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Has the difference in stock liquidity and stock returns between Chinese state owned and privately owned enterprises become smaller?

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ABSTRACT

This paper contrasts the stock liquidity and stock returns between Chinese state owned enterprises (SOEs) and privately owned enterprises (POEs) before and after the split-share structure reform initiated in 2005. This reform converted a huge volume of non-tradable shares into tradable shares and opened the gate to further privatization of Chinese SOEs. We find the liquidity of SOE stocks was higher than the liquidity of POE stocks before the reform, but their liquidity increased significantly to reach the same level after the reform. Since higher liquidity facilitates arbitrage trading, we hypothesize that arbitrage gains across SOE and POE stocks should shrink after the reform. Consistent with our hypothesis, we find that SOE stock returns stochastically dominated POE stock returns before the reform, but there was no dominance relationship between them after the reform.

1. Introduction

Before China's economic reform in 1978 from a centrally planned to a market-oriented economy, most Chinese enterprises were state owned enterprises (SOEs). The 1978 reform, together with a series of other reforms, provided more power and incentives to Chinese enterprises, which eventually evolved into a fundamental change in ownership of the enterprises. Many financially plagued SOEs were privatized and more privately owned enterprises (POEs) emerged and started to compete with the SOEs.

As a strategy to reform SOEs, the Shanghai and Shenzhen stock exchanges were established in the early 1990s to provide a platform for share issue privatization (SIP) of SOEs. However, when SOEs went public, they could issue only minority tradable shares (TS) to institutional and individual investors; the Chinese government retained its control by holding dominant non-tradable shares (NTS) that were not allowed to be traded in the secondary market (Li and Yamada, 2015). The split-share structure was thus established during SIP. At the beginning of 2005, approximately two-thirds of the Chinese stock market comprised NTS and 74% of the NTS were state-owned (Liao et al., 2014). The split-share structure created serious problems for Chinese listed firms and the Chinese stock market. In 2005, a split-share structure reform (SSSR) was initiated to dismantle the split-share structure of both SOEs and POEs by converting their NTS into TS. This reform was simultaneously carried out on SOEs and POEs with a split-share structure. For POEs, the reform dismantled the split-share structure. For SOEs, the reform additionally removed the legal and technical obstacles to transferring their state-owned shares to public investors, which led to the expectation of further privatization and opened the gate

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to further privatization of Chinese SOEs (Liao et al., 2014).[1]

A few studies have compared the impact of the SSSR on SOEs and POEs. Liao et al. (2014) find that the output, profit, and employment of listed Chinese firms substantially increased after the reform, but much more so for SOEs. They also find that SSSR improved the corporate governance of SOEs and POEs, but there is no consistent evidence showing SOEs experienced greater improvement in corporate governance than POEs. Tsai et al. (2015) report that multiple large shareholders in POEs can monitor the controlling shareholders, which reduces the POEs' leverage ratio after SSSR. In contrast, multiple large shareholders can collude with controlling shareholders in SOEs to expropriate through debt financing, which increases SOEs' leverage ratio after SSSR. Tan et al. (2015) compare the effect of SSSR on firms' innovation output. Their analysis demonstrates a larger increase in the innovation output of SOEs than of POEs after SSSR. Recently, Huang (2017) finds controlling shareholders' tunneling activities after SSSR were significantly reduced in both SOEs and POEs.

Although previous studies compared the impact of SSSR on the SOEs and POEs, to the best of our knowledge, there is no research directly looking at their stocks before and after SSSR. This paper aims to extend the literature by analyzing two important concerns of investors, i.e., stock liquidity and stock returns, of SOEs and POEs before and after SSSR. Since this reform converted a huge volume of NTS to TS in SOEs and POEs, we therefore expect that the liquidity of both SOE and POE stocks could significantly increase after the reform. Consistent with our expectation, we find that the liquidity of SOE and POE stocks increased significantly after SSSR. Many researchers (e.g., Chordia et al., 2008; Chung and Hrazdil, 2010) find that higher liquidity facilitates arbitrage trading, which enhances market efficiency. We therefore hypothesize that the arbitrage gains across SOE and POE stocks should reduce after SSSR. To test this hypothesis, we adopt a stochastic dominance (SD) approach to examine the dominance relationship between SOE and POE stock returns before, during and after SSSR. The SD approach is superior and less restrictive than traditional methods of stock evaluation, such as the mean–variance (MV) criterion (Markowitz, 1952) and the capital asset pricing model (CAPM) statistics (Jensen, 1969; Sharpe, 1964; Treynor, 1965).[2] Consistent with our hypothesis, we find the returns of SOE stocks stochastically dominated the returns of POE stocks before the reform, but there is no dominance relationship during and after the reform.

