An Inelastic Demand Curve for Stocks

Abstract

In 2005 and 2006, the split-share structure reform converted the nontradable shares of most domestic public firms in China to tradable shares. This conversion imparted a drastic supply shock to the public market. Studying this unique event, we provide direct evidence to support an inelastic demand curve for stocks. Abnormal returns of the sample firms resulting from the reform are found to be negatively associated with the size of the supply shock. This finding is free from the confounding information effects present in many prior studies of stock price elasticity. It is also robust after controlling for opposite price impacts of ROA, firm size, and ownership concentration.
1. Introduction

Many financial theories are developed based on the assumption of elastic demand for stocks. In a real market, where individual stocks are not perfectly substitutable, stock price is contingent on market supply, *ceteris paribus*. In recognition of the importance of establishing the inelastic demand curve for stocks, a growing collection of empirical studies has tested stock price movements following events that cause shifts in demand or supply.

In the earliest study on stock price elasticity, Scholes (1972) investigates the price impact of secondary equity distributions and finds the largest absolute price impact associated with equity sales by insiders. He concludes that information effects are responsible for price revisions around secondary distributions. Mikkelson and Partch (1985) reexamine secondary equity distributions and surmise that the larger price impact for larger offerings is not an artifact of downward-sloping demand curves but is more likely due to the revelation of adverse information. Studies of secondary equity issuances, like studies of block sales of equity or primary offerings, may not represent clean tests of price elasticity due to the confounding information effects conveyed in the price changes.

Shleifer (1986) and Harris and Gurel (1986) are the first to recognize that a permanent price response associated with addition to the index is consistent with stocks possessing downward-sloping demand curves. They postulate that a stock being added to a market index will experience higher market demand simply from mutual funds and other index-tracking investment trusts. Subsequently, several other
studies have examined S&P 500 inclusions and deletions and have generally found a permanent component in the price changes after a partial reversal (Dhillon and Johnson, 1991; Beneish and Whaley, 1996; Lynch and Mendenhall, 1997; Wurgler and Zhuravskaya, 2002). Nevertheless, this permanent price change may be explained by alternative hypotheses.

Chen, Noronha, and Singal (2004) document an asymmetric price response to index inclusion and deletion. There is a permanent increase in the price of added firms but no permanent decline for deleted firms. Chen et al. suggest that changes in investor awareness contribute to the asymmetric price effects of S&P 500 index additions and deletions. More recently, Elliott, Van Ness, Walker, and Wan (2006) present an analytical survey of competing explanations for the increase in stock value associated with inclusion in the S&P 500 index. They find that increased investor awareness is the primary factor behind the cross-sectional of abnormal announcement returns but find no evidence that long-run downward-sloping demand curves for stocks are related to the cross-section of announcement or inclusion returns.

In a related study, Kaul, Mehrotra, and Morck (2000) find that stock values changed in response to the re-weighting of the Toronto Stock Exchange 300 index in 1996. While index inclusion might be associated with new information, re-weighting of an index is much more likely to be a pure information-free event. Like other studies of stock demand shifts, Kaul et al.’s tests, which support the contention that stock prices change with demand shifts, provide indirect evidence consistent with the downward slope of demand curves.
An obvious event with which to directly examine the slope of the demand curve for stocks is one that changes supply (see Kaul et al., 2000). Direct evidence of an inelastic demand curve for stocks has been absent in the literature mainly due to the unavailability of data. Fortunately, the recent split-share structure reform in China’s A-share stock market provides an ideal setting to examine the slope of the demand curve for stocks. The reform converted previously nontradable shares to shares tradable on stock exchanges, causing an outward supply shift of shares in the public market. As we will show in further discussion, this event is free from confounding information effects.

Prior to April 2005, Chinese domestic-listed (A-share) firms issued two classes of shares: tradable and nontradable. Minority shares were issued to the public and were allowed to be traded on the listing exchange, either the Shanghai or Shenzhen Stock Exchange. Majority shares were issued mainly to the founders and strategic partners of A-share firms and were prohibited from exchange trading. Otherwise, tradable shares and nontradable shares carry identical rights. Under this split-share structure, a small number of nontradable shareholders control the management of an A-share firm. This separation of public ownership and management created agency problems, which were blamed for the deteriorating corporate performance of A-share firms. Under the split-share structure reform initiated in April 2005 by the China Securities Regulatory Commission (CSRC - the Chinese equivalent of the U.S. Securities and Exchange Commission), most A-share firms converted their nontradable shares to exchange-tradable shares by the end of 2006. Owners of nontradable shares
compensated owners of tradable shares with gift shares, cash, or a combination of shares, cash and rights for the conversion. The gift shares were exchange tradable immediately, while the converted shares were set to become exchange tradable after a series of specified lockup periods. The market supply of shares of a reformed firm thus was instantly increased by the amount of the gift shares. It was also expected to shift upward in the future, or “distantly,” by the amount of converted shares. Since the gift shares were transferred from non-tradable shareholders, there were no extra share issuances in the reform. Therefore, there was no dilution effect associated with seasoned issuances. Under the guidance of CSRC, all A-share firms were stipulated to complete the split-share reform. So there was no negative information accompanying the reform. Furthermore, the term of the reform is negotiable on a firm level, that is, the tradable shareholders had the right to veto the action. Thus an expected positive abnormal return was a necessary condition for the reform’s completion. Overall, there were no confounding negative information effects associated with the event.

The split-share structure reform was well received by the market, with an average return of approximately 20% over the 21 trading days around each A-share firm’s reform. After controlling for the three Fama-French factors, we find the cumulative abnormal return (CAR) due to the reform averages 13.2%. This positive abnormal return is believed to reflect the alleviation of agency difficulty caused by the split-share structure. Furthermore, we find a statistically and economically significant negative relation between the reform CAR and the size of the supply shock. This negative relation is robust after controlling for firm size, profitability, and the
concentration of nontradable share ownership. Since short sales are not allowed in China’s A-share market, the supply curve of A-share stock is vertical.\(^1\) An outward shift of the supply curve with negative implications for share prices thus lends direct support to the downward slope of the demand curve.

