Stockholm School of Economics
Department of Finance
Master Thesis
Spring 2012

Can industries predict the stock market in China?

Abstract: In the thesis we investigate the return predictabilities of ten industry portfolios on the Chinese stock market as well as intra and inter industry predictabilities. We find a number of industry returns, including energy, telecommunication services and financials are able to predict the market up to three days. Gradual information diffusion theory is applied to understand our results. An industry's ability to predict the market is not correlated with its propensity to forecast industrial production growth. To detect inter and intra industry prediction power and linkages, autoregressions and vector autoregressions of the industry portfolios are further conducted.

Keywords: *Asset pricing, Industrial portfolios, Gradual information diffusion, Return predictability, Chinese stock market*

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Acknowledgements:
We are grateful to our supervisor Cristian Huse for his kind support and insightful comments and MSCI for supplying primary data.

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1. INTRODUCTION

The Chinese economy has undoubtedly been increasing its size and significance in the world over the past decades. In 1978, China only contributed 1.87% to the world's GDP while in 2009 the figure has risen to 8.86%; over the past decade, GDP also experienced a tenfold increase *(Figure 1)*. Much of this growth is accredited to the economic restructuring including jumpstarting a diversified banking system, linking the Renminbi a basket of currencies instead of merely USD, strong export strategy, as well as introducing public financing possibilities (Gordon et al., 2009). Since the introduction of the first stock exchange in 1990, the economy was further boosted and embarked on a near exponential growth path.

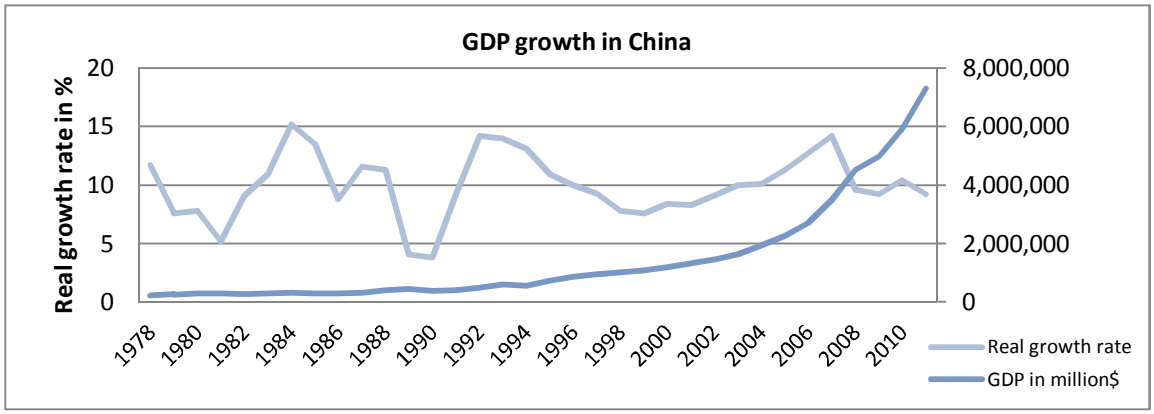

Figure 1: GDP growth in USD from 1978 to 2011
(Source: National Bureau of Statistics of China)

A large number of past empirical studies have documented ways in which asset returns can be predicted based on publicly accessible knowledge. In an efficient market, security prices always fully reflect the available information (Fama, 1970). The first empirical evidence of predictable returns by Shiller (1984) and Summers (1986) in a way was used as fact against the presence of market efficiency. However, later research (Fama French, 1988a) suggested that market efficiency does not necessarily conflict with return predictability.

The established CAPM and APT models have provided good building block for asset pricing. An alternative approach to understand asset pricing and price movements is to start from the behavioral perspective.

There have been plenty of previous researches that suggested reasons for why deviations from the traditionally rational and unconstrained investors' image occur. Among others, Laibson (1997) introduced consumers with imperfect commitment technology such as an illiquid asset. Sims (2001) speculated yet another direction for the deviation from the traditional and idealistic model. Sims believed that lead-lag relationship between returns can be also due to investors' limited information processing capacity and bounded rationality. Kahneman (1973) and Pashler and Johnston (1998) suggested attention as a scarce cognitive resource; consequently attention to one assignment will be compromised by attention to other assignments. Traders may just specialize in a certain industry and ordinary investors only have adequate apprehension to a limited number of assets. Therefore, if two asset classes are influenced by the same underlying forces, the less well-known one's returns is likely to follow the more well-known one's returns as investors do not have access to or cannot absorb all the news at the same instant. Previous scholars commonly call this phenomenon gradual information diffusion process, which forms an important building block for our paper.

A number of researches helped improve understanding of bounded rationality among investors and existence of gradual knowledge diffusion process. Hou (2007) concluded that in the same industry, returns on corporations with higher degree of analyst coverage tend to lead returns on corporations with lower degree of coverage. Hong, Torous and Valkanov (2007) proved in the US that return movements in certain industries that are connected with market fundamentals will precede the overall stock market and therefore can be used as a reference to forecast the market. However, no research has been conducted in the largest emerging market, i.e. China, where investors' mentalities and the speed at which information disseminates might be very different from the developed markets.

Our paper attempts to provide empirical evidence on the predicting power of industry portfolios on the overall Chinese stock market, and to test if an industry return's ability to forecast the market is caused by its correlation with industrial production growth. The paper also undertakes intra and inter industry return predictability analyses because we

believe that it will be worth seeing if leading industries' past returns can influence their future returns.

According to Global Industry Classification Standard (GICS[3]), we used data from MSCI which divided Chinese stocks into ten industry portfolios. They are Health Care, Energy, IT, Financials, Consumer Staples, Industrials, Materials, Telecommunication, Consumer Discretionary, and Utilities. Market indices are employed based on capitalization size and two stock exchanges in mainland China. In addition, we also conducted autoregression and vector autoregression (VAR) analysis for industry portfolios. Our results complement the gradual information diffusion empirical research in addition to the past US-focused ones and will provide useful reference in terms of return predictability to fund analysts and portfolio managers, etc.

2. BACKGROUND

2.1 The Chinese stock market

2.1.1 History

The first stock exchange in China was established in Hong Kong in 1891. In the beginning of the 20th century, the first stock exchanges (Shanghai and Shenzhen) appeared in mainland China. In July 1984, Shanghai Feiyue Audio Equipment Company issued the first equity share to the general public in mainland China under the permission of People's Bank of China - the Chinese central bank. The Chinese stock market embarked on the journey of becoming a more regulated one following the enactment of Securities Law of People's Republic of China in July 1999. At present, Shanghai and Shenzhen are both under direct supervision of Chinese Securities Regulatory Commission (CSRC). After 22 years of development, the security market has rapidly grown to an indispensable component of the Chinese economy as well as one of the most active financial markets in the world. Shanghai Stock Exchange is ranked as the fifth largest below NYSE-Euronext

[3] Developed by MSCI and Standard & Poor's, GICS is an industry taxonomy consists of 10 sectors and 24 industries. The system is comparable to ICB (Industry Classification Benchmark) that is used by Dow Jones Indexes and FTSE Group.

and NASDAQ-OMX, Tokyo Stock Exchange and London Stock Exchange (Cakici et al., 2010).

Despite other positive evidence, the relationship between the development of the stock market and the GDP growth in China is said to be vague. In a well-functioned and developed stock market, the existence of equity financing should give fair chance to competent ventures and thus boosts economic growth. However, the Chinese stock market is said to suffer from the adverse selection problem – the bigger and more renowned companies get financed while SMEs with great ideas have a hard time to secure equity funding. (Han, 2011) With the market becoming more regulated, the problem will lessen in the future.

2.1.2 Three stock exchanges in China

- *Shanghai Stock Exchange*

Founded in the November of 1990, the Shanghai Stock Exchange (SSE) is the earliest stock exchange in Mainland China. Major functions of SSE are serving as market place for securities trading, designing regulations, accepting and facilitating listings, organizing securities trading, and managing and disseminating market information.

Until April 1 2012, there were 934 companies with 978 stocks listed (924 A shares and 54 B shares). Reported total market capitalization has exceeded RMB 14.84 trillion ($2.35 trillion) and the capital raised in 2011 was RMB 31.9 billion ($5.06 billion). The average price earnings ratio was 14.45 overall with A Shares at 14.45 and B Shares at 13.86. The present system can handle 80,000 transactions per second with more than 120million transaction settlement capacity per day.

The total listing in 2010 increased to nine times that of 1992 over the 20-year time horizon. *Figure 2* illustrates the historical index level on a daily basis for the exchange. Wang and Lin (2006) found that A Share stocks tend to lead B Shares at Shanghai exchange. Prices peaked during 2008 before being affected by the global financial crisis.

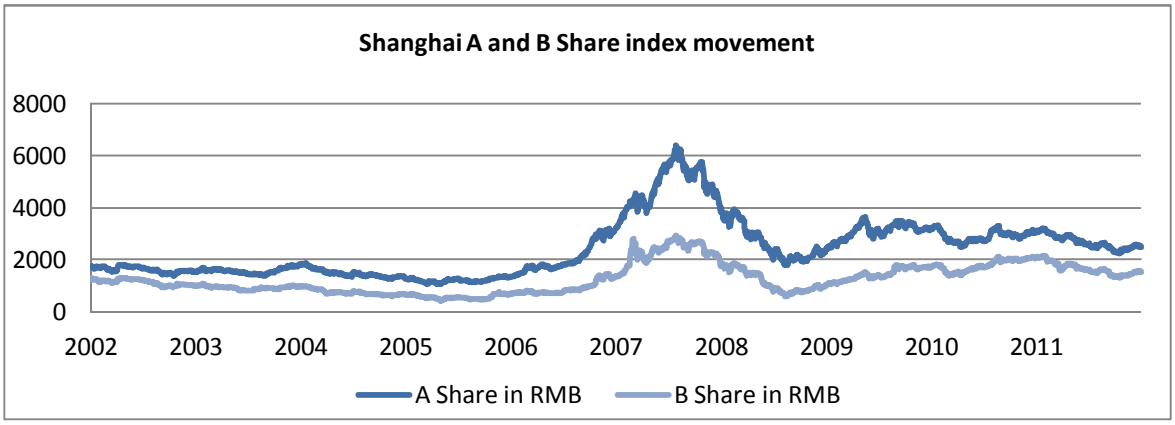

Figure 2. Shanghai index development
(Source: Shanghai Stock Exchange)

- ***Shenzhen Stock Exchange***

In December 1990, Shenzhen Stock Exchange was established soon after the Shanghai Stock Exchange. The major goals of Shenzhen Stock Exchange at the time were supporting small to mid-sized companies in terms of raising equity and creating market sophistication. Until the end of 2011, there were 1411 listed companies with market capitalization of RMB 6.6 trillion ($1.05 trillion). *Figure 3* illustrates the rise and fall in 2008 though the changes are less drastic. A Shares does not show a clear leadership role over B at Shenzhen exchange (Wang and Lin (2006)).