The rest of our paper is organized as follows. Section 2 reviews the problems of the split share structure and its reform in 2005. Section 3 describes the data. Section 4 introduces our methodology. Section 5 analyzes the empirical findings and Section 6 concludes the paper.

2. Review of the split-share structure reform

The split-share structure caused serious agency problems for the corporate governance of Chinese listed firms and hindered the development of the Chinese stock market. On one hand, NTS holders were relatively indifferent to stock price movements because of the impossibility of selling their shares. On the other hand, although TS holders cared about stock price movements, they had limited ability to monitor and affect the management decisions of listed firms. Consequently, controlling NTS holders could easily exploit minority TS holders (Liao et al., 2014). In addition, the small public float of listed firms decreased stock market liquidity and reduced merger and acquisition activity among Chinese listed firms (Firth et al., 2010; Liao et al., 2014).

The Chinese government gradually recognized the serious problems associated with the split-share structure. On January 31, 2004, the State Council issued Some Opinions of the State Council on Promoting the Reform, Opening and Steady Growth of Capital Markets as a blueprint for SSSR. On April 29, 2005, the Chinese Securities Regulatory Commission (CSRC) announced a reform aimed at dismantling the split-share structure and converting all NTS to TS. In May 2005, the Shanghai and Shenzhen stock exchanges issued *Operation Instructions on the Pilot Program of Non-Tradable Share Reform in Listed Companies*, which formally launched the reform. The reform was supervised and guided by the CSRC, the State-Owned Assets Supervision and Administration Commission of the State Council (SASAC), and the Ministry of Finance (MOF). The reform adopted the strategy of forcing NTS holders to pay negotiated compensation to TS holders in exchange for the right to sell their shares. The compensation could be paid in cash, stock, stock options, or warrants. To encourage listed firms to participate in this reform, the CSRC imposed this reform as a prerequisite for seasoned equity offerings. In September 2005, all A-share firms participated in the reform and, by the end of December 2007, 1254 firms representing over 97% of the Chinese A-share market capitalization at the time, had completed the reform (Li et al., 2011).

3. Data

We collected data on shareholder identity from the CSMAR database, which has provided shareholder data for Chinese listed companies since 2003. Our sample starts in January 2003 and ends in December 2013. Consistent with the literature (e.g., Liao et al., 2014), we classify a firm as an SOE by checking whether its ultimate controller is central or local government and POE, otherwise.[3] We exclude special treatment (ST) firms and firms whose relevant data are incomplete or cannot be acquired. We then compute the value-weighted returns of SOE and POE portfolios for our SD test. Table 1 displays the basic statistics of the daily stock returns of SOEs and POEs. It shows that there is no significant difference between the means and variances of the stock returns of SOEs and

[1] Section 2 details the problems caused by the split-share structure and the 2005 split-share structure reform.

[2] For example, the MV criterion and CAPM statistics rely on the assumptions of a normal distribution and quadratic utility functions; but the SD approach can accommodate any distribution and a wide range of underlying utility functions. In addition, the MV criterion depends only on the first two moments of return distribution (i.e., the mean and variance). Thus, using the MV criterion misses important information contained in higher moments (i.e., skewness, kurtosis, etc.). Since the SD approach uses the entire return distribution, it is superior to the MV criterion for analyzing investment decision-making under uncertainty.

[3] Please refer to Liao et al. (2014) for detailed information.

Table 1
Summary statistics of daily stock returns of Chinese SOEs and POEs.

This table reports the summary statistics of daily stock returns of Chinese SOEs and POEs for the pre-reform, reform and post-reform periods. SOEs are defined as firms for which the ultimate controllers are either central or local government; otherwise, firms are defined as POEs. Jarque–Bera is a normality test statistic with the null hypothesis of normally distributed stock returns. The *t*-test for equality in mean is for testing whether there is a significant difference between the means of the stock returns of SOEs and POEs. The *F*-test for equality in variance is for testing whether there is a significant difference between the variances of the stock returns of SOEs and POEs. The numbers in parentheses are *p*-values. *** indicate significance at the 1% level, respectively.

