

PARENT COMPANY PUZZLE IN JAPAN:
ANOTHER CASE OF THE LIMITS OF ARBITRAGE*

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Abstract

During the internet bubble in the U.S., there were several instances that the market value of a parent firm was less than the market value of its holdings of a publicly traded subsidiary. This parent company puzzle is also observed in Japan. The objective of this paper is to investigate whether this puzzle represents mispricing by the stock market, and, if so, to investigate why the observed mispricing persisted for a long period of time. The results are inconsistent with market efficiency. Because of market frictions, there is no guarantee that distortions in stock prices will always be quickly corrected by arbitrage transactions. Surprisingly, even highly liquid stocks listed on the First Section of the Tokyo Stock Exchange (TSE) can deviate substantially from fundamental values for a long period of time. We suggest these large and persistent price distortions could be attributable to the lack of active arbitrage activity in Japan due to market frictions.

Keywords: limits of arbitrage, anomaly, market frictions

JEL classification: G14, G15

According to the Nikkei Financial Daily of February 5, 2003, Eifuku Master Fund, a hedge fund with estimated total assets under management of \$300 million, went bankrupt due directly to losses on the arbitrage transaction of selling NTT DoCoMo and buying its parent firm, NTT. When the fund sold DoCoMo short and bought NTT long on January 6, 2003, the relative price of DoCoMo was too high compared to the price of NTT which owned more than 50 percent of DoCoMo shares. However, after the fund took the arbitrage position, the stock price disparity between NTT and DoCoMo widened resulting in unsustainable losses to the hedge fund.

I. *Introduction*

A growing number of papers support the finding that identical or nearly identical securities selling in separate markets, sometimes even in the same market but in a different “package,” do not satisfy the law of one price. The plethora of empirical studies on closed-end mutual funds supports this notion. For another example, Gagnon and Karolyi (2003) document that shares of stocks trading simultaneously in different world markets display deviations from parity that can

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be large and persistent.¹ This paper focuses on the price discrepancy that is known as the parent company puzzle: the market value of the parent company is less than the value of the shares owned in its publicly-traded subsidiary. A classic example in the U.S. is the Palm and 3Com companies. In March 2000, 3Com sold about 5 percent of its stake in Palm to the market. Palm's market price was \$95.06 (at end of the first day of trading) while 3Com's market price fell to \$81.81 the same day, despite the fact that a share of 3Com entitled the investor to a claim of 1.5 shares of Palm. According to Lamont and Thaler (2003), this mispricing leads to a "stub value" (the implied value of 3Com's non-Palm assets) of *negative* \$63. Lamont and Thaler suggest that the stock market was saying in effect that the value of 3Com's other businesses were worth a negative \$22 billion!

In Japan, as in the U.S., a small number of firms exhibit this parent company puzzle. For instance, on February 7, 2000, the *Nihon Keizai Shimbun*, a Japanese major financial newspaper, reported a distortion in stock prices whereby the market capitalization of Seven-Eleven Japan Co., Ltd. (subsidiary) and Ito-Yokado Co., Ltd. (parent) became inverted. The opportunity existed to purchase Ito-Yokado for \$36 billion, which automatically included Seven-Eleven's stock, whose market value was \$55 billion.² Here again we find a stub value of negative \$19 billion.

In this paper, we focus on the issue of why arbitrage does not quickly correct the mispricing. In particular, we investigate whether arbitrageurs could obtain abnormal return from hypothetical arbitrage trading both in the stock market and in the corporate acquisition market. The results are consistent with market inefficiency and the limits (or costs) of arbitrage. Due to market frictions, there is no guarantee that distortions in stock prices will always be quickly corrected by arbitrage transactions. As this suggests, even prices of stocks with high liquidity, listed in the First Section of the Tokyo Stock Exchange (TSE), can deviate from fundamental values for a long time.

II. *The Law of One Price and the Parent Company Puzzle*

The notion that two securities with claims to the same cash flows must sell for the same price is a fundamental cornerstone of financial economics: the law of one price. However, financial studies have long documented violations of the law of one price in financial markets. One prime example is the closed-end mutual fund puzzle. The shares of the closed-end funds frequently trade at discounts (sometimes at a premium) to the net asset value of the fund. Many different studies have examined every conceivable market imperfection in attempting to explain the closed-end fund puzzle without overwhelming success. Lee, Shleifer, and Thaler (1991) suggest small investor sentiment as a behavioral explanation for this phenomenon. Regardless the explanation, the question still remains regarding the potential to arbitrage the pricing discrepancies such as purchasing the closed-end fund share and simultaneously selling the fund's portfolio (in the case of a discount) or purchasing the entire discounted fund in the M&A market. Pontiff (1996) examines the limits to arbitrage in the closed-end fund market.

¹ Similarly, Froot and Dabora (1999) show that "twin" stocks whose shares trade in different world markets also display large and persistent price discrepancies.

² \$1 = ¥110, the prevalent yen-dollar exchange rate between 1999 and 2000

Another body of literature documenting violations of the law of one price concerns shares of the same common stock selling in two different countries' stock markets. Early work in the area, such as Kato, Linn, and Schallheim (1991) did not find significant violations of price differentials between American Depository Receipts (ADR) shares (foreign shares sold in the U. S.) and the shares sold in the home market. However, Froot and Dabora (1999) find that "Siamese twin" companies with stocks traded around the world but with the same underlying cash flows appear to violate the law of one price. Gagnon and Karolyi (2003) examine a large sample of American ADRs and their home-market shares and find deviations from parity that usually lie within a band of 15 to 20 basis points, but can be as far apart as 87 percentage points. There are many more examples of price discrepancies in financial markets throughout the world (such as Goetzmann, Spiegel, and Ukhov (2002)). In our study we examine securities displaying price discrepancies in Japan known as the parent company puzzle.

Several papers have recently documented the parent company puzzle. Cornell and Liu (2001), after examining seven cases focusing on tax costs, liquidity, noise trader behavior, and excess demand for subsidiary's stock, concluded that they could not find any reason compatible with market efficiency. They also pointed out that five of the seven companies became acquisition targets with acquisition prices that were set to dissolve the gap. In other words, a distortion in prices in the stock market can be corrected in the M&A market.