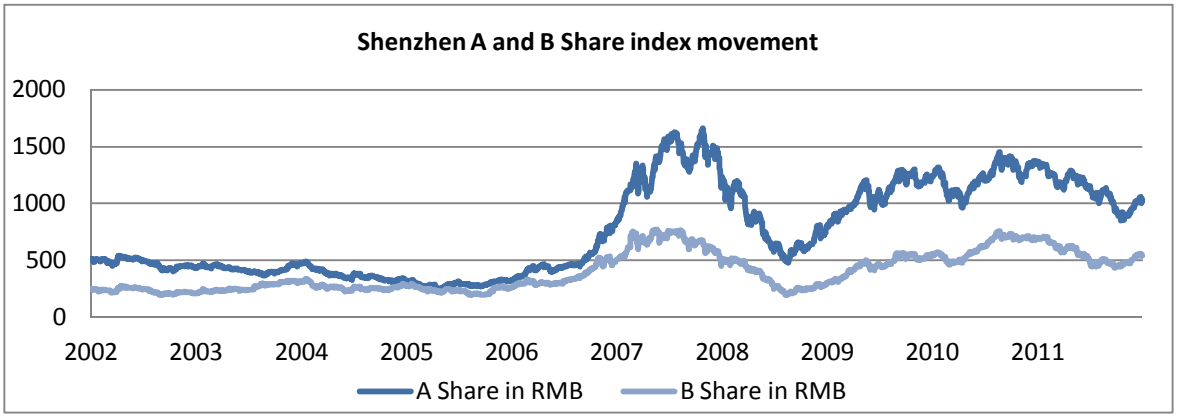

Figure 3. Shenzhen index development
(Source: Shenzhen Stock Exchange)

- ***Hong Kong Stock Exchange***

Informal securities trading activities emerged in Hong Kong in the mid-19th century. Nonetheless, the first official exchange, the Association of Stockbrokers (later became Hong Kong Stock Exchange in 1914) was only established in 1891. By the end of 2011, the stock exchange had 1,477 listed companies with a total market capitalization of HK$ 16.99trillion ($2.19 trillion). Unlike the exchanges in Mainland China, the Hong Kong stock exchange is governed by the Securities and Futures Commission (SFC).

2.1.3 Types of shares

- ***A Share***

A shares are traded in Shanghai and Shenzhen stock exchanges and are listed in Renminbi currency. Foreigners are not allowed by the Chinese government to participate in the trading of A shares. Companies that issue A Shares are required to comply with People's Republic of China Generally Accepted Accounting Principles (PRC GAAP) and are audited by local auditors (Zeng, 2011).

- ***B Share***

B was initially introduced to international investors due to 1) the domestic Chinese market was still considered immature and 2) Renminbi was not freely exchanged in the market. The share class became also partly available to domestic Chinese investors since February 2002. The face value of B Shares is denominated in Renminbi but B Shares are traded in US dollar and Hong Kong dollar for the convenience of overseas investors.

The reported differences between A and B Shares include liquidity (A is more liquid than B), information asymmetry (investors of A are more knowledgeable of their investments than investors of B), demand elasticity (A Share investors are less price sensitive due to lack of alternatives; while B has more foreign investors who have wider spectrum of choices for their portfolios) and investors' philosophy (A Share investors are said to be more speculative and risk tolerant than B) (Liu, 2008).

- ***H Share***

H share refers to stocks of companies that have been incorporated in Mainland China but are listed in Hong Kong. Many companies issue equity both in one of the two mainland exchanges as well as the stock exchange in Hong Kong. Listing in Hong Kong provides companies with an international platform and also an opportunity to improve operations and accounting transparency. Firms that want to list themselves in H Shares must follow the International Financial Reporting Standards (IFRS) or Hong Kong GAAP that are audited by international certified accounting and auditing firms.

- ***Red Chip***

Red Chip shares indicate equity of mainland companies that are incorporated abroad and listed in Hong Kong.

- ***P Chip***

P Chip implies the equity of privately owned Chinese firms incorporated in the Cayman Islands, Bermuda and the British Virgin Islands.

2.2 Overview of Chinese sectors

Conventionally, the Chinese economy is divided into three categories including agriculture, manufacturing, and services. Agriculture and industries that perform resource extraction are by norm called the primary sector; manufacturing of goods and production of energy are by norm referred to as industrial or secondary sector; services include the rest of the economic activities and are often thought as intangibles.

As *Figure 4* shows, the proportion of agriculture in the economy is on constant decrease over the past 30 years. Service has doubled from a mere 20 percent in 1979 to 43.14 percent in 2009. Manufacturing has maintained at a level between 40 to 50 percent over the past three decades. The result is unsurprising since the Chinese economy is currently rather dependent on exports, particularly in the manufacturing sector that is resource intensive. The manufacturing sector also includes energy production – China is the largest

producer of coal in the world. The government has been introducing policies such as directing more investments and executing tax reductions that help develop the service sector which is overall more sustainable (Evenett and Zhang, 2010). Comparing to other developing countries, the Chinese service sector still accounts for a smaller national income.

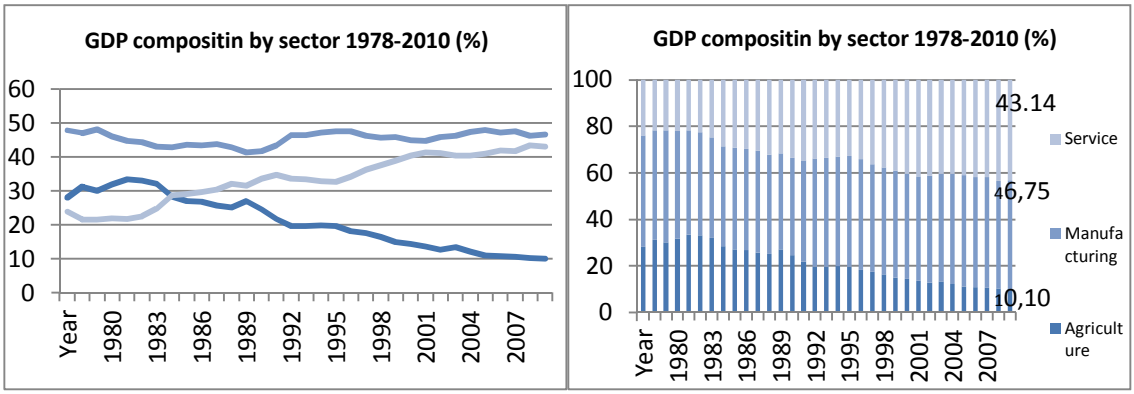

Figure 4. GDP sector composition

*Agriculture includes farming, forestry, animal husbandry and fishery etc. Manufacturing includes mining, water, utilities and construction etc. Service includes everything in addition to agriculture and manufacturing and it mainly consists of transportation and other services.

(Source: National Bureau of Statistics of China)

Furthermore, automobiles, steel, construction, IT, textiles, energy, cement, and shipbuilding have been among the top industries that drive the economic growth in China (World Finance Report, 2010). The processing and manufacturing of chemicals such as petroleum goods, fertilizers, and pharmaceuticals is another sizable and growing segment.

Before 1978, Chinese economy is dominated by public ownership. State-owned enterprises made up 77.6 percent of the total and collectively owned enterprises made up 22.4 percent. Until today, the oil and gas industries in China remain almost exclusively government-owned.

3. LITERATURE REVIEW

3.1 Gradual information diffusion hypothesis

Merton (1987) believed that models based on frictionless markets and complete information are in many cases inadequate to capture the complexity of investors' behaviors. In order to develop further insight into the behavior of security prices, he proposed an equilibrium model in which only incomplete information is available to investors and they tend to focus on the more established stocks. As a result, less well-known stocks of companies with smaller equity holders tend to enjoy relatively larger expected returns comparing to the perfect-market model.

Kahneman (1973) and Pashler and Johnston (1998) suggested attention as a scarce cognitive resource; consequently attention to one assignment will be compromised by attention to other assignments. Cohen and Frazzini (2008) discovered that news of economically related firms were not promptly absorbed into their stock prices and late reaction extent is more severe when binding attention constraints are present. Furthermore, Hirshleifer and Teoh (2003) established a model describing how different ways that firms present informational equivalent disclosure affect market prices in a context of limited investor attention.

In addition to attention constraints, Menzly and Ozbas (2010) investigated the cross predictability of industry stock returns and provided evidence supporting the theory that investor specialization and market segmentation are the causes of gradual information diffusion. Prices correct towards the their true values as information disperses.

Motivated by recent popularity of using word of mouth theory to explain asset prices, Hong, Hong and Ungureanu (2010) developed a model in which there are only two types of investors: those knowing the news and those not knowing the news. So starting from the instant when news start to spread, the population with disagreement is maximized when

half of the population knows about the news and the other half does not. Later on when the news start to spread more, opinions start to converge again. Once a stock is underpriced, its price is assumed to go up more quickly if the speed of information dispersion is high.

Hong and Stein (1999) constructed a model in which there were two representative types of investors: news watchers and momentum traders. Different investors hold different incomplete private information and the asset price is population weighted average of investor expectations. Hong and Stein thus deducted that the asset prices are biased and there will be price corrections as words being passed on in between investors. Lin (2010) employed laboratory markets and demonstrated that pricing errors reduce when private information disperses.

3.2 Empirical work on lead-lag relationship

Several prior studies has pointed out lead-lag cross autocorrelations as a crucial component of stock returns. Lo and Mackinlay (1990) found that weekly stock returns are positively related with the lead-lag pattern between firms of different size. In addition, Hou (2007) found that the lead-lag effect is predominantly an intra-industry phenomenon: returns on large firms lead returns on small firms within the same industry, and the intra-industry lead-lag effect drives the industry momentum anomaly. In other words, in the same industry, returns on corporations with higher degree of analyst coverage tend to lead returns on corporations with lower degree of coverage.

Based on Merton's model, Hong, Torous and Valkanov (2007) confirmed that market returns could be predictable with certain time lags by industry portfolios. In USA, they investigated whether the returns of industry portfolios can predict the movement of stock market. With monthly data from 1946 to 2002, they found that Retail, Services, Commercial Real Estate, Metal and Petroleum could forecast the stock market by up to two months. 14 out of 34 industries lead the market by one month while 12 out of 34 significantly predict market fundamentals such as production growth at 10% level. In

addition, the authors extended their analysis to the largest eight stock markets outside USA (UK, Australia, Canada, France, Germany, Japan, Netherlands, Switzerland) and found similar patterns.

Wu and Shamsuddin (2012) used monthly data of 37 industry portfolios containing more than 1700 stocks from 1990 to 2009 in Australia and conducted similar research as Hong, Torous and Valkanov (2007). Differing from the prior researchers by adding market predictors and using a different industry classification (ICB), Wu and Shamsuddin did not find significant prediction power of leading industries over market fundamentals. On the other hand, they directly tested the gradual information hypothesis by confirming that the ability of an industry to lead the market is connected to the investor recognition and business cycle of the industry. Since chances are that small and illiquid stocks are often ignored by investors (Hou and Moskowitz 2005; Hou, 2007), they tend to lead the market since it takes more time for the market to absorb their information.

3.3 Return predictability in China

Shao and Rennie (2007) found that returns from large firm portfolios and value portfolios tend to predict stock market movements by up to one month. Jiang (2009) et al. regressed excess returns of the Chinese market and portfolios sorted based on industry, size, book-to-market ratio, and ownership concentration on potential predictors such as D/P and D/E ratios, respectively. The authors found that returns are predictable for particular industries, small-cap and low ownership concentration equity shares.

Cakici, Chan and Topyan (2011) conducted predictability research using well-known predictors such as size, price and cashflow-to-price ratio for the stocks listed in Shanghai and Shenzhen stock exchanges. The authors utilized both portfolio method and cross-sectional regression and confirmed strong predictive power of book-to-market ratio, price, cashflow-to-price ratio, earnings-to-price ratio and size.

Others (Chen et al., 2009) found weak return predictability in China by established 18 firm characteristic variables and conjectured two reasons for the finding. One was that return predictors are more homogenously distributed in China than in the US and greater homogeneity causes less return sensitivity to predictors; two was thought to be presence of price inefficiency in China.

