University of Alberta

Essays in Corporate Finance and Financial Markets

by

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DEDICATION

To my parents

ABSTRACT

This document presents three essays in both corporate governance and financial markets. The second chapter explores the relationship between indexing and value premium of the S&P 500 index firms relative to those of other similar firms. It finds that S&P 500 firms have value premiums relative to the benchmark firms, and the premiums fluctuate in accordance with money indexed to the S&P 500 index. Granger's causality tests show that inclusion in the index causes prices of member stock to rise. The findings are consistent with downward sloping demand curves hypothesis proposed by Shleifer (2000) and Wurgler and Zhuravskaya (2002). Indexing causes demand for S&P member firm to rise, and the rightward shifted demand curve increases the stock price. The findings are also consistent with the hypothesis that the Standard and Poor's, being a bond rating specialist, might have superior techniques in picking "winners" in the market. The third chapter presents a case of good corporate governance in pre-communist China where neither economic development, nor legal environment, favored business. However, a bank, located in inland China, invented a governance structure that avoided entrenching managers while providing these managers with incentive aligned pecuniary benefits. These managers exhibited firm value maximizing practices, consistent with Jensen and Meckling (1976), Morck *et al.* (1988, 2000) and Stulz (1988). The fourth chapter examines the roles institutional and trading restrictions play in asset pricing. This chapter observes persistent and non-ignorable price disparities between twin A-shares and B-shares issued by the same firms in China's stock markets. A technique of co-

integration is applied to show that before the removal of B-share ownership restrictions, the prices of twin A-shares and B-shares diverged. This chapter explores many factors that may contribute to the disparities and concludes that (a) different attitudes towards systematic risk, (b) A-share noise traders' momentum, and (c) Huizhuan Trading restrictions play important roles in explaining the observed price disparities.

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CHAPTER 1

INTRODUCTION

This thesis presents three essays spanning corporate finance and financial markets. The seemingly unrelated topics are connected to each other by a unifying theme of efficiency versus anomaly – in financial markets or within corporations. The factors that contribute to financial market anomalies can be behavioral, such as investor sentiment, or limited arbitrage. These factors can also be institutional, such as a possible indexing bubble in the US capital markets (Chapter Two), or distortions caused by ownership and trading restrictions in the Chinese equity markets (Chapter Four). In contrast, Chapter Three presents an example of a good "anomaly", in which a firm emerged and exuberated in the highly inefficient and corrupt economy of Qing Dynasty China.

Chapter Two observes that S&P 500 index member firms enjoy significant value premiums relative to benchmark firms of similar size. The premiums are robust and increase in proportion to the money directed into the index funds that track the S&P 500 index. Granger's causality tests show it to be more likely that indexing elevates the value of S&P 500 member firms and causes these premiums. However, the tests do not totally eliminate the possibility of a limited feedback effect: the elevated value of S&P 500 firms attracts more money into indexing. Suggestions for eliminating this anomaly include forming a broad based index, such as a total market index, for funds to track.

Chapter Three raises an example of a good "anomaly". In this example, the macroeconomic environment is extremely inefficient: the government is highly corrupt, the judiciary system is unfair, there is no private property rights protection, and the financial system does not function. However, an innovative entrepreneur solves these problems by reputation based informal contracting, and a special class of stock to compensate professional managers. This *expertise stock* grants dividend rights and very limited control rights. Specifically, it does not entitle managers to any voting rights regarding to broad strategic issues or managerial firing, hiring and compensation. This simple innovation not only renders the Rising Sun the first modern bank in China, but also allows it one full century of prosperity. For academics, this innovation casts light on issues in modern finance. The Rising Sun bank's share structure solves such problems as how to align the interest between shareholders and managers while preventing the managers from becoming entrenched; how to attract highly capable managers to family owned corporations; how to motivate managers to plan for the longer term; and how to solve the problem of control rights passing to unqualified heirs. These are all important problems in corporate governance through out the world.

Chapter Four examines possible reasons why A-shares and B-shares, which are two classes of shares issued by many Chinese firms and are endowed with equal voting and dividend rights, are priced strikingly differently. Two explanations emerge to fit the empirical evidence. The first one is differential risk. When investors are separated into mutually exclusive groups, with each group facing different investment opportunity sets, investors in each group can assign different values to identical assets. Eventually, prices of the same stocks diverge. B-share investors request significantly higher returns than A-share investors do when holding the Chinese risky assets, reflecting B-share investors' assessment that there are higher risks related to China's macroeconomic environment. The second possible explanation is the Huizhuan Trading restrictions that prevent A-share investors from selling the equity purchased earlier the same business day. In contrast, there are no Huizhuan trading restrictions on B-share investors. Huizhuan Trading restrictions could prevent information from being reflected promptly in stock prices, and might elevate A-share prices. Further studies are required to distinguish the relative importance of the two hypotheses in determining the observed price disparities.

CHAPTER 2

GROWING VALUE OF S&P 500 MEMBERSHIP

2.1. Introduction

When asked for investment advice at cocktail parties, most finance professors hesitantly recommend a well-diversified index fund, such as one that tracks the Standard and Poor's (S&P) 500 Index of blue chip shares. This advice may have been far sounder than its propagators ever imagined.

The view that investors should entrust their savings to a well-diversified index fund follows from the semi-strong form of the Efficient Markets Hypothesis (EMH), which states that no publicly available information is useful in predicting stock returns. Despite a large literature on market anomalies, behavioral studies of investors, and the like, the hypothesis that the market is semi-strong form efficient rightly retains its place of prominence in introductory finance textbooks, for studies critical of it have yet to coalesce into a coherent alternative framework.

If the semi-strong form of the EMH is valid, and it is impossible to pick stocks that will perform better than average on a risk adjusted basis, the optimal investment strategy is to keep transactions costs low and remain widely diversified. Index funds generally accomplish these two goals better than other investment channels available to typical cocktail party guests.

Indexing has grown phenomenally in popularity over the past decade. The proxies for the growth in indexing shown in Table 2.1 give a sense of this upsurge. The total magnitude of indexing is not known with certainty because of the large number of relatively small index funds and because of informal indexing by actively managed funds. Goetzmann and Massa (2003) estimate that \$80 to \$100 billion was formally indexed to the S&P 500 in mid-1998 (Standard and Poor's estimates it as \$1 trillion: http://www2.standardandpoors.com). This works out to about ten percent of the market capitalization of the S&P 500. This certainly understates the real magnitude of indexing. In part, this is because of informal indexing by active money managers. Because these money managers are often evaluated relative to the S&P 500, they adopt a baseline indexing strategy, and then deviate from it as investment opportunities become apparent. The growing importance of indexing, both formal and informal, makes an understanding of its economic consequences an important question.

Investor demand affects securities prices. Event studies of the inclusions and deletions of firms by indexes used as passive investment benchmarks show prices to be positively correlated with demand. Moreover, an increasing number of studies find these value effects to be at least partially permanent.

If the increased value associated with inclusion in the S&P index is indeed permanent, it should be detectable in average Tobin's q ratios. Average q ratios are market to book ratios that are adjusted carefully for differences between book values and market values of liabilities and assets due to accounting conventions, interest rate changes, and inflation.

We find that membership in the S&P 500 index is associated with significantly higher average q ratios, even after controlling for standard variables known to affect q ratios. Moreover, this premium rises steadily from 1976 to 2000, in step with the growth of indexing, and then declines slightly as index funds experience net withdrawals. Granger causality tests suggest that being in the index causes the value premium; and that reverse causation is less statistically important, although it cannot be rejected in some specifications.

One interpretation of this finding is that a presently unknown intangible asset associated with membership in the S&P 500 has a value that coincidentally varies in time with the popularity of indexing. Another interpretation is that varying demand for stocks in the S&P 500 index by index funds affects their prices.

We argue that, although both explanations may well be valid, the second explanation should be taken seriously, and that the cocktail party advice, which adherents to the efficient markets hypothesis have promulgated, may have had the perverse effect of undermining the efficiency of the stock market. Nonetheless, it turned out to be very good advice.

[Table 2.1 about here]

2.2. Share Values and Investor Demand

Evidence that investor demand affects securities prices comes from the literatures on block purchases, international capital flows, patterns of domestic savings, and changes in the composition of indexes. Lakonishok, Shleifer and Vishny (1991, 1992), Chan and Lakonishok (1993, 1995), and others find that large block equity sales depress share prices, while large block purchases raise share prices. Froot, O'Connell and Seasholes (2001) and Clark and Berko (1996) find that domestic stock prices rise and fall in proportion to a country's net international capital inflow. Warther (1995) and Zheng (1999) find a positive contemporaneous correlation between aggregate net investment in stocks and the market return. Garry and Goetzmann (1986), Harris and Gurel (1986), Shleifer (1986), Dhillon and Johnson (1991), Beniesh and Whaley (1996) and Lynch and Mendenhall (1997), and Kaul *et al.* (2001) find that the addition of a stock to an index followed by index funds raises the price of the stock and that the dropping of a stock from such an index lowers its price.

One interpretation of all of these studies is that a stock's price rises when investor demand for that stock rises. Although indexing can also be accomplished with derivatives, many institutional investors and mutual funds constrain themselves from using derivatives.[1] They must therefore hold the index stocks. Also, because index fund managers are penalized for tracking error, and so *must* hold precisely the stocks in the index they are tracking and no others. Stocks in the index thus do not have close substitutes insofar as far as these index fund managers are concerned.

This interpretation is illustrated in Figure 2.1. Thus, when a stock is added to a widely tracked index, the added demand by passive investors shifts its demand curve outwards, from D to D_1. This causes its price to rise from P to P_1, generating a price increase.

[1] Also, if investors betting the opposite way with derivatives hedge by holding the underlying stocks, this only relocates the demand for index stocks.

[Figure 2.1 about here]

Other interpretations have to do with information release, liquidity effects, risk reduction, and behavioral issues.

For example, some authors attribute the price effects associated with additions to indexes (and deletions from them) to inclusion in the index having an accreditation aspect. Dhillon and Johnson (1991) show that included firms' bond prices rise in step with their stock prices, and Jain (1987) finds abnormal returns for inclusions into industry indexes that are not used as passive investment benchmarks. Based on this evidence, these authors argue that inclusion in the index amounts to a "certification of quality", and that this is the ultimate cause of the value increase. Since Standard and Poor's rates bonds as its core business, such a certification effect would seem plausible. According to this view, the S&P 500 is therefore not representative of the market as a whole, but rather is reflective of the stock picking ability of Standard and Poor's employees.

This certification view is particularly cogent for studies of large block trades, such as Lakonishok, Shleifer and Vishny (1991, 1992), Chan and Lakonishok (1993, 1995), and others. Purchases or sales by large block shareholders could easily raise and lower prices because this leads public shareholders to make inferences about the value of the firm.

However, Wurgler and Zhuravskaya (2002) find that the abnormal returns associated with inclusion in the S&P 500 are larger for stocks that are less likely to have close substitutes. Such a finding is consistent with a demand shift explanation, but not with a certification story. Also, Kaul *et al.* (2000) observe a mechanical rearrangement of the weights of stocks already in a widely followed index. Since no new stocks were added to the index, a certification effect can be ruled out categorically. Yet stocks whose weights rise gain value, while stocks whose weights fall lose value.

Other authors attribute these price changes to a temporary "price pressure" due to a liquidity shortfall. Harris and Gurel (1986) find a complete subsequent reversal of the price changes associated with index inclusions. Malkiel and Radisich (2001) support this with long horizon event studies on quarterly data explicitly controlling for a linear time trend. However, Goetzmann and Massa (2003), in an analogous study, but using daily data and a conventional methodology, reject a complete reversal. Garry and Goetzmann (1986) and Shleifer (1986) find no reversal. Dhillon and Johnson (1991), Beniesh and Whaley (1996), Lynch and Mendenhall (1997), and Kaul *et al.* (2001) find a partial reversal only. Notably, Kaul *et al.* (2000) observe trading volume and spreads, and reject a complete reversal long after these have returned to normal. Dhillon and Johnson (1991) also show that the prices of call options on newly included stocks increase on the announcement date. Since corresponding put prices do not rise, these increases are not caused by increased implied volatility. Consequently, options traders must regard the price gains as not subject to reversal, at least before the expiry of the call options.

In examining the correlation between capital inflows and stock prices, an issue of causation also arises. Capital inflows might increase investor demand, and so push up prices. Alternatively, rising prices might induce "positive feedback" investors to buy equity, as in De Long *et al.* (1990). Warther (1995) argues that his finding of a contemporaneous correlation of returns with inflows is not due to positive feedback investors because he finds current month inflows to be unrelated to previous month returns. However, Edelen and Warner (2001) find evidence of positive feedback using bi-weekly and daily data.

In summary, the contention that investor demand affects individual stock prices remains subject to debate, though more recent evidence tends to support this view.

2.3. Empirical Framework

We begin by graphing the time series of stock price changes upon inclusion in the S&P 500 index from 1976 to 2001. Unlike previous studies, we focus on long-term cumulative abnormal returns over periods that should encompass subsequent reversions as short-term price pressure effects abate. We use a conventional event study methodology for this exercise.

A problem in testing for the complete reversion of included stocks' prices to their pre-inclusion values is that the power of event study tests declines as the event window lengthens. This study seeks to overcome this problem by using time varying firm-specific benchmarks against which to measure firm value changes. Constructing these benchmarks and using them to gauge abnormal changes in value is an involved exercise, and the remainder of this section describes this methodology.

To compare the actual market value of firm j in year t, $V_{t,j}$, with an estimate of that value based on a vector of firm-specific financial data, $\mathbf{x}_{j,t}$, we consider

$$[2.1]\ V_{t,j} = f_t(\mathbf{x}_{t,j}) + \varepsilon_{t,j}\,.$$

If we find that firms in the S&P Index consistently have market values higher than those we predict, that is, if $\varepsilon_{t,j} > 0$, we can conclude that S&P membership is associated with higher market value.

As a first approximation, we assume the functional form

$$[2.2]\ f_t(\mathbf{x}_{t,j}) = \beta_{0,t}A_{t,j} + \beta_{1,t}rd_{t,j} + \beta_{2,t}adv_{t,j} + \beta_{3,t}debt_{t,j} + \beta_{4,t}n(A_{t,j})\,.$$

That is, we assume firm j's market value to be proportional to the replacement cost of its tangible assets, $A_{t,j}$, plus an additional effect associated with possession of proprietary technology, which we assume proportional to research and development spending, $rd_{t,j}$, and another effect associated with the possession of brand names and the like, which we take to be proportional to advertising spending, $adv_{t,j}$. We allow for a possible effect on value of leverage, $debt_{t,j}$, and also allow for a nonlinear relationship of market value to tangible assets replacement cost by including an effect proportional to some function $n(A_{t,j})$.

We thus consider

[2.3] $V_{t,j} = \beta_{0,t}A_{t,j} + \beta_{1,t}rd_{t,j} + \beta_{2,t}adv_{t,j} + \beta_{3,t}debt_{t,j} + \beta_{4,t}n(A_{t,j}) + \varepsilon_{t,j}$.

It is plausible that the value of $\beta_{0,t}$ might differ across industries. Typical firms in industries where certain sorts of intangible assets are important, such as newspapers, where subscriber lists are a key asset, might have a much higher market value per dollar of tangible replacement cost than would firms in industries such as cement manufacturing, where tangible assets account for most of firms' market values. This line of reasoning suggests that we replace $\beta_{0,t}A_{t,j}$ in [2.3] with $\sum_{i=1}^{I} \gamma_{i,t}\delta_{i,t,j}A_{t,j}$ where

$$[2.4]\ \delta_{i,t,j} \equiv \begin{cases} 0 & \text{if firm } j \text{ is not in industry } i \text{ in year } t \\ 1 & \text{if firm } j \text{ is in industry } i \text{ in year } t \end{cases}$$

and the $\gamma_{i,t}$ are a vector of 3-digit SIC code industry-specific estimated coefficients. Heteroskedasticity problems make the estimation of [2.3] by least squares problematic because both positive and negative valuation errors are likely to be larger for larger firms. That is, $\varepsilon_{t,j}$ is likely to be proportional to measures of firm size, such as $A_{t,j}$. Since least squares estimation techniques place greater weight on more extreme observations, direct estimation of [2.3] risks ignoring smaller firms. To remedy this, we divide through [2.3] by $A_{t,j}$ to get

$$[2.5]\ \frac{V_{t,j}}{A_{t,j}} = \sum_{i=1}^{I} \gamma_{i,t}\delta_{i,t,j} + \beta_{1,t}\frac{rd_{t,j}}{A_{t,j}} + \beta_{2,t}\frac{adv_{t,j}}{A_{t,j}} + \beta_{3,t}\frac{debt_{t,j}}{A_{t,j}} + \beta_{4,t}n'(A_{t,j}) + \zeta_{t,j},$$

where the transformed error term,

$$[2.6]\ \zeta_{t,j} \equiv \frac{\varepsilon_{t,j}}{A_{t,j}}.$$

is plausibly independently and identically distributed (iid) across firms within each time period. Note that the dependent variable in [2.5] is equal to firm *j*'s average q ratio in year *t*.

Our objective is to test for a valuation effect associated with S&P 500 index membership in each year. We therefore expect $\zeta_{t,j}$ to be larger for firms that are in the index. That is, we expect that

$$[2.7]\ \zeta_{t,j} = \beta_{5,t}\eta_{t,j} + u_{t,j},$$

where

$$[2.8]\ \eta_{t,j} \equiv \begin{cases} 0 & \textit{if firm j is not in the index in year t} \\ 1 & \textit{if firm j is in the index in year t} \end{cases}$$

and $u_{t,j}$ is an *iid* error.

Our empirical framework is thus to estimate the regression

[2.9]

$$\frac{V_{t,j}}{A_{t,j}} = \sum_{i=1}^{I} \gamma_{i,t}\delta_{i,t,j} + \beta_{1,t}\frac{rd_{t,j}}{A_{t,j}} + \beta_{2,t}\frac{adv_{t,j}}{A_{t,j}} + \beta_{3,t}\frac{debt_{t,j}}{A_{t,j}} + \beta_{4,t}\ln(A_{t,j}) + \beta_{5,t}\eta_{t,j} + u_{t,j}$$

cross-sectionally in each time period *t*. We test directly for a valuation effect by testing the statistical and economic significance of $\beta_{5,t}$ and observing how the value and significance of this coefficient change over time.

The S&P 500 index is value-weighted, so some firms make up greater parts of the index portfolio than others. We measure the importance of a firm in the index by its value weight,

$$[2.10]\ w_{t,j} \equiv \frac{\eta_{t,j}V_{s,t,j}}{\sum_{k\in S\&P500} V_{s,t,k}}$$

Our second empirical test is therefore to run the regression

$$[2.11]\quad \frac{V_{i,t}}{A_{i,t}} = \sum_{i}^{I} \gamma_{i,t}\delta_{i,i,t} + \beta_{1,t}\frac{rd_{i,t}}{A_{i,t}} + \beta_{2,t}\frac{adv_{i,t}}{A_{i,t}} + \beta_{3,t}\frac{debt_{i,t}}{A_{i,t}} + \beta_{4,t}\ln(A_{i,t}) + \beta_{5,t}w_{i,t} + u_{i,t}$$

cross-sectionally in each time period t and again to note the statistical and economic significance of $\beta_{5,t}$.

To test whether index membership causes higher firm values or higher firm value causes index membership, we supplement this regression analysis with some simple Granger causality tests (see Granger, 1969; Sims, 1972). Augmented Dickey-Fuller test cannot reject the hypothesis that the series involved in equation [2.12] and [2.13] are difference stationary. We thus make the coefficients from [2.9] and [2.11], and the proxies of the amount of money indexed (table 2.1) stationary by taking either first differences or first differences of logarithms (rates of growth).

To test the hypothesis that indexing 'causes' a valuation premium for stocks in the index, we then regress

$$[2.12]\quad \beta_{5,t} = \gamma_0 + \sum_{\tau=1}^{L} \lambda_\tau \beta_{5,t-\tau} + \sum_{\tau=0}^{L} \kappa_\tau x_{t-\tau} + z_t$$

where $\beta_{5,t}$ now represents the first difference of the coefficient from either [2.9] or [2.11], x_t is now the first difference of the amount of money indexes to the S&P 500 Index in year t, and z_t is a roughly *iid* error. That is, we regress the measures of the differenced S&P500 value premium on lagged values of itself and on current and on the differenced value of funds indexed to the S&P500.

We then run the restricted regression

$$[2.13]\quad \beta_{5,t} = \theta_0 + \sum_{\tau=1}^{L} \vartheta_\tau \beta_{5,t-\tau} + \upsilon_t$$

without current and past values of x_t.

We test the joint significance of $\{x_1, \ldots x_L\}$ by testing whether the sum of squared residuals of the restricted regression is significantly larger than that of the corresponding unrestricted regression. If the difference in sums of squared residuals is statistically significant, we concluded that indexing 'Granger-causes' the valuation premium (or, changes in indexing Granger-cause changes in the valuation premium).

To compare the sum of squared errors of the restricted regression [2.13], denoted $SSE(u)$ with that of the unrestricted regression [2.12], denoted $SSE(r)$, we employ the statistic

$$[2.14]\ s_1 \equiv \frac{[SSE(r) - SSE(u)] / L}{SSE(u) / (n - 2L - 1)}$$

which has an F distribution with L and $n - 2L - 1$ degrees of freedom, where L is the number of lags (restrictions) and n the number of observations. An alternative approach is to use the statistic

$$[2.15]\ s_2 = \frac{SSE(r) - SSE(u)}{SSE(u) / L}$$

which has a χ^2 distribution with L degrees of freedom.

We then test for reverse causality by switching the dependent and independent variables in [2.12] and [2.13], and repeating the whole procedure.

2.4. Construction of Data Sample and Key Variables

This section is a technical explanation of the construction of our data sample and key variables.

2.4.1. Data Sample

Our basic sample begins with all firms listed in Compustat in the twenty-six-year panel from 1976 to 2001. We do not include firms in banking and financial industries - Standard Industrial Classification (S.I.C.) codes 6,000 through 6,999 – as accounting information for these firms is not comparable to that of other firms. We delete observations in which sales, the share price, the number of shares outstanding, inventories, or property plant and equipment (PPE) are missing or negative. Where these variables are present, but entries for research and development spending, advertising spending, short term debt, long term debt, or non-inventory short-term assets are missing, the missing variables are assumed to be nil. We call the resulting firm-year observations our *basic sample*.

We define a company as being in the S&P 500 Index in year *t* if it is in the index on December 31 of that year. To construct the list of S&P 500 members for each year, we begin with the current year's list of members and work backwards, adjusting the list for firms dropped from and added to the index each year.[2] We double-check the resulting sequence of lists by purchasing from Standard and Poor's Corporation its S&P 500 membership list for 1982, the earliest year for which such data are available. Where discrepancies were found, they were corrected using newspaper records. This procedure generates our *index firms sample* for each year.

The first column in Table 2.2 lists the number of S&P500 index firms we use each year. The number is less than 500 because some firms in the index are financial firms, and so are excluded from our basic sample. We refer to this *index subsample* as I_1.

[Table 2.2 about here]

We wish to contrast S&P 500 index member firms against other comparable firms. We do this in two ways: by using a multiple regression framework across a

[2] We are grateful to Jeff Wurgler for providing us with index additions and deletions data.

broad sample of non-S&P500 firms and by constructing subsamples of matched pair firms.

The second column of Table 2.2 lists the number of firms in the basic sample each year that are not members of the S&P 500 index and that are at least as large as the smallest S&P 500 firm that year. Size is measured as estimated replacement cost, the construction of which variable is described below. This subsample, denoted *C*, we call our *control subsample*. We do not include firms smaller than the smallest S&P500 index firm for a specific year on the grounds that very small firms may not be valued by investors in the same way as larger firms. This subsample contains some extreme observations, which probably reflect coding errors by Compustat.[3] We therefore winsorize the data at the first and 99th percentiles for all important variables.

The third and fourth columns in Table 2.2 list the number of S&P firms for which industry and size matched pair firms are available. We select matching firms for each index firm as follows. We define our match *candidate sample* as our *basic sample* less S&P index firms. For each year, we first match each index firm with a list of all candidate sample firms having the same primary three-digit industry code. We then rank each potential match by the percentage difference between its replacement cost and that of the index firm in question. The potential matching firm closest to the index firm by this metric is then chosen as the industry and size matched firm corresponding to that index firm. If there are several index firms in the same industry, we match the smallest firm first, then delete its match from the candidate sample, and then match the next smallest firm. This process insures that each S&P index firm has a unique industry and size matching control firm. In some cases, the number of index firms in an industry exceeds the number of candidate firms. If this occurs, several S&P firms are paired with the same control firm. The control firm observation only

[3] We checked a randomly selected ten extreme observations in the ratios displayed in Table 2.2 by comparing Compustat figures to printed annual reports. Of these, 7 observations or 70%, reflect coding errors by Compustat, such as misplaced decimal points. A similar check of ten observations from the central parts of the distributions characterized in Table 2.2 found no coding errors. We therefore correct the 7 erroneous observations and then winsorize the resulting sample at the first and 99th percentiles on the grounds that tail observations contain a disproportionately high fraction of coding errors.

appears once, so the *match index subsample*, denoted M_1, may be smaller than I in some years.

Some of the matched pairs of index and control firms in I and M_1 are not terribly close matches. We therefore delete match pairs where the difference in replacement cost between the index firm and its match is greater than half that of the index firm. The remaining samples or S&P 500 firms and matched firms, denoted I_2 and M_2 respectively, we call our *close match index subsample* and *close match controls subsamples*.

We run our regressions first on the subsample of index firms and control firms at least as large as the smallest index firm that year. We then repeat our regressions on the matched pairs of index and control firms. Finally we re-estimate our regressions using the close matched pairs only.

2.4.2. Construction of Key Variables

Our key variables are constructed from Compustat data. In using this data, it is necessary to adjust for Compustat's fiscal year-end convention. Compustat defines the data from fiscal years ending between June 1 of year t-1 and May 31 of year t as 'year t data'. We redefine the data so that year t data is the data from the fiscal year that ended during the calendar year t. This adjustment is necessary, since we wish to explain variables constructed from calendar year-end share prices with accounting data, and do not wish to use future information to predict the past. Unless otherwise indicated, all data are in current dollars.

Table 2.3 displays simple univariate statistics for these variables, whose construction we now describe in detail in the remainder of this section - which can be omitted by the reader without loss of continuity.

[Table 2.3 about here]

Firm Market Value

The market value of a firm is essentially a marking to market of all the components of the liabilities and net worth side of it's balance sheet. We take the market value, $V_{t,j}$, of firm j at time t to be the market value of all outstanding equity plus the market value of all outstanding debts. This subsection describes in detail the construction of each of these components of $V_{t,j}$.

First, we take the market value of common stock, $V_{cs,t,j}$, to be the price per share on December 31 times the number of shares outstanding.[4] The market value of preferred shares, $V_{ps,t,j}$, is the net number of preferred shares outstanding in the event of involuntary liquidation multiplied by their per share involuntary liquidating value.[5] Data to construct both $V_{cs,t,j}$ and $V_{ps,t,j}$ are taken from Compustat.

Second, market value of net short-term debts, $V_{sd,t,j}$, is assumed equal to their book value. Since their short durations render the market and book values similar for short-term liabilities and most short-term assets, we take them at book value.[6]

Third, we estimate the market value of long-term debt as

$$[2.16] \quad V_{ld,t,j} \cong B_{ld,t,j} \sum_{a=2}^{20} f_{a,t,j} \sum_{s=1}^{2\cdot(20-a)} \left(\frac{\frac{r_{t-a}}{2}}{(1+\frac{r_t}{2})^s} + \frac{1}{(1+\frac{r_t}{2})^{2\cdot(20-a)}} \right)$$

where $B_{ld,t,j}$ is the book value of the firm's long-term debts at the end of year t, $f_{a,t,j}$ is the fraction of firm j's long-term debt that is A years old as of year t, and r_t is average Moody's BAA bond rate for year t.[7] We thus take the difference between the book value of the firm's long-term debts in year $t-a$ and year $t-a-1$ to be the book value of it's a-year-old debt. The book value of vintage a debt is multiplied by the market value of BAA debt of that age per dollar of book value, estimated using the standard formula for the price of 20-year debt issued at par a years ago.

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[4] Compustat *item 24* times *item 25*.
[5] Compustat *item 10*.
[6] Compustat *item 34*.
[7] Compustat *item 9* is $B_{t,j}$

We are thus simplifying by assuming all debt to be 20-year BAA coupon bonds issued at par and that the current BAA rate is an appropriate discount rate for pricing future coupons and final debt payments. We are also ignoring call features, security, and other factors that can cause bond prices to deviate from the simple coupon bond formula. Thus, bond prices are year-specific, but not firm-specific.

Long-term debt with one year to maturity is treated as short-term debt. We take the fraction of the firm's debt that is a years old as

$$[2.17]\ f_{a,t,j} \cong \frac{B_{ld,t-a,j} - B_{ld,t-a-1,j}}{B_{ld,t,j}}.$$

In some cases, it is not possible to obtain precise values for the book values of long-term debt in all 19 previous years. We therefore use an estimated debt age structure based on the aggregate fractional debt age structure across all firms in Compustat in that year. To do this, we sum the book values of long-term debt outstanding for all Compustat firms in each year and then take differences between the sums for each pair of successive years to construct an aggregate long-term debt age profile. We divide the components of each 19-year-long age profile by the total long-term debt outstanding in the 20th year to get an average fractional age structure for long-term debt in each year. Thus, we take

$$[2.18]\ f_{a,t} \cong \frac{\sum_j \left(B_{t-a,j} - B_{t-a-1,j}\right)}{\sum_j B_{t,j}}.$$

Thus, if the values of $f_{j,a,t}$ are missing for $a < a_0$, we renormalize the corresponding $f_{a,t}$ for the missing debt vintages to obtain approximations for the missing fractions using

$$[2.19]\ \hat{f}_{a,t,j} \equiv f_{a,t}\left(\frac{1-\sum_{a>a_0} f_{a,t,j}}{\sum_{a<a_0} f_{a,t}}\right).$$

Finally, we take the market value, $V_{t,j}$, of firm j at time t to be the sum of the market values of common and preferred equity, net short-term liabilities, and long-term debts,

$$[2.20]\quad V_{t,j} \equiv V_{cs,t,j} + V_{pf,t,j} + V_{sd,t,j} + V_{ld,t,j}.$$

Firm Replacement Cost

The replacement cost of a firm's tangible assets is essentially a marking to market of all the entries on the assets side of its balance sheet. Ideally, we would estimate a firm's replacement cost by making a detailed list of all the firm's individual assets and obtaining a value for each from second-hand capital goods markets. In practice, this is not possible because firms' asset accounts are not sufficiently detailed and because appropriate second-hand capital goods markets prices are often not available. Moreover, many of the assets that make up a typical firm are industry-specific. Others, such as proprietary technology or reputation are intangible, and are missing from conventional accounting balance sheets. Because of these complications, we begin by estimating the part of replacement cost that can be estimated with a degree of confidence, and then consider a series of control variables that are plausibly related to these missing components of true replacement cost.

We begin by taking the replacement cost of firm j's tangible assets at time t, $A_{t,j}$, to be the sum of the market values of its property, plant and equipment (PP&E), $A_{ppe,t,j}$, inventories, $A_{inv,t,j}$, 'other assets', $A_{oa,t,j}$ and net current asset $A_{nca,t,j}$. This subsection describes in detail the construction of each of these components of $A_{t,j}$.

To estimate $A_{ppe,t,j}$, we begin with the book value of firm j's net PP&E in year t, denoted $B_{ppe,t,j}$.[8] The $A_{ppe,t,j}$ are estimated as

$$[2.21]\quad A_{ppe,t,j} \cong B_{ppe,t,j} \frac{\hat{p}_t}{\hat{p}_{t-a_{t,j}}},$$

where $\hat{p}_t$ is a capital goods price index (the fixed non-residential investments GDP deflator) and $a_{t,j}$ is the average age of firm j's PP&E in year t.

We estimate $a_{t,j}$ as

$$[2.22]\quad a_{t,j} \cong \frac{B^{G}_{ppe,t,j} - B_{ppe,t,j}}{D_{t,j}},$$

where $B^{G}_{ppe,t,j}$ and $D_{t,j}$ are the 'gross value of PP&E' and 'income statement depreciation' of firm j as reported for the fiscal year ending in year t.[9] While $a_{t,j} \geq 19$, $a_{t,j} = 19$, and if $a_{t,j} \leq 0$, $a_{t,j} = 0$.

To estimate $A_{inv,t,j}$, the value of firm j's inventories in time t, we follow different procedures depending on the inventory accounting method used by the firm.[10] If the firm reports inventories using the 'first in first out' (FIFO) method, the book value of inventories is likely to be close to the market value, and no adjustment in necessary. If the firm uses 'last in first out' (LIFO) accounting, the book value of inventories is based on old prices, and may thus deviate from market value – especially during and after periods of high inflation.

Accordingly, the reported inventories value for firms using LIFO, $B_{inv,t,j}$, is adjusted recursively as

[2.23]

$$A_{inv,t,j} = \frac{p_t}{p_{t-1}} A_{inv,t-1,j} + (B_{inv,t,j} - B_{inv,t-1,j}) \text{ for } B_{inv,t,j} \geq B_{inv,t-1,j}$$

or

$$A_{inv,t,j} = \frac{p_t}{p_{t-1}} A_{inv,t-1,j} * (B_{inv,t,j} / B_{inv,t-1,j}) \text{ for } B_{inv,t,j} < B_{inv,t-1,j}$$

[8] Compustat *item 8*.

[9] $B^{G}_{ppe,t,j}$ is Compustat *item 7*.