Mitchell, Pulvino, and Stafford (2002) used the parent company puzzle that occurred relative to a carved-out subsidiary to see if there was any excess return on arbitrage trading. Their research demonstrated that arbitrage trading is not free of all risk. There is the fundamental risk of the parent-subsidiary relationship vanishing (as through acquisition of parent and/or subsidiary or bankruptcy of parent). The profits from arbitrage might be restricted by the risk of a protracted period before the negative stub value dissolves, a period in which unexpected fluctuations in stock prices make it difficult and costly to maintain an arbitrage position. This is usually called horizon risk. Finally, there is possibly incomplete information about the exact nature of the apparent mispricing (and associated learning costs).

Lamont and Thaler (2003) selected a sample of equity carve-outs in which the parent company states its intention to spin-off its subsidiary (distributing the remaining shares in the subsidiary to the parent's shareholders). In this case, arbitrage is free from some of the restrictions Mitchell et al. (2002) pointed out, such as the risk of the parent-subsidiary relationship disappearing, the period before this relation dissolves, and incomplete information. However, even in this more reasonable case where an arbitrage opportunity obviously exists, arbitragers would not be able to earn excess returns because of the high costs associated with short selling the overvalued stock.

Kobayashi and Yamada (2001) attempt to explain the parent company puzzle in Japan focusing on the effect of mimicking the index. Their model shows how excess demand for shares of a subsidiary can develop in a "hot market." Though index fund managers attempt to construct the mimicking portfolio to the TOPIX (Tokyo Stock Exchange Stock Price Index) by holding both shares, they did not account for the shares owned by the parent firm. As a result, excess demand occurs for subsidiary stocks in the case of dual listing.

However, the inefficiency of the benchmark alone cannot explain an inversion in market capitalization of a parent company against its subsidiary in Japan. In particular, we do not have an adequate explanation of why investors other than passive investors leave the apparent mispricing for such a long period of time. In addition, we find an example that negative stub

values persist for a long period even in the bear market that following the hot market of 1999. The newspaper *Nihon Keizai Shimbun* on November 5, 1999 reported that investors simply viewed parents and subsidiaries as completely different stocks in the market. If so, the stock price of a parent company may not reflect the market value of its holding of financial assets, specifically, the value of its subsidiary. While this market inefficiency might be consistent with irrationality on the part of some investors, it may also be that the price discrepancies arise from the potential for multiple market equilibria, for example, as presented in Spiegel (1998).

In our study, we provide a detailed examination of the price discrepancies between three pairs of parent companies and subsidiaries (Ito-Yokado and Seven-Eleven, NTT and NTT DoCoMo, and Itochu and CTC). In our attempt to explain the negative stub values, we examine issues of limits to arbitrage relating to the most actively traded issues listed on the Tokyo Stock Exchange.

III. *Three Extreme Cases*

1. **Sample Selection**

We examined all stocks listed on the First Section of the TSE in order to obtain our sample of parent and subsidiary firms. In order to obtain the information on dual listings, we used Bloomberg's information terminals and TD-Net Data Base of Tokyo Stock Exchange to screen companies whose largest shareholder's stake is over 50 percent from 1997 to 2003. The largest shareholders also needed to be listed on the First Section of the TSE. Under these criteria, we obtained a total of 116 pairs of firms (parent and subsidiary) during the sample period. Each subsidiary's financial performance is fully consolidated into its parent's financial reports under Japanese GAAP. Financial information of the parent company that market participants use to value the parent companies fully includes its subsidiary's assets and cash-flow information. Since both parent and its subsidiary follow the same regulation as the listed stocks on the TSE, the market value of the parent company should incorporate the market value of its subsidiary.

We examine the difference (DIF) between the market value of the parent company and the market value of its stake in subsidiary. When the DIF, obtained using equation (1), is negative, it is defined as a negative stub value as in Mitchell et al. (2002) and Lamont and Thaler (2003).

$$DIF = MV_P - MV_S \times HR_P \quad (1)$$

where MV_P and MV_S are the market capitalization of the parent company and its subsidiary, respectively, and HR_P is the stake the parent company has in the subsidiary expressed as a percentage.

Although we limit our analysis to the case when the parent firm owns more than 50 percent of its subsidiary share, there are other cases that stock prices do not reflect their holdings of financial assets. For example, as of the end of March 2000, Toyota Industries Corporation was the largest shareholder of Toyota Motor Corporation, with a 5.2 percent stake, but its market capitalization was about 2.5 percent of the market value of Toyota Motor Corporation. In other words, although they are not in a parent/subsidiary relation by our definition, a negative stub value was observed, and this implies that negative stub values are

not limited to the cases we analyze in this paper.

From the 116 pairs of firms, we found three pairs that have substantial and significant negative stub values for a long period of time. Other than these three pairs, no other pairs exhibit anomalous price behavior for a long time in the period analyzed. These three pairs are: Seven-Eleven Japan Co., Ltd. (subsidiary, hereinafter SE or Seven-Eleven) and Ito-Yokado Co., Ltd. (parent, Ito-Yokado); NTT DoCoMo, Inc. (subsidiary, NTT DoCoMo) and Nippon Telegraph and Telephone Corporation (parent, NTT); and Itochu Techno-Science Corporation (subsidiary, CTC) and Itochu Corporation (parent, Itochu).

Descriptions of the six companies are shown in Table 1. All six firms are leading companies in their industries with market capitalization over \$5 billion. All three subsidiaries are among the top 50 in the TSE First Section in terms of market capitalization, and among the top 20 in market trading volume in March 2000. Seven-Eleven and NTT DoCoMo, in particular, were the most actively traded issues in the TSE First Section at the time.

Incidences of negative stub value are concentrated between the second half of 1999 and early 2000. The period occurs during the so-called "IT stock bubble," and is usually dubbed a "hot market."³ Mitchell et al. (2002) documented that a negative stub was observed in a total of 70 IPO companies between 1985 and 2000, and that during the five years between 1996 and 2000, negative stubs occurred in 33 companies, 15 of which are connected to Internet-related businesses. An "overheated" stock market seems a common key factor of the occurrence of negative stubs both in Japan and in the United States. Unlike the U.S. case, all these six Japanese stocks are actively traded and highly liquid.