4. DATA

4.1 Data source

The price indices for industries and markets are provided by MSCI (formerly Morgan Stanley Capital International), a leading provider of investment decision support tools worldwide. The MSCI global industry indices are constructed using the Global Industry Classification Standard (GICS), which is an industry analysis framework for investment research, portfolio management and asset allocation. The price indices are downloaded through Datastream[4] and control variables' historical data are obtained from National Statistical Bureau of China.

4.2 Sample selection

4.2.1 Market returns

As is mentioned before, our samples of market returns are divided into two categories – domestic and foreign. The domestic stock market is represented by *MSCI China A indices* and the market for overseas investors is represented by *MSCI China indices. Table 1* below summarizes all the market indexes we have included into our analyses.

[4] Datastream is maintained by Thompson Reuters and is updated daily. Historical equity information goes back as far as 1973. It covers across 175 countries in 60 global markets.

Division by cap size	
- Domestic investors	*-Foreign investors*
MSCI China A Large Cap Index	MSCI China Large Cap Index
MSCI China A Mid Cap Index	MSCI China Mid Cap Index
MSCI China A Small Cap Index	MSCI China Small Cap Index
Division by geography	
-Domestic investors	*-Foreign investors*
Shanghai SE A Share Price Index	Shanghai SE B Share Price Index
Shenzhen SE A Share Price Index	Shenzhen SE B Share Price Index

Table 1. Market index summary
(Source: Shanghai & Shenzhen Stock Exchange, MSCI)

MSCI China A stocks include A shares that are listed under Renminbi currency and traded in the two main stock exchanges - Shanghai Stock Exchange and Shenzhen Stock Exchange. Due to government restrictions, foreign investors are not entitled to purchase A shares. *MSCI China* indices contain shares that are authorized for foreign investors. H, B, Red Chip and P Chip are the constituents of the *MSCI China* indices.

Shanghai SE A Share Price Index and *Shenzhen SE A Share Price Index* are enclosed for analysis from the perspective of domestic investors, while *Shanghai SE B Share Price Index* and *Shenzhen SE B Share Price Index* have been chosen for foreign investor analysis.

In addition, for both domestic and foreign equities we employ non-overlapping size-segment indices based on market capitalization. For domestic indices, we select *MSCI China A Large Cap Index, MSCI China A Mid Cap Index* and *MSCI China A Small Cap Index*; for foreign indices, we choose *MSCI China Large Cap Index, MSCI China Mid Cap Index* and *MSCI China Small Cap Index*. The large cap indices consist of companies of which markets value is greater than $4,779 million. Mid cap indices include companies with market value larger than $1,692 million, and small cap indices contain companies with market capitalization larger than $145 million. For instance, *MSCI China A Small Cap Index* targets approximately 14% of market's free-float adjusted market capitalization; the *MSCI China Large Cap Index* targets approximately 70% of each market's free-float

adjusted market capitalization.

4.2.2 Industry portfolios

On the right hand side of the regressions, we include ten industry portfolios respectively. Descriptions of the industry portfolios are listed in *Table 2*. Ten industries are Consumer Discretionary, Consumer Staples, Energy, Financials, Health Care, Information Technology (IT), Industrials, Materials, Telecommunication Services and Utilities. All the returns are taken on a daily basis under time horizon from 2004/12 to 2012/02.

	Industry	Sub-division
1	**Consumer Discretionary**	Retail Media Automobiles & Components Consumer Services Consumer Durables & Apparel
2	**Consumer Staples**	Household & Personal Products Food Beverage & Tobacco Food & Staples Retailing
3	**Energy**	Energy Equipment, Oil, Gas & Fuels
4	**Financials**	Insurance Diversified Financials Banks
5	**Health Care**	Pharmaceuticals, Biotechnology & Life Sciences Health Care Equipment & Services
6	**Information Technology**	Technology Hardware & Equipment Semiconductors & Semiconductor Equipment Software & Services
7	**Industrials**	Transportation Commercial & Professional Services Capital Goods
8	**Materials**	Materials
9	**Telecommunication Services**	Diversified and Wireless T/CM Services
10	**Utilities**	Electric, Gas, Water, Multi-utilities and Independent Power Produces

Table 2. Industry index composition (Source: MSCI)

4.2.3 Control variables

Historical data on the control variables are obtained from National Bureau of Statistics of China. The set of control variables includes well-established market predictors such as lagged market return (Hong, et al., 2007), inflation (Fama and Schwert, 1977), term spread (Fama and French, 1989) and volatility (Hong, et al., 2007) over the same period. Inflation rate is derived from monthly consumer price index: $i_t = \frac{CPI_t}{CPI_{t-1}} - 1$. Since inflation data is only available on a monthly basis, in order to obtain daily frequency we assumed that the monthly inflation rate also applies to every day in the month. Term spread is the difference between five-year deposit rate and three-month deposit rate. Market volatility is calculated as the standard deviations of monthly market returns.

5. METHOD

5.1 Industry portfolios and market returns

Firstly, for each 10 industry portfolios, we run multiple linear regressions of lagged industry portfolio excess returns ($R_{i,t-k}$) on market excess returns (Rm_t), controlling for lagged market return (Rm_{t-k}) and other well-known predictors such as inflation (inf_{t-k}), term spread ($tspd_{t-k}$), and market volatility (sd_{t-k}) (Hong, Torous and Valkanov ,2007). The predictive regression model is as following:

$$Rm_t = \alpha_i + \beta_{1,i} R_{i,t-k} + \beta_{2,i} inf_{t-k} + \beta_{3,i} tspd_{t-k} + \beta_{4,i} sd_{t-k} + \beta_{5,i} Rm_{t-k} + e_{i,t} \quad (1)$$

Where i goes from 1 to 10 because we have 10 industry portfolios. We estimate the above equation separately for each of the 10 industries. By doing that, we take log returns for both market and industry returns. This regression is run on Shanghai and Shenzhen market returns as well as large, mid, and small cap stock market returns. For each lag number (k=1 to 3) this regression is performed once.

The problem with the above regression is omitted variable bias (OVB). OVB occurs when a model incorrectly leaves out one or more crucial causal factors. As a result, the model

compensates for the overlooked variable by over or under estimating other factors. By pooling all lagged industry returns into a joint regression model, we are able to reduce the OVB problem. Nonetheless the cost of doing this is increased standard errors since we cannot estimate the coefficients very precisely based on a limited number of observations.

The joint regression model looks like the following:

$$Rm_t = \alpha_i + \sum_{i=1}^{10} \beta_{1,i} R_{i,t-k} + \beta_2 inf_{t-k} + \beta_3 tspd_{t-k} + \beta_4 sd_{t-k} + \beta_5 Rm_{t-k} + e_{i,t} \quad (2)$$

Where i goes from 1 to 10 and $\sum_{i=1}^{10} \beta_{1,i} R_{i,t-k}$ represents the sum of all the excess industry returns. If the correlation coefficient between two industries is higher than 0.7, we delete one of them as input in regression (2). However we also conduct regressions based on a full set of industry return variables for comparison purpose.

5.2 Industries and market fundamental

In this section, we attempt to test if a sector's ability to predict the market is correlated with its capability to forecast industrial production growth (IPG) – one of the important market fundamentals. IPG is chosen since it is one the few measures of economic activities that is available on monthly frequency.

$$IPG_t = \alpha_i + \beta_{1,i} R_{i,t-k} + \beta_{2,i} inf_{t-k} + \beta_{3,i} tspd_{t-k} + \beta_{4,i} sd_{t-k} + \beta_{5,i} Rm_{t-k} + e_{i,t} \quad (3)$$

For each of the 10 industries, the above equation is conducted once. Four control variables - lagged market excess returns, inflation, term spread and the market standard deviation - are included same as in equation (1) and (2).

5.3 Industry autoregression

After testing market return predictability, we study if industry portfolios have self-prediction power. Bayesian information criterion (BIC) test was run firstly to determine the

lag number we should choose for our regressions. Comparing with Akaike information criterion (AIC), BIC has a better measurement of the relative fitness of a statistical model. The AIC penalizes the number of parameters less strongly than the BIC does (Mcquarrie and Tsai, 1988). The model is specified as below:

$$R_{i,t} = \alpha_i + \sum_{k=1}^{K} \beta_i R_{i,t-k} + e_{i,t} \tag{4}$$

5.4 Vector autoregression

To investigate whether inter-industry effect exists between 10 industry portfolios, vector autoregressions (VAR) is employed. The lag number to use in VAR should be close to the number chosen in the previous autoregression results. At the same time, including higher order lags than the true lag (overfitting) or lower order lags (underfitting) should be avoided. Overfitting induces mean-square forecasting errors whilst underfitting generates auto-correlated errors (Lutkepohl, 1993). Taking into account of the parameters mentioned, our estimations are conducted with two lags based on equation (5) below.

$$\begin{bmatrix} R_{1,t} \\ R_{2,t} \\ \vdots \\ R_{10,t} \end{bmatrix} = \alpha_0 + \begin{bmatrix} \alpha_{1,1} & \cdots & \alpha_{1,10} \\ \vdots & \ddots & \vdots \\ \alpha_{10,1} & \cdots & \alpha_{10,10} \end{bmatrix} \begin{bmatrix} R_{1,t-1} \\ R_{2,t-1} \\ \vdots \\ R_{10,t-1} \end{bmatrix} + \begin{bmatrix} \beta_{1,1} & \cdots & \beta_{1,10} \\ \vdots & \ddots & \vdots \\ \beta_{10,1} & \cdots & \beta_{10,10} \end{bmatrix} \begin{bmatrix} R_{1,t-2} \\ R_{2,t-2} \\ \vdots \\ R_{10,t-2} \end{bmatrix} + \begin{bmatrix} e_{1,t} \\ e_{2,t} \\ \vdots \\ e_{10,t} \end{bmatrix} \tag{5}$$

6. RESULTS AND DISCUSSIONS

6.1 Industry portfolios and market returns

By using methodology described in section five, we firstly start to explore the ability of each industry's returns to lead the Chinese stock market. Selected regression results based on Equation (1) are presented in *Table 3* and *Table 4* for domestic shares and foreign shares, respectively. Similarly, chosen results from Equation (2) are outputted in *Table 5* and *Table 6*. Both the results and their interpretations are discussed in this section.

6.1.1 Individual regressions on industry indices

-Domestic share results

To recap, the predictive regression model is as (1) in section five. A Shares are listed in the Renminbi currency and are only traded by mainland China's individual and institutional investors. The regression statistics including coefficients, t-stats and R-square are listed in *Appendix 1* in more detail where the significant coefficients are denoted by asterisks. *Table 3* below summarizes industries with significant prediction power at both 10% and 5% levels. Only industries with significant coefficients are listed in *Table 3* with corresponding t-stats. For Shanghai, three out of ten industry portfolios are significant (Energy, Financials, and Telecommunications); as for Shenzhen, four out of ten are statistically significant (Energy, Industrials, Telecommunications and Utilities).

Telecommunications, Energy and Utilities appeared most times and are able to predict every market index included in the scope of our research during the time period from 2004 to 2012. The two industries are both among the driving forces of the Chinese economy as reported. (World Finance Report, 2010). As was presented in the beginning of the paper (*Figure 4*), manufacturing in which Utilities, Energy and Industrials are major components makes up about 47 percent of the total GDP over the years. It is natural to see these industries as leaders for the overall domestic stock indices demonstrating positive correlation with the market.