	SOEs Pre-reform	POEs	SOEs Reform	POEs	SOEs Post-reform	POEs
Mean	−0.000	−0.001	0.001	0.002	−0.001	0.000
Median	−0.001	−0.001	0.005	0.005	−0.000	0.001
Max.	0.079	0.076	0.094	0.094	0.058	0.052
Min.	−0.046	−0.059	−0.094	−0.092	−0.063	−0.062
Std. dev.	0.013	0.014	0.027	0.027	0.014	0.014
Skewness	0.727	0.476	−0.576	−0.642	−0.161	−0.271
Kurtosis	5.480	5.061	4.217	4.241	4.070	3.760
Jarque–Bera	225.416***	140.689***	84.021***	95.359***	35.332***	24.631***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
t-test for equality in mean (*p*-value)	0.542		−0.171		−0.265	
	(0.588)		(0.865)		(0.791)	
F-test for equality in variance (*p*-value)	1.115		1.019		1.046	
	(0.163)		(0.801)		(0.562)	

POEs. Since employing the MV criterion results in missing important information contained in higher moments, we need to adopt the SD approach.[4]

4. Methodology

Let F and G be the cumulative distribution functions (CDFs), and f and g be the corresponding probability density functions (PDFs) of two investments X and Y (i.e., the stock returns of SOEs and POEs in this study), respectively, with common support $[a, b]$ where $a < b$. We define:

$$H_0 = h, \quad H_j(x) = \int_a^x H_{j-1}(t)dt \tag{1}$$

for $h = f, g$; $H = F, G$; and $j = 1, 2, 3$. We call the integral H_j the j th order cumulative distribution function (CDF) for $H = F, G$ and for $j = 1, 2$ and 3.

The most commonly used SD rules associated with three broadly defined utility functions are first-, second-, and third-order SD for risk-averse investors, denoted as FSD, SSD, and TSD, respectively. A hierarchical relationship exists in SD: FSD implies SSD, which in turn implies TSD. However, the converse is not true. Jarrow (1986) and Falk and Levy (1989) claim that, under FSD, investors increase their wealth and expected utility when they switch from holding the dominated asset to the dominant one; under SSD, this switch increases risk-averse investors' expected utility; under TSD, this switch increases the expected utility of risk-averse investors possessing decreasing absolute risk aversion (DARA). In addition, SD provides a way to test whether a stock market is efficient. Specifically, confirmation of the dominance relationship implies the existence of arbitrage gains in wealth or expected utility across the dominant and dominated stocks, suggesting the market is not efficient (e.g., Jarrow, 1986; Falk and Levy, 1989; Wong et al., 2008).

In this study, we adopt the SD test proposed by Linton et al. (2005) (hereafter the LMW test) to examine the existence of arbitrage gains across SOE and POE stocks before, during and after SSSR. One advantage of the LMW test over other SD tests (e.g., Davidson and Duclos, 2000; Barrett and Donald, 2003; Bai et al., 2015) is that this test is well suited to financial data because it does not require the data to be identically and independently distributed (i.i.d.). In particular, the LMW test is well suited to financial time series that exhibit dependence, such as GARCH or stochastic volatility and serial correlations (Fong, 2010).[5]

The LMW test is based on subsampling and its test statistic is:

$$T_j = \sup_x \sqrt{N}\,[\widehat{F}_j(x) - \widehat{G}_j(x)] \tag{2}$$

where N is the sample size, $\widehat{H}_j(x) = \frac{1}{N(j-1)!}\sum_{i=1}^{N}(x - z_i)_+^{j-1}$, $H = F, G$, $j = 1, 2$ and 3.

The LMW test shows that the asymptotic null distribution of this statistic is non-standard. Linton et al. (2005) propose using

[4] The Jarque–Bera statistics indicate that neither the SOE nor POE portfolio returns are normally distributed, which suggests that the SD approach used in this study is more suitable than the traditional MV criterion and CAPM statistics in evaluating the SOE and POE stocks.

