				
Total Returns	6.2	6.6	9.9	0.02
Income	4.2	4.2	2.0	0.85
Capital Appreciation	2.0	2.3	8.4	-0.18
Medium-Term Treasury Bonds				
Total Returns	5.6	5.8	6.3	0.02
Income	4.6	4.6	2.3	0.78
Capital Appreciation	1.0	1.1	5.5	-0.22
Short-Term Treasury Bonds (Total Returns)				
	3.9	3.9	3.4	0.47
Inflation				
	4.1	4.3	6.2	0.78

exhibit a slightly negative serial correlation of **-0.06**, which is quite insignificant.

Small-company stocks are the riskiest asset class with an annual standard deviation of **66.44%**, and provide the greatest rewards to long-term investors in return, with an arithmetic mean annual return of **34.83%** and a geometric mean of **21.40%**. The annual returns on small company stocks exhibit a negative serial correlation of **-0.19**.

Long-term enterprise bonds, long-term Treasury bonds, and medium-term Treasury bonds are all less risky, and they have lower average returns as a consequence. The standard deviation of annual returns on enterprise bonds is **8.93%** and the arithmetic mean is **5.28%**. For long- and medium-term Treasury bonds, annual returns have standard deviations of **9.94%** and **6.34%**, respectively. They have arithmetic mean return of **6.61%** and **5.80%**, respectively. Long-term Treasury bonds have a decomposition of income of **4.19%** and capital appreciation of **1.98%**; medium-term Treasury bonds have **4.60%** and **1.00%**.

We also note that annual returns on long-term enterprise bonds exhibit substantial negative serial correlation of **-0.47**, while returns on long- and medium-term Treasury bonds exhibit

only slightly positive serial correlation of 0.02 and 0.02, respectively.

Short-term Treasury bonds are nearly riskless and have the lowest return of 3.86%. The standard deviation in their returns, 3.45%, reflects the time variation in short-term interest rates, rather than the risk in their returns. We also see strong positive serial correlation reflecting the persistence in short-term interest rates over time.

3.4 Correlations between Asset Returns

Correlations among the returns of different assets represent the commonality in their risks. Common risks are of particular interest because they capture the systematic elements to which the risks the assets are exposed. It is widely believed that systematic risks are ultimately related to the expected returns on these assets.

Table 3.2 presents the cross-correlations between the annual returns on the seven asset classes. Despite diversification within each asset class (except Treasury bonds), the correlation in risks across asset classes is in general quite substantial.

Table 3.2: Basic Series: Serial and Cross Correlations of Historical Annual Returns

Series	Large Stocks	Small Stocks	LT Ente Bonds	LT Tres Bonds	MT Tres Bonds	ST Tres Bonds	Inflation
Large Co Stocks	1.00						
Small Co Stocks	0.73	1.00					
LT Ente Bonds	-0.49	-0.43	1.00				
LT Tres Bonds	-0.27	-0.23	0.90	1.00			
MT Tres Bonds	-0.26	-0.23	0.86	0.98	1.00		
ST Tres Bonds	0.00	0.05	0.38	0.76	0.74	1.00	
Inflation	-0.17	-0.16	0.11	-0.01	-0.06	-0.10	1.00
Serial Correlations	-0.06	-0.19	-0.47	0.02	0.02	0.47	0.78

Returns on large- and small- company stocks exhibit a correlation of 0.73. Somewhat surprisingly, they both exhibit significant negative correlation with returns on enterprise bonds, -0.49 and -0.43, respectively. Stocks also exhibit substantial negative correlation with Treasury bonds. Returns on large-company stocks exhibit negative correlation with long- and medium-term Treasury bonds of -0.27 and -0.26. Small-company stocks exhibit similar negative correlation with long- and medium-term Treasury bonds, with slightly smaller magnitude. Both large- and small-company stocks also have non-trivial negative correlation with

inflation of **-0.17** and **-0.16**.

The correlation between returns on long-term enterprise bonds and long-term Treasury bonds 0.90, meaning strong co-movement between these two assets. This is not surprising. Since enterprise bonds are highly rated, there is limited credit risk, which makes them close substitutes to Treasury bonds and mostly driven by interest rates. The correlation between long-term enterprise bonds and medium-term Treasury bonds is at a similar level, at **0.86**. The correlation between enterprise bonds and short-term Treasury bonds remains significantly positive, but smaller in magnitude, which is **0.38**.

The correlations among Treasury bonds across three maturity ranges are all quite high, above 0.80. The correlation between long- and medium-term Treasury bonds is as high as **0.98**.

If inflation is unanticipated, it should have a negative effect on fixed income securities. Surprisingly, long-term enterprise bond returns are positively correlated with inflation at **0.11**. On the other hand, short-, medium-, and long-term Treasury bond returns are negatively correlated with inflation.

The annual cross-correlations and serial correlations of the four risk premium series and the inflation rate are presented in Table 3.3.