More importantly, according to Shanghai Stock Exchange, their market capitalizations are 0.98% (Telecommunications), 2.00% (Energy) and 2.78% (Utilities) respectively and are the lowest of all industries listed under A Shares at Shanghai Stock Exchange. Their respective market capitalizations at Shenzhen Stock Exchange are 1.13%, 1.75% and 1.75% and are also the lowest in market capitalization value. This finding is consistent with the logic of gradual information diffusion theory. Since the market index is comprised of stocks from all ten industries, news in each industry shall be reflected in the market. Smaller-sized industries are assumed to enjoy less investor recognition and attention, and

less investor recognition implies slower spread of information. Thus, the overall market will not absorb news of small-sized industries as fast as news of large-sized industries (more attention-grabbing industries). Wu and Shamsuddin (2012) had similar conclusion stating that industries that are small and illiquid tend to lead the market.

Since the Energy sector is mainly comprised of oil, gas, coal and consumable fuels, the negative relationship between Energy returns and market premium appears to make economic sense. When energy prices experience unanticipated shocks, the economy tends to be negatively affected. This result is also consistent with the findings of Hong, Torous and Valkanov (2007). Furthermore, the correlations between a certain industry and different market indexes are mostly constant in direction. This shows that the industry returns affect the market indexes similarly. As for Telecommunications, since China is having a growing middle class, the demand for telecommunication services turns out to be significant.

Looking at lag numbers, industries that are significantly leading at higher number of lags can predict the market from even earlier return than lower lags. Industrials, Energy and Telecommunication Services are among the ones with earlier and better prediction power.

Next we analyze the size indices' regression results. Keeping in mind the gradual knowledge diffusion mechanism, the large cap index is expected to be less well-predicted in contrast to medium to small capped indices. Large-capped stocks supposedly shall be more exposed under investors' radar so that any news is accounted for by the price index almost at the same instant. What comes along is less industry predictability over the index. Diving into the results in *Table 3*, we can easily see that most industries can only predict the large cap index one day ahead (news travels fast for large-sized stocks) with only two industries significant at 2 and 3 lags (one at 5% and the other at 10%); mid cap index has in total four industries predicting at 2 and 3 lags (three out of four at 5%) whilst small cap index can be forecasted by up to five industries at 2 and 3 lags (four out of five at 5%). An industry's ability to forecast the future market index more days in advance can be

interpreted as slower speed of knowledge dissemination.

represents significance at 10% level; **represents significance at 5% level.

	(t-1)	R^2		(t-2)	R^2		(t-3)	R^2
Shanghai A								
Energy	-0,089 (-2.1370)**	0.0353	Telecommunication	-0,0882 (-3.2950)**	0,0380	Telecommunication	-0,067 (2.5035)**	0,0394
Financials	0,1488 (3.2235)**	0.0385						
Telecommunication	-0,0537 (-2.0028)**	0,0350						
Shenzhen A								
Energy	-0.0865 (-2.3280)**	0,0292	Industrials	0.1639 (1.7356)*	0,0308	Industrials	0.1741 (1.8481)*	0,0332
			Telecommunication	-0.0779 (-2.9183)**	0,0319	Telecommunication	-0.0588 (-2.2059)**	0,0336
			Utilities	0.1278 (2.5055)**	0,0321			
Large A								
Health care	-0.0680 (-1.8072)*	0,0310	Telecommunication	-0.0985 (-3.5604)**	0,0348	Energy	-0.0743 (-1.8310)*	0,0323
						Telecommunication	-0.0678 (-2.4477)**	0,0338
Energy	-0.1168 (-2.8806)**	0,0339						
IT	-0.0702 (-1.9451)*	0,0313						
Financials	0.1861 (3.0745)**	0,0345						
Consumer staples	-0.0687 (-1.7078)*	0,0308						
Industrials	-0.1697 (-2.7830)**	0,0336						
Materials	-0.1081 (-2.0957)**	0,0317						
Telecommunication	-0.0783 (-2.8303)**	0,0337						
Consumer discretionary	-0.0905 (-1.7913)*	0,0310						

Mid A								
Energy	-0.0691	0,0267	Industrials	0.2384	0,0305	Consumer staples	0.0903	0,0286
	(-1.8265)*			(2.3075)**			(1.7630)*	
			Telecomm unication	-0.0742	0,0301	Industrials	0.2635	0,0302
				(-2.6976)**			(2.5571)**	
			Utilities	0.1472	0,0312	Telecomm unication	-0.0577	0,0285
				(2.7475)**			(-2.0980)**	
Small A								
Health care	0.1040	0,0267	Industrials	0.1903	0,0320	Consumer staples	0.1173	0,0284
	(1.8452)*			(2.3668)**			(2.4088)**	
Energy	-0.0679	0,0265	Telecomm unication	-0.0614	0,0290	Industrials	0.2773	0,0308
	(-1.8948)*			(-2.1787)**			(3.4632)**	
			Utilities	0.1510 (2.8247)**	0,0327	Material	0.0968 (1.7544)*	0,0286
						Utilities	0.1160 (2.1736)**	0,0275

Table 3. Domestic (A Share) individual regression summary

- Foreign share results

As was explained in the background section, B Shares were initially issued for overseas investors who wished to diversify their portfolio risks or were attracted to the growth potential of China. Comparing to A Share, B has less number of listed companies and much smaller market capitalization (0.49% in Shanghai and 1.00% in Shenzhen). *Table 4* below summarizes industries with significant prediction power at 10% and 5% levels. Only industries with significant coefficients are listed in Table 4 with corresponding t-stats. For Shanghai Stock Exchange, six out of ten industry portfolios are statistically significant at different lag numbers. They are Health Care, Industrials, Materials, Consumer Discretionary, Telecommunications, and IT. At Shenzhen Stock Exchange, Health Care, Telecommunications and IT are the three leading industries. Comparing to A Shares, the leading industries for foreign market expand to Health Care, Materials, Consumer Discretionary and IT leaving out Energy and Utilities. Looking at Shanghai and Shenzhen combined, there are six leading industries with 2% average market capitalization and the rest three industries with 15% average market capitalization. It seems fair to conclude that

small to medium sized industries have leading effect in the B Share market.

Theoretically, we expect B Share indices to express more market predictability based on the hypothesis of gradual information dissemination. Recalling from section 2, the differences between A and B Shares enclose liquidity, information asymmetry, demand elasticity, and investors' philosophy. Directly relevant to our hypothesis is the fact that B Shares are more illiquid and more information asymmetry is present. Previous studies have found that investors are less aware of illiquid stocks (Grullon et al., 2004; Hou and Moskowitz, 2005; Bodnaruk and Ostberg, 2009) and less knowledgeable about stocks with asymmetric information. Consequently, the intuition is that news of B shares disperses less quickly which implicates greater predictability. In our results, six industries display significance for B Shares at Shanghai and Shenzhen comparing to five industries in case of A Shares. We do not see a considerable difference between A and B. One of the possible conjectures for this result is that since mainland investors are allowed to trade B stocks from the beginning of the 21st century, the two share types have become more related and integrated (Liu, 2007).

As for the size indices, there is no apparent display of better industry ability to predict the small cap index over large cap.

	(t-1)	R^2		(t-2)	R^2		(t-3)	R^2
Shanghai B								
Health care	-0.0780	0,0311	Telecommunication	-0.0806	0,0210	IT	0.0851	0,0210
	(-1.7585)*			(-2.1601)**			(1.9738)**	
Industrials	-0.1077 (-1.9386)*	0,0317						
Material	-0.0821 (-1.8501)*	0,0314						
Consumer discretionary	-0.0876 (-1.6584)*	0,0307						
Shenzhen B								
			Health	-0.0762	0,0202	IT	0.1125	0,0215

			care	(-1.7727)*			(2.8173)**	
			Telecommunication	-0.0711 (-2.0277)**	0,0253			
Large foreign								
Telecommunication	-0,0854 (-1.6540)*	0.0161	Industrials	0,1487 (2.3790)**	0.0199	Consumer staples	0.0969 (2.3248)**	0.0190
			Consumer discretionary	0,1042 (2.5349)**	0.0206			
			Utilities	0,1448 (3.1110)**	0.0238			
Mid foreign								
			Material	-0.1159 (-2.1566)**	0.0231	Consumer staples	0.0905 (1.9103)*	0.0188
			Telecommunication	-0.0755 (-1.7741)*	0.0217	Material	-0.1295 (-2.4043)**	0.0210
			Utilities	0.0948 (1.9376)*	0.0223			
Small foreign								
Telecommunication	-0.0666 (-1.6597)*	0.0201	Energy	-0.0648 (-1.6550)*	0.0257	Consumer staples	0.0797 (1.8244)*	0.0220
			Material	-0.0902 (-2.1732)**	0.0276	Material	-0.0752 (-1.8069)*	0.0219
			Telecommunication	-0.0721 (-1.8009)*	0.0262			
			Utilities	0.0797 (1.7598)*	0.0260			

Table 4. Foreign (B, H, red & P chip Share) individual regression summary

6.1.2 Joint regressions on industry indices

Table 5 and Table 6 present regression results of market returns and industries by pooling 10 industry returns and performing one regression for each lag (k=1 to 3). All 10 industries are entered into the regression in order to reduce omitted variable bias.

-Domestic share results

This result is summarized in *Table 5*. Industrials, Materials and Consumer discretionary are deleted from the regression for A Shares due to high correlations. As can be seen from the table below, the number of significant industries have greatly reduced as expected comparing to the single regression case. This result shows that industries in China are rather correlated to each other. Two industries are significant predictors of Shanghai and Shenzhen exchange, respectively. Energy, Financials and Utilities remain significant for A Shares. No difference between industry's prediction power is shown from the size indices.

	(t-1)	R^2	(t-2)	R^2		(t-3)	R^2
Shanghai A							
Energy	-0.0730	0.0283			Financials	0.0871	0.0296
	(-1.8700)*					(2.4689)**	
Shenzhen A							
Energy	-0.1073	0.0411			Utilities	-0.1597	0.0349
	(-2.5351)**					(-1.7683)*	
Large A							
Energy	-0.0721	0,0274			Consumer staples	0.0341	0,0289
	(-1.8449)*					(1.8735)*	
Mid A							
Energy	-0.0923	0.0391			Consumer staples	0.0994	0,0342
	(-2.1149)**					(1.8735)*	
Small A							
Energy	-0.1120	0,0426			Consumer staples	0.1049	0,0362
	(-2.4298)**					(1.9194)*	

Table 5. Domestic (A Share) joint regression summary

-Foreign share results

After computation of the correlation coefficients, Financials and Materials were taken away from the regression of B Shares. Three (IT, Industrials and Consumer Discretionary) out of ten industries are able to predict the Shanghai and Shenzhen market, respectively. If regress without deletion, Financials would have been significant as well. Furthermore, it

does not appear likely that small-sized index is more easily predicted than large capped.

	(t-1)	R^2		(t-2)	R^2		(t-3)	R^2
								0.0171
Shanghai B						IT	0.1832 (3.2429)**	
						Industrials	0.2277 (1.8829)*	
						Consumer discretionary	-0.2531 (-2.5868)**	
Shenzhen B								
						IT	0.1959 (3.2429)**	0.0217
						Industrials	0.2220 (1.8829)*	
						Consumer discretionary	-0.2569 (-2.5868)**	
Large foreign								
IT	0.0645 (1.6814)*	0.0181	Consumer discretionary	0.1032 (2.2522)**	0.0341	Consumer staples	0.0925 (2.1037)**	0.0264
			Utilities	0.1357 (2.8178)**		Telecommunication	-0.1013 (-2.0615)**	
Mid foreign								
			Telecommunication	-0.1138 (-1.9313)*	0.0334	Consumer staples	0.0925 (2.1037)**	0.0258
			Consumer discretionary	0.0899 (1.7233)*		Telecommunication	-0.1431 (-2.4174)**	
			Utilities	0.1145 (2.2290)**				
Small foreign								
Consumer staples	0.0668 (1.6535)*	0.0598	Consumer discretionary	0.0784 (1.8548)*	0.0568	Telecommunication	-0.1093 (-2.3477)**	0.0470
			Utilities	0.0784 (1.7775)*				

Table 6. Foreign(B,H, red & P chip Share) joint regression summary

To sum up, from the individual regressions at 5% significance level, three out of ten industries are able to predict Shanghai and Shenzhen A Shares index, respectively; two out of ten industries are able to forecast the B shares at the markets combined. When we pool all the industries into one regression, the numbers for A and B Shares reduce to two and one correspondingly. Our results from individual regression for A Shares appear to be consistent with the gradual information diffusion hypothesis.

