PREFACE

The Glucksman Institute for Research in Securities Markets awards fellowships each year to outstanding second year Stern MBA students to work on independent research projects under a faculty member's supervision. Five research projects completed by the Glucksman Fellows of 2006-2007 are included in this special issue of the Finance Department Working Paper Series. These papers focus on important topics in empirical financial economics.

Harsh Nanda, under the supervision of David Yermack, examines the difference in premiums paid in US Management Buyouts versus the UK. Narendra Chokshi, under the direction of Kose John examines the regulatory, legal, and structuring challenges faced by financial investors in executing leveraged buyouts in India. Andrew MacNamara, under the supervision of Stephen Brown, examines a non-traditional method for constructing risk measures for a company based on industry composition. Andrew Verdasca, under the direction of Yakov Amihud, examines the factors behind common stock PIPE *(*Private Investments in Public Equity) issuers' discounts and their long-term performance. Jeven Dew, under the direction of Richard Levich, evaluates whether futures contracts linked to terrorism would be successful as widely-traded hedging instruments. These papers, reflecting the research effort of five outstanding Stern MBA students, are summarized in more detail in the Table of Contents on the next two pages.

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Do Management Buyouts of US Companies Demand Higher Premiums than UK Companies? Why?

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I. INTRODUCTION

"Control Premiums" and "Synergies" help justify most discrepancies between the market price of an asset and the price a buyer actually pays to acquire the asset. That is not necessarily the case in Leveraged Buyouts (LBOs) and more specifically Management Buyouts (MBOs). For the purpose of this research we define MBOs as transactions where a public company goes private and the management of the company is part of the buying consortium.

MBOs do not have synergies in most cases. Unlike an acquisition, the company continues to run as it was doing before going private. No two assets are being put together to generate synergies. Control premium theory also does not provide enough justification for the ~35% premium on average (over all MBO transactions since 1st Jan 2000) that MBOs require. In most MBOs the management's share in the company does not change significantly before and after the transaction. The control does change hands, from shareholders to the new equity holders (PE players etc.) but that does not explain why management would be willing to pay a premium.

MBOs and LBOs share a common characteristic, benefit from leverage, that partially drives their premiums. In this paper we have attempted to develop a better understanding of the drivers of MBO premiums through a specific observation: significant difference in premiums paid in US MBOs and UK MBOs when no such difference exists between US and UK for LBOs and for general acquisitions.

In Section II of the paper we talk about the minimal previous research that has been done in this area, Section III outlines the data source and attributes that we have used in our research. In Section IV we establish the existence of a statistically significant difference between MBO premiums in US and UK and that no such difference exists for LBOs and general acquisitions. In Section V we analyze the transactions with respect to the various hypothesis that could potentially support our observations and demonstrate why none of them seem to be valid and finally in Section VI we provide our conclusion and some suggestions for future research.

II. PREVIOUS WORK

Not much systematic research has been done on the drivers of MBO premiums or on identifying or understanding differences in MBO premiums in different parts of the world. Renneboog, Simons and Wright[2] have done some research on the sources of shareholder wealth gains of UK going-private transactions, but nothing specific to MBOs and nothing to differentiate MBOs from LBOs.

III. DATA

i. Data Description

We are analyzing Premiums paid in Management Buyouts. We define Management Buyouts as Leverage Buyouts where Management was part of one of the bidder groups who eventually won the transaction. Specifically, we are looking at transactions from Jan-2000 to Oct-2006 with Transaction Size > $50 million. We have 47 MBO transactions with UK targets and 52 MBO transactions with US targets that meet the above criteria.

The key quantitative aspects of the transactions which we collected and have used in our analysis are:

- Target nation. Target industry
- Final premiums, 1-day, 1-week and 4-weeks prior to the announcement date
- Initial premiums, 1-day, 1-week and 4-weeks prior to the announcement date
- Increase in premium between initial and final offer
- % ownership of the acquirer (management team in case of an MBO) prior to the transaction
- Number of bidders

ii. Data Source

We are using SDC to get data described above. SDC has flags that allows the user to choose: 1) Date range of transaction, 2) Leveraged Buyouts, 3) Management Involvement, 4) Transaction value range, hence allowing us to get exactly the data that we require. We further used Factiva to do a detailed analysis of a small subset of the transactions by going through relevant news articles around the dates of the transaction. This analysis helped us understand in further detail the nuances of the transactions and verify some of the data we obtained through SDC database.

IV. PREMIUM ANALYSIS

A detailed analysis was performed on the premiums paid during transactions involving US and UK targets that were announced between 1st January, 2000 and 31st October, 2006. The summary of the same is given below:

Table 1: Summary of Average Premiums Paid for US and UK targets during various transactions

	# of Transactions	1-Day	1-Week	4-Weeks
LBO-US	168	28.25%	31.25%	34.21%
LBO-UK	86	26.38%	31.19%	31.29%
Difference		**1.87%**	**0.06%**	**2.92%**
MBO-US	52	36.27%	42.08%	44.69%
MBO-UK	47	26.39%	31.19%	32.48%
Difference		**9.88%**	**10.89%**	**12.20%**
All-US	2250	28.40%	32.25%	36.77%
ALL-UK	491	27.21%	31.24%	32.86%
Difference		**1.19%**	**1.01%**	**3.92%**

As can be seen above, Premiums paid for US targets are significantly higher than the premiums paid for UK-targets for Management Buyouts, while the difference is negligible for LBOs (a super set[1] of MBOs) and All-transactions (a super set of LBOs). Further, the difference – 9.88% for 1-Day prior to announcement premium, 10.89% for 1-Week prior to announcement premium and 12.20% for 4-Weeks prior to announcement premium is statistically significant as demonstrated by the t-value tests. t Statistic for the 1-Day prior premium is 1.85, for the 1-Week prior premium is 1.89 and the 4-Weeks prior premium is 2.34.

Further detail of the distribution of the premiums paid during Management Buyouts of US and UK targets (histograms) are provided in Exhibits 1, 2 & 3. The histogram for US MBO transactions are skewed right. To verify that it was not just a few blockbuster deals in US that was causing the right skew and our

[1] Set A is a super set of set of set B if all transactions in set B are also in set A. By definition given in Section III, LBO transactions is a super set of MBO transactions and All-Transactions is a super set of LBO transactions.

higher mean premium, we analyzed the distribution more carefully. We looked at the medians, 75th percentile and 90th percentile premium values for US and UK.

The data demonstrates that even the median premium value for the 4-Weeks prior premium between US and UK MBOs differs by around 10.5%. Further the difference increases as we go to higher percentiles (19.7% for 75th Percentile and 17.56% for 90th Percentile). To verify that the difference in the means of the two distributions is statistically significant, we performed the Wilcoxon Rank-Sum test. The Wilcoxon Rank-Sum test confirms that the US MBO 4-weeks prior premiums are greater than the UK MBO 4-weeks prior premium with alpha = 0.05 and US MBO 1-Week prior premiums are higher than the corresponding UK premiums for alpha = 0.1.

We believe that the 4-Week prior premium is the most reliable metric strongly confirming our hypothesis that US MBO premiums are significantly higher than UK MBO premiums.

V. TRANSACTION ANALYSIS

Having established the significance of the difference in premiums paid in MBOs of US targets vs. UK targets, we looked at the various transactions in further detail in order to find possible reason for the difference.

Number of Transactions: The number of MBO transactions is US and UK is very similar – 52 vs. 47, hence this probably does not help in explaining the discrepancy.

Size of Transactions: UK Transactions in general are of a smaller size than US transactions (almost 1/3rd on average). It is not clear intuitively whether smaller transactions should get a higher premium than larger transactions or lower. Correlation between Enterprise Value of the deals and premium compared to 4-Weeks prior is -0.26 for UK MBO transactions and -0.17 for US MBO transactions. Both the values are small and negative probably implying that smaller deals get higher premiums which runs counter to what we observe between US and UK where UK has smaller deals but have lower premiums.

Competition: MBO transactions in US seem to be more competitive than UK MBO transactions. Couple of data points that help understand this further are given below:

1. Almost all UK MBO transactions had a single bidder. Only 1 transaction had 2 bidders leading to an average of 1.02 bidders per transaction. On the other hand, for US MBO transactions the equivalent number is 1.1. 5 out of 52 transactions had more than 1 bidder.

2. An interesting (though unexpected) related observation is that the final premiums paid for transactions with more than 1 bidders are *not* significantly different (one would expect them to be higher) than the overall average. For example, the average premium paid for the 5 US MBOs which had more than 1 bidder is 38.72%, 44.81% and 41.14% for 1-Day prior, 1 Week prior and 4 Weeks prior to announcement respectively. This is very similar to the average

premiums paid for all US MBOs – 36.27%, 42.08% and 44.69% for 1-Day prior, 1 Week prior and 4 Weeks prior to announcement respectively.

3. On the other hand, quite contrary to our expectations, the initial premium offered for transactions with more than 1 bidder is 18.61%, 23.92% and 22.37% for 1-Day prior, 1 Week prior and 4 Weeks prior to announcement respectively which is around 10% lower than the average initial premium paid for all US MBOs.

4. A more drastic data point is the % change in Final Price offered as compared to the Initial Price offered. For UK MBOs this number is only 0.68% implying that for most deals, the initial offer is accepted as-is, or that the negotiations result in very little change from the initial offer. On the other hand for US MBO transactions, the equivalent number is 7.70%! This implies that the final offer for the MBO transactions on an average is 7.70% higher than the initial offer indicating that the bidding and negotiation process was intense and quite competitive.

Table 2: Comparison of Initial & Final Premiums Paid for US and UK targets during MBOs

	1-Day	1-Week	4-Weeks
MBO-US-Final	36.27%	42.08%	44.69%
MBO-UK-Final	26.39%	31.19%	32.48%
Difference	**9.88%**	**10.89%**	**12.20%**
MBO-US-Initial	27.76%	32.43%	35.50%
MBO-UK-Initial	24.40%	28.98%	30.19%
Difference	**3.36%**	**3.45%**	**5.31%**

5. Finally, a very interesting observation is that the difference in the initial premium (i.e. premiums calculated based on the initial offer) between US MBOs and UK MBOs is significantly smaller than the difference in the final premiums (Table 2).

Based on 1, 2 & 3 above, we can conclude that although there is a slight difference between the number of bidders in US MBOs and UK MBOs (US MBOs having slightly higher number of bidders on average), that does not by itself explain the higher final premium paid in US MBOs. In fact, we observe that transactions which have multiple bidders have lower initial offer premiums probably implying that low initial offer premiums attract other bidders driving the bids up to a high final premiums. This points towards a more competitive bidding environment in US and highlights one probable reason why even transactions with single bidders have final premiums close to the final premiums of transactions with multiple bidders; the fear of multiple bidders.

4 & 5 above clearly demonstrate that although the US environment requires a higher premium upfront as part of the initial offer, a key difference arises between the announcement date and the completion date, probably due to the way the process is conducted even when there is a single bidder.

Ownership Structure: Another possible hypothesis was the difference in ownership structure causing the difference in premiums i.e. higher % ownership of acquirer in UK prior to the transaction causing a reduced competition and lower premiums paid. Interestingly the average % of company owned by the

management led team prior to the transaction in UK is around 9% and is lower than % held prior to transaction in US which is around 18.5%. Hence this does not support the hypothesis that larger pre-transaction ownerships in UK leads to lower premiums. Even for the cases where pre-transaction ownership by MBO team is non-zero, ownership in UK (38%) is lower than ownership in US (42.5%). Further, the correlation between % ownership prior to transaction and premium 4 weeks prior for UK is 0.067, hence almost no correlation. For US the equivalent number is 0.10324. Hence the correlation is extremely low and probably not significant enough for us to make any conclusion about the relation between pre-transaction ownership structure and premiums paid.

Detailed UK Transaction Analysis: To further understand the UK transactions, we randomly sampled 7 UK deals and followed the transactions through various Factiva articles. Our key observations are:

1. In all the cases the deal was not awarded directly to the management led team. In all cases the independent board rejected the original offer (in some form or shape) and opened it up for competitive bidding.

2. In spite of the existence of competitors in some cases who kept increasing their stake in the company, in no case did that translate into a counter offer. Hence, in all the cases management led team was the only party to officially make an offer to the board. This could have been because of other factors such as “the need of approval from RBS” to make a bid for Macdonald hotels when RBS was supporting the management led team.

Hence, although procedurally boards in UK do open up the process for competitive bidding, there are probably other not so obvious factors that keep the process from being truly competitive.

VI. CONCLUSION

In this article we started with a discussion about the factors that drive Management Buyouts and how that is significantly more complicated than explaining premiums of general acquisitions. We further focused on the differences on premiums paid in Management Buyouts in UK and US, first demonstrating that the difference is statistically significant and then exploring the various obvious hypothesis of why the differences could exist. In our research we have demonstrated that none of the most obvious hypothesis e.g. higher number of transactions in US, higher management ownership in UK, difference in transaction size in US and UK, seem to be consistent with our observations of the premiums in US and UK MBOs.

We did find indications of US MBO environment being more competitive than in the UK with noticeable differences in premiums arising between the first offer and the final offer. This is probably due to way MBOs are conducted in US vs. UK but our research is inconclusive about what exactly in the US process leads to higher premiums or what in the UK process keeps the premiums low on a general basis.

As part of our research we have identified two key areas which warrant further investigation and might bring us closer to understanding the driving factors of the premium differences between US and UK MBOs.

First is the difference in leverage ratios in US and UK. US transactions seem to be much more levered as compared to the UK transactions[2]. If UK markets in general allow lower leverage this might help explain why acquirers might be able to extract a lesser value with a LBO type structure in UK as compared to US which might translate into lower premiums paid in UK LBO and MBO transactions. It is still not clear if this will help explain why the difference exists between US and UK only for MBOs and not for LBOs.

Another issue worth further exploration is the issue of “irrevocable commitments” in UK transactions[1]. In general, a bidder in US can withdraw his bid at any time, at least prior to the execution of the merger agreement. If the bids in the UK cannot be withdrawn as easily, it would not be surprising for managers to bid lower price, since their risk in the deal is not diversified across many deals. Further research into the structure of “irrevocable commitments” in UK might help clarify the impact of those on the premiums paid. Again it needs to be seen why the impact is seen primarily for MBOs and not for LBOs in the two countries.

EXHIBITS

Exhibit 1: 1-Day Prior Premium Histogram comparison of MBOs of US and UK targets

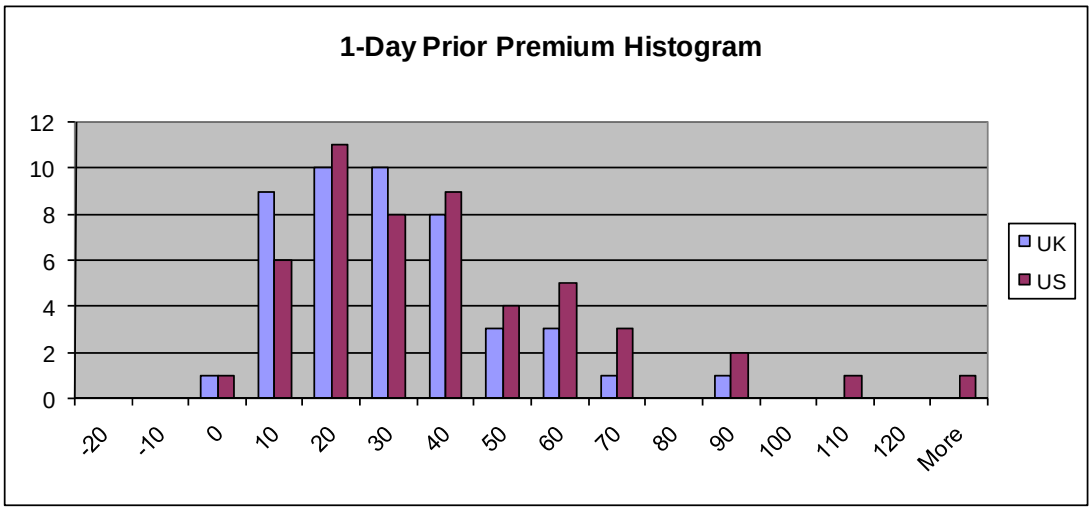


Exhibit 2: 1-Week Prior Premium Histogram comparison of MBOs of US and UK targets

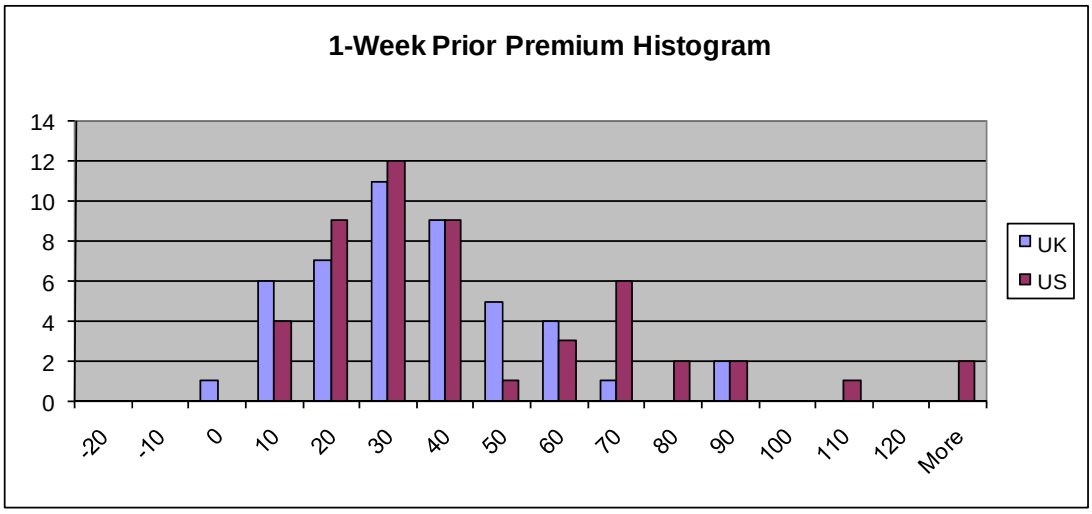
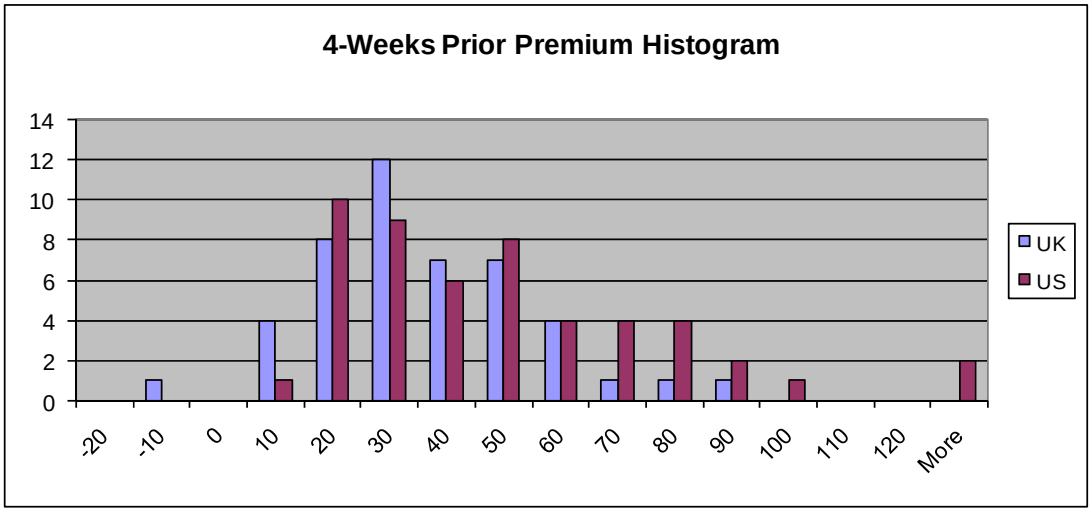


Exhibit 3: 4-Weeks Prior Premium Histogram comparison of MBOs of US and UK targets



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Challenges Faced In Executing Leveraged Buyouts in India
The Evolution of the Growth Buyout

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I. INTRODUCTION

Merger and acquisition ('M&A') activity in India, though currently at its peak, is not as vibrant as that in the U.S. or Europe. M&A transactions tend to be financed largely by equity and / or cash. While debt-financed deals are a handful, financing of acquisitions using high-yield bonds is non-existent in India. Though the corporate debt market in India has been in existence since Independence, state-owned public sector undertakings account for nearly 80% of the primary market for debt issuances.