[10] Firms' inventory accounting methods are from Compustat *item 59*.

where p_t is PPI deflator for year t.[11] The market value of inventories is taken as equal to the book value in the first year in which the firms is listed in Compustat.

Some firms use several inventory accounting methods. For these firms, Compustat ranks the methods in order of importance. We use the rules of thumb described in Table 2.4 to apply [2.17] to fractions of these firms' inventories.

[Table 2.4 about here]

Thus, each year, we apply the recursive formula [2.17] to the fraction of the firm's inventories listed in the third column of Table 2.4, and assume the market value of the remainder of the firm's inventories to equal their book value.

To estimate $A_{oa,t,j}$, the market value of 'other assets', we consider reported 'investments in unconsolidated subsidiaries', 'other investments', and 'investments in intangibles'.[12] Since these assets are carried at historical cost, their book values may understate their true replacement costs. We therefore adjust these book values using a recursive procedure identical to that described for LIFO inventories in [2.17]. The only difference is that the deflator in calculating $A_{oa,t,j}$ is the fixed non-residential investment GDP deflator instead of PPI deflator in the A_{inv} formula.

The last component of tangible replacement cost is 'net current assets', $A_{nca,t,j}$, (net of inventories, which are adjusted to market above). Remaining current assets include 'cash & short term investments', 'receivables', and 'other current assets'. Since these assets are quite liquid, their book values are reasonable estimates of their market values. We thus value 'net current assets' at the total book value of current asset minus the total book value of inventories.[13]

Finally, we take the tangible assets replacement cost of firm j at time t, $A_{t,j}$, as the sum of the estimated replacement costs of PP&E, inventories and 'other assets',

$$[2.24]\quad A_{t,j} \equiv A_{ppe,t,j} + A_{inv,t,j} + A_{oa,t,j} + A_{nca,t,j}$$

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[11] $B_{inv,t,j}$ is Compustat *item 3*.

[12] Compustat *items 31, 32* and *33* respectively.

Note that $A_{t,j}$ is expressed in 1982 dollars.

Tobin's Average q Ratio

We are interested in whether or not S&P membership boosts the market value of a firm, as opposed to its marginal investment opportunities. Consequently, we require an estimate of Tobin's average q, not Tobin's marginal q (as estimated, for example, by *Durnev et al.* 2003).

We take Tobin's average q as

$$[2.25] \quad q_{t,j} \equiv \frac{V_{t,j}}{A_{t,j}}$$

Control variables

In this section, we describe the construction of the control variables introduced in the Empirical Framework section above.

We define industry fixed effects using three-digit Standard Industrial Classification (SIC) codes, as provided by Compustat. Each firm's industry code is defined as the industry code of the segment reporting the largest volume of sales in the relevant year.

We take advertising, $adv_{t,j}$, and research and development (R&D) expense, $rd_{j,t}$, as reported in Compustat.[14] If these variables are listed as 'negligible', they are set to zero. If they are coded as 'missing', we assume they were not disclosed and therefore were judged by the auditor to be negligible.

We estimate each firm's total debt in each year as the sum of the market values of long and short-term debts,

$$[2.26] \quad debt_{t,j} = V_{sd,t,j} + V_{ld,t,j}$$

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[13] Compustat *item4 minus item 3.*

[14] Compustat *items 45* and *46*, respectively.

Non-linear effects on market value associated with firm size are captured by the logarithm of the replacement cost of the firm.

We include industry fixed effects, either directly using three-digit SIC code dummies or indirectly by adjusting our average q ratios. The adjustment is

$$[2.27]\quad \hat{q}_{t,j} \equiv q_{t,j} - \left(\frac{n_{t,i(t,j)} q_{t,i(t,j)} - q_{t,j}}{n_{t,i(t,j)} - 1} \right)$$

where firm j is in industry $i(t,j)$ in period t, which industry contains $n_{t,i}$ firms and where $q_{t,i(t,j)}$ is the mean average q of all firms in industry $i(t,j)$. Thus, the adjusted average q is the original average q ratio minus the mean of the average q ratios of all *other* firms in the same industry (excluding the firm in question). If $n_{t,i}$ = 1, the observation is dropped. This second approach is econometrically preferable to simple fixed effects if some industries contain very few firms.

S&P Membership

Our primary measure of S&P membership is an S&P 500 membership indicator variable

$$[2.28]\quad \eta_{t,j} \equiv \begin{cases} 0 & \textit{if firm } j \textit{ is not in the index in year } t \\ 1 & \textit{if firm } j \textit{ is in the index in year } t \end{cases}$$

The procedure for classifying firms as S&P member firms is discussed in detail above in section 2.4.1.

We measure the importance of each firm in the index each year with an S&P 500 Index weight variable, defined as

$$[2.29]\quad w_{t,j} \equiv \frac{\eta_{t,j} V_{(S,t,j)}}{\sum_j \eta_{t,j} V_{(S,t,j)}}$$

where $V_{csi,j}$ is the market value of firm j's common stock at the end of calendar year t. The variable $w_{t,j}$ thus measures the weight of firm j in the value-weighted S&P 500 index in year t. For firms not included in S&P500, this weight equals zero by construction.

Assets Indexed to the S&P 500

In the Granger-Sims causality tests below, we require an estimate of the amount of money invested in passively tracking the S&P 500 Index. Besides the numerous mutual funds indexed to S&P 500, a huge amount of money is informally indexed to the S&P 500 by corporate and public sector pension funds. In addition, many actively managed funds use the S&P 500 as a benchmark. This creates an incentive for their managers to invest money in the S&P index and then deviate from that strategy when they feel they have private information. The result is another tier of less formally indexed investment. These considerations make a precise measurement of the total value of assets indexed to S&P 500 a virtual impossibility.

Fortunately, several reasonable proxies are readily available, and are arguably roughly proportional to the value of S&P indexed assets. Our primary proxy for funds indexed to S&P 500 index is the net market capitalization of Vanguard 500 index fund, the first index fund. The Vanguard 500 fund is the oldest and largest index fund. It was established in 1976, and its success led to the establishment of numerous other funds. Thus, in the first years of its existence, the Vanguard 500 is a good proxy for assets indexed to the S&P 500, but in later years, it captures a smaller share of the action. This measure is available from Vanguard Group for the years 1976 through 2001, the last year of our data.

As an alternative proxy, we employ the total market capitalization of the Vanguard index fund family, which includes not only the index funds that track the S&P 500, but also those that track other indices. The advantage of this proxy is that it is more likely to accurately reflect the full extent of the growth of indexing in the 1980s and 1990s. Its disadvantage is that it is not confined to S&P 500 funds. This measure is from the Standard and Poor's NetAdvantage for 1976 through 2001.

Our final proxy for the value of funds indexed to the S&P 500 is the total market value of 34 index funds whose market capitalization exceeded $500 million on June 30, 2002. The candidate funds were obtained at www.indexfunds.com, and their market capitalization for each year from 1992 to 2002 were obtained from Standard and Poor's NetAdvantage. Among the 34 funds, 23 were incepted in or after 1992, while for the rest of the 11 funds, 9 started in 1990 to 1991, 1 started in 1988 and 1 started in 1985. We do not have data for these years, and we thus proxy for each missing years' value for each of the 11 funds by backward subtracting their corresponding average growth amounts.

These three proxies are shown in the left panel of Table 2.1. All three proxies for the extent of indexing are also scaled by total market capitalization, and the results are shown in the right panel.

Cumulative Abnormal Returns

We also construct cumulative abnormal returns for each firm newly included in the S&P 500 index. The *inclusion date* is the date the firm actually becomes part of the index. Between 1989 and 1999, Standard and Poor's announced new additions to its index prior to actually including the stocks. Thus, for this period, we have an announcement data, $t_A < t_I$. For the remainder of the sample period, , $t_A = t_I$.

We estimate abnormal returns using a market model calibrated over the period from 308 to 109 trading days prior to the inclusion date, t_I. We then use this model to estimate abnormal return variances over the period from 108 to 60 trading days prior to t_I. This leaves a large enough gap that t_A is never included in the estimation period.

Cumulative abnormal returns are then estimated for various windows, extending from one trading day prior to the announcement date, $t_A \leq t_I$, to ten, fifteen or twenty trading days after the inclusion date, $t_I \geq t_A$. We also estimate shorter term cumulative abnormal returns as checks to insure that our findings are in line with those of earlier studies; however these results are not shown. Our focus is on windows long enough to encompass any reversal as temporary liquidity effects abate. Kaul et al. (2001) find that volumes and spreads return to normal levels after one to two weeks, equivalent to five to ten trading days. Consequently, we believe windows extending to ten, fifteen, and twenty trading days after the event should be more than adequate.

2.5. Findings

Figure 2.2 plots annual averages of cumulative abnormal returns estimated from one trading day prior to the inclusion announcement to five, ten and fifteen days after the actual inclusion. Table 2.5 lists these averages and shows that most are significantly different from zero in the event window extending ten trading days (two weeks) after inclusion. Since this period ought to be long enough to allow for a return to normal market volumes, this set of results argues against a complete reversal over most of the years we study.

Intriguingly, the average cumulative abnormal returns subsequent to 1999 are zero or even negative. Figure 2.2 also plots an estimate of the importance of indexing against time, as measured by the net asset value of the Vanguard 500 index fund as a fraction of total market capitalization. Note that the cumulative abnormal returns abate precisely as the importance of indexing abates. We return to this issue below.

As the window is extended to fifteen and twenty trading days beyond the event date, the standard errors associated with each cumulative abnormal return estimate grow. Although the signs of the cumulative abnormal returns remain predominantly positive, significance levels in the z-tests fall, so that reversion over these longer time periods cannot be statistically rejected. However, this is because the estimates grow noisier, making any inferences difficult, not because of any direct evidence *for* complete reversion. This problem leads us to consider our proposed q ratio methodology for detecting value increases.

[Figure 2.2 about here]

The core of our results is in Table 2.6, which displays means of Tobin's average q ratios, defined as market value per dollar of replacement cost or V_{tj}/A_{tj}, for firms in the S&P 500 index and for various control firm subsamples. The left panel compares index firms with all control firms at least as large as the smallest index firm in the relevant year. The middle panel contrasts index firms with size and industry matched non-index firms for each year. The right panel repeats this, but only including matched pairs that are close to the same size. In two of the three panels, no value premium is evident in the early years of our sample window. In the middle panel, the premium is statistically insignificant, while in the leftmost panel, a significant value *discount* associated with index membership is apparent in some years. However, from 1986 on, a statistically significant positive value premium associated with membership in the S&P 500 index is evident. Moreover, this premium grows steadily with time until 2000, and then declined slightly – though it remains highly statistically significant.

[Table 2.6 about here]

The t-tests described in Table 2.6 are standard two-tail t-tests. Substituting Bonforoni t-tests, which control for difference in the size of the two subsamples being compared, yield a similar pattern of statistical significance.

2.5.1. Regression Results

We run OLS regression of average Tobin's average q on S&P 500 membership, controlling for three-digit industry fixed effects, R&D spending, advertising spending, leverage and firm size, as described in equation 2.9, for each year from 1976 to 2001. Table 2.7 presents representative regressions for 1978, 1988, and 1998 run on the same three subsamples used in Table 2.2. Consistent with typical average q regressions, we find significant positive coefficients on R&D spending, advertising spending, and leverage, and significant negative coefficients on firm size measures.

The coefficients of interest in Table 2.7 are those of the S&P 500 membership dummy, which are positive and significant in all three years and in all specifications. The economically important point from Table 2.7 is that this coefficient is low in 1978, higher in 1988, and much higher in 1998 in all specifications. This indicates an increasing valuation premium associated with S&P500 membership through our observation window.

[Tables 2.7 and 2.8 about here]

Table 2.8 repeats the regressions in Table 2.7, but substitutes each firm's weight in the S&P 500 index for the index membership dummy. Firms not in the index have an index weight of zero. The weight of a firm in the index is the market value of its equity divided by that of all 500 firms in the index. Table 2.8 thus tests for a relationship between average q and the *importance* of a firm in the index., rather than its mere presence in the index. The coefficients of index weight are also positive and significant in all years and specifications, uniformly higher in 1988 than in 1978, and highest in 1998.

The differences in value associated with S&P inclusion are economically as well as statistically significant. For example, regression 2.7.3 shows that inclusion in the S&P 500 in 1998 is associated with a 69% premium in average q, - substantially larger than the 7% premium for 1978. Given a 1998 average replacement cost for S&P500 firms of 6 billion dollars, this implies an addition to shareholder value of $4 billion for the typical index firm, and of about $2 trillion dollars for all S&P 500 index firms. Regression 2.8.3 shows that a one tenth of one percent greater weight in the index is associated with a value premium increase of 0.001 x 211 = 21% of replacement cost. Since the average stock in the index has a replacement cost of about 6 billion dollars and an index weight of one five-hundredth, or 0.002, this implies an increased value of 6 x 0.002 x 211 = $2.5 billion for the typical index firm. For all five hundred firms, this adds up to $1.27 trillion.

[Table 2.9 about here]

Table 2.9 displays the regression coefficients of S&P membership dummies and S&P weights in regressions analogous to those in Tables 2.7 and 2.8 for all years from 1978 to 2001. The coefficients of control variables are not shown to conserve space and enhance readability. There is a clear and near uniform upward trend in the addition to shareholder value associated with S&P index membership and weight. This is illustrated graphically in Figures 2.3 and 2.4.

[Figures 2.3 and 2.4 about here]

We conclude that a large value premium for S&P 500 member firms developed over the past two decades, and that this premium is proportional to the weight of the firm in the S&P 500 index.

2.5.2. Regression Robustness Checks

Reasonable changes in the sample or specification of the regressions we run generate qualitatively similar results, by which we mean that the signs, relative magnitudes, and significance patterns of the coefficients on S&P membership or weight are similar to those shown in the tables.

For example, Shleifer (1986), Dhillon and Johnson (1991), Beniesh and Whaley (1996) and Lynch and Mendenhall (1997) show that the prices of firms added to the S&P index rise upon the announcement of this. If this is a temporary effect, as Harris and Gurel (1986) argue, the elevated q ratios we detect for S&P member firms might be largely due to these newly included firms. We therefore redo Tables 2.6 through 2.8 after dropping all firms that have been in the S&P 500 for less than one year. Results qualitatively similar to those shown in the tables ensue.

The results shown contrast index firms with non-index firms larger than the smallest S&P 500 firm that year. Using cutoffs of 50% or 25% the size of the smallest S&P 500 firm that year also generates qualitatively similar results. The regressions shown use data that are winsorized at the first and 99th percentiles. Winsorizing at the 5th and 95th percentiles generates qualitatively similar results. Alternative ways of dealing with outliers include using Cook's D statistics to delete selected observations, deleting "obvious outliers" based on visual inspection of the distribution, and substituting ranks for all continuous variables in the regressions. All three alternative techniques produce qualitatively similar results to those shown.

The regression variables are normalized by estimated replacement cost. Any reasonable alternative measure of firm size that maintains a fixed proportion with replacement cost can also be used. Normalizing all variables by sales instead of replacement cost, and using sales to measure firm size, generates qualitatively similar results. Normalizing all variables by book value results in the same pattern of parameters and significance levels.

We use total debt to measure leverage. Substituting long-term debt generates qualitatively similar results. We use the logarithm of replacement cost to control for size in the regressions shown. Using the dollar value of replacement cost generates qualitatively similar findings.

Our replacement cost estimation technique yields, as a by-product, an estimate of the average age of a firm's physical capital. Adding the average age of physical capital or its logarithm generates qualitatively similar results.

We conclude that our finding of a value premium associated with S&P 500 membership is highly robust.

2.5.3. The Direction of Causality

The regression results described above demonstrate a statistically and economically meaningful relationship between membership in the S&P 500 index and an elevated average q ratio. They do not, however, allow us to conclude that index membership 'causes' higher average q ratios. Indeed, the causation might run the opposite way. Standard and Poor's might select firms with high q ratios for inclusion in its index.

Event study evidence unambiguously indicates that inclusion in the index 'causes' an immediate share price increase. Shleifer (1985), Harris and Gurel (1986), Jain (1987), Beneish and Whaley (1996) and Lynch and Mendenhall (1997) Dhillon and Johnson (1991), Wurgler and Zhuravskaya (2002), and Kaul *et al.* (2000) all find that when a stock is added to the index, its value rises sharply. Figure 2.2 and Table 2.5 confirm this. Inclusion in the index unquestionably *causes* the stock price to rise.

However, cumulative abnormal returns around inclusion are smaller – by an order of magnitude – than the q ratio premiums and the changes in q ratios during the inclusion year, which are graphed in Figure 2.5. Thus, the value changes immediately surrounding the inclusion date are insufficient to explain the whole of the valuation premium in index firms. Moreover, although Figure 2.2 shows cumulative abnormal returns on the event day itself roughly tracking the growth of indexing, wider windows blur the relationship. In particular, large cumulative abnormal returns for wider windows are evident for early years – before the greater part of the growth in indexing. This suggests either a more complicated causality story, in which high valuation also "causes" index inclusions or a price impact of being included in the index that is not concentrated around the inclusion date.

To test causality in very low frequency data, such as our annual q ratio differences, we therefore run causality tests of the form recommended by Granger and Sims, and described in equation [2.30].

$$[2.30]\ \Delta y_t = \sum_{l=1}^{L} \alpha_l \Delta y_{t-l} + \sum_{l=1}^{L} \Delta\beta_l x_{t-l} + \varepsilon_t$$

These are joint significance tests of the hypothesis that change of the past values of x_t, the total amount of money invested in S&P 500 index funds as a percentage of total market capitalization, predict the change of the current year's value of y, which in this case is $\beta_{5,t}$, the coefficient of S&P membership (either the dummy or index weight), after controlling for past values of y. The significance of these lagged values of x can be assessed using either F-tests or χ^2-tests, whose significance can be interpreted as evidence that the magnitude of funds tracking the index 'causes' increased share values in index member firms.

These tests are run using the change of S&P value premiums from 1976 to 2001, as shown in Table 2.9, and the proxies for the amount of money passively tracking the S&P 500 shown in the right panel of Table 2.1. Since the first index fund, the Vanguard 500 was founded in 1976, our window stretches back to the beginning of indexing.

If growing demand for index member firms' stock is responsible for the elevated q ratios we detect, then increases in the amount of money passively tracking the S&P 500 index should 'cause' increases in the regression coefficient associated with index membership (or weight) in the sense of Granger (1969) and Sims (1972).

Table 2.10 displays our results. In general, the Granger-Sims tests are more consistent with indexing causing the value premium than with the converse. Thirty-six of the thirty-six tests of indexing causing the premium are statistically significant at a 5% confidence levels; whereas, only fourteen of the thirty six tests of reverse causality are significant. While the incidence of statistical significance in the direct causality tests (100%) is much higher than that expected through type two errors (5%), the incidence of significant reverse causality (33%) is also too high to be due to chance.

Overall, our findings are consistent with the view that the increasing amount of money passively tracking the S&P 500 Index "causes" the valuation premium associated with index membership and with a member firm's weight in the index, and that the growing value premium of S&P 500 stocks, in turn, also "causes" more funds to flow into indexing.

2.5.4. Further Robustness Checks

The tests in Table 2.10 use our measures of indexing scaled by total market capitalization. Using the total amount of funds indexed, in 1982 constant dollars, as shown in the left panel of Table 2.1, generates qualitatively similar results. Thirty-five of the thirty-six tests of indexing causing the premium are statistically significant at a 5% confidence levels; whereas, only twenty-three of the thirty six tests of reverse causality are significant. (not shown here)

Rerunning the causality regressions in Table 2.10 using value premiums based only on S&P 500 firms that have been in the index for more than one year also generates qualitatively similar results. Twenty-five of the thirty-six tests of indexing causing a premium are statistically significant at a 5% confidence levels; whereas, only fourteen of the thirty six tests of reverse causality are statistically significant. Qualitatively similar results ensue if we use dollar value measures of the importance of indexing, rather than proportions of market capitalization.

The χ^2 and F tests in Table 2.10 are all run using two lags of either the S&P membership or weight coefficient and two lags of the value of funds under indexing. When we allow the data to select the number of lags, the results are similar to those shown in Table 2.10. When the data selects the number of lags, reverse causation is rejected in all specifications involving the coefficient on the membership dummy. When the regression coefficient is that of the index weight, causality appears to run in both directions. (holy!)

2.6. Implications

Although high valuation certainly causes Standard and Poor's to add a firm to its index, causality certainly runs in the other direction too. Being included in the S&P 500 index appears to cause a value premium. Our results are thus supportive of Garry and Goetzmann (1986) and Shleifer (1986), who argue that stock prices respond to investor demand, and that this response is at least partly permanent. They also support Goetzman (1999) and Masso, who find that the S&P index return to be positively correlated with net inflows into index funds.

How downward sloping demand curves might lead to our findings is easy to see *in reductio ad absurdum*. If the amount of money indexed to the S&P 500 grows without bound, index funds will come to buy and hold virtually all the shares in the firms in the index. Obviously, if still more money is pumped into index funds, investors squatting on the last few shares of each index member firm can demand exorbitant prices. The downward sloping demand curves story is basically that this economic logic sets in when index funds' stakes are still moderate.

For these effects to be permanent, arbitrageurs must not correct valuation gaps between index firms and non-index firms with similar risks and expected payouts. Shleifer (2000) attributes the persistence of downward sloping demand curves for stocks to costly arbitrage. However, permanence is a stronger term than persistence. For such demand-driven value increases to be permanent, an enduring impediment against arbitrage must exist for index stocks. One possibility is positive feedback trading, as in De Long *et al.* (1990). Funds flowing into indexing might drive up index stock prices, which attracts more funds to indexing, which further drives up index stock prices, *ad valorem*. Warther (1995) rejects such positive feedback trading in index stocks, but Edelen and Warner (2001) find evidence of positive feedback using higher frequency data.

If positive feedback trading is occurring, arbitrageurs might see little gain from shorting overvalued index stocks and buying comparable non-index stocks. Index stocks may be overvalued, but they are likely to grow more overvalued. While admittedly controversial, such a story is consistent with our findings, and those of Goetzmann and Massa (2003), that the elevated valuations of index stocks are very long lived.

This interpretation of our findings has several implications.

First, firms whose stocks are included in widely followed indexes, and consequently overvalued, should issue additional shares and use the funds so raised to acquire productive assets or to acquire firms not in widely-followed indexes. In other words, indexing may cause economically inefficient overinvestment by index member firms and economically inefficient M&A activity. Both are examples of capital misallocation problems.

Second, passive investing should be redefined as the buying and holding as diversified a portfolio as possible, rather than the tracking a particular set of stocks. This would have the salubrious effect of spreading passive demand for stocks across the market more evenly, thereby avoiding price distortions of this sort. Consistent with this, the performance of passively run firms should be measured against the performance of the whole market. This could be measured, for example, by the Center for Research in Securities Prices (CRSP) *Value-Weighted Market Return*, which is constructed like the S&P 500, but of all the stocks in the market.

Third, the performance of actively managed funds should be measured relative to an index that includes the whole market or that is not used as a benchmark for passive investment. Non-inclusive indexes used for passive investing are susceptible to price distortions driven solely by the demand for indexing. Beating such an index then becomes a mug's game. Active fund managers should instead be measured relative to a whole market benchmark, or perhaps even to a benchmark that excludes index stocks. Note that this implication also follows if one believes the alternative story, that Standard and Poor's is uncannily skillful at picking stocks. This is so because the S&P 500 is then not a passive portfolio, but an actively managed one. Consequently, it is neither a neutral benchmark for gauging active manager performance nor a faithful representation of the overall growth in market fundamental value.

Fourth, should indexing ever fall seriously out of favor with the public, the prices of index member stocks could collapse abruptly. This is because arbitrage involving short positions in index stocks and long positions in similar non-index stocks is deterred by the rising premium associated with a large, continuing flow of funds into indexing. If the flow stops or reverses for any prolonged period, this impediment to arbitrage is removed. Profitable arbitrage should then push index stock prices down to fundamentals. Whether this price adjustment would happen gradually or perceptively is hard to say.

While neither our evidence, nor that of other studies to date, is sufficiently strong to confirm that such an expectations-driven effect is occurring, we believe that enough evidence does exist to warrant further study and to justify a degree of concern among practitioners about the usefulness of the S&P500 index as a passive investment target and as a performance benchmark for active fund managers.

2.7. Conclusions

This paper documents a large value premium in the average q ratios of firms in the S&P 500 index relative to the q ratios of other similar firms. This premium appears a few years after the founding of the first S&P 500 index fund, grows steadily and in step with the growth of indexing, and then declines slightly in recent years as demand for indexing abates.

The existence of a value premium in average q ratios of index member firms makes it highly unlikely that the price increases associated with index inclusions are temporary liquidity effects. Moreover, it is clear that the values of all firms in the index, not just those newly added to it, are elevated relative to the values of other firms.

One interpretation of this finding is that Standard and Poor's has a conspicuous ability to select firms with large and growing value premiums for its index. This is not impossible, for Standard and Poor's is a bond rating firm, and has detailed information about fundamental values that other investors do not possess. But this interpretation also requires that Standard and Poor's became steadily better at stock picking in lock-step with the growth of indexing, and then lost its stock picking skill when net withdrawals from indexing occurred in recent years.

A second interpretation is that indexing directly causes the value premium in index stocks by boosting demand for index stocks. In other words, index member firm stocks have downward sloping demand curves. Increased demand for the stocks pushes up their prices, and hence their average q ratios.

Our statistical tests indicate that causality runs in both directions, and that both interpretations are consequently true to some extent.

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Table 2.1
Proxies for the Growth of Indexing
Proxies for the growth of indexing include the total assets of the Vanguard 500, the oldest and largest S&P 500 index fund, the total assets of all Vanguard Index funds, and the value of 34 index funds whose market capitalization exceeds $500 million by June 30, 2002. Values in the left panel are deflated to millions of 1982 dollars using the GDP Price Index. Values in the right panel are expressed as percentages of the total equity market value, as supplied by the Center for research in Securities Prices (CRSP) at the University of Chicago

	In Millions of 1982 dollars			*As Percentage of Market Capitalization*		
Year	*Vanguard 500* [a]	*Vanguard Index Fund Family* [a,b]	*34 Large Index Funds* [c]	*Vanguard 500* [a,d]	*Vanguard Index Fund Family* [a,b,d]	*34 Large Index Funds* [c,d]
1976	21.9	21.9	21.9	0.015	0.015	0.015
1977	30.9	30.9	30.9	0.024	0.024	0.024
1978	90.7	90.7	90.7	0.073	0.073	0.073
1979	100.2	100.2	100.2	0.074	0.074	0.074
1980	115.0	115.0	115.0	0.072	0.072	0.072
1981	96.7	96.7	96.7	0.071	0.071	0.071
1982	119.0	119.0	119.0	0.081	0.081	0.081
1983	224.1	224.1	224.1	0.128	0.128	0.128
1984	268.9	298.6	268.9	0.165	0.183	0.165
1985	354.2	386.6	627.5	0.179	0.196	0.318
1986	426.6	452.1	719.6	0.196	0.208	0.332
1987	705.4	730.1	1017.1	0.335	0.346	0.483
1988	871.4	921.8	1542.9	0.390	0.413	0.691
1989	1435.3	1578.5	2242.0	0.548	0.603	0.856
1990	1664.1	2227.8	3018.8	0.731	0.979	1.327
1991	3210.4	4372.0	5141.1	1.091	1.486	1.747
1992	4722.6	6744.6	8468.6	1.496	2.137	2.683
1993	5827.7	9800.7	11554.7	1.648	2.772	3.268
1994	6456.0	10879.1	13156.9	1.883	3.173	3.837
1995	11731.5	19900.1	23609.5	2.579	4.375	5.191
1996	20095.4	34271.9	39921.8	3.681	6.277	7.312
1997	32073.6	55974.4	66856.2	4.610	8.045	9.610
1998	47653.0	84459.8	101894.5	5.616	9.954	12.008
1999	66252.2	123610.4	139782.9	6.198	11.564	13.077
2000	54614.1	112124.8	128969.5	5.743	11.791	13.562
2001	44374.3	98528.4	114368.8	5.353	11.885	13.796

a. *Obtained from Vanguard and NetAdvantage*
b. *Obtained from NetAdvantage*
c. *Obtained from NetAdvantage and www.Indexfunds.com. This includes the Vanguard 500 and is coextensive with it until 1985, when SEI Investment Management Corporation established its S&P 500 Index fund. The remaining 32 funds were formed in the late 1980s to the early 1990s.*
d. *Denominator obtained from the Center for Research in Securities Prices*

Table 2.2
Subsamples and Full Basic Sample Sizes

year	*S&P 500 index firms with complete data*	*control firms larger than smallest index firm*	*S&P500 index firms with size & industry matches*	*size & industry matched control firms*	*S&P firms with size & industry close matches*	*size & industry close matches*	*Full Basic sample*
sample	*I*	*C*	I_1	M_1	I_2	M_2	*I* U *C*
1976	447	1675	447	431	226	223	2122
1977	449	1644	449	427	225	218	2093
1978	449	1500	449	419	221	212	1949
1979	452	1696	452	428	212	207	2148
1980	450	2240	450	433	199	198	2690
1981	452	2025	452	432	188	184	2477
1982	452	1245	452	402	192	176	1697
1983	446	1399	446	409	192	181	1845
1984	448	1406	448	409	193	176	1854
1985	446	1390	446	413	192	184	1836
1986	443	1560	443	423	200	195	2003
1987	442	1483	442	422	200	193	1925
1988	433	1312	433	407	194	182	1745
1989	429	1243	429	393	189	173	1672
1990	430	1221	430	394	192	175	1651
1991	431	1296	431	400	192	175	1727
1992	432	1116	432	394	192	172	1548
1993	432	1930	432	415	194	190	2362
1994	429	1227	429	402	209	197	1656
1995	417	1383	417	398	187	180	1800
1996	419	1148	419	391	193	178	1567
1997	414	1162	414	381	201	182	1576
1998	410	1246	410	382	197	178	1656
1999	414	1226	414	388	201	184	1640
2000	392	1382	392	371	191	179	1774
2001	353	1157	353	324	170	150	1510

Table 2.3
Univariate Statistics for Main Regression Variables
Firms are indexed by j and time by t. Average Tobin's q is estimated market value, $V_{t,j}$, over estimated replacement cost, $A_{t,j}$. Research and development (R&D) spending and advertising spending are expressed as fractions of replacement cost. Leverage is the estimated market value of short and long-term debt over replacement cost, and firm size is the logarithm of replacement cost.

		Mean	Standard Deviation	Minimum	First Percentile	Median	99th Percentile	Maximum
Dependent Variable								
Average Tobin's q	$\frac{V_{t,j}}{A_{t,j}}$	1.47	1.14	0.31	0.40	1.18	6.20	19.11
Control Variables								
R&D spending	$\frac{rd_{t,j}}{A_{t,j}}$	0.02	0.04	0.00	0.00	0.00	0.17	3.71
Advertising spending	$\frac{adv_{t,j}}{A_{t,j}}$	0.01	0.04	0.00	0.00	0.00	0.18	1.04
Leverage	$\frac{debt_{t,j}}{A_{t,j}}$	0.40	0.37	0.00	0.00	0.33	1.69	8.70
Firm size	$\ln(A_{t,j})$	6.33	1.42	3.35	3.87	6.07	10.12	12.16
Index Membership Variables								
S&P 500 Indicator	$\eta_{t,j}$	0.23	0.42	0.00	0.00	0.00	1.00	1.00
Weight in S&P 500	$w_{t,j}$	0.00	0.00	0.00	0.00	0.00	0.01	0.07

Sample is full basic sample described in Table 2.2 (1 U C), all years combined.

Table 2.4
Inventory Valuation
Conventions for marking inventories to market for firms that use more than one inventory accounting method

Number of inventory accounting methods used	Rank in importance of LIFO accounting	Assumed fraction of inventories subject to LIFO
2	1	66.7
2	2	33.3
3	1	50.0
3	2	33.3
3	3	16.7

Table 2.5
Cumulative Abnormal Returns Associated with Inclusions in the S&P 500 Index
Abnormal returns are estimated using a market model estimated over the period [-308, -109], where the event date - the date the inclusion becomes effective - is time *t* and the date on which the announcement that the stock will be included is date *s*. Between 1989 and 1999, *s* < *t*; for other periods, *s* = *t*. The period [-108, -60] is used to estimate abnormal return variances.