6.2 Industries and market fundamental

To further investigate whether industries with perceivable impact on the stock market are related to market fundamentals - industrial production growth (IPG), we run individual regressions of industry portfolios on IPG. The results are presented in *Appendix 5*, for domestic shares, we found Energy, Information Technology, Industrials and Utilities are significant at 5% level, and Consumer Staples is significant at 10% level; whereas for foreign shares, the returns from Consumer Staples, Industrials, and Materials have predictive level at 10% significant level.

	(t-1)		**(t-2)**
Domestic shares			
Utilities	0.1382	Energy	-0,1177
	(2.6079)**		(-1.9565)**
		IT	-0.1917
			(-3.2433)**
		Consumer staples	-0.1093
			(-1.8531)*
		Industrials	-0.2113
			(-3.5137)**
Foreign shares			
Consumer staples	0.0937		
	(1.7931)*		
Industrials	0.1043		
	(1.9039)*		

Materials	0,0857
	(1.8156)*

Table 7. Industries and production growth

Lamont (2001) found that industry returns could track different economic activities such as industrial production growth and consumption growth in United States. Hong (2007) found that twelve of the thirty-four industries are statistically significant at the 10% level and nine are significant at the 5% level. Thus an industry's ability to predict the market returns is positively correlated with its ability to forecast market fundamentals such as industrial production growth.

As it turns out, our results' pattern is different from Hong (2007) and Lamont (2001)'s hypothesis that industries contain valuable information about future economic fundamentals. Nonetheless, Wu and Shamsuddin (2012) also did not identify significant correlation between an industry's ability to forecast industrial production growth and market returns, which is consistent with our findings.

We conjecture that the difference may come from a number of sources. First, compared with American stock market, Chinese stock market has less than two decades of history and is still relatively inefficient. For example, the relationship between the development of the stock market and the GDP growth in China has been said to be vague due to problems like adverse selection and information asymmetry (Han, 2011). Secondly, the industry classification method used in this paper is also different from Hong et al who obtained portfolio data from Ken French's and NAREIT website. We used Global Industry Classification Standard (GICS).

6.3 Industry autoregressions

To further gauge the predication possibility within an industry's returns, regression (4) $R_{i,t} = \alpha_i + \sum_{k=1}^{K} \beta_i R_{i,t-k} + e_{i,t}$ was performed on the ten industry portfolios. K is the

number of lags included and it is decided by the BIC test results. Industries from Energy, Information Technology and Financials can be predicated from the past four days. Health care, Consumer Staples, Industrials, Consumer Discretionary and Utilities can be led by the returns of past three days. Most industries appear to have significant self-prediction capability. Notice here that we only included daily data into the analysis which is likely to increase prediction significance.

Industry	(t-1)	(t-2)	(t-3)	(t-4)
Health care	0.1342 (5.5895)	-0.0058 (-0.2403)	0.0964 (4.0130)	
Energy	0.0685 (2.8464)	0.0177 (0.7364)	0.0666 (2.7705)	0.0826 (3.4338)
IT	0.0685 (2.8464)	0.0177 (0.7364)	0.0666 (2.7705)	0.0826 (3.4338)
Financials	0.0497 (2.0648)	0.0355 (1.4737)	0.0542 (2.2495)	0.0709 (2.9463)
Consumer staples	0.1105 (4.6040)	0.0017 (0.0708)	0.1004 (4.1815)	
Industrials	0.1031 (4.2950)	0.0225 (0.9314)	0.1020 (4.2475)	
Material	0.1210 (5.0383)	0.0092 (0.3817)	0.0756 (3.1352)	0.1041 (4.3381)
Telecommunications	-0.0093 (-0.382)			
Consumer discretionary	0.1153 (4.7982)	0.0057 (0.2356)	0.0879 (3.6568)	
Utilities	0.0856 (3.5614)	0.0450 (1.8695)	0.0880 (3.6613)	

Table 8. Industry auto regression summary

6.4 Vector autoregressions

The results based on equation (5) are as shown in *Table 9*. For domestic portfolios returns

(Panel A), our result shows clear inter-industry lead-lag relationships. Industries that can be led by highest number of others include Industrials, Energy and Financials (all predicated by five others). These industries are more interconnected with others, which is reasonable since Energy and Financials are both fundamental to the growth of other sectors. For Energy industry, the returns could be predicated by returns of Financials, Industrials and Materials with one lag, plus IT and utilities with two lags. While for Financials, it could be predicated by returns from Energy, Telecommunications, Consumer Discretionary, Materials and Utilities.

For foreign portfolio returns (Panel B), Energy, Financial, and Materials have high inter-connectedness with other sectors. This result again seems to makes economic as packaging industry as an important part of Materials has been found to correlate with the overall economy in the US. More demand for packaging means better economic outlook.

There are obvious differences between the results of domestic and foreign markets. Financials, for example, are led by different industries for the two markets. This difference could be originated from a number of reasons. Firstly, the sample differences between domestic and foreign stock shares. Besides component differences, the equity market for domestic shares is more active than foreign shares (Jun, 1998). Other research suggests that domestic A Share market has become more integrated than foreign share market overtime. Secondly, there could be differences between investment decisions of foreign and domestic investors. Since B Shares etc. are mostly traded by foreign investors who might understand the interplay between industries differently than Chinese mainland investors, the investment demand for foreign shares could differ from mainland. This demand for different industries also will affect the prices and returns' lead lag relationship. Additionally, spillover effects from other countries to Chinese stock market also exist (Anders C. & Christer L., 2006). Foreign equity market could be higher correlated with other markets abroad. For instance, the changes of interest rates or the innovation of foreign stock market abroad could affect foreign investors' investment decisions on Chinese stock market.

Panel A: VAR Model on domestic industries

*Here we only report the significant industries of the VAR results and corresponding t-stat results. *Significant at 10% level. **Significant at 5% level*

Health Care$_t$	Energy$_{t-1}$			
	-0.0851			
	(-1.69)*			
	Health Care$_{t-2}$	Materials$_{t-2}$	Utility$_{t-2}$	
	-0.1043	-0.1496	0.1141	
	(-1.66)*	(-2.02)**	(1.76)*	
Energy$_t$	Financials$_{t-1}$	Industrials$_{t-1}$	Materials$_{t-1}$	
	0.1928	-0.3660	0.2337	
	(3.19)**	(-2.68)**	(2.57)**	
	IT$_{t-2}$	Utility$_{t-2}$		
	-0.1312	0.1577		
	(-1.75)*	(2.09)**		
IT$_t$	IT$_{t-1}$	Industrials$_{t-1}$		
	0.1494	-0.2556		
	(2.09)**	(-1.89)*		
	Telecom$_{t-2}$	Utility$_{t-2}$		
	-0.0653	0.1305		
	(-1.70)*	(1.75)*		
Financials$_t$	Energy$_{t-1}$	Financials$_{t-1}$	Telecom$_{t-1}$	ConDis$_{t-1}$
	-0.1073	0.2485	-0.0827	-0.1836
	(-1.95)*	(4.40)**	(-2.20)**	(-1.70)*
	Financials$_{t-2}$	Materials$_{t-2}$	Utility$_{t-2}$	
	0.0984	-0.1840	0.1266	
	(1.96)*	(-2.28)**	(1.79) *	
ConStaples$_t$	Energy$_{t-1}$			
	-0.0915			
	(-1.83)*			
	Telecom$_{t-2}$			
	-0.0782			
	(-2.37)**			
Industrials$_t$	Energy$_{t-1}$	Financials$_{t-1}$		
	-0.1310	0.0964		
	(-2.47)**	(1.77)*		
	Financials$_{t-2}$	Materials$_{t-2}$	Telecom$_{t-2}$	Utility$_{t-2}$
	0.0820	-0.1321	-0.0579	0.1125
	(1.69)*	(-1.69)*	(-1.65)*	(1.65)*
Materials$_t$	Energy$_{t-1}$	Financials$_{t-1}$	Industrials$_{t-1}$	Materials$_{t-1}$
	-0.1491	0.1778	-0.2234	0.2136
	(-2.64)**	(3.06)**	(-1.70)*	(2.44)**
	Materials$_{t-2}$	Utility$_{t-2}$		
	-0.1536	0.1334		
	(-1.85)*	(1.84)*		
Tele$_t$	Energy$_{t-1}$	IT$_{t-1}$	ConStaples$_{t-1}$	
	-0.1141	0.1875	-0.1343	
	(-1.82)*	(2.43)**	(-1.73)*	
	Materials$_{t-2}$			
	-0.1737			
	(-1.89)*			
ConDis$_t$	Energy$_{t-1}$			
	-0.1430			
	(-2.65)**			
	Materials$_{t-2}$	Utility$_{t-2}$		
	-0.1352	0.1161		
	(-1.70)*	(1.67)*		

$Utility_t$	$Energy_{t-1}$	$Financials_{t-1}$	$Materials_{t-1}$	
	-0.1104	0.1076	0.1343	
	(-2.32)**	(2.20)**	(1.82)*	

Panel B: VAR Model on foreign shares

*Here we only report the significant industries of the VAR results and corresponding t-stat results. *Significant at 10% level. **Significant at 5% level*

$Health\ Care_t$	$Utilities_{t-1}$			
	0.2391			
	(2.38)**			
	$Financials_{t-2}$			
	0.3721			
	(3.05)**			
$Energy_t$	$Energy_{t-1}$	$Telecom_{t-1}$		
	0.1512	-0.1280		
	(1.96)**	(-1.90)*		
	$Energy_{t-2}$	$Telecom_{t-2}$	$Utility_{t-2}$	
	-0.1486	-0.1424	0.1381	
	(-1.86)*	(-2.03)**	(1.87)*	
IT_t	$Utility_{t-1}$			
	0.1708			
	(2.23)**			
$Financials_t$	$Financials_{t-1}$			
	0.1481			
	(1.82)*			
	$Energy_{t-2}$	$Financials_{t-2}$	$Telecom_{t-2}$	$ConDis_{t-2}$
	-0.1689	0.1445	-0.1425	0.1292
	(-2.31)**	(1.84)*	(-2.22)**	(2.15)**
$ConStaples_t$	$Industrials_{t-1}$	$ConDis_{t-1}$		
	-0.2800	0.1005		
	(-3.42)**	(2.04)**		
	$Energy_{t-2}$			
	-0.1514			
	(-2.50)**			
$Industrials_t$	$Financials_{t-1}$			
	0.1417			
	(1.78)*			
	$Financials_{t-2}$	$ConDis_{t-2}$		
	0.1909	0.1066		
	(2.48)**	(1.81)*		
$Materials_t$	$Energy_{t-2}$	$Financials_{t-2}$	$Telecom_{t-2}$	$ConDis_{t-2}$
	-0.1799	0.2922	-0.1856	0.1751
	(-1.91)*	(2.68)**	(-2.24)**	(2.26)**
$Tele_t$	$Telecom_{t-2}$			
	-0.0979			
	(-1.75)*			
$ConDis_t$	$ConStaples_{t-1}$			
	0.1136			
	(1.72)*			

	Energy_{t-2}	Industrials_{t-2}	Telecom_{t-2}
	-0.1348	0.1822	-0.1747
	(-1.65)*	(1.70)*	(-2.43)**
Utility_t	IT_{t-1}	Industrials_{t-1}	
	-0.0798	-0.1369	
	(-1.87)*	(-1.65)*	
	Telecom_{t-2}		
	-0.1161		
	(-2.16)**		

Table 9. VAR results

7. CONCLUSION

In the thesis we first investigate the predictability of ten industry portfolios on the Chinese stock market based on the theory of gradual information diffusion process. From the individual regressions at 5% significance level, three out of ten industries are able to predict Shanghai A Shares index (Energy, Telecommunication Services, and Financials) and Shenzhen A Shares index (Energy, Telecommunication Services and Utilities) respectively; two (Telecommunication Services and IT) out of ten industries are able to forecast the B shares at Shanghai, Shenzhen Stock Exchange. When we pool all the industries into one regression, the numbers for A and B Shares reduce to two (Shanghai A: Financials and Energy; Shenzhen A: Energy and Utilities; Shanghai and Shenzhen B: Consumer Discretionary and Industrials). We conjecture several reasons for differences in results between A and B Shares such as liquidity and asymmetric information. Nonetheless, joint regression results do not show significant contrasts between A and B Shares.