Table 3.3: Risk Premia and Inflation: Serial and Cross Correlations of Historical Annual Returns

Series	Large Stock Premia	Small Stock Premia	Default Premia	Term Premia	Inflation
Equity Risk Premia	1.00				
Small Stock Premia	-0.18	1.00			
Default Premia	-0.34	0.15	1.00		
Term Premia	-0.40	0.10	0.03	1.00	
Inflation	-0.06	0.13	-0.11	0.02	1.00
Serial Correlations	-0.12	-0.01	0.06	-0.24	0.78

We observe that large stock premia is negatively correlated with small stock premia as well as default premia and term premia. Its correlations with default and term premia are quite substantial, at **-0.34** and **-0.40**, respectively. Small stock premia, however, exhibit positive correlation with default and term premia as well as inflation.

Table 3.4 presents annual cross-correlations and serial correlations of the inflation-adjusted

asset return series. It is interesting to see how the relationship between the asset returns change after they are adjusted for inflation. In general, the cross-correlations between asset classes become smaller in magnitude when one accounts for inflation. The serial correlations in inflation-adjusted annual returns also become somewhat smaller in magnitude when compared with nominal returns.

Table 3.4: Inflation-Adjusted Series: Serial and Cross Correlations of Historical Annual Returns

Series	Inflation-Adjusted						
	Large Stocks	Small Stocks	LT Ente Bonds	LT Tres Bonds	MT Tres Bonds	ST Tres Bonds	Inflation
Large Co Stocks	1.00						
Small Co Stocks	0.74	1.00					
LT Ente Bonds	-0.44	-0.37	1.00				
LT Tres Bonds	-0.24	-0.18	0.90	1.00			
MT Tres Bonds	-0.21	-0.15	0.85	0.98	1.00		
ST Tres Bonds	0.05	0.14	0.34	0.74	0.78	1.00	
Inflation	-0.25	-0.25	-0.12	-0.23	-0.37	-0.58	1.00
Serial Correlations	-0.06	-0.17	-0.45	0.17	0.23	0.67	0.78

3.5 Changes in the Risk of Assets Over Time

Investors are also concerned about the change in risk, indicated by the standard deviation or volatility of the return series over different periods. In this section, we examine how volatility of the basic and derived returns series varies over time.

A Annualized Monthly Volatility by Five-Year Periods

Table 3.5 reports the annualized monthly standard deviations of the basic data series by five years sub-periods starting from 1990, reflecting differences and changes in volatility of returns over time.

In terms of overall levels, we find that the volatility of stock returns is consistently much higher than that of bond returns and the inflation rate. Within stocks, small-company stocks are more volatile than that of large companies, as expected. Clearly, asset volatility varied substantially in the period we examine, from 1993 to 2016. The volatility of stocks was extremely high during the first a few years, for both large and small stocks. It then decreased

Table 3.5: Annualized Monthly Standard Deviation by 5-year periods (%)

	1993-1997	1998-2002	2003-2007	2008-2012	2013-2016
Large Company Stocks	62.34	29.44	27.79	32.61	26.74
Small Company Stocks	87.73	29.53	42.66	38.56	43.49
Long-Term Enterprise Bonds	.	2.88	6.25	5.42	3.40
Long-Term Treasury Bonds	.	5.17	6.45	5.18	4.25
Medium-Term Treasury Bonds	.	3.85	3.53	5.46	3.14
Short-Term Treasury Bonds	.	2.24	1.22	1.55	1.67
Inflation	2.02	0.29	0.51	0.77	0.15

over time. But in the period containing the sharp down turn in 2007 in China's stock market, the global financial crisis and then the turbulent period around 2015, stock market volatility went up substantially.

The volatility of bond returns also exhibits a similar pattern in time variation: initially high, decreased during the first half of 2000s, then increased during the second half of 2000s, and fell to a lower level in more recent years.

The volatility of inflation rate followed a similar path, high in the 1990s, dropped significantly in the first half of 2000s, increased during the second half of 2000s, and then returned to a lower level more recently.

B Rolling Period Standard Deviations

Rolling period standard deviations are derived by rolling the fixed-length window along each time series and computing the standard deviation of the asset class in each period. It is a useful tool in examining the volatility or riskiness of assets with holding periods similar to those actually faced by investors. Since the volatility is reported by the end date of the rolling window, it represents the realized volatility during the window, up to the end date.

Figure 3.2 presents the rolling window volatility for large- and small- companies. The data of the monthly horizon are used to enlarge the number of data points in computation.

It is clear that the rolling window standard deviations were relatively large for small- and large- company stocks from 1997 to 1998, and were low from 2001 to 2005. The volatility increases again after 2006 and peaked in 2009. Afterward, the volatility had shown a steady decline trend until the first half year of 2015, and then switched to an upward trend since the market turmoil in the second half of 2015.