2. Evidence about Negative Stubs

Table 2 shows occurrences of negative stub values for our three pairs using the NS ratio. The NS ratio is the ratio of DIF to the market value of the parent firm.

Negative stubs were observed during the nine periods for three parent/subsidiary pairs. The length of these anomalous periods are from 21 to 595 calendar days. Average negative stub values range from 1 to 20 billion U.S. dollars that are much larger than those in the U.S.⁴

It is possible the net book values of these parent firms after subtracting the subsidiary value are negative during the period and this may be related to the observed anomalous patterns. In order to examine this possibility, we compute the book value ratio, the ratio of the subsidiary's book value to its parent's book value, for all three pairs. However, the book value ratios of the three pairs are less than one, indicating that the parent companies do not show liabilities in excess of assets.

We also examine the possibility of a large off-balance sheet liability or unrealized loss. We found no reports about hidden liabilities for Ito-Yokado or NTT. Itochu posted over ¥300 billion in unrealized losses from its business restructuring during the year ending March 2000,

³ Judging from newspaper articles in the *Nihon Keizai Shimbun* between 1999 and 2001, the three subsidiary firms were regarded as leading IT-related companies and thus received a lot of attention in the market: Seven-Eleven was a hub for e-commerce and the most capable terminal for multimedia businesses; NTT DoCoMo, the biggest cell phone service operator in Japan, was one of country's most prominent IT-related companies; and CTC was one of the key system integrators in the country.

⁴ Cornell and Liu (2000) report typical cases of negative stub value in the United States are approximately \$5 billion dollars.

TABLE 1. DESCRIPTION OF THREE SUBSIDIARY-PARENT COMPANIES: FINANCIAL AND MARKET DATA FOR THE THREE SUBSIDIARY-PARENT PAIRS IN U.S. DOLLARS

(In Million US Dollars / As of FY 2000)

Status	Company	Company Description	Market Cap (Mar 2000)	% of Total Market Cap of TSE 1st	Total Sales	Operating Profit	Profit After Tax	Total Assets	Net Book Assets
Subsidiary	Seven- Eleven Japan	The largest convenience store in Japan	93,343	2.2%	3,203	1,305	682	6,636	4,939
Parent	Ito- Yokado	The largest general merchandise store in Japan	28,980	0.7%	30,619	1,721	452	19,976	9,481
Subsidiary	NTT DoCoMo	The largest mobile communication company in Japan	382,894	9.0%	28,369	5,183	2,395	34,316	18,383
Parent	NTT	The largest tele- communication company in Japan	245,127	5.8%	82,373	9,311	-644	174,867	58,283
Subsidiary	CTC	The largest listed system vendor company in Japan	20,638	0.5%	1,977	108	58	1,333	678
Parent	Itochu	The third largest trading company in Japan	7,406	0.2%	115,343	425	-838	57,623	2,672

Market Cap shows market value of shares of the respective companies as of the end of March, 2000. % of Total Market Cap of TSE 1st shows the ratio of market value of the respective companies to the total market value of all companies listed on the TSE 1st Section. All financial figures are the results of the fiscal year 2000. All the values and figures are shown in U.S. dollar amount with the exchange rate as of March, 2000.

TABLE 2. DESCRIPTION OF PERIODS OF NEGATIVE STUBS
(Amounts are in millions Japanese Yen)

Subsidiary	Parent	First Week	Last Week	Days	% of Subsidiary's Shares Held by Parent	Negative Stub			Parent's Book Value		
						Average NS Ratio	Average Amount	Maximum NS Ratio		Maximum Amount	Book Value Ratio
Seven- Eleven	Ito- Yokado	1999/8/20	1999/9/24	35	50.7%	-4.8%	-148,304	-10.0%	-354,496	24%	1,009,892
		1999/10/1	2001/2/23	511	50.7%	-38.8%	-1,180,618	-104.6%	-2,718,251	25%	998,295
NTT DoCoMo	NTT	2000/2/25	2000/5/19	84	67.1%	-8.8%	-2,033,759	-26.6%	-5,946,242	21%	6,136,616
		2000/9/29	2000/12/29	91	67.1%	-16.5%	-2,590,712	-31.3%	-4,578,695	23%	6,326,671
CTC	Itochu	2001/1/26	2002/9/13	595	67.1%→64% (2001/2/23)	-21.3%	-1,885,235	-44.5%	-2,748,704	32%	6,859,155
		2002/10/4	2002/10/25	21	64.0%	-4.2%	-286,999	-10.1%	-690,122	33%	5,906,315
		2003/1/10	2003/10/17	280	64%→61.6%	-12.1%	-877,138	-20.9%	-1,370,155	37%	5,843,158
		2000/1/14	2000/5/26	133	60.0%→58.1% (2000/3/10)	-40.9%	-309,138	-102.1%	-795,887	16%	281,325
		2000/10/13	2000/12/22	70	53.1%	-18.7%	-130,219	-33.6%	-231,329	13%	316,940

NTT sold a small fraction of its holdings in NTT DoCoMo during the year 10/1/2002 to 9/30/2003. The changes were relatively small so we assume the sale was executed on 3/31/2003 and 9/30/2003 based on the disclosure by NTT. First Week is the last day of the week that the negative stub was first observed and Last Week is the last day of the week that the negative stub ended. Days is the period from the First Week to the Last Week. Negative Stub is defined when a difference between the market value of the parent company and the market value of its stake in subsidiary is negative. NS Ratio is the ratio of negative stub value to market value of the parent shares. Book Value Ratio is the ratio of the subsidiary's book value to its parent's book value.

but it was offset by unrealized profit. As a result, its consolidated net assets did not show any large drop against the previous year. Judging from the contents of the financial statements of the three parent companies, there is no reason to assume that the debt of the parent companies exceeded assets due to unrealized loss or hidden liabilities.

Because the three negative stub cases were prominently reported in the *Nihon Keizai Shimbun*, it is unlikely that the market participants are unaware of such anomalous stock price behavior. In addition, these three pair of stocks are most actively traded on the TSE and such patterns are persisted over a long period of time. There are three possible scenarios: (1) The parent firm's stock is underpriced; (2) The subsidiary's stock is overpriced; or (3) both stocks are mispriced. In the following three sections, we examine the mispricing of each pair in more detail.