Commercial banks are among the most important players in the capital markets, especially in respect of debt financing. The dominance of the commercial banking system can be gauged from the fact that the proportion of bank loans to GDP is approximately 36%, while that of corporate debt to GDP is only 4%. By the same measure, the government securities market is nine to ten times as large as the corporate debt market. This is despite the fact that all major stock exchanges in India have trading platforms for debt securities.

In the past, Indian commercial banks have lent money to Indian companies for acquisition of government-owned companies slated for privatization. However, these transactions have been largely balance sheet financing, with Indian banks favoring the traditional asset-backed and balance sheet financing.

It is important to note that India has a large private sector, which regularly taps the capital markets, in India as well in the U.S. and Europe, for its financing requirements. There is a developed government securities market with a yield curve, which can provide a reliable benchmark for the pricing of leveraged debt and all major stock exchanges in India have trading platforms for debt securities. The reasons for the under-development of the debt market and the relative lack of leveraged buyouts in India are much more profound than meets the eye.

This paper identifies and explains the reasons that make execution of leveraged buyouts in India difficult in the current environment. This paper also examines recent leveraged buyouts and explains how the factors identified affect leveraged buyouts in India.

II. LEVERAGED BUYOUTS

A leverage buyout ('LBO') is the acquisition of a business, typically a mature company, by a financial investor whose objective is to exit the investment after 3-7 years realizing an Internal Rate of Return ('IRR') of in excess of 20% on its investment over the horizon.

The term **'Leveraged'** signifies a significant use of debt for financing the transaction. The purpose of a LBO is to allow an acquirer to make large acquisitions without having to commit a significant amount of capital. A typically transaction involves the setup of an acquisition vehicle that is jointly funded by a financial investor and management of the target company. Often the assets of the target company are used as collateral for the debt. Typically, the debt capital comprises of a combination of highly structured debt instruments including prepayable bank facilities and / or publicly or private placed bonds commonly referred to as high-yield debt.

Table 1: Typical financial instruments used for financing a LBO

Components of capital	*% of total capital*	*Tenure (years)*	*Traditional suppliers of capital*
Senior debt			
Revolving	30%-60%	5-8	Investment bank
Term			Commercial bank
Subordinated debt			
Senior / subordinated notes	10%-25%	7-10	Investment bank
Discount notes			Commercial bank
Traditional mezzanine		9-10	Mezzanine fund
Preferred stock / Mezzanine securities			
Preferred stock	0%-35%	7-10+	Investment bank
			Commercial bank
Pay-In-Kind ('PIK') debt			Mezzanine fund
Warrants			
Common equity			
Common equity	25%-40%	3-7	Private equity fund
Vendor loan notes (deeply subordinated)		10-12	Vendor loan notes

The new debt in a LBO is not intended to be permanent. LBO business plans call for generating extra cash by selling assets, shaving costs and improving profit margins. The extra cash is used to pay down the LBO debt. Managers are given greater stake in the business via stock options or direct ownership of shares.

The term **'Buyout'** suggests the gain of control of a majority of the target company's equity. The target company goes private after a LBO. It is owned by a partnership of private investors who monitor performance and can act right away if something goes awry. Again, the private ownership is not intended to be permanent. The most successful LBOs go public again as soon as debt has been paid down sufficiently and improvements in operating performance have been demonstrated by the target company.

Target companies that have the following operating and financial characteristics are considered ideal LBO targets:

Table 2: Typical operating and financial characteristics of attractive LBO targets

Operating characteristics	***Financial Characteristics***
Leading market position - proven demand for product	Significant debt capacity
Strong management team	Steady cash flow
Portfolio of strong brand names (if applicable)	Availability of attractive price
Strong relationships with key customers and suppliers	Low capital intensity
Favorable industry characteristics	Potential operating improvement
Fragmented industry	Ideally low operating leverage
Steady growth	Management's success in implementing substantial cost reduction programmes

III. MACRO FACTORS MAKING LEVERAGED BUYOUTS DIFFICULT IN INDIA

This paper distinguishes between buyouts of Indian companies from those buyouts where an Indian company does a LBO of a foreign target company, with the intention of analyzing the former. The reason for making this distinction and restricting the scope of this paper to buyouts of Indian companies is, in the case of LBOs where the target company is located in countries such as the United Kingdom or the United States, the acquiring Indian companies / financial investors are able to obtain financing for the leveraged buyouts from foreign banks and the buyout is governed largely by the laws and regulations of the target company's country.

On the other hand, a leveraged buyout of an Indian company by either an Indian or a foreign acquirer needs to comply with the legal framework in India and the scope of execution permissible in India. This section of the paper examines the legal and regulatory hurdles to a successful LBO of an Indian company.

India has experienced a number of buyouts and leveraged buyouts since Tata Tea's LBO of UK heavyweight brand Tetley for £271 million in 2000, the first of its kind in India.

Table 3: List of buyouts by Indian companies

Target Company	*Country*	*Indian Acquirer*	*Value*	*Type*
Tetley	United Kingdom	Tata Tea	£271 million	LBO
Whyte & Mackay	United Kingdom	UB Group	£550 million	LBO
Corus	United Kingdom	Tata Steel	$11.3 billion	LBO
Hansen Transmissions	Netherlands	Suzlon Energy	€465 million	LBO
American Axle[1]	United States	Tata Motors	$2 billion	LBO
Lombardini[2]	Italy	Zoom Auto Ancillaries	$225 million	LBO

[1] Potential bid [2] Buyout attempt

Table 4: List of buyouts of Indian companies

Company	*Financial investor*	*Value*	*Type*
Flextronics Software Systems[1]	Kohlberg Kravis Roberts & Co. ('KKR')	$900 million	LBO
GE Capital International Services ('GECIS')	General Atlantic Partners, Oak Hill	$600 million	LBO
Nitrex Chemicals	Actis Capital	$13.8 million	MBO[2]
Phoenix Lamps	Actis Capital	$28.9 million[3]	MBO
Punjab Tractors[4]	Actis Capital	$60 million[5]	MBO
Nilgiris Dairy Farm	Actis Capital	$65 million[6]	MBO
WNS Global Services	Warburg Pincus	$40 million[7]	BO
RFCL (businesses of Ranbaxy)	ICICI Venture	$25 million	LBO
Infomedia India	ICICI Venture	$25 million	LBO
VA Tech WABAG India	ICICI Venture	$25 million	MBO
ACE Refractories (refractories business of ACC)	ICICI Venture	$60 million	LBO
Nirula's	Navis Capital Partners	$20 million	MBO

[1] Renamed Aricent. Referred to as Flextronics Software Systems throughout this paper.
[2] Management Buyout ('MBO')
[3] Paid for 36.7% promoter stake. Post the open offer, Actis' stake will increase from 45% to 65%.
[4] Government privatization.
[5] Total controlling interest of 28.4%. Punjab Tractors continues operating as a publicly listed company.
[6] Paid for 65% controlling stake. Balance held by the promoter family.
[7] Purchase of an 85% stake from British Airways

III.1 Restrictions on Foreign Investments in India

There are 2 routes through which foreign investments may be directed into India – the Foreign Institutional Investor ("FII") route and the Foreign Direct Investment ("FDI") route.

The FII route is generally used by foreign pension funds, mutual funds, investment trusts, endowment funds and the like to invest their proprietary funds or on behalf of other funds in equities or debt in India. Private equity firms are known to use to FII route to make minority investments in Indian companies. The FDI route is generally used by foreign companies for setting up operations in India or for making investments in publicly listed and unlisted companies in India where the investment horizon is longer than that of an FII and / or the intent is to exercise control.

III.1.A Limits on FII Investment

The Government of India has laid down investment limits for FIIs of 10% based on certain requirements and the maximum FII investment in each publicly listed company, which may at times be lower than the sectoral cap for foreign investment in that company. For example, the sectoral cap on foreign investment in the telecom sector is 100%. However, cumulative FII investment in an Indian telecom company would be subject to a ceiling of 24% or 49%, as the case may be, of the issued share capital of the said telecom company.

III.1.B Restrictions and Caps and Foreign Investment Promotion Board ('FIPB') Approval

Sectors where FDI is not permitted are Railways, Atomic Energy and Atomic Minerals, Postal Service, Gambling and Betting, Lottery and basic Agriculture or plantations with specified exceptions. Further, the Government has placed sector caps on ownership by foreign corporate bodies and individuals in Indian companies and 100% foreign ownership is not allowed in a number of industry sub-sectors under the current FDI regime.

Further, under the FDI route, FIPB approval is required for foreign investments where the proposed shareholding is above the prescribed sector cap or for investment in sectors where FDI is not permitted or where it is mandatory that proposals be routed through the FIPB [Refer Appendix I for industry-wise sector caps].

III.1.C Regulatory Developments in FDI

Despite the detailed guidelines for foreign investment in India, regulations relating to foreign investment continue to get formulated as the country gradually opens its doors to global investors. The evolving regulatory environment coupled with the lack of clarity about future regulatory developments create significant challenges for foreign investors.

For example, the Indian government lifted a ban on foreign ownership of Indian stock exchanges just three weeks before the NYSE Group, Goldman Sachs and other investors bought a 20% stake in the National Stock Exchange of India. At the time of lifting the ban, the Indian Government allowed international investors to buy as much as a combined 49% (FDI up to 26% and FII investment of up to 23%) in any of the 22 Indian stock exchanges. The limit for a single investor was set at 5% by the Securities and Exchange Board of India ('SEBI').

III.1.D List of Sectors where FDI Limit is Less Than 100%

The following table summarizes the list of sectors where the FDI limit is less than 100%.

Table 5: List of sectors where the FDI limit is less than 100% (as of February 26, 2006)

Sector	*Ownership Limit*	*Entry Route*
Domestic Airlines	49%	Automatic
Petroleum refining-PSUs	26%	FIPB
PSU Banks	20%	
Insurance	26%	Automatic
Retail Trade	51%	FIPB
Trading (Export House, Super Trading House, Star Trading House)	51%	Automatic
Trading (Export, Cash and Carry Wholesale)	100%	FIPB
Hardware facilities - (Uplinking, HUB, etc.)	49%	
Cable network	49%	
Direct To Home	20%	
Terrestrial Broadcast FM	20%	
Terrestrial TV Broadcast	Not Permitted	
Print Media - Other non-news/non-current affairs/specialty publications	74%	
Newspapers, Periodicals dealing with news and current affairs	26%	
Lottery, Betting and Gambling	Not Permitted	
Defense and Strategic Industries	26%	FIPB
Agriculture (including contract farming)	Not Permitted	
Plantations (except Tea)	Not Permitted	
Other Manufacturing - Items reserved for Small Scale	24%	Automatic
Atomic Minerals	74%	FIPB

Source: Investment Commission of India

III.1.E Key Advantages and Disadvantages of the Investment Routes

The key advantages and disadvantages of investments made through these routes are summarized below:

Table 6: Key advantages and disadvantages of the FDI and FII routes of investment

FDI	*FII*
Advantages	**Advantages**
▪ FDI route used when foreign investment is in excess of 10%. ▪ Allotment of shares on preferential basis as per the requirements of the Companies Act, 1956, possible. ▪ Off-market / Non-stock exchange purchases may be executed. ▪ FDI is the only route available for investing in unlisted companies in India. ▪ Automatic approval for FDI for investments in specified sectors based on the FDI guidelines.	▪ Ability to buy and sell securities freely on a stock exchange. ▪ The total investments by FII and Sub-Accounts in any Indian Company cannot exceed 24% of its total paid up capital. However, in certain companies, which have passed a Special Resolution in this regard, the total FII investment can be made upto 49% of the paid up capital. This limit of 24% / 49% is exclusively available for investments by FII only.
Disadvantages	**Disadvantages**
▪ FDI sector caps as per the Government FDI policy. ▪ FIPB approval required for investment in specified sectors.	▪ SEBI acts as the nodal point in the registration of FIIs. FII registration is a cumbersome process which involves registration with SEBI and approval from the Reserve Bank of India ('RBI'). ▪ FIIs are heavily regulated by SEBI through the Securities and Exchange Board of India (Foreign Institutional Investors) Regulations, 1995. ▪ No FII can hold more than 10% of the share capital of any publicly listed company. ▪ All non-stock exchange sales/purchases require RBI permission.

Despite the various restrictions on foreign investment in Indian companies, the FDI route is the only feasible route for leveraged buyouts in India by foreign investors.

III.2 Limited Availability of Control Transactions and Professional Management

Private equity firms face limited availability of control transactions in India. The reason for this is the relative small pool of professional management in corporate India. In a large number of Indian companies, the owners and managers are the same. Management control of such target companies wrests with promoters / promoter families who may not want to divest their controlling stake for additional capital. As a result, a large number of private equity transactions in India are minority transactions [Refer Appendix VI for recent minority private equity transactions in India].

In management buyouts, the Indian model is different from that in the West. Most of the MBOs in India are not of the classic variety wherein the company's managements create the deal and then involve financial investors to fund the change of control. In the Indian version, promoters have spun off or divested and private equity players have bought the businesses and then partnered with the existing management. The managements themselves don't have the resources to engineer such a buyout.

In the absence of control, it may be difficult to finance a minority investment using leverage given the lack of control over the cash flows of the target company to service the debt. Further, a minority private equity investor will be unable to sell it's holding to a strategic buyer, thereby limiting the exit options available for the investment.

III.3 Underdeveloped Corporate Debt Market

India is a developing country where the dependence on bank loans is substantial. The country has a bank-dominated financial system. The dominance of the banking system can be gauged from the fact that the proportion of bank loans to GDP is approximately 36%, while that

of corporate debt to GDP is only 4%. As a result, the corporate bond market is small and marginal in comparison with corporate bond markets in developed countries.

The corporate debt market in India has been in existence since Independence. Public limited companies have been raising capital by issuing debt securities in small amounts. State-owned public sector undertakings ('PSU') that started issuing bonds in financial year 1985-86 account for nearly 80% of the primary market. When compared with the government securities market, the growth of the corporate debt market has been less satisfactory. In fact, it has lost share in relative terms.

Table 7: Resources raised from the debt markets *INR billion*

Financial Year	***2000-01***	***2001-02***	***2002-03***	***2003-04***	***2004-05***
Total debt raised	1,850.56	2,040.69	2,350.96	2,509.09	2,050.81
Of which: Corporate[1]	565.73	515.61	531.17	527.52	594.79
	31%	*25%*	*23%*	*21%*	*29%*
Of which: Government	1,284.83	1,525.08	1,819.79	1,981.57	1,456.02
	69%	*75%*	*77%*	*79%*	*71%*

[1] Excludes euro issues
Sources: RBI, NSE, Prime Database

Another noteworthy trend in the corporate debt market is that a bulk of the bulk of debt raised has been through private placements. During the five years 2000-01 to 2004-05, private placements, on average, have accounted for nearly 92% of the total corporate debt raised annually. The dominance of private placements has been attributed to several factors, including ease of issuance, cost efficiency and primarily institutional demand. PSUs account for the bulk of private placements. The corporate sector has accounted for less than 20% of total private placements in recent years, and of that total, issuance by private sector manufacturing/services companies has constituted only a very small part. Large private placements limit transparency in the primary market.

Another interesting feature of the Indian corporate debt market is the preference for rated paper. Ratings issued by the major rating agencies have proved to be a reliable source of information. The data on ratings suggest that lower-quality credits have difficulty issuing bonds. The concentration of turnover in the secondary market also suggests that investors' appetite is mainly for highly rated instruments, with nearly 84% of secondary market turnover in AAA-rated securities. In addition, the pattern of debt mutual fund holdings on 30 June 2004 showed that nearly 53.3% of non-government security investments were held in AAA-rated securities, 14.7% in AA-rated securities and 10.8% in P1+ rated securities.

This is in sharp contrast to the use of high-yield bonds (also known as junk bonds) which became ubiquitous in the 1980s through the efforts of investment bankers like Michael Milken, as a financing mechanism in mergers and acquisitions. High-yield bonds are non-investment grade bonds and have a higher risk of defaulting, but typically pay high yields in order to make them attractive to investors. Unlike most bank debt or investment grade bonds, high-yield bonds lack 'maintenance' covenants whereby default occurs if financial health of the borrower deteriorates beyond a set point. Instead, they feature 'incurrence' covenants whereby default only occurs if the borrower undertakes a prohibited transaction, like borrowing more money when it lacks sufficient cash flow coverage to pay the interest.