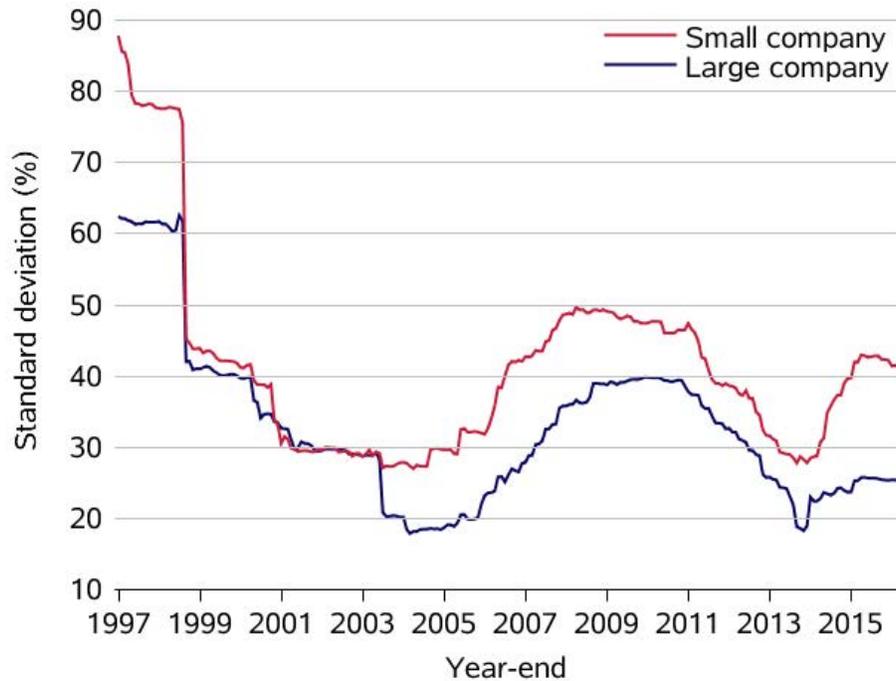


Figure 3.2: Rolling 60-Month Standard Deviation (%) for Large and Small Company Stocks

Figure 3.3 plots the rolling window volatility for long-term, medium-term and short-term Treasury bonds. Monthly data from 1997 to 2016 are used to enlarge the number of data points in computation. Compared with small- and large- company stocks, the rolling window volatility of Treasury bonds is much smaller, ranging from 0 to 2%.

C Rolling Period Correlations

Rolling period correlations are derived by rolling the fixed-length window along each time series and computing the cross-correlation between the two asset classes in each period. It is a useful method in examining how asset classes vary with each other in holding periods similar to those actually faced by investors. Data of monthly horizon are used to enlarge the number of data points in computation.

Figure 3.4 shows the cross-correlation between two asset classes with a rolling period of 60 months. The first rolling period is from January 1997 to December 2001, so the time axis starts at December 2001. The red line shows the correlation between large company stocks and long-term Treasury bonds, which ranges widely between -0.6 to 0.3 over the past 16 years. The blue line reflects the correlation between short-term Treasury bonds and inflation rate,

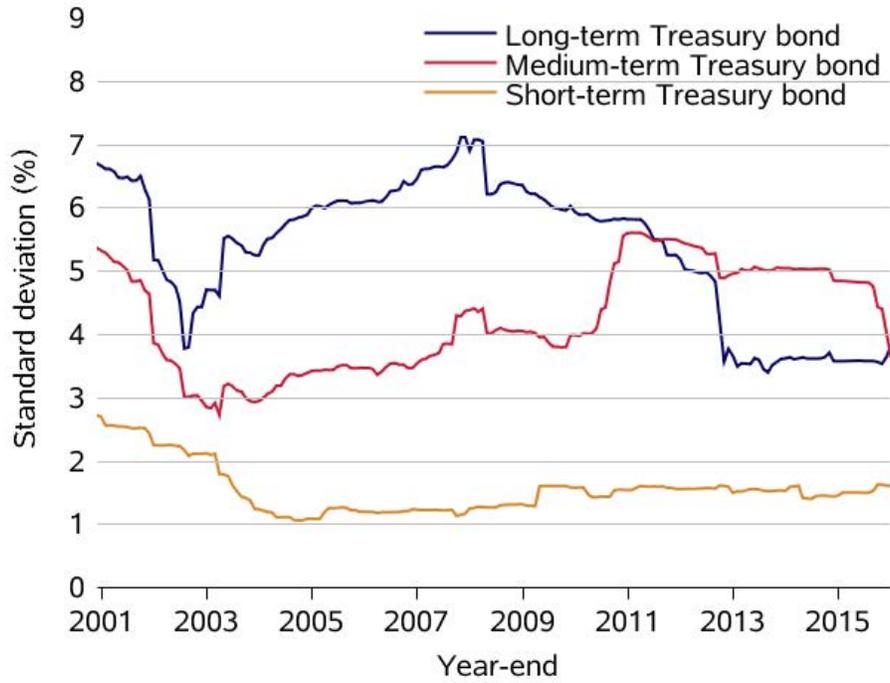


Figure 3.3: Rolling 60-Month Standard Deviation (%) for Treasury Bonds

which was negative before 2007 and turned marginally positive after 2008.