Seven-Eleven and Ito-Yokado

Seven-Eleven is the largest convenience store chain that went public in 1979 as a subsidiary of Ito-Yokado and Ito-Yokado is one of the largest supermarket chains in Japan. The percentage of shares held by Ito-Yokado has remained unchanged since 1989. A negative stub was first observed in 1999. According to the financial press, the rise in Seven-Eleven's stock price after 1999 is attributed to its strong performance, growth potential as a terminal for multimedia business, e-commerce, and rising expectations for its entry into the settlement banking business. Beginning in April 2000, Seven-Eleven's stock price start to drop rapidly, following the plunge in prices of IT-related stocks in the United States. The negative stub finally disappeared in February 2001.

Figure 1a shows the time series behavior of negative stub values between Seven-Eleven and Ito-Yokado. Figure 1b shows Price-to-Book Ratio (PBR) of Seven-Eleven and Ito-Yokado and the NS Ratio. On the one hand, we observe a high valuation of Seven-Eleven's shares relative to its book value during the period when large negative stub was observed. On the other hand, Ito-Yokado's PBR remains stable during the same period. During the period of remarkably high valuation of Seven-Eleven's stock, there were many newspaper reports on their growth potential and brisk performance. At the same time, others pointed out that the stock price had risen to a point that was extremely difficult to explain with economic rationality. These indications suggest that market views on the stock prices were not unanimous at the time when the negative stub occurred.

NTT DoCoMo and NTT

Figure 2a shows the negative stub value that occurred between NTT DoCoMo and NTT. NTT DoCoMo is the largest mobile telecommunication company which was carved out from NTT in 1998, and NTT is the largest telecommunication company in Japan. Up until November 1999, both stocks had been moving in an upward trend. Beginning in December 1999, however, NTT's share prices started to fall, while prices of NTT DoCoMo shares stayed high. This led directly to a negative stub value in February 2000. In March 2000, NTT DoCoMo stock prices took a downward turn on the back of the fall in prices of IT-related stocks in the U.S. Since NTT stocks remained on a downward trend, the negative stub value continued intermittently. The most recent negative stub, which occurred in January 2003, ended in October 2003.

Figure 2b shows PBR of NTT and NTT DoCoMo. As in the case of Seven-Eleven and Ito-Yokado, a temporally high valuation of NTT DoCoMo's shares relative to its book value

FIG. 1a. MARKET VALUE OF SEVEN-ELEVEN AND ITO-YOKADO AND NEGATIVE STUB

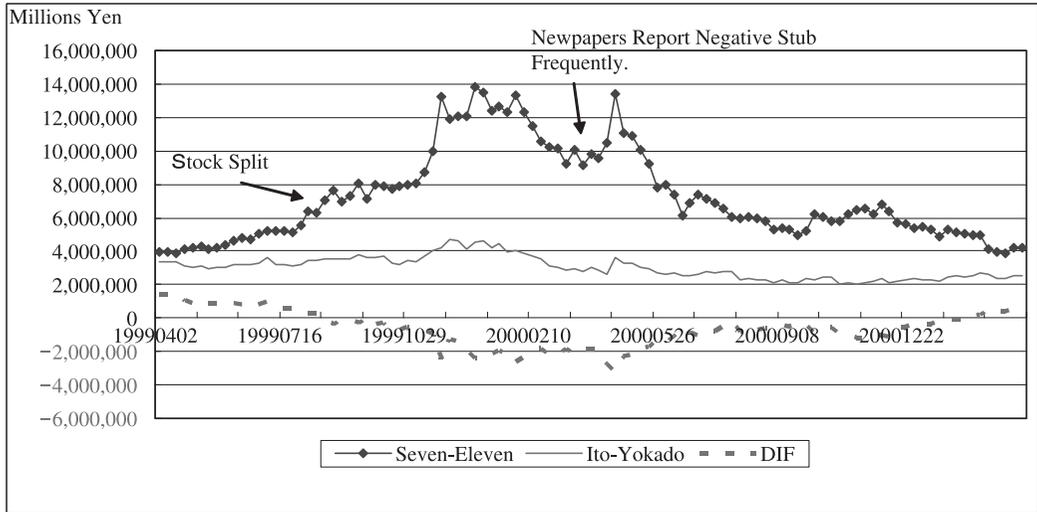
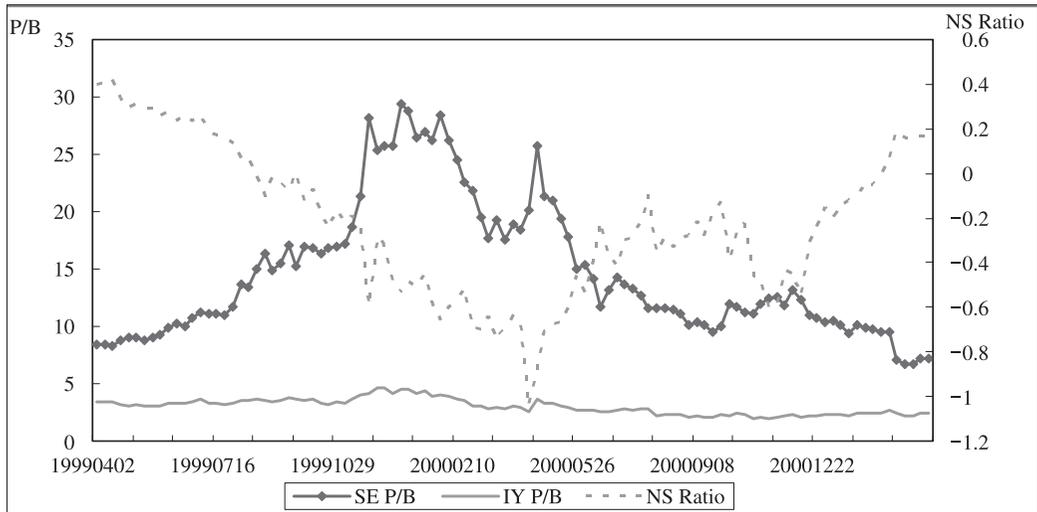


FIG. 1b. PRICE-TO-BOOK RATIO OF SEVEN-ELEVEN AND ITO-YOKADO



DIF in Figure 1a is defined as the difference between the market value of the parent company and the market value of its stake in subsidiary. When the DIF is negative, it is defined as a negative stub value. NS Ratio in Figure 1b is the ratio of DIF to market value of the parent company. P/B in Figure 1b represents price to book value ratio of the companies.