This paper documents direct empirical evidence of an inelastic demand curve for stocks, which had been sought after by many researchers studying stock price elasticity since Scholes (1972). As Scholes points out, establishing the downward-sloping demand curve has important implications for finance practice and theory development. This paper also presents evidence that China’s A-share market experienced instant and distant supply shocks caused by the gift shares and the converted time-locked shares. Moreover, it shows evidence that the A-share investors responded positively to the split-share structure reform in recognition of the improved ownership structure of A-share firms. Proxies for agency difficulty caused by the split-share structure explain the cross-section of reform CARs. The empirical findings of the emerging China’s A-share market in this paper are consistent with the efficient market hypothesis.

The remainder of this paper is organized as follows. Section 2 discusses the split-share structure reform and research hypotheses. Section 3 discusses the research methodology. The data and empirical results are presented in Section 4. Finally, Section 5 summarizes the findings.

\(^1\) Short selling changes the supply (see Mitchell, Pulvino, and Stafford, 2004).
2. Institutional Background and Research Hypotheses

2.1 China’s Split-share Structure Reform

China’s A-share\(^2\) stock market was launched in 1990 with the establishment of the Shanghai and Shenzhen Stock Exchanges. Most of the companies listed on these two exchanges were transformed from state-owned enterprises. Since its inception, the A-share market has been distinguished by its unique split-share structure, whereby a large fraction of outstanding shares of listed firms was prohibited from trading on either exchange. Owners of nontradable shares otherwise had exactly the same rights in voting and cash distribution as tradable shareholders. Nontradable shares were initially and subsequently issued to the founders and strategic partners of the listed firms, mostly state enterprises or agencies, and their employees. Tradable shares were initially and subsequently issued to public institutional and individual investors for market prices. Infrequently, nontradable shares changed hands among qualified entities, off exchange, for prices negotiated using the scale of book values.\(^3\) As of April 2005, just before the start of the reform, about two-thirds of the domestic A-shares outstanding were nontradable.

The split-share structure has been described by some as being the biggest impediment to the development of China’s equity market. Under the split-share structure, a firm’s management is controlled by the owners of the firm’s highly

\(^2\) Domestic public firms in China issue A-shares, B-shares, and/or H-shares. A-shares refer to the common stock listed on the Shanghai and Shenzhen Stock Exchanges. A small number of A-share firms also issue B-shares on the same exchanges, which are priced and traded in U.S. dollars. H-shares refer to the Chinese domestic firms listed on the Hong Kong Stock Exchange.

\(^3\) This split-share structure was designed so that the A-share market could be used to raise capital for state-owned firms without jeopardizing the majority state ownership.
concentrated nontradable shares. Agency problems arise from the separation of public ownership and management. For example, holders of nontradable shares bear no interest in the market performance of the firm’s tradable shares. Instead, they value the firm according to its net book assets. The off-exchange trade prices of nontradable shares are typically based on the book value per share, which is substantially below the market prices of tradable shares. The shortcut to boost book value, ironically, is to issue tradable shares to public investors for high, liquidity premium-embedded prices. This approach is contrary to the objective of public investors, who aim at higher share prices boosted by competitive corporate management and performance. The conflict of interests between the two classes of shareholders led to the lackluster corporate performance of the Chinese A-share firms (see Wu, 2004; Wu, 2006).

The Chinese government recognized the defect in the split-share structure. In April 2005, CSRC initiated a multi-stage program of split-share structure reform with the goal of converting nontradable shares into tradable shares. Under this program, holders of an A-share firm’s nontradable shares converted their shares to tradable shares for a negotiated compensation to tradable shareholders. The offered compensation, which came in the form of stocks, cash, or combinations of the two and rights, had to be approved separately by vote by the majority of each class of shareholders. CSRC set the end of 2006 as the deadline for completing the process. To provide further incentives, CSRC stipulated that only firms that had completed the reform would be allowed to raise new capital4. By the end of 2006, 1,139 listed firms

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4 Both initial public offerings and seasoned equity offerings had been frozen since April 2005.
completed the reform, representing over 80 percent of market capitalization.

2.2 Price Impact of Supply Shock

In this paper, we focus on A-share firms that paid gift shares in lieu of conversion compensation. These firms consisted of the majority of all reform firms. Under the reform, a fractional share is offered for each tradable share in exchange for the tradable shareholders’ consent for exchange tradability of the remaining nontradable shares.

The conversion of nontradable shares to tradable shares imparted supply shocks to the public market. The first result of the split-share structure reform was the price impact of the supply shock of tradable shares. Few people would quarrel with the contention that, in a market where firms have no perfect substitutions, stock prices are discounted when more shares are supplied. If this contention is true, the price discount is an increasing function of the size of the supply increase. Even though the price inelasticity hypothesis is intuitively appealing and has important implications for the development of financial theory and practice, the literature is mute on this hypothesis.

In a model of portfolio choice and stock trading volume with loss-averse investors, Gomes (2005) concludes that the elasticity of the aggregate demand curve for stocks changes substantially depending on the distribution of wealth across investors. However, the elasticity of stock demand can only be determined by empirical tests (Scholes, 1972).

We directly test the elasticity of the stock demand curve. The price inelasticity
hypothesis postulates a negative relation between the cumulative abnormal return of the reform firm over the split-share structure reform period and the size of the supply shock. The supply shock is measured by the relative supply increase, that is, the ratio of the number of nontradable shares and tradable shares. The price inelasticity hypothesis can be directly tested by stratifying the reform CARs by the size of total supply increase.

Assume nontradable shareholders offer $b$ gift shares for each tradable share. These gift shares will be immediately exchange tradable after the reform, which causes an instant supply shock to the market. The remaining converted shares, by contract, will be exchange tradable after a set of lockup periods. These converted shares thus impose a distant, yet expected supply shock to exchange trading.