The following table compares the corporate bond spreads in the US those in India. The bonds spreads for Indian companies in the low investment grade and non-investment grade bonds are clearly influenced by the limited number of such bonds in circulation and the lack of liquidity in those segments of the corporate debt market.

Table 8: Comparison of bond spreads of US Industrial companies with Indian companies

	AAA	AA	A+	A	A-	BBB+	BBB	BBB-
US Industrial companies (Nov 30, 2006)								*basis points*
1 Year	27	33	37	41	53	61	72	77
2 Years	34	41	42	46	55	63	72	91
3 Years	48	53	55	59	67	73	81	100
4 Years	59	64	67	70	77	83	93	112
5 Years	60	67	69	70	79	87	101	131
7 Years	49	56	64	68	78	87	106	144
8 Years	62	65	69	72	82	87	104	140
9 Years	73	77	83	87	97	102	110	146
10 Years	61	65	72	75	87	107	126	152
Indian companies (Oct 31, 2006)								*basis points*
1 Year	85	113	143	161	181	211	247	287
2 Years	94	120	149	167	186	214	252	292
3 Years	93	121	153	175	193	223	265	308
4 Years	95	124	155	177	195	224	267	311
5 Years	97	128	158	179	197	226	270	314
7 Years	104	131	163	185	203	238	285	332
8 Years	106	134	166	189	207	241	289	337
9 Years	108	137	170	192	212	244	293	341
10 Years	110	140	173	196	216	247	297	346

Source: Bloomberg and Fixed Income Money Market and Derivatives Association of India

The use of credit derivatives allows lenders to transfer an asset's risk and returns from one counter party to another without transferring the ownership. The credit derivatives market is virtually non-existent in India due to the absence of participants on the sell-side for credit protection and the lack of liquidity in the bond market.

Indian enterprises now have the ability to raise funds in foreign capital markets. Indeed, an underdeveloped domestic market pushes the better-quality issuers abroad, thereby accentuating the problems of developing the corporate debt market in India. All these drawbacks of the Indian corporate debt market make the use of the domestic debt market for financing leveraged buyouts in India virtually impossible.

III.4 Reserve Bank of India ('RBI') Restrictions on Lending

Domestic banks are prohibited by the RBI from providing loans for the purchase of shares in any company. The underlying reason for the prohibition is to ensure the safety of domestic banks. The RBI has issued a number of directives to domestic banks in regard to making advances against shares. These guidelines have been compiled in the Master Circular Dir.BC.90/13.07.05/98 dated August 28, 1998. As per these guidelines, domestic banks are not allowed to finance the promoters' contribution towards equity capital of a company, the rationale being that such contributions should come from the promoters' resources.

The RBI Master Circular states that the question of granting advances against primary security of shares and debentures including promoters' shares to industrial, corporate or other borrowers should not normally arise. The RBI only allows accepting such securities as collateral for secured loans granted as working capital or for other 'productive purposes' from borrowers. [Refer Appendix IV for an extract of the Master Circular]

The RBI has made an exception to this restriction. With the view to increasing the international presence of Indian companies, with effect from June 7, 2005, the RBI has allowed domestic banks to lend to Indian companies for purchasing equity in foreign joint ventures, wholly owned subsidiaries and other companies as strategic investments. Besides framing guidelines and safeguards for such lending, domestic banks are required to ensure that such acquisitions are beneficial to the borrowing company and the country.

Besides raising financing from Indian banks, companies have the option of funding overseas acquisitions through External Commercial Borrowings ('ECBs'). The Indian policy on ECBs allow for overseas acquisitions within the overall limit of US$500 million per year under

the automatic route with the conditions that the overall remittances from India and non-funded exposures should not exceed 200% of the net worth of the company.

The Reserve Bank of India has prescribed that a bank's total exposure, including both fund based and non-fund based, to the capital market in all forms covering

(a) direct investment in equity shares,

(b) convertible bonds and debentures and units of equity oriented mutual funds;

(c) advances against shared to individuals for investment in equity shares (including IPOs), bonds and debentures, units of equity-oriented mutual funds; and

(d) secured and unsecured advances to stockbrokers and guarantees issued on behalf of stockbrokers and market makers

should not exceed 5% of its total outstanding advances as on March 31 of the previous year (including Commercial Paper). Within the above ceiling, bank's direct investment should not exceed 20% of its net worth.

All these restrictions make it virtually impossible for a financial investor to finance a LBO of an Indian company using bank debt raised in India.

III.5 Prohibition on Borrowing from Indian Banks – FIPB Press Note 9

A somewhat arcane regulation, FIPB's Press Note 9 dated April 12, 1999 bars a foreign investment company from borrowing from an Indian bank to buy into a company in India.

Large banks – foreign as well as local – some multinational companies and a few private equity players have been lobbying with the Indian Government to change this rule. While bankers in India believe that they should have the freedom to invest in a wider number of asset classes, foreign investors argue that dismantling the norm will not only raise the return on the

equity they contribute in, but also make it possible for them to pay a higher price for the shares of local companies they buy.

The subject has assumed a deeper significance with the advent of a large number of private equity players - which are technically foreign investment companies, and thus cannot borrow from banks in India to invest in local firms. Whatever the private equity players invest is either pure equity or FDI cleared by the FIPB. This regulation clearly stands in the way of leveraged buyouts of Indian companies by foreign private equity firms. The World Economic Forum is also understood to have drawn the Indian Government's attention to Press Note 9. [Refer Appendix III for a copy of Press Note 9]

III.6 Restrictions on Public Companies from Providing Assistance to Potential Acquirers

Companies Act, 1956, Section 77(2) states that a public company (or a private company which is a subsidiary of a public company) may not provide either directly or indirectly through a loan, guarantee or provision of security or otherwise, any financial assistance for the purpose of or in connection with a purchase or subscription made or to be made by any person of or for any shares in the company or in its holding company.

Under the Companies Act, 1956, a public company is different from a publicly listed company. The restrictions placed by this section on public companies implies that prior to being acquired in a LBO, a public company, if it is listed, must delist and convert itself to a private company. Delisting requires the Company to follow the Securities and Exchange Board of India (Delisting of Securities) Guidelines – 2003. This section makes it impossible to obtain security of assets / firm financing arrangements for a publicly listed company until it delists itself and converts itself into a private company.

III.7 Restrictions Relating to Exit Through Public Listing

The most successful LBOs go public as soon as debt has been paid down sufficiently and improvements in operating performance have been demonstrated by the LBO target.

SEBI guidelines require mandatory listing of Indian companies on domestic exchange prior to a foreign listing. Indian companies may list their securities in foreign markets through the Issue Of Foreign Currency Convertible Bonds And Ordinary Shares (Through Depositary Receipt Mechanism) Scheme, 1993. Prior to the introduction of this scheme, Indian companies were not permitted to list on foreign bourses.

In order to bring these guidelines in alignment with the SEBI's guidelines on domestic capital issues, the Government incorporated changes to this scheme by requiring that an Indian company, which is not eligible to raise funds from the Indian capital markets including a company which has been restrained from accessing the securities market by the SEBI will not be eligible to issue ordinary shares through Global Depository Receipts ('GDR'). Unlisted companies, which have not yet accessed the GDR route for raising capital in the international market would require prior or simultaneous listing in the domestic market, while seeking to issue ordinary shares under the scheme. Unlisted companies, which have already issued GDRs in the international market, would now require to list in the domestic market on making profit beginning financial year 2005-06 or within three years of such issue of GDRs, whichever is earlier.

Thus, private equity players that execute a LBO of an Indian company and are looking at exiting their investment will require dual listing of the company – on a domestic stock exchange as well as a foreign stock exchange – if they intend to exit the investment through a foreign listing.

SEBI listing regulations require domestic companies to identify the promoters of the listing company for minimum contribution and promoter lock-in purposes. In case of an IPO, the promoters have to necessarily offer at least 20% of the post-issue capital. In case of public issues by listed companies, the promoters shall participate either to the extent of 20% of the proposed issue or ensure post-issue share holding to the extent of 20% of the post-issue capital.

Further, SEBI guidelines have stipulated lock-in (freeze on the shares) requirements on shares of promoters primarily to ensure that the promoters, who are controlling the company, shall continue to hold some minimum percentage in the company after the public issue. In case of any issue of capital to the public the minimum contribution of promoters shall be locked in for a period of three years, both for an IPO and public issue by listed companies. In case of an IPO, if the promoters' contribution in the proposed issue exceeds the required minimum contribution, such excess contribution shall also be locked in for a period of one year. In addition, the entire pre-issue share capital, or paid up share capital prior to IPO, and shares issued on a firm allotment basis along with issue shall be locked-in for a period of one year from the date of allotment in public issue.

For a private equity investor in a LBO of an Indian company, the IPO route does not allow the investor a clean exit from its investment due to the minimum promoter contribution and lock-in requirements.

Besides these drawbacks, there are other factors that play an important role in exiting a LBO in India. Exit through the public markets depends upon the target company’s operations. If the operations are located solely in India, sale in the domestic public markets is most lucrative. If the portfolio company has operations or an export presence in foreign markets, it may be more beneficial to list the company in foreign capital markets.

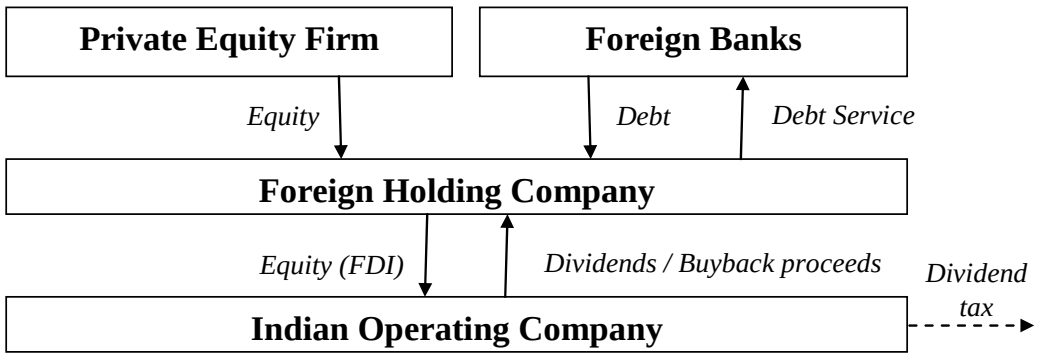
IV. STRUCTURING CONSIDERATIONS FOR LEVERAGED BUYOUTS IN INDIA

The hurdles to executing a LBO in India, as discussed in the previous section, has given rise to two buyout structures, referred to in this paper as the Foreign Holding Company Structure and the Asset Buyout Structure, that may be used for effecting a LBO of an Indian company. However, both these structures are rife with their own set of challenges that are unique to the Indian environment. The Holding Company and the Asset Buyout structures along with key considerations / drawbacks are discussed as follows.

IV.1 Foreign Holding Company Structure

The financial investor incorporates and finances (using debt and equity) a Foreign Holding Company. Debt to finance the acquisition is raised entirely from foreign banks. The proceeds of the equity and debt issue is used by the Foreign Holding Company to purchase equity in the Indian Operating Company in line with FIPB Press Note 9. The amount being invested to purchase a stake in the India Operating Company is channeled into India as FDI. The seller of the Indian Operating Company may participate in the LBO and receive securities in the Foreign Holding Company as part of the payment, such as rollover equity and seller notes.

Figure 1: Illustrative Foreign Holding Company Structure



The operating assets of the purchased business are within the corporate entity of the Indian Operating Company. As a result, cash flows are generated by the Indian Operating Company while principal and interest payment obligations reside in the Foreign Holding Company. The Indian Operating Company makes dividend or share buyback payments to the Foreign Holding Company, which is used by the latter for servicing the debt. Under the current FDI regime foreign investments, including dividends declared on foreign investments, are freely repatriable through an Authorized Dealer. [Refer Appendix V for buyout structure of Flextronics Software Systems]

IV.1.A Lien on Assets

Based on the LBO structure above, the debt and the operating assets lie in two separate legal entities. The Indian Operating Company is unable to provide collateral of its assets for securing the debt which resides in the Foreign Holding Company. While this feature of the Foreign Holding Company Structure may be anathema for lenders looking at providing secured debt for the LBO, it may be of less significance when the LBO target is an asset-light business such as a business process outsourcing or a information technology services company. Investing in a services company may be a rational strategy of using this LBO structure.

Financial investors may consider legally placing certain assets of the business in the Foreign Holding Company, such as customer contracts of a business process outsourcing or information technology services company. These assets may be used as collateral and generate operating income for the Foreign Holding Company. Contracts between the Foreign Holding Company and the Indian Operating Company will have to satisfy India's transfer pricing regulations.

IV.1.B Non-deductibility of Interest Payments

Given that the debt and the operating assets reside in separate legal entities, there is no deduction of interest payments from operating income of the Indian Operating Company. One of the financial justifications for a LBO is lost under this structure. However, this factor assumes less significance for export-oriented companies which operate out of Special Economic Zones or Software Technology Parks (under the Software Technology Park scheme) in India and avail tax incentives which lowers their effective tax rate significantly.

IV.1.C Foreign Currency Risk

The Foreign Holding Company structure entails an exposure to foreign currency risk since revenues of the Indian Operating company are denominated in Indian Rupees and the debt in the Foreign Holding Company is denominated in foreign currency. The foreign currency risk may be hedged in the financial markets at a cost, which increases the overall cost of the LBO. Alternatively, if the Indian Operating Company's revenues are denominated primarily in foreign currency due to an export-focus, this risk is mitigated due to the natural hedge provided by foreign currency denominated revenues.

IV.1.D Tax Leakage through Dividend Tax

There is tax leakage under the Foreign Holding Company structure through mandatory dividend tax payments on dividends paid by the Indian Operating Company to service the debt of the Foreign Holding Company. As per Budget 2007 introduced for the financial year 2007-2008, Dividend Distribution Tax rate has increased from 12.5% to 15%.

IV.1.E Restrictions Relating to Share Buyback

Often, the Indian Operating Company may make remittances to the Foreign Holding Company through share buybacks instead of dividends. The number of shares and size of

buybacks are governed by the Companies Act, 1956. Section 77A of the Act allows companies to buyback shares. However, the provisions for the buyback of shares comes with certain conditions, which are detailed as follows:

(a) A company may buyback share only out of free reserves, the securities premium account or from the proceeds of any different kind of shares or other specified securities. This condition puts a restriction on the amount of the buyback based on the balance sheet of the target company.

(b) No offer of buyback shall be made within a period of 365 days reckoned from the date of the last offer of buy-back. As a result, companies may buyback its own shares only once every year.

(c) The buyback of equity shares in any financial year cannot exceed 25% of its total paid-up (book) equity capital in that financial year. Similar to (a) above, this condition puts a limit on the number of shares that can be bought back in each financial year.

(d) The ratio of the debt owed by the company is not more than twice the (book) capital and free reserves after such buy-back. This condition is critical to structuring the LBO. In the Foreign Holding Company structure this condition puts a limit of the amount of debt that may be assumed by the Indian Operating Company. The amount of debt in the Indian Operating Company puts a limit of the amount of shares that may be bought back. Thus, there is a trade-off between the size of the buyback and the amount of debt that may be raised by the Indian Operating Company.

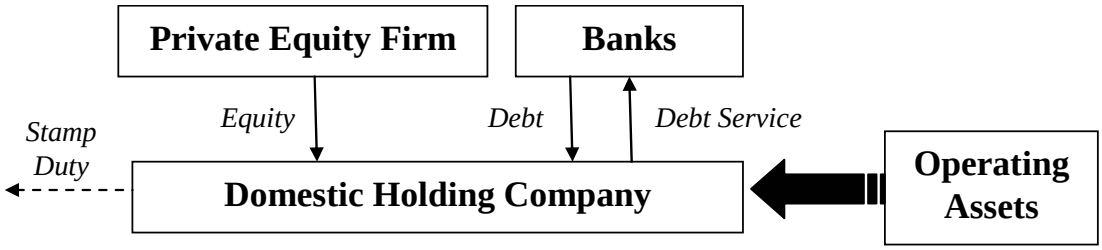
IV.1.F Facilitation of Exit Through Foreign Listing

The Foreign Holding Company structure allows the financial investor to list the holding company domiciled in a foreign jurisdiction on a US / European stock exchange without listing the Indian Operating Company on the Indian stock exchange. This provides the financial investor a clean exit from the investment.

IV.2 Asset Buyout Structure

Under an Asset Buyout, the financial investor incorporates a Domestic Holding Company and finances it using debt and equity. The debt is raised based on an purchase agreement to buy operating assets and is secured by those assets, since asset-backed, project loans and secured working capital loans is permissible for domestic banks in India. The Domestic Holding Company then purchases the operating assets of the business on an asset-by-asset basis e.g. land, building, machinery etc. Foreign investors may invest in the equity of the Domestic Holding Company through the FDI route.

Figure 2: Illustrative Asset Buyout Structure



IV.2.A Stamp Duty Liability and Execution Risk

In an Asset Buyout structure, the Domestic Holding Company which is buying the operating assets is liable to pay stamp duty on the assets purchased. Stamp duty adds an additional 5-10% to the total transaction cost depending upon the assets purchased and Indian state in which stamp duty is assessed, since different states have different rates of stamp duty. Further, the purchase of assets requires the purchaser to identify and value each of the assets purchased separately for the purpose of assessment by the relevant authorities e.g. land, building, machinery etc as each such asset has a separate rate of stamp duty. A LBO of an asset-intensive company may make the transaction unfeasible.

The identification and valuation of individual assets purchased along with assessment of the stamp duty by the relevant authorities involves complex structuring of the transaction making the execution of this structure complex and risky.

IV.2.B Higher Tax Liability for Seller

The purchase and sale of shares of a company (as envisaged by the Foreign Holding Company Structure) attracts Securities Transaction Tax (0.125%) for listed shares and Long Term Capital Gains Tax (10-20%). However, sale of assets by the seller is treated as a revenue by the Income Tax Act, 1956 and such gain is assessed as business income on which the tax rate is 30% to be increased by a 10% surcharge and an education cess of 3% (34% effective tax rate).