FIG. 2a. MARKET VALUE OF NTT DoCoMo AND NTT AND NEGATIVE STUB

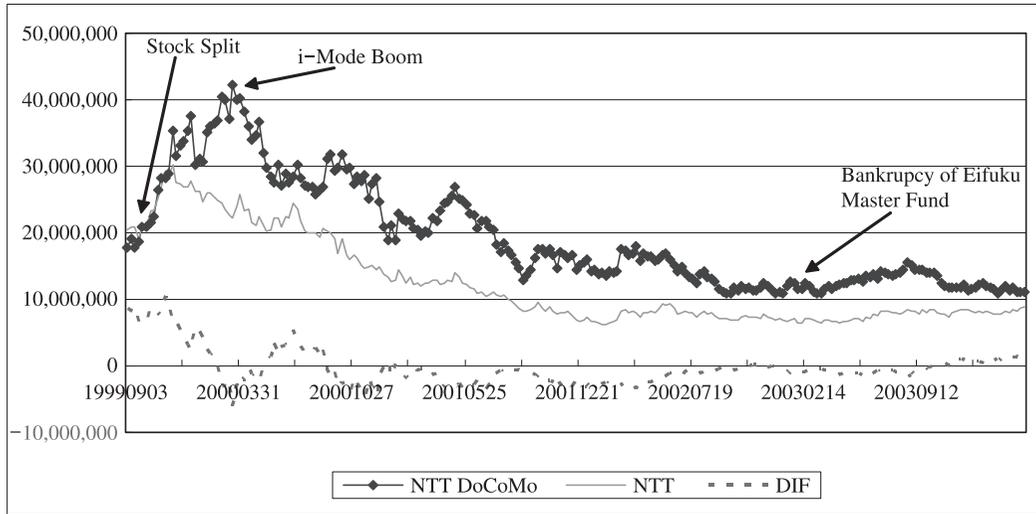
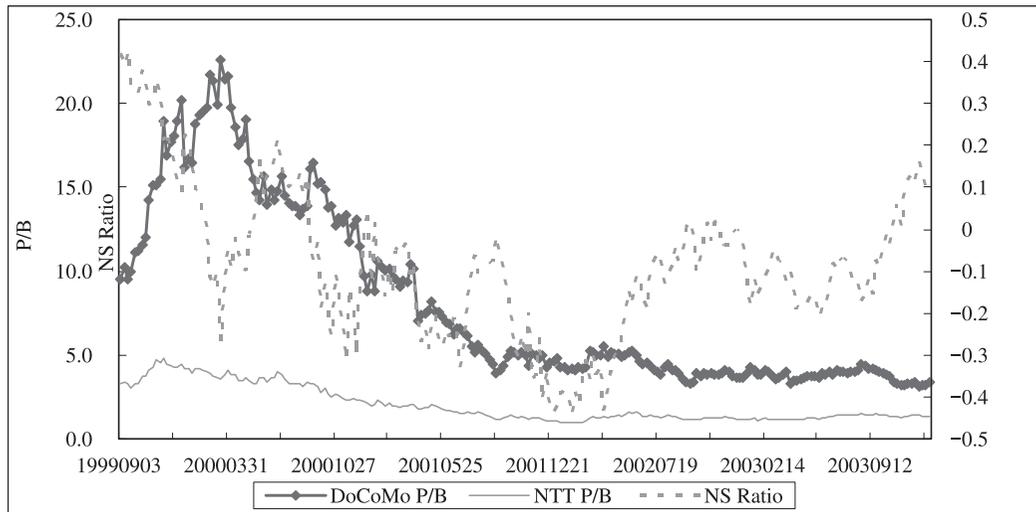


FIG. 2b. PRICE-TO-BOOK RATIO OF NTT DoCoMo AND NTT



DIF in Figure 2a is defined as the difference between the market value of the parent company and the market value of its stake in subsidiary. When the DIF is negative, it is defined as a negative stub value. NS Ratio in Figure 2b is the ratio of DIF to market value of the parent company. P/B in Figure 2b represents price to book value ratio of the companies.

coincides with the emergence of the negative stub. Different from Seven-Eleven's case, NTT's share valuation relative to its book value was in downward trend during the period that negative stub was observed, and this prolonged the period that negative stub was observed. Thus, this case is different from the other two cases due to the fact that the negative stub values continued to occur intermittently over a long period of time beyond the IT boom period.

CTC and Itochu

The market values and negative stub value for CTC and Itochu are shown in Figure 3a. CTC is one of the leading producers of system integration services, and Itochu is one of the largest general trading companies in Japan. CTC was carved out in December 1999, and a negative stub value occurred as early as January 2000. After temporarily disappearing in May, it returned in October, eventually disappearing in December 2000. Unlike the cases of Seven-Eleven and NTT DoCoMo, the negative stub value associated with CTC dissolved in a relatively short period of time. Throughout the period the negative stub was observed, CTC's market value displayed large fluctuations within the range of ¥1 trillion and ¥2.5 trillion, while Itochu stayed within a narrower range that hovered around ¥700 billion. As this evidence suggests, the direct trigger for the negative stub value coincides with a temporary high valuation of CTC shares.

Figure 3b compares the PBR of CTC and Itochu. Similar patterns to Seven-Eleven and Ito-Yokado are observed for CTC and Itochu. Itochu's PBR remains quite stable over the period while CTC's PBR displays large fluctuations. The high valuation of CTC's share relative to its book value coincides with the observed negative stub. In other words, CTC share price is inexplicably high during the period.