In a typical pricing model, the stock price at date $t$ (the trading day before reform) is related to the supply of shares:

$$\ln P_t = p + \beta \ln Q_t,$$  

(1)  

where $Q_t$ is the number of outstanding tradable shares and $\beta$ is a coefficient. If there is no informational effect, the share price change between time $t$ and $t+\tau$ (the first post-reform trading day) is

$$\ln P_{t+\tau} - \ln P_t = \beta (\ln Q_{t+\tau} - \ln Q_t).$$  

(2)  

The change of supply has two components. First, the gift shares ($b$ per original tradable share), becoming tradable instantly after the reform, impose an imminent supply shock. Second, the converted shares will be allowed to trade on the listing
exchange after agreed-upon lockup periods, which will impose expected, distant
supply shocks. Denoting $q$ as the proportion of nontradable shares in total outstanding
shares, the relative distant shock is $q/(1-q)-b$ per original tradable share. The above
equation can be rewritten as:

$$\ln P_{t+1} - \ln P_t = \beta_1 \cdot b + \beta_2 \cdot (q/(1-q) - b)$$

(3)

where $\beta_1$ and $\beta_2$ denote the respective coefficients of the instant and distant
supply increases. In the empirical analysis, an alternative test of the price inelasticity
hypothesis is to show negative $\beta_1$ and $\beta_2$ in a regression in line with equation (3).
By further investigating the values of $\beta_1$ and $\beta_2$, we show that the market
distinguishes instant and distant supply increases.

2.3 Ownership Structure and Firm Value

Good corporate governance should enable owners to exercise control over
management (Jensen and Meckling, 1976; Fama and Jensen, 1983). The literature
documents voluminous evidence of agency problems caused by the separation of
ownership and control (e.g., see Elston and Goldberg, 2003). Under the split-share
structure, the ownership of nontradable shares of an A-share firm, consisting of the
majority of its outstanding shares, was highly concentrated. This literally separated
the public ownership from corporate management, creating agency costs. For example,
nontradable shareholders and corporate executives do not make corporate
performance of the listed firms a priority. Rather, they often seek to abuse the
resources of the listed companies for their own benefit (Chen and Wang, 2005). In
addition, anecdotal evidence shows that mutual fund managers and financial analysts often complain about the difficulty and inconvenience involved in communicating with top executives of A-share firms.

It is appropriate to assume that ownership structure has an immediate effect on firm value (Morck, Shleifer, and Vishny, 1988; McConnell and Servaes, 1990). CSRC’s motivation for the split-share structure reform was to revive China’s stock market by converging the interests of the two separated shareholder classes. Agency difficulties caused by the split-share structure were expected to be alleviated significantly after the reform. The improvement of the corporate governance structure would be recognized by investors in an efficient market. Here we offer our second hypothesis: Proxies of agency difficulties caused by the split-share structure explain the cross section of the reform CARs. This share-structure hypothesis is consistent with the convergence-of-interests hypothesis in the finance literature (Jensen and Meckling, 1976). The latter predicts that firm value increases as managerial equity ownership rises. In our example, a small number of nontradable shareholders control firm management. Within this framework, convergence of interests alleviates agency difficulties by reducing the potential for misallocation of resources, thus enhancing firm value. This hypothesis can be directly tested by stratifying the reform CARs by the value of the agency cost proxy.

If the ownership structure change caused by the reform affects firm value, a term of positive governance change can be incorporated in the equation as
\[
\ln P_{t,\tau} - \ln P_t = \beta_1 \cdot b + \beta_2 \cdot (q/(1-q) - b) + \xi \Delta \text{gov},
\]

where \( \Delta \text{gov} \) denotes the proxy for agency difficulties caused by the split-share structure and \( \xi \) is a coefficient. The third term in equation (4) should equal the present value of the cash flow enhancement that resulted from the reform.

Now, we need to identify an appropriate proxy for the magnitude of agency costs caused by the firm’s split-share structure. The first candidate is ROA because agency costs hamper profitability, \textit{ceteris paribus}. The literature has documented evidence consistent with the hypothesis that firm profitability is negatively related to agency problems (Malatesta and Walkling, 1988; Randøy and Goel, 2003). More specifically, Cronqvist and Nilsson (2003) analyze 309 listed Swedish firms and find ROA significantly lower for firms with concentrated vote control (inducing agency costs). Since ROA is affected by a firm’s industry affiliation, we obtain adjusted ROA by subtracting the industry median from each firm’s ROA. This adjusted ROA, measured as a percentage, is used in further analysis.

Under the split-share structure, a small number of nontradable shareholders control the firm. These shareholders do not have a direct financial interest in boosting the secondary market price of the firm’s tradable shares. If the ownership of nontradable shares is concentrated, the firm’s value enhancement due to convergence is weaker. This contention is consistent with the ownership distribution literature (Fama and Jensen, 1983; DeAngelo and DeAngelo, 1985; Stulz, 1988; Barclay and Holderness, 1989). In particular, Slovin and Sushka (1993) find evidence that the
concentration of insider ownership is negatively related to firm value. Their evidence also suggests that large inside blockholders, who are likely to dominate decision making, are not effective monitoring agents for public shareholders. In the split-share structure setting, their contention implies that large nontradable shareholders may not be effective monitoring agents for public shareholders. In our empirical analysis, we calculate a Herfindahl measure of stock concentration to proxy the concentration of nontradable shares. Herfindahl measures of stock concentration have been used in previous studies such as Demsetz and Lehn (1985), Baysinger, Kosnik, and Turk (1991), and Denis, Denis, and Sarin (1997).