[5] We also performed the Brock, Dechert, Scheinkman (BDS) test (Brock et al., 1996), which essentially tests for deviations from i.i.d. behavior in portfolio returns. We find that all portfolio return series are non-i.i.d, which highlights the importance of using the LMW SD test instead of other SD tests in this study. To save space, we do not report the results, but they are available upon request.

Table 2
Liquidity of Chinese SOEs and POEs.

This table reports Amihud (2002) liquidity measures for SOEs and POEs for the pre-reform, reform and post-reform periods. We use the natural logarithm of the Amihud (2002) measure of liquidity calculated as $liquidity_{i,t} = \log\left(\frac{\text{trading volume in million RMB}_{i,t}}{|return_{i,t}|}\right)$, where $return_{i,t}$ is daily stock return in percentage points calculated as the difference between closing prices on day t and $t-1$ scaled by closing prices on day $t-1$, multiplied by 100. Every year for each firm, we calculate the liquidity measure on every trading day and take the median value during the year as the measure of stock market liquidity for the firm. SOEs are defined as firms for which the ultimate controllers are either central or local government; otherwise, firms are defined as POEs. *** indicate significance at the 1% level, respectively.

	SOEs	POEs	Difference between SOEs and POEs	*t*-statistics (*p*-value)
Pre-reform	1.400	1.190	0.210	4.056 *** (0.000)
Reform	2.751	2.584	0.167	4.390*** (0.000)
Post-reform	3.301	3.250	0.051	1.390 (0.165)
Difference between post- and pre-reform	1.901	2.060		
t-statistics (*p*-value)	50.163*** (0.000)	39.182*** (0.000)		

subsampling bootstrap simulations to compute the empirical *p*-values of the test. The subsampling method requires computing $(N - b + 1)$ times the following test statistic for a subsample of size b such that:

$$T_{j,i} = \sup_x \sqrt{b}\,[\widehat{F}_{j,i}(x) - \widehat{G}_{j,i}(x)] \text{ for } i = 1, 2, \ldots, N - b + 1 \tag{3}$$

The distribution of this subsample test statistic is then used to approximate the distribution of Eq. (2). Since each subsample taken without replacement is, in fact, a sample of size b from the true sampling distribution of the original data, the procedure has the asymptotically correct size (Theorem 2, Linton et al. (2005)). In addition, by sampling blocks of observations (rather than individual observations), the procedure allows for general dependence in the data. Let $\widehat{p}_j$ denote the corresponding empirical *p*-value. We reject the null hypothesis at the α significance level if:

$$\widehat{p}_j = \frac{1}{N - b + 1} \sum_{i=1}^{N-b+1} 1(T_{j,i} - T_j > 0) < \alpha. \tag{4}$$

Specifically, the following two sets of null and alternative hypotheses are tested:

$$\begin{aligned} &H_{0j}\colon F_j(x_i) \le G_j(x_i) \text{ for all } x; \text{and} \\ &H_{1j}\colon F_j(x_i) > G_j(x_i) \text{ for some } x \end{aligned} \tag{5}$$

$$\begin{aligned} &H'_{0j}\colon G_j(x_i) \le F_j(x_i) \text{ for all } x; \text{and} \\ &H'_{1j}\colon G_j(x_i) > F_j(x_i) \text{ for some } x \end{aligned} \tag{6}$$

for $j = 1$, 2 and 3, the null hypothesis of H_{0j} states that SOE stock returns dominate POE stock returns (not strictly) at order j, denoted by $F \succeq_j G$; while the null hypothesis of H'_{0j}states that POE stock returns dominate SOE stock returns (not strictly) at order j, denoted by $G \succeq_j F$. The alternative hypothesis is that the SD relationship fails at some points.

5. Results

To obtain information about the liquidity of SOE and POE stocks, we compute the natural logarithm of the Amihud (2002) measure of liquidity, $liquidity_{i,t} = \log\left(\frac{\text{trading volume in million RMB}_{i,t}}{|return_{i,t}|}\right)$, where $return_{i,t}$ is the daily stock return in percentage points. We then calculate the average liquidity of SOE and POE stocks before, during and after SSSR, respectively.[6] Table 2 shows that before the reform the liquidity of SOE stocks was higher than that of POE stocks. This may be because SOEs dominated the Chinese economy and thus attracted much attention from investors before SSSR. Table 2 also shows that the liquidity of SOE and POE stocks increased significantly to reach the same level after the reform. This is a reasonable finding because SSSR converted a huge volume of NTS into TS, and POEs became more and more important in the Chinese economy.