These three cases demonstrate very similar patterns of emergence and disappearance of negative stubs. When the parent shares do not reflect the increased market value of subsidiary shares, we observe negative stub values. For all cases, the negative stub values vanished without any specific event to explain the disappearance. This is in sharp contrast with the pattern reported by Mitchell, et al. (2002), who identified specific events for the disappearance of the negative stubs for seventy-five percent of their sample. These events included the spin-off of the subsidiary's shares to parent's shareholders or the acquisition of parent and/or subsidiary which contributed to the termination of the negative stub values. The three Japanese cases present opportunities to earn large arbitrage profit, regardless of the source of share price distortion, parent's or subsidiary's.

IV. Limits of Arbitrage

The previous section documents the attractive investment opportunities potentially represented by the negative stubs. Why didn't rational investors step in to correct the mispricing? The persistence of a negative stub value despite the presence of the opportunity to earn excess returns suggests some limits to arbitrage. The negative stubs cases are similar to the closed end fund puzzle. However, arguments pertaining to agency costs by the fund managers, tax liabilities, and bad estimates of net asset value do not apply to the negative stubs case.

An arbitrager may face differences in liquidity when he sells overpriced subsidiary stocks and simultaneously buys underpriced parent firm stocks. However, liquidity may not be a

FIG. 3a. MARKET VALUE OF CTC AND ITOCHU AND NEGATIVE STUB

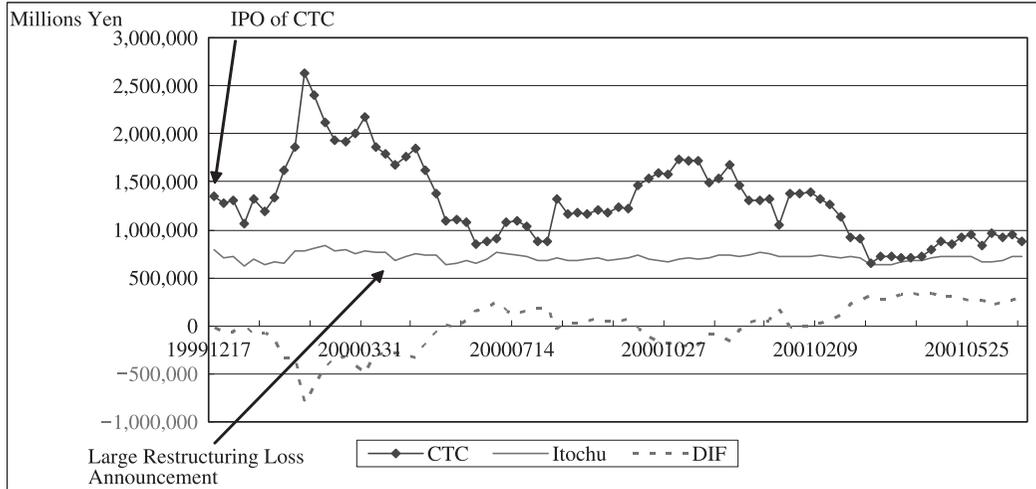
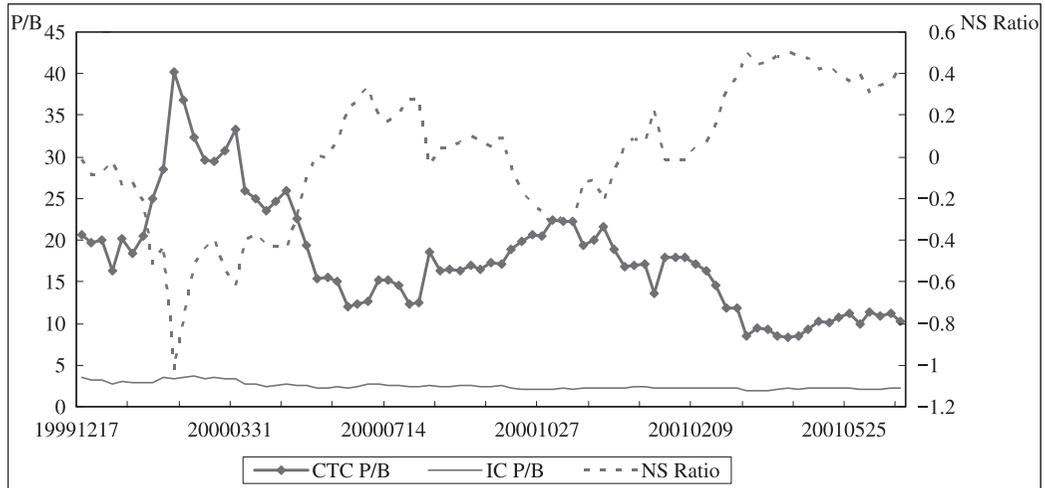


FIG. 3b. PRICE-TO-BOOK RATIO OF CTC AND ITOCHU



DIF in Figure 3a is defined as the difference between the market value of the parent company and the market value of its stake in subsidiary. When the DIF is negative, it is defined as a negative stub value. NS Ratio in Figure 3b is the ratio of DIF to market value of the parent company. P/B in Figure 3b represents price to book value ratio of the companies.

crucial issue for these six firms. Since they are ranked among the top 100 with respect to their market capitalization, these stocks should be quite liquid. We compute the average turnover of these firms and find that average weekly turnover of these firms (the ratio of the weekly trading volume to the number of shares outstanding) are much higher than the average weekly turnover of all firms of the TSE during the period when the negative stub value occurred (hereinafter “the Negative-Stub-Period”). Unlike the U.S. case, our six stocks are large and highly liquid firms.

Recent studies pointed out that stock prices often deviate from fundamental value for a long period of time due to market frictions. As a result, arbitrage trade does not necessarily enforce the law of one price. We examine how such market frictions are related to the parent company puzzle in Japan. In the following section, we will focus on short sales and capital constraints.

1. Short Sales and Capital Constraints

The law of one price in financial markets is enforced by arbitrage trading, which is the simultaneous buying and selling of the same security if two different prices prevail. In our case, an arbitrager must buy the parent firm share and sell the subsidiary share short simultaneously. To be able to sell a subsidiary share short, it must be borrowed. The cost of shorting is reflected in the interest rate rebate the seller receives on the short sale proceeds. The rebate can be negative if the seller has difficulty finding a lender who is willing to lend a large amount of shares in order to conduct arbitrage transactions.