Our results from individual regression for A Shares appear to be consistent with the gradual information diffusion hypothesis. In addition, the correlation coefficients between a certain industry and different market indexes are mostly constant in sign. This shows that the same industry affects the market indexes similarly.

Furthermore, we test if an industry's abilities to predict the market returns and to predict market fundamentals are related. Industrial production growth is employed as an indicator of market fundamentals. However, our results do not show a positive relationship between

the two factors.

Finally, the paper explore the possible interplay between different industries in Chinese equity markets. Financials and Energy are found to be correlated with highest number of other industries which makes economic sense for the fact that these two industries are instrumental to the development of other industries. Additionally, we found that inter-industry patterns between domestic and foreign markets are different. This difference could be originated from a number of reasons. Firstly, it could be due to the sample differences between domestic and foreign stock shares. A and B Shares differ in their components, degree of integration and liquidity. Secondly, there could be disparity between investment decisions of foreign and domestic investors due to difference in investment philosophy and overseas spillover effect.

However, the conclusion derived could be subjected to some limitations. First, the sample period can be divided into sub-periods to see whether ability of these industries to lead the market differs among sub-periods. For instance, during 2008 and 2009, a series of banks and insurance company failures triggered a financial crisis. It is recommended to test separately for pre-crisis and post-crisis periods, and verify whether the results are consistent. Second, because of data availability, we adopt ten industry portfolios' data for the past seven years. The more detailed sub-industry portfolios are only available on a monthly basis with shorter time period. Third, if data is accessible, it may be useful to include China specific predictor such as bank loan expansion rate since Chinese stock market is likely to subject to liquidity problem in a larger degree than developed markets (Jiang et al., 2009).

For further research, it is desirable to construct an investor recognition variable to direct test if the lead lag relationship between industries and market is due to investors' awareness. Another interesting study would be to collect industry return data based on firm size. By doing so, it is possible to further test if small cap firms are able to lead large cap return indices within the same industry.

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APPENDIX

Appendix 1. Domestic individual regression results

*represents significance at 10% level; **represents significance at 5% level.

INDIVIDUAL regression results on sectors' predictability of the stock market - SHANGHAI A

Industry	(t-1)	R^2	(t-2)	R^2	(t-3)	R^2
Health care	-0,0363 (-0.9858)	0.0333	-0,0214 (-0.5820)	0,0321	0.0110 (0.2978)	0,0360
Energy	-0,089 (-2.1370)**	0.0353	-0,0318 (-0.7629)	0,0322	-0,0612 (-1.4700)	0,0371
IT	-0,032 (-0.8862)	0.0332	-0,0463 (-1.2821)	0,0328	-0,0142 (-0.3926)	0,0360
Financials	0,1488 (3.2235)**	0.0385	0,0208 (0.4497)	0,0320	0,0101 (0.2191)	0,0359
Consumer staples	-0,0278 (-0.7402)	0.0330	0,0024 (0.0637)	0,0319	0,0486 (1.2983)	0,0369
Industrials	-0,0636 (-1.0626)	0.0334	0,009 (0.1505)	0,0319	0,0329 (0.5507)	0,0361
Material	-0,0302 (-0.6131)	0.0329	-0,0385 (-0.7831)	0,0322	-0,0064 (-0.1300)	0,0359
Telecommunication	-0,0537 (-2.0028)**	0,0350	-0,0882 (-3.2950)**	0,0380	-0,067 (2.5035)**	0,0394
Consumer discretionary	-0,01 (-0.2056)	0.0327	-0,0226 (-0.4659)	0,0320	-0,0324 (-0.6677)	0,0362
Utilities	-0,017 (-0.3766)	0.0328	0,0743 (1.6419)	0,0334	0,0059 (0.1304)	0,0359

Table 1. Individual regression results of sectors on the Shanghai A index

INDIVIDUAL regression results on sectors' predictability of the stock market - SHENZHEN A						
Industry	(t-1)	R^2	(t-2)	R^2	(t-3)	R^2
Health care	0.0585 (1.1274)	0,0293	-0.0106 (-0.2028)	0,0287	0.0067 (0.1292)	0,0321
Energy	-0.0865 (-2.3280)**	0,0292	0.0080 (0.2141)	0,0287	-0.0094 (-0.2528)	0,0321
IT	0.0196 (0.3553)	0,0291	-0.0457 (-0.8253)	0,0292	-0.0267 (-0.4832)	0,0324
Financials	0.0295 (0.8098)	0,0356	0.0205 (0.5586)	0,0296	0.0289 (0.7901)	0,0330
Consumer staples	0.0191 (0.3939)	0,0290	0.0448 (0.9182)	0,0290	0.0628 (1.2902)	0,0336
Industrials	-0.0843 (-0.8968)	0,0290	0.1639 (1.7356)*	0,0308	0.1741 (1.8481)*	0,0332
Material	-0.0317 (-0.5008)	0,0291	0.0029 (0.0460)	0,0287	0.0265 (0.4171)	0,0322
Telecommunication	-0.0383 (-1.4418)	0,0297	-0.0779 (-2.9183)**	0,0319	-0.0588 (-2.2059)**	0,0336
Consumer discretionary	0.0984 (1.1299)	0,0296	0.0507 (0.5796)	0,0290	-0.1284 (-1.4711)	0,0325
Utilities	0.0200 (0.3928)	0,0290	0.1278 (2.5055)**	0,0321	0.0649 (1.2732)	0,0323

Table 2.Individual regression results of sectors on the Shenzhen A index

INDIVIDUAL regression results on sectors' predictability of the stock market - LARGE A Share						
Industry	(t-1)	R^2	(t-2)	R^2	(t-3)	R^2
Health care	-0.0680	0,0310	-0.0334	0,0281	-0.0072	0,0305
	(-1.8072)*		(-0.8853)		(-0.1925)	
Energy	-0.1168	0,0339	-0.0441	0,0283	-0.0743	0,0323
	(-2.8806)**		(-1.0846)		(-1.8310)*	
IT	-0.0702	0,0313	-0.0567	0,0290	-0.0160	0,0306
	(-1.9451)*		(-1.5681)		(-0.4431)	
Financials	0.1861	0,0345	0.0069	0,0277	-0.0652	0,0311
	(3.0745)**		(0.1141)		(-1.0742)	
Consumer staples	-0.0687	0,0308	-0.0177	0,0278	0.0179	0,0306
	(-1.7078)*		(-0.4386)		(0.4457)	
Industrials	-0.1697	0,0336	-0.0256	0,0277	-0.0086	0,0305
	(-2.7830)**		(-0.4186)		(-0.1404)	
Material	-0.1081	0,0317	-0.0692	0,0287	-0.0176	0,0305
	(-2.0957)**		(-1.3385)		(-0.3405)	
Telecommunication	-0.0783	0,0337	-0.0985	0,0348	-0.0678	0,0338
	(-2.8303)**		(-3.5604)**		(-2.4477)**	
Consumer discretionary	-0.0905	0,0310	-0.0459	0,0281	-0.0695	0,0315
	(-1.7913)*		(-0.9076)		(-1.3750)	
Utilities	-0.0666	0,0304	0.0616	0,0287	-0.0054	0,0305
	(-1.4652)		(1.3546)		(-0.1190)	

Table 3. Individual regression results of sectors on the large cap index

INDIVIDUAL regression results on sectors' predictability of the stock market - MID A Share						
Industry	(t-1)	R^2	(t-2)	R^2	(t-3)	R^2
Health care	0.0893	0,0267	0.0132	0,0267	0.0332	0,0276
	(1.6046)		-0,2362		(0.5949)	
Energy	-0.0691	0,0267	0.0129	0,0268	0.0019	0,0275
	(-1.8265)*		(0.3385)		(0.0489)	
IT	0.0227	0,0267	-0.0454	0,0270	-0.0068	0,0275
	(0.3999)		(-0.7945)		(-0.1189)	
Financials	0.0265	0,0358	0.0168	0,0278	0.0320	0,0283
	(0.7367)		(0.4660)		(0.8877)	
Consumer staples	0.0370	0,0267	0.0531	0,0271	0.0903	0,0286
	(0.7236)		(1.0337)		(1.7630)*	
Telecommunication	-0.0325	0,0272	0.2384	0,0305	0.2635	0,0302
	(-0.3151)		(2.3075)**		(2.5571)**	
Utilities	-0.0037	0,0274	0.0151	0,0269	0.0581	0,0285
	(-0.0575)		(0.2310)		(0.8912)	
Telecommunication	-0.0356	0,0274	-0.0742	0,0301	-0.0577	0,0285
	(-1.2960)		(-2.6976)**		(-2.0980)**	
Consumer discretionary	0.0982	0,0283	0.0930	0,0277	-0.0559	0,0276
	(1.0825)		(1.0213)		(-0.6145)	
Utilities	0.0409	0,0269	0.1472	0,0312	0.0822	0,0280
	(0.7660)		(2.7475)**		(1.5349)	

Table 4. Individual regression results of sectors on the mid cap index

INDIVIDUAL regression results on sectors' predictability of the stock market - SMALL A Share						
Industry	(t-1)	R^2	(t-2)	R^2	(t-3)	R^2
Health care	0.1040 (1.8452)*	0,0267	0.0210 (0.3694)	0,0271	0.0700 (1.2370)	0,0269
Energy	-0.0679 (-1.8948)*	0,0265	0.0282 (0.7827)	0,0271	0.0326 (0.9059)	0,0264
IT	0.0683 (1.1115)	0,0270	-0.0036 (-0.0615)	0,0267	0.0430 (0.6968)	0,0268
Financials	-0.0052 (-0.1482)	0,0372	0.0256 (0.7246)	0,0284	0.0454 (1.2882)	0,0279
Consumer staples	0.0328 (0.6738)	0,0269	0.0588 (1.2028)	0,0276	0.1173 (2.4088)**	0,0284
Industrials	-0.0315 (-0.3930)	0,0298	0.1903 (2.3668)**	0,0320	0.2773 (3.4632)**	0,0308
Material	-0.0030 (-0.0551)	0,0291	0.0476 (0.8609)	0,0276	0.0968 (1.7544)*	0,0286
Telecommunication	-0.0359 (-1.2800)	0,0266	-0.0614 (-2.1787)**	0,0290	-0.0430 (-1.5293)	0,0267
Consumer discretionary	0.0924 (1.1916)	0,0318	0.1150 (1.4753)	0,0295	0.0564 (0.7245)	0,0267
Utilities	0.0444 (0.8344)	0,0277	0.1510 (2.8247)**	0,0327	0.1160 (2.1736)**	0,0275