	Event window $[t_A-1, t_I+1]$		Event window $[t_A-1, t_I+10]$		Event window $[t_A-1, t_I+15]$		Event window $[t_A-1, t_I+20]$		
year	CAR	z-test p-level	CAR	z-test p-level	CAR	z-test p-level	CAR	z-test p-level	inclusions
1976	-0.008	(0.09)	-0.009	(0.35)	-0.008	(0.36)	-0.025	(0.23)	6
1977	0.007	(0.07)	0.012	(0.13)	0.001	(0.47)	0.004	(0.44)	8
1978	0.030	(0.00)	0.015	(0.07)	0.003	(0.41)	0.004	(0.40)	11
1979	0.021	(0.00)	0.009	(0.22)	0.004	(0.37)	-0.019	(0.18)	14
1980	0.041	(0.00)	0.035	(0.00)	0.008	(0.24)	-0.000	(0.49)	12
1981	0.030	(0.00)	0.009	(0.26)	-0.006	(0.35)	-0.007	(0.35)	20
1982	0.023	(0.00)	0.029	(0.01)	0.022	(0.09)	0.037	(0.03)	26
1983	0.021	(0.01)	0.002	(0.46)	-0.013	(0.16)	-0.023	(0.17)	9
1984	0.017	(0.01)	0.002	(0.45)	0.000	(0.49)	-0.000	(0.50)	28
1985	0.018	(0.00)	0.013	(0.07)	0.012	(0.10)	0.001	(0.46)	27
1986	0.036	(0.00)	0.044	(0.00)	0.053	(0.00)	0.043	(0.00)	26
1987	0.057	(0.00)	0.060	(0.00)	0.062	(0.00)	0.059	(0.00)	24
1988	0.036	(0.00)	0.039	(0.00)	0.043	(0.00)	0.052	(0.00)	24
1989	0.030	(0.00)	0.023	(0.02)	0.023	(0.05)	0.016	(0.12)	28
1990	0.044	(0.03)	0.030	(0.04)	0.007	(0.39)	0.021	(0.20)	10
1991	0.066	(0.00)	0.035	(0.04)	0.014	(0.32)	0.011	(0.35)	10
1992	0.057	(0.03)	0.057	(0.03)	0.065	(0.04)	0.033	(0.25)	6
1993	0.055	(0.00)	0.024	(0.21)	0.009	(0.35)	0.024	(0.13)	8
1994	0.049	(0.00)	0.024	(0.21)	0.009	(0.39)	0.009	(0.39)	15
1995	0.055	(0.00)	0.041	(0.00)	0.021	(0.15)	0.014	(0.26)	24
1996	0.071	(0.00)	0.054	(0.00)	0.049	(0.01)	0.047	(0.01)	20
1997	0.081	(0.00)	0.060	(0.00)	0.045	(0.00)	0.031	(0.04)	25
1998	0.088	(0.00)	0.045	(0.01)	0.015	(0.24)	0.014	(0.28)	36
1999	0.065	(0.00)	0.050	(0.03)	0.048	(0.05)	0.018	(0.27)	36
2000	0.014	(0.14)	-0.018	(0.20)	-0.016	(0.22)	-0.032	(0.08)	50
2001	0.003	(0.41)	-0.025	(0.09)	-0.020	(0.16)	-0.012	(0.30)	26

Table 2.6
The Value Premium Associated with Being in the S&P500 Index
Mean Tobin's average q ratios for firms in the S&P 500 index and various control firm subsamples.

	Firms as Large as Smallest S&P firm				**Size & Industry Matched-Pair Control Group**				**Very Close Matched-Pair Control Group**			
year	*S&P firms*	*other firms*	*Index premium*	*t-test p-value*	*S&P firms*	*other firms*	*Index premium*	*t-test p-value*	*S&P firms*	*other firms*	*Index premium*	*t-test p-value*
sample	I	C	$I - C$		I_1	M_1	$I_1 - M_1$		I_2	M_2	$I_2 - M_2$	
1976	0.99	0.88	0.11	0.00	0.99	0.87	0.12	0.00	1.01	0.86	0.15	0.00
1977	0.90	0.89	0.01	0.59	0.90	0.86	0.03	0.15	0.92	0.85	0.07	0.03
1978	0.86	0.87	-0.01	0.46	0.86	0.82	0.04	0.10	0.89	0.80	0.09	0.01
1979	0.87	0.95	-0.07	0.00	0.87	0.88	0.00	0.96	0.90	0.85	0.05	0.12
1980	0.95	1.12	-0.17	0.00	0.95	0.95	-0.01	0.89	1.01	0.89	0.13	0.04
1981	0.85	0.95	-0.10	0.00	0.85	0.89	-0.04	0.27	0.90	0.78	0.11	0.01
1982	0.95	0.94	0.01	0.71	0.95	0.93	0.02	0.61	1.02	0.87	0.15	0.01
1983	1.11	1.20	-0.10	0.00	1.11	1.15	-0.04	0.35	1.16	1.04	0.12	0.05
1984	1.12	1.13	-0.01	0.82	1.12	1.08	0.04	0.29	1.21	0.98	0.23	0.00
1985	1.34	1.32	0.02	0.50	1.34	1.27	0.07	0.10	1.44	1.12	0.32	0.00
1986	1.50	1.44	0.06	0.11	1.50	1.38	0.12	0.02	1.57	1.26	0.31	0.00
1987	1.48	1.36	0.12	0.00	1.48	1.35	0.13	0.01	1.55	1.32	0.23	0.00
1988	1.49	1.41	0.08	0.03	1.49	1.34	0.15	0.00	1.54	1.28	0.26	0.00
1989	1.69	1.50	0.19	0.00	1.69	1.43	0.26	0.00	1.80	1.32	0.47	0.00
1990	1.53	1.32	0.21	0.00	1.53	1.32	0.21	0.00	1.63	1.33	0.30	0.00
1991	1.78	1.61	0.17	0.01	1.78	1.57	0.22	0.01	1.83	1.58	0.25	0.05
1992	1.79	1.68	0.12	0.04	1.79	1.64	0.15	0.03	1.87	1.55	0.32	0.00
1993	1.85	1.91	-0.06	0.28	1.85	1.80	0.06	0.43	1.95	1.70	0.25	0.02
1994	1.73	1.64	0.09	0.06	1.73	1.58	0.16	0.01	1.80	1.56	0.24	0.00
1995	1.99	1.83	0.17	0.01	1.99	1.75	0.25	0.00	2.11	1.72	0.39	0.00
1996	2.09	1.83	0.26	0.00	2.09	1.86	0.23	0.00	2.19	1.81	0.38	0.00
1997	2.41	1.93	0.48	0.00	2.41	1.97	0.44	0.00	2.41	1.79	0.63	0.00
1998	2.66	1.89	0.77	0.00	2.66	1.90	0.76	0.00	2.56	1.74	0.82	0.00
1999	3.21	2.40	0.81	0.00	3.21	2.31	0.91	0.00	3.26	2.35	0.91	0.00
2000	3.09	2.04	1.05	0.00	3.09	2.17	0.93	0.00	3.56	2.23	1.32	0.00
2001	2.64	1.92	0.72	0.00	2.64	1.98	0.66	0.00	2.91	1.87	1.04	0.00

Table 2.7

Regressions of Average Tobin's Q On a Dummy Indicating S&P 500 Membership

Controls are 3-digit industry fixed effects, R&D, advertising, leverage, and firm size. Data are for 1978, 1988, and 1998. Regressions 2.7.1, 2.7.4, and 2.7.7 use 1978 data, regressions: 2.7.2, 2.7.5, and 2.7.8 use 1988 data, and regressions 2.7.3, 2.7.6, and 2.7.9 use 1998 data. Average Tobin's q is estimated market value, $V_{t,j}$, over estimated replacement cost, $A_{t,j}$. Research and development (R&D) spending and advertising spending are expressed as fractions of replacement cost. Leverage is the estimated market value of short and long-term debt over replacement cost, and firm size is the logarithm of replacement cost. S&P membership dummy is one for firms in the index that year and zero otherwise.

	Index firms and control firms at least as large as smallest index firm			Size and Industry Matched Pairs			Very Close Size and Industry Matched Pairs		
	2.7.1	2.7.2	2.7.3	2.7.4	2.7.5	2.7.6	2.7.7	2.7.8	2.7.9
year	1978	1988	1998	1978	1988	1998	1978	1988	1998
S&P membership dummy $\eta_{t,i}$	0.07	0.29	0.69	0.07	0.32	0.57	0.09	0.33	0.74
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
R&D spending $\frac{rd_{t,i}}{A}$	5.51	1.95	7.78	6.97	2.50	9.88	4.09	3.93	7.17
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Advertising spending $\frac{adv_{t,i}}{A}$	0.73	2.67	2.37	1.02	2.31	3.39	1.55	3.56	3.10
	(0.00)	(0.00)	(0.02)	(0.00)	(0.00)	(0.01)	(0.00)	(0.01)	(0.14)
Leverage $\frac{debt_{t,i}}{A}$	0.31	0.45	0.23	0.12	0.47	0.25	0.15	0.58	0.43
	(0.00)	(0.00)	(0.01)	0.09	(0.00)	(0.10)	(0.14)	(0.00)	(0.02)
Firm size $\ln(A_{t,i})$	-0.04	-0.11	-0.07	-0.05	-0.13	0.08	-0.04	-0.17	-0.05
	(0.00)	(0.00)	(0.09)	(0.00)	(0.00)	(0.20)	(0.06)	(0.00)	(0.62)
Regression F statistic	5.79	5.33	4.69	4.88	5.13	4.66	3.15	3.80	3.55
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
R-squared	0.42	0.44	0.42	0.47	0.50	0.49	0.48	0.54	0.54
Sample[c]	$I \cup C$	$I \cup C$	$I \cup C$	$I_1 \cup M_1$	$I_1 \cup M_1$	$I_1 \cup M_1$	$I_2 \cup M_2$	$I_2 \cup M_2$	$I_2 \cup M_2$

a. *Data are winsorized at the 1st and 99th percentiles.*

b. *Firm size is measured by replacement cost of assets, $A_{t,j}$.*

c. *Sample sizes are as described in Table 2.2*

Table 2.8
Regressions of Average Tobin's Q On S&P 500 Index Weight

Controls are 3-digit industry fixed effects, R&D spending, advertising spending, leverage, and firm size. Data are for 1978, 1988, and 1998. Regressions 2.8.1, 2.8.4, and 2.8.7 use 1978 data, regressions: 2.8.2, 2.8.5, and 2.8.8 use 1988 data, and regressions 2.8.3, 2.8.6, and 2.8.9 use 1998 data. Average Tobin's q is estimated market value, $V_{t,i}$, over estimated replacement cost, $A_{t,i}$. Research and development (R&D) spending and advertising spending are expressed as fractions of replacement cost. Leverage is the estimated market value of short and long-term debt over replacement cost, and firm size is the logarithm of replacement cost. S&P index weight is the market value of the firm's equity divided by the total market value of the equity of all index firms, and is zero for non-index firms.

		Index firms and control firms at least as large as smallest index firm			Size and Industry Matched Pairs			Very Close Size and Industry Matched Pairs		
		2.8.1	2.8.2	2.8.3	2.8.4	2.8.5	2.8.6	2.8.7	2.8.8	2.8.9
year		1978	1988	1998	1978	1988	1998	1978	1988	1998
S&P index weight	$w_{t,i}$	13.78	25.16	210.87	13.92	30.80	210.68	46.33	39.76	311.41
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.02)	(0.00)
R&D spending	$\frac{rd_{t,i}}{A}$	5.46	2.27	7.86	6.77	3.20	9.81	4.06	4.77	7.35
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Advertising spending	$\frac{adv_{t,i}}{A}$	0.78	2.80	2.03	1.09	2.48	2.99	1.55	3.94	3.44
		(0.00)	(0.00)	0.03	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.10)
Leverage	$\frac{debt_{t,i}}{A}$	0.31	0.43	0.24	0.12	0.43	0.18	0.15	0.52	0.19
		(0.00)	(0.00)	0.01	0.10	(0.00)	(0.20)	(0.14)	(0.00)	(0.30)
Firm size	$\ln(A_{t,i})$	-0.04	-0.06	-0.10	-0.05	-0.08	-0.10	-0.07	-0.17	-0.24
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.08)	(0.00)	(0.00)	(0.04)
Regression F statistic		5.90	5.04	5.54	5.07	4.53	6.08	3.31	3.19	3.58
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
R-squared		0.43	0.43	0.47	0.48	0.47	0.56	0.50	0.50	0.55
Sample size		$I \cup C$	$I \cup C$	$I \cup C$	$I_1 \cup M_1$	$I_1 \cup M_1$	$I_1 \cup M_1$	$I_2 \cup M_2$	$I_2 \cup M_2$	$I_2 \cup M_2$

a. Data are winsorized at the 1^{st} and 99^{th} percentiles.
b. Firm size is measured by replacement cost of assets, $A_{t,i}$.
c. Sample sizes are as described in Table 2.2

Table 2.9

How Regression Coefficients on Dummy Indicating S&P 500 Membership or on Index Weight Changed Over Time

Dependent variable is average q ratio, estimated market value, $V_{t,j}$, over estimated replacement cost, $A_{t,j}$. Controls include 3-digit industry fixed effects, R&D, advertising, leverage, and firm size. R&D and advertising spending are fractions of replacement cost. Leverage is the estimated market value of total debt over replacement cost, and firm size is the logarithm of replacement cost. S&P index weight is the market value of the firm's equity divided by the total market value of the equity of all index firms, and is zero for non-index firms. The S&P membership dummy is one for firms in the index that year and zero otherwise. S&P Index firms, I, are compared with all control firms, C, industry and size-matched pairs, M_1, and industry and size matched pairs where the size difference is less than 50%, M_2.

sample	Coefficient on S&P 500 membership dummy						Coefficient on weight in S&P 500 Index					
	$I \cup C$		$I_1 \cup M_1$		$I_2 \cup M_2$		$I \cup C$		$I_1 \cup M_1$		$I_2 \cup M_2$	
year	$\beta_{S,t}$	$\Pr(\beta_{S,t} = 0)$	$\beta_{S,t}$	$\Pr(\beta_{S,t} = 0)$	$\beta_{S,t}$	$\Pr(\beta_{S,t} = 0)$	$\beta_{S,t}$	$\Pr(\beta_{S,t} = 0)$	$\beta_{S,t}$	$\Pr(\beta_{S,t} = 0)$	$\beta_{S,t}$	$\Pr(\beta_{S,t} = 0)$
1976	0.13	0.00	0.12	0.00	0.12	0.00	18.34	0.00	17.66	0.00	68.10	0.00
1977	0.08	0.00	0.08	0.00	0.08	0.01	13.98	0.00	13.27	0.00	59.65	0.00
1978	0.07	0.00	0.07	0.00	0.09	0.00	13.78	0.00	13.92	0.00	46.33	0.00
1979	0.07	0.00	0.06	0.01	0.05	0.08	10.59	0.01	13.08	0.00	11.28	0.14
1980	0.16	0.00	0.16	0.00	0.14	0.00	17.59	0.02	23.27	0.00	18.33	0.12
1981	0.07	0.04	0.10	0.01	0.12	0.00	12.33	0.03	17.68	0.00	42.20	0.01
1982	0.12	0.00	0.15	0.00	0.15	0.00	16.72	0.00	21.33	0.00	45.71	0.00
1983	0.11	0.01	0.14	0.00	0.15	0.00	18.80	0.00	24.60	0.00	44.42	0.00
1984	0.18	0.00	0.22	0.00	0.24	0.00	19.23	0.00	24.92	0.00	36.92	0.00
1985	0.25	0.00	0.32	0.00	0.35	0.00	20.79	0.00	28.70	0.00	46.39	0.00
1986	0.31	0.00	0.35	0.00	0.39	0.00	29.49	0.00	42.07	0.00	62.23	0.00
1987	0.34	0.00	0.33	0.00	0.28	0.00	28.69	0.00	33.84	0.00	47.00	0.02
1988	0.29	0.00	0.32	0.00	0.33	0.00	25.16	0.00	30.80	0.00	39.76	0.02
1989	0.46	0.00	0.49	0.00	0.52	0.00	38.25	0.00	50.82	0.00	48.33	0.04
1990	0.32	0.00	0.34	0.00	0.35	0.00	43.74	0.00	52.41	0.00	54.78	0.01
1991	0.35	0.00	0.35	0.00	0.29	0.01	82.67	0.00	101.45	0.00	86.60	0.00
1992	0.32	0.00	0.34	0.00	0.39	0.00	80.59	0.00	99.27	0.00	111.23	0.00
1993	0.31	0.00	0.29	0.00	0.32	0.00	55.75	0.00	80.05	0.00	122.20	0.00
1994	0.32	0.00	0.29	0.00	0.25	0.00	79.67	0.00	95.36	0.00	100.61	0.00
1995	0.40	0.00	0.38	0.00	0.34	0.00	107.09	0.00	128.75	0.00	141.42	0.00
1996	0.30	0.00	0.28	0.00	0.23	0.03	136.31	0.00	154.24	0.00	185.68	0.00
1997	0.46	0.00	0.46	0.00	0.60	0.00	174.37	0.00	192.35	0.00	227.45	0.00
1998	0.69	0.00	0.57	0.00	0.74	0.00	210.87	0.00	210.68	0.00	311.41	0.00
1999	1.08	0.00	1.05	0.00	1.02	0.00	288.59	0.00	304.36	0.00	596.42	0.00
2000	1.19	0.00	1.12	0.00	1.26	0.00	190.37	0.00	200.84	0.00	415.13	0.00
2001	0.82	0.00	0.83	0.00	1.12	0.00	115.81	0.00	118.74	0.00	229.04	0.00

Samples for each year are as described in Table 2.2. Regressions are identical to those shown in full in Tables 5 and 6.

a. *Data are winsorized at the 1st and 99th percentiles.*
b. *Firms at least half as large, in terms of replacement cost of assets, $A_{t,i}$, as the smallest S&P500 firm in the same year.*
c. *Firms at least as large, in terms of replacement cost of assets, $A_{t,i}$, as the smallest S&P500 firm in the same year.*

TABLE 2.10
Granger's Causality Tests

Tests for x causing y are F-tests for the joint significance of the regression parameters φ_1 and φ_2 in regressions of the form $y_t = \gamma_0 + \gamma_1 y_{t-1} + \gamma_2 y_{t-2} + \varphi_1 x_{t-1} + \varphi_2 x_{t-1} + \eta_t$. Proxies for assets indexed are from Table 2.1. Value premiums are from Table 2.9.

Subsample used to estimate index premium		Premium associated with	Proxy for assets indexed	Assets indexed → premium F test	Assets indexed → premium χ^2 test	Pemium → assets indexed F test	Pemium → assets indexed χ^2 test
Index firms & large control firms	$I \cup C$	Index membership	Vanguard 500	5.56 (0.01)	14.21 (0.00)	2.67 (0.10)	6.81 (0.03)
Index firms & large control firms	$I \cup C$	Index weight	Vanguard 500	20.76 (0.00)	53.06 (0.00)	5.68 (0.01)	14.52 (0.00)
Index firms & large control firms	$I \cup C$	Index membership	Vanguard Index family	3.86 (0.04)	9.86 (0.01)	2.55 (0.11)	6.51 (0.04)
Index firms & large control firms	$I \cup C$	Index weight	Vanguard Index family	11.95 (0.00)	30.55 (0.00)	2.12 (0.15)	5.41 (0.06)
Index firms & large control firms	$I \cup C$	Index membership	Large index funds	4.30 (0.03)	10.99 (0.00)	1.58 (0.23)	4.04 (0.13)
Index firms & large control firms	$I \cup C$	Index weight	Large index funds	30.81 (0.00)	78.73 (0.00)	1.01 (0.38)	2.59 (0.27)
Matched pairs	$I_1 \cup M_1$	Index membership	Vanguard 500	4.72 (0.02)	12.07 (0.00)	2.96 (0.08)	7.57 (0.02)
Matched pairs	$I_1 \cup M_1$	Index weight	Vanguard 500	25.82 (0.00)	65.98 (0.00)	4.76 (0.02)	12.17 (0.00)
Matched pairs	$I_1 \cup M_1$	Index membership	Vanguard Index family	3.51 (0.05)	8.97 (0.01)	2.68 (0.10)	6.84 (0.03)
Matched pairs	$I_1 \cup M_1$	Index weight	Vanguard Index family	13.91 (0.00)	35.56 (0.00)	2.11 (0.16)	5.40 (0.07)
Matched pairs	$I_1 \cup M_1$	Index membership	Large index funds	4.33 (0.03)	11.06 (0.00)	1.70 (0.21)	4.35 (0.11)
Matched pairs	$I_1 \cup M_1$	Index weight	Large index funds	25.66 (0.00)	65.58 (0.00)	1.13 (0.35)	2.88 (0.24)
Close matched pairs	$I_2 \cup M_2$	Index membership	Vanguard 500	6.68 (0.01)	17.08 (0.00)	0.69 (0.52)	1.76 (0.41)
Close matched pairs	$I_2 \cup M_2$	Index weight	Vanguard 500	11.40 (0.00)	29.14 (0.00)	12.07 (0.00)	30.85 (0.00)
Close matched pairs	$I_2 \cup M_2$	Index membership	Vanguard Index family	5.58 (0.01)	14.25 (0.00)	1.14 (0.34)	2.92 (0.23)
Close matched pairs	$I_2 \cup M_2$	Index weight	Vanguard Index family	11.05 (0.00)	28.24 (0.00)	13.32 (0.00)	34.04 (0.00)
Close matched pairs	$I_2 \cup M_2$	Index membership	Large index funds	6.46 (0.01)	16.51 (0.00)	5.37 (0.01)	13.73 (0.00)
Close matched pairs	$I_2 \cup M_2$	Index weight	Large index funds	15.94 (0.00)	40.73 (0.00)	0.12) (0.89)	0.31 (0.85)

Figure 2.1
A Downward Sloping Demand Curve For a Stock
If stocks have downward sloping demand curves, their prices reflect the interplay of supply and demand, like the prices of other economic goods. If a stock is added to a widely-tracked index, this shifts its demand curve to the right, from D_0 to D_1, and thereby increases the stock's price from P_0 to P_1. For simplicity, and without loss of generality for the topic at hand, we represent the supply curve, S, for the stock as a vertical line. In practice, firms might issue more stock as their stock prices rise, causing their stocks' supply curves to slope upward.

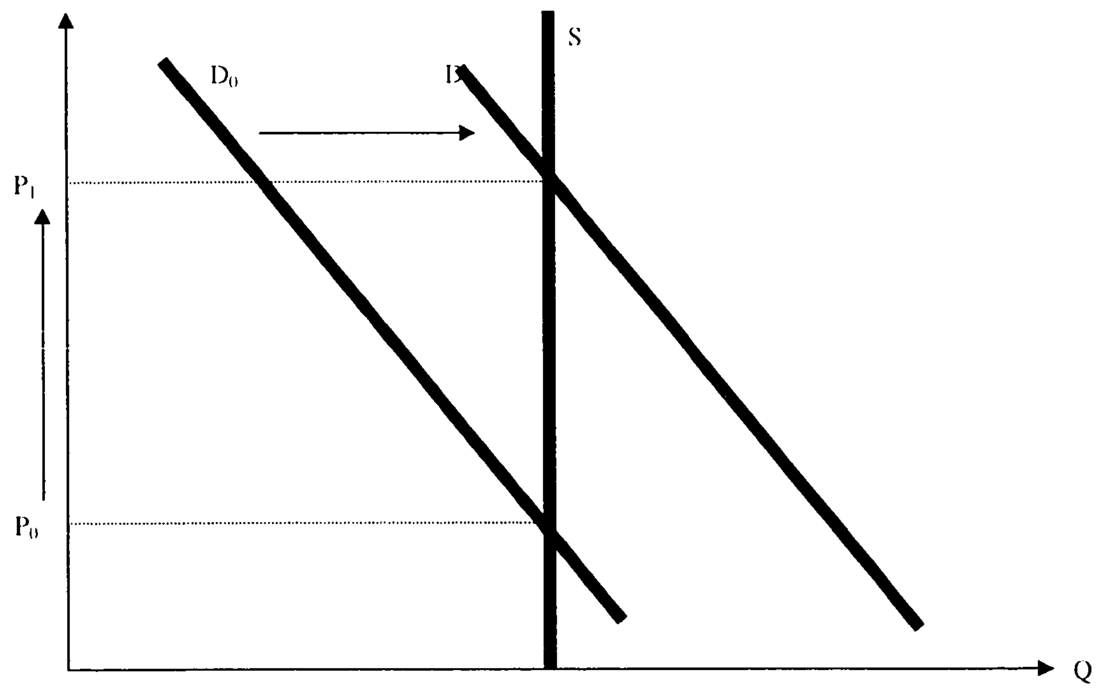


Figure 2.2
Cumulative Abnormal Returns Associated with Inclusions in the S&P 500 Index
Abnormal returns are estimated using a market model estimated over the period [-308, -109], where the event date - the date the inclusion becomes effective - is time *t* and the date on which the announcement that the stock will be included is date *s*. Between 1989 and 1999, $s < t$; for other periods, $s = t$. The period [-108, -60] is used to estimate abnormal return variances.

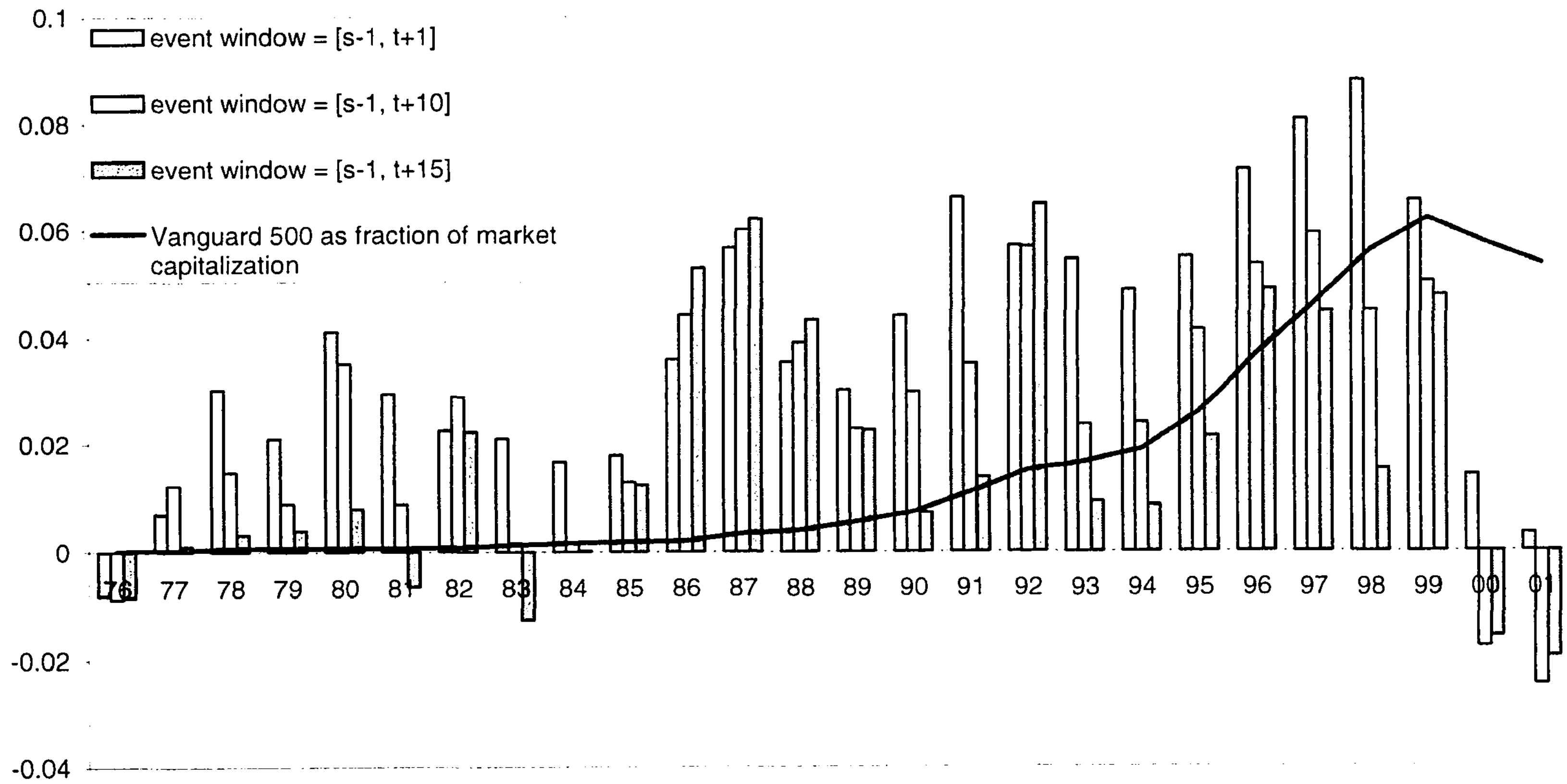
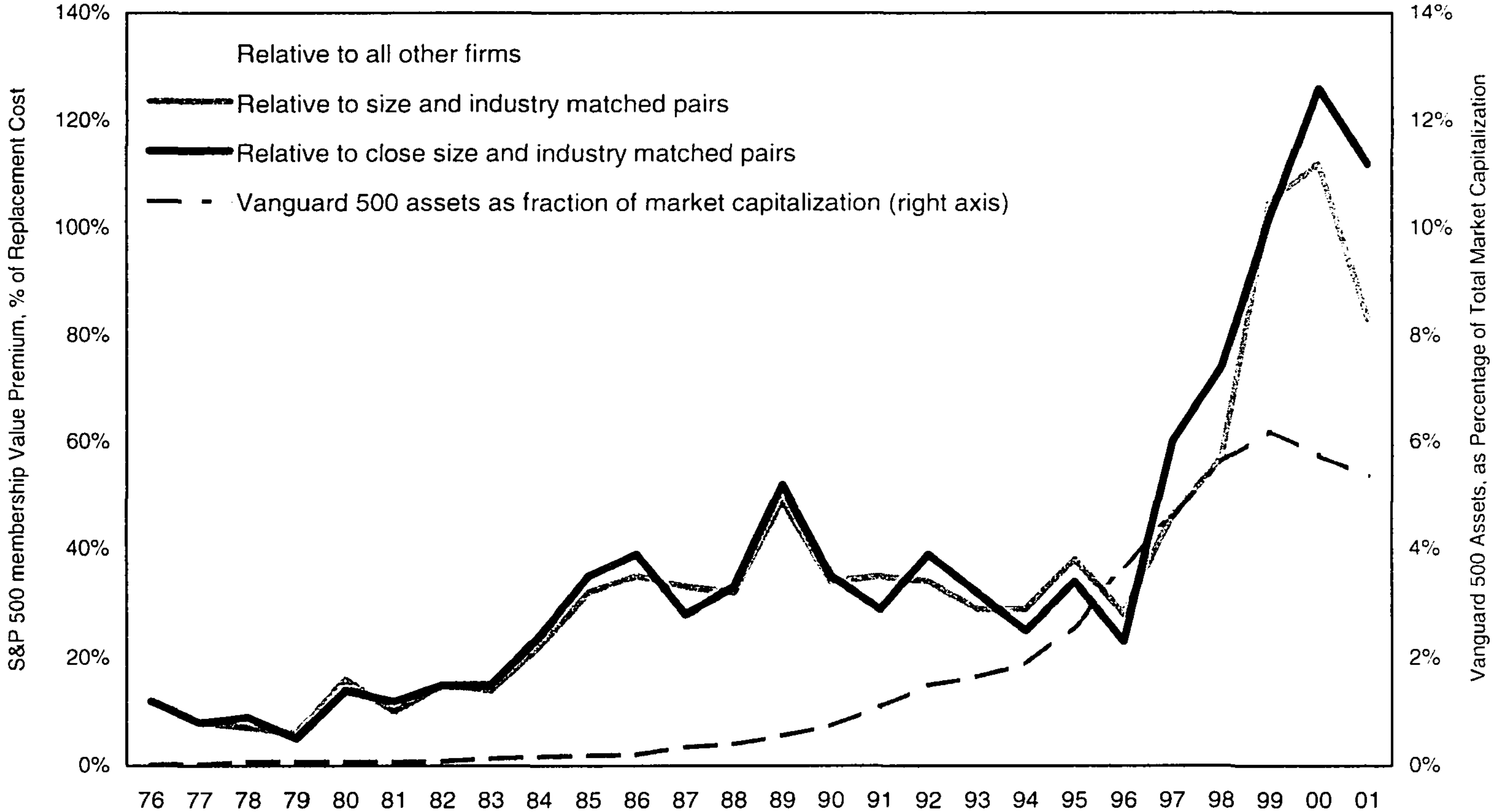


Figure 2.3
The Value Premium Associated with S&P 500 Membership and the Growth of Indexing
The value premium is the coefficient of an S&P membership indicator variable in a regression of average q on R&D, advertising, leverage, (all three scaled by replacement cost), the log of replacement cost, and the S&P membership indicator variable, as in Table 2.8. The total assets of the Vanguard 500 Index Fund, as a fraction of total US market capitalization, are used as a proxy for the growth of indexing.