[6] We also calculated the liquidity of SOEs and POEs one year and two years before and after the reform. The results are qualitatively same as reported in Table 2. In addition, as a robustness test, we calculated both daily and monthly trading volume, which is measured by the natural logarithm of value of shares traded (in million RMB) (Brennan et al., 1998), for SOE and POE stocks. The findings are consistent with Table 2. For example, before the reform, the average monthly trading volume of SOEs is 4.835, which is significantly higher than that of POEs (4.676). After the reform, the average monthly trading volume of SOEs and POEs increase to 6.713 and 6.691, respectively, which are not significantly different. To save space, we do not report the detailed results here, but they are available upon request.

Table 3
LMW SD test results for Chinese SOEs and POEs.

This table reports the median of subsampling *p*-values of the LMW SD test (Linton et al., 2005) between value-weighted returns of SOEs and POEs for two null hypotheses: H_{0j}: $F \succeq_j G$ and H_{0j}: $G \succeq_j F$, here $j = 1$, 2 and 3. *F* and *G* are the CDFs of the stock returns of SOEs and POEs, respectively. The null hypothesis of H_{0j}states that SOE stock returns dominate POE stock returns (not strictly) at order *j*; while the null hypothesis of H'_{0j} states that POE stock returns dominate SOE stock returns (not strictly) at order *j*. FSD, SSD, and TSD stand for the first-, second-, and third-order SD for risk-averse investors, respectively. SOEs are defined as firms for which the ultimate controllers are either central or local government; otherwise, firms are defined as POEs. We follow Cho et al. (2007) to set the subsample of size *b* to range of $N^{0.3} \sim N^{0.7}$, where *N* is the sample size. For each *b*, we form a sequence of 20 equally spaced subsamples to compute the *p*-values and draw our statistical inference based on the median value of these simulated *p*-values.

	H_{0j}: $F \succeq_j G$			H'_{0j}: $G \succeq_j F$		
	FSD ($j = 1$)	SSD ($j = 2$)	TSD ($j = 3$)	FSD ($j = 1$)	SSD ($j = 2$)	TSD ($j = 3$)
Pre-reform	0.486	0.995	0.998	0.760	0.006	0.000
Reform	0.368	0.310	0.666	0.885	0.698	0.338
Post-reform	0.160	0.708	0.841	0.941	0.296	0.163

Table 3 presents our LMW test results. First, we analyze the pre-reform period. We find we cannot reject the hypotheses of $F \succeq_1 G$ and $G \succeq_1 F$ (*p*-values are 0.486 and 0.760, respectively), suggesting that SOE and POE stock returns do not dominate each other at FSD. The second- and third-order LMW test results show that we cannot reject the hypotheses of $F \succeq_2 G$ and $F \succeq_3 G$ (*p*-values are 0.995 and 0.998, respectively), but we can reject the hypotheses of $G \succeq_2 F$and $G \succeq_3 F$ (*p*-values are 0.006 and 0.000, respectively). These results indicate that SOE stock returns dominate POE stock returns in the sense of SSD and TSD before SSSR, suggesting that risk-averse investors could increase their expected utility when they switch their investment from POE to SOE stocks. In contrast, for both the reform and post-reform periods, Table 3 shows that the returns of SOE and POE stocks do not dominate each other, suggesting that there is no arbitrage gain in expected utility across SOE and POE stocks. Overall, our results provide strong evidence showing that the arbitrage gain across SOE and POE stocks disappeared (and Chinese stock market became more efficient) after SSSR.

6. Conclusion

The SSSR in 2005 was a watershed event in China's financial liberalization. In this study, we compare the stock liquidity and stock returns between SOEs and POEs before and after SSSR. Our results indicate that the liquidity of SOE and POE stocks increased significantly after SSSR. Since higher liquidity facilitates arbitrage trading, we test the hypothesis that the arbitrage gains across SOE and POE stocks decreased after SSSR by using the SD approach, which studies the entire return distribution. Consistent with our hypothesis, we find that SOE stock returns dominated POE stock returns before SSSR, but there is no dominance relationship between them during and after the SSSR, which enhances Chinese stock market liquidity and opens the gate to further privatization of China's SOEs.

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