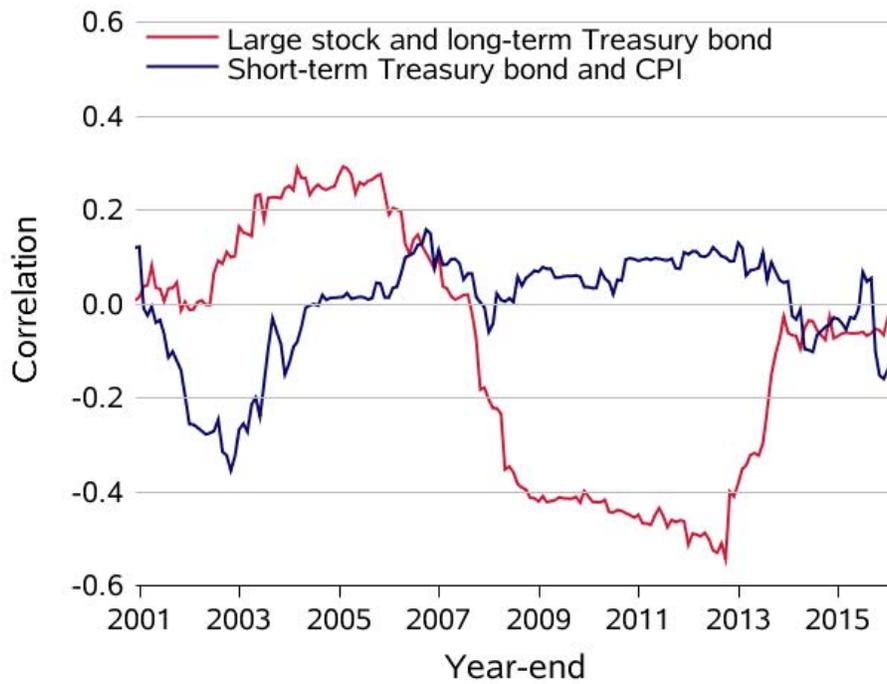


Figure 3.4: Rolling 60-Month Correlations (%) between Stocks and Bonds

4 Firm Size and Return

The relationship between firm size and stock return is one of the most notable findings in modern finance (see, for example, Banz (1981) and Fama and French (1992)). On average, stocks of small companies have higher returns than those of large ones. This phenomenon is also confirmed in previous chapters for the small stocks traded on the Shanghai and Shenzhen Stock Exchanges. The relationship between firm size and return spreads across the entire size spectrum. In this section, returns across the entire range of firm sizes are examined.

The firm size phenomenon is illustrated in the following several ways. Firstly, the greater systematic risk of small-company stocks does not fully explain their higher returns in the long run. In the Capital Asset Pricing Model, only systematic, or beta risk, is rewarded. However, empirical tests show that, small-company stocks have returns in excess of those implied by the betas of small stocks.

Secondly, the difference in annual returns between small- and large-company stocks is serially correlated, implying that annual returns in the past may be valuable in predicting those in the future. Such serial correlation, or autocorrelation, is empirically insignificant in large-company stocks and most other capital markets.

In addition, the firm size effect is seasonal. For example, small-company stocks outperform large-company stocks in February, March, July, August, September and November, but it is the other way around in June and December.

These aspects of the firm size effect, namely, long-term returns in excess of risk, serial correlation and seasonality, will be analyzed after the data are presented.

4.1 Construction of Size Portfolios

To construct the ten size deciles, we use the breakpoints based on the market capitalization of stocks that are listed on the main boards of Shanghai and Shenzhen exchanges at the end of each calendar year. We then assign all A share stocks into ten deciles according to the breakpoints. The portfolios are re-balanced yearly according to their closing market value of the last trading day in the year. In this paper (and this section), decile 1 portfolio represents the largest stocks and decile 10 portfolio represents the smallest.

Appropriate adjustments are made to stock prices to account for corporate events including

dividends, rights offerings, and the Split-Share Structure Reform. The return on a portfolio for one month is calculated as the value-weighted average of the returns for the individual stocks in the portfolio. Annual portfolio returns are calculated by compounding the monthly portfolio returns.

Table 4.1: Size-Decile Portfolio of Bounds, Size, and Composition

Decile	Historical Average Percentage of Total Capitalization	Recent Number of Companies	Recent Decile Market Capitalization (in Thousands)	Recent Percentage of Total Capitalization
1-Largest	44.6%	178	¥18,364,200,112	49.2%
2	13.5	200	4,344,533,234	11.6
3	9.51	242	3,242,067,497	8.68
4	7.48	245	2,412,093,671	6.46
5	6.08	272	2,129,993,969	5.70
6	5.19	282	1,813,908,788	4.86
7	4.42	310	1,645,335,299	4.41
8	3.72	293	1,277,782,911	3.42
9	3.10	358	1,255,090,090	3.36
10-Smallest	2.40	451	860,067,265	2.30
Large-Cap 1-3	67.6	620	25,950,800,842	69.5
Mid-Cap 4-7	23.2	1109	8,001,331,728	21.4
Small-Cap 8-10	9.22	1102	3,392,940,266	9.09