2.3 Overall Price Reaction to Reform

The overall price reaction to the split-share structure reform is a mix of two contrary effects: the negative supply shock effect and a positive ownership structure effect. This price reaction is illustrated in Figure 1, under the framework of a downward-sloping demand curve and a vertical supply curve. \( Q_{t+\tau} \) denotes the effective post-reform tradable share quantity that reflects the instant and distant supply shocks. \( \Delta P_S \) reflects the price decline due to supply shocks. According to our price inelasticity hypothesis, \( \Delta P_S \) is negatively related to the size of supply shock. \( \Delta P_O \) reflects the price increase due to the ownership structure improvement by the reform. Technically, it is calculated from an outward shift of the demand curve given the vertical supply curve at time \( t+\tau \). According to our ownership structure hypothesis, \( \Delta P_O \) is related to the degree of agency difficulty. In our paper, we predict that the degree of agency difficulty is negatively related to ROA. On the other hand, the
Herfindahl measure of nontradable share ownership reflects the agency difficulty caused by concentration of ownership rather than by the split-share structure. Therefore, \( \Delta P_O \) is predicted to be negatively associated with ROA and the Herfindahl measure of nontradable share ownership.

The abnormal return to a tradable share due to the reform is approximately the sum of \( b \) and the price change, \( \Delta P_S + \Delta P_O \). Since the consent of tradable shareholders is a necessary condition for the reform to occur, we expect this abnormal return to be positive. This prediction is supported by the data. However, the overall share price change, \( \Delta P_S + \Delta P_O \), is not necessarily positive.

In summary, the price inelasticity hypothesis and ownership structure hypothesis have opposite price implications in the split-share structure reform. This reform thus offers an ideal setting to test price inelasticity directly without the confounding information effects present in previous studies.

3. Research Methodology

Under the split-share reform, trading was suspended when an A-share firm held special shareholder meetings to vote on the proposed reform and then resumed after the reform had been accepted and declared. In some cases, the reform proposals were disapproved before trading was resumed. The time window of the reform is presented in Figure 2, where day 0 denotes the first trading day after the suspension.

Over the suspension period, we allow a normal expected return to a tradable share. The price equation (4) is thus changed to
\[ \ln P_{t+1} - \ln P_t = \beta_1 \cdot b + \beta_2 \cdot (q/(1-q) - b) + \xi \Delta \text{gov} + E(r_{t+\tau}^{\text{norm}}), \]  
(5)

where \( E(r_{t+\tau}^{\text{norm}}) \) denotes the expected return over the reform period under a typical pricing model as if there is no reform. The cumulative abnormal return rate of one original tradable share has three components:

\[ \text{CAR}_{(t_1, t_2)} \equiv (1 + \beta_1) \cdot b + \beta_2 \cdot (q/(1-q) - b) + \xi \Delta \text{gov}. \]  
(6)

We follow typical event-study methodology in analyzing price change in response to the split-share structure reform. For each trading day other than day 0, the daily return is estimated as \( R_t = P_t / P_{t-1} - 1 \). Provided \( b \) fraction of gift share, the return of the first post-suspension trading day is calculated as \( R_0 = (1+b)P_0 / P_{-1} - 1 \). The cumulative return (CR) for period \((t_1, t_2)\) is equal to the sum of daily returns:

\[ \text{CR}_{(t_1, t_2)} = \sum_{t=t_1}^{t_2} R_t. \]  
(7)

We employ the Fama and French (1993) three-factor model to estimate the normal returns of a reform firm. Daily trading returns of the sample firm in the period \((-180, -21)\) are utilized in fitting the following regression model:

\[ R_t - r_{f,t} = \alpha + \beta_m (R_{m,t} - r_{f,t}) + \beta_{SMB} SMB_t + \beta_{HML} HML_t + \epsilon_t, \]  
(8)

where \( r_{f,t} \) denotes the risk-free rate, \( R_{m,t} \), \( SMB_t \), and \( HML_t \) denote the respective daily returns to the market, small-minus-big, and high-minus-low portfolios, and \( \epsilon_t \) denotes the error term. The intercept, \( \alpha \), is included for generality. The risk-free rate

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\[ 1 + E(r_{t+\tau}^{\text{norm}}) + \text{CAR} = \frac{(1+b)P_{t+\tau}}{P_t} \Rightarrow \text{CAR} \equiv \ln(1+b) + \ln P_{t+\tau} - \ln P_t - E(r_{t+\tau}^{\text{norm}}) \]

\[ = \ln(1+b) + \beta_1 \cdot b + \beta_2 \cdot (q/(1-q) - b) + \xi \Delta \text{gov} \equiv (1 + \beta_1) \cdot b + \beta_2 \cdot (q/(1-q) - b) + \xi \Delta \text{gov} \]
used in the analysis is the holding period return of annual interest rate of one-year maturity set by China’s central bank.

All three simulation portfolios are constructed following Fama and French (1993), rebalanced in January, and weighted by the market value of each firm’s tradable shares. The market portfolio includes all A-share firms. All A-share firms are then grouped into two equal groups by capitalization size (Small, Big). We further divide each size portfolio into three subportfolios by book-to-market ratio (Low, Medium, High). The breakpoints are the bottom 30th percentile and the top 30th percentile. We thus obtain six size-BE/ME portfolios (S/L, S/M, S/H, B/L, B/M, B/H). The daily returns of the SMB and HML portfolios are calculated as follows:

\[
SMB_t = \left( \frac{S/L_t + S/M_t + S/H_t}{3} \right) - \left( \frac{B/L_t + B/M_t + B/H_t}{3} \right),
\]

(9)

and

\[
HML_t = \left( \frac{S/H_t + B/H_t}{2} \right) - \left( \frac{S/L_t + B/L_t}{2} \right).
\]

(10)

Once all coefficients are estimated from regression (8), we estimate the normal return rate of each sample firm at day \( t \):

\[
E(R_t^{\text{norm}}) = \alpha + r_{f,t} + \beta_m (R_{m,t} - r_{f,t}) + \beta_{SMB} SMB_t + \beta_{HML} HML_t.
\]

(11)

The abnormal return rate for day \( t \) is \( AR_t = R_t - E(R_t^{\text{norm}}) \). The cumulative abnormal return (CAR) for period \(( t_1, t_2)\) is set as

\[
CAR_{(t_1, t_2)} = \sum_{t=t_1}^{t_2} (R_t - E(R_t^{\text{norm}})).
\]

(12)
We now turn to empirical analysis.