V. HYPOTHETICAL FINANCIAL MODEL OF A LEVERAGED BUYOUT IN INDIA

I have constructed a financial model of a leveraged buyout in India for a hypothetical business process outsourcing company. The operating and financial characteristics of the company are loosely based on those of the LBO of Flextronics Software Systems by KKR using information available from public sources, to the extent available. However, this model may not be considered representative of Flextronics Software Systems or its LBO given the limited availability of financial information since it went private in 2005.

V.1 Key Inputs and Assumptions

The key inputs used in the model are elaborated as follows:

Table 9: Hypothetical Opening Balance Sheet

($ in millions) **Consolidated Opening Balance Sheet**	**Pre-Transaction**
Accounts Receivable	25.0
Prepaid & Other Assets	20.0
Total Current Assets	$45.0
PP&E	$25.0
Total Assets	**$70.0**
Current Liabilities & Provisions	$30.0
Common Equity	$2.0
Retained Earnings	$38.0
Shareholders' Equity	$40.0
Total Liabilities & Shareholders' Equity	**$70.0**

Table 10: Hypothetical Income Statement in Year 1

($ in millions) **Income Statement**	**Year 1**
Total Revenues	100.0
Cost of Goods Sold	(32.0)
Gross Profit	$68.0
Operating Expenses	($20.0)
EBITDA	48.0
Depreciation & Amortization	($8.0)
Capital Expenditures	(12.0)

Table 11: Sources and Uses of Funds

($ in millions)

Sources of Funds	Without Stamp Duty	With Stamp Duty	Uses of Funds	Without Stamp Duty	With Stamp Duty
Revolving Credit Facility (1)	$0.0	$0.0	Purchase Price	$540.0	$540.0
Term Loan	155.0	155.0	Estimated Fees and Expenses	20.0	75.0
Seller Notes	130.0	130.0			
Equity Contribution	275.0	330.0			
Total Sources	$560.0	$615.0	Total Uses	$560.0	$615.0

(1) Total commitment of $30.0 million.

Operating Assumptions for the projection period are as follows:

- Revenue growth of 20% (Years 2 and 3), 15% (Years 4 to 6) and 10% (Year 7 to 8);
- Gross margins of 60% (Years 1 to 3), 55% (Years 4 to 6) and 50% (Year 7 to 8);
- EBITDA margins of 40% (Years 1 to 3), 35% (Years 4 to 6) and 30% (Year 7 to 8);
- Depreciation and capital expenditures at 8% and 12% of total revenues respectively;
- The Revolving Credit Facility and the Term Loan is priced at LIBOR + 300 basis points;
- The Revolving Credit Facility commitment fee is 0.5%;
- The Seller Notes carry a 11% Pay-In-Kind ('PIK') coupon;
- Financing costs are written off over a period of 7 years;
- Components of net working capital as a % of revenue / cost of goods sold are constant;
- The effective tax rate for the Company is 10% through the projection period;
- Dividend Distribution Tax is 15% based on the Budget for 2007;
- Foreign currency risks and hedging costs have been ignored;
- Stamp duty paid under the Asset Buyout Structure, assumed at 10% of the transaction cost, is funded by increased equity contribution, $330 million instead of $275 million, since debt capacity is fully utilized; and
- We assume exit from the investment at the end of Year 6 at an exit multiple of 12x EBITDA.

V.2 Case 1: Foreign Holding Company Structure with Dividend Payments

Table 12: Output for Foreign Holding Company Structure with Dividends (and Dividend Tax)

($ in millions)	Year							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Total Revenues	$100.0	$120.0	$144.0	$165.6	$190.4	$219.0	$240.9	$265.0
Growth %		*20.0%*	*20.0%*	*15.0%*	*15.0%*	*15.0%*	*10.0%*	*10.0%*
Gross Profit	$60.0	$72.0	$86.4	$91.1	$104.7	$120.5	$120.5	$132.5
Margin %	*60.0%*	*60.0%*	*60.0%*	*55.0%*	*55.0%*	*55.0%*	*50.0%*	*50.0%*
EBITDA	$40.0	$48.0	$57.6	$58.0	$66.7	$76.7	$72.3	$79.5
Margin %	*40.0%*	*40.0%*	*40.0%*	*35.0%*	*35.0%*	*35.0%*	*30.0%*	*30.0%*
EBITDA	$40.0	$48.0	$57.6	$58.0	$66.7	$76.7	$72.3	$79.5
Less: Cash Interest Expense	(12.6)	(11.4)	(9.9)	(7.9)	(5.6)	(2.9)	(0.6)	0.3
Less: Cash Taxes	(0.2)	(0.8)	(1.5)	(1.4)	(2.0)	(2.8)	(2.2)	(2.7)
Less: (Incr.)/Decr. in Working Capital	0.0	(3.0)	(3.6)	3.0	(2.8)	(3.2)	6.6	(1.8)
Less: Capital Expenditures	(12.0)	(14.4)	(17.3)	(19.9)	(22.9)	(26.3)	(28.9)	(31.8)
Free Cash Flow before Dividend Tax	15.2	18.4	25.3	31.8	33.4	41.4	47.1	43.4
Less: Dividend Tax	(2.3)	(2.8)	(3.8)	(4.8)	(5.0)	(6.2)	(7.1)	(6.5)
Free Cash Flow	**$12.9**	**$15.6**	**$21.5**	**$27.0**	**$28.4**	**$35.2**	**$40.1**	**$36.9**
Cumulative Free Cash Flow	12.9	28.5	50.0	77.1	105.4	140.6	180.7	217.6
Capitalization:								
Cash & Cash Equivalents	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$25.7	$62.6
Revolving Credit Facility	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Term Loan	142.1	126.5	105.0	77.9	49.6	14.4	0.0	0.0
Total Senior Debt	142.1	126.5	105.0	77.9	49.6	14.4	0.0	0.0
Seller Notes	144.7	161.0	179.2	199.5	222.1	247.2	275.1	306.2
Total Debt	286.8	287.5	284.2	277.5	271.6	261.5	275.1	306.2
Credit Statistics:								
Senior Debt / EBITDA	3.55x	2.63x	1.82x	1.34x	0.74x	0.19x	0.00x	0.00x
Total Debt / EBITDA	7.17x	5.99x	4.93x	4.79x	4.08x	3.41x	3.81x	3.85x
EBITDA / Cash Int. Exp.	3.17x	4.20x	5.81x	7.32x	11.91x	26.49x	112.83x	NA
(EBITDA - Capex) / Cash Int. Exp.	2.22x	2.94x	4.06x	4.81x	7.83x	17.41x	67.70x	NA

Table 13: Exit Valuation and Range of Values for IRR

Exit Valuation	**$ millions**
Exit Year	6
Exit Multiple	12.0x
Exit Year EBITDA	$76.7
Exit Valuation (Total Firm Value)	$919.8
Term Loan	14.4
Seller Notes	247.2
Less: Accumulated Cash	0.0
Net Debt	$261.5
Equity Value	$658.3

IRR Calculation		**Exit Year**				
	0.2	4	5	6	7	8
Exit Multiple	11.0x	7.0%	10.9%	13.3%	10.3%	10.9%
	11.5x	9.1%	12.5%	14.5%	11.3%	11.8%
	12.0x	11.0%	13.9%	**15.7%**	12.3%	12.6%
	12.5x	12.9%	15.3%	16.8%	13.2%	13.4%
	13.0x	14.7%	16.7%	17.8%	14.0%	14.1%

The term loan is fully repaid in Year 7. The financial investor earns an IRR of 15.7% based on 12.0x EBITDA exit valuation in Year 6.

V.3 Case 2: Foreign Holding Company Structure with Share Buyback

Table 14: Output for Foreign Holding Company Structure with Share Buyback

($ in millions)	Year							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Total Revenues	$100.0	$120.0	$144.0	$165.6	$190.4	$219.0	$240.9	$265.0
Growth %		*20.0%*	*20.0%*	*15.0%*	*15.0%*	*15.0%*	*10.0%*	*10.0%*
Gross Profit	$60.0	$72.0	$86.4	$91.1	$104.7	$120.5	$120.5	$132.5
Margin %	*60.0%*	*60.0%*	*60.0%*	*55.0%*	*55.0%*	*55.0%*	*50.0%*	*50.0%*
EBITDA	$40.0	$48.0	$57.6	$58.0	$66.7	$76.7	$72.3	$79.5
Margin %	*40.0%*	*40.0%*	*40.0%*	*35.0%*	*35.0%*	*35.0%*	*30.0%*	*30.0%*
EBITDA	$40.0	$48.0	$57.6	$58.0	$66.7	$76.7	$72.3	$79.5
Less: Cash Interest Expense	(12.5)	(11.1)	(9.3)	(6.8)	(4.0)	(1.3)	0.2	0.7
Less: Cash Taxes	(0.2)	(0.8)	(1.6)	(1.5)	(2.2)	(3.0)	(2.2)	(2.8)
Less: (Incr.)/Decr. in Working Capital	0.0	(3.0)	(3.6)	3.0	(2.8)	(3.2)	6.6	(1.8)
Less: Capital Expenditures	(12.0)	(14.4)	(17.3)	(19.9)	(22.9)	(26.3)	(28.9)	(31.8)
Free Cash Flow before Dividend Tax	15.3	18.7	25.9	32.7	34.8	42.9	47.9	43.8
Less: Dividend Tax	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Free Cash Flow	**$15.3**	**$18.7**	**$25.9**	**$32.7**	**$34.8**	**$42.9**	**$47.9**	**$43.8**
Cumulative Free Cash Flow	15.3	34.0	59.8	92.6	127.4	170.3	218.2	262.0
Capitalization:								
Cash & Cash Equivalents	$0.0	$0.0	$0.0	$0.0	$0.0	$15.3	$63.2	$107.0
Revolving Credit Facility	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Term Loan	139.7	121.0	95.2	62.4	27.6	0.0	0.0	0.0
Total Senior Debt	139.7	121.0	95.2	62.4	27.6	0.0	0.0	0.0
Seller Notes	144.7	161.0	179.2	199.5	222.1	247.2	275.1	306.2
Total Debt	284.4	282.1	274.4	261.9	249.7	247.2	275.1	306.2
Credit Statistics:								
Senior Debt / EBITDA	3.49x	2.52x	1.65x	1.08x	0.41x	0.00x	0.00x	0.00x
Total Debt / EBITDA	7.11x	5.88x	4.76x	4.52x	3.75x	3.22x	3.81x	3.85x
EBITDA / Cash Int. Exp.	3.20x	4.32x	6.21x	8.47x	16.69x	60.94x	NA	NA
(EBITDA - Capex) / Cash Int. Exp.	2.24x	3.02x	4.35x	5.57x	10.97x	40.04x	NA	NA

Table 15: Exit Valuation and Range of Values for IRR

Exit Valuation	**$ millions**
Exit Year	6
Exit Multiple	12.0x
Exit Year EBITDA	$76.7
Exit Valuation (Total Firm Value)	$919.8
Term Loan	0.0
Seller Notes	247.2
Less: Accumulated Cash	(15.3)
Net Debt	$231.9
Equity Value	$688.0

IRR Calculation		**Exit Year**				
	0.2	4	5	6	7	8
Exit Multiple	11.0x	8.1%	11.9%	14.2%	11.3%	11.9%
	11.5x	10.1%	13.5%	15.4%	12.3%	12.7%
	12.0x	12.1%	14.9%	**16.5%**	13.2%	13.5%
	12.5x	13.9%	16.2%	17.6%	14.1%	14.2%
	13.0x	15.6%	17.5%	18.6%	14.9%	14.9%

The term loan is fully repaid in Year 6 instead of Year 7 as per the earlier scenario. The financial investor earns a higher IRR of 16.5% based on 12.0x EBITDA exit valuation.

V.4 Case 3: Asset Buyout Structure

Table 16: Output for Asset Buyout Structure (including Stamp Duty)

($ in millions)	Year							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Total Revenues	$100.0	$120.0	$144.0	$165.6	$190.4	$219.0	$240.9	$265.0
Growth %		*20.0%*	*20.0%*	*15.0%*	*15.0%*	*15.0%*	*10.0%*	*10.0%*
Gross Profit	$60.0	$72.0	$86.4	$91.1	$104.7	$120.5	$120.5	$132.5
Margin %	*60.0%*	*60.0%*	*60.0%*	*55.0%*	*55.0%*	*55.0%*	*50.0%*	*50.0%*
EBITDA	$40.0	$48.0	$57.6	$58.0	$66.7	$76.7	$72.3	$79.5
Margin %	*40.0%*	*40.0%*	*40.0%*	*35.0%*	*35.0%*	*35.0%*	*30.0%*	*30.0%*
EBITDA	$40.0	$48.0	$57.6	$58.0	$66.7	$76.7	$72.3	$79.5
Less: Cash Interest Expense	(12.5)	(11.1)	(9.2)	(6.6)	(3.7)	(1.1)	0.3	0.8
Less: Cash Taxes	0.0	(0.0)	(0.8)	(0.7)	(1.4)	(2.2)	(1.5)	(2.8)
Less: (Incr.)/Decr. in Working Capital	0.0	(3.0)	(3.6)	3.0	(2.8)	(3.2)	6.6	(1.8)
Less: Capital Expenditures	(12.0)	(14.4)	(17.3)	(19.9)	(22.9)	(26.3)	(28.9)	(31.8)
Free Cash Flow before Dividend Tax	15.5	19.5	26.8	33.7	35.9	43.9	48.8	43.9
Less: Dividend Tax	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Free Cash Flow	**$15.5**	**$19.5**	**$26.8**	**$33.7**	**$35.9**	**$43.9**	**$48.8**	**$43.9**
Cumulative Free Cash Flow	15.5	35.0	61.8	95.5	131.3	175.2	224.0	267.8
Capitalization:								
Cash & Cash Equivalents	$0.0	$0.0	$0.0	$0.0	$0.0	$20.2	$69.0	$112.8
Revolving Credit Facility	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Term Loan	139.5	120.0	93.2	59.5	23.7	0.0	0.0	0.0
Total Senior Debt	139.5	120.0	93.2	59.5	23.7	0.0	0.0	0.0
Seller Notes	144.7	161.0	179.2	199.5	222.1	247.2	275.1	306.2
Total Debt	284.2	281.0	272.5	259.0	245.7	247.2	275.1	306.2
Credit Statistics:								
Senior Debt / EBITDA	3.49x	2.50x	1.62x	1.03x	0.35x	0.00x	0.00x	0.00x
Total Debt / EBITDA	7.11x	5.86x	4.73x	4.47x	3.69x	3.22x	3.81x	3.85x
EBITDA / Cash Int. Exp.	3.20x	4.34x	6.29x	8.74x	18.01x	72.05x	NA	NA
(EBITDA - Capex) / Cash Int. Exp.	2.24x	3.04x	4.41x	5.74x	11.84x	47.35x	NA	NA

Table 17: Exit Valuation and Range of Values for IRR

Exit Valuation	**$ millions**
Exit Year	6
Exit Multiple	12.0x
Exit Year EBITDA	$76.7
Exit Valuation (Total Firm Value)	$919.8
Term Loan	0.0
Seller Notes	247.2
Less: Accumulated Cash	(20.2)
Net Debt	$226.9
Equity Value	$692.9

IRR Calculation		**Exit Year**				
	0.1	4	5	6	7	8
Exit Multiple	11.0x	3.5%	8.1%	11.0%	8.6%	9.5%
	11.5x	5.4%	9.6%	12.1%	9.6%	10.3%
	12.0x	7.2%	10.9%	**13.2%**	10.4%	11.0%
	12.5x	9.0%	12.2%	14.2%	11.3%	11.7%
	13.0x	10.6%	13.5%	15.2%	12.1%	12.4%

The term loan is fully paid off in Year 6. The financial investor earns the lowest IRR among the 3 scenarios – 13.2% based on 12.0x EBITDA exit valuation.

VI. FINDINGS OF LEVERAGED BUYOUTS IN INDIA

VI.1 Industries of Focus

Two of the largest LBOs in India were those of business process outsourcing companies – Flextronics Software Systems (renamed Aricent after the LBO) and GECIS (renamed Genpact). Attractive industry sectors for LBOs in India would be outsourcing companies, service companies and high technology companies. Companies in these industry sectors are labor intensive and their costs are globally competitive due to a low-cost, highly educated English speaking workforce in India. The labor intensity of these businesses makes the target company scalable for achieving the high growth required to make the LBO successful. Further these companies typically earn their revenues from exports denominated in foreign currency, which mitigates foreign currency risk when the LBO is financed using foreign currency denominated debt raised from foreign banks. These companies also have low tax rates due to the tax incentives of operating from Special Economic Zones and Software Technology Parks.

Outsourcing, service and technology companies form an important part of India's exports, boast of a global customer base and have established a global reputation for service, quality and delivery.

VI.2 Growth Critical to the Success of the LBO

Standard & Poors expect the Indian economy to grow at a rate of 7.9 – 8.4% for the year 2007-2008. One of the key drivers of return in a LBO in India is growth. India is in a growth stage and the markets are relatively young compared to those in developed countries. Indian companies face large capital requirements and despite the ample availability of capital in the international markets and in India for portfolio investments, there is a shortage of capital for funding operations and growth.

Indian companies that are targets of buyouts are experiencing significant year-on-year growth, generally 15-20% every year and sometimes as high as 40-60%. A joint report published by NASSCOM and McKinsey in December 2005 projected a 42.1% compound annual growth rate of the overall Indian offshore business process outsourcing industry for the period 2003-2006. The NASSCOM-McKinsey report estimates that the offshore business process outsourcing industry will grow at a 37.0% compound annual growth rate, from $11.4 billion in fiscal 2005 to $55.0 billion in fiscal 2010. The NASSCOM-McKinsey report estimates that India-based players accounted for 46% of offshore business process outsourcing revenue in fiscal 2005 and India will retain its dominant position as the most favored offshore business process outsourcing destination for the foreseeable future. It forecasts that the Indian offshore business process outsourcing market will grow from $5.2 billion in revenue in fiscal 2005 to $25.0 billion in fiscal 2010, representing a compound annual growth rate of 36.9%. Additionally, it identifies retail banking, insurance, travel and hospitality and automobile manufacturing as the industries with the greatest potential for offshore outsourcing.