Decile	Recent Market Capitalization (in Thousands)	Company ID	Company Name
1-Largest	¥1,287,280,519	601857	Petrochina Company Limited
2	30,336,646	600153	Xiamen C&D Inc
3	16,185,650	600348	Yang Quan Coal Industry (Group) Co., Ltd.
4	11,136,354	600108	Gansu Yasheng Industrial (Group) Co.,Ltd
5	8,669,662	002326	Zhejiang Yongtai Technology Co.,Ltd.
6	7,058,040	002110	Sansteel Minguang Co.,Ltd.Fujian
7	5,817,107	300096	YLZ Information Technology Co., Ltd
8	4,801,202	600156	Hunan Huasheng Co.,Ltd
9	3,974,487	002478	Jiangsu Changbao Steeltube Co.,Ltd.
10-Smallest	2,917,800	300516	Hubei Jiuzhiyang Infrared System Co., Ltd

Table 4.1 shows the market share of the decile portfolios. It reveals that at the end of 2016, stocks in the top three deciles take up most of market value (nearly 70%), with 178

stocks in the first decile alone taking up nearly one half of the total capitalization. On the contrary, the 451 stocks in the smallest decile represents only 2% of the total market value.

The data in the second column of Table 4.1 are averaged across 24 years. Of course, the proportions represented by the various deciles vary from year to year. The number of companies and market capitalization, listed in the third and fourth columns, gives a snapshot of the structure of each decile at the end of 2016.

The bottom part of the Table 4.1 shows the largest firm in each decile and its market capitalization.

4.2 Returns on Size Portfolios

Summary statistics of annual returns of the 10 deciles and size groupings from 1993-2016 are presented in Table 4.2.

Table 4.2: Size-Decile Portfolio of Summary Statistics of Annual Returns

Decile	Geometric Mean	Arithmeric Mean	Standard Deviation	Serial Correlation
1-Largest	5.8	17.8	59.1	-0.06
2	7.6	19.7	60.8	-0.09
3	10.7	22.7	60.6	-0.14
4	10.2	21.9	59.1	-0.11
5	12.6	24.9	60.8	-0.15
6	13.0	24.1	59.2	-0.15
7	15.5	27.7	62.2	-0.18
8	18.4	31.0	62.9	-0.18
9	20.3	31.9	60.5	-0.15
10-Smallest	21.4	34.8	66.4	-0.19
Large-Cap 1-3	6.8	18.3	58.1	-0.08
Mid-Cap 4-7	12.5	24.1	59.5	-0.15
Small-Cap 8-10	20.1	32.5	62.5	-0.17
All	9.2	20.2	56.7	-0.11

It is clear that the geometric/arithmetric mean return tends to increase when moving from the largest decile to the smallest one. The total risk, or standard deviation of annual returns, also declines with firm size in general. It is also worth noting that while the largest stocks exhibit little serial correlation in their annual returns, medium to small size portfolios do exhibit weakly negative autocorrelation.

For easy comparison, we also group several decile portfolios into portfolios with different size ranges. By pooling together stocks in decile portfolios 1, 2, and 3, we obtain the large-capitalization portfolio. Decile portfolios 4, 5, 6 and 7 form the middle-cap portfolio and decile portfolios 8, 9 and 10 form the small-cap portfolio. The returns characteristics of these three portfolios are reported in Table 4.2 as well. The positive relation between size and mean return as well as volatility remains, although the magnitude is smaller.

The last row of Table 4.2 gives the statistical properties of the return. It has a geometric mean of 9.25%, an arithmetic mean of 20.17%, and standard deviation of 56.73%.

4.3 Long-Term Returns in Excess of Risk

Given that small company stocks tend to be riskier, their higher returns can be at least in part compensation for risk. A benchmark model for the risk premium of an asset as compensation for its risk is the Capital Asset Pricing Model (CAPM). The systematic risk of an asset is measured by its beta with respect to the market. The beta greater than 1 indicates that the security is riskier than the market. According to CAPM, investors are compensated for bearing additional systematic risk.

The Capital Asset Pricing Model (CAPM), however, does not fully explain the higher returns of small-company stocks. Table 4.3 shows the returns in excess of the risk-free rate over the sample period for different size portfolios traded on the Shanghai and Shenzhen stock exchanges. We find that the size premium, which could not be explained by CAPM model, is high across all deciles.

Table 4.3: Size-Decile Portfolios of Long-Term Returns in Excess of CAPM

Decile	Beta	Arithmetic Mean Return (%)	Actual Return in Excess of Riskless Return(%)	CAPM Return in Excess of Riskless Rate (%)	Size Premium (Return in Excess of CAPM)
Mid-Cap, 4-7	1.08	24.08	19.80	15.15	4.65
Small-Cap, 8-10	1.11	32.46	28.18	15.54	12.64

However, based on historical return of the Shanghai and Shenzhen portfolios, returns of smaller deciles are not fully explainable by CAPM model. The residual in excess of CAPM

grows larger as one moves from the largest companies in decile 1 to the smallest in decile 10, and is especially pronounced for small-cap stocks in decile 8-10. This size-related phenomenon has prompted a revision to the CAPM that the size premium should be taken into account.

The CAPM is used to calculate return in excess of the risk-free rate and to compare this estimate with historical performance. According to CAPM, the return of a security consists of the risk-free rate and the excess return. The excess return is computed as multiplying β by the equity risk premium, which is the compensation that investors receive for taking on market risk. The difference between the excess return predicted by the CAPM and the realized excess return is the size premium.