Table 5. Individual regression results of sectors on the small cap index

Appendix 2. Foreign individual regression results

INDIVIDUAL regression results on sectors' predictability of the stock market – SHANGHAI B						
Industry	(t-1)	R^2	(t-2)	R^2	(t-3)	R^2
Health care	-0.0780	0,0311	-0.0298	0,0168	0.0063	0,0171
	(-1.7585)*		(-0.6656)		(0.1410)	
Energy	-0.0571	0,0302	-0.0251	0,0168	-0.0370	0,0180
	(-1.4941)		(-0.6523)		(-0.9606)	
IT	-0.0524	0,0295	-0.0163	0,0165	0.0851	0,0210
	(-1.2242)		(-0.3786)		(1.9738)**	
Financials	0.0210	0,0283	0.0195	0,0165	0.0232	0,0174
	(0.4771)		(0.4406)		(0.5253)	
Consumer staples	-0.0281	0,0284	-0.0176	0,0165	0.0285	0,0175
	(-0.5998)		(-0.3727)		(0.6053)	
Industrials	-0.1077	0,0317	-0.0230	0,0165	0.0432	0,0177
	(-1.9386)*		(-0.4102)		(0.7701)	
Material	-0.0821	0,0314	-0.0379	0,0170	-0.0163	0,0172
	(-1.8501)*		(-0.8484)		(-0.3651)	
Telecommunication	-0.0601	0,0306	-0.0806	0,0210	-0.0284	0,0177
	(-1.6203)		(-2.1601)**		(-0.7583)	
Consumer discretionary	-0.0876	0,0307	-0.0441	0,0170	-0.0217	0,0173
	(-1.6584)*		(-0.8279)		(-0.4068)	
Utilities	-0.0748	0,0299	-0.0138	0,0164	-0.0024	0,0171
	(-1.3769)		(-0.2529)		(-0.0432)	

Table 6. Individual regression results of sectors on the Shanghai B index

INDIVIDUAL regression results on sectors' predictability of the stock market - SHENZHEN B						
Industry	(t-1)	R^2	(t-2)	R^2	(t-3)	R^2
Health care	-0.0283 (-0.6607)	0,0237	-0.0762 (-1.7727)*	0,0202	0.0366 (0.8510)	0,0166
Energy	-0.0430 (-1.1937)	0,0229	-0.0320 (-0.8841)	0,0202	-0.0267 (-0.7372)	0,0170
IT	-0.0226 (-0.5667)	0,0225	-0.0356 (-0.8895)	0,0196	0.1125 (2.8173)**	0,0215
Financials	0.0657 (1.5229)	0,0237	0.0001 (-0.0181)	0,0184	0.0023 (0.0537)	0,0170
Consumer staples	-0.0421 (-0.9261)	0,0224	-0.0350 (-0.7666)	0,0196	0.0723 (1.5856)	0,0172
Industrials	-0.0483 (-0.8728)	0,0235	-0.0520 (-0.9390)	0,0205	0.0826 (1.4875)	0,0177
Material	-0.0365 (-0.8465)	0,0235	-0.0462 (-1.0660)	0,0214	-0.0023 (-0.0529)	0,0165
Telecommunication	-0.0139 (-0.3963)	0,0236	-0.0711 (-2.0277)**	0,0253	-0.0381 (-1.0859)	0,0169
Consumer discretionary	-0.0549 (-1.0861)	0,0228	-0.0733 (-1.4463)	0,0214	0.0116 (0.2281)	0,0165
Utilities	-0.0299 (-0.5762)	0,0227	-0.0206 (-0.3944)	0,0194	0.0392 (-0.7519)	0,0165

Table 7. Individual regression results of sectors on the Shenzhen B index

INDIVIDUAL regression results on sectors' predictability of the stock market - LARGE foreign share						
Industry	(t-1)	R^2	(t-2)	R^2	(t-3)	R^2
Health care	0,0053 (0.2539)	0.0134	-0,0125 (-0.5973)	0.0146	0.0230 (1.0975)	0.0148
Energy	0,0402 (0.5884)	0.0137	-0,0388 (-0.5678)	0.0146	0.0130 (0.1907)	0.0136
IT	0,0559 (1.5133)	0.0156	0,0027 (0.0718)	0.0143	-0.0279 (-0.7556)	0.0142
Financials	0,0465 (0.6349)	0.0138	0,0468 (0.6397)	0.0147	-0.0347 (-0.4734)	0.0138
Consumer staples	0,0392 (0.9402)	0.0142	0,0189 (0.4530)	0.0145	0.0969 (2.3248)**	0.0190
Industrials	-0,0225 (-0.3591)	0.0135	0,1487 (2.3790)**	0.0199	0.0840 (1.3398)	0.0154
Material	-0,0032 (-0.0726)	0.0134	0,0011 (0.0243)	0.0143	-0.0429 (-0.9739)	0.0145
Telecommunication	-0,0854 (-1.6440)	0.0161	-0,0678 (-1.3050)	0.0160	-0.0114 (-0.2188)	0.0136
Consumer discretionary	-0,0056 (-0.1364)	0.0134	0,1042 (2.5349)**	0.0206	0.0465 (1.1266)	0.0149
Utilities	0,0234 (0.5001)	0.0136	0,1448 (3.1110)**	0.0238	0.0456 (0.9755)	0.0145

Table 8. Individual regression results of sectors on the large foreign (B, H,red&P chip) index

INDIVIDUAL regression results on sectors' predictability of the stock market - MID foreign share						
Industry	(t-1)	R^2	(t-2)	R^2	(t-3)	R^2
Health care	0.0059 (0.2663)	0.0240	-0.0152 (-0.6801)	0.0190	0.0182 (0.8112)	0.0159
Energy	-0.0058 (-0.1333)	0.0240	-0.0531 (-1.2003)	0.0200	0.0000 (0.0030)	0.0152
IT	0.0346 (0.9159)	0.0248	-0.0231 (-0.6102)	0.0189	-0.0110 (-0.2887)	0.0153
Financials	0.0224 (0.4034)	0.0241	-0.0121 (-0.2166)	0.0186	-0.0319 (-0.5710)	0.0155
Consumer staples	0.0635 (1.3462)	0.0257	-0.0161 (-0.3389)	0.0186	0.0905 (1.9103)*	0.0188
Industrials	-0.0649 (-0.9136)	0.0248	0.0408 (0.5719)	0.0189	0.0036 (0.0500)	0.0152
Material	-0.0168 (-0.3137)	0.0240	-0.1159 (-2.1566)**	0.0231	-0.1295 (-2.4043)**	0.0210
Telecommunication	-0.0497 (-1.1697)	0.0253	-0.0755 (-1.7741)*	0.0217	-0.0106 (-0.2468)	0.0153
Consumer discretionary	0.0215 (0.4204)	0.0241	0.0822 (1.6028)	0.0211	0.0298 (0.5768)	0.0155
Utilities	-0.0114 (-0.2340)	0.0240	0.0948 (1.9376)*	0.0223	0.0253 (0.5137)	0.0155

Table 9. Individual regression results of sectors on the mid foreign (B, H,red&P chip) index

INDIVIDUAL regression results on sectors' predictability of the stock market - SMALL foreign share						
Industry	(t-1)	R^2	(t-2)	R^2	(t-3)	R^2
Health care	0.0033 (0.1600)	0.0174	-0.0254 (-1.2168)	0.0244	0.0178 (0.8484)	0.0194
Energy	-0.0041 (-0.1031)	0.0173	-0.0648 (-1.6550)*	0.0257	-0.0187 (-0.4767)	0.0189
IT	0.0386 (1.1343)	0.0186	-0.0389 (-1.1465)	0.0242	-0.0413 (-1.2134)	0.0202
Financials	-0.0038 (-0.0833)	0.0173	-0.0553 (-1.2167)	0.0244	-0.0464 (-1.0178)	0.0197
Consumer staples	0.0319 (0.7304)	0.0179	-0.0376 (-0.8614)	0.0237	0.0797 (1.8244)*	0.0220
Industrials	-0.0436 (-0.7644)	0.0179	-0.0097 (-0.1710)	0.0230	0.0132 (0.2307)	0.0187
Material	-0.0162 (-0.3890)	0.0175	-0.0902 (-2.1732)**	0.0276	-0.0752 (-1.8069)*	0.0219
Telecommunication	-0.0666 (-1.6597)*	0.0201	-0.0721 (-1.8009)*	0.0262	-0.0225 (-0.5601)	0.0190
Consumer discretionaries	-0.0183 (-0.4299)	0.0175	0.0314 (0.7389)	0.0235	0.0162 (0.3806)	0.0188
Utilities	0.0094 (0.2065)	0.0174	0.0797 (1.7598)*	0.0260	0.0175 (0.3843)	0.0188

Table 10. Individual regression results of sectors on the small foreign (B,H,red&P chip) index

Appendix 3. Domestic joint regression results

JOINT regression results on sectors' predictability of the stock market - SHANGHAI A						
Industry	(t-1)	R^2	(t-2)	R^2	(t-3)	R^2
Health care	-0,0493 (-0.9949)	0.0283	-0.0193 (-0.3891)	0.0250	0.0443 (0.8941)	0.0296
Energy	-0.0730 (-1.8700)*		-0.0348 (-0.8891)		-0.0629 (-1.6121)	
IT	-0.0362 (-0.7611)		-0.0771 (-1.6147)		-0.0342 (-0.7180)	
Financials	0.0462 (1.3097)		0.0314 (0.8889)		0.0871 (2.4689)**	
Consumer staples	0.0110 (0.2382)		0.0377 (0.8183)		0.0318 (0.6917)	
Telecommunication	0.0577 (1.0278)		0.0455 (0.8089)		0.0643 (1.1445)	
Utilities	0.0391 (0.5376)		-0.0282 (-0.3873)		-0.0785 (-1.0795)	

Table 11. Joint regression results of sectors on the Shanghai A index

JOINT regression results on sectors' predictability of the stock market - SHENZHEN A						
Industry	(t-1)	R^2	(t-2)	R^2	(t-3)	R^2
Health care	0.0501	0.0411	-0.0209	0.0273	0.0114	0.0349
	(0.8945)		(-0.3698)		(0.2018)	
Energy	-0.1073		0.0034		-0.0312	
	(-2.5351)**		(0.0790)		(-0.7352)	
IT	0.0164		-0.0446		-0.0050	
	(0.2829)		(-0.7639)		(-0.0863)	
Financials	0.0623		0.0122		0.0449	
	(1.5848)		(0.3071)		(1.1371)	
Consumer staples	0.0001		0.0475		0.0792	
	(0.0117)		(0.9296)		(1.5548)	
Telecommunication	0.0562		-0.0076		0.0436	
	(0.7801)		(-0.1052)		(0.6025)	
Utilities	0.0627		0.0464		-0.1597	
	(0.6976)		(0.5121)		(-1.7683)*	