4. Data and Empirical Results

4.1 Summary of Data

Corporate financial data and data of the split-share structure reform were collected and provided by Wind Info. Market and trading data were obtained from the Tsinghua Financial Database of CCFR. At the end of 2006, there were 1,329 public firms that had been listed for more than one year in China’s A-share market on the Shanghai or Shenzhen stock exchanges. Among them, 1,124 firms completed the split-share structure reform by the end of 2006, the deadline stipulated by CSRC.¹ We set the minimum listing history at one year so the included sample firms would have enough corporate and market data for further analysis. In this sample, we exclude the 58 “ST” firms that were under “special treatment” by CSRC as a result of poor corporate performance. Due to cash shortages and performance failures, the split-share structure reforms of these ST firms were mostly accompanied by simultaneous corporate reorganizations or capital restructuring. We also exclude the eight financial firms in the sample following the convention. Finally, we exclude 162 firms that executed the reform by offering conversion compensation in the form of combinations of gift shares, cash, repurchase, and/or rights. Since this paper directly tests the price inelasticity hypothesis, we limit our analysis to the sample firms where only gift shares were used as conversion compensation in the reform. The final sample (summarized in Table 1) for further analysis includes 896 firms that executed the

¹ A total of 1,139 A-share firms completed the reform by the end of 2006. Among them, 15 did not meet the data requirement.
reform by offering gift shares in lieu of conversion compensation.

We first estimate the abnormal returns of each sample firm under the Fama-French framework. Figure 3 presents the average abnormal returns. On average, the abnormal return, adjusted for Fama-French factors, is about 6.5% in the first post-suspension trading day. The average single-day abnormal returns are generally positive in the 20 days preceding the trading suspension and are barely zero in the 20 days after the first post-suspension trading day. The curve of cumulative abnormal returns moves upward until day 1. It suggests that the market positively responded to the news about the sample firms’ scheduled shareholder voting for the reform. Market price is fully adjusted for the approval of the reform in the first post-suspension trading day. This supports the semi-strong form of EMH in the Chinese A-share market.

Reported in Table 2, $\text{CAR}_{(-10, 10)}$, the CAR of the 21 days around day 0, averages 13.2%, with a median of 10.1% and $t$-statistic of 20.10. Consistent with our initial contention, sample firms accumulated significant, positive abnormal returns over the period in which their split-share structure reforms were completed. We also examine the CARs of alternative time windows. Results in Table 2 show that the CAR statistics under alternative time windows are consistent. We will use $\text{CAR}_{(-10, 10)}$ in further analysis. Descriptive statistics of $\text{CAR}_{(-10, 10)}$, $\text{CR}_{(-10, 10)}$, and other key variables are reported in Table 3. On average, each tradable share was compensated with a 0.571 gift share. The distant supply shock, $q/(l-q)-b$, is averaged at 1.224 times the existing tradable shares. These gift shares represent a substantial supply increase to the public.
market that may have had a significant impact on market price.

4.2 Distribution of CARs across Size of Supply Shock, ROA, and Ownership Concentration

The two key hypotheses to test in this paper are the price inelasticity and the ownership structure impact on firm value. We first examine the distribution of CARs in two dimensions: the supply shock measured by conversion size $q/(1-q)$ and a proxy for ownership structure impact. We first break the sample firms into three groups by conversion size. The breakpoints are the bottom 30\textsuperscript{th} percentile and the top 30\textsuperscript{th} percentile. So the three groups contain the bottom 30\%, mid 40\%, and top 30\% of the sample firms, respectively. In each group we break the firms into three subgroups by adjusted ROA. The breakpoints are the bottom 30\textsuperscript{th} percentile and the top 30\textsuperscript{th} percentile. By construction, reported in Panel A of Table 4, the large $q/(1-q)$-high ROA subgroup includes 9\% of sample firms. From Panel A, we observe that CARs monotonically decrease with the size of supply shock, $q/(1-q)$, controlling for adjusted ROA; CARs monotonically decrease with adjusted ROA, controlling for $q/(1-q)$. The subgroup of small $q/(1-q)$-low ROA experienced the highest average CAR of 0.186. In contrast, the subgroup of big $q/(1-q)$-high ROA experienced the lowest average CAR of 0.082. The negative relation between CARs and $q/(1-q)$ lends intuitive support for a downward-sloping demand curve.\footnote{Figure 3 and Table 2 show that the positive abnormal returns related to the reform is not reversed in the 4 weeks following the suspension. This suggests that the negative price impact by supply shock is not due to temporary price pressure (e.g., Elliott and Warr, 2003).} On the other hand, the negative relation between CAR and adjusted ROA supports the hypothesis that sample firms with lower profitability can benefit more from the ownership structure improvement.
For a robustness check, we use the Herfindahl measure of nontradable share ownership as an alternative proxy for the ownership structure impact on stock price. The five largest owners of nontradable shares were disclosed by the A-share firms. For the 896 sample firms, the average ownership of the five largest nontradable shareholders is 1.379% of all outstanding shares, while the lower quartile is 0.041%, a relatively insignificant number. This implies that the five largest nontradable shareholders own most of the nontradable shares—in this case, about two-thirds of outstanding shares. We calculate the Herfindahl measure of the five largest nontradable share ownerships. This measure should capture the concentration of the nontradable share ownerships.

We group the sample firms following the same stratification method stated above and report the two-dimension stratification in Panel B of Table 4. The results show that CARs monotonically decrease with \( q/(1-q) \), controlling for the Herfindahl measure, and vice versa. This stratification is consistent with the results in Panel A. In addition to supporting our price inelasticity hypothesis, it also suggests that agency difficulty is alleviated to a lesser degree by split-share structure reform in firms with more concentrated nontradable share ownership (that is, a high Herfindahl measure).