Warburg Pincus purchased 85% of WNS Global Services, a business process outsourcing company, from British Airways for $40 million in 2002. WNS Global Services offers a wide range of offshore support services to its global customers, particularly within the travel, insurance, financial, enterprise and knowledge industries. WNS Global Services completed its initial public offering on the NYSE in July 2006. WNS Global Services has a market capitalization (as of March 2007) of $1.19 billion. WNS Global Services was a young and growing company (instead of a mature company with steady cash flows as required for a typical LBO) when it was acquired by Warburg Pincus. Given the size of the transaction, it was all equity financed as it may not have been possible to obtain debt for a transaction of that size.

The following table elaborates on the growth history / prospects of some of the companies that are buyouts / leveraged buyouts in India.

Table 18: Growth History / Prospects of Target Companies

Company	*Growth History / Prospects*
Flextronics Software Systems	Revenues for the year ended March 31, 2005 amounted to $117.5 million as per reported US GAAP financial statements. Based on an October 2006 interview, the company disclosed annual revenues to be 'a bit more than $300 million'. The company is targeting to achieve revenues of $1 billion by 2011-12.
GE Capital International Services	Annual revenues of $404 million and $493 million in 2004 and 2005 respectively. The Company has set a stiff target of achieving an annual revenue of $1 billion by December 2008. Of this, the additional revenue growth of $500 million includes $350 million through organic growth and $150 million through acquisitions.
WNS Global Services	Reported revenues of $104 million, $162 million and $203 million for 2004, 2005 and 2006 respectively. Between fiscal 2003 and fiscal 2006, revenue grew at a compound annual growth rate of 54.9%.
RFCL (businesses of Ranbaxy)	Expected to double revenues in the financial year 2006-2007.
Infomedia India	Expected to show a very significant increase in revenue and profits in financial year 2007, and is expected to double its profits in that year from that in the previous year.
VA Tech WABAG India	Revenues at VA Tech WABAG are expected to grow at a rate of 30% over financial year 2005-06.
ACE Refractories (refractories business of ACC)	Ace Refractories is expecting to grow revenues by more than 20%, with exports growing by about 40%.

The high growth characteristics of the target company entails greater execution risk for the management of the target company and the financial investor. Most of the equity returns are generated from growth by scaling and ramping up the operations of the portfolio company through hiring and training employees, expanding capacity and adding additional customer contracts. This sort of rapid scaling up of operations requires high quality management talent, robust internal processes and a large pool of skilled human resources. Executing the growth business plan and delivering the growth is key to return on the investment.

The following table from the financial model illustrates the dramatic decline in profitability as a result of slower than planned growth of the target company.

Table 19: Output for Foreign Holding Company Structure with Share Buyback (Slow Growth Case)

($ in millions)	Year							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Total Revenues	$100.0	$115.0	$128.8	$141.7	$155.8	$168.3	$181.8	$192.7
Growth %		*15.0%*	*12.0%*	*10.0%*	*10.0%*	*8.0%*	*8.0%*	*6.0%*
Gross Profit	$60.0	$69.0	$77.3	$77.9	$85.7	$92.6	$90.9	$96.3
Margin %	*60.0%*	*60.0%*	*60.0%*	*55.0%*	*55.0%*	*55.0%*	*50.0%*	*50.0%*
EBITDA	$40.0	$46.0	$51.5	$49.6	$54.5	$58.9	$54.5	$57.8
Margin %	*40.0%*	*40.0%*	*40.0%*	*35.0%*	*35.0%*	*35.0%*	*30.0%*	*30.0%*
EBITDA	$40.0	$46.0	$51.5	$49.6	$54.5	$58.9	$54.5	$57.8
Less: Cash Interest Expense	(12.5)	(11.1)	(9.4)	(7.3)	(4.9)	(2.3)	(0.4)	0.3
Less: Cash Taxes	(0.2)	(0.6)	(1.1)	(0.8)	(1.2)	(1.5)	(0.9)	(1.2)
Less: (Incr.)/Decr. in Working Capital	0.0	(2.3)	(2.1)	3.4	(1.6)	(1.4)	5.3	(0.8)
Less: Capital Expenditures	(12.0)	(13.8)	(15.5)	(17.0)	(18.7)	(20.2)	(21.8)	(23.1)
Free Cash Flow before Dividend Tax	15.3	18.2	23.5	27.9	28.1	33.5	36.8	33.0
Less: Dividend Tax	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Free Cash Flow	**$15.3**	**$18.2**	**$23.5**	**$27.9**	**$28.1**	**$33.5**	**$36.8**	**$33.0**
Cumulative Free Cash Flow	15.3	33.5	57.0	84.9	113.0	146.5	183.2	216.2
Capitalization:								
Cash & Cash Equivalents	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$28.2	$61.2
Revolving Credit Facility	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Term Loan	139.7	121.5	98.0	70.1	42.0	8.5	0.0	0.0
Total Senior Debt	139.7	121.5	98.0	70.1	42.0	8.5	0.0	0.0
Seller Notes	144.7	161.0	179.2	199.5	222.1	247.2	275.1	306.2
Total Debt	284.4	282.6	277.3	269.7	264.1	255.7	275.1	306.2
Credit Statistics:								
Senior Debt / EBITDA	3.49x	2.64x	1.90x	1.41x	0.77x	0.14x	0.00x	0.00x
Total Debt / EBITDA	7.11x	6.14x	5.38x	5.44x	4.84x	4.34x	5.04x	5.30x
EBITDA / Cash Int. Exp.	3.20x	4.13x	5.47x	6.80x	11.05x	25.41x	144.78x	NA
(EBITDA - Capex) / Cash Int. Exp.	2.24x	2.89x	3.83x	4.47x	7.26x	16.70x	86.87x	NA

Table 20: Exit Valuation and Range of Values for IRR (Slow Growth Case)

Exit Valuation	**$ millions**
Exit Year	6
Exit Multiple	12.0x
Exit Year EBITDA	$58.9
Exit Valuation (Total Firm Value)	$706.9
Term Loan	8.5
Seller Notes	247.2
Less: Accumulated Cash	0.0
Net Debt	$255.7
Equity Value	$451.2

IRR Calculation		**Exit Year**				
	0.1	4	5	6	7	8
Exit Multiple	11.0x	0.1%	4.1%	6.1%	3.6%	4.5%
	11.5x	2.3%	5.7%	7.4%	4.7%	5.4%
	12.0x	4.3%	7.3%	**8.6%**	5.8%	6.3%
	12.5x	6.2%	8.7%	9.8%	6.8%	7.1%
	13.0x	8.1%	10.1%	10.8%	7.7%	7.9%

Note that the growth assumptions in this case are far higher than those of LBOs in the US and in Europe.

VI.3 Growth Puts Structural Limitations on Leverage

The internal operating cash flows generated by a target company which is growing in excess of 15-20% every year would be required to finance the growth through investment in capital expenditure and working capital. As a result, a financial investor may not be able to gear a capital-intensive target company to the same level as that in international markets. The hypothetical model in section V assume capital expenditure at 12% of revenues, which may be significantly understating reality for industrial companies.

VI.4 Indian LBOs Favor The Use of Pay-In-Kind Securities with Bullet Repayment

Since the debt servicing for a typical Indian LBO is through dividend payments / proceeds of share buyback and the Foreign Holding Company receives lump sum sale proceeds on divestiture of the portfolio company, the debt that most is most friendly to the LBO is a non-amortizing loan with Pay-In-Kind ("PIK") interest payments and a 5-8 year bullet repayment at maturity. The debt is not required to be serviced through cash payments during the investment period, thus saving dividend tax and the requirement to remit proceeds through share buybacks. Further, the payment on divestiture of the operating company may be used to make the bullet repayment of the loan. This is very similar to the Seller Note used as financing in the LBO of Flextronics Software Systems by KKR. However, providing collateral to the lenders remains an issue that may be addressed through the pricing of such a security.

VI.5 Ideal LBO Targets in India

Diversified conglomerates operate in number of non-core business areas in India that they are constantly looking to divest. These businesses make ideal LBO targets in India since they have established operations, business processes and professional management in place. There is a large interest among private equity players to buy non-core businesses from conglomerates.

Table 21: List of Buyouts Carved out of Conglomerates

Company	*Financial investor*	*Seller*
Flextronics Software Systems	KKR	Flextronics International
GE Capital International Services	General Atlantic Partners, Oak Hill	General Electric
Nitrex Chemicals	Actis Capital	ICI India
WNS Global Services	Warburg Pincus	British Airways
RFCL	ICICI Venture	Ranbaxy
Infomedia India	ICICI Venture	Tata Group
VA Tech WABAG India	ICICI Venture	VA Tech
ACE Refractories	ICICI Venture	ACC

Other potential targets for LBOs in India include mid-cap second generation family run businesses looking at bringing in professional management (Phoenix Lamps, Nilgiris Dairy Farm, Nirula's), distress sale of companies and privatization by the Government (Punjab Tractors).

VI.6 Debt Raised in India

Indian banks participate in providing working capital loans to companies that are buyout targets. Further, Indian banks also tend to participate in the syndicate for bank debt of LBOs.

Table 22: Details of Participation

Company	*Debt*	*Details of Participation*
GE Capital International Services	$215 million	ICICI Bank was one of 6 lead arrangers of the loan.
		ICICI Bank participated in the syndicate by holding 8.6% of the loan.
GE Capital International Services	$250 million	ICICI Bank was one of 6 co-arrangers of the loan.
		ICICI Bank participated in the syndicate by holding 7.4% of the loan.
AE Rotor Holding BV (subsidiary of Suzlon Energy)	€450 million[1]	ICICI Bank and State Bank of India were among the lenders holding 33.33% and 25% of the debt respectively.
UB Group	INR 13.1 billion	ICICI Bank – Mandated arranger

Source: Bloomberg Loan Syndication Data
1 Raised for the LBO of Hansen Transmissions, Netherlands

The list above does not include participation by Indian branches of foreign banks such as Citigroup, HSBC and Standard Chartered Bank.

VI.7 Exit Strategies for Private Equity Investments

In the past, there have been 2 successful / partial exits from the list in Table 4. WNS Global Services was taken public by Warburg Pincus on the New York Stock Exchange, while Actis has sold off the trading division of Nitrex Chemicals to a strategic player – Danish firm East Asiatic Co AS. Exit opportunities for LBOs in India are similar to those available to existing private equity players who make equity / minority investments in companies in India. These include listing on the domestic stock exchanges, listing on a US stock exchange or a strategic sale.

The following table lists some recent / notable private equity exist in India.

Table 23: Recent Private Equity Exits in India

Company	*Seller (Stake)*	*Exit*	*Year*
Suzlon Energy	Citicorp, ChrysCapital	Domestic IPO	2005
Punj Lloyd	Merlion, Stanchart, Temasek	Domestic IPO	2005
HT Media	Henderson, CIFC	Domestic IPO	2005
YES Bank	CVC International, ChrysCapital	Domestic IPO	2005
Shopper's Stop	ICICI Ventures, IL&FS Investment Managers	Domestic IPO	2005
IVRCL	ChrysCapital	Domestic IPO	2005
PVR Cinemas	ICICI Venture	Domestic IPO	2005
Bharti Tele-Ventures	Warburg Pincus	Sale on domestic stock exchange	2004 / 2005
Gujarat Ambuja	Warburg Pincus	Sale on domestic stock exchange	2005
WNS Global Services	Warburg Pincus	NYSE IPO	2006
UTI Bank	Actis	Financial buyer – HSBC Global Investment Fund	2004
Baazee.com	ChrysCapital	Strategic buyer – eBay	2004
Mphasis BFL Software	Barings Private Equity Partners	Strategic buyer – EDS	2006
BPL Communications	Actis, AIG	Strategic buyer – Essar	2005
Daksh e-Services	Actis, General Atlantic Partners	Strategic buyer – IBM	2004
JobsAhead.com	ChrysCapital	Strategic buyer – Monster	2004
Matrix Laboratories	TPG Newbridge	Strategic buyer – Mylan Laboratories	2006
i-flex	CVC International	Strategic buyer – Oracle	2005
Spectramind e-Services	ChrysCapital	Strategic buyer – Wipro	2002

VI.8 The Advent of Global Private Equity Players in India

India has witnessed a significant inflow of foreign capital including that from global private equity players that are setting up shop in India. This trend is expected to continue and fuel the growth of buyout and leveraged buyout activity in India.

European buyouts veteran Henderson Private Capital, which manages funds of $1.5 billion, is investing in India out of its $210 million Henderson Asia Pacific Equity Partners I Fund. It was set to create a $300-million fund for Asia, of which 40% will be invested in India.

The Singapore government, the second largest foreign private equity investor in India has shifted focus from early-stage investments to growth and buyout capital. Its direct investments company Temasek Holdings has teamed up with Standard Chartered Private Equity to set up the $100 million Merlion India Fund.

Global private equity firm The Carlyle Group announced in mid-2005 that it had established a buyout team in India based out of Mumbai. The Carlyle India buyout team is part of Carlyle's Asia buyout group, which manages a $750 million Asia buyout fund. Carlyle also has two dedicated Asia growth capital funds totaling $323 million.

The Blackstone Group recently elevated India to one of its key strategic hubs in Asia. Blackstone hired several consulting firms, including McKinsey & Co., and looked at investing in various emerging markets. It chose India as the place to set up its next in-country office and intends to invest $1 billion in local companies.

London-based Actis is among the most experienced investors in India. Actis' Fund II is a $1.6 billion fund of which $325 million has been earmarked for investments in India. Actis has been active in India since 1998 in private equity and since 1996 as a venture capital investor. Another experience global player, Warburg Pincus has been is active in India since 1995 and has

made several successful private equity investments and profitable exits in India such as the sale of a 19% stake in Bharti Tele-Ventures for $1.6 billion (cost $292 million). General Atlantic Partners has an office in India since 2001 and has executed several successful private equity transactions including the sale of Daksh e-Services and the initial public offering of Patni Computers.

With the presence of most major BO / LBO shops in India, a greater number of buyouts / leveraged buyouts are expected going forward.

Appendix I

SECTOR CAPS AND ENTRY ROUTES (AS ON 26 FEBRUARY 2006)

Source: Investment Commission of India – www.investmentcommission.in

A. Infrastructure Sectors	Ownership Limit	Entry Route	Remarks
Power	100%	Automatic	Includes generation (except nuclear power where FDI is prohibited), transmission and distribution of power
Telecom	100%	Automatic	
Basic, cellular and value-added services			
ISP with gateways			
ISP without gateways			
Email, Voice mail			
Radio Paging			
End-to-End Bandwidth			
Infrastructure Providers providing Dark Fibre			
Telecom Manufacturing			
Roads	100%	Automatic	Includes construction and maintenance of roads, highways, bridges and tunnels
Ports	100%	Automatic	Applies to construction and maintenance of ports
Civil Aviation			
Airports	100%	FIPB beyond 74%	100% FDI under automatic route is permissible for greenfield airports.
Domestic Airlines	49%	Automatic	Subject to no direct or indirect equity participation by foreign airlines. FDI up to 100% allowed for NRIs
Petroleum & Natural Gas			
Petroleum refining	100%	Automatic	
Petroleum product pipelines	100%	Automatic	
Petroleum product marketing	100%	Automatic	Subject to divestment of 26% equity in favour of the Indian partner / public within 5 years.
Petroleum refining-PSUs	26%	FIPB	
Others			
Mass Rapid Transport System	100%	Automatic	Includes associated real estate development in all metropolitan cities
EOU/SEZ/Industrial park construction	100%	Automatic	Subject to SEZ Act 2005 and Foreign Trade Policy.
Satellite establishment and operation	74%	FIPB	

B. Services Sectors	Ownership Limit	Entry Route	Remarks
Banking			
Indian Private Banks	74%	Automatic	Foreign banks can take an equity stake of more than 5% (up to 74%) only in the private sector banks which have been identified by the RBI for restructuring
PSU Banks	20%		Subject to compliance with RBI guidelines
NBFCs	100%	Automatic	Includes 19 specified activities; Subject to minimum capitalisation norms and compliance with RBI guidelines
Insurance	26%	Automatic	Includes both Life and Non-Life Insurance; Subject to licence from Insurance Regulatory & Development Authority
Real estate and construction	100%	Automatic	Subject to minimum land area of 10 hectare for serviced housing plot and built-up area of 50,000 sq. mts. for construction development projects. Also minimum capitalisation and completion norms
Townships			
Housing			
Construction – Development Projects			
Build-up Infrastructure			
Trading			
Retail Trade	51%	FIPB	Only for single brand products
Trading (Export House, Super Trading House, Star Trading House)	51%	Automatic	
Trading (Export, Cash and Carry Wholesale)	100%	FIPB	
Tourism			
Hotels, restaurants, beach resorts	100%	Automatic	Includes facilities for providing accommodation and food services
Tour and travel agencies	100%	Automatic	
Broadcasting			
TV software production	100%		Subject to maximum foreign equity up to 49% including FDI/NRI/FII
Hardware facilities - (Uplinking, HUB, etc.)	49%		Subject to maximum foreign equity up to 49% including FDI/NRI/FII; FDI in news and current affairs channels which uplink from India is capped at 26%
Cable network	49%		Subject to maximum foreign equity up to 49% including FDI/NRI/FII
DTH	20%		Subject to maximum foreign equity upto 49% including FDI/NRI/FII. FDI not to exceed 20%
Terrestrial Broadcast FM	20%		Subject to licensee being a company registered in India under the Companies Act, 1956
Terrestrial TV Broadcast	Not Permitted		
Print Media			
Scientific/Technical journals	100%		
Other non-news/non-current affairs/specialty publications	74%		
Newspapers, Periodicals dealing with news and current affairs	26%		
Other Services			
Advertising and Film	100%	Automatic	Includes all film related activities

Courier services	100%	FIPB	Includes all postal services except the distribution of letters
Lottery, Betting and Gambling	Not Permitted	—	
Defence and Strategic Industries	26%	FIPB	Subject to security and licensing requirement; to be sold primarily to the Ministry of Defence
R&D activities	100%	Automatic	

C. Manufacturing Sectors	Ownership Limit	Entry Route	Remarks
Metals	100%	Automatic	Includes manufacture of Steel, Aluminium etc.
Textiles and Garments	100%	Automatic	
Electronics Hardware	100%	Automatic	
Chemicals and Plastics	100%	Automatic	Includes plastics
Automobiles	100%	Automatic	Includes Two -wheelers, Cars and Commercial Vehicles
Auto Components	100%	Automatic	
Gems and Jewellery	100%	Automatic	
Food and Agro Products			
Food Processing	100%	Automatic	
Agriculture (including contract farming)	Not Permitted	-	
Plantations (except Tea)	Not Permitted	-	
Other Manufacturing			
Items reserved for Small Scale	24%	Automatic	100% FDI permitted through FIPB route subject to undertaking of export obligation of 50%

D. Resource Based Sectors	Ownership Limit	Entry Route	Remarks
Coal and Lignite			
Coal Processing	100%	Automatic up to 50%	
Captive Coal mining	100%	Automatic	Subject to provision of Coal Mines (Nationalisation) Act 1973.
Other Mining and Quarrying			
Mineral Ores	100%	Automatic	Including Gold, Silver and other mineral ores
Diamonds and precious stones	100%	Automatic	
Atomic Minerals	74%	FIPB	Includes only mining, mineral separation and subsequent value addition
Oil and Natural Gas Exploration	100%	Automatic	

E. Knowledge Economy Sectors	Ownership Limit	Entry Route	Remarks
Pharma and Biotech	100%	Automatic	FIPB route is needed if industrial licence is required or involves recombinant DNA technology, cell/tissue formulations
Healthcare	100%	Automatic	
Information Technology	100%	Automatic	

Appendix II

COMPANIES ACT, 1956 – SECTION 77

Restrictions on purchase by company, or loans by company for purchase, of its own or its holding company's shares

(1) No company limited by shares, and no company limited by guarantee and having a share capital, shall have power to buy its own shares, unless the consequent reduction of capital is effected and sanctioned in pursuance of sections 100 to 104 or of section 402.