This phenomenon can also be shown graphically, as depicted in Figure 4.1. It is clear that investing in micro-capitalization stock portfolio would receive more than in low- and mid-capitalization stock portfolio. Besides, the mid-capitalization one moves more stable than the others. The security market line is constructed based on the CAPM model without adjusting for the size premium. Given the risk (or beta) of a security, the expected return should fluctuate around the security market line. However, the expected returns of the smaller deciles in the Shanghai and Shenzhen stock exchanges lie above the line, indicating that these deciles have excessive returns.

5 Value and Momentum Investing

In addition to the size premium discussed in the previous chapter, value premium is another widely studied phenomenon in asset pricing (see, for example, Fama and French (1992)). Value (growth) firms, though with various definitions, refer to firms with high (low) fundamental value relative to their market value. Extensive research has shown that value firms have higher average returns than growth firms in the U.S. and many international stock markets. In this section, we exam returns of value and growth stocks in the Chinese market.

On average, value stocks outperform growth stocks from 1993 to 2016. However, a closer look reveals that this out-performance is largely driven by the strong performance of only a couple of years. Considering the relative short history of the capital market in China, it is unclear whether the value premium is robust for the Chinese stock market.

Lastly, we examine the return of the popular momentum strategy. Surprisingly, we find

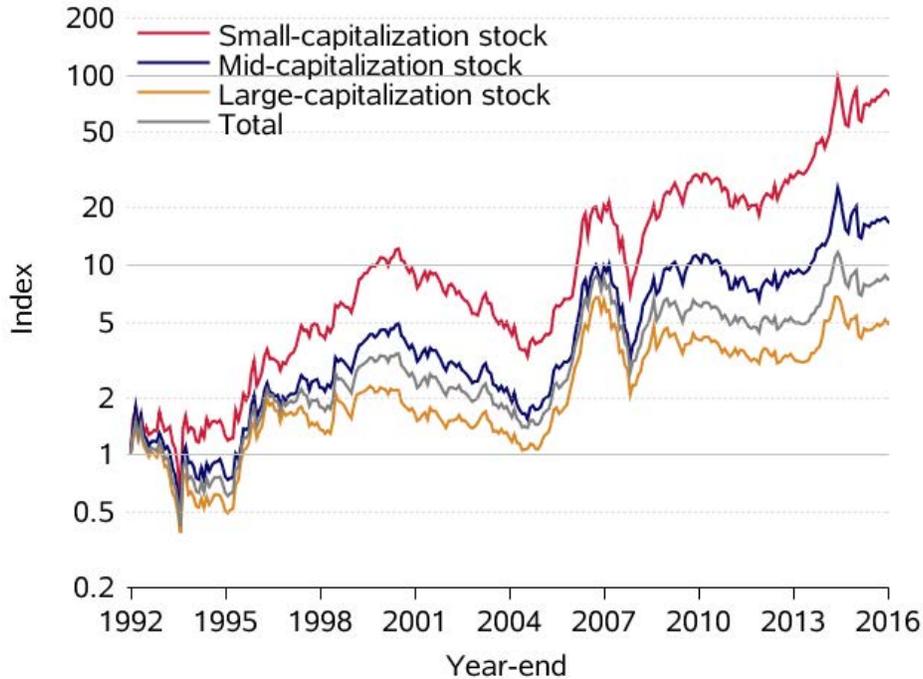


Figure 4.1: Size-Decile Portfolios: Wealth indexes of Investments in Mid-, Low-, Micro-, and Total Capitalization Stocks. Index (Year-End 1992 = CNY 1.00)

no momentum effect in the Chinese stock market. Controlling for firm size, loser stocks with low past returns don't yield different returns from winner stocks with high past returns.

5.1 Construction of the Growth and Value Portfolios

Following the classic Fama-French methodology, we use book-to-market equity ratio (B/M) to define growth and value firms. Considering that Chinese-listed firms often have multiple share classes and domestic investors can publicly trade only floating A shares, we define book-to-market equity ratio as the fraction of book value of equity per share and floating A-share price at the end of December. The numerator is calculated as the total book value divided by the total number of shares, which represents the book value for one unit of floating A shares. Companies with low book-to-market ratios are defined as growth firms, and those with high book-to-market ratios are defined as value firms.

We match B/M ratios for all Chinese firms listed on Shanghai and Shenzhen Exchanges in calendar year $t - 2$ (1991-2014) with the returns from January to December in year t (1993-2016). The accounting data needed for the calculation of B/M ratios are extracted from the firms' annual reports. Because all listed firms end their fiscal year in December

and are required by law to submit their annual reports no later than the end of April, the 12-month lag between accounting data and market returns ensures that book-to-market ratios are publicly available and that the embedded information has been reflected in market prices.