4.3 Regression Results

In this section, we run regressions on CARs in line with equation (6) and report the results in Panel A, Table 5. An intercept is included in the OLS regressions for the

\[ \text{Herfindahl} = \sum_{i=1}^{5} \text{ownership}_i \], where \( \text{ownership}_i \) denotes the fraction of outstanding shares owned by \( i \) of the five largest nontradable shareholders.
sake of generality. The literature has established that firm size is an important characteristic in terms of firm valuation (Fama and French, 1993). So we include firm size in all regressions as an explanatory variable. To address misspecification due to omitted variables, each regression includes industry effect dummy variables for industry affiliation (see Altınkılıç and Hansen, 2003).\(^9\) In regression A, the size of distant supply shock, \(q/(1-q)-b\), is negatively related to CAR. The estimate of its coefficient, \(\beta_2\), is -5.872, significant at the 1% confidence level. The coefficient of adjusted ROA is estimated as -0.417, also significant at the 1% level. Both estimates provide strong support for our two key hypotheses. Interestingly, the coefficient estimate of conversion compensation is insignificant from zero. In equation (6), the coefficient associated with conversion compensation \(b\) is \((1+\beta_1)\). The \(t\)-test cannot meaningfully reject that the true value of the estimate of \((1+\beta_1)\) is zero. Equivalently, the \(t\)-test cannot reject the null hypothesis that \(\beta_1\) is equal to -1. A direct implication is that the marginal price decline for 1% of supply shock is -1%. The nontradable shareholders paid \(b\) nontradable share to each tradable share for the tradability of their remaining shares. These gift shares increased the number of shares owned by tradable shareholders by the fraction of \(b\). They also hampered the share price by the fraction of \(b\). Therefore, these gift shares did not significantly contribute to the CAR of tradable shareholders. This suggests that nontradable shareholders did not overpay for their share conversion.

\(^9\) We follow the industry group classification defined by CSRC. There are twelve primary industry groups among the 896 sample firms: mining, media and cultural, utilities, real estate, construction, transportation, agricultural and fishery, trade, social services, information technology, manufacturing, and multi-industrial. Every industry effect is captured by a zero-one dummy variable, except for multi-industrial, which is set as the default industry effect.
In regression B, the Herfindahl measure of nontradable share ownership is negatively related to CAR at the 5% confidence level, controlling for the supply shock size. This result is consistent with our contention that concentrated nontradable share ownership hampers firm value. However, when both the Herfindahl measure and ROA are included in the regression (see regression (C)), the ROA retains significance, while the Herfindahl measure is no longer significant at the conventional level. This suggests that the adjusted ROA, firm performance, has a direct connection with the degree of agency difficulty caused by the split-share structure. When this agency difficulty is alleviated by the reform, firm value is boosted. The increase of firm value is a decreasing function of the ROA (or, say, agency difficulty). On the other hand, the concentration of nontradable share ownership is related to the firm’s sustaining agency difficulty, that is not likely to be alleviated by the split-share structure reform. The higher the concentration (greater sustaining agency difficulty), the lower the increase in firm value realized by the split-share structure reform. The results in regression (C) suggest that the adjusted ROA is more informative than the Herfindahl measure of the ownership concentration.

In each of the three regressions, the coefficient of the size of distant supply shock, $q/(1-q)-b$, is negative at the conventional significance level. The null hypothesis of the negative sign of the coefficient of $b$ cannot be meaningfully denied by the $t$-test. Therefore, the market distinguished the price impacts of the instant supply shock caused by the gift shares and the distant supply shock caused by the conversion of remaining nontradable shares. These results, obtained controlling for ROA, the
concentration of nontradable share ownership, and firm size, support our price inelasticity hypothesis. They are also consistent with the negative association of CAR and size of supply shock reported in Table 4.

4.4 Robustness Checks

The preceding regressions are applied on the CARs, adjusted for the three Fama-French factors. To check the robustness of these regressions, we run the same regressions on the raw CARs and report the results in Panel B, Table 5. In all three regressions, the coefficients for the distant supply shock, \( q/(1-q)-b \), are negative at the conventional significance level. This is consistent with the results in Panel A. The coefficients of the adjusted ROA and Herfindahl measure retain the same sign but are no longer significant. The coefficient of firm size is positive and significant at the 5% level in each regression. This suggests that corporate governance of larger firms is expected by investors to improve more after the reform. This is consistent with our initial contention that the ownership structure change caused by the reform should provide greater benefits to firms with higher agency costs. Intuitively, agency costs increase with firm size (see e.g. Aron, 1988). The positive relation between agency costs and firm size is implied in the pioneering theoretical work by Jensen and Meckling (1976) and empirically supported by Ang, Cole, and Lin (2000), and Harvey, Lins, and Roper (2004).

The results reported in Tables 5 suggest that the firm size effect on CARs due to the reform is well captured by the Fama-French framework. The price impact of
ownership structure is captured by the adjusted ROA after controlling for firm size. Overall, the negative price impact of the supply shock is significant after controlling for firm size, ownership concentration, and firm profitability.

To test the sensitivity of the choice of time window, we apply the same regression analysis to CARs under alternative time windows of (-20, 20), (-5, 5), and (-5, 10), respectively. The results are essentially consistent with the results reported in Table 5.

4.5 Economic Significance and Implications

As reported in Table 3, the mean (median) distant supply increase, $q/(1-q)-b$, is 1.224 (1.162) shares per tradable share. Multiplied by the coefficient estimated for the supply shock in regression (C) of Table 5, this is translated to an average (median) CAR impact of 6.33% (6.01%). The average (median) compensation, $b$, is 0.571 (0.533) per tradable share. So the average price impact of the distant supply shock of 1.224 shares per tradable share is approximately 63%. That is, the price of a tradable share would on average decline 63% in response to the increased, locked supply of converted shares, other things being the same. The average capitalization of all tradable shares of the sample firms on day -11 was ¥695 million. So the marginal supply shock price impact was valued by investors at ¥438 million per sample firm, and ¥392 billion in total. This finding has important implications for firm value creation in terms of controlling the supply of shares. It also suggests that appraisers and experts consider price inelasticity in evaluating the value of assets in litigations.