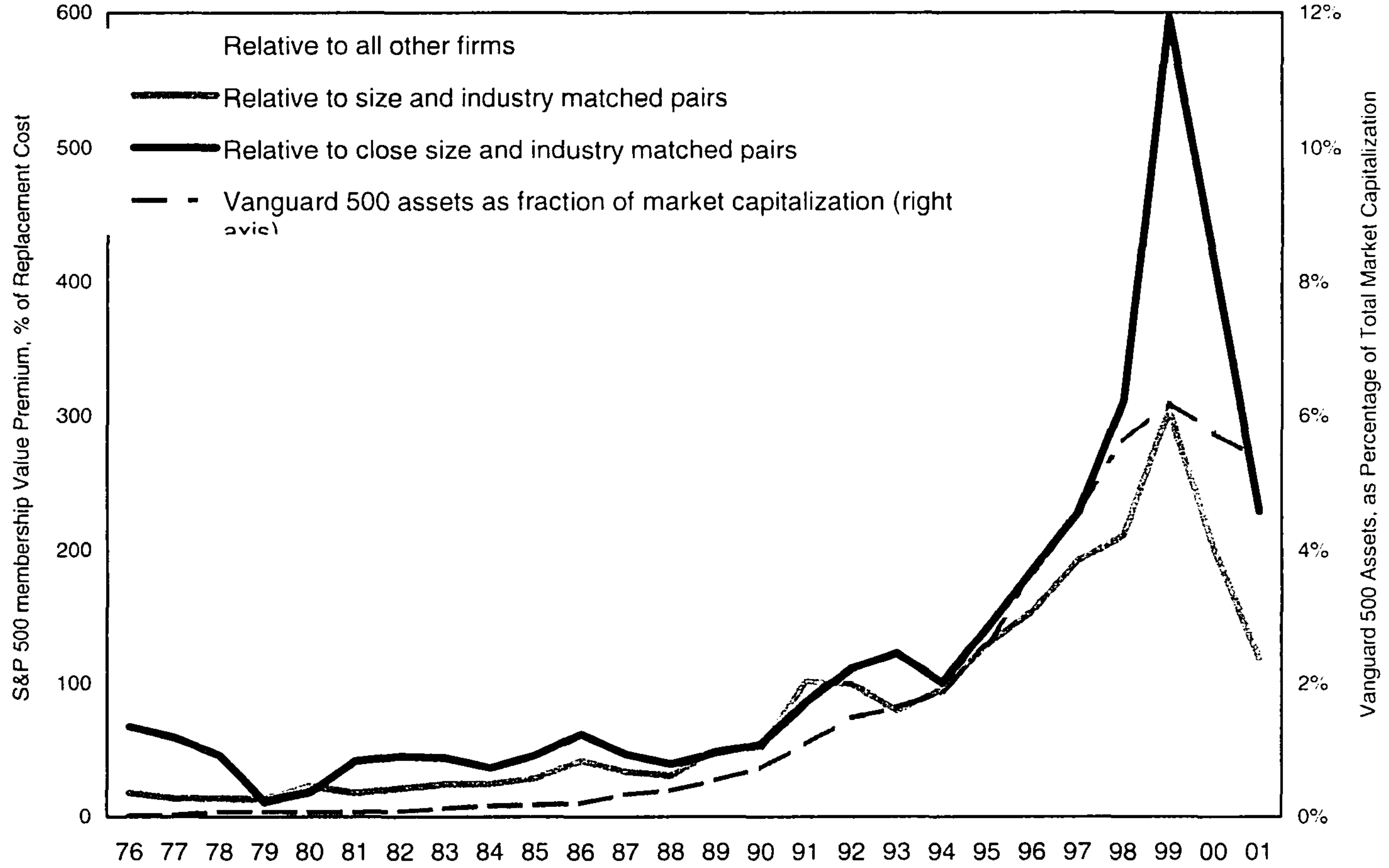


Samples used in estimating the valuation effects are as described in Table 2.2

Figure 2.4

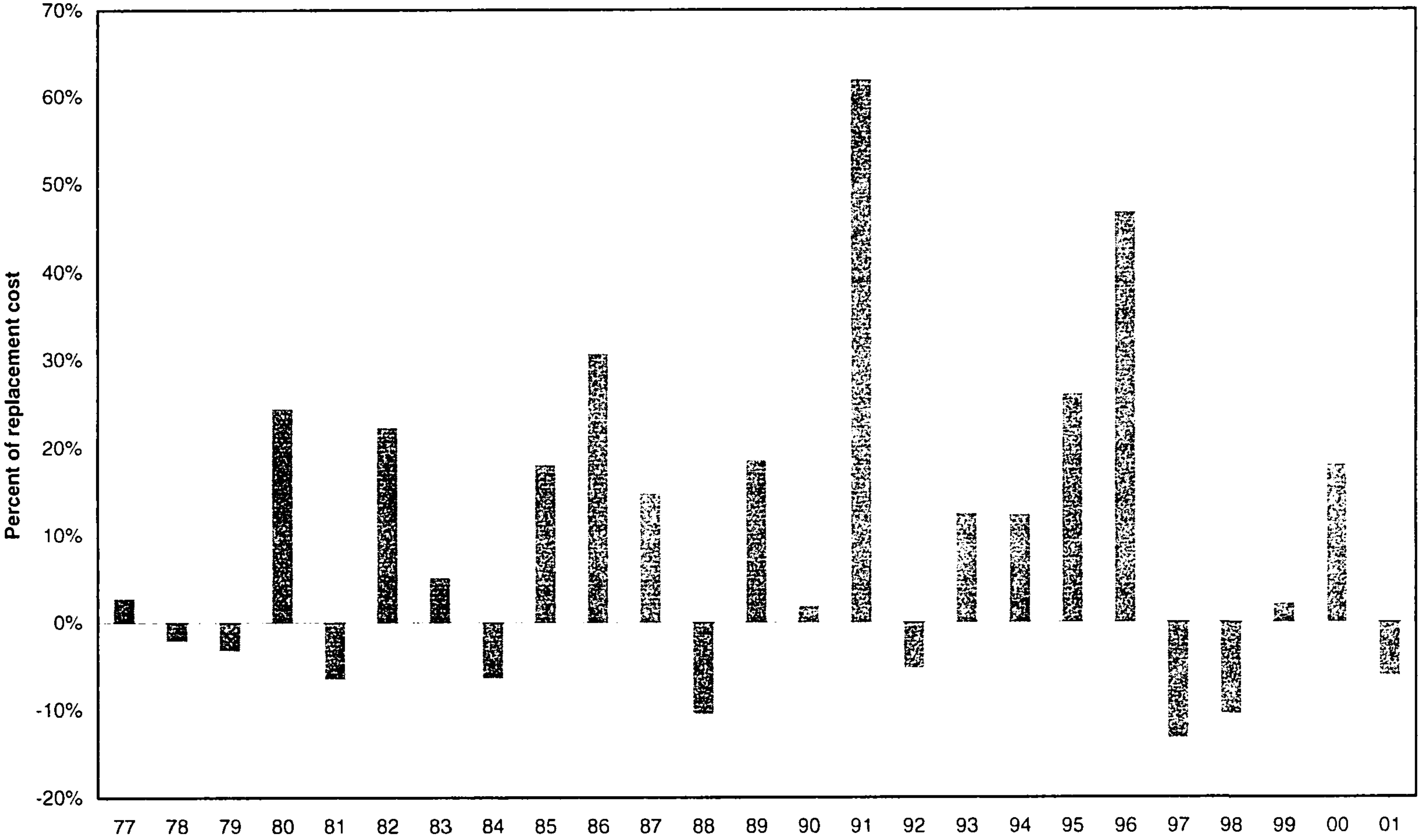
The Value Premium Associated with a Firm's Weight in the S&P 500 and the Growth of Indexing

The value premium is the coefficient of the firm's weigh in the S&P index in a regression of average q on R&D, advertising, leverage, (all three scaled by replacement cost), the log of replacement cost, and the weight, as in Table 2.8. Firms not in the index are assigned a weight of zero. The total assets of the Vanguard 500 Index Fund, as a fraction of total US market capitalization, are used as a proxy for the growth of indexing.



Samples used in estimating the valuation effects are as described in Table 2.2.

Figure 2.5
Normalized Change in Median Tobin's Average q Ratio upon Inclusion
The vertical axis shows the average q ratios of newly included firms at the end of the inclusion year minus their average q ratios one year earlier. This change is normalized by subtracting the same change in average q ratios for size and industry-matched firms that are not in the S&P500 index. The horizontal index is the calendar year of the inclusion.



CHAPTER 3

THE RISING SUN BANK
A CASE STUDY OF GOOD CORPORATE GOVERNANCE IN A CORRUPT ECONOMY

3.1. Introduction

The Rising Sun Bank, founded in 1823 in the remote inland Shanxi Province, became the premier Chinese financial institution in the latter years of the Qing Dynasty (1644-1911), an era of deeply corrupt and chaotic political and economic decay. Overcoming a commercial environment comparable to "failed states" in the contemporary third world, the Rising Sun Bank prospered and facilitated financial and commercial transactions throughout the Chinese Empire.

Recent work, such as King and Levine (1993), shows that a well-developed financial system is one critical prerequisite for sustained, broad based, economic growth. Yet, La Porta et al. (1997, 1998) show that financial markets and institutions seldom attain any degree of sophistication or scale in economies plagued by high levels of corruption. The Rising Sun bank stands in stark contrast to these otherwise generally correct empirical findings. A detailed analysis of how the Rising Sun bank attained such an exceptional success is therefore of considerable interest to students of financial and economic development.

Two insights emerge. First, a financial institution can prosper in a profoundly corrupt political environment if it can devise private systems of contract enforcement that substitute for official courts and exempt itself from the sway of those courts. Second, the bank's decline shows how important its skillfully crafted governance structure was in maintaining the credibility of this balance. Some of the tools used by the Rising Sun bank, such as making itself indispensable to the ruling elite, are well understood; but others, like holding relatives of key employees as hostages, may not transfer well to modern developing countries. However, the bank's innovative ownership structure, voting rights distribution, and executive compensation formulae, may well be worthy of modern emulation.

3.2. The History of the Rising Sun Bank

In 1823, Li Daquan founded the Rising Sun Bank in the inland city of Pingyao, Shanxi Province. He chose the propitious name 日昇昌, or Rishengchang, for this new enterprise. The name combines three Chinese roots ri meaning sun, sheng meaning rise, and chang meaning prosperity. Translated here as the Rising Sun Bank, the name connotes financial success growing in brilliance like the rising sun. Li died in 1826, and his three sons inherited the bank. Between 1823 and 1932, control passed through four more generations of Li. After more than a century of continuous operation, the bank closed amid scandal in 1932.

The Qing Dynasty Economic Environment

In the early 17th century, English and Dutch raiders disrupted China's trade with Spanish America, and destabilized China's bimetallic monetary system by cutting off silver imports. Repeated wars against Mongols and Manchus depleted the treasury, and plague felled taxpayers all across China. The final emperors of the Ming Dynasty (1368-1644) levied punitive taxes in silver to pay for their armies. To escape Imperial tax collectors, peasants abandoned their fields and tradesmen their shops. In 1627, the peasants revolted en masse, and the economy collapsed. In the culmination of years of chaos, the key rebel leader Li Zicheng captured Beijing. The Ming General Wu Sangui appealed to the Manchu warlord Dorgon for aid. Dorgon suppressed the rebellion, installed his five year old nephew, Kangxi, as the first Qing Emperor, and ruled China as Regent. Qing emperors reigned until the 1911 Revolution that established the Republic of China.

In Chinese eyes, the Qing emperors were foreign barbarians, ruling only by right of conquest. Although they adopted Chinese customs, culture, and language; their barbarous origins repeatedly confounded their Mandate of Heaven to rule China. For example, the leaders of the Taiping rebellion (1850-64) proclaimed "Can the Chinese still consider themselves men? Ever since the Manchu poisoned China, the flame of oppression has risen up to heaven, the poison of corruption has defiled the emperors' throne, ..."[1]

Easterly and Levine (1997) show that ethnically divided modern African states invest remarkably little in public education, public infrastructure, and the like. This appears to be because ethnic minority rulers view their tenure in office as uncertain, and seek to extract as much wealth as possible from the state apparatus in as little time as possible. General education and other infrastructure investments, whose returns are in the far future and must, in any case, be shared by all ethnic groups, are thus low priorities. They are even more undesirable if they absorb funds that might instead be used to fund the police and military to maintain the power of the incumbent ethnic minority rulers.

Some of these same considerations probably also influenced the Manchu Qing emperors, who ruled over a population composed mostly of Han Chinese. Like a previous barbarian dynasty, the Mongol Yuan Dynasty (1271 - 1368), the Qing funded the Imperial Army generously. In addition, they co-opted the Imperial civil service, which was perhaps even more important than the military to their holding the throne. These policies preserved Qing rule into the early 20th century, but required permanently high taxation that probably critically undermined the economy.

Baumol (1990) describes many examples of highly bureaucratic governments stifling innovation and perpetuating economic stagnation through the histories of many regions and countries, including China. Entrepreneurs had highly uncertain property rights over their profits. As in Murphy et al. (1991), the most talented individuals sought to make their fortunes in the Imperial Bureaucracy, for business and commerce offered little prospect of wealth or advancement. To a large extent, this was because the bureaucrats exercised highly discretionary taxation authority, and could be expected to confiscate any profits the feudal lords failed to seize.

Bureaucrats were hired and assigned positions on the basis of civil service examination scores. However, once hired, they were dependent on their superiors in the Imperial Bureaucracy for promotions and assistance. Senior bureaucrats came to

[1] See Spence (1990, p. 173) for further discussion.

expect regular large bribes from the lower-level bureaucrats who reported to them, who, in turn, expected bribes from their underlings. All of this was financed by tax collections, supervised by promotion-hungry bureaucrats whose objective was probably short term tax revenue maximization. By the late 18th century, the bureaucracy was thoroughly corrupt, and the emperors, critically dependent on bureaucratic support, had neither the power nor the desire to initiate reforms.

Nor was there an effective or independent judiciary to check this corruption. The Qing legal system was procedurally highly formal, but Djankov et al. (2003) and La Porta et al. (2003) find that measures of procedural formalism are negatively correlated with measures of the effectiveness of a country's judicial system. Moreover, the Imperial Bureaucracy exercised all judicial powers. The imperially appointed Administrator, or 知县, of each county served as its sole Judge and Prosecutor. There were no juries or defense attorneys. Consequently, Administrators wielded unchecked judicial powers, and so were immensely powerful individuals capable of extracting large bribes from wealthy individuals in return for favorable treatment in court. Since prolonged court maneuverings, including appeals, were both expensive and socially demeaning, a quick and favorable verdict was regarded as essential to maintaining one's reputation.[2] This was best insured by bribing the local Administrator.

De Soto (1989,2000) Baumol (1990), Klitgaard (1995), La Porta et al. (1998) and many others stress the critical role of reliable property rights protection and contract enforcement for all but the most basic of commercial and financial activities. In modern developed economies, the institutions that uphold these rights are so ingrained that they are often taken for granted. This is not so in many modern third world countries, and was definitely not the case in 19th century China. Land titles, regulatory approvals, tax rates, and contracts were only as secure as ones ability to bribe the local Administrator.

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[2] In Chinese and other East Asian cultures, going to court was deeply shameful regardless of the circumstances surrounding the case. This may have reflected the apparently rational view that the courts were instruments of oppression, not of justice.

This situation made commercial and financial dealings with all but one's immediate family, trusted friends, and close neighbors very uncertain. Ellickson (1991) finds that, where the cost of learning about the law and engaging in formal resolution procedures is high, people circumvent the judicial system and fall back on common-sense norms. The Qing judiciary was so costly, replete with arcane ritual formalism, and likely to return blatantly unfair rulings as to be virtually unusable by merchants or money lenders.

However, local communities were compact – everyone in a village or city neighborhood knew everyone else. This made personal and family reputations effective guarantees of good faith in transactions within such communities. That is, contracts were meaningful because failing to honor one's commitments brought unbearable loss of face.

However, the impossibility of holding strangers to the terms of contracts they signed surely made running such operations difficult and impeded the growth of new ones. Putnam (1993), La Porta et al. (1997b), and others show that widespread belief that strangers act in good faith is an important precondition to sustaining large organizations. Thus, large-scale businesses in Qing Dynasty China were precarious operations, constrained severely by their inability to trust their employers, financiers, customers, or suppliers.

Weak also property rights generally discouraged capital accumulation and entrepreneurship. Any individuals or families who accumulated significant wealth drew the notice of local bureaucrats or landed aristocrats, who could seize such wealth by manipulating the legal system. Since upstarts lacked wealth to pay bribes, the corrupt judicial system entrenched the established aristocratic and bureaucratic elites. Corruption became an insurmountable barrier to entry for prospective entrepreneurs.

The aristocracy derived their income from agricultural estates, and the bureaucrats obtained most of their revenue by taxing this income. Trade, commerce, finance, and industry, though important in earlier eras, threatened the positions of aristocrats and bureaucrats alike. Families whose wealth had mercantile origins remained important, but many sought to conceal their dishonor and pass as more pedigreed aristocrats.

Foreign trade, in particular, had brought vast riches to a merchant class in the 15th century. In the 15th century, China's Star Fleet, hundreds of ocean-going junks, explored the coasts of South Asia and Africa and may even have neared southwest Europe. The vast wealth its officers and backers earned through trade disturbed the established social order, as did the foreign philosophies and ideas the Star Fleet carried home. The next emperor ordered the ships destroyed, their logs burned, and foreign travel proclaimed a capital offence. Trade with the outside world remained contentious, and was still highly restricted in the 1823, when the Rising Sun Bank was founded.

The Qing dynasty thus oversaw an inward-looking economic decline spanning centuries, culminating in the chaotic despotism of the 19th and early 20th centuries. Talented individuals sought their fortunes in the Imperial bureaucracy, business was subject to arbitrary taxation and corrupt courts, and overall national wealth was steadily declining amid rising general official corruption.

The Establishment of the Rising Sun Bank

Despite this hostile environment, the Rising Sun Bank built an Empire-wide financial business that supported long distance trade and long term investments. The founder of the bank, Li Daquan, owned a chain of dye factories and stores called Xiyucheng. Its headquarters were in Pingyao and it had branches as far south as in Wuhan (in present day Hunan Province) and as far north as in Beijing.

At the time, paper money was not used in China, and currency consisted of coins and chunks of precious metal, such as silver and gold.[3] Coins and metals were valued by weight and purity. This atavistic monetary system made large commercial transactions over long distances difficult. This is because the transportation of large amounts of metals was expensive, slow, and at risk of plunder.

[3] Paper currency appeared in China in the ninth century, and remained in use until 1455, when a hyperinflation devastated the economy and China returned to metallic currency.

The manager of the Wuhan branch of Xiyucheng, Lei Lutai, realized that these high costs of using silver to settle his accounts, and those of other companies, impeded interregional trade. Lei sensed a business opportunity for a firm that would specialize in clearing the accounts of businesses engaged in such trade.

In January 1823, Lei persuaded his employer, the sole shareholder of Xiyucheng, Li Daquan, to restructure his chain of dye factories and stores into a branch banking operation. The bank would provide its customers with cross-regional settlement and clearance, deposit accounts and loans for businesses and individuals, and third-party guarantees for businesses. On the Chinese New Year's Day of 1823, Li renamed his firm the Rising Sun Bank and set up its first branch in Pingyao, a city in Shanxi, a landlocked province of north central China.

Li Daquan provided the bank's entire initial capitalization of 300,000 liang of silver – about 482,400 troy ounces.[4] The executive management team consisted of three professional managers - Lei Lutai, the General Manager; Mao Hongsui, the Vice President of Operation; and Chen Dapei, the Vice President of Logistics.

Locating in Shanxi made eminent sense in 1823. Neither Shanghai nor Hong Kong would begin developing as business centers until the end of the first Opium War in 1842. Although Qing Dynasty China was never as hermetically sealed as Tokogawa Japan, China's trade was still largely internal in the 18th and early 19th centuries. Shanxi was a central trading depot because internal political stability attracted talented individuals from other regions. By tapping this talent pool, Lei could restructure a chain of dye shops into a multi-branch bank.

The Initial Ownership Structure

The main problem Li and Lei confronted was establishing a corporate governance mechanism that would allow their bank to tap this expertise and to operate throughout China despite the ambient corruption of the Qing Dynasty economy. The solution they hit upon was a somewhat complicated and historically unique stock ownership structure.

[4] One *liang* is 1.608 troy ounces.

Share ownership normally confers two rights, each of which affects corporate governance. Cash flow rights theoretically give shareholders dividends, while voting rights theoretically let shareholders choose the firm's top managers. Jensen and Meckling (1976) argue that giving insiders larger cash flow rights aligns their interests more with those of other shareholders, and so leads to better corporate governance. The proposals of Jensen and Murphy (1990) and others argue that professional managers be compensated with stock or stock options are premised on reducing this divergence of interests agency problem. However, the downside of large managerial equity ownership is that this also gives insiders large voting rights. If the firm's managers or their heirs, control enough votes, they cannot be displaced even if they no longer provide able management. Morck et al. (1988, 2000) and Stulz (1988) refer to this as an entrenched management agency problem. They argue that a medial degree of insider ownership balances these two agency problems, and maximizes firm value. Too little inside ownership permits excessive divergence of interests problems, while too much permits entrenchment problems.

The Rising Sun Bank developed a more thoroughgoing solution to this balance. Lei and Li realized that higher ownership mitigates Jensen and Meckling's (1976) divergence of interests problem by assigning insider cash flow rights, while the entrenchment problems described by Morck et al. (1988) and Stulz (1988) arise from giving insiders excessive voting rights. By hiving off voting rights from cash flow rights, they could give insiders huge cash flow rights, closely aligning their interests with those of other shareholders, much as executive stock options are thought to do in the modern United States.[5] But by giving insiders minimal voting rights, they could avoid entrenchment problems.

This was accomplished by giving managers non-voting shares. Note that this is precisely the opposite to modern firms with voting and non-voting shares. Nenova (2003) describes how insiders typically hold the voting shares, and so become entrenched while holding very small cash flow rights. This provides the worst of both problems – little convergence of interests between insiders and outsiders and insider

[5] See Paul (1992), Lewellen *et al.* (1992), and others.

entrenchment simultaneously. The Rising Sun Bank sought the best of both worlds by paying professional managers in non-voting stock – this aligned their interests with those of shareholders and prevented their entrenchment.

The Rising Sun Bank initially had two classes of equity – capital shares and expertise shares. These were not precisely the same as voting and non-voting shares in a modern corporation, so a short explanation is in order.

Capital shares, which represented fractional ownership of the bank's assets, were initially owned by the Li Daquan and his heirs. The capital shareholders collectively owned all of the bank's assets. They were entitled to dividends, which were paid every four years and were equal on a per share basis to those paid to other classes of shareholders. The four year cycle matched the bank's 48 month long fiscal year. Capital shareholders had no control over the bank's daily operations, and could not influence its business decisions directly. Their only powers were to force the retirement of the General Manager if a majority of them thought it the proper time and to set the pay of professional managers by allocating them expertise shares.

Expertise shares, which did not represent claims to the bank's assets, were granted to professional managers. The managers made no monetary investment in the bank; their investment was their expertise. More important or successful professional managers, as judged by the capital stockholders, had more expertise shares. The general managers and vice presidents were granted from 0.25 to 1.3 shares of expertise stock; clerks were granted between zero and 0.2 shares. Expertise shareholder had no claim on the bank's assets. However, an expertise share paid the same dividend as a capital share every four years. The expertise shareholders controlled the day-to-day operation of the firm, and each professional manager's voice in these decisions was proportional to his holdings of expertise stock.

Since the professional managers sole source of income was their dividends, their interests were closely aligned to those of the capital shareholders. Actions that would increase the dividend were equally in the interests of both; actions that would decrease the dividend were equally detrimental to both. Once every four years, after the dividend was paid, the capital shareholders evaluated the performance of the managers and decided whether to adjust the number of the expertise shares each manager held. This meant that managers' compensation could actually be more highly dependent on their performance than was the capital shareholders income. In this way, the Rising Sun Bank avoided the divergence of interests agency problem described by Jensen and Meckling (1976).

Entrenchment problems were mitigated by carefully partitioning the voting rights of the two classes of shares. Expertise shares gave professional managers no voting rights in decisions about keeping them on or firing them, nor about their compensation. Only capital shareholders voted on these issues. Thus, professional managers could not become entrenched. Capital shares, in contrast, provided no voting rights on issues concerning the operation of the bank on the grounds that these decisions were best left to the expert professional managers. This meant that capital shareholder also could not become entrenched managers because they had no say over management, except to admonish or reward the expertise shareholders every fourth year.

In modern companies, the heirs to the founding family often retain a strong voice in corporate decision-making – to the detriment of the firm's value. Pérez-González (2001) finds that firms' share prices drop sharply upon news that the current CEO's son will take over – especially if he is not educated at a top university. Smith and Amoako-Adu (1999), Morck et al. (2000), and Amit and Villalonga (2004) show that heir-controlled firms underperform benchmark firms significantly. These problems most likely arise because heirs vote large blocks of stock, but lack the expertise to use their voting power wisely. This is the essence of the entrenchment problem described by Morck et al. (1988) and Stulz (1988).

The Rising Sun Bank mitigated problems regarding heirs in two ways.

First, if the manager retired in good standing or died while still working at the bank, his expertise stock continued to pay dividends to him or his heir for a period defined in his employment contract. However, neither the retired manager nor his heirs had any voting rights at all. (If a professional manager quit the bank, his expertise stock vanished immediately.) This prevented the heirs of professional managers from becoming entrenched.

Second, although capital shares were passed from generation to generation, the attached voting power was restricted to decisions about the hiring, firing, and compensation of managers. This also worked to avoid entrenchment problems. Since the capital shareholders had no control over day to day operations, they could not interfere in affairs about which they knew little.

In short, the bank could provide professional managers with the incentive effects of large equity ownership stakes while limiting the extent to which they or their heirs could become entrenched because of those equity holdings. By limiting the scope of the voting rights of capital shareholders, the bank could also prevent them from becoming entrenched.

The Recruitment of Professional Managers

Although the bank had branches in regional trade centers throughout China, all bank employees everywhere had to be Pingyao locals. This seemly minor rule actually was a powerful corporate governance mechanism. The dividends on expertise stock owned by managers of distant branches were paid to their families in Pingyao. These managers knew that the social and economic status of their families depended on their allotment of expertise stock, and that malfeasance of any kind could endanger not only this status, but also the health and lives of their relatives.

When the bank was about to hire a candidate, it conducted a background check going back three generations. This was relatively straightforward because families seldom left their native counties, and longstanding neighbors knew intimate details about each others' families. Candidates whose background checks were clean were then invited to present the bank with a personal guarantee letter from an eminent personage in their county. The background check and the guarantee letter ensured the loyalty and honesty of all the bank's employees.

This arrangement protected the professional managers too. In the event that a dispute arose between the bank and the manager, the eminent personage who guaranteed the manager would represent him in negotiations with the bank. This prevented the bank from dealing unfairly with its managers, for that would impugn the reputations of both the bank and the guarantor. But it also prevented the professional manager from dealing unfairly with the bank, for this would compromise the eminent personage.

Although modern civil libertarians might be uncomfortable with some parts of this arrangement, it was a realistic approach to conditions in Qing Dynasty China. The arrangement motivated both hard work and honesty in an economy characterized by endemic corruption. Throughout bank's century-long history, there was no hint of fraud or deceit by any professional manager.

Early Growth and Emergence of Rival Banks

Three years after its foundation, in 1826, the bank's owner Li Daquan died, and his three sons each inherited one third of the bank's capital stock. Li's eldest son, Li Zhenting, took over as Chairman of Board. Li Zhenting injected a further 60,000 liang silver, raising the bank's total capital shares outstanding to thirty-six, with book value of 10,000 liang per share. This ownership structure, with three equal capital shareholders, remained in place until the early 20th century when the heir of Li Zhenting restructured the bank.

Also, in 1826, the Vice President of Operations, Mao, quarreled with the General Manager, Lei, and resigned, losing all of his expertise shares. He was promptly retained by another group of investors to serve as the General Manager of a new rival bank, and was compensated well for his loss. As still more investors hired professional bank managers away from both existing banks, expertise in banking began to spread, and Pingyao soon emerged as the leading financial center of Qing Dynasty China.

Immunization against Official Corruption

As mentioned above, a key problem for any successful business in Qing Dynasty China was the threat of expropriation by officials, bureaucrats or the feudal nobility, who could confiscate wealth with impunity because their ability to manipulate the legal system made redress impossible. This danger was probably most acute for rapidly growing middle sized businesses. Very small businesses are generally not rich enough targets to warrant extensive expropriation. Businesses that have become very large can bribe local Administrators themselves, and so might fight back. The Rising Sun Bank was most vulnerable to official expropriation when it was just emerging as a national banking house. The bank managed to survive this dangerous stage of development by taking advantage of a political crisis to make itself indispensable to the Imperial Bureaucracy.

British trading companies discovered in the early 1800s that paying for Chinese products with opium from British India was considerably more advantageous than paying in silver. British reprisals against Chinese efforts to stamp out British drug traffickers culminated in the First Opium War (1839-42). After the Royal Navy captured Guangzhou and Shanghai, the Chinese capitulated. The terms of the peace, the Treaty of Nanjing, opened the treaty ports of Guangzhou, Xiamen, Fuzhou, Ningbo, and Shanghai to British merchants; ceded Hong Kong Island to Britain; legalized opium; and awarded Britain an indemnity of 21,000,000 liang of silver as war reparations.

Since the imperial government has little silver, it levied a tax on each province, and ordered the provincial governments to transfer the silver to port cities where the British waited to collect it. This was a simple matter for the coastal provinces, where the distances involved were short. However, the inland provinces of Shanxi, Shaanxi, Sichuan, Hunan and Anhui confronted a crisis. Collecting the silver locally was feasible, but the inland provincial governments lacked the means to transport such huge amounts of silver securely to port cities, especially within the short time the British allowed.

Lei Lutai, the General Manager who had first conceived of the Rising Sun Bank, saw an opportunity in the crisis to safeguard the bank from official predation – and a huge business opportunity to boot. Lei instructed his branch managers in the inland provinces to approach their provincial government officials with an offer. For a service fee, the Rising Sun Bank would transfer the money to the designated ports before the deadline.

The transactions were arranged as follows. Each provincial government deposited the amount due (plus the fee) in silver in its local Rishengchang branch in return for a bank draft, valid at a Rising Sun Bank branch in the designated port city. A representative of each provincial government then took its draft to the port city, cashed it in for silver, and gave the silver to the British representatives there. In preparation for this, the bank's headquarters, via its private postal express system, arranged for all its branches near each designated port city to move silver immediately to the port branches. Thus, when the provincial government representatives arrived at the port branches, the silver was already waiting.

The system worked flawlessly, and an impending disaster was averted. The emperor was so impressed that he bestowed a nickname on the Rising Sun Bank - "Remittance Service Allover China", or "汇通天下". From this point on, the Rising Sun Bank was unquestionably the most important bank in China. At a single stroke, it was now also too powerful and well connected to be vulnerable to bureaucratic or aristocratic predation. The Rising Sun Bank could now attract business by touting its Imperial connections as insurance against such predation.

The Transfer of Power and the Self-Strengthening Movement

The first General Manager, Lei Lutai, who first conceived of the bank and then grasped the opportunity in the 1842 indemnity, died at his post in 1849. Although his own son was a candidate to succeed him, Lei nominated Cheng Qingpan, the son of the Vice President of Logistics, as his successor. Choosing other than one's son as a successor was extraordinary in China in this era, but the Rising Sun Bank's governance structure meant that the capital stockholders would not have left a poor manager in charge. Presumably, Lei understood this, realistically evaluated the ability of his son, and acted accordingly.

From 1850, the Taiping Rebellion, led by anti-opium nationalists threatened the stability of China. When Chinese authorities seized a Hong Kong ship suspected of piracy and smuggling in 1856, the Second Opium War with Britain ensued. France joined the fray after Guangxi provincial authorities executed a French missionary. The Rising Sun Bank found no opportunities in this war to match those in the First Opium War. In fact, the general chaos spreading across China curtailed business opportunities, and the bank closed several branches during the war.

In 1858, China accepted a truce based on the Treaties of Tianjin, which opened eleven treaty ports to French, Russian, and American trade. When the Chinese reneged, and refused to permit foreign legations in Beijing, the war resumed. British and French troops occupied Beijing on September 26, 1860. The Emperor Xianfeng ratified the treaty three weeks later, and acquiesced to foreign pressure to legalize opium and Christianity. The Taiping Rebellion was finally suppressed, with foreign assistance, in 1864.

An additional feature of the Treaties of Nanjing and Tianjin, which ended the two Opium Wars, was extraterritoriality. Extraterritoriality meant that British subjects in China were subject neither to Chinese law nor Chinese courts. Rather, cases involving Britons were referred to British common law courts operating in the treaty ports. Similar arrangements granted analogous rights to American, French, German, Japanese, Russian citizens in China. These arrangements were high priorities for foreign merchants, dismayed by China's corrupt judicial system, and anxious to establish legal systems favorable to themselves.

Extraterritoriality encouraged the rapid development of foreign banks and foreign financed businesses in and near the treaty ports. Although the Chinese interior remained the preserve of the Rising Sun Bank and its Chinese rivals, western banks dominated in these enclaves of foreign law. As Ching Dynasty corruption worsened, the treaty ports became safe havens for Chinese goods, capital, and people. By the end of the Second Opium War, foreign banks based in the treaty ports were important players in almost all aspects of the Chinese economy. A tripartite division of Chinese banking emerged: foreign owned banks financed international trade, the Shanxi banks – including the Rising Sun Bank – handled interregional trade, and Chinese banks based in Shanghai and other treaty ports financed local investment, ultimately including industrial development.

China's defeats in the Opium Wars and her inability to quash the Taiping Rebellion herself impressed upon the Qing leadership the need for urgent reform. The "self-strengthening" movement, prominent from 1870s through the 1890s, had two main components – adopting Western technology and restoring traditional Confucian morality to Chinese officials to make them worthy of authority. More radical reformers, such as Wang Tao (1828-1897), a journalist writing from the protection of the British enclaves, advocated the Westernization of China's entire society along the lines of the Meji reforms then occurring in Japan.

As all of this unfolded, the Rising Sun Bank grew cautious and conservative. Cheng's next two successors brought a conservative style to the Rising Sun Bank. The daring moves of Lei were perhaps necessarily to establish the bank's preeminence. Now, the goal was to protect the bank's dominance. The Rising Sun Bank remained the primary conduit for tax revenues flowing into Beijing from the provinces. In addition to handling government finances, the bank also took deposits, drafted financing agreements, guaranteed customers, exchanged internal currencies (China had various systems of coinage with different base metals contents), and financed patronage. For example, individuals purchasing appointments in the Imperial Bureaucracy routinely used the bank to handle the transaction.

The Rising Sun Bank now benefited from the status quo, and needed continued good relations with China's established elite – especially provincial governors and officials.

Provincial governors were the primary advocates of the self-strengthening movement – reconstructing roads and irrigation systems, reintegrating refugees into the economy, and adopting Western technology to build railroads, telegraphs, mines, and factories. Corporate governance in all these enterprises revolved around the principle of "state supervision and merchant operation." Provincial officials made major strategic decisions, and merchants made day-to-day operational decisions.