In terms of arbitrage activities, Lamont and Thaler (2002) show that margin selling ratios (# of shares shorted / # of shares outstanding) are much higher for subsidiary stocks than for parent stocks during the first three months of the negative stub period. This indicates arbitrage transactions are costly for arbitragers in the U.S. because the lender is likely to demand a higher lending fee for subsidiary stocks. According to Lamont and Thaler, the margin-selling ratio became 43.4 percent on the second negative stub month. The ratio became even higher in the following months.

Alternatively, as presented in Table 3, average margin selling ratios in Japan are less than 1 percent for all seven periods, which is much smaller than the U.S. ratios.⁵ Based on this number, arbitrage trading in Japan does not seem to be as active as that in the U.S. However, this conclusion may be misleading because an arbitrager in Japan may use the negotiated margin transactions outside the Tokyo Stock Exchange. Since the information about the negotiated margin transactions is not publicly available, we cannot directly compare our results

⁵ There are two types of margin transactions in Japan as discussed in Hirose et al. (2008). While individual investors mainly use the standardized margin transactions, institutional investors can use both the standardized and the negotiated margin transactions. Under the standardized margin transactions, the investors follow the rule set by the Tokyo Stock Exchange. Not all shares on the TSE are eligible for short sales. In our case, CTC was not an eligible issue under the standardized margin rules by the Tokyo Stock Exchange during the period. On the other hand, under the negotiated margin transactions, the borrower directly communicates with the lender to determine the detail of transactions. This means that any shares can be sold short under the negotiated margin transactions. Unfortunately, because the transaction information about the negotiated margin is not available to us, our analysis focuses only on the standardized margin transactions. Therefore, we exclude the CTC case from Table 3 because CTC was not an eligible issue under the standardized margin transactions.

TABLE 3. MARGIN TRADING POSITION AND SHORTING COSTS

Subsidiary	Parent	First Week	Last Week	(a) Net Margin Trading At The First Week (in thousand Shares)	(a) / Outstanding Shares	Average Margin Selling Ratio	Average Margin Buying Ratio	Max Short Rebate (Annual term)	Adjusted Period Return
Seven-Eleven	Ito-Yokado	1999/8/20	1999/9/24	2081	0.50%	0.18%	0.56%	-	10.6%
		1999/10/1	2001/2/23	1847	0.22%	0.05%	0.23%	4.03%	-50.0%
NTT	NTT	2000/2/25	2000/5/19	27	0.32%	0.04%	0.37%	-	12.4%
DoCoMo		2000/9/29	2000/12/29	26	0.27%	0.06%	0.21%	-	20.9%
		2001/1/26	2002/9/13	-0	-0.00%	0.15%	0.19%	61.67%	9.2%
		2002/10/4	2002/10/25	-3	-0.16%	0.32%	0.14%	-	13.2%
		2003/1/10	2003/10/17	-2	-0.02%	0.07%	0.08%	43.79%	12.5%
Mean					0.19%	0.12%	0.27%		4.1%

First Week is the end day of week that negative stub was firstly observed and Last Week is the end of week that negative stub was lastly observed. Net Margin Trading is a net position of margin buying and short selling of the stock in standardized stock lending market. Net Margin Trading is negative when the subsidiary's short selling account exceeds margin buying account, and is positive otherwise. Average Margin Selling (Buying) Ratio is the ratio of average margin selling (buying) during the period to the number of outstanding shares of the subsidiary. Max Short Rebate is an annualized rate of the maximum daily short rebates observed during the period. Adjusted Period Return is an arbitrage return during the period after taking both capital constraint and shorting costs into account.

with the U.S. results concerning margin selling ratio. Instead, we investigate if there are high borrowing costs for these pairs caused by arbitrage transactions during our sample period.

D'Avolio (2002) reports maximum borrowing costs of four subsidiaries, 50 percent in annual terms for Stratos Lightwave in December 2000, 35 percent for Palm in July 2000 and 10 percent each for PFSWeb in June 2000 and Retek in September 2000. Our results are presented in Table 3. For the case of NTT and NTT DoCoMo, we observe a high borrowing cost close to 60 percent in annual terms, which is larger than those in the U.S. Our results are surprising since margin transactions using the standardized margin do not seem to be active in Japan considering relatively low margin selling ratios under the standardized margin transactions. High borrowing costs may imply that the arbitrage activities using the negotiated margin are active and therefore, high borrowing cost may reflect the high demand for subsidiary shares outside of the TSE. Thus, short sales may be costly in Japan. High borrowing costs prevent investors from employing arbitrage transactions by selling expensive subsidiary's share.

In addition to the borrowing costs, an arbitrager must take the capital constraints into account. Brokerage houses initially require a margin trader to put up collateral of a minimum of 40 percent of the market value of one's net position. If the investor deposits parents' shares and the proceeds from short sales as collateral, no additional funds are needed initially. However, because the proceeds are not usually used as collateral under the standardized margin, only the parents' shares are used as collateral. Under the mark to market system, the margin call is set when the collateral value is below the maintenance margin. The maintenance margin is set at 30 percent of the market value of one's net position.⁶

We investigate whether the collateral value falls below the maintenance margin when we pursue the hypothetical arbitrage trading strategy. The hypothetical arbitrage trading used here is initiated when the negative stub hits -10 percent. We calculate the arbitrage returns following the approach used in Mitchell, et al. (2002) for seven periods. For the Seven-Eleven case, the strategy hit the maintenance margin during the 511 day negative stub period. Assuming no additional capital injection, an arbitrager is forced to close his position at that time. The loss becomes -50 percent in this case. However, no other cases have to close their arbitrage positions. Due to the capital constraints, arbitrage is not a risk free transaction under the standardized margin transactions.

Both short sales and capital constraints may prevent an arbitrager in Japan from arbitrage transactions in the parent firm puzzle when an arbitrager uses the standardized margin transactions. What if an arbitrager buys the whole parent firm to obtain subsidiary shares instead of using the margin transactions? We will examine this issue in the following section.