(2) No public company, and no private company which is a subsidiary of a public company, shall give, whether directly or indirectly, and whether by means of a loan, guarantee, the provision of security or otherwise, any financial assistance for the purpose of or in connection with a purchase or subscription made or to be made by any person of or for any shares in the company or in its holding company:

Provided that nothing in this sub-section shall be taken to prohibit-

(a) the lending of money by a banking company in the ordinary course of its business; or

(b) the provision by a company, in accordance with any scheme for the time being in force, of money for the purchase of, or subscription for, fully paid shares in the company or its holding company, being a purchase or subscription by trustees of or for shares to be held by or for the benefit of employees of the company, including any director holding a salaried office or employment in the company; or

(c) the making by a company of loans, within the limit laid down in sub-section (3) to persons (other than directors [1][***] or managers) bona fide in the employment of the company with a view to enabling those persons to purchase or subscribe for fully paid shares in the company or its holding company to be held by themselves by way of beneficial ownership.

(3) No loan made to any person in pursuance of clause (c) of the foregoing shall exceed in amount his salary or wages at that time for a period of six months.

(4) If a company acts in contravention of sub-sections (1) to (3), the company, and every officer of the company who is in default, shall be punishable with fine which may extend to [2][ten thousand rupees].

(5) Nothing in this section shall affect the right of a company to redeem any shares issued under section 80 or under any corresponding provision in any previous companies law.

1. The words "managing agent, secretaries and treasurers" omitted by Act 53 of 2000, sec. 33 (w.e.f. 13-12-2000).

2. Subs by Act 53 of 2000, sec. 33, for "one thousand rupees" (w.e.f. 13-12-2000).

Appendix III

GOVERNMENT OF INDIA

MINISTRY OF INDUSTRY

DEPARTMENT OF INDUSTRIAL POLICY AND PROMOTION

***

PRESS NOTE NO. 9 (1999 SERIES)

SUBJECT: Policy relating to the standard conditions applicable to foreign owned Indian holding companies requiring prior and specific approval of FIPB/Government for downstream investment in Annexure III activities, which qualify for Automatic Approval.

1. The Government have reviewed the existing policy relating to the standard conditions applicable to foreign owned Indian holding companies requiring prior and specific approval of FIPB/Government for downstream investment. On careful consideration of the matter and with a view to further simplifying the investment procedures for downstream investment, it has been decided to permit foreign owned Indian holding companies to make downstream investment in Annexure III activities, which qualify for Automatic Approval subject to the following conditions:-

    a. downstream investments may be made within foreign equity levels permitted for different activities under the automatic route;

    b. proposed/existing activities for the joint venture company being fully confined to Annexure III activities;

    c. increase in equity level resulting out of expansion of equity base of the existing/fresh equity of the new joint venture company;

    d. the downstream investment involving setting up of an EOU/STP/EHTP project or items involving compulsory licensing; SSI reserved items; acquisition of existing stake in an Indian company by way of transfer/ as also buyback shall not be eligible for automatic approval and shall require prior approval of FIPB/Government;

    e. the holding company to notify SIA of its downstream investment within 30 days of such investment even if shares have not been allotted alongwith the modality of investment in new/existing ventures (with/without expansion programme);

    f. proposals for downstream investment by way of induction of foreign equity in an existing Indian Company to be duly supported by a resolution of the Board of Directors supporting the said induction as also a shareholders= Agreement and consent letter of the Foreign Collaborator;

    g. issue/transfer/pricing/valuation of shares shall be in accordance with SEBI/RBI guidelines;

    h. foreign owned holding companies would have to bring in requisite funds from abroad and not leverage funds from domestic market for such investments. This would, however, not preclude downstream operating companies to raise debt in the domestic market.

2. The above procedure will form part of the FIPB Guidelines and paragraph 11 (a) of the Guidelines for the consideration of Foreign Direct Investment (FDI) proposals by the Foreign Investment Promotion Board (FIPB)@ notified vide Press Note NO. 3(1997 Series) shall stand modified accordingly in respect of down stream investment by foreign owned Indian holding companies.

3. All investors and entrepreneurs may please take note of the aforesaid revision in the policy.

Sd/-

(ASHOK KUMAR)

JOINT SECRETARY

F.No. 7(13)/99-IP

New Delhi, the 12th April, 1999

Forwarded to the Press Information Bureau for giving wide publicity to the contents of the above Press Note.

Press information Officer,
Press Information Bureau,
New Delhi.

Appendix IV

EXTRACTS OF THE MASTER CIRCULAR

Date: Aug 28, 1998
Dir.BC.90/13.07.05/98
28 August 1998

Advances against Shares, Units, Debentures and Public Sector Undertaking (PSU) Bonds

7. Advances to other borrowers against shares/debentures/bonds

   The question of granting advances against primary security of shares and debentures including promoters shares to industrial, corporate or other borrowers should not normally arise. However, such securities can be accepted as collateral for secured loans granted as working capital or for other productive purposes from borrowers other than NBFCs. In such cases banks may increasingly accept shares in dematerialised form. Banks may accept shares of promoters only in dematerialised form wherever demat facility is available.

   In the course of setting up of new projects or expansion of existing business or for the purpose of raising additional working capital required by units other than NBFCs, there may be situations where such borrowers are not able to find the required funds towards margin, pending mobilisation of long term resources. In such cases, there would be no objection to the banks obtaining collateral security of shares and debentures by way of margin. Such arrangements would be of a temporary nature and may not be continued beyond a period of one year. Banks have to satisfy themselves regarding the capacity of the borrower to raise the required funds and to repay the advance within the stipulated period.

8. Bank Loans for Financing Promoters contribution

   The promoters' contribution towards the equity capital of a company should come from their own resources and the bank should not normally grant advances to take up shares of other companies. However, banks are permitted to extend loans to corporates against the security of shares (as far as possible in dematerialised form) held by them to meet the promoters' contribution to the equity of new companies in anticipation of raising resources subject to the following terms and conditions, in addition to the general guidelines given in the Annexure:

   a. The margin and period of repayment of the loans may be determined by the banks.

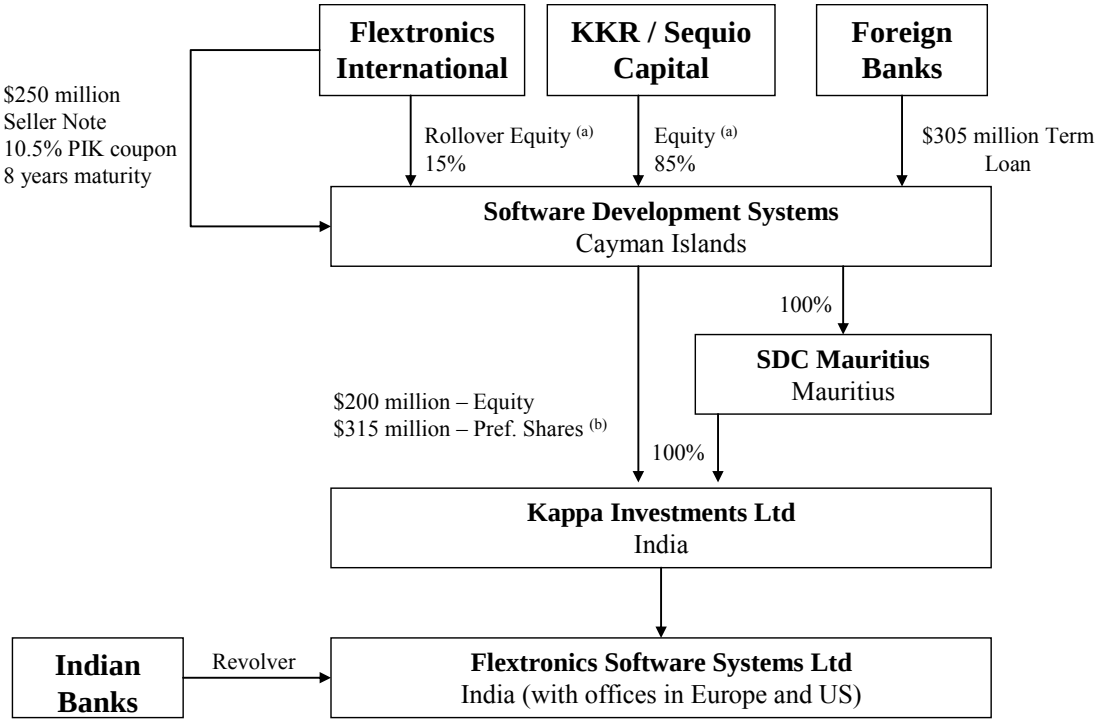
   b. Loans sanctioned to corporates for meeting promoters' contribution should be treated as banks' investments in shares and would thus come under the ceiling of 5 per cent of the incremental deposits of the previous year prescribed for investments in shares/convertible debentures of PSUs, corporate bodies, units of mutual fund schemes and in equity of dedicated venture capital funds meant for information technology.

   c. With the approval of the Boards of Directors, the banks should formulate internal guidelines with appropriate safeguards for this purpose.

   d. Under the refinance scheme of Export-Import Bank of India, the banks may sanction term loans on merits to eligible Indian promoters for acquisition of equity in overseas joint ventures/wholly owned subsidiaries, provided the term loans have been approved by the EXIM Bank for refinance.

Appendix V

Foreign Holding Company Structure of Flextronics Software Systems



(a) Total Equity = $345 million + Transaction fees and expenses not exceeding $37 million
(b) Redeemable optionally convertible preference shares with a non-cumulative coupon rate of 0.1 per cent per annum

Sources:
Flextronics International Ltd Form 8-K filed on April 13, 2006
"KKR of US to invest $515 m in Indian IT sector" – Business Line – Jul 14, 2006

Appendix VI

MINORITY PRIVATE EQUITY TRANSACTIONS IN INDIA

Announce Date	Target Name	Acquirer Name	Announced Total Value (mil.)	Deal Status	Description
Jul 2006	Allsec Technologies	The Carlyle Group	16.86	Pending	Stake of 25%
Feb 2006	Bajaj Auto Finance	ChrysCapital	10.48	Complete	Sale of 5% through private placement
Apr 2006	Dalmia Cement (Bharat)	Actis Capital LLP	25.00	Pending	Negotiations for an 11% stake
Jun 2006	Diamond Cables	Clearwater Capital Partners	5.17	Complete	Private placement of 14.9%
Feb 2006	DTDC Courier & Cargo	Reliance Capital Limited	15.83	Complete	Purchase of 44%
Jul 2006	Emcure Pharmaceuticals	Blackstone Group	50.00	Complete	
Aug 2006	EMI Transmission	Reliance Power India Fund	11.00	Complete	23% stake
Aug 2006	Endurance Group	Standard Chartered PLC	33.00	Complete	
May 2006	Greenply Industries	Aeneas Portfolio Co LP	5.89	Pending	13.81% stake
Mar 2006	Hexaware Technologies	General Atlantic LLC	67.57	Pending	Preferential allotment of 14.99% equity stake
Jul 2006	Imimobile	Pequot Capital Management	10.00	Complete	
Jun 2006	Indiabulls Buildcon	FIM Ltd	3.28	Complete	36% stake
Jan 2006	Indiabulls Housing Finance	Farallon Capital	25.43	Pending	
Jan 2006	Intas Pharmaceuticals	ChrysCapital	10.77	Pending	12.5% stake purchased from ICICI Ventures
Apr 2006	Jai Parabolic Springs	Clear Water Capital Partners	3.46	Complete	Private placement
Mar 2006	Jindal Poly Films	Saif Partners Ltd	12.54	Complete	6.66% stake through an off-market transaction
Nov 2005	JMT Auto	ChrysCapital	0.02	Complete	20% open offer along with Bach Ltd
Mar 2006	Kopran	Clearwater Capital Partners	5.80	Complete	14.95% stake new equity issue
Apr 2006	Maxwell Industries	Reliance Capital Partners	6.44	Pending	14.55% stake
Nov 2005	Merittrac Services	Hav2 Mauritius Ltd	3.61	Complete	
May 2006	Metropolis Health Services	ICICI Bank Ltd	7.80	Complete	
Aug 2006	Microland	Multiple Acquirers	11.00	Complete	Funding from Cargill Ventures, Intel Capital, Trident Capital and JAFCO
Nov 2005	Naturol Bioenergy	APIDC Venture Capital Ltd	3.92	Complete	Venture capital deal for setting up a plant in AP

Announce Date	Target Name	Acquirer Name	Announced Total Value (mil.)	Deal Status	Description
Oct 2006	OCM India	Wl Ross & Co	37.00	Complete	The acquisition, billed as the first 100 per cent buyout by a global turnaround fund, was carried out by ARCIL, the company said.
Mar 2006	People Interactive Pvt Ltd	Westbridge Capital Partners	8.00	Complete	
Oct 2005	Prasad Corp Pvt Ltd	IL&FS Investment Managers	6.66	Complete	
Mar 2006	Redington India Ltd	ChrysCapital	15.09	Complete	11% stake
Dec 2005	Sandhar Locking Devices Ltd	Actis Capital LLP	23.00	Complete	Actis has invested $23 million
Nov 2005	Semantic Space Pvt Ltd	UTI Ventures Ltd	2.00	Complete	Venture capital investment
Feb 2006	Shriram Holdings Madras	Newbridge Capital LLC	108.00	Complete	49% purchase
Nov 2005	Sify Ltd-Sponsored ADR	Infinity Capital Ventures LP	62.60	Pending	31.61% sale by Satyam
Oct 2005	Spentex Industries	Citigroup Inc	14.19	Complete	
Dec 2005	Spentex Industries	Citigroup Inc	9.21	Pending	
Sep 2006	Textrade International	Reliance Capital Limited	10.00	Complete	26% acquisition
Jan 2006	Unichem Laboratories Ltd	New Vernon Private Equity	12.69	Complete	5% stake

Source: Bloomberg

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Industry Betas and Equilibrium Models:
An Alternate Approach to Calculating Risk Measures

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April 2, 2007

I. Introduction

According to standard financial theory, investors in financial assets are, on average, compensated for the risk of a particular asset by its distribution-inclusive return. Many equilibrium models attempt to capture and quantify this idea, from the Capital Asset Pricing Model (CAPM) to various incarnations of the Arbitrage Pricing Theory (APT).

In the CAPM, risk is measured by beta, a statistical construct designed to capture the amount by which a liquid financial asset's returns change in relation to the returns on "the market." The APT model takes this a step further, relating the return on a stock to a set of "factors" that represent macroeconomic effects, weighted by each stock's exposure to each factor, or *factor loadings*.

Much academic research has focused on testing these equilibrium models in an attempt to determine whether they adequately describe the markets and to determine which model describes markets best. Lintner[1] used regressions to determine betas for a set of 301 stocks from 1954 to 1963. Then he performed a cross-sectional regression to test the security market line, regressing each stock's return over the period against its beta and its residual risk. He found evidence that the residual risk is priced, contradicting the CAPM's predictions. In response, Miller and Scholes[2] critiqued some of the statistical problems with Lintner's model, and found that the misestimation of betas caused a significant problem. Black, Jensen, and Scholes[3] attempted to

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[1] Douglas, George. *Risk in the Equity Markets: An Empirical Appraisal of Market Efficiency.* (Ann Arbor, Mich.: University Microfilms, Inc., 1968).
[2] Miller, M.H. and M. Scholes. "Rates of Return in Relation to Risk: A Re-Examination of Some Recent Findings," in Jensen, M. (ed.). *Studies in the Theory of Capital Markets* (New York: Praeger, 1972).
[3] Black, F., M.C. Jensen, and M. Scholes. "The Capital Asset Pricing Model: Some Empirical Tests," in Jensen, M. (ed.). *Studies in the Theory of Capital Markets* (New York: Praeger, 1972).

correct this by forming decile portfolios of stocks to reduce this misestimation; they found strong support of the two-factor or zero-beta form of the CAPM. Finally, Fama and MacBeth[4] extended the second pass cross-sectional regression analysis, performing it for each month in their study rather than across the entire time period, and testing other implied hypotheses of the CAPM. Again, their tests provide support for the CAPM.

While most of these tests focused on the U.S. markets, other studies were done internationally. It was found that the traditional equilibrium models did *not* fit the Japanese markets nearly as well as they fit the U.S. markets. In 1990, Brown & Otsuki performed a study of an APT model on the Japanese markets, but with a twist: they allowed the factor loadings for the Japanese stocks to be related to the industries to which the Japanese companies were exposed.[5] Thus, the factor loadings for the stocks, rather than being estimated with a regression and being fixed for each company over the entire period of study, were allowed to vary as the Japanese companies changed their industry exposure through investment and divestment. Brown & Otsuki found that this modified equilibrium model fit the Japanese markets to a degree that was comparable with traditional studies of the U.S. markets.