The Rising Sun Bank prospered throughout this period, and its capital and expertise shareholders grew rich together. To allow expertise shareholders to reinvest their dividends in the bank, a third class of stock was created in 1880. Non-voting capital stock, like capital stock, bestowed no control rights over day-to-day bank operations. But like expertise stock, it also bestowed no control rights over long-term strategy either. Non-voting capital stock provided dividend rights, but nothing else.

Li Wudian, the adopted son of Li Zhenting succeeded his father as Chairman of the Board in1891. Li Wudian was a highly talented manager himself – able to select highly capable managers, and take a hand in managing the bank himself. The former talent led the bank to its apogee, while the latter ultimately brought it to ruin.

The bank's fourth General Manager died on post after less than one year's service. Li Wudian appointed Zhang Xingbang, formerly managing the bank's Beijing branch, as the new General Manager.

The Zenith of the Rising Sun

By the 1890s, however, it seemed Wang had been right. Japan defeated China in the Sino-Japanese War, and in 1895 imposed peace conditions analogous to those won by the Western Powers in the Opium Wars. Japan and the other foreign powers then set about carving out larger spheres of influence within Chinese territory. The Emperor decided that China needed a total reform of her society, and turned over power to the radical reform advocate Kang You-wei (1858-1927). Kang issued edicts establishing universal public schools, democratically elected assemblies at all levels of government, and bureaucratic and military reform.

These reforms profoundly threatened vested interests at all levels of Chinese society. Since the provincial governors had enthusiastically re-equipped their personal armies with Western military technologies and practices as part of the self-strengthening movement, they resisted military reform. Popularly elected provincial assemblies also seemed pointless to them, and Kang's edicts were largely ignored outside Beijing. The Imperial Bureaucracy, built upon ancient traditions of patronage and favor trading, and driven by centuries of momentum, exerted its full power to resist reform. After one hundred days, the Dowager Empress Ci Xi (1835-1908), headed a coup that retrenched the Imperial Bureaucracy and delegated sweeping powers to provincial governors. Beijing's authority over the provinces was now sharply circumscribed.

This decline in central authority upset the longstanding tripartite balance between the foreign banks, who handled international transactions; Chinese banks in the treaty ports, who handled local investments; and the inland banks, like the Rising Sun Bank, who handled interregional transactions. Taxes no longer flowed through the Rising Sun Bank to Beijing, and the Imperial Government no longer had the power to protect the banks' operations throughout China from local corruption and predation.

As economic and political power shifted increasingly to provincial governments, the bank's close ties to the Imperial government no longer guaranteed prosperity. Zhang concluded that bold action, reminiscent of the bank's daring founder, Lei, was needed, and immediately instated a cadre of new managers who were much less risk averse that their predecessors. The bank now began a rapid expansion throughout China, with the number of regional branches reaching a record high of thirty-five. Under Zhang, the bank's annual transactions rose into the fifty to eighty million liang per year range, its deposits rose to about twenty five million liang, and its cross-regional settlements averaged about forty million liang per year.

As a reward for overseeing this rapid growth, the capital stockholders granted Zhang 1.3 shares of expertise stock. He was the only manager in the bank's history whose expertise stock exceeded one share.

However, as the provinces grew increasingly independent and Beijing's sway weakened, the foreign banks continued to gain market share. The Qing government, starved of tax revenue, began borrowing from foreign banks to pay the indemnity Japan extracted in 1895. The foreign banks, in return, obtained increasingly solid extraterritorial rights that virtually exempted them from Chinese law. Foreign banks expanded from international finance into the local market, taking a rising share of local deposits and issuing bank notes for circulation within China.

Economic conditions remained difficult in much of the country for the remainder of the 1890s. The Boxer Rebellion of 1900, in which a state-financed xenophobic secret society attacked foreigners in Beijing, brought foreign garrisons into the capital. The crisis reinvigorated the reform agenda, and a series of radical initiatives now issued forth from Beijing, endorsed by the powerful foreign legations now stationed there. In 1909, elected provincial assemblies were created, and an elected national assembly followed in 1910. Radical reforms to the Imperial Bureaucracy probably undid a good part of the bank's business by ending the sale of civil service jobs, transactions the bank had previously underwritten. The same reforms perhaps also reduced the value of the Imperial Government as a protector of the Rising Sun Bank from corrupt officials.

The Breakdown of Corporate Governance

General Manager Zhang Xingbang died in 1908, and the Chairman of the Board, Li Wudian, appointed Guo Shubing as the new General Manager. However, Li was no longer content merely to influence the bank's general strategy every four years at meetings of the capital shareholders.

Li commissioned an audit of the bank, which ascertained that its assets totaled 382,800 liang of silver. Li and the other shareholders decided that each capital share should represent assets worth 12,000 liang of silver, rather than the 10,000 liang established by Li Zhenting in the 1820s. The higher share value implied that the bank had assets to back only 31.9 capital shares. However, Li and his brothers agreed that the fixed number of capital shares was 36. To solve this problem, Li invented privilege shares, which carried dividend and control rights of capital shares but no title to a share of the bank's assets. Li allocated himself 1.7 privilege shares and granted 0.7 to each of his brothers. This made Li the largest owner of capital stock, which now included the original capital shares and the new privilege shares.

More importantly, Li now broke with tradition and awarded himself a share of the expertise stock that had previously been the preserve of expert professional managers. This gave Li the same control over day-to-day operations as the General

Manager and a consequent leading role in day-to-day management. Li now took part in day-to-day management decisions. Although he did not have a majority of the expertise stock, his control over the compensation and tenure of the other professional managers insured their cooperation. This new structure gave Li virtually unhindered control over all aspects of the bank's management, both as major owner and as senior manager.

The duties of the General Manager and the various vice presidents had been clearly delineated in the past. Li's direct participation in management upset this balance. As the legitimate duties of the various executives blurred, each began interfering in all aspects of the bank's management. This caused each to lose track of what the bank was doing. Contradictory instructions and general confusion left the bank's bookkeeping in disorder. Coming as it did amid the unstable political and economic conditions following China's defeat by Japan, this internal muddle was perilously costly. The bank's financial situation deteriorated rapidly.

The Failure of the Rishengchang Bank

When the Imperial Government launched its ambitions reforms from 1909 on, creating elected assemblies and reforming the Imperial Bureaucracy, it also set about reforming the army and nationalizing the railroads. An army revolt, supported by provincial governors and railroad owners, rapidly spread across China. Provinces began seceding and general chaos erupted. Sun Yatsen declared a Republic in 1911, and organized elections for a national assembly, in which his Kuomintang party won a majority. Leaders of different party factions, intent on seizing power, took up arms. Provinces again started seceding, and their governors degenerated into independent warlords.

The failure of central government severely weakened the Rising Sun Bank, for its fees for remitting taxes to Beijing now evaporated. Even worse, the central government could no longer shield the bank from corrupt officials. After years of consistent profits, the bank posted net losses in both 1911 and 1912. Li arranged for Rishengchang to borrow money from sources other than depositors. Li's younger brothers apparently panicked, and began withdrawing silver. Their original capital shares were claims on the bank's assets, and each entitled its owner to withdraw 12,000 liang of silver at any time. This hemorrhage of capital further undermined the bank's finances.

The Rising Sun Bank had long guaranteed the dealings of its customers, including associated banks, based only on the reputations of their principals. This practice made sense under normal business conditions, when the largest risk was the ethics of borrowers. In the chaos surrounding the formation of the Republic of China, this policy no longer worked. In 1914, the Beijing branch of the Rising Sun Bank guaranteed the performance of the Heshengyuan Bank, based in the neighboring Qi County. When Heshengyuan failed, its creditors sued the bank's Beijing branch. Instead of solving the dispute in the court, the terrified branch manager fled home to Shanxi. The creditors then filed charges against Li. Since the bank was not a limited liability company, Li was imprisoned.

The Rising Sun Bank declared bankruptcy in 1915. In 1921 its creditors proposed a restructuring schedule. The debts were to be converted to capital stock and the creditors would become the new owners of the bank. They would then withdraw the charges against Li. Of the 296 creditors, all but two accepted the proposal. The Li brothers lost all their equity. They were, however, granted 1000 liang of silver per year, as a sort of silver parachute.

The reorganized bank had a greatly broadened base of investors, making it essentially widely held. However, the rapidly changing economic and political environment in early 20th century China was a tough economic environment. The Rising Sun Bank's core business had always been government finances. With the old government gone and the new one still to form, the bank needed other sources of profit. But banks based in the foreign enclaves around Shanghai and other treaty ports enjoyed a critical advantage over purely Chinese banks. Foreign banks, protected by their governments from predation by local warlords, magistrates, or bureaucrats, became especially preferred places for wealthy Chinese to store their savings. Chinese banks, even the venerable Rising Sun Bank, seemed too vulnerable to corruption, and could not attract new deposits, or even retain old ones. This extraterritorial law did not disappear until 1949 in most of the port cities.

This growing concentration of capital in foreign banks and Chinese banks based in the foreign enclaves in treaty ports attracted business that formerly would have gone to the Rising Sun Bank. The banks political ties to the Qing Dynasty, that previously bestowed upon it a similar advantage, were now worthless. Ultimately, the reorganized Rising Sun Bank closed its doors permanently in 1932.

3.3. Good Governance in a Corrupt Economy

The Rising Sun Bank arose in a remote inland province, but quickly came to dominate the deeply corrupt economy of Qing Dynasty China. It accomplished this by adroitly stepping in to rescue the Imperial Government from impending disaster by coordinating the payment of reparations to the British following the Fist Opium War. This saved China from renewed war, and probably bought the Qing Dynasty several decades of continued power. Having earned Imperial gratitude, the bank obtained a long-term low risk source of income by handling tax remissions from the provinces to Beijing. This, in turn, let it enter other dimensions of banking from a position of strength.

The success of the Rising Sun Bank clearly reflected adept political rent seeking, rather than superior banking technology. But, this adeptness was clearly due to highly intelligent professional managers who skillfully grasped a series of rent-seeking opportunities and then ran a sound operation to preserve and expand the wealth they accumulated. Such managers existed because of an innovative corporate governance system.

This system featured two classes of shares. The bank's financial backers, the owners of its capital shares, initially the Li family, had no role in corporate governance aside from periodically appointing a cast of professional managers and setting their remuneration. Capital shares were claims on the bank's assets that, by design, had strictly limited voting rights. The patriarch of the Li family apparently wanted to provide for his descendents' financial wellbeing, but did not trust them to run a bank. These managers were remunerated through grants of expertise shares, which paid the same dividends as capital shares. Expertise shares, though they provided no claim on the bank's assets, entitled their owners to votes on all major business decisions.

This arrangement differs starkly from that in most modern systems of dual class shares, in which the founding family typically has superior voting shares and other investors have restricted voting shares. Professional managers are often salaried help. The typical modern arrangement has four problems, at least two of which the Rising Sun Bank largely avoided.

First, superior voting rights give the modern founding family unchecked control over the firm regardless of whether or not it contains a competent manager. Unless business acumen is genetically inherited, this can be a problem. Caselli and Gennaioli (2002) build a theoretical model to explain why unskilled heirs retain control, despite recognizing their inability to run the firm well, to preserve private benefits they derive from control. Considerable empirical work supports the economic importance of entrenched heir control. Morck et al. (1988, 2000), Amit and Villalonga (2004) and others associate poor performance with heir-run firms.6 Also consistent with this view, Smith and Amoako-Adu (1999) and Pérez-González, (2001) report that firms' share prices fall sharply upon the news that their founders' heirs are taking over. Morck et al. (2000) and Morck and Yeung (2003) link old money families with extensive corporate governance power to slow economy growth and a variety of related institutional problems. By carefully qualifying the voting rights of his heirs, Li sought to entrust the management of the Rising Sun Bank to qualified professionals.

Second, modern family firms allegedly discriminate against professional managers and favor family in promotions and compensation. (See e.g. Dailey and Reuschling, 1980). This deters highly able managers from working in such firms and limits the power of any who do sign up, and so might also explain much of the

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[6] Anderson and Reeb (2003) report slightly superior performance by heir controlled firms. However Amit and Villalonga (2004) dispute this finding on several grounds.

empirical evidence reviewed above. The Rising Sun Bank avoided this problem by awarding professional managers expertise shares that gave them alone voting rights to make operating decisions. The founding family had voting rights only as regarded the periodic appointment of professional managers and their allocation of expertise shares. Excluded from management, the family sought only to maximize their wealth rather than direct the bank's assets towards gaining private benefits of control. The result was a string of highly able managers adept at exploiting the opportunities presented by the corrupt economic environment.

Third, old established families allegedly have longer-term planning horizons than professional managers. These families are concerned not just with current and near term future earnings, but with the survival of their business dynasty over a timescale of generations. If professionally managed firms have inefficiently myopic planning horizons, this thesis is consistent with the finding of Anderson and Reeb (2003) that family firms perform relatively well. This virtue of family control is compromised when professional managers are granted control, even if they are more able than any members of the family. The Rising Sun Bank attempted to avoid this problem by making its professional managers owners of expertise shares and entitled to the same dividends as capital shareholders. However, to avoid diluting the Li family's control, they constructed expertise shares to lose their voting rights upon their owner's death or retirement, and to cease paying dividends after a predetermined period. These posthumous dividends probably instilled a longer term perspective in the bank's top professional managers. Lower level managers' interests were aligned with those of the Li family by virtue of the proximity of their relatives to the bank's headquarters in Shanxi. Managers who put their own interests ahead of the bank's risked sacrificing the lives or freedom of their relatives.

Modern family firms attempt to accomplish the same thing with executive stock options and grants of registered non-voting shares. Jensen and Murphy (1990b) stress two factors that are critical to the effectiveness of the top executive incentive systems: the level of the payment and how the change of the payment responds to changes in corporate performance. High expected pay attracts and retains top flight managers. Pay closely tied to changes in corporate performance induces the executives to exert greater effort to raise firm performance.

The Rising Sun Bank clearly appreciated both points. Its professional managers were handsomely paid. The 1885 fiscal year dividend exceeded 2,800 liang of silver per share. Even if that was for four years, the annualized dividend was still 700 liang. This was a huge sum of money compared to the Mayor of Pingyao's annual salary of 45 liang. Although more than 40 banks operated in Pingyao, such high pay attracted the best managers to the Rising Sun Bank. The top professional managers' pay was also tightly linked to firm performance by the mechanism of expertise shares. This presumably encouraged the talented managers to work hard to raise the dividend, as in Jensen and Meckling (1976).

A fourth issue concerns modern controlling families allegedly sacrificing growth to retain control. (See Daily and Dollinger, 1991). Indeed Landes (1949) stresses how French family controlled firms, whose patriarchs focused on preserving their patrimony, fell behind professionally managed British firms. This, he argues, occurred because family firms were unwilling to take risks, and because they were unwilling to share control with outsiders to raise capital for growth. However, Anderson and Reeb (2003) report that American family firms do not seem more risk averse or less capable of growth than other American firms. Non-voting shares and other arrangements to lock in family control permit modern family firms to tap external capital without permitting outsiders to have a voice in corporate governance. The Rising Sun Bank similarly tapped additional capital by creating non-voting capital stock, which carried no control rights of any kind but let wealthy expertise shareholders reinvest their dividends in the company.

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CHAPTER 4

THE PUZZLE OF CHINA'S A-SHARE AND B-SHARE PRICE DISPARITIES

4.1. Introduction

With the growing globalization of the world economy, more and more countries liberalize their domestic capital markets by opening doors to foreign portfolio investment. Meanwhile, almost all countries have an increasing number of domestic firms seeking finance abroad. Despite the argument that stock market liberalization may help to reduce liberalizing countries' cost of equity capital[1], there are still some countries adopting protectionist strategies by forbidding foreign portfolio investment or imposing restrictions on foreign ownerships of their domestic firms. The most common ownership restriction is the quota, by which foreign investors are allowed to own a fraction of domestic firms. For instance, France imposes an upper limit of 20 per cent foreign ownership on her domestic firms. Refer to Appendix 4.1 for more details[2]. The second kind of ownership restriction is dual- or multiple-class shares that separate domestic investors from foreign investors. Swiss and Chinese capital markets both feature such restrictions.

Chinese regulators permit certain domestic firms to issue dual-class shares (twin shares). One share of a Class A share (A-share) is entitled to the same dividends and voting rights as one share of its twin Class B share (B-share). Furthermore, transaction costs (roughly the summation of income taxes and commissions paid to brokers) of twin shares are equivalent. However, A-shares were restricted to Chinese investors until May 2003, and have been permitted for both Chinese residents and qualified foreign institutional investors (QFII) ever since; while B-shares were

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[1] Do share market liberalizations cause investment booms? Peter Henry, JFE 2000
R. Glenn Hubbard. Capital-Market Imperfections and Investment. *Journal of Economic Literature*. Vol. 36, No. 1. (Mar., 1998), pp. 193-225

[2] Source: a model of international asset pricing with a constraints on foreign equity ownership, by cheol S. Eun; S. Janakiramanan, JF 1986

restricted to foreign investors until February 2001, and have been allowed for both foreign investors and Chinese individual investors ever since.

With respect to trading restrictions, A-share investors face T+1 Huizhuan Trading[3] restrictions from January 1995 on, while B-share investors are given such restrictions after 2002. On the Chinese stock exchanges, T+1 Huizhuan Trading prohibits an investor from selling the stocks he purchased on the same business day, and the earliest sell-order can be placed one business day later. T stands for the date of purchase, and T+1 stands for one business day later. Huizhuan Trading does not impose restrictions on purchasing activities, i.e., if an investor sells a certain stock, he can always buy that stock back as many times as he wants before market closes that day.

Standard asset pricing models predict that two shares' prices should be identical if these shares claim identical cash flows from same assets, all other things equal. The empirical implication of this prediction is that, all else equal, any pair of A-shares and B-shares should be priced equally if ownership and trading restrictions do not affect asset pricing. If these restrictions do matter, we face the task of identifying why. The objective of this paper is to (1) explore the roles ownership and trading restrictions play in asset pricing; (2) identify any mechanism through which these restrictions affect asset prices.

The rest of this paper is organized as follows. Section II is the literature review. Section III provides an overview of China's stock markets. Section IV presents hypotheses and tests. Section V shows the data. Section VI discusses the results. Section VII examines possible explanations, and concludes the paper.

4.2. Literature Review

On the Chinese stock markets, A-shares show persistent price premiums relative to their twin B-shares. On average, the price of a typical A-share is about 3.6 times that of its twin B-share's. For each individual pair of the twin shares, the premium

[3] *Huizhuan* is the Chinese term for *turning around*.

fluctuates throughout the entire data window. For all twin shares, the premiums show a large variation at any point in time.

Price disparity between "twin shares" is not uniquely observed in the Chinese stock markets. Froot and Dabora (1999), Stulz and Wasserfallen (1995), Rosenthal and Young (1990), and others document a wide variety of stock price disparities in many equity markets. Also, the closed-end fund puzzle documented by Lee, Shleifer and Thaler (1991) is a case of price disparity between the same assets, packaged differently.

Froot and Dabora (1999) observe that locations of trade and ownership influence the relative prices of three "Siamese twin" pairs of companies, which have nearly identical cash flows. The three "Siamese twin" pairs are Royal Dutch & Shell, Unilever N.V. & Unilever PLC, and SmithKline Beecham. Royal Dutch is traded primarily in the U.S. and the Netherlands, with more than 2/3 of its outstanding shares concentrated in these two countries. Shell, in contrast, is traded predominantly in the U.K., with about 96% of its outstanding shares owned by U.K. investors. The authors show that, first, the price ratio of the "Siamese twin" stocks is significantly different from their theoretical price parity; second, the price of each stock seems to move more like the markets where it is traded most intensively. The authors suggest three possible explanations: tax-induced investor heterogeneity, country-specific noise and institutional inefficiencies. Rosenthal and Young (1990) report the same phenomenon between two Anglo-Dutch combines: Royal Dutch versus Shell group and Unilever N.V. versus Unilever PLC. By exploring inter- and intra-market rules in the exchanges where the stocks are traded, the authors conclude that taxes imposed by each country prevent arbitrage from eliminating these differences.

Stulz and Wasserfallen (1995) document a price premium on the Swiss equity market of unrestricted shares (which can be held by any investors) relative to their corresponding restricted shares (which can only be held by Swiss investors). Their model is based on classical third degree price discrimination. If a firm can price discriminate among investors, it can charge different prices to different classes of investors to achieve maximum financing. Applying this model to the Swiss equity markets, the authors claim that certain foreign investors face greater deadweight costs[4] in holding their home country's stocks than in holding Swiss stocks. In order to obtain Swiss stocks, these investors are willing to pay higher prices. As a result, demand functions for Swiss stocks differ between Swiss and foreign investors, and there is a capital flight targeting to Switzerland. Aware of this, a Swiss firm (Nestle) issues unrestricted and restricted stocks to differentiate foreign investors from Swiss investors, and charges more with unrestricted stocks to maximize the firm value. Other researchers, such as Domowitz, Glen and Madhavan (1997), observe similar price premiums in Mexico. Their findings reinforce Stulz and Wasserfallen's theory.

Price disparity is observed in other contexts. Closed-end funds start out at almost a 10% premium at the funds' IPO when fund managers raise money to buy the securities included in the funds. Within days, closed-end fund prices move to an average of more than a 10% discount, and the discount fluctuates considerably over time. Lee, Shleifer and Thaler (1991) explain the closed-end fund puzzle with changing noise trading sentiment towards the closed-end funds. When noise traders are pessimistic, the funds are undervalued relative to their fundamental values, and thus the discount is larger than when noise traders are optimistic.

This paper presents a clearer test of the impact of ownership restrictions on equity pricing because each pair of Chinese twin shares is issued by the same firm, whatever corporate internal factors that affect A-shares also affect their twin B-shares. The price disparity of A-shares and B-shares is free from any difference in corporate strategies, and is an exclusive effect of investors' activities. That A-shares and B-shares are the same shares, with respect to almost all aspects except ownership and Huizhuan Trading restrictions, provides an opportunity to study the effects of legally-enforced ownership and trading restrictions on valuation of the involved stocks.

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[4] "... Investors bear deadweight costs for holding risky assts which differ across investors and across countries. Example of such deadweight costs might be withholding taxes, political risks, transaction costs or information acquisition costs. If, as a result of these costs, the demand for shares from domestic investors is more price elastic than the demand from foreign investors, the shares available to foreign investors trade at a premium relative to the shares available to domestic investors. ..." (Foreign Equity Investment Restrictions, Capital Flight, and Shareholder Wealth Maximization: Theory and Evidence. Rene M Stulz; Walter Wasserfallen, 1995.)

4.3. Price Disparities Observed in China's Stock Markets

4.3.1. China's Stock Markets, an Overview

The Shanghai Stock Exchange (SHSE) and the Shenzhen Stock Exchange (SZSE) are the only two national stock exchanges in China. The exchanges are regulated by the China Securities Regulatory Commission (CSRC), which in turn is monitored by the State Council and the National People's Congress of China. Moreover, government entities such as the Central Bank, the Ministry of Finance, the State-owned Assets Supervision and Administration Commission, the State Administration of Foreign Exchange, and the State Administration of Taxation also have substantial influence in regulating the Chinese stock exchanges.

There are two classes of shares, A-shares and B-shares, traded on both exchanges. A-shares are denominated in Ren Min Bi[5] (RMB), the local currency. A-shares could be held and traded only by Chinese residents until May 2003, and have been allowed to be held by both Chinese residents and qualified foreign institutional investors (QFII) afterwards. B-shares are denominated in US dollars if listed on the SHSE, and in Hong Kong dollars if listed on the SZSE. Both SHSE and SZSE B-shares were restricted to exclusive foreign ownership before February 20, 2001. After that, Chinese individual investors have been permitted to own B-shares. Table 4.1, Panel A summarizes the changes in the ownership structure of A-shares and B-shares.

Theoretically, any Chinese firm can issue A-shares, B-shares, or both on either exchange, but listing one specific firm's shares on both exchanges is prohibited. If a firm is listed on the SHSE, its shares (Class A, Class B or both) may not be traded on the SZSE, and vise versa. In practice, listing on the stock exchanges is based on national planning: a quota is imposed on each province and each industry. Provincial governments or industries of the central government recommend candidate firms to the CSRC for screening. After approval by the CSRC, a firm can be listed on either the SHSE or the SZSE. The State Council declared the aggregate supply of listing (in total market capitalization) publicly before 1999. This mechanism was abandoned in 1999.

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[5] *Ren Min Bi* means *People's Money*

When established, the SHSE and the SZSE followed the Hong Kong Exchanges (HKEX) with respect to the trading system. Both the SHSE and the SZSE are order-driven auction markets without designated dealers or specialists. In each business day (Monday through Friday, except national holidays), there is an opening call auction from 9:15 to 9:25 A.M.; all orders are pooled to set a single open price for each stock. After the call auction, there are two continuous bidding periods, 9:30 to 11:30 A.M. and 1:50 to 3:00 P.M. In each period, ask-orders and bid-orders enter the exchanges' computer systems continuously and are matched automatically based on price-time priority. Although limit orders are most prevalent, market orders are also acceptable. Since no firm is listed on both exchanges, we observe unique open and close price for each stock each day.

Although the trading mechanism on the SHSE and the SZSE is mostly modeled after the HKEX, some more restrictive rules are enforced on China's markets. First, short selling is absolutely prohibited. If it is detected, the short side is forced to liquidate its position immediately, with a fine. Second, common shares are divided into ST, PT[6] and regular shares. For regular shares, the intra-day price limit is ± 10% (10% cap and -10% floor) of the previous trading day's close price; for ST shares, the limit is ± 5%; and PT shares are not really tradable shares, they can only be transferred among investors on each Friday, if there are applications for transfer. In contrast, there is no intra-day price limit on the HKEX. Third, Chinese investors face T+1 Huizhuan Trading restrictions on the Chinese stock markets, while there is no day-trading restrictions on the HKEX. Fourth, transactions in A-shares are settled one business day after the transaction day; while for B-shares, settlement comes three business days later. Finally, the minimum ticker size for A-shares is 0.01 RMB; while for B-shares, it is 0.001 US dollars if listed on the SHSE, and 0.01 HK dollars if listed on the SZSE. Panel A of Table 4.1 presents the institutional restrictions related to

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[6] *ST* stands for *special treatment*. If a firm reports loss for three consecutive years, it is treated as ST firm.
PT stands for *particular transfer*. When a firm is classified as PT firm, its stocks are not traded regularly, instead, the stocks are traded only once per week. Each Friday from 9:30 A.M to 3:00 P.M, the stock is ready for transfer and all applications are pooled to reach a single price by 3:00 PM when the market is closing. All the transfers are done at this price.

ownership and trading activities. Given these different institutional restrictions, the entire data window is divided into eight sub-windows accordingly.

[Table 4.1, Panel A about here]

4.3.2. Price Disparities Between A-shares and B-shares

There are currently more than 700 firms listed on the SHSE and more than 600 firms listed on the SZSE[7]. Most of the listed shares are A-shares. Currently, there are 54 B-shares listed on the SHSE and 58 on the SZSE[8]. Excluding those that do not have corresponding A-shares, and those that do not have valid data from DataStream, my basic sample has 87 pairs of twin shares, 44 on the SHSE and 43 on the SZSE. China united exchange rates in January 1994. I exclude observations before that event to avoid possible noise caused by dual exchange rates. Therefore, my basic sample is composed of market data of these 87 pairs of twin shares spanning from January 1994 to July 2004.

[Table 4.1, Panel B about here]

Although the number of B-shares amounts to about 10% (112 B-shares relative to about 1100 A-shares) that of A-shares, the total market capitalization of all the B-shares is less than 5% that of all the A-shares. Within the basic sample of 87 twin shares, mean market capitalization of a typical B-share (equally weighted) is about 19% that of a typical A-share. Both mean and median A-share market capitalizations are larger than those of B-share's in the entire data window (row 3, Panel A of Table 4.2). This indicates that A-shares dominate B-shares in a typical firm that issues twin shares. Trading volume of a typical A-share is higher than that of a typical B-share for most sub-windows except sub-window 6. In sub-window 6, both mean and median B-share trading volumes are higher than those of A-share's, and further exploration

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[7] When the data was extracted from DataStream
[8] source: the HKEX

shows that the larger B-share trading volume is associated with the partial removal of B-share ownership restrictions.

[Table 4.2 about here]

Conventional finance theory holds that the stock price is the properly discounted expected future cash flows. Without anomalies, claims to identical current and future cash flows should be priced equally. However, this is not observed in China's A-shares and B-shares. Given the same claims on identical assets, with similar transaction costs, prices of A-shares and B-shares issued by the same firm are strikingly different.

Log price disparity, defined as $\log\left(\frac{P_A}{P_B \times X(RMB/\$)}\right)$, is introduced to proxy A-share price premiums relative to its twin B-share. PA is the A-share price, PB is the B-share price, and *X(RMB/$)* is the official exchange rate between RMB and foreign currency (Hong Kong dollars on the SZSE or US dollars on the SHSE), indicating how much RMB one unit of foreign currency can buy. If the A-share price is equal to its twin B-share price, adjusted for the exchange rate, the log price disparity should be 0. A positive (negative) log price disparity implies an A-share price premium (discount) relative to its twin B-share. The further away the disparity is from the theoretical ratio of 0, the more the A-share price deviates from its twin B-share price. Showing figures of 87 disparities, one by one, is not practical; I thus create a sub-sample of 3 representative firms in order to show the main features of the price disparities. Table 4.3 contains background information of this sub-sample. After the individual analysis, I also report a summary figure of the price disparity for all 87 pairs.

[Table 4.3 about here]

[Figure 4.1 about here]

Figure 4.1 presents the log price disparity of Konka Group Co. Ltd. (Konka), an electronics appliance producer with both A-shares and B-shares listed on the SZSE. Konka's disparity grows at a small but constant rate until the partial removal of B-share ownership restrictions in February 2001. After this event, increase in the B-share price and decrease in the A-share price make the disparity decrease dramatically, but not entirely. The disparity remains at the ex-removal level until now.

[Figure 4.2 about here]

Figure 4.2 shows the log price disparity of Jinan Qingqi Motorcycle Co. Ltd. (Qingqi). Qingqi is listed on the SHSE and it is a veteran producer of motorcycles. The data window is from June 17, 1997 to April 30, 2003. During the period from June 1997 to February 2001, Qingqi's A-share price is much higher than its twin B-share price. After the restrictions on B-share ownership were partially removed in February 2001, the disparity shrunk significantly. Although the disparity continues to fluctuate, the prices of the twin shares are more or less the same after the event.

[Figure 4.3 about here]

China WorldBest Company is a diversified conglomerate that has six subsidiaries listed on either the SHSE or the SZSE. Shanghai WorldBest (WB) is a special subsidiary that issues both A-shares and B-shares listed on the SHSE. Unlike Qingqi and Konka, WB's log price disparity started to drop well before February 2001. The disparity remained at a substantial level after this event.

[Figure 4.4 about here]

Figure 4.4 presents the evolution of the log price disparity for a typical firm that issues both A-shares and B-shares. This "typicality" is attained by two value-weighted price indexes of eligible A-shares (P_A) and B-shares (P_B), then, logarithm is applied to their quotient: $\log(\frac{\sum_{i=1}^{87} w_i P_A}{\sum_{i=1}^{87} w_i P_B \times X(RMB/\$)})$. Figure 4.4 aims at showing the evolution of the "systematic" price disparity between a typical A-share and a typical B-share. The curve followed a downward trend until July 1994, and increased until February 2001, when it dropped dramatically with the event of the partial removal of B-share ownership restrictions. The curve remains at a low but stable level afterwards. What happened in July 1994 was a result of a joint policy release: out of the eight government agencies, which have considerable influence on the Chinese stock markets, the four that are most influential declared new policies. As a result, the disparity widened to such a degree that the price of a typical B-share was never able to reach the same level of its twin A-share's price.

4.3.3. Characteristics of the Price Disparities

As is observed in the above figures, patterns of log price disparities among the three representative firms vary. WB's disparity is larger than those of Konka's and Qingqi's before partial removal of B-share ownership restrictions, while Konka's disparity turns out to be the largest afterwards. Are price disparities significantly different across all 87 firms? If the price disparities are not significantly different across firms, it is more likely that the disparities are associated with factors that affect the entire Chinese stock markets rather than with factors that are firm specific. In contrast, if the disparities are different across firms, firm specific facts may contribute substantially to the disparities.

For firm i, which issues both A-shares and B-shares, it's A-share and B-share log price disparity is $\log(\frac{P_{A,i}}{P_{B,i} \times X(RMB/\$)})$, (as is defined in section 4.3.2.), and the B-share price is converted into local currency by official exchange rates. The mean price disparity for firm i is the sample mean of $\log(\frac{P_{A,i}}{P_{B,i} \times X(RMB/\$)})$ over T. If firm i's mean price disparity is significantly larger than 0, its A-shares are priced significantly higher than its B-shares. Furthermore, if firm i's mean price disparity is significantly different from that of firm j's, (where i = 1 to 87, j = 1 to 87, j $\neq$ i), this indicates that price disparities are heterogeneous across firms, and these disparities are more likely to associate with firm specific attributes. This paper applies generalized linear model (GLM) based unbalanced one-way analysis of variance (ANOVA) to detect the pair-wise differences among mean price disparities for all 87 candidate firms:

$$[4.1] \quad \log\left(\frac{P_{A,i}}{P_{B,i} \times X(RMB/\$)}\right) = \beta_i \times ID_{i,t} + \varepsilon_{i,t}$$

Where i = 1 to 87. ID is the classification variable, representing 87 pairs of twin shares. β_i is the mean price difference associated with ID.