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10 This amount is about USD49 billion, provided exchange rate of $1=¥8 in 2006.
Establishing evidence of price inelasticity has further implications for theoretic development in optimal capital structure and dividend policy (See Scholes, 1972).

5. Summary

In 2005 and 2006, most public firms listed in China’s A-share market completed the split-share structure reform under the guidance of the China Securities Regulatory Commission. All nontradable shares, consisting of about two-thirds of outstanding shares, were converted to tradable shares. The conversion of nontradable shares imparted a drastic supply shock to the public market. Studying this unique event, we provide direct evidence that supports an inelastic demand curve for stocks. Abnormal returns of the sample firms due to the reform are found to be negatively associated with the size of supply shock. Further analysis shows that public investors distinguish the instant supply shock caused by the gift shares paid to tradable shareholders and the distant supply shock caused by the converted, locked shares. The evidence of a downward-sloping demand curve for stocks documented in this paper is free from confounding information effects present in most prior studies of stock price elasticity. The findings are robust after controlling for opposite price impacts of ROA, firm size, and nontradable share ownership concentration. The findings are robust after controlling for industry effects and survive a number of other robustness tests.

We also document evidence that ownership structure affects firm value. The cumulative abnormal return over the 21 trading days surrounding the reform averages 13.2% across the sample firms. Proxies of agency difficulty caused by the split-share ownership structure explain the cross-section of the reform CARs.
References


Table 1. Sample Selection
A total of 1,139 A-share firms completed the split-share structure reform by the end of 2006. Among them, 1,124 had at least one year of listing history, which meets the requirement of market and corporate data for the empirical analysis in this paper.

<table>
<thead>
<tr>
<th>Sample Description</th>
<th>Number</th>
<th>% of Full Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full sample: Firms listed for more than one year by the end of 2006</td>
<td>1,329</td>
<td>100</td>
</tr>
<tr>
<td>Firms completing the split-share structure reforms by the end of 2006</td>
<td>1,124</td>
<td>84.6</td>
</tr>
<tr>
<td>Special Treatment firms</td>
<td>58</td>
<td>(4.4)</td>
</tr>
<tr>
<td>Financial firms</td>
<td>8</td>
<td>(0.6)</td>
</tr>
<tr>
<td>Firms paying more than gift shares in lieu of conversion compensation</td>
<td>162</td>
<td>(12.2)</td>
</tr>
<tr>
<td>Selected sample: Firms completing the split-share structure reforms by end of 2006</td>
<td>896</td>
<td>67.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 2. Cumulative Abnormal Returns under Alternative Time Windows
Reported are the mean, median, and $t$-statistics of the cumulative abnormal returns adjusted for the three Fama-French factors of the 896 sample firms under alternative time windows. Day 0 denotes the first trading day after suspension.

<table>
<thead>
<tr>
<th>Time Window (begin, end)</th>
<th>-10, 10</th>
<th>-10, 5</th>
<th>-3, 3</th>
<th>-20, 20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>0.132</td>
<td>0.134</td>
<td>0.078</td>
<td>0.153</td>
</tr>
<tr>
<td>$t$-statistic</td>
<td>20.10**</td>
<td>20.74**</td>
<td>14.15**</td>
<td>19.52**</td>
</tr>
<tr>
<td>Median</td>
<td>0.101</td>
<td>0.104</td>
<td>0.058</td>
<td>0.119</td>
</tr>
</tbody>
</table>

Note: ** denotes significance at the 1% level.
Table 3. Descriptive Statistics of Key Variables
Reported are the means and the first, second, and third quartiles of key variables of the 896 sample firms. CR and CAR, respectively, denote the cumulative return and the cumulative abnormal return under the Fama-French framework for the 21 trading days around the first post-reform trading day. \(b\) denotes the gift share fraction for each tradable share in lieu of conversion compensation. \(q\) is the fraction of each firm’s outstanding shares that were nontradable before the reform. ROA is the return on assets (in percentages) of each sample firm minus its industry median. Herfindahl refers to the Herfindahl measure of the top five ownerships of each sample firm’s nontradable shares. Ln_Assets refers to the logarithm of total assets of each sample firm.

<table>
<thead>
<tr>
<th></th>
<th>CR</th>
<th>CAR</th>
<th>(b)</th>
<th>(q/(1-q)-b)</th>
<th>ROA</th>
<th>Herfindahl</th>
<th>Ln_Assets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>0.198</td>
<td>0.132</td>
<td>0.571</td>
<td>1.224</td>
<td>0.180</td>
<td>0.234</td>
<td>21.28</td>
</tr>
<tr>
<td>1\text{st} Quartile</td>
<td>0.056</td>
<td>0.025</td>
<td>0.367</td>
<td>0.849</td>
<td>-1.637</td>
<td>0.120</td>
<td>20.67</td>
</tr>
<tr>
<td>Median</td>
<td>0.163</td>
<td>0.101</td>
<td>0.533</td>
<td>1.162</td>
<td>-0.001</td>
<td>0.205</td>
<td>21.23</td>
</tr>
<tr>
<td>3\text{rd} Quartile</td>
<td>0.305</td>
<td>0.228</td>
<td>0.736</td>
<td>1.533</td>
<td>2.197</td>
<td>0.333</td>
<td>21.83</td>
</tr>
</tbody>
</table>
Table 4. Distribution of CAR in Two Dimensions
All 896 sample firms are divided into 3×3 groups by $q/(1-q)$ and adjusted ROA in panel A, and by $q/(1-q)$ and Herfindahl measure of nontradable share ownership in panel B. The breakpoints are the top 30\textsuperscript{th} and bottom 30\textsuperscript{th} percentiles. Reported are average CARs adjusted for the three Fama-French factors.