One presumption of the study is that the high degree to which Japanese companies changed their industry exposures over the period studied caused the traditional equilibrium models to "fail" and the modified model to "work." In other words, it was not the fact that Japanese companies tended to be exposed to more industries than U.S. companies, but rather the fact that they changed those industry exposures so much more than U.S. companies. To see why,

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[4] Fama, Eugene, and J. MacBeth. "Risk, Return, and Equilibrium: Empirical Tests." *Journal of Political Economy.* 71 (May/June 1973). pp. 607-636.
[5] Brown, Stephen J. and Toshiyuki Otsuki. "Macroeconomic Factors and the Japanese Equity Markets: The CAPMD Project." *Japanese Capital Markets*. Ballinger Publishing Co. 1990.

consider a conglomerate firm. If it does not change its industry exposures much during a particular time period, a traditional regression of the firm's returns on the market index or on a set of APT factors should capture the effect of diversification for that time period. However, if it changes those industry exposures, a traditional regression would estimate only an average of the effects of its industry exposures over time, and thus would be subject to significant error.

This study relates to other types of research on equilibrium models. For example, many research papers have examined the proposition that companies' risk changes over time. Cho and Engle have shown that CAPM betas vary predictably over time.[6] Blume[7] and Levy[8] have shown that company betas tend to converge on the market beta of one as companies become more mature. This study allows the risk factors to change over time as well, and it might be interesting to revisit these other types of studies to see how much of the time-varying nature of betas is due to changing industry exposure and how much is due to other factors.

Another related idea in finance is that of a "bottom-up" or fundamental beta. According to Aswath Damodaran, a company's beta is related to whether the company's products or services are discretionary or not and the degree of leverage, both operating and financial, with which the company operates.[9] This study aims to show that a company's risk is related to the industries in which it operates, taking care of one of these fundamental factors.

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[6] Cho, Young-Hye and Robert F. Engle. "Time-Varying Betas and Asymmetric Effects of News: Empirical Analysis of Blue Chip Stocks." Under revision. February 2000.
[7] Blume, Marchall. "Betas and Their Regression Tendencies." *Journal of Finance*. Vol. X, No. 3 (June 1975). pp. 785 – 795.
[8] Levy, Robert. "On the Short-Term Stationarity of Beta Coefficients." *Financial Analysts Journal*. Vol. 27, No. 5 (Dec. 1971). pp. 55 – 62.
[9] Damodaran, Aswath. *Investment Valuation.* 2nd Edition. New York: John Wiley & Sons. 2002. p. 193.

Given the similarity to other concepts in finance, I believe that risk measures that vary with time in relation to a company's industry exposure should, on average, improve the power of the equilibrium model under study to explain the market's returns.

II. Methodology

The traditional way to calculate industry returns is to form portfolios of stocks based on the main reported line of business in which the relevant company operates. However, this methodology ignores the fact that many companies operate in several industries. In the U.S. markets, conglomerates like this have become much more rare, but in the Japanese markets studied by Brown & Otsuki, this was a major problem.

Their solution was to impute the returns on the industries by a statistical method that considers all the public companies in the economy as well as each one's reported industry exposures. These data were not publicly available at the time, but Brown & Otsuki were granted access to a dataset specially compiled to include just this information. Luckily, U.S. public companies are required to report segmentation in their regulatory filings.

I decided that though U.S. companies tend not to be segmented as much as Japanese companies, including the reported segmentation for each company rather than just the main reported line of business is a more "correct" methodology and is more in line with the goals of the study, which aim to determine how the company's risk changes with changes in industry exposure. Therefore, this was the method I used to compute industry returns in my study.

Specifically, I assumed that on average, companies' returns were a linear combination of industry returns, weighted by the companies' exposures to those industries. The variable I used as a proxy for "exposure" was percentage of total sales reported by the company to have come from a particular industry. In other words:

$R_i = b_{1,i} \times I_1 + b_{2,i} \times I_2 + \mathsf{K} + b_{N,i} \times I_N$, where:

- R_i is the return on a particular stock.
- $b_{j,i}$ is the i^{th} company's exposure to the j^{th} industry.
- I_j is the return on the j^{th} industry.

This looks remarkably like a cross-sectional regression model, where we know the company returns and the company exposures and the regression coefficients would give us the industry returns. However, this model suffers from a problem: all the *b* variables add up to 100%, a violation of the basic assumptions of ordinary least squares regression. Therefore, I transformed the model to correct this.

Since we know the sum of the *b* variables is 100%, we can write $b_{N,i} = 1 - b_{1,i} - b_{2,i} - \mathsf{L} - b_{N-1,i}$. Substituting this back into the original model, we obtain:

$$R_i = b_{1,i} \times I_1 + b_{2,i} \times I_2 + \mathsf{K} + b_{N-1,i} \times I_{N-1} + \left(1 - b_{1,i} - b_{2,i} - \mathsf{L} - b_{N-1,i}\right) \times I_N .$$

Rearranging,

$$R_i = b_{1,i} \times \left(I_1 - I_N\right) + b_{2,i} \times \left(I_2 - I_N\right) + \mathsf{K} + b_{N-1,i} \times \left(I_{N-1} - I_N\right) + I_N .$$

This model does not suffer from the linear combination effect. In fact, if we used this model to perform a cross-sectional regression on all stocks for a given time period, with the *b* variables (from 1 to $N - 1$) as independent variables, we would obtain regression coefficients that generally represent the difference between a particular industry's return and the N^{th} industry's return, and a constant term that represented the N^{th} industry's return. Deriving the actual industry returns from these coefficients is simply a matter of adding back the constant term to the regression coefficients corresponding to the independent variables. As described below, this technique is exactly how I derived the industry returns for each period of time.

Additionally, a key assumption of this study relates to the formation of the factor loadings for a particular company based on the factor loadings for a company. Specifically, I assume that the set of factor loadings for a portfolio of securities is equal to a set of weighted averages of factor loadings for the individual portfolio companies, weighted by their portfolio weights. Thus, if we consider a company as a portfolio of industry exposures, we should be able to calculate that company's overall set of factor loadings as a weighted average of the factor loadings of its component industries.

I chose the Fama-French factor model, a form of APT, as the main equilibrium model for this study. This model is specified as:

$R_i = a + b_{RM-RF}\left(R_m - R_f\right) + b_{SMB}\left(SMB\right) + b_{HML}\left(HML\right) + \varepsilon$, where:[10]

- $R_m - R_f$, the excess return on the market, is the value-weighted return on all NYSE, AMEX, and NASDAQ stocks (from CRSP) minus the one-month Treasury bill rate (from Ibbotson Associates).
- SMB (Small Minus Big) is the average return on the three small portfolios minus the average return on the three big portfolios.
- HML (High Minus Low) is the average return on the two value portfolios minus the average return on the two growth portfolios.

The *b* variables in this APT model are factor loadings, and these are the main point of my study. As described below, I calculated two sets of factor loadings for each stock: one set using

[10] From Kenneth French's Data Library page: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library/f-f_factors.html

the traditional regression method and the other set using another method that accounted for changing industry exposure.

Finally, I chose to test the fit of the equilibrium model using the two different sets of factor loadings with another cross-sectional regression in a manner similar to Fama and MacBeth's tests of the CAPM. As described above, this test uses a cross-sectional regression on a monthly basis to measure the strength of the fit of the model. In the original study, the goals were to test certain other claims of the CAPM and to see if any other risk factors were priced besides beta. In this study, I am interested only in the fit of the equilibrium model to the returns data, and so I used a modified cross sectional model to record the R^2 statistics:

$R_i = a + \lambda_{RM-RF} b_{i_{RM-RF}} + \lambda_{SMB} b_{i_{SMB}} + \lambda_{HML} b_{i_{HML}} + \varepsilon$, where for a given month over the period 1995 – 2005:

- R_i is the return on company i
- a is an output of the regression: the average return on a stock with zero sensitivity to any of the factors
- λ_k is an output of the regression: the market price of factor k
- b_{ik} is the factor loading of factor k on company i

III. Data Used

I used the following data sources:

Monthly returns data from CRSP:[11]

- PERMNO – Unique number for each security listed by CRSP

[11] CRSP and Compustat data accessed through the WRDS system.

- DATE
- TICKER
- COMNAM – Company name
- EXCHCD – Exchange on which the security trades
- SHROUT – Number of shares outstanding
- PRC – Stock price
- RET – Monthly percentage return, dividend and split adjusted

Yearly segment data from Compustat:

- GVKEY – Unique number for each company listed by Compustat
- NPERMNO – Identifier that corresponds with the CRSP PERMNO for this company
- DNUM – Primary SIC code for the company
- CONAME – Company name
- SMBL – Ticker symbol
- SRCYR – Year the data was reported (can be different from the fiscal year of the company in cases like restated filings)
- SCRFYR – Month the data was reported
- STYPE – Segment type (e.g. geographical or business – I used only business segments)
- YEAR – Fiscal year of the data being reported
- FYR – Month of the end of the company's fiscal year for the data being reported
- CYR – Calendar year of the data being reported
- SALE – Segment sales for the year

- SNAME – Name of the segment
- SNAICS1 – Primary NAICS code of the segment
- SRCCYR – Calendar year of when the data was reported

Fama-French factors

- DATE – Month and year of the data
- RMRF – Return on market minus the risk-free rate
- SMB – Return on portfolio of small market cap stocks minus return on portfolio of large market cap stocks
- HML – Return on portfolio of value stocks (high book value of equity / market value of equity) minus return on portfolio of growth stocks (low book value of equity / market value of equity)

There were several issues I had with the data as it was obtained directly from the service providers. First, Compustat data for a given fiscal year is repeated if a company restates earnings. I fixed this by running a filter through the data to select only the latest source date for a given reporting period—thus I chose only the latest restated earnings. Second, Compustat segment data is reported only on a yearly basis. To match monthly CRSP returns, I split the yearly segment breakdown evenly across each month of the fiscal year reported. However, companies can change fiscal years, leaving overlapping and missing data.

To fix this, I created a new, empty table of Compustat segment data, but using a monthly basis instead of a yearly basis. Then, for each company in the data set, for each reported year of the company's segment data, starting at the earliest and ending with the latest year's data, I computed the total sales for that company for that fiscal year. I did not include corporate segments that have negative sales. I computed each segment's percentage of the total sales based

on this modified total sales number. Then, starting with the last month of that fiscal year and working back to the first month of the fiscal year, I copied the segment percentage data into the new data table for each month. Last, I iterated through all months of the new data table reported for the company in order, and if a month was missing, I copied the previous month's data forward.

This procedure had several effects. First, in the case of overlapping fiscal reporting periods, it ensures the newer data takes priority. Second, in the case of missing months, the latest data from previous months is copied forward to fill the gap.

IV. Procedure

I selected a set of companies to examine for which I had enough data: at least eleven years of both returns and segment data (or 132 monthly observations): that is, beginning on or before January 1995 and ending on December 2005. This resulted in a set of 1,994 companies.

I then computed a set of factor loadings for each company over the time period studied, using the traditional regression technique. The model I used was the factor model described above as specified by Professors Fama and French.

To do this, I exported each series of company returns into the statistical package R and ran the APT regression in order to determine each of the factor loadings (*b*'s). I exported the resulting factor loadings for each company back into my database. Since these factor loadings are estimated over the entire period I studied and do not change over the period, I will refer to them as the "static" factor loadings.

I examined the industries reported by the companies in the set I had selected. I used the first two digits of the SNAICS1 field from the Compustat data to group industries. There were 26

of these industry groups, including a “00” group whose Compustat data were empty and a “99” group, which Compustat uses to indicate a non-operating or liquidating company.

Then I created a set data matrices that could be used by my statistical package for performing the regression to derive returns series for each industry. I created one such matrix for each month in the period I studied. Each matrix contained a cross-sectional set of data for each company listed in Compustat and CRSP (in order to maximize the number of observations for calculating industry returns). The columns of the matrix contained the company identifier, the company’s return, and columns containing the company’s exposure to each industry, as shown in the example column headers below:

PERMNO	RET	Industry 1 pct.	Industry 2 pct.	…	Industry *N-1* pct.

I discarded industry percentage columns for which the sum of the squared values equaled zero (to eliminate industries that had no corresponding companies in that month), and dropped the column with the lowest sum of squared values. The second modification ensured that the data fit the statistical model described above. I then exported the corresponding data matrix into the statistical package R, and ran a cross-sectional regression to derive each industry’s average return in that month.

The regression resulted in coefficients that represented the difference in returns between each industry and the industry whose column I dropped from the data matrix. To correct for this, I took the constant term to be the return on the industry I had dropped, and added that constant term to each coefficient term in order to derive each industry’s returns for that month. I exported these returns back into my database. I repeated this process for each month from January 1995 to December 2005.

Once I had derived returns for each industry for the entire time period, I computed a set of factor loadings for each industry using the derived industry return data. I used the same Fama-French APT model and procedure as I had used in computing each company's factor loadings, except instead of company returns, I used the derived industry returns. I exported the resulting factor loadings for each industry back into my database.

Based on these industry factor loadings, I calculated an alternate set of factor loadings for each company for each month. As described above, I calculated the factor loadings on a portfolio of securities as weighted averages of the factor loadings on the individual securities in the portfolio, weighted by the portfolio weight of each security. Therefore, in each month, I calculated the factor loadings of a security by weighting the factor loadings of each industry by the company's exposure to each industry (percentage of total sales), and adding them together.

This procedure ensured that *industry* factor loadings do not change over time in this model. However, *company* factor loadings change when their reported industry exposure changes. I will refer to these factor loadings as the "dynamic" factor loadings, as opposed to the traditionally calculated "static" factor loadings calculated previously.

Then I ran a series of cross-sectional regressions to test the strength of this method of calculating factor loadings. For each month in the period I studied, I created two tables, each containing cross-sectional data for every company in the sample. The first table contained each company's return and factor loadings as calculated by a traditional regression technique. The second table contained each company's return and factor loadings as calculated by the derived-industry-returns technique. I exported these tables to R and performed the cross-sectional regression described earlier. I then saved all the regression statistics from R back into my database for later comparison.

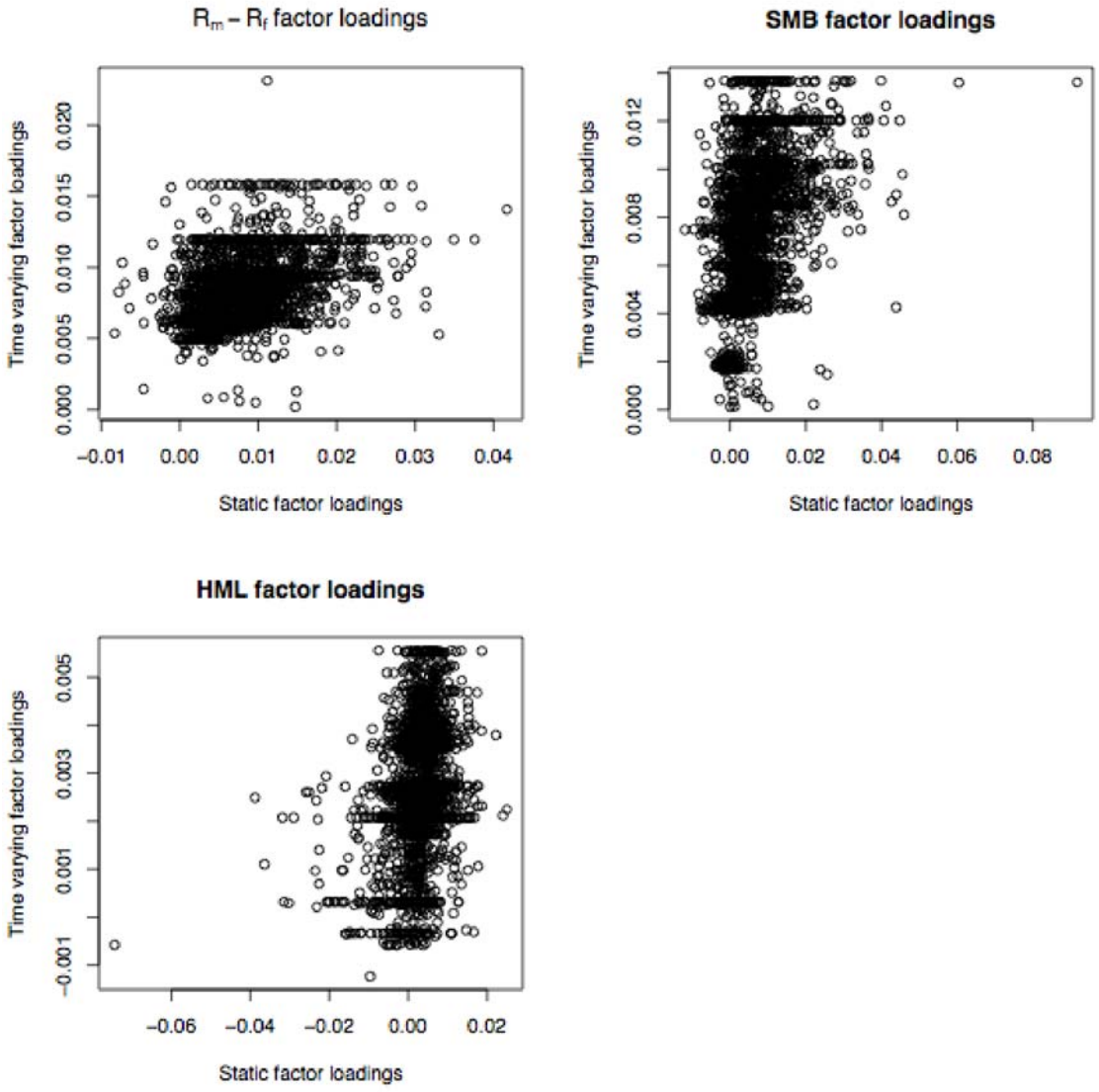
Because of the results that are described below, I did further cross-sectional tests. These followed the same procedures as in the previous paragraph, but instead of including all 1,994 stocks, I took sub-samples of the companies for each other test. I examined the subset of those 1,994 stocks that had reported sales from more than one distinct industry over the entire time period, and another subset of stocks that had reported sales from more than two distinct industries to test whether the number of industries a company is exposed to influences these regressions.