2. Inactive M&A Market and Tax Consideration

Could we really obtain Seven-Eleven shares worth ¥6 trillion by purchasing Ito-Yokado for ¥4 trillion, gaining an arbitrage return of ¥2 trillion as reported in Nihon Keizai Shimbun? Cornell and Liu (2000) show that five of the seven pairs with negative stub value were involved in corporate control transactions, structured to exploit the apparent mispricing.

⁶ We rely on the rule of the standardized margin transactions under the Tokyo Stock Exchange since we have no information available about the negotiated margin transactions.

Mitchell, et al. (2002) reported that seventy-five percent of the sample eliminated the negative stub value by spin-off transaction or acquisitions.

In order to acquire the parent firm, an M&A arbitrageur must purchase the parents' shares in the market. A hostile takeover was rare in Japan during our sample period, however. Since the cross-shareholdings are still tightly held among Japanese firms, it is difficult for an arbitrageur to obtain a sufficient number of the parent shares to win the take over game.

For the case of Ito-Yokado, the ownership share of the top ten shareholders remained over 40 percent throughout the period of this study. Thirteen percent belongs to the founder's family and the remainder to Japanese financial institutions which are major lenders to Ito-Yokado. Ito-Yokado also owns a large portion of shares of these financial institutions. This ownership structure remained unchanged throughout the period of the study. These shareholders are not likely to sell their shares in response to a call of a hostile take-over-bid (TOB).⁷

With over 50 percent of its shares still owned by the Japanese government, NTT cannot be acquired by a hostile TOB. Similar to Ito-Yokado, Itochu's top ten shareholders own more than 30 percent. These shareholders are mainly friendly financial institutions and corporations which are unlikely to sell the shares of Itochu to corporate raiders. This implies that the success of a hostile takeover is very unlikely for Itochu.

In addition to the difficulty of the TOB, Japanese tax rules do not favor an arbitrageur. In the United States, it is possible to allocate subsidiary shares to parent's shareholders as a tax-free transaction (spin-off), but it is not possible under Japanese Tax Law. When investors acquire a parent company and want to sell the parent's stake in a subsidiary to lock in an arbitrage profit, the difference between the book value of the subsidiary shares and the selling price is recognized as a taxable profit, producing a huge tax burden for the investors.

As noted previously and shown in Table 4, the book value of the subsidiary shares was considerably lower than the market value, and, in all nine cases, the amount of capital gain tax exceeded the value of the negative stub at the time the subsidiary shares would have been sold. This means that acquiring the parent firm may not be profitable arbitrage transactions for Japanese corporations.

In summary, cross-shareholdings in the Japanese market and the delayed development of the tax system for spin-offs discourage an arbitrageur to participate in the M&A market during our sample period.

Recently, the situation has changed dramatically. Cross-shareholdings in the TSE listed companies in Japan have become less prominent and hostile-takeover attempts have increased recently. Considering the change in the M&A market place, on April of 2005, Ito-Yokado acquired 100 percent of Seven-Eleven shares by stock acquisition to avoid potential takeover attempts to profit from under-priced Ito-Yokado shares. This is exactly the case where the management team of Ito-Yokado steps-in to correct the parent company puzzle. This incident shows that the fundamental risk emphasized by Mitchell et al. (2002) is also important for the Japanese negative stubs case.⁸

⁷ There were two unsuccessful TOB attempts, Shoen by a private equity fund in 2000 and Hokuetsu Paper Mills by Ohji Paper Group in 2006. In both cases, the acquirers could not acquire a sufficient number of target shares because banks, financial institutions and friendly firms did not sell the target shares.

⁸ The fundamental risk is possibility that the parent-subsidiary link sever before the mispricing is corrected.

TABLE 4. TAX COSTS OF SPIN-OFFS

Subsidiary	Parent	First Week	Last Week	Negative Stub		(A) Book Value of Subsidiary Shares at Parent	(B) Market Value of Subsidiary Shares Held by Parent	Capital Gain (B)-(A)	Capital Gain Tax
				Average	Maximum				
				(In Millions Japanese Yen)					
Seven Eleven	Ito-Yokado	1999/8/20	1999/9/24	-148,304	-354,496	16,894	3,735,154	3,718,260	-1,561,669
		1999/10/1	2001/2/23	-1,180,618	-2,718,251	16,894	4,124,144	4,107,250	-1,725,045
NTT DoCoMo	NTT	2000/2/25	2000/5/19	-2,033,759	-5,946,242	13,073	24,846,899	24,833,826	-10, 430, 207
		2000/9/29	2000/12/29	-2,590,712	-4,578,695	13,073	18,129,078	18,116,005	-7,608,722
Itochu	CTC	2001/1/26	2002/9/13	-1,885,235	-2,748,704	13,073	11,173,541	11,160,468	-4,687,397
		2002/10/4	2002/10/25	-286,999	-690,122	13,073	7,442,698	7,429,625	-3,120,443
Itochu	CTC	2003/1/10	2003/10/24	-850,560	-1,450,483	13,073	8,233,205	8,220,132	-3,452,455
		2000/1/14	2000/5/26	-309,138	-795,887	476	1,046,044	1,045,568	-439,139
		2000/10/13	2000/12/22	-130,219	-231,329	435	835,447	835,012	-350,705

First Week is the end day of week that negative stub was firstly observed and Last Week is the end of week that negative stub was lastly observed. Average and Maximum Negative Stub are respectively average and maximum negative stub observed during the assumed arbitrage period. Market Value of Subsidiary Shares Held by Parent is average market value during the period. Capital Gain Tax is the assumed tax costs for parents when the parent sells all the subsidiary shares calculated with effective tax-rate at the time in Japan.

V. Conclusion

In this paper, we examined the parent company puzzle that the market value of a parent firm was less than the market value of its holdings of a publicly traded subsidiary focusing on three Japanese cases. We investigate whether an arbitrager could obtain abnormal return from hypothetical arbitrage trading both in the stock market and in the corporate acquisition market. The results are inconsistent with market efficiency but consistent with the limits of arbitrage. Due to market frictions, there is no guarantee that distortions in stock prices will always be quickly corrected by arbitrage transactions. These results suggest even prices of stocks with high liquidity, listed in the First Section of the Tokyo Stock Exchange, can deviate from fundamental values for a long period of time.

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