After obtaining estimates of β_i, $\hat{\beta}_i$, I test the significance of $\hat{\beta}_i$. If $\hat{\beta}_i$ is significantly different from 0, I make pair-wise comparisons between $\hat{\beta}_i$ and $\hat{\beta}_j$ across eligible firms for each sub-window. A standard t-statistic is applied to test the hypothesis that firm i's mean price difference is not significantly different from firm j's mean price difference, or $\frac{1}{T}\sum_{t=1}^{T}(\beta_{i,t} - \beta_{j,t})$, is not significantly different from 0. When firm i has a different sample size from firm j, a Bonferroni t-test is applied instead, which adjusts for the difference in sample size. Rejecting the null hypothesis, that the mean price disparity between firms i and j is not significant from 0, suggests that firm i's price disparity is significantly differently from firm j's price disparity. And if this is true for each firm i (i = 1 to 87) and firm j (j = 1 to 86, j $\neq$ i), then, it can be concluded that a price disparity exists within each pair of all 87 twins, that the disparities for all 87 twins are heterogeneous for the period of interest.

Regression results of equation [4.1] are summarized in Table 4.4, which is partitioned into panels A and B. Panel A consists of summary statistics of equation [4.1] for all the firms that have available data in the specified window periods.

Columns 2-10 contain regression results of the eight sub-windows defined in Table 4.1. Sub-window 1's results (Column 2) show that there are 46 valid pairs of twin shares, and the price disparities of 44 of these pairs are significantly different from 0. The R-square of 0.81 indicates that more than three quarters of the price disparities' variation can be explained by the difference among these pairs. With regard to sub-window 6's regression results (Column 7), the R-square of 0.62 (Column 7, Row 6) is substantially lower than the R-squares in other sub-windows. This indicates that factors beyond firm specific differences contribute substantially to the variation of the disparities during the period when the partial removal of B-share ownership restrictions was effective.

Panel B reports summary statistics of pair-wise comparisons among the feasible firms with respect to mean price disparities. The comparisons are arranged in columns. There are 2070 pair-wise comparisons ($\log(\frac{P_{A,i}}{P_{B,i} \times X(RMB/\$)})$, i=1 to 46, j=1 to 45, j $\neq$ i) in sub-window 1 (Column 2), and of these comparisons, 1758 pairs are significantly different (at 0.05 level). This observation is consistent with figures 4.1 to 4.3, in which price disparities are dissimilar across most individual firms. The pair-wise comparison of the mean price disparity between any twin shares is done by the Bonferroni t-test, based on the concern of unbalanced cells. Sub-window 6's results (Column 7) show that some (about 16%) mean price disparities among the 87 firms are similar for that year, the largest amount of similar price disparities among all sub-windows. In sub-window 6, Chinese stock markets related factors contribute significantly to the heterogeneous price disparities; while in sub-window 2, more firm specific attributes contribute significantly to the heterogeneous price disparities among the twin shares.

[Table 4.4, Panels A and B about here]

Now that this paper has shown the cross sectional features of price disparities among the 87 pairs of twin shares, it is sensible to explore time series features:

whether each disparity tends to converge or diverge in the long run, and whether the partial removal of ownership restrictions affects this tendency.

It is not surprising to observe that two unrelated price series diverge from each other, while it would be amazing to detect that two price series of the same equity diverge in the long run. When two time series do not diverge, these two series are co-integrated. Two co-integrated time series may be driven apart by some temporary shocks, but if they continue to drift too far apart, in the long run, some internal mechanism that governs the dynamics of these series will bring them back to current levels, or drive them to converge. The concept of co-integration can be applied in the framework of A-shares and B-shares to investigate whether the price series of any twin shares converge or diverge in the long run. The economic significance of non co-integrated price series between any A-share and its twin B-share is that, if keeping current ownership structure and trading regulations, the A-share price diverges from its twin B-share price. This indicates that the ownership restriction or trading mechanism is so strong that it cuts off the link between the A-share and B-share prices and the fundamental values of the firm, making one or both of the share prices bubble.

The co-integration of two individual price series is different from the market integration. Market integration is defined as a situation where investors earn the same risk-adjusted expected returns from similar financial instruments in different but integrated markets[9]. The basic logic is that, when two markets are integrated, capital flows freely between these markets, thus, risk free rates and risk-adjusted returns should be the same in these markets. When testing integration (or segmentation) of two markets, researchers investigate whether information contained in the index of one market is also reflected in the index of the other. For instance, whether the B-share market is integrated into the A-share market, can be tested by whether the B-share market index has more explanatory power to individual B-share returns than the A-share market index does. If the B-share market index does have extra explanatory power, then the B-share market is not integrated with the A-share market. Given ownership restrictions on China's A-shares and B-shares, and China's control over

[9] Canadian share market Integrated with that of U.S.A.

foreign exchange, capital flows cannot move freely between the two markets and these markets, by definition, are not integrated. However, further tests are necessary before concluding whether A-share and B-share markets are empirically integrated or not, which is out of the scope of this paper. This paper is interested in whether the price disparity within each pair of A-shares and B-shares persists after the partial removal of B-share ownership restrictions, and this can be tested by a price co-integration model.

The test of whether two times series, {X}t and {Y}t are co-integrated can be transformed into the test on the existence of unit root in the residual series of regressing {Y}t on {X}t. Consider the following regression:

[4.2] $Y_t = \phi + \theta X_t + \upsilon_t$

If both $\{X\}_t$ and $\{Y\}_t$ are stationary by differencing once, or $I(1)$ [10] series, the error series, $\{\upsilon\}_t$, is either $I(0)$ or $I(1)$ series[11]. Usually, $\{\upsilon\}_t$ is an $I(1)$ series with only one exceptional case of $I(0)$, that is when $\{X\}_t$ and $\{Y\}_t$ are co-integrated. In other words, if the error series, $\{\upsilon\}_t$, is $I(1)$, or has a unit root , the target series, $\{X\}_t$ and $\{Y\}_t$, are not co-integrated. In contrast, if $\{\upsilon\}_t$ is $I(0)$, then, $\{X\}_t$ and $\{Y\}_t$, are co-integrated. The one-one correspondence between co-integration of $\{X\}_t$ and $\{Y\}_t$ and the stationarity of $\{\upsilon\}_t$ makes it possible to transform co-integration test into test on existence of unit root in $\{\upsilon\}_t$. That is, the test of co-integration of $\{X\}_t$ and $\{Y\}_t$ in [4.2] is equivalent to the test of whether $\varphi = 1$ in [4.3].

[4.3] $\upsilon_t = \varphi \upsilon_{t-1} + \varepsilon_t$

[10] Stationary referred in this paper is weak stationary, or, wide-sense stationary in which mean, variance and covariance for any lag h, are invariant with respect to displacement in time. When a time series is stationary, we denote it by $I(0)$, or integrated of order 0. For a non-stationary time series, it has the chance of being stationary after differencing d times, or integration of order d, and we denote such series as $I(d)$ series.

[11] The residuals in a regression can at most take the order of integration of the highest order of the variables in the regression. Granger and Newbold (1974).

H_0: $\varphi = 1$ (there is unit root)

H_1: $\varphi < 1$ (there is no unit root, thus, $\{X\}_t$ and $\{Y\}_t$ are co-integrated)

The case that φ is greater than 1 can not happen because $\{X\}_t$ and $\{Y\}_t$ are $I(1)$ already. If H_0 is rejected with very significant P value, the residual series, $\{\upsilon\}_t$, is $I(0)$, which implies that $\{X\}_t$ and $\{Y\}_t$ are co-integrated.

An ordinary least square model (OLS) can obtain the residuals, $\hat{\upsilon}_t$, and whether $\varphi=1$ can be test in the following regression:

[4.4] $\hat{\upsilon}_t = \varphi\hat{\upsilon}_{t-1} + e_t$

However, the Augmented Dickey-Fuller test of unit root (equation [4.5]) can do a better job because it takes into account possible higher order autocorrelations.

[4.5] $\Delta\hat{\upsilon}_t = \gamma\hat{\upsilon}_{t-1} + \sum_{i=1}^{p}\eta_i\Delta\hat{\upsilon}_{t-1} + \varsigma_t$

Where Δ is difference operator.

H_0: If γ=0, then $\hat{\upsilon}_t$ is $I(1)$, implying that $\{X\}_t$ and $\{Y\}_t$ are not co-integrated;

H_1: If γ<0, then $\hat{\upsilon}_t$ is $I(0)$, indicating that $\{X\}_t$ and $\{Y\}_t$ are co-integrated.

Now, replacing $\{Y\}_t$ by $\{P_A\}_t$, and $\{X\}_t$ by $\{P_B\}_t$, we can test for co-integration of A-share price and its twin B-share price. Similarly, replacing $\{Y\}_t$ by $\{LAP\}_t$ and $\{X\}_t$ by $\{LBP\}_t$, we can test co-integration of co-integration of log A-share price and log of its twin B-share price as a robustness check.

Given the event of the partial removal of B-share ownership restrictions in February 2001, the co-integration test shall be done with two partitions of the data window – before and after the event. If each twin price series diverge before the event and converge (or at least stop diverging) afterwards, this indicates that the removal of ownership restrictions eliminates price disparity within each pair of twin shares, and that investors have a more similar belief in pricing the same assets after this event. Before investigating the issue of interest, I have to show that the "usual technicality conditions" that the target series, $\{P_A\}_t$ and $\{P_B\}_t$, are $AR(1)$ series.

Table 4.5 summarizes unit root test results on the target series, $\{P_A\}_t$ and $\{P_B\}_t$. The Tau value of -1.70 (row 3, column 6 of Table 4.5) shows that the null hypothesis, that there is both a trend and a unit root in $\{P_A\}_t$, cannot be rejected at a conventional significance level. The Tau of -1.29 (row 3, column 6) illustrates that the null hypothesis, that there is a unit root in $\{P_A\}_t$, cannot be rejected. This result illustrates that from 1994 to 2000, Konka's A-share price series has a unit root of order one. The same pattern can be detected in row 5 of Panel A, which illustrates that Konka's B-share price series has a unit root of order one. These two rows of statistics confirm that price series of Konka's A-shares and B-shares meet the technical requirement of AR(1), and thus are qualified for the price co-integration test from 1994 to 2000. Rows 4 and 6 show that price series of Konka's A-shares and B-shares are also qualified for the price co-integration test from 2001 to 2004. More general results are summarized in the last four rows of the Panel. There are 68 firms qualified for the price co-integration test (i.e., both their A-share and B-share price series are AR(1)) for both windows, from 1994 to 2000 and from 2001 to 2004, respectively.

[Table 4.5 about here]

Table 4.6 reports price co-integration test results within each qualified pair of twin shares. The Tau of -2.54 (row 3, column 3) is significantly larger than the critical value of the Tau (-3.8 is at 0.05 significance level and -4.36 at 0.01 level). This illustrates that the null hypothesis, that $\{\upsilon\}_t$ is $I(1)$, cannot be reject. In other words, $\{\upsilon\}_t$ has a unit root, and thus the target price series of the A-share and B-share, $\{P_A\}_t$ and $\{P_B\}_t$), are not co-integrated. Konka's A-share price series diverges from its B-share price series from 1994 to 2000. However, the exogenous decision of the CSRC, to partially remove ownership restrictions, breaks this pattern. The Tau value drops to – 4.68 (row 4, column3) after this event. This value is smaller than the critical value of

– 4.36 (at the 0.01 significance level). This result illustrates that the null hypothesis of no co-integration between Konka's twin share prices can be rejected at the 0.01 level, from 2001 to 2004. Contrast of the Tau values, before and after this event, shows that before this event, Konka's twin price series behaved like two irrelevant series, while after this event, the two series start to behave like each other. The same pattern of Tau values can be observed for Qingqi, but not for WB. More general results are reported in rows 9 and 10: each of 68 qualified twin shares has its A-share price series diverge from its B-share price series before the event of the partial removal of B-share ownership restrictions. Owing to this event, 48 pairs converge, or at least keep at the current level. This result supports the hypothesis that the partial removal of B-share ownership restrictions is associated with significant reduction in price disparity within twin A-shares and B-shares.

[Table 4.6 about here]

Figures 4.1 to 4.4 and the simple statistics show that price disparities of each twin A-shares and B-shares vary across firms and fluctuates over time. Given that all else equal, except such institutional factors as ownership and Huizhuan Trading restrictions, it is sensible to relate disparities to these factors. In the next section, this paper discusses hypotheses and tests related to the observed price disparities.

4.4. Hypotheses and Tests

Bailey (1994) is the first to document the B-share discount puzzle. Bailey shows that the discount exhibits little association with the instruments of international risk premiums, such as the market indexes of Hong Kong, the U.S. etc. Bailey suggests some candidate explanations for the B-share discount, such as (1) differential risk premiums, (2) differential liquidity and information availability, or (3) unseasoned optimistic Chinese investors. Given the limited data window (March 1992 to March 1993) and the small sample size (8 pairs of twin shares), Bailey only applies straightforward summary statistics and correlations to characterize the behavior of B-share returns and price discounts, and he does not set out to identify which hypothesis contributes the most to the B-share discount. In the following paragraphs, this paper explores these prevalent hypotheses as well as hypotheses proposed by this paper.

Differential risk hypothesis

The intuition behind this hypothesis is that if investors can be divided into different and mutually exclusive groups, with each group facing different investment opportunity sets, investors from various groups may have a different reference of systematic risks when making investment decisions. This, in turn, causes investors among different groups to request different expected returns from identical stocks. Eventually, prices of the same stocks diverge. If this hypothesis is valid, significant association between A-share premiums and the market indexes of China, Hong Kong and the US, shall be observed.

Fernald and Rogers (2002) find no evidence that B-share discounts are related to either B-share or A-share covariance risks, rejecting the risk differential hypothesis. Among those who find significant association between levels of risks and B-share discounts, Chen, Lee and Rui (2001) propose a positive relationship between B-share discounts and risk levels while Su (1999) reports significant positive association between A-share return premiums and B-share covariance risks with respect to the Hong Kong Hang Seng Index; Eun, Janakiramanan and Lee (2001) find that B-share discounts are positively related to the covariance risk with the Morgan Stanley World Market Index and with the difference between the world and Chinese risk-free interest rates.

Liquidity premium hypothesis

The theoretical origin of this hypothesis lies in Amihud and Mendelson (1986). The authors observe expected returns to be an increasing and concave function of illiquidity (measured by the bid-ask spread). The rationale of this theory, from the perspective of investors, is that illiquid stocks have higher expected returns and are priced lower to compensate investors for increased trading costs; and from the perspective of firms, is that firms have incentives to increase liquidity of the claims they issue, since this will lower their cost of capital and increase the firms' market value. If this hypothesis is consistent with A-share and B-share behavior, we shall observe that the A-share premium is negatively associated with the relative liquidity level of the twin shares.

Based on the assumption that China's B-shares are substantially more illiquid than A-shares, Chen, Lee and Rui (2001), find that both A-share trading volumes and B-share trading volumes are strongly, and negatively related to B-share price discounts. The paper argues that the B-share discounts are, "primarily due to illiquid B-share markets." Chen and Xiong (2001) present additional support for the liquidity premium hypothesis.

Asymmetric Information Hypothesis

Trading activities have different levels of informational significance and price change is a function of information contained in these trading activities (Grossman and Stiglitz (1980), Kyle (1985) etc.). Koski and Michaely (2000) show that information content increases with trading size and the information asymmetry of the trading period; that price and liquidity are positively associated with information asymmetries; and that large trades have a greater price impact during times when asymmetric information is at its greatest. Chakravarty, Sarkar, and Wu (1998) argue that one reason for the large B-share discount is that foreign investors have less information on Chinese stocks than domestic investors do. Although concurring that asymmetric information plays an important role in the B-share discount, Chui and Kwok (1998) obtain results opposite to those of Chakravarty, Sarkar, and Wu (1998). According to Chui and Kwok (1998), foreigners have an informational advantage, since Chinese investors may face an information barrier set by Chinese authorities. Given the two opposing assumptions, without concrete evidence, the empirical results of the asymmetry information hypothesis remain unclear.

Noise Traders' Momentum Hypothesis

Odean (1998) examines the stock market, where price-taking noise traders, informed traders, and market makers are overconfident. Overconfidence increases expected trading volume, while its effect on price depends on who is overconfident. When noise traders are over confident, they can cause prices to under-react to the information of the rational informed traders. The degree of this under-reaction or over-reaction depends on the fraction of all traders who underweight or overweight the information. The implication of this theory, in relation to Chinese stock markets, is that if the A-share noise traders are overconfident, the A-share market under-reacts to the information of informed traders, creating an A-share price bubble. Meanwhile, the A-share trading volumes remain substantially high.

Huizhuan Trading Induced Distortion Hypothesis

Huizhuan Trading is a peculiar observation in the Chinese stock markets. A-share investors confront T+1 Huizhuan Trading restrictions (which means they cannot sell stocks purchased earlier the same day), while B-share investors do not. This distinction is striking, from the perspective of informational efficiency of the markets: (1) new information is reflected in A-share prices at a slower pace than it is reflected in its twin B share; and (2) A-share prices are tilted to a higher range. Suppose on any trading day, one piece of positive information related to a firm arrives at the stock market first, followed by a piece of negative information. Both A-share and B-share investors trade on the positive information by purchasing A-shares and B-shares respectively. When the negative information arrives at the market afterwards, those investors who bought A-shares earlier cannot do anything, except wait until the next trading day to act on this negative information. In contrast, B-share investors can sell their holdings of B-shares if they wish. Suppose, in contrast, that one piece of negative information arrives at the market, followed by a positive one, A-share investors can always buy A-shares back after selling these shares. In short, the T+1 Huizhuan Trading mechanism is so designed that A-share investors are encouraged to buy, but not to sell. Eventually, A-share price may be cumulated to be higher than its twin B-share.

A simple model is developed to test the competing hypotheses. A-share return (r_A), B-share return (r_B), or Return differential ($r_{(A-B)}$) between A-shares and B-shares is regressed on the Total China Market Index ($totmkch$) , the Total Hong Kong Market Index ($totmkhk$), and the Total US Market Index ($totmkus$), adjusted by the respective exchange rates. Two firm specific measures, A-share Turnover Ratio ($turnover_A$) and B-share Turnover Ratio ($turnover_B$), are introduced to capture the influence trading activities cast on the return differential. Following the model developed by Gagnon and Karolyi[12], I also include one-week-lagged price difference ($P_{(A-B),t-1}$) to explore the effect of mean price reversion. All variables are based on weekly intervals.

[4.6]

$$X_{i,t} = \alpha_i + \theta_i \times P_{(A-B)i,t-1} + \beta_{1,i} \times totmkch_t + \beta_{2,i} \times totmkus_t \times RMB/US\$_t$$
$$+ \beta_{3,i} \times totmkhk_t \times RMB/HK\$_t + \gamma_{1,i} \times turnover_{A,i,t} + \gamma_{2,i} \times turnover_{B,i,t} + \varepsilon_{i,t}$$

For each i = 1,...,87

Where :

$X_{i,t} = r_{A,i,t}$, A - share return of week t;

or $X_{i,t} = r_{B,i,t}$, B - share return of week t;

or $X_{i,t} = r_{(A-B),i,t}$, return differential of week t;

$P_{(A-B),i,t-1}$ is price differential of week t - 1;

$totmkch_t$ is Total China Market Index during week t;

$totmkus_t$ is Total U.S. Market Index during week t;

$totmkhk_t$ is Total Hong Kong Market Index during week t;

$RMB/US\$_t$ is week t's exchange rate of how much RMB one US$ can buy;

$RMB/HK\$_t$ is week t's exchange rate of how much RMB one HK$ can buy;

$turnover_{A,i,t}$ is turnover ratio of A - share in week t;

$turnover_{B,i,t}$ is turnover ratio of B - share in week t.

Since the exchange rates are pegged rates and do not fluctuate actively, I do not treat these rates as independent variables in the regression, because invariant observations of both rates add to the co-linearity of the regression.

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[12] Multi-Market Trading and Arbitrage. Louis Gagnon and G. Andrew Karoly.

This model generates results for each individual firm as well as for the pooled 87 firms. Given frequent institutional changes (summarized in Table 4.1, Panel A), the model is run in eight sub-windows. The results of various model specifications can be used to test the competing hypotheses discussed above.

Noise Traders' Momentum Hypothesis: The economic sense behind autocorrelated A-share or B-share returns is noise traders' momentum. These traders are not totally irrational in making investment decisions and they do condition their forecasts on the past price changes. The test for the impact of A-share noise traders' momentum can be done as follows:

First, run equation [4.6] with A-share return as the dependent variable, for each A-share, in each sub-window:

[4.6 a]

$$r_{A,i,t} = \alpha_i + \theta_i \times P_{(A-B)i,t-1} + \beta_{1,i} \times totmkch_t + \beta_{2,i} \times totmkus_t \times RMB/US\$_t + \beta_{3,i} \times totmkhk_t \times RMB/HK\$_t + \gamma_{1,i} \times turnover_{A,i,t} + \gamma_{2,i} \times turnover_{B,i,t} + \varepsilon_{i,t}$$

Where i = 1 to 87, and t = 1 to 8.

Then, divide the results into two groups based on the generalized Durbin-Watson (DW) test results: the group with A-share traders momentum contains the regressions with autocorrelation, while the group without momentum contains the regressions without autocorrelation; For B-share returns, do the same regression and obtain similar groups: the group with B-share traders momentum and the group without.

[4.6 b]

$$r_{B,i,t} = \alpha_i + \theta_i \times P_{(A-B)i,t-1} + \beta_{1,i} \times totmkch_t + \beta_{2,i} \times totmkus_t \times RMB/US\$_t + \beta_{3,i} \times totmkhk_t \times RMB/HK\$_t + \gamma_{1,i} \times turnover_{A,i,t} + \gamma_{2,i} \times turnover_{B,i,t} + \varepsilon_{i,t}$$

Where i = 1 to 87, and t = 1 to 8.

Third, compare the corresponding mean regression coefficient of these two groups to test the hypothesis that the group with noise traders' momentum has less price impact than the group without. Pool the regression coefficients together, and run unbalanced two-way analysis of variance model (ANOVA) on each coefficient to test the impact of noise traders' momentum on the magnitude of the coefficient $\theta, \beta_1, \beta_2, \beta_3, \gamma_1$ *and* γ_2.

[4.7] $X = \alpha_1 \times Amomen + \alpha_2 \times Bmomen + \zeta \times Amomen \times Bmomen + \varepsilon$

Where X is regression coefficient from [4.6 a] and [4.6 b] such as $\theta, \beta_1, \beta_2, \beta_3, \gamma_1,$ *and* γ_2 , as well as the trading volume of each A-share and B-share.

$$Amomen \equiv \begin{cases} 0 & \text{if there is no A - share noise trader momentum} \\ 1 & \text{if there is A - share noise trader momentum} \end{cases}$$

$$Bmomen \equiv \begin{cases} 0 & \text{if there is no B - share noise trader momentum} \\ 1 & \text{if there is B - share noise trader momentum} \end{cases}$$

Amomen and Bmomen capture the main group effects while $Amomen \times Bmomen$ captures the cross effect.

If the regression coefficients ($\theta, \beta_1, \beta_2, \beta_3, \gamma_1,$ *and* γ_2) of the group with A-share traders' momentum are significantly lower than the group without; in addition, if the trading volume of the group with A-share traders' momentum is substantially higher than the group without, we cannot reject the hypothesis that A-share noise traders' momentum help to make A-share returns under-react to the information of the rational traders.

Autocorrelation adds to technical complexity. The serially correlated errors can break the assumptions, based on which an OLS estimator is established as efficient and unbiased. The generalized DW statistic is applied to detect possible autocorrelated errors and the White (1980) specification test is employed for possible heteroskedasticity. If both tests imply that the model does not have autocorrelated and heteroskedastic errors, the OLS estimator will be employed and the ordinary t-statistics will be used to test the significance of the coefficients. If the error series is heteroskedastic but not autocorrelative, the heteroskedasticity consistent standard errors will be employed to test the significance of the coefficients. If autocorrelation is detected, with or without heteroskedasticity, the Newey-West heteroskedasticity and autocorrelation consistent standard error will be employed to test the significance of the coefficients. The test for heteroskedasticity is the Lagrange Multiplier Test (LM Test), with the null hypothesis that the error series is homoskedastic; and the test for autocorrelation is the generalized DW test, with the null hypothesis that the error series is white noise.

Equation [4.6 c] generates regression results to test other hypotheses.

[4.6 c]

$$r_{(A-B),i,t} = \alpha_i + \theta_i \times P_{(A-B),i,t-1} + \beta_{1,i} \times totmkch_t + \beta_{2,i} \times totmkus_t \times RMB/US\$_t$$
$$+ \beta_{3,i} \times totmkhk_t \times RMB/HK\$_t + \gamma_{1,i} \times turnover_{A,i,t} + \gamma_{2,i} \times turnover_{B,i,t} + \varepsilon_{i,t}$$

For each $i = 1,\dots,8$

Where:

$r_{(A-B),i,t}$ is return differential of week t;

$P_{(A-B),i,t-1}$ is price differential of week t - 1;

$totmkch_t$ is Total China Market Index during week t;

$totmkus_t$ is Total U.S. Market Index during week t;

$totmkhk_t$ is Total Hong Kong Market Index during week t;

$RMB/US\$_t$ is week t's exchange rate of how much RMB one US$ can buy;

$RMB/HK\$_t$ is week t's exchange rate of how much RMB one HK$ can buy;

$turnover_{A,i,t}$ is turnover ratio of A - share in week t;

$turnover_{B,i,t}$ is turnover ratio of B - share in week t.

Huizhuan Trading Induced Distortion Hypothesis: Sub-window 2 includes the event of imposing T+1 Huizhuan Trading restrictions on A-shares, but not on B-shares. This is a perfect sub-window to test the hypothesis of Huizhuan Trading induced distortion. If T+1 Huizhuan Trading for A-shares does generate different trading patterns, or risk attitudes, from B-shares, we shall observe the regression coefficients in sub-window 2 to be significantly different from those of sub-window 1, in which both A-shares and B-shares do not have T+1 Huizhuan Trading restrictions.

Differential Risk Hypothesis: Each of the slope coefficients of all market indexes ($\beta_1, \beta_2, or\ \beta_3$) of equation [4.6 c] shall be equal to zero if A-share and B-share investors do not have differential risk attitudes toward systematic risks in each market. Rejecting this null hypothesis leads to the conclusion that the risk differential hypothesis is consistent with the price disparity observed in China's A-share and B-share markets. Furthermore, if β_1 is significantly less than zero, B-share investors request more compensation for Chinese macroeconomics related risks than A-share investors do. If β_1 is significantly greater than zero, A-share investors require more risk premiums than B-share investors do.

The slope coefficient of one-week-lagged price difference (θ) captures the rate at which the price difference decays. If θ is in the neighborhood of 1, the difference tends to be arbitrarily large and remains at that level for an extended period of time. If θ is not significantly different from zero, the price disparity remains at current levels, and a negative θ indicates that the price difference reverts to the parity of equal A-share and B-share prices. The larger negative value of θ, the faster the price difference reverts to parity.

Liquidity Premium Hypothesis: If the slope coefficients of A-share and B-share turnover ratios ($\gamma_1\ or\ \gamma_2$) are equal to zero, then firm specific trading activities have no effect on A-share and B-share return differentials. Rejecting the null hypothesis means trading restrictions do affect the return differential. If the turnover ratio measures a stock's liquidity in the Chinese stock market, we shall observe A-share (B-share) turnover ratios to be negatively (positively) associated with the return differentials. This is consistent with the liquidity theory that the more illiquid an A-share is, the higher A-share's requested returns, hence, the larger return differentials between A-shares and B-shares.

4.5. The Data

The market data (individual stock returns and market indexes, exchange rates between RMB, HK dollars and US dollars) is extracted from DataStream. The window period spins from January 1994 to July 2004. The basic sample contains 87 pairs of twin shares that have valid data in DataStream. Within this basic sample, 44 pairs are listed on the SHSE and 43 pairs on the SZSE. However, there are a few pairs with unbalanced data – there are only valid data after the event of the partial removal of ownership restrictions. For the price co-integration test, shares with unbalanced data are omitted. Accounting data and industry information are obtained through the WorldScope of DataStream. Information with regard to institutional changes within China's stock markets is obtained through major newspapers or from the CRSR webpage.

I further choose 3 firms to form a sub-sample to show more detailed figures. This sub-sample includes Konka Group Co. Ltd (Konka), Jinan Qingqi Motorcycle Co. Ltd. (Qingqi), and Shanghai WorldBest (WB). Detailed information on this sub-sample can be found in Table 4.3 and summary statistics can be found in Appendix 2.

Non-synchronicity in trading between the US markets and the Chinese markets is a concern. To adjust for this problem, the date of the US data is shifted one day forward. That is, the Thursday data is taken from the Chinese stock markets (the SHSE, the SZSE and the HKEX), while the Wednesday data is taken from the US markets. The returns are weekly effective returns calculated from the DataStream total return indexes, and the turnover ratio is weekly total trading volume scaled by total shares outstanding.

4.6. Results and Explanations

Table 4.7 summarizes the regression results of equations [4.6] and [4.7] to test the noise traders' momentum hypothesis. Panels A-C show regression results of the three representative firms in the sub-sample, while Panel D compares the regression coefficients between the group with noise traders' momentum and the group without. Panels A-C report the generalized DW test for autocorrelation, and the LM test for heteroskedasticity, the adjusted R-square, coefficients for each independent variable, and the corresponding t-statistics.

The generalized DW test results (column 10 of Panel A, Table 4.7) show that there is no autocorrelation for Konka in most sub-windows except sub-window 2. The statistical significance of this observation is that the autocorrelation is not detected and the OLS estimator suffices, except in sub-window 2. Economically, this means that the noise traders' momentum is not significant among Konka's investors in most data periods. This observation also means that the Newey-West autocorrelation and heteroskedasticity consistent matrix is applied to test the significance of the coefficients in sub-window 2. The LM Statistics (Column 9 of Panel A, Table 4.7) indicates that heteroskedasticity is not detected in all sub-windows except sub-window 2.

Coefficients of the one-week-lagged price difference (Column 3 of Panel A, Table 4.7) indicate that mean reversion is not often observed in Konka, except during sub-window 2, where T+1 Huizhuan Trading is imposed on A-share investors, and sub-window 6, where B-share ownership restrictions are partially removed. In these two sub-windows, the coefficients are significantly less than 0. This indicates that Konka's return differentials reduce at a significant rate and that the prices revert to parity. This result is consistent with that of the price co-integration test: the difference between Konka's A-share and B-share prices disappear at a considerable rate after Chinese investors are allowed to invest in B-shares.

The coefficients of the Total China Market Index (Column 4 of Panel A, Table 4.7) are negative and significant in three sub-windows, and among the significant coefficients, the magnitude does not change drastically by window specification. These negative coefficients indicate that Konka's A-share and B-share investors assume different systematic risks related to the Chinese macro-economy in sub-windows 3, 4 and 6. Konka's B-share investors request about 50 basis points more rewards than the A-share investors do, for bearing China's macro-economy related systematic risks. The total US and Hong Kong market indexes (Columns 5 and 6) do not show significant influence on Konka's return differential.

The coefficients of Konka's A-share turnover ratio are significantly larger than 0 in four sub-windows, and the coefficients of the B-share turnover ratio are significantly less than 0 in four sub-windows. This positive (negative) association between the expected return differentials and the A-share (B-share) trading activities is opposite to what the liquidity hypothesis predicts.

[Table 4.7, Panel A about here]

The regression results of Qingqi are summarized in Panel B of Table 4.7 and these results are similar to those of Konka's except for the coefficients of the A-share turnover ratio. Generalized DW Statistic detects no significant autocorrelation for all sub-windows. This means Qingqi's noise traders' momentum is not at all strong. Furthermore, it seems that trading activities in each window period do not have significant impact on the return differentials.

WB's regression results are summarized in Panel C of Table 4.7. Generalized DW tests detect autocorrelation in sub-windows 3 and 5. This indicates a substantial noise trader's momentum during the periods of interest. With respect to the slope coefficients, WB's results are similar to those of Konka's, i.e., negatively significant Chinese Total Return Index in some sub-windows, positive significant A-share turnover, and negative significant B-share turnover.

[Table 4.7, Panels B and C about here]

Table 4.7 Panel D is to test the noise traders' momentum hypothesis. The regression coefficients ($\theta, \beta_1, \beta_2, \beta_3, \gamma_1$ *and* γ_2.), A-share trading volume and B-share trading volume (proxied by the corresponding turnover ratios), grouped by whether there is A-share traders momentum or not, are reported in Panel D. Amomen (Bmomen) captures the main group effect of A-share (B-share) noise traders' momentum while $Amomen \times Bmomen$ captures the cross effect. Although the cross effect is statistically significant, very small ζ values show that the economic significance is small, thus I only report the main group effects.

The main group effect of A-share noise traders' momentum is summarized in rows 3 and 4. The 0.34 (row 3, column 4) shows that when there is no A-share noise traders' momentum, A-share return increases by 0.34 per cent if the Total China Market Index goes up by 1 per cent. When there is A-share noise traders' momentum, A-share return increases by only 0.22 per cent. There is a difference between these two coefficients and the difference is significant at the 0.05 level. The 2.06 (row 3, column 7) and 1.74 (row 4, column 7) shows that the coefficient of A-share turnover ratio is significantly less influential when there is A-share traders' momentum than when there is not. The same pattern can be observed in the coefficient of the Total Hong Kong Market Index, and the B-share turnover ratio. In the mean time, A-share turnover ratios of 0.03 and 0.04 (rows 3 and 4, column 9) demonstrate that A-share trading is significantly higher when there is noise traders' momentum. The combination of these results is consistent with the hypothesis that noise traders' momentum is associated with return that under-reacts to informational events, while trading volumes remain high.