At the end of December of year $t - 1$, two size portfolios are formed by dividing all stocks on the Shanghai and Shenzhen exchanges into two groups according to their floating A-share market capitalization. The breakpoints for the two size portfolios are the median of the floating A-share market capitalization of all A share stocks listed on the main boards of Shanghai and Shenzhen exchanges. The three B/M portfolios are formed by dividing all stocks into three groups by their book-to-market ratios: low, medium, and high. The three subgroups represent the bottom 30%, middle 40%, and top 30%, respectively. The book-to-market ratios are calculated as the ratio of book value per share and floating A-share price at the end of year $t - 2$. The intersection of the two size and the three B/M groups produces six portfolios. The monthly return of each portfolio is calculated as the value-weighted average return of its individual stocks' monthly returns. Portfolios are then held for 12-months and re-formed at the end of year t . Annual portfolio returns are calculated by compounding the monthly portfolio returns over the year, from the beginning of January to the end of December.

We consider only four portfolios in the low and high B/M subgroups, namely, large value, large growth, small value and small growth. By double-sorting stocks by their market capitalization and book-to-market ratios, we can ensure that the size effect on returns is properly controlled and results are purely driven by value and growth. In the discussion below, we will focus on comparing the returns of large value stocks against large growth stocks, and the returns of small value stocks against small growth stocks.

5.2 Historical Returns of the Growth and Value Portfolios

Table 5.1 summarizes annual returns of the four growth and value series. The geometric and arithmetic mean returns suggest that value stocks on average outperform growth stocks. Comparing the two portfolios with large size stocks, the geometric mean of annual return of large value stocks is 10.33%, 6.79 percentage points higher than the mean return of large growth stocks. The arithmetic mean of annual return of large value stocks is 23.14%, 9.73 percentage points higher than the mean return of large growth stocks. In addition, large value

stocks have larger standard deviation (64.57%) than large growth stocks (51.21%). The average return pattern is similar for small stocks. Small value stocks have better returns than small growth stocks, 3.32 percentage points higher in terms of geometric mean and 1.17 percentage points higher in terms of arithmetic mean. The return standard deviation of the small growth stocks is 70.72%, slightly higher than the return standard deviation of the small value stocks of 66.63%.

Although Table 5.1 shows that the returns of value stocks outperform the growth stocks on average, the results are largely driven by a few years in the early period when the Chinese stock market were extremely volatile. For example, the geometric mean of annual return of a portfolio that longs the large value stocks and shorts the large growth stocks drops to only 3.71% for the period from 1997 to 2016, 2.68 percentage points lower than the geometric mean of the portfolio for the period from 1993 to 2016. Similarly, the arithmetic mean of annual return of this portfolio drops to only 6.58% for the period from 1997 to 2016, 3.15 percentage points lower than the arithmetic mean of the portfolio for the period from 1993 to 2016. Considering the short history of the Chinese stock market and the large standard deviations of stocks' returns, it is unclear that the value premium is robust in the Chinese market. In fact, adjusted for volatility, the value premium is not statistically significant for the whole sample period. For more detailed discussion on the value premium, Readers can refer to Hu, Chen, Shao, and Wang (2017).

Table 5.1: Growth and Value Series: Annual Returns (%), 1993 through 2016

	#Years	Geometric Mean	Arithmetic Mean	Standard Deviation
FF Large Growth Stocks	24	3.5	13.4	51.2
FF Large Value Stocks	24	10.3	23.1	64.6
FF Small Growth Stocks	24	15.3	30.6	70.7
FF Small Value Stocks	24	18.6	31.8	66.6

Figure 5.1 gives a graphic presentation of the performance of the four value and growth return series. It plots the accumulated payoff of a hypothetical CNY 1.00 invested at the end of December 1992 in each value and growth portfolio. The payoff for the large value and large growth portfolio moves almost in tandem for most of the period between January 1993 and

the end of 1995. The two series start to diverge from the beginning of 1996, as the payoff for the large value stocks climbs at a faster rate than that of the large growth stocks. After 1996, the figure shows that investing in the large value portfolio always gives a better return than the large growth portfolio. Similarly, the two small size portfolios have similar payoffs until the end of 1995, and the small value portfolio started to yield better payoff relative to the small growth portfolio after 1996.