Table 12. Joint regression results of sectors on the Shenzhen A index

JOINT regression results on sectors' predictability of the stock market - LARGE A Share						
Industry	(t-1)	R^2	(t-2)	R^2	(t-3)	R^2
Health care	-0.0502	0,0274	-0.0203	0,0242	0.0434	0,0289
	(-1.0136)		(-0.4084)		(0.6598)	
Energy	-0.0721		-0.0339		-0.0621	
	(-1.8449)*		(-0.8655)		(-0.5438)	
IT	-0.0369		-0.0777		-0.0348	
	(-0.7747)		(-1.6274)		(0.3230)	
Financials	0.0473		0.0326		0.0881	
	(1.3418)		(0.9217)		(1.1042)	
Consumer staples	0.0135		0.0402		0.0341	
	(0.2929)		(0.8719)		(1.8735)*	
Telecommunication	0.0590		0.0467		0.0654	
	(1.0494)		(0.8292)		(1.2319)	
Utilities	0.0366		-0.0307		-0.0808	
	(0.5028)		(-0.4210)		(-0.9581)	

Table 13. Joint regression results of sectors on the large cap A index

JOINT regression results on sectors' predictability of the stock market - MID A Share						
Industry	(t-1)	R^2	(t-2)	R^2	(t-3)	R^2
Health care	0.0875	0.0391	0.0083	0.0276	0.0395	0,0342
	(1.4678)		(0.1379)		(0.6598)	
Energy	-0.0923		0.0100		-0.0238	
	(-2.1149)**		(0.2276)		(-0.5438)	
IT	0.0240		-0.0446		0.0191	
	(0.4075)		(-0.7521)		(0.3230)	
Financials	0.0507		0.0034		0.0436	
	(1.2888)		(0.0850)		(1.1042)	
Consumer staples	0.0193		0.0493		0.0994	
	(0.3654)		(0.9270)		(1.8735)*	
Telecommunication	0.0928		0.0157		0.0939	
	(1.2211)		(0.2058)		(1.2319)	
Utilities	0.0610		0.0909		-0.0908	
	(0.6454)		(0.9558)		(-0.9581)	

Table 14. Joint regression results of sectors on the mid cap A index

JOINT regression results on sectors' predictability of the stock market - SMALL A Share						
Industry	(t-1)	R^2	(t-2)	R^2	(t-3)	R^2
Health care	0.0901	0,0426	-0.0077	0,0277	0.0408	0,0362
	(1.4817)		(-0.1252)		(0.6687)	
Energy	-0.1120		0.0092		-0.0185	
	(-2.4298)**		(0.1983)		(-0.4003)	
IT	0.0584		-0.0235		0.0337	
	(0.9288)		(-0.3700)		(0.5336)	
Financials	0.0073		-0.0024		0.0334	
	(0.1752)		(-0.0575)		(0.7971)	
Consumer staples	-0.0105		0.0403		0.1049	
	(-0.1931)		(0.7337)		(1.9194)*	
Telecommunication	0.0779		0.0143		0.0960	
	(1.1221)		(0.2043)		(1.3767)	
Utilities	0.0828		0.0903		-0.0854	
	(0.8864)		(0.9582)		(-0.9094)	

Table 15. Joint regression results of sectors on the small cap A index

Appendix 4. Foreign joint regression results

JOINT regression results on sectors' predictability of the stock market - SHANGHAI B						
Industry	(t-1)	R^2	(t-2)	R^2	(t-3)	R^2
Health care	-0.0798	0.0299	-0.0297	0.0164	-0.0540	0.0171
	(-1.2225)		(-0.4502)		(-0.8254)	
Energy	-0.0070		-0.0078		-0.0485	
	(-0.1238)		(-0.1365)		(-0.8599)	
IT	0.0198		0.0164		0.1832	
	(0.3047)		(0.2505)		(2. 8081)**	
Consumer staples	0.0750		0.0140		0.0432	
	(1.1243)		(0.2077)		(0.6461)	
Industrials	-0.6888		0.0830		0.2277	
	(-0.5524)		(0.6604)		(1.8251)*	
Material	-0.0394		-0.0540		-0.0586	
	(-0.4827)		(-0.6554)		(-0.7165)	
Consumer discretionaries	-0.0095		-0.0734		-0.2531	
	(-0.0890)		(-0.6817)		(-2.3662)**	
Utilities	0.0047		0.0214		-0.0223	
	(0.0610)		(0.2750)		(-0.2880)	

Table 16. Joint regression results of sectors on the Shanghai B index

JOINT regression results on sectors' predictability of the stock market - SHENZHEN B						
Industry	(t-1)	R^2	(t-2)	R^2	(t-3)	R^2
Health care	0.0017		-0.0878		-0.0510	
		0.0266		0.0191		0.0217
	(0.0272)		(-1.4267)		(-0.8363)	
Energy	-0.0420		-0.0129		-0.0500	
	(-0.7958)		(-0.2440)		(-0.9535)	
IT	0.0153		0.0219		0.1959	
	(0.2527)		(0.3593)		(3.2429)**	
Consumer staples	-0.0268		0.0342		0.0773	
	(-0.4268)		(0.5422)		(1.2365)	
Industrials	0.0144		0.0559		0.2220	
	(0.1209)		(0.4695)		(1.8829)*	
Material	0.0125		-0.0329		-0.0760	
	(0.1626)		(-0.4265)		(-0.9953)	
Consumer discretionary	-0.0502		-0.0819		-0.2569	
	(-0.5026)		(-0.8181)		(-2.5868)**	
Utilities	0.0163		0.0416		0.0157	
	(0.2252)		(0.5716)		(0.2179)	

Table 17. Joint regression results of sectors on the Shenzhen B index

JOINT regression results on sectors' predictability of the stock market - LARGE foreign share						
Industry	(t-1)	R^2	(t-2)	R^2	(t-3)	R^2
Health care	0.0026	0.0181	-0.0230	0.0341	0.0136	0.0264
	(0.1211)		(-1.0819)		(0.6362)	
Energy	0.0576		0.0001		0.0522	
	(0.7981)		(0.0139)		(0.7258)	
IT	0.0645		-0.0128		-0.0412	
	(1.6814)*		(-0.3371)		(-1.0784)	
Consumer staples	0.0423		-0.0102		0.0925	
	(0.9614)		(-0.2326)		(2.1037)**	
Industrials	-0.0407		0.1084		0.1000	
	(-0.5459)		(1.4670)		(1.3470)	
Telecommunication	-0.0039		-0.0701		-0.1013	
	(-0.0801)		(-1.4342)		(-2.0615)**	
Consumer discretionary	-0.0134		0.1032		0.0377	
	(-0.2912)		(2.2522)**		(0.8185)	
Utilities	0.0289		0.1357		0.0284	
	(0.5952)		(2.8178)**		(0.5862)	

Table 18. Joint regression results of sectors on the large cap foreign (B,H,red&P chip) index

JOINT regression results on sectors' predictability of the stock market – MID foreign share						
Industry	(t-1)	R^2	(t-2)	R^2	(t-3)	R^2
Health care	0.0042	0.0277	-0.0180	0.0334	0.0109	0.0258
	(0.1858)		(-0.8011)		(0.4835)	
Energy	0.0013		-0.0517		0.0383	
	(0.0260)		(-1.0332)		(0.7632)	
IT	0.0383		-0.0258		-0.0203	
	(0.9851)		(-0.6666)		(-0.5222)	
Consumer staples	0.0596		-0.0238		0.0788	
	(1.2480)		(-0.4988)		(1.6456)*	
Industrials	-0.0790		0.0611		0.0279	
	(-1.0195)		(0.7896)		(0.3591)	
Telecommunication	0.0032		-0.1138		-0.1431	
	(0.0549)		(-1.9313)*		(-2.4174)**	
Consumer discretionary	0.0191		0.0899		0.0221	
	(0.3657)		(1.7233)*		(0.4205)	
Utilities	0.0021		0.1145		0.0224	
	(0.0416)		(2.2290)**		(0.4342)	

Table 19. Joint regression results of sectors on the mid cap (B,H,red&P chip) index

JOINT regression results on sectors' predictability of the stock market - SMALL foreign share						
Industry	(t-1)	R^2	(t-2)	R^2	(t-3)	R^2
Health care	-0.0048	0.0598	-0.0262	0.0568	-0.0107	0.0470
	(-0.2497)		(-1.3598)		(-0.5520)	
Energy	-0.0093		-0.0420		0.0459	
	(-0.2162)		(-0.9740)		(1.0580)	
IT	0.0154		-0.0056		-0.0076	
	(0.4681)		(-0.1700)		(-0.2297)	
Consumer staples	0.0668		-0.0092		0.0566	
	(1.6535)*		(-0.2285)		(1.3901)	
Industrials	-0.0963		0.0428		-0.0093	
	(-1.4865)		(0.6600)		(-0.1428)	
Telecommunication	-0.0012		-0.0699		-0.1093	
	(-0.0264)		(-1.5109)		(-2.3477)**	
Consumer discretionary	0.0288		0.0784		0.0325	
	(0.6831)		(1.8548)*		(0.7658)	
Utilities	0.0588		0.0784		-0.0130	
	(1.3373)		(1.7775)*		(-0.2936)	

Table 20. Joint regression results of sectors on the small cap (B,H,red&P chip) index

Appendix 5. Industries and industrial production growth

Individual regressions of A Share industry portfolios on industrial production growth			
	(t-1)	(t-2)	(t-3)
Health care	0.0010	-0.0331	0.0318
	(-0.0196)	(-0.5944)	(0.5718)
Energy	0,0327	-0,1177	0,0930
	(0.5914)	(-1.9565)**	(1.5289)
IT	0.0347	-0.1917	0.0979
	(0.6097)	(-3.2433)**	(1.5487)
Financials	0.0238	0.0361	-0.0439
	(0.3866)	(0.5248)	(-0.6345)
Consumer Staples	0.0204	-0.1093	0.0871
	(0.3777)	(-1.8531)*	(1.4563)
Industrials	0.0505	-0.2113	0.0958
	(0.8644)	(-3.5137)**	(1.4673)
Material	0.0191	-0.0943	0.0628
	(0.3338)	(-1.4992)	(0.9853)
Telecommunication	-0.0072	-0.0425	0.0679
	(-0.1465)	(-0.7766)	(1.2382)
Consumer Discretionary	0.0297	-0.0845	0.0769
	(0.5074)	(-1.3077)	(1.1890)
Utilities	0.1382	-0.0602	0.0976
	(2.6079)**	(-0.9762)	(1.6090)

Table 21. Individual regressions of A Share industry portfolios on industrial production growth

Individual regressions of foreign share industry portfolios on industrial production growth			
	(t-1)	(t-2)	(t-3)
Health care	0.0501	-0.0047	-0.0121
	(1.0972)	(-0.0894)	(-0.2303)
Energy	0.0435	-0.0125	-0.0070
	(0.8327)	(-0.2087)	(-0.1167)
IT	-0.0189	0.0211	0.0878
	(-0.2978)	(0.2922)	(1.2385)
Financials	0.0668	0.0370	-0.0450
	(1.2784)	(0.6088)	(-0.7121)
Consumer staples	0.0937	-0.0408	-0.0065
	(1.7931)*	(-0.6668)	(-0.1019)
Industrials	0.1043	-0.0942	-0,0028
	(1.9039)*	(-1.4954)	(-0.0435)
Material	0,0857	-0,0365	0,0034
	(1.8156)*	(-0.6538)	(0.0591)
Telecommunication	0,0518	-0,0219	0,0414
	(1.4611)	(-0.5316)	(0.9782)
Consumer discretionary	0,0233	-0,0901	0,0209
	(0.3794)	(-1.2995)	(0.2975)
Utilities	0,0806	0,0901	0,0162
	(1.3293)	(0.0159)	(0.2327)

Table 22. Individual regressions of foreign share industry portfolios on industry production growth