The impact of B-share noise traders' momentum is ambiguous: first, B-share noise traders' momentum is not associated with substantially higher B-share trading volume (rows 11 and 12, column 10), actually, the trading volumes between the two groups are not significantly different; Second, the price impacts of the Total Market Indexes of China and Hong Kong are not significantly different between the two groups of B-share investors.

[Table 4.7, Panel D about here]

Table 4.8 summarizes regression results of equation [4.6 c] for each sub-period to test for the rest of the hypotheses. Panels A-C report aggregate results of all 87 firms with A-share returns, B-share returns, and return differentials as dependent variables, respectively. However, firm specific characters might bring firm-specific fixed effects on the regression results. Thus, I test for the fixed effects with the F test:

$$[4.8] \quad F_{\text{firm fixed effect}} = \frac{(R_u^2 - R_{pooled}^2)/(n-1)}{(1-R_u^2)/(nT-n-k)}$$

Where T is the total number of temporal observations, n is the number of groups, and k is the number of regressors in the model. R2u is the R-square of the model with least square dummy variables, and R2pooled is the R-square of the pooled model.

The F test results are summarized in column 8 of Panel A, Table 4.8. Rejecting the null hypothesis of no fixed effects indicates that firm specific variations contribute substantially to the discrepancy among the return differentials in the sub-window of interest. Panel A also shows the mean A-share and B-share trading size of each sub-window (Columns 10 and 11).

There is significant mean reversion effect in each sub-window (column 2 of Panel A, Table 4.8), but the prices revert at very a slow rate of 1 per cent or less. The coefficients of the Total China Market Index (column 3 of Panel A, Table 4.8) show that there is significant association between the Total China Market Index and the return differentials for all sub-windows. Furthermore, the coefficients are not the same in all eight sub-windows. This means the risk premiums requested by B-share investors, relative to A-share investors, are not constant in different sub-windows: 1.12 in sub-window 1 shows that A-share investors request a significant risk premium relative to B-share investors, while -0.8 in sub-window 2 illustrates that B-share investors request a significant risk premium relative to A-share investors. In sub-windows 3-8, B-share investors request significant risk premiums relative to A-share investors. The coefficients of the Total US Market Index (column 4 of Panel A, Table 4.8) demonstrate more changes over the sub-periods: in sub-window 1, the risk premium for the US market is not significant; in sub-windows 2 and 3, B-share investors request significantly more risk premium than A-share investors do; and in the subsequent sub-windows, A-share investors request significantly more risk premium than B-share investors do. The coefficients of the Total Hong Kong Market Index (column 5 of Panel A, Table 4.8) show even more fluctuations: sub-windows 1, 5 and 7 show B-share premiums; sub-windows 2, 3 and 6 demonstrate A-share premiums; and sub-windows 4 and 8 show insignificant premiums. These findings reject the null hypothesis that all market coefficients are not significantly different from 0. The observation that the coefficients of the Chinese market in all sub-windows are different from 0 is consistent with the risk differential hypothesis that foreign investors assign different risks to Chinese equity markets than local investors do, and thus, request different returns for taking the same risks. While the observation that the coefficients of the Total US and Hong Kong Market Indexes, in most of the sub-windows are different from 0, indicates investing in the Chinese market is not an "isolated" decision, but a decision relative to international capital markets, and that Chinese investors and foreign investors assume different relative risks when investing in China's stock markets.

Sub-window 1 is the only period in which both A-shares and B-shares do not have Huizhuan Trading restrictions. The mean A-share weekly turnover ratio of 0.066 (row 2, column 10 of Panel A, Table 4.8) is significantly larger than those of other sub-windows. The regression results in sub-window 1 (row 2 of Panel A, Table 4.8) are substantially different from those of other sub-windows. First, the coefficient of the Total China Market Index of 1.12 shows that A-share investors request more Chinese macro-economy related risk premiums than B-share investors do. Second, the B-share turnover ratio is positively associated with the return differential. These observations are consistent with the hypothesis that Chinese investors are aware of A-share trading activities that might make the A-share markets more risky, and thus request higher risk premiums. Furthermore, these Chinese investors refer to B-share trading activities for information.

Sub-window 2 begins by imposing the T+1 Huizhuan Trading restrictions on A-shares while keeping B-shares intact. The observation that there is a 3-fold increase (from 0.023 to 0.081) in the mean B-share turnover ratio is more interesting than the observation that there is a substantial decrease (from 0.066 to 0.054) in A-share turnover ratios. The decrease in A-share turnover ratios is intuitive: the T+1 mechanism reduces multiple trading activities on any A-share in any single business day; while the increase in B-share turnover ratios are puzzling: why should B-share investors trade more than they used to, when A-share investors cannot trade freely? What makes these B-share investors trade? Furthermore, the price impact of both A-share and B-share trading activities in this period is significantly less than that of the other periods. Again, the decreased price impact of A-share turnover ratios is intuitive, as the T+1 Huizhuan Trading mechanism delays information being reflected into the price, while the lower price impact of B-share trading activities remains a puzzle.

Consistent and positively (negatively) significant coefficients of A-share (B-share) turnover ratios demonstrate predictions opposite to the liquidity theory for most sub-windows, except sub-window 1. Please keep in mind that trading activities in the Chinese stock markets are distorted by trading restrictions and it is not surprising to see that what concluded from standard microstructure theory may not apply here. The seemingly controversial results call for further exploration into A-share and B-share trading activities, and will be discussed in Table 4.9.

[Table 4.8, Panels A-C about here]

Rejecting the null hypothesis of zero coefficients with respect to A-share and B-share turnover ratios leads to further exploration into the attributes that makes the trading volumes different between A-shares and B-shares, such as information capital structure, and firm fundamentals. Another simple model is developed in order to detect the factors that are represented by A-share and B-share turnover ratios, if not predicted by standard microstructure theory that the turnover ratio represents liquidity.

A-share or B-share turnover ratios are regressed on the possible firm specific attributes. Since institutional features (the state ownership) do not frequently fluctuate, and fundamental measures (accounting variables) are annual, this regression is run on an annual basis:

[4.9]

$$turnover_A = \alpha_t + \lambda_1 \times Aliquid_t + \lambda_2 \times Bliquid_t + \kappa_1 \times Stshare_t + \gamma_1 \times prof_t + \gamma_2 \times DE_t + \varepsilon$$
$$turnover_B = \alpha_t + \lambda_1 \times Aliquid_t + \lambda_2 \times Bliquid_t + \kappa_1 \times Stshare_t + \gamma_1 \times prof_t + \gamma_2 \times DE_t + \varepsilon$$

For each year t from 1995 to 2003

Where:

Turnover is the overall trading volume of a specific share in one year over its total shares outstanding. The higher the turnover, the more the share is traded in one year relative to its shares outstanding.

Aliquid (*Bliquid*) is the overall non-trading day of a specific A-share (B-share) in one year over total trading days of this year. it is shown13 that in emerging market where stocks are not as liquid as those in developed market, non-trading day is a better measure of liquidity than bid-ask spread.

Since most of the listed firms have a dominant portion of state-ownership (only 19 of all 87 firms do not have state-ownership), these firms still keep the feature of state-ownership. To estimate whether state-ownership has any influence on the turnover ratios, I include state-ownership (*Stshare*) in the regression. Credits for Chinese firms are mainly provided by the state-owned banks. These firms are prone to the wide-spread bad-loan problems. To test whether investors take into account the debt in pricing assets, I include the debt equity ratio (*DE*). The variable, Prof, is the summary variable measuring whether investors care about a firm's fundamental characters, when making investment decisions. *SSE* is included in the model to measure the degree of co-movement14 a firm's stock has with the Chinese, Hong Kong and the US markets.

As is mentioned above, equation [4.9] aims at identifying the factors that contribute cross-sectionally to the trading activities of all 87 pairs of twin shares. The regression is thus cross-sectional, and is run for each year. Panels A and B of Table

[13] Lesmond, Ogden and Trzeinka, 1999

[14] The calculation of the co-movement measure, SSE, follows Morck, Yeung and Yu (2000)

4.9 summarize the regression results of equation [4.9] for A-share and B-share turnover ratios, respectively.

The White test (Column 11 of Panel A, Table 4.9) shows that 8 of the 9 annual cross sectional regressions have homogenous error structures and the OLS estimator can be used. For 2003, the White test rejects the null hypothesis of homogeneous error structure, and thus the heteroskedasticity consistent covariance matrix is used for the test of regression coefficients' significance. The same treatment is given to the regression in the 2002 B-share turnover ratios (Panel B, Table 4.8).

Panel A of Table 4.9 shows that state-ownership (Column 6 of Panel A) is the factor that consistently associated with the A-share investors' turnover ratio: A-shares that have a larger percentage of state ownership tend to be less traded. In contrast, we do not observe the influence of the ownership structure on the trading decisions of B-share investors (Column 6 of Panel B), where none of the 9 coefficients is significantly different from 0. This contrast indicates that local Chinese investors tend to trade A-shares that have less state-ownership, while foreign investors do not take state-ownership into consideration when trading B-shares.

Other firm specific factors, such as profitability, leverage, ratio of non-trading date, and the stock's degree of co-movement do not have much explanatory power in A-share turnover ratio. A-share investors trade on private information that is not reflected in these variables, they trade without taking into account the firm specific information, or the T+1 Huizhuan Trading mechanism distorts most of the rationale behind the A-share investors' trading activities.

As for B-share investors some, but not all, firm specific factors, are influential in each year. For instance, in 1995, B-share investors tended to trade B-shares that were less co-moving with the markets (10.55 in row 2, column 3 of Panel B, Table 4.8), and they tended to trade stocks of firms with more debt (4.53, in row 2, column 7).

[Table 4.9, Panels A and B about here]

Combining the results of equations [4.6 c] and [4.9], Table 4.9 shows that A-share and B-share return differentials are negatively associated with the Total China Market Index. Furthermore, the more A-shares are traded, the larger the return differential, while the less B-shares are traded, the larger the return differential. Given the Huizhuan Trading restrictions and the daily price limits, the turnover ratios of A-shares and B-shares do not purely reflect information or liquidity. Actually, the turnover ratio is associated more with state ownership than with other variables for A-shares. This does not explain why higher expected A-share return is associated with more trades in A-shares. However, it does help to explain why this observation is not consistent with the liquidity compensation theory, because the trading activities do not necessarily mean liquidity in this case.

4.7. Conclusion and Further Research Direction

This paper presents evidence consistent with the assumption that ownership restrictions are associated with price disparities between twin shares issued by the same firm, but to different and restricted investor groups. The models and the empirical results show that price disparities between A-shares and B-shares could diverge from each other before the partial removal of the B-share ownership restrictions, while evidence does not support the assumption that the twin price series diverge afterwards. It is logical to say that the removal of B-share ownership restrictions contributes to the elimination of price disparities observed in twin A-shares and B-shares.

The regression results of equations [4.6] and [4.8] are consistent with the risk differential hypothesis and the noise traders' momentum hypothesis, but not the liquidity premium hypothesis.

When investors are divided into 2 mutually exclusive groups, each facing different investment opportunity sets, where one group (A-share investors) can only invest in the A-share markets, and the other group (B-share investors) can invest in both the B-share and world markets, then the two groups request different levels of rewards for the systematic risks they bear. B-share investors require a higher expected return for investing in the Chinese stock markets than A-share investors do in most sub-windows.

When there is A-share noise traders' momentum, total market indexes of China and Hong Kong, both A-share and B-share trading activities have less impact on A-share returns than when there is no A-share noise traders' momentum. In the mean time, A-share trading volume is significantly higher when there are momentum traders than when there is not. Evidence of noise traders' momentum is not observed among B-share investors.

Trading activities help to explain substantial portions of the return differentials: the more a firm's A-shares are traded, the higher its return differentials, while the more its B-shares are traded, the lower its return differentials. Given that Chinese stock markets are distorted by the T+1 Huizhuan Trading restrictions and daily price limits, turnover by volume does not really measure liquidity. Further exploration shows that A-share trading activities are negatively associated with the percentage of state ownership: for a firm with higher state ownership, its A-shares tend to be less traded, while its twin B-shares are not affected by this factor. Factors that influence B-share trading activities are liquidity and fundamentals. This observation is consistent with the assumption that B-share investors have distinct trading patterns from that of A-share investors, and that the trading of A-shares is associated with institutional factors, while the trading of B-shares is associated with liquidity and fundamental factors.

When T+1 Huizhuan Trading is imposed on A-shares, A-share trading activities are substantially reduced, and the price impact of A-share trading drops to a record low. Furthermore, in association with the lower trading volume, A-share investors request less risk premiums related to the Chinese stock markets. Curiously, B-share investors trade excessively high during this period, the price impact of B-share trading drops to a record low, and B-share investors request high Chinese market related risk premiums. Why do A-share investors request less risk premium when they cannot trade freely? Why do B-share investors trade more than they used to, when there is no direct institutional change with respect to B-share trading regulations? Why is there a lower price impact of B-share trading activities when A-share traders are restricted from trading freely. The Huizhuan Trading distortion hypothesis remains a puzzle and calls for further investigation.

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Table 4.1
Panel A: Institutional Events That Affect Trading Activities and Ownership Restrictions

Date	Sub-Window	Event
	19940101-19941231	**No trading restrictions**
January 1, 1995	*19950101-19961212*	**T+1 Huizhuan Trading restrictions on A-shares, not on B-shares**
December 13, 1996	*19961213-19980421*	**10% daily price limits**
April 22, 1998	*19980422-19990708*	**ST trading mechanism**
July 9, 1999	*19990709-20010219*	**PT trading mechanism**
February 28, 2001	*20010220-20020623*	**Partial removal of B-share ownership restriction**
June 23, 2002	*20020624-20030526*	**Officially stop state-ownership reduction**
May 27, 2003	*20030527-20040630*	**Qualified foreign institutional investors**

Table 4.1
Panel B: Distribution of the Firms That Issue both A-shares and B-shares with Respect to the Stock Exchanges, Equity Structure and Location, as of July, 2004

		Class A Stock	Class B Stock
Stock Exchanges (the Basic sample of 87 Pairs)	*Shanghai Stock Exchange*	44	44
	Shenzhen Stock Exchange	43	43
Equity Structure (the Basic sample of 87 Pairs)	*Firms With State Owned Stocks*	68	68
	Firms Without State Owned Stocks	19	19
Location (the Basic sample of 87 Pairs)	*Headquarters Located in Shanghai*	35	35
	Headquarters Located in Shenzhen	26	26
	Headquarters Located in Rest of the Country	26	26
Industry (the Basic sample of 87 Pairs)	*Industrial*	31	31
	Consumer's Goods	28	28
	Others	28	28

Table 4.2
General Information about A-shares and B-shares: Market Capitalization and Trading Volume, as of July, 2004

Year	*Class of Share*	*Market Capitalization, in Millions of RMB*					*Trading Volume, in Thousands of Shares*				
		Mean	*Std*	*Median*	*Min*	*Max*	*Mean*	*Std*	*Median*	*Min*	*Max*
Sub-window 1	***A***	1903.8	1938.3	1237.1	194.9	15120.0	1905.5	5710.4	553.8	7.7	183417.2
	B	391.2	352.7	233.2	30.9	1997.3	473.6	1107.2	208.9	0.0	25398.9
Sub-window 2	***A***	2037.0	2446.9	1168.4	321.1	26551.9	1913.9	5944.1	358.2	1.8	**181370.0**
	B	286.1	275.4	186.2	22.3	3030.8	1619.7	42552.4	165.7	0.0	**2674463.0**
Sub-window 3	***A***	3121.0	3363.6	2168.1	379.4	36280.2	1755.8	4559.8	688.6	16.5	97717.6
	B	461.9	499.7	275.3	21.1	4633.3	510.7	905.1	193.7	0.0	11622.0
Sub-window 4	***A***	2926.5	2439.8	2194.6	629.2	21050.3	1226.5	2913.0	521.2	5.5	75436.6
	B	249.9	267.5	156.3	16.9	1958.6	546.7	1324.0	133.7	0.0	32304.0
Sub-window 5	***A***	4160.0	3346.0	3051.3	794.8	26339.8	1786.8	4580.0	786.5	17.1	185688.3
	B	374.4	345.9	267.9	33.3	2442.9	733.9	1271.8	286.8	0.0	18323.2
Sub-window 6	***A***	**4429.4**	**3357.9**	**3528.6**	**687.5**	**25790.0**	**1077.7**	**2338.5**	**540.4**	**10.2**	**93240.9**
	B	**1046.1**	**746.4**	**894.8**	**59.7**	**5528.8**	**2308.6**	**4147.6**	**892.6**	**0.0**	**64810.5**
Sub-window 7	***A***	3828.1	3231.8	2908.0	858.9	24307.6	1035.4	2423.1	401.8	6.7	55311.0
	B	857.2	626.8	726.0	66.8	3711.1	654.9	1640.1	232.2	0.1	41070.8
Sub-window 8	***A***	3383.6	3227.3	2127.1	592.2	23849.0	1262.0	2589.6	513.9	4.4	53621.7
	B	865.8	858.2	651.1	51.1	6768.4	760.5	1289.5	331.9	0.1	19792.6

Table 4.3
Sub-Sample of the Three Firms That Are Analyzed in More Details

Company Name	Listing Exchange	Details of the Firm	Industry	Location	B Share Currency
Konka Group Co. Ltd. Shorten for Konka	SZSE	Konka produces TV monitors and electronics. It does not have any form of state-ownership in its capital structure	Industrial	Shenzhen	HK $
Jinan Qingqi Motorcycle Co. Ltd. Shorten for Qingqi	SHSE	Qingqi is a veteran producer of motorcycles. In the past few years, the firm faces some financial distress and received ST from 1999	Industrial	Shandong Province	US $
Shanghai Worldbest Co. Ltd. Shorten for WB	SHSE	WB is one of the public listed subsidiaries of China WorldBest Company – a widely diversified conglomerate. Six of China WorldBest's subsidiaries are listed on either exchanges	Industrial	Shanghai	US $

Table 4.4
Cross Sectional Variation of Price Disparities among 87 Pairs of Twin Shares

Panel A: Model Specification: $\log(\frac{P_{A,t}}{P_{B,t} \times X(RMB/\$)}) = \beta_i \times ID_{i,t} + \varepsilon_{i,t}$ **where i = 1 to 87**

Dependent Variable Is the Price Difference Between Each Individual Pair of Twin Share (P_{A-B})
Independent Variables Are the Firm Identification Number (ID) And Each ID Represents One Pair of Twin Share

	Data Window								
	Sub-window 1	*Sub-window 2*	*Sub-window 3*	*Sub-window 4*	*Sub-window 5*	*Sub-window 6*	*Sub-window 7*	*Sub-window 8*	*Entire Window*
Parameter Estimates	44 of 46 Sig 0.01	56 of 57 Sig 0.01	76 of 76 Sig 0.01	78 of 78 Sig 0.01	84 of 84 Sig 0.01	87 of 87 Sig 0.01	87 of 87 Sig 0.01	86 of 86 Sig 0.01	87 of 87 Sig 0.01
R-square	0.81	0.77	0.63	0.81	0.71	0.62	0.94	0.84	0.23
DF	46	57	76	78	84	87	87	86	87
F Value	289.5	1715.4	1248.7	4236.8	4769.6	1126.6	6627.4	2186.9	1721.5
P	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Panel B. Model Specification: $d_{i-j} = \hat{\beta}_i - \hat{\beta}_j = \frac{1}{n}\sum_{i=1}^{n} ID_i - \frac{1}{m}\sum_{j=1}^{m} ID_j$

The Dependent Variable is the Difference in the Means of the Price Difference Defined above (d_{i-j}).
The objective of this test is whether d_{i-j} is significantly different from each other. The t-test is based on Bonferroni t-test which adjusts for the difference in sample size

	Data Window Specification								
	Sub-window 1	*Sub-window 2*	*Sub-window 3*	*Sub-window 4*	*Sub-window 5*	*Sub-window 6*	*Sub-window 7*	*Sub-window 8*	*Entire Window*
Total No. of comparisons	2070	3192	5700	6006	6972	7482	7482	7310	7482
Sig. different from 0	1758 85%	2900 91%	4592 81%	5406 90%	6022 86%	6314 84%	7010 94%	6648 91%	6458 86%

Table 4.5
Unit Root Test on A-share and B-share Price Series, P_A and P_B

The Model Specification: $\Delta X_t = \gamma X_{t-1} + \sum_{i=1}^{p} \eta_i \Delta X_{t-i} + \varsigma_t$

Where X_t stands for the target series. γ that is not significantly different from 0 indicates existence of unit root

Data Window			*Augmented Dicky-Fuller Test on AR(1)*			
			AR(1) process with constant, no trend		*AR(1) process with constant and trend*	
			Tau	*Prob<Tau*	*Tau*	*Prob<Tau*
ID =Konka	*A stock*	*1994-2000*	**-1.29**	**0.64**	**-1.70**	**0.75**
		2001-2004	**-2.26**	**0.19**	**-2.33**	**0.41**
	B stock	*1994-2000*	**-1.73**	**0.42**	**-1.83**	**0.69**
		2001-2004	**-1.84**	**0.36**	**-2.17**	**0.50**
ID = Qingqi	*A stock*	*1994-2000*	**-1.24**	**0.66**	**-1.09**	**0.93**
		2001-2004	**-1.29**	**0.63**	**-2.62**	**0.27**
	B stock	*1994-2000*	**-2.28**	**0.18**	**-1.57**	**0.80**
		2001-2004	**-1.43**	**0.57**	-4.93	0.00
ID = WB	*A stock*	*1994-2000*	**-0.53**	**0.88**	**-1.68**	**0.76**
		2001-2004	**-1.25**	**0.65**	**-2.68**	**0.25**
	B stock	*1994-2000*	**-0.12**	**0.94**	**-0.40**	**0.98**
		2001-2004	**-1.18**	**0.68**	-5.18	0.00
*All the 76 individual firms**	*A stock*	*1994-2000*	72 out of the 76 stocks cannot reject H0 of AR(1)			
		2001-2004	73 out of the 76 stocks cannot reject H0 of AR(1)			
	B stock	*1994-2000*	73 out of the 76 stocks cannot reject H0 of AR(1)			
		2001-2004	74 out of the 76 stocks cannot reject H0 of AR(1)			

* Out of the 87 firms that issue both A- and B-shares, only 76 firms have valid data for both before and after February 2001 data.

Table 4.6
Co-integration Test on A-shares and B-shares Price Series, P_A and P_B

The model specification is $P_{A,t} = \phi + \theta P_{B,t} + \upsilon_t$				
Which is simplified into testing whether γ is significantly different from 0 in the model specification: $\Delta\hat{\upsilon}_t = \gamma\hat{\upsilon}_{t-1} + \sum_{i=1}^{p} \eta_i \Delta\hat{\upsilon}_{t-i} + \varsigma_t$				
γ that is significantly less than 0 indicates that $\{\upsilon\}_t$ is white noise. This indicates that the two series of $\{P_A\}$ and $\{P_B\}$ are co-integrated.				
Data Window		*Phillips and Ouliaris Test on Co-integration*		
		Tau	*Critical values for Tau At 0.05 significant level***	*Critical values for Tau At 0.01 significant level***
ID =Konka	**1994-2000**	-2.54	-3.8	-4.36
	2001-2004	**-4.68**	-3.8	-4.36
ID = Qingqi	**1994-2000**	-2.87	-3.8	-4.36
	2001-2004	**-4.55**	-3.8	-4.36
ID = WB	**1994-2000**	-1.97	-3.8	-4.36
	2001-2004	-2.48	-3.8	-4.36
68 qualified firms*	**1994-2000**		**0 (out of 68) pairs of stocks with prices that are co-integrated at 0.05 level**	**0 (out of 68) pairs of stocks with prices that are co-integrated at 0.01 level**
	2001-2004		**48 (out of 68) pairs of stocks with prices that are co-integrated at 0.05 level**	**40 (out of 68) pairs of stocks with prices that are co-integrated at 0.01 level**

* Why 68 instead of 76 co-integration? The unfit root test from previous table shows that although for each sub-window, there are more than 68 pairs of twin stocks qualified for co-integration test; the intercept of both sub-windows has only 68 pairs.

** The critical values for *Tau* are taken from Phillips and Ouliaris (1990) paper IIc. Since SAS does not provide the P value, I can only compare the Tau value with the critical values at 0.05 or 0.01 level. If the *Tau* is smaller than the critical value, it indicates that the null hypothesis of no co-integration is rejected at the corresponding level.

Table 4.7

Panel A: Regression of Return Differential on Various Factors of Konka.

This table reports results from equation (4.6). The dependent variable is Konka's weekly return differential between the twin shares (r_{A-B}); the independent variables are one-week lagged price difference $(P_{A-B})_{t-1}$, Total China Market Index (totmkch), Total US Market Index (totmkus) and Total Hong Kong Market Index (totmkhk), A-share turnover by volume ($turnover_A$), and B-share turnover by volume ($turnover_B$). In the individual regressions (Panel A-C), Generalized DW statistic for autocorrelation and LM test for heteroskedasticity are reported with the p values in the parentheses. For time series showing autocorrelation, GMM estimator with Newey-West autocorrelation, Heteroskedasticity consistent T test replaces the OLS estimators. Adjusted R-square is reported with degree of freedom in parentheses. The data window is from January 1994 to July 2004, and divided into eight sub-windows.

Model	*Constant*	$P_{(A-B)t-1}$	*China Market Index*	*US Market Index*	*HK Market Index*	*A-Share Turnover*	*B-Share Turnover*	*LM Test*	*DW Statistic*	*R2 (DOF)*
Sub-window 1	-0.04	-0.01	0.11	-0.14	0.19	**0.85**	-1.73	**3.65**	2.38	0.34
	(0.45)	(0.62)	(0.87)	(0.93)	(0.73)	**(0.04)**	(0.80)	**(0.06)**	(0.79)	(25)
Sub-window 2*	0.01	**-0.02**	**-0.55**	-0.23	0.53	**0.37**	**-0.02**	0.60	**1.66**	0.18
Huizhuan Trading	(0.39)	**(0.00)**	**(0.01)**	(0.76)	(0.15)	**(0.00)**	**(0.00)**	(0.43)	**(0.04)**	(83)
Sub-window 3	0.01	-0.00	-0.20	-0.83	0.05	**0.29**	**-2.43**	0.20	2.27	0.17
10% daily limits	(0.85)	(0.79)	(0.36)	(0.12)	(0.88)	**(0.07)**	**(0.06)**	(0.65)	(0.81)	(51)
Sub-window 4	0.21	-0.03	**-0.68**	0.29	-0.15	**1.08**	-1.11	0.24	2.14	0.46
St	(0.01)	(0.00)	**(0.00)**	(0.48)	(0.57)	**(0.00)**	(0.49)	(0.62)	(0.58)	(51)
Sub-window 5	0.04	-0.00	-0.15	0.05	-0.27	0.15	1.17	0.02	2.22	0.09
PT	(0.51)	(0.38)	(0.34)	(0.86)	(0.23)	(0.43)	(0.49)	(0.88)	(0.79)	(66)
Sub-window 6	0.09	**-0.02**	**-0.66**	0.03	0.19	0.23	**-0.57**	0.65	2.11	0.49
B-share ownership	(0.00)	**(0.01)**	**(0.02)**	(0.95)	(0.58)	(0.48)	**(0.03)**	(0.42)	(0.57)	(51)
Sub-window 7	-0.01	-0.00	0.25	0.28	-0.43	1.19	**-2.15**	0.02	2.17	0.23
state-ownership	(0.85)	(0.89)	(0.24)	(0.19)	(0.21)	(0.12)	**(0.09)**	(0.90)	(0.59)	(33)
Sub-window 8	0.02	-0.01	-0.00	0.15	-0.22	0.53	-0.75	0.02	2.11	0.14
QFII	(0.36)	(0.23)	(0.98)	(0.68)	(0.55)	(0.16)	(0.12)	(0.89)	(0.57)	(47)

* Newey-west autocorrelation, heteroskedasticity consistent matrix is applied.

Table 4.7

Panel B: Regression of Return Differential on Various Factors of Qingqi.

This table reports results from equation (4.6). The dependent variable is Qingqi's weekly return differential between the twin shares (r_{A-B}); the independent variables are one-week lagged price difference $(P_{A-B})_{t-1}$, Total China Market Index (totmkch), Total US Market Index (totmkus) and Total Hong Kong Market Index (totmkhk), A-share turnover by volume ($turnover_A$), and B-share turnover by volume ($turnover_B$). In the individual regressions (Panel A-C), Generalized DW statistic for autocorrelation and LM test for heteroskedasticity are reported with the p values in the parentheses. For time series showing autocorrelation, GMM estimator with Newey-West autocorrelation. Heteroskedasticity consistent T test replaces the OLS estimators. Adjusted R-square is reported with degree of freedom in parentheses. The data window is from July 1997 to April 2003, and divided into five sub-windows.

Model	*Constant*	$P_{(A-B)t-1}$	*China Market Index*	*US Market Index*	*HK Market Index*	*A-Share Turnover*	*B-Share Turnover*	*LM Test*	*DW Statistic*	*R2 (DOF)*
Sub-window 1										
Sub-window 2										
Huizhuan Trading										
Sub-window 3	**0.31**	**-0.04**	**-0.37**	-0.08	-0.00	0.37	-0.57	0.05	1.93	0.40
10% daily limits	**(0.02)**	**(0.02)**	**(0.08)**	(0.88)	(0.99)	(0.89)	(0.25)	(0.82)	(0.33)	(29)
Sub-window 4	-0.02	0.00	**-0.42**	0.40	0.00	2.57	-1.31	1.61	2.31	0.19
St	(0.72)	(0.86)	**(0.02)**	(0.30)	(1.00)	(0.13)	(0.35)	(0.20)	(0.81)	(51)
Sub-window 5	0.08	-0.02	**-0.41**	**0.61**	-0.40	0.82	**-1.25**	0.07	2.11	0.29
PT	(0.40)	(0.42)	**(0.02)**	**(0.05)**	(0.11)	(0.21)	**(0.01)**	(0.79)	(0.61)	(66)
Sub-window 6	0.03	-0.03	-0.27	-0.00	0.06	-0.32	**-0.14**	0.45	2.13	0.40
B-share ownership	(0.08)	(0.02)	(0.33)	(0.99)	(0.87)	(0.75)	**(0.06)**	(0.50)	(0.60)	(51)
Sub-window 7	0.04	-0.07	**-0.63**	-0.09	0.17	0.97	-0.03	0.03	2.40	0.41
state-ownership	(0.14)	(0.04)	**(0.01)**	(0.73)	(0.65)	(0.25)	(0.93)	(0.86)	(0.83)	(32)
Sub-window 8										
QFII										

Table 4.7

Panel C: Regression of Return Differential on Various Factors of WB.

This table reports results from equation (4.6). The dependent variable is WB's weekly return differential between the twin shares (r_{A-B}); the independent variables are one-week lagged price difference $(P_{A-B})_{t-1}$, Total China Market Index (totmkch), Total US Market Index (totmkus) and Total Hong Kong Market Index (totmkhk). A-share turnover by volume ($turnover_A$), and B-share turnover by volume ($turnover_B$). In the individual regressions (Panel A-C), Generalized DW statistic for autocorrelation and LM test for heteroskedasticity are reported with the p values in the parentheses. For time series showing autocorrelation, GMM estimator with Newey-West autocorrelation. Heteroskedasticity consistent T test replaces the OLS estimators. Adjusted R-square is reported with degree of freedom in parentheses. The data window is from July 1997 to July 2004, and divided into six sub-windows.

Model	*Constant*	$P_{(A-B)t-1}$	*China Market Index*	*US Market Index*	*HK Market Index*	*A-Share Turnover*	*B-Share Turnover*	*LM Test*	*DW statistic*	*R2 (DOF)*
Sub-window 1										
Sub-window 2										
Huizhuan Trading										
Sub-window 3***	0.17	-0.04	-0.51	-0.95	0.24	0.22	**-0.57**	2.18	**2.74**	0.37
10% daily limits	(0.13)	(0.12)	(0.15)	(0.09)	(0.34)	(0.59)	**(0.00)**	(0.13)	**(0.98)**	(27)
Sub-window 4	0.21	-0.05	**-0.55**	0.41	-0.04	**0.56**	**-0.58**	**3.23**	1.96	0.26
St	(0.21)	(0.23)	**(0.03)**	(0.43)	(0.91)	**(0.08)**	**(0.03)**	**(0.07)**	(0.33)	(51)
Sub-window 5***	0.16	-0.02	-0.37	-0.06	-0.11	0.37	**-0.81**	1.62	**2.47**	0.38
PT	(0.00)	(0.00)	(0.14)	(0.85)	(0.65)	(0.13)	**(0.00)**	(0.20)	**(0.97)**	(66)
Sub-window 6	0.02	-0.01	**-0.62**	-0.19	0.29	**1.01**	-0.17	1.52	1.73	0.44
B-share ownership	(0.39)	(0.23)	**(0.01)**	(0.55)	(0.30)	**(0.05)**	(0.18)	(0.22)	(0.11)	(51)
Sub-window 7	0.00	-0.01	-0.19	0.05	0.05	**6.00**	**-2.40**	**16.81**	1.83	0.48
state-ownership	(0.88)	(0.60)	(0.31)	(0.78)	(0.84)	**(0.00)**	**(0.00)**	**(0.00)**	(0.20)	(33)
Sub-window 8	**0.09**	**-0.04**	-0.22	0.00	0.25	**1.48**	**-4.22**	0.34	1.78	0.40
QFII	**(0.00)**	**(0.00)**	(0.29)	(0.99)	(0.60)	**(0.00)**	**(0.00)**	(0.56)	(0.15)	(47)

* Newey-west autocorrelation, heteroskedasticity consistent matrix is applied.