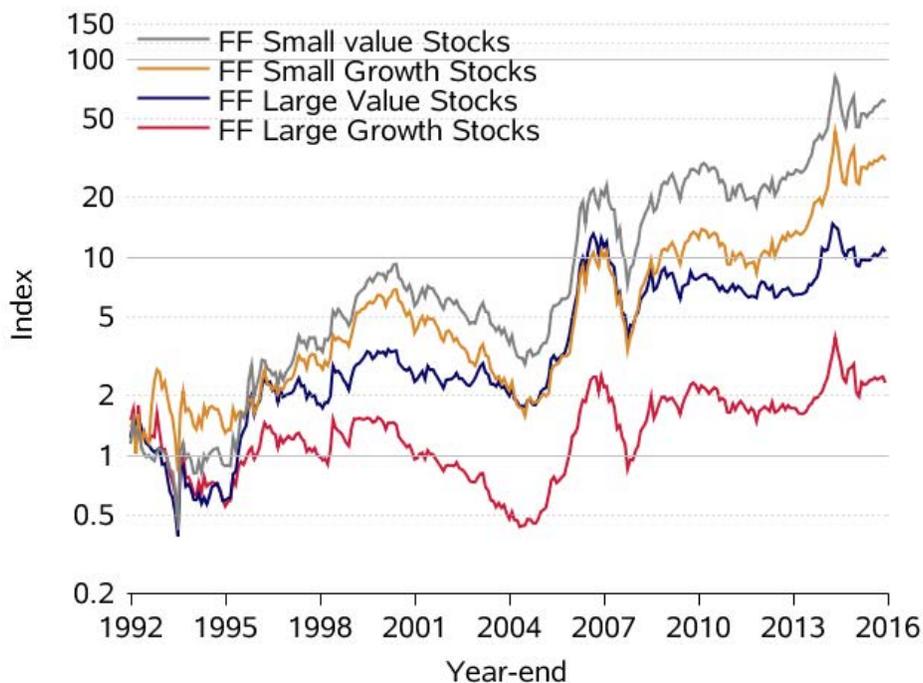


Figure 5.1: Small Value, Small Growth, Large Value, and Large Growth Stocks. Index (Year-End 1992 = CNY 1.00)

5.3 Momentum

Lastly, we consider the returns of the popular momentum strategy (see, for example, Jagadeesh and Titman (1993)). We construct six monthly portfolios as the intersections of two portfolios formed on size and three portfolios formed on the prior return. The two size portfolios, small and large, are formed from all A share stocks on the Shanghai and Shenzhen exchanges, based on the median of floating A-share market capitalization of stocks listed on the main boards of the two exchanges at the end of month $t - 1$. The three prior return portfolios, down, medium, and up, are formed based on the breakpoints of the 30th and the 70th percentiles of the returns from the beginning of month $t - 12$ to the end of month $t - 2$. To be included in

a portfolio for month t , which is formed at the end of month $t - 1$, a stock must have a valid floating A-share market capitalization at the end of month $t - 1$, a price for the end of month $t - 13$ and a good return for $t - 2$. Annual portfolio returns are calculated by compounding the monthly portfolio returns over a 1-year horizon, from the beginning of January to the end of December. Similar as before, we consider only four portfolios in the low and high prior return subgroups, namely, large down, large up, small down and small up. By double-sorting stocks by their market capitalization and prior returns, we can ensure that the size effect on returns is properly controlled and results are purely driven by their prior returns. In the discussion below, we will focus on comparing the returns of large down stocks against large up stocks, and the returns of small down stocks against small up stocks.

Table 5.2: Momentum Series: Annual Returns (%), 1993 through 2016

	#Years	Geometric Mean	Arithmetic Mean	Standard Deviation
FF Large Down Stocks	24	3.70	16.98	63.24
FF Large Up Stocks	24	7.58	17.28	52.20
FF Small Down Stocks	24	17.58	31.06	68.77
FF Small Up Stocks	24	16.25	27.75	58.51
FF Large Up - Large Down Stocks	24	0.74	3.12	24.17
FF Small Up - Small Down Stocks	24	-4.15	-2.60	17.28

Table 5.2 summarizes the annual returns of the four momentum series. The pattern of the geometric mean and arithmetic mean suggest that there is no significant difference in the returns of portfolios with low prior returns and those with high prior returns. Among the large stocks, the geometric mean of the annual returns of the large down stocks is 3.70%, only slightly lower than the geometric mean of 7.58% for the annual returns of the large up stocks; the arithmetic mean of the annual returns of the large down stocks is 16.98%, is also very close to the arithmetic mean of 17.28% for the annual returns of the large up stocks. Likewise, the small down stocks also show similar annual returns as the small up stocks. The geometric mean of the small down stocks annual returns is 17.58%, close to the geometric mean of 16.25% for the small up stocks; the arithmetic mean of the annual returns on the small down stocks is 31.06%, also close to the arithmetic mean of 27.75% for the small up stocks. Considering the large standard deviations of these four portfolios' annual

returns, in the range from 52.20% to 68.77%, it is clear that the portfolios with low and high prior returns don't exhibit different returns. Apparently, the momentum phenomenon often observed in other markets is not evident in China's stock market.

References

- Banz, R. W. (1981). The Relationship between Return and Market Value of Common Stocks. *Journal of Financial Economics* 9(1), 3–18.
- Fama, E. and K. R. French (1992). The Cross-Section of Expected Stock Returns. *Journal of Finance* 47(2), 427–465.
- Hu, G. X., C. Chen, Y. Shao, and J. Wang (2017). Fama-French in China: Size and Value Factors in Chinese Stock Returns. *International Review of Finance*, forthcoming.
- Jegadeesh, N. and S. Titman (1993). Returns to Buy Winners and Selling Losers: Implications for Stock Market Efficiency. *Journal of Finance* 48, 65–91.
- Wang, J., X. Hu, and J. Pan (2017). *2017 Chinese Capital Market Yearbook*. China Academy of Financial Research, Shanghai Jiao Tong University.
- Zhang, C. (2001). The Development of China’s Security Market (The Republic of China). *Security Market Herald* 5, 45–52.