<table>
<thead>
<tr>
<th></th>
<th>Large $q/(1-q)$ (top 30%)</th>
<th>Medium $q/(1-q)$ (mid 40%)</th>
<th>Small $q/(1-q)$ (bottom 30%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>High ROA (top 30%)</td>
<td>0.082</td>
<td>0.087</td>
<td>0.155</td>
</tr>
<tr>
<td>Medium ROA (mid 40%)</td>
<td>0.122</td>
<td>0.126</td>
<td>0.169</td>
</tr>
<tr>
<td>Low ROA (bottom 30%)</td>
<td>0.127</td>
<td>0.161</td>
<td>0.186</td>
</tr>
<tr>
<td>High Herfindahl (top 30%)</td>
<td>0.087</td>
<td>0.111</td>
<td>0.167</td>
</tr>
<tr>
<td>Medium Herfindahl (mid 40%)</td>
<td>0.119</td>
<td>0.125</td>
<td>0.176</td>
</tr>
<tr>
<td>Low Herfindahl (bottom 30%)</td>
<td>0.118</td>
<td>0.134</td>
<td>0.187</td>
</tr>
</tbody>
</table>
Table 5. Regression Results

In the regressions in Panel A, the dependent variable is the cumulative abnormal return (in percentage) of each stock over the reform period adjusted for the three Fama-French factors. In Panel B, the dependent variable is the cumulative return of each stock (in percentage) over the reform period. The number of observations in all regressions is 896. \( b \) denotes the gift share fraction for each tradable share in lieu of conversion compensation. \( q \) is the fraction of each firm’s outstanding shares that were nontradable before the reform. ROA is the return on assets (in percentage) of each sample firm minus its industry median. Herfindahl refers to the Herfindahl measure of the top five ownerships of each sample firm’s nontradable shares. Ln_Assets refers to the logarithm of total assets of each sample firm. Industry effects are zero-one dummy variables for industry group, whose coefficient estimates are not reported. Reported in parentheses are the \( t \)-statistics.

### Panel A. Regressions on Cumulative Abnormal Returns

<table>
<thead>
<tr>
<th>Intercept</th>
<th>( b )</th>
<th>( q/(1-q)\cdot b )</th>
<th>ROA</th>
<th>Herfindahl</th>
<th>Ln_Assets</th>
<th>Industry Effects</th>
<th>adj. ( R^2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A)</td>
<td>2.937</td>
<td>3.969</td>
<td>-5.872</td>
<td>-0.417</td>
<td>0.776</td>
<td>yes</td>
<td>2.9%</td>
</tr>
<tr>
<td></td>
<td>(0.180)</td>
<td>(1.208)</td>
<td>(-2.531)**</td>
<td>(-2.717)**</td>
<td>(1.035)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(B)</td>
<td>-5.835</td>
<td>6.210</td>
<td>-6.343</td>
<td>-12.757</td>
<td>1.230</td>
<td>yes</td>
<td>2.6%</td>
</tr>
<tr>
<td></td>
<td>(-0.346)</td>
<td>(1.895)</td>
<td>(-2.752)**</td>
<td>(-2.171)*</td>
<td>(1.581)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(C)</td>
<td>-5.061</td>
<td>4.844</td>
<td>-5.171</td>
<td>-0.394</td>
<td>-11.647</td>
<td>yes</td>
<td>3.2%</td>
</tr>
<tr>
<td></td>
<td>(-0.301)</td>
<td>(1.463)</td>
<td>(-2.207)*</td>
<td>(-2.568)**</td>
<td>(-1.983)*</td>
<td>(1.518)</td>
<td></td>
</tr>
</tbody>
</table>

### Panel B. Regressions on Cumulative Returns

<table>
<thead>
<tr>
<th>Intercept</th>
<th>( b )</th>
<th>( q/(1-q)\cdot b )</th>
<th>ROA</th>
<th>Herfindahl</th>
<th>Ln_Assets</th>
<th>Industry Effects</th>
<th>adj. ( R^2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A)</td>
<td>-10.945</td>
<td>3.727</td>
<td>-5.681</td>
<td>-0.275</td>
<td>1.685</td>
<td>yes</td>
<td>2.0%</td>
</tr>
<tr>
<td></td>
<td>(-0.607)</td>
<td>(1.028)</td>
<td>(-2.220)*</td>
<td>(-1.625)</td>
<td>(2.035)*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(B)</td>
<td>-19.579</td>
<td>5.491</td>
<td>-5.717</td>
<td>-12.563</td>
<td>2.127</td>
<td>yes</td>
<td>2.1%</td>
</tr>
<tr>
<td></td>
<td>(-1.056)</td>
<td>(1.521)</td>
<td>(-2.253)*</td>
<td>(-1.942)</td>
<td>(2.483)*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(C)</td>
<td>-19.084</td>
<td>4.617</td>
<td>-4.967</td>
<td>-0.252</td>
<td>-11.853</td>
<td>yes</td>
<td>2.3%</td>
</tr>
<tr>
<td></td>
<td>(-1.030)</td>
<td>(1.264)</td>
<td>(-2.153)*</td>
<td>(-1.488)</td>
<td>(-1.829)</td>
<td>(2.444)*</td>
<td></td>
</tr>
</tbody>
</table>

Note: * and ** denote significance levels of 5% and 1%, respectively.
Figure 1. Price Reaction to Reform

\[ P_t, \quad P_{t+\tau}, \quad \Delta P_s, \quad \Delta P_o, \quad D_t, \quad D_{t+\tau} \]
**Figure 2.** Time Window of the Split-share Structure Reform

<table>
<thead>
<tr>
<th>Pre-suspension Trading</th>
<th>Shareholders vote on reform proposal.</th>
<th>Post-suspension Trading</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trading Suspension</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day (-m)</td>
<td>Day (-1)</td>
<td>Day 0</td>
</tr>
</tbody>
</table>
Figure 3. Cumulative Abnormal Returns (CAR) and Abnormal Returns (AR) adjusted for Fama-French Factors