Table 4.7
Panel D: Impact of Independent Variables on A-share Returns and B-share Returns by Momentum Groups

Noise Traders' Momentum		*Impact of Independent Variables on A-share Returns by Momentum Groups*							
A-share Noise Trader	*B-share Noise Trader*	$P_{(A-B)t-1}$	*China Market Index*	*US Market Index*	*HK Market Index*	*A-Share Turnover*	*B-Share Turnover*	*A-share trading Volume*	*B-share trading volume*
No (amomen=0)		-0.017*	0.34*	-0.04*	-0.14*	2.06*	-0.12*	0.03*	0.03*
Yes(amomen=1)		-0.019	0.22	-0.20	-0.09	1.74	-0.03	0.04	0.05
	No (bmomen=0)	-0.019*	0.32	-0.07*	-0.12*	2.02*	-0.12	0.02*	0.04
	Yes (bmomen=1)	-0.016	0.32	-0.09	-0.16	1.85	-0.09	0.03	0.05
		Impact of Independent Variables on B-share Returns by Momentum Groups							
A-share Noise Trader	*B-share Noise Trader*	$P_{(A-B)t-1}$	*China Market Index*	*US Market Index*	*HK Market Index*	*A-Share Turnover*	*B-Share Turnover*	*A-share trading Volume*	*B-share trading volume*
No (amomen=0)		0.004*	0.72*	-0.13*	-0.19*	0.45*	0.75*	0.03*	0.03*
Yes(amomen=1)		0.003	0.68	-0.20	-0.20	0.62	0.54	0.04	0.05
	No (bmomen=0)	0.004*	0.72	-0.16*	-0.19	0.50*	0.74*	0.02*	0.04
	Yes (bmomen=1)	0.005	0.72	-0.10	-0.19	0.41	0.55	0.03	0.05

* Significantly different at 0.05 level

Table 4.8

Panel A: Regression of Return Differential on Various Factors of 87 Pairs of Twin Firms.

This table reports results from equation (4.6). The dependent variable is weekly return differential between the twin shares ($r_{A\text{-}B}$); the independent variables are one-week lagged price difference $(P_{A\text{-}B})_{t\text{-}1}$, Total China Market Index (totmkch), Total US Market Index (totmkus) and Total Hong Kong Market Index (totmkhk), A-share turnover by volume ($turnover_A$), and B-share turnover by volume ($turnover_B$). The data window is from January 1994 to July 2004, and is further divided into eight sub-windows. In each sub-window, data is pooled for one regression model. F test on fixed effect is reported. Regression coefficients based on either fixed effect models (when fixed effect is detected) or based on generalized least square models are reported. Also reported are the mean weekly turnover ratios of A- and B-share.

Model	$P_{(A\text{-}B)t\text{-}1}$	*China Market Index*	*US Market Index*	*HK Market Index*	*A-Share Turnover*	*B-Share Turnover*	*Fixed Effects*	*Average R2*	*Mean Trading Size, A-share*	*Mean Trading Size, B-share*
Sub-window 1	-0.01	1.12	0.34	-0.55	0.36	0.11	1.44	0.21	0.066	0.023
	(0.00)	(0.00)	(0.31)	(0.00)	(0.00)	(0.00)	(0.03)			
Sub-window 2	-0.01	-0.80	-0.27	0.61	0.09	-0.003	2.25	0.09	0.054	0.081
Huizhuan Trading	(0.00)	(0.00)	(0.02)	(0.00)	(0.00)	(0.01)	(0.00)			
Sub-window 3	-0.01	-0.42	-0.27	0.11	0.26	-0.44	2.17	0.16	0.036	0.020
10% daily limits	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.03)			
Sub-window 4	-0.01	-0.54	0.35	0.05	0.35	-0.54	1.55	0.16	0.024	0.017
St	(0.00)	(0.00)	(0.02)	(0.24)	(0.00)	(0.01)	(0.00)			
Sub-window 5	-0.003	-0.33	0.20	-0.20	0.38	-0.41	1.87	0.17	0.027	0.024
PT	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)			
Sub-window 6	-0.01	-0.78	0.00	0.27	0.47	-0.22	6.20	0.46	0.017	0.083
B-share ownership	(0.00)	(0.00)	(0.99)	(0.00)	(0.00)	(0.00)	(0.00)			
Sub-window 7	-0.01	-0.15	0.07	-0.10	0.45	-0.29	2.59	0.12	0.013	0.017
state-ownership	(0.00)	(0.00)	(0.01)	(0.02)	(0.00)	(0.00)	(0.00)			
Sub-window 8	-0.01	-0.11	0.28	-0.09	0.45	-0.29	2.07	0.09	0.015	0.020
QFII	(0.00)	(0.00)	(0.00)	(0.13)	(0.00)	(0.00)	(0.00)			

Table 4.8

Panel B: Regression of A-share Return on Various Factors of 87 Pairs of Twin Firms.

This table reports results from equation (4.6). The dependent variable is A-share weekly return (r_A); the independent variables are one-week lagged price difference $(P_{A-B})_{t-1}$, Total China Market Index (totmkch), Total US Market Index (totmkus) and Total Hong Kong Market Index (totmkhk), A-share turnover by volume ($turnover_A$), and B-share turnover by volume ($turnover_B$). The data window is from January 1994 to July 2004, and is further divided into eight sub-windows. In each sub-window, data is pooled for one regression model. F test on fixed effect is reported. Regression coefficients based on either fixed effect models (when fixed effect is detected) or based on generalized least square models are reported.

Model	$P_{(A-B)t-1}$	*China Market Index*	*US Market Index*	*HK Market Index*	*A-Share Turnover*	*B-Share Turnover*	*Fixed Effects*	*Average R2*
Sub-window 1	**-0.01**	**1.83**	0.18	**-0.85**	**0.34**	**0.36**	1.73	0.37
	(0.00)	**(0.00)**	(0.53)	**(0.00)**	**(0.00)**	**(0.00)**	(0.01)	
Sub-window 2	**-0.001**	**0.25**	**-0.35**	0.05	**0.09**	**-0.004**	1.26	0.09
Huizhuan Trading	**(0.00)**	**(0.00)**	**(0.02)**	(0.42)	**(0.00)**	**(0.01)**	(0.10)	
Sub-window 3	**-0.01**	**0.39**	-0.02	**-0.33**	**0.32**	**-0.24**	2.93	0.16
10% daily limits	**(0.00)**	**(0.00)**	(0.78)	**(0.00)**	**(0.00)**	**(0.00)**	(0.03)	
Sub-window 4	**-0.01**	**0.09**	**-0.20**	0.02	**0.54**	**0.17**	4.89	0.21
St	**(0.00)**	**(0.00)**	**(0.02)**	(0.48)	**(0.00)**	**(0.01)**	(0.00)	
Sub-window 5	**-0.01**	**0.20**	**-0.15**	-0.00	**0.58**	**0.29**	7.03	0.21
PT	**(0.00)**	**(0.00)**	**(0.00)**	(0.91)	**(0.00)**	**(0.00)**	(0.00)	
Sub-window 6	**-0.01**	**0.49**	0.03	**-0.14**	**0.63**	**0.04**	3.43	0.22
B-share ownership	**(0.00)**	**(0.00)**	(0.43)	**(0.00)**	**(0.00)**	**(0.00)**	(0.00)	
Sub-window 7	**-0.01**	**0.99**	**0.17**	**-0.60**	**0.65**	**0.10**	1.57	0.34
state-ownership	**(0.00)**	**(0.00)**	**(0.00)**	**(0.00)**	**(0.00)**	**(0.01)**	(0.00)	
Sub-window 8	**-0.01**	**0.01**	-0.04	0.03	**0.75**	**0.30**	2.89	0.15
QFII	**(0.00)**	**(0.69)**	(0.59)	(0.63)	**(0.00)**	**(0.00)**	(0.00)	

Table 4.8

Panel C: Regression of B-share Return on Various Factors of 87 Pairs of Twin Firms.

This table reports results from equation (4.6). The dependent variable is B-share weekly return (r_B); the independent variables are one-week lagged price difference $(P_{A-B})_{t-1}$, Total China Market Index (totmkch), Total US Market Index (totmkus) and Total Hong Kong Market Index (totmkhk), A-share turnover by volume ($turnover_A$), and B-share turnover by volume ($turnover_B$). The data window is from January 1994 to July 2004, and is further divided into eight sub-windows. In each sub-window, data is pooled for one regression model. F test on fixed effect is reported. Regression coefficients based on either fixed effect models (when fixed effect is detected) or based on generalized least square models are reported.

Model	$P_{(A-B)t-1}$	*China Market Index*	*US Market Index*	*HK Market Index*	*A-Share Turnover*	*B-Share Turnover*	*Fixed Effects*	*Average R2*
Sub-window 1	0.001	**0.71**	-0.15	**-0.30**	-0.02	**0.21**	0.75	0.10
	(0.11)	**(0.00)**	(0.41)	**(0.00)**	(0.13)	**(0.00)**	(0.89)	
Sub-window 2*	0.01	**1.05**	-0.07	**-0.58**	**0.02**	-0.002	2.05	0.16
Huizhuan Trading	(0.00)	**(0.00)**	(0.46)	**(0.00)**	**(0.02)**	(0.07)	(0.00)	
Sub-window 3	0.001	**0.81**	**0.25**	**-0.44**	**0.04**	**0.20**	0.37	0.29
10% daily limits	(0.08)	**(0.00)**	**(0.00)**	**(0.00)**	**(0.01)**	**(0.00)**	(1.00)	
Sub-window 4	0.00	**0.65**	**-0.56**	-0.04	**0.17**	**0.62**	0.73	0.26
St	(0.31)	**(0.00)**	**(0.02)**	(0.35)	**(0.00)**	**(0.01)**	(0.96)	
Sub-window 5	-0.001	**0.53**	**-0.34**	**0.20**	**0.20**	**0.70**	**1.87**	0.17
PT	(0.00)	**(0.00)**	**(0.00)**	**(0.00)**	**(0.00)**	**(0.00)**	**(0.00)**	
Sub-window 6	0.01	**1.28**	0.03	**-0.41**	**0.17**	**0.27**	**2.18**	0.56
B-share ownership	(0.00)	**(0.00)**	(0.56)	**(0.00)**	**(0.00)**	**(0.00)**	**(0.00)**	
Sub-window 7	0.00	**1.15**	**0.08**	**-0.48**	**0.20**	**0.29**	1.08	0.41
state-ownership	(0.31)	**(0.00)**	**(0.01)**	**(0.02)**	**(0.00)**	**(0.00)**	(0.29)	
Sub-window 8	0.00	**0.12**	**-0.32**	**0.12**	**0.30**	**0.58**	**1.81**	0.17
QFII	(0.49)	**(0.00)**	**(0.00)**	**(0.05)**	**(0.00)**	**(0.00)**	**(0.00)**	

* GLS model is used.

Table 4.9

Panel A: Cross Sectional Regression of A-Share Turnover Ratio on Various Factors of 87 Pairs of Twin Firms.

The dependent variable is A-share annual turnover of firm i; the independent variables are Degree of Co-movement, A-share liquidity, B-share liquidity, percentage of state-ownership, leverage, and profitability. There are 9 cross sectional regressions for the 9 years when there are enough observations. Given the possible autocorrelation, and short of data to adjust for the autocorrelation, no panel regression is run. The data window is from 1995 to 2003.

Model	*Constant*	*Degree of Co-movement*	*A-Share Liquidity*	*B-Share Liquidity*	*State Ownership*	*Leverage (Debt/Asset)*	*Profitability*	*Adj R2 (DOF)*	*F Stats (P value)*	*White test (P value)*
1995	1.78	0.02	6.04	-2.46	**-4.15**	**2.63**	10.71	0.11	1.93	12.76
	(0.65)	(0.99)	(0.33)	(0.57)	**(0.08)**	**(0.03)**	(0.52)	(45)	(0.10)	(0.99)
1996	8.97	-0.33	18.59	**-9.35**	**-7.12**	0.84	-7.42	0.19	**2.91**	23.42
	(0.02)	(0.94)	(0.11)	**(0.03)**	**(0.02)**	(0.62)	(0.67)	(48)	**(0.02)**	(0.66)
1997	2.91	4.41	1.53	-2.94	**-3.10**	0.16	2.36	0.10	**2.14**	12.76
	(0.06)	(0.27)	(0.83)	(0.11)	**(0.02)**	(0.81)	(0.77)	(59)	**(0.06)**	(0.99)
1998	0.13	2.77	**13.05**	-0.31	**-0.74**	0.02	-0.55	0.30	**5.62**	31.61
	(0.72)	(0.01)	**(0.00)**	(0.50)	**(0.07)**	(0.82)	(0.67)	(64)	**(0.01)**	(0.25)
1999	1.00	1.62	0.81	-0.27	**-1.18**	0.01	0.57	0.05	1.64	14.26
	(0.10)	(0.08)	(0.87)	(0.71)	**(0.05)**	(0.83)	(0.61)	(69)	(0.15)	(0.98)
2000	**3.20**	-2.55	-2.30	-1.22	**-1.69**	0.01	0.56	0.09	**2.39**	10.36
	(0.00)	(0.18)	(0.72)	(0.22)	**(0.01)**	(0.68)	(0.72)	(76)	**(0.04)**	(0.99)
2001	**2.27**	**-2.83**	**10.54**	**-11.56**	**-0.86**	0.00	-0.10	0.15	**3.25**	28.16
	(0.00)	**(0.02)**	**(0.00)**	**(0.00)**	**(0.01)**	(0.96)	(0.52)	(76)	**(0.01)**	(0.40)
2002	**0.93**	2.47	1.36	**-2.56**	**-0.51**	0.03	0.02	0.10	**2.39**	18.76
	(0.00)	(0.26)	(0.30)	**(0.07)**	**(0.02)**	(0.55)	(0.82)	(77)	**(0.04)**	(0.88)
2003*	**1.15**	2.71	2.05	**-3.45**	**-0.64**	0.02	0.14	0.24	**5.13**	43.32
	(0.00)	(0.14)	(0.08)	**(0.00)**	**(0.00)**	(0.72)	(0.43)	(77)	**(0.00)**	(0.02)

* The test on the parameter estimates are based on the heteroskedasticity consistent covariance matrix

Table 4.9

Panel B: Cross Sectional Regression of B-Share Turnover Ratio on Various Factors of 87 Pairs of Twin Firms.

The dependent variable is B-share annual turnover of firm i; the independent variables are Degree of Co-movement, A-share liquidity, B-share liquidity, percentage of state-ownership, leverage, and profitability. There are 9 cross sectional regressions for the 9 years when there are enough observations. Given the possible autocorrelation, and short of data to adjust for the autocorrelation, no panel regression is run. The data window is from 1995 to 2003.

Model	*Constant*	*Degree of Co-movement*	*A-Share Liquidity*	*B-Share Liquidity*	*State Ownership*	*Leverage (Debt/Asset)*	*Profitability*	*Adj R2 (DOF)*	*F Stats (P value)*	*White test (P value)*
1995	-4.47	**10.55**	2.93	-0.20	-2.61	**4.53**	25.18	0.08	1.69	21.93
	(0.49)	**(0.02)**	(0.77)	(0.97)	(0.50)	**(0.02)**	(0.36)	(45)	(0.15	(0.74)
1996	**2.74**	0.22	2.00	**-2.68**	-0.75	-0.03	1.82	0.18	**2.78**	21.06
	(0.00)	(0.83)	(0.46)	**(0.01)**	(0.27)	(0.92)	(0.65)	(48)	**(0.02)**	(0.78)
1997	0.55	0.40	-2.64	0.83	-0.06	-0.04	**8.53**	0.13	**2.46**	13.96
	(0.26)	(0.76)	(0.26)	(0.17)	(0.90)	(0.85)	**(0.00)**	(59)	**(0.04)**	(0.98)
1998	0.07	0.38	1.27	**0.77**	-0.12	-0.00	1.00	0.14	**2.74**	34.21
	(0.74)	(0.51)	(0.44)	**(0.00)**	(0.57)	(0.97	(0.16)	(64)	**(0.02)**	(0.16)
1999	**0.81**	-0.08	2.33	0.68	-0.43	-0.02	0.61	0.03	1.40	21.36
	(0.03)	(0.89)	(0.41)	(0.12)	(0.22)	(0.55)	(0.38)	(69)	(0.23)	(0.77)
2000	**0.71**	0.16	-4.03	**2.48**	-0.02	0.00	**-1.29**	0.37	**8.3**	16.74
	(0.00)	(0.85)	(0.15)	**(0.00)**	(0.94)	(0.94)	**(0.06)**	(76)	**(0.00)**	(0.94)
2001	**4.88**	-1.54	-5.88	2.38	0.02	0.10	-0.27	0.00	0.96	33.05
	(0.00)	(0.55)	(0.41)	(0.75)	(0.98)	(0.41)	(0.41)	(76)	(0.46)	(0.20)
*2002**	**0.55**	**6.33**	0.20	0.32	0.15	-0.02	**-0.13**	0.10	**2.42**	46.87
	(0.00)	**(0.01)**	(0.87)	(0.80)	(0.50)	(0.66)	**(0.00)**	(77)	**(0.03)**	(0.01)
2003	**0.94**	**10.94**	**5.13**	**-5.96**	0.19	-0.07	0.01	0.35	**8.04**	26.37
	(0.00)	**(0.00)**	**(0.00)**	**(0.00)**	(0.49)	(0.31)	(0.98)	(77)	**(0.00)**	(0.50)

* The test on the parameter estimates are based on the heteroskedasticity consistent covariance matrix

Figure 4.1
Price Disparity of Konka Group Co. Ltd

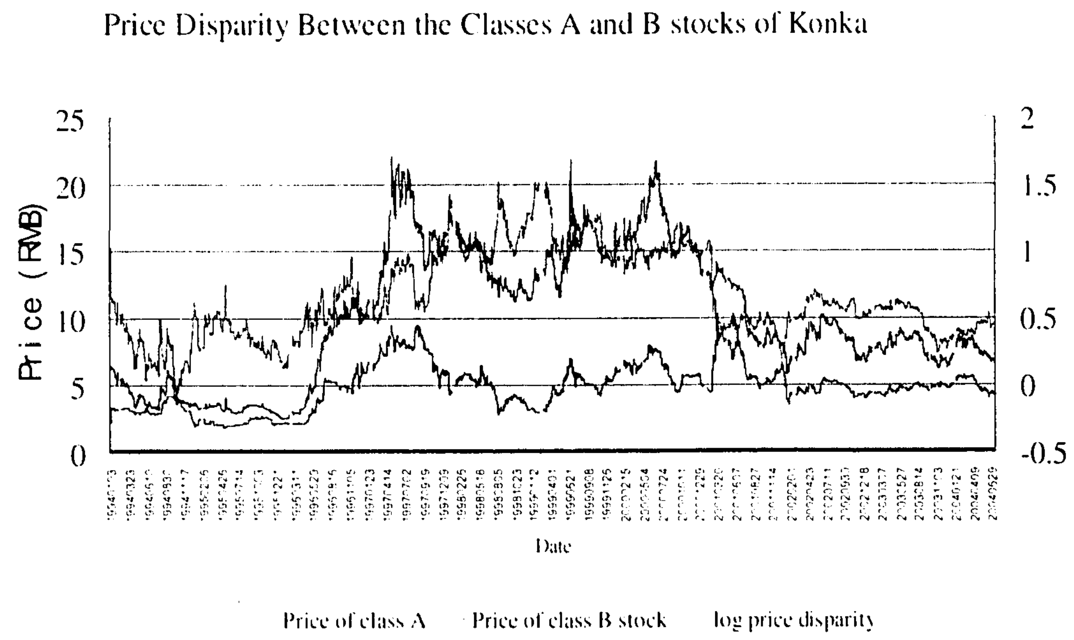


Figure 4.2
Price Disparity of Jinan Qingqi Motorcycle Co. Ltd. (Qingqi)

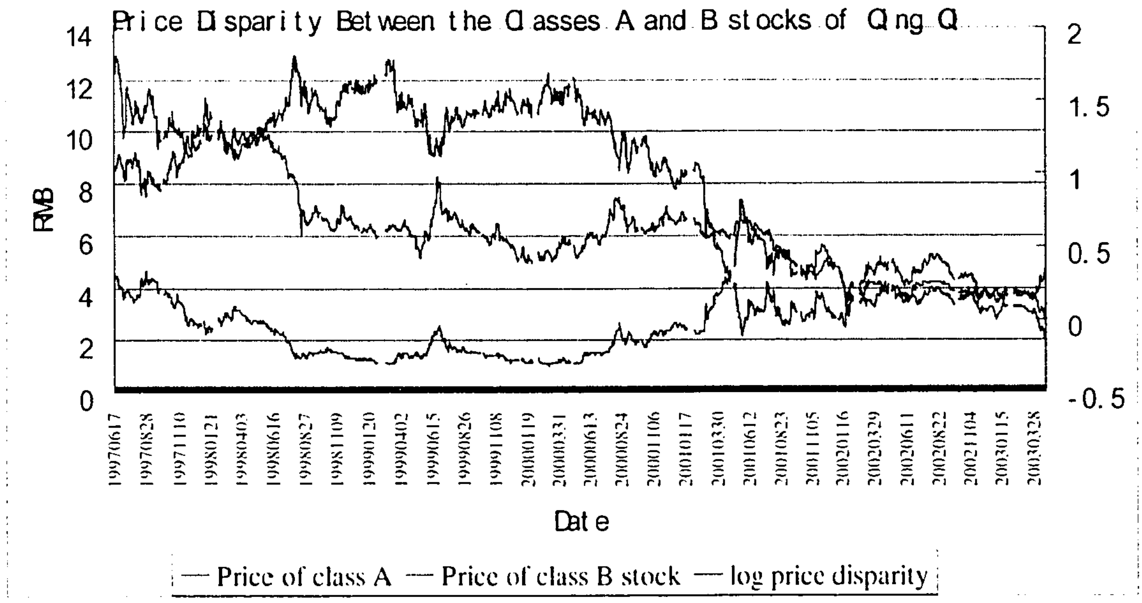


Figure 4.3
Price Disparity of Shanghai WorldBest (WB)

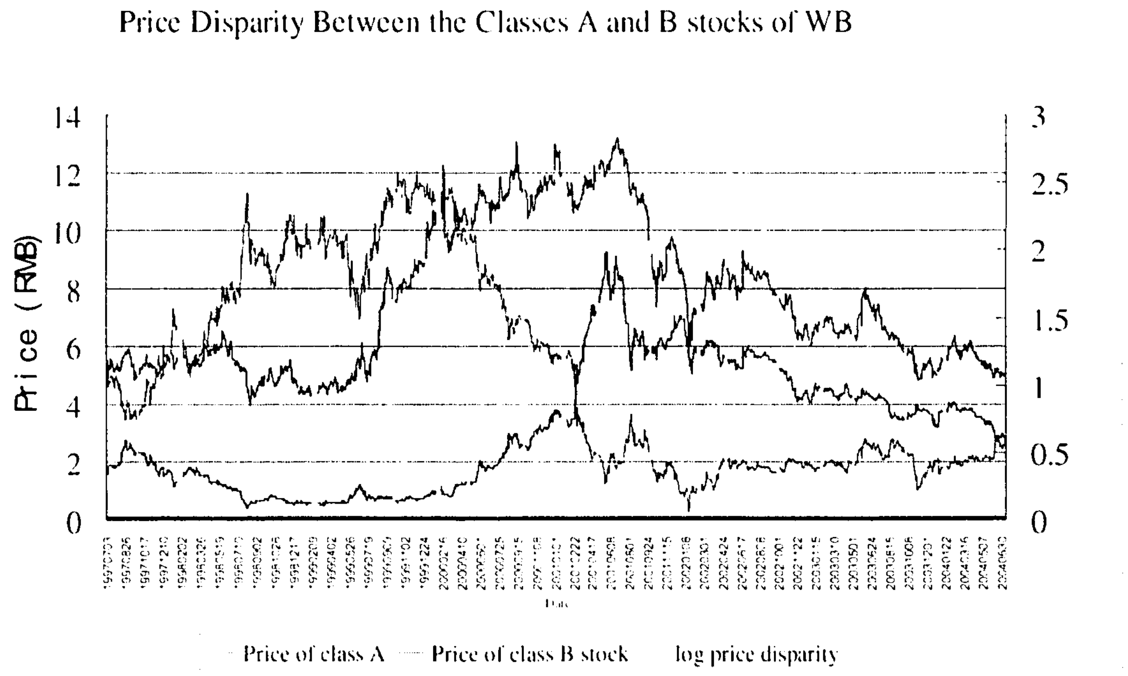
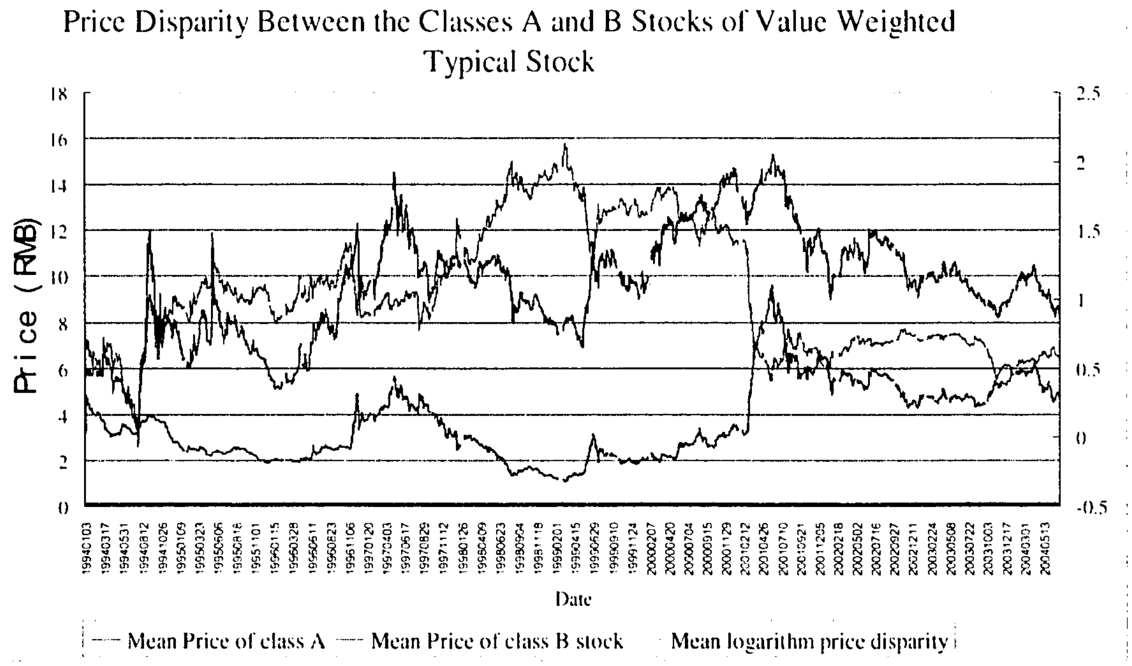


Figure 4.4
Price Disparity of a Typical Twin Share



Appendix 4.1: Countries That Impose the quota on the Foreign Portfolio Investment.

Country	Restrictions on Foreign Ownership
Australia	10% in banks, 25% in Uranium mining, 20% in broadcasting, and 50% in new mining ventures.
Burma	Investment is not allowed.
Canada	20% in broadcasting, and 25% in banks and insurance companies.
Finland	Limited to 20%.
France	Limited to 20%
India	Maximum of 49%.
Indonesia	Maximum of 49%.
Japan	Maximum of 25-50% in a group of 11 major firms. Acquisition of over 10% of the shares of a single firm requires approval of the Ministry of Finance.
South Korea	Maximum of 15% of the major firms eligible to foreigners for investment.
Malaysia	20% in banks, 30% in natural resources, and a maximum of 70% in other firms.
Mexico	Maximum of 49%.
Netherlands	No restrictions in listed securities. Special permission needed if investment is in unlisted securities.
Norway	10% in banking industry, 20% in industrial or oil shares, 50% in shipping industry, and 0% in pulp, paper, and mining.
Spain	Maximum of 50% with no investment in defense and public information.
Sweden	20% of voting shares and 40% of total share capital.
Switzerland	A local firm can issue either bearer shares or registered shares. Foreigners can hold only bearer shares.

Data source: George and Giddy [10], ABD Securities [1], Esslen [6], and various publications of Price-Waterhouse [14].

Appendix 4.2: Univariate Statistics of the Target Variables

Panel A

Univariate Statistics of A- and B-shares of Konka Group Co. Ltd. (Konka). Both shares are traded on the SZSE. The returns and the prices in this table are converted into local currency (RMB). Konka is among a few companies without state-ownership.

	Class	Mean	Std	Skewness	Kurtosis	Q-test	AR(1)*
Effective weekly return $r_t = \frac{P_t - P_{t-1} + D_t}{P_{t-1}}$	A	0.002	0.062	**1.242**	**7.345**	**11.2**	0.032
		0.43		**0.00**	**0.00**	**0.08**	0.50
	B	0.004	0.067	**0.514**	**4.788**	8.2	0.077
		0.22		**0.00**	**0.00**	0.22	0.11
Continuously compounded return $R_t = \log(1 + r_t)$	A	0.001	0.061	**0.626**	**4.720**	**11.6**	0.029
		0.86		**0.00**	**0.00**	**0.07**	0.55
	B	0.002	0.067	-0.096	**4.017**	7.3	0.061
		0.59		0.39	**0.00**	0.29	0.20
Price p	A	**10.42**	5.18	0.06	**-1.17**	**2589.7**	**0.991**
		0.00		0.61	**0.00**	**0.00**	**0.00**
	B	**4.83**	1.83	**0.46**	-0.13	**2329.9**	**0.978**
		0.00		**0.00**	0.56	**0.00**	**0.00**
Logarithm of Price $P = \log(p)$	A	**2.19**	0.61	**-0.57**	**-1.01**	**2651.8**	**0.995**
		0.00		**0.00**	**0.00**	**0.00**	**0.00**
	B	**1.50**	0.40	**-0.36**	**-0.63**	**2441.3**	**0.986**
		0.00		**0.00**	**0.00**	**0.00**	**0.00**

Panel B

Univariate Statistics of A- and B-shares of Jinan Qingqi Motorcycle Co. Ltd. (Qingqi). Both shares are traded on the SHSE. The returns and the prices in this table are converted into local currency (RMB). Qingqi is an ST (special-treatment) firm.

	Class	Mean	Std	Skewness	Kurtosis	Q-test	AR(1)*
Effective weekly return $r_t = \frac{P_t - P_{t-1} + D_t}{P_{t-1}}$	A	-0.003	0.050	**0.487**	**1.649**	8.3	-0.014
		0.38		**0.00**	**0.00**	0.21	0.81
	B	0.000	0.068	**0.576**	**1.772**	**17.2**	**0.206**
		0.99		**0.00**	**0.00**	**0.01**	**0.00**
Continuously compounded return $R_t = \log(1 + r_t)$	A	-0.004	0.050	0.233	**1.505**	9.1	-0.016
		0.19		0.08	**0.00**	0.17	0.79
	B	-0.002	0.067	0.232	**1.520**	**16.0**	**0.194**
		0.59		0.08	**0.00**	**0.01**	**0.00**
Price p	A	6.76	2.34	**1.08**	**0.80**	**1628.9**	**0.982**
		0.00		**0.00**	**0.00**	**0.00**	**0.00**
	B	2.84	1.36	**0.57**	-0.42	**1508.8**	**0.985**
		0.00		**0.00**	0.12	**0.00**	**0.00**
Logarithm of Price $P = \log(p)$	A	1.86	0.32	**0.32**	-0.25	**1594.0**	**0.977**
		0.00		**0.02**	0.36	**0.00**	**0.00**
	B	0.92	0.50	-0.09	**-1.25**	**1554.4**	**0.987**
		0.00		0.52	**0.00**	**0.00**	**0.00**

Panel C

Univariate Statistics of A- and B-shares of Shanghai Worldbest Co. Ltd. (WB). Both shares are traded on the SHSE. The returns and the prices in this table are converted into local currency (RMB). WB is one of the six public listed subsidiaries of China WorldBest Company.

	Class	Mean	Std	Skewness	Kurtosis	Q-test**	AR(1)*
Effective weekly return $r_t = \frac{P_t - P_{t-1} + D_t}{P_{t-1}}$	A	0.004	0.058	0.320	2.786	19.6	-0.077
		0.28		0.01	0.00	0.00	0.19
	B	0.009	0.078	0.597	2.115	8.9	0.092
		0.04		0.00	0.00	0.18	0.11
Continuously compounded return $R_t = \log(1 + r_t)$	A	0.002	0.058	-0.118	3.438	20.1	-0.078
		0.55		0.34	0.00	0.00	0.18
	B	0.006	0.077	0.173	1.750	8.9	0.089
		0.16		0.17	0.00	0.18	0.12
Price p	A	7.60	2.44	0.29	-0.67	1684.9	0.983
		0.00		0.02	0.01	0.00	0.00
	B	2.84	2.24	0.82	-0.61	1868.0	0.993
		0.00		0.00	0.01	0.00	0.00
Logarithm of Price $P = \log(p)$	A	1.97	0.34	-0.28	-0.78	1667.9	0.980
		0.00		0.02	0.00	0.00	0.00
	B	0.71	0.84	0.08	-1.36	1871.7	0.992
		0.00		0.53	0.00	0.00	0.00

* is the autocorrelation coefficient.
** Q-test statistics uses up to six lags.