I also attempted to derive a measure of how much a company changes over time. For a given company and industry, I took the difference between the percentage of sales in a particular time period and the percentage of sales in the previous time period as a measure of how that company had changed in a particular industry in a particular month. I added the absolute value of this measures across all industries and across all time periods studied for each company. I took this as the overall measure of how much a company's industry exposure changed: it has a bottom limit of zero if the company did not change at all and no practical upper limit. I divided the group of 1,994 companies into two equal-sized groups: those that had a low change measure and those with a high change measure. I ran the cross-sectional regression on these two last, expecting that the high-change group would show better results than the low-change group.

V. Results

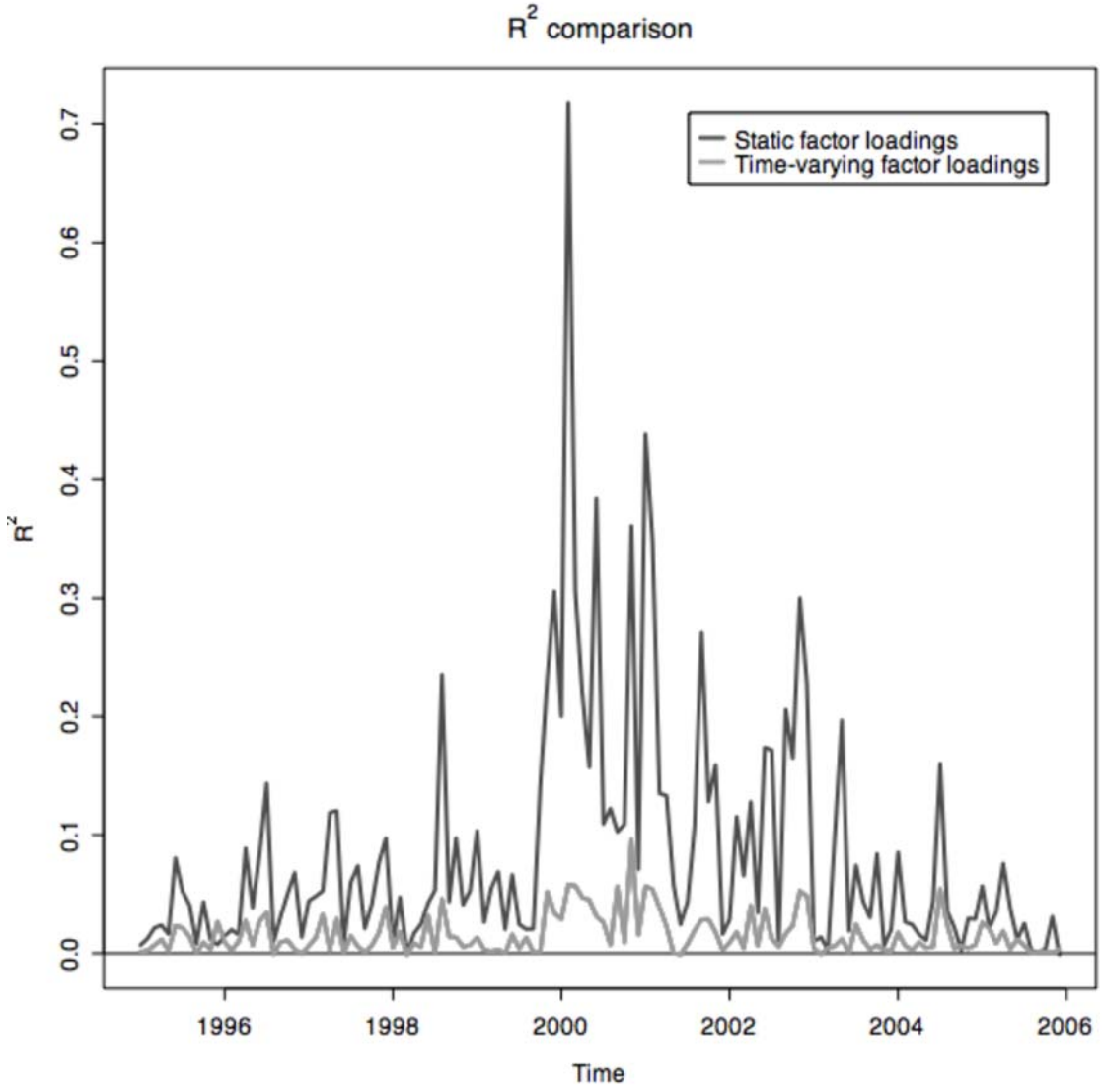
Overall, the data show a complete lack of support for the original hypothesis. The R^2 measures of the regressions show that these factors explain very little of the variation in the stock returns. More importantly, the tests using the dynamic factor loadings that were the main point of the study had a significantly lower average R^2 than the tests using the traditionally calculated, static factor loadings. Even the tests of subsets of the companies showed similar results.

The following charts show scatterplots for each of the three sets of factor loadings, of the static version versus the dynamic (or time-varying) version. The dynamic factor loadings in these charts are averages of each factor loading across all time periods for each company. When creating these charts, I did not expect to see any particular relationship between the two types of factor loadings: after all, I am trying to improve on the estimation of this measure. However, there are several interesting points to observe. First, there are several horizontal bands in each chart. I believe this represents companies who report the same industry, but have wildly different factor loadings. To extend Professor Damodaran's "bottom-up beta" analogy, there may be factors other than a company's industry exposure that influence that company's exposure to a particular risk factor; this analysis does not capture them. Second, notice the scales of the three charts. The static factor loadings for the excess market return $R_m - R_f$ range from around -0.01 to a little over 0.04; the corresponding dynamic factor loadings range from 0 to just above 0.02. The disparity between the scales of the two types of factor loadings is even greater for the other factor loadings. This seems to show that many of the companies in the sample have greater exposure to these risk factors than indicated by the weighted average of their component industries' exposure to these factors.



The following chart shows the actual results of the cross-sectional regression meant to test the strength of this industry-beta methodology. It depicts two time series of adjusted R^2s, output from each of the monthly cross-sectional regressions I performed. Note that the actual R^2s of these regressions were not materially different from the adjusted R^2s. The solid black line represents the regressions using the traditionally calculated static factor loadings, while the gray line represents the regressions using the dynamic factor loadings. As shown in the chart, except for a few months, the R^2s of the regressions using the static factor loadings was significantly

greater than those of the regressions using the dynamic factor loadings. There is no other conclusion to be drawn except that the dynamic factor loadings as I calculated them are poorer estimates of the "true" factor loadings than the static factor loadings, directly contradicting my hypothesis.



In addition to this graph, I found an average of the R^2s for the regressions using each set of factor loadings. For the 132 monthly regressions using static factor loadings, I found that the average R^2 (*not* adjusted R^2) from January 1995 to December 2005 was 8.6%. For the

corresponding regressions using dynamic factor loadings, the average R^2 was 1.7%. For reference, *Modern Portfolio Theory and Investment Analysis* by Elton, Gruber, Brown, and Goetzmann list R^2s for Fama and MacBeth's cross-sectional tests of the CAPM equilibrium model. Their study used 20 beta-ranked portfolios of securities, rather than individual securities, to minimize the beta estimation error, so the R^2s they report are not directly comparable to those I found. However, as a reference, they report an R^2 of 29% for their basic CAPM test over the period 1935 – 1968.[12]

Faced with these disappointing results, I attempted to see whether there was any glimmer of hope for my hypothesis. Since this methodology was used successfully in the Japanese markets, perhaps it works better for companies that are in more than one line of business—conglomerates. Alternatively, as explained above, the Japanese phenomenon may have been due more to the amount of change in industry structure rather than the number of cross holdings in each company. To examine this possibility, I ran the cross-sectional regressions again on subsets of the 1,994 companies.

First, I examined subsets based on how many industries each company was in. I selected subsets of the companies that, at any point over the 132 months I examined, had reported sales from more than just one segment, narrowing the number of companies to 987. Next, I selected subsets of the companies that had reported sales from more than *two* segments, further narrowing the number of companies to 447. The corresponding adjusted-R^2 plots of the resulting cross-sectional regressions are given below. First, the companies with more than one segment:

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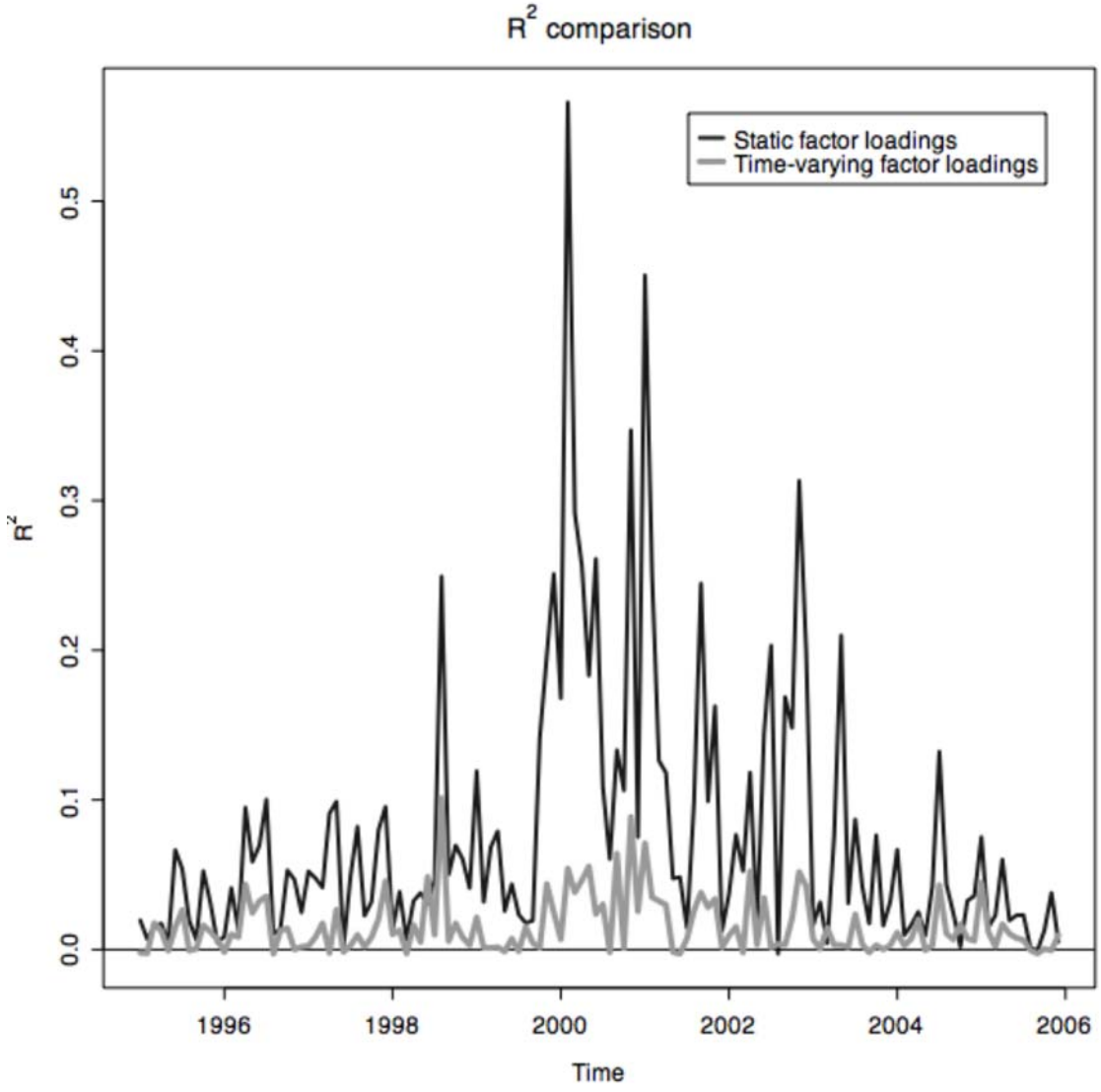
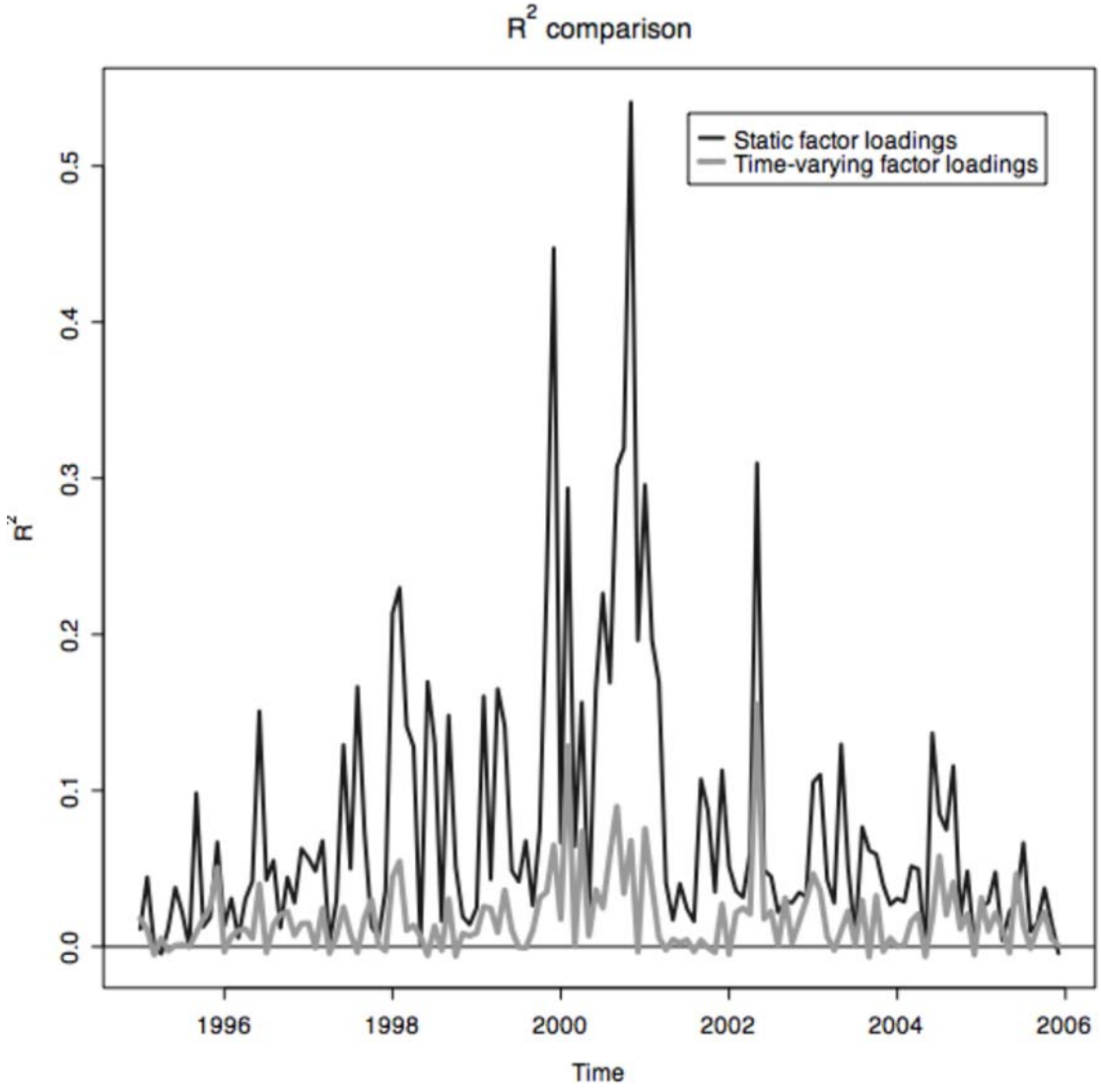
[12] Elton et al. "Chapter 15: Empirical Tests of Equilibrium Models." *Modern Portfolio Theory and Investment Analysis, Sixth Edition.* John Wiley & Sons: 2003. p. 348.



Next, the companies with more than two segments:



As shown, these results are hardly different; they lead to the same conclusions as the regression over all 1,994 stocks. The average R^2s were:

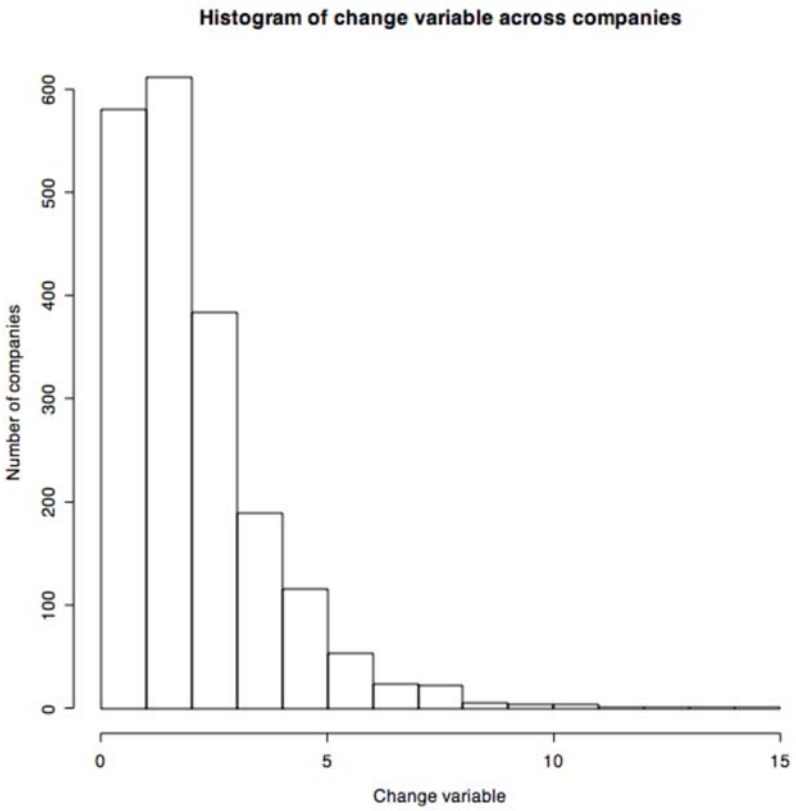
Companies with:	Dynamic factor loadings	Static factor loadings
> 1 segment	1.9%	8.1%
> 2 segments	2.5%	8.4%

These results show that the dynamic factor loadings are no better a representation of the factor loadings for companies with more than two segments than they are for companies with more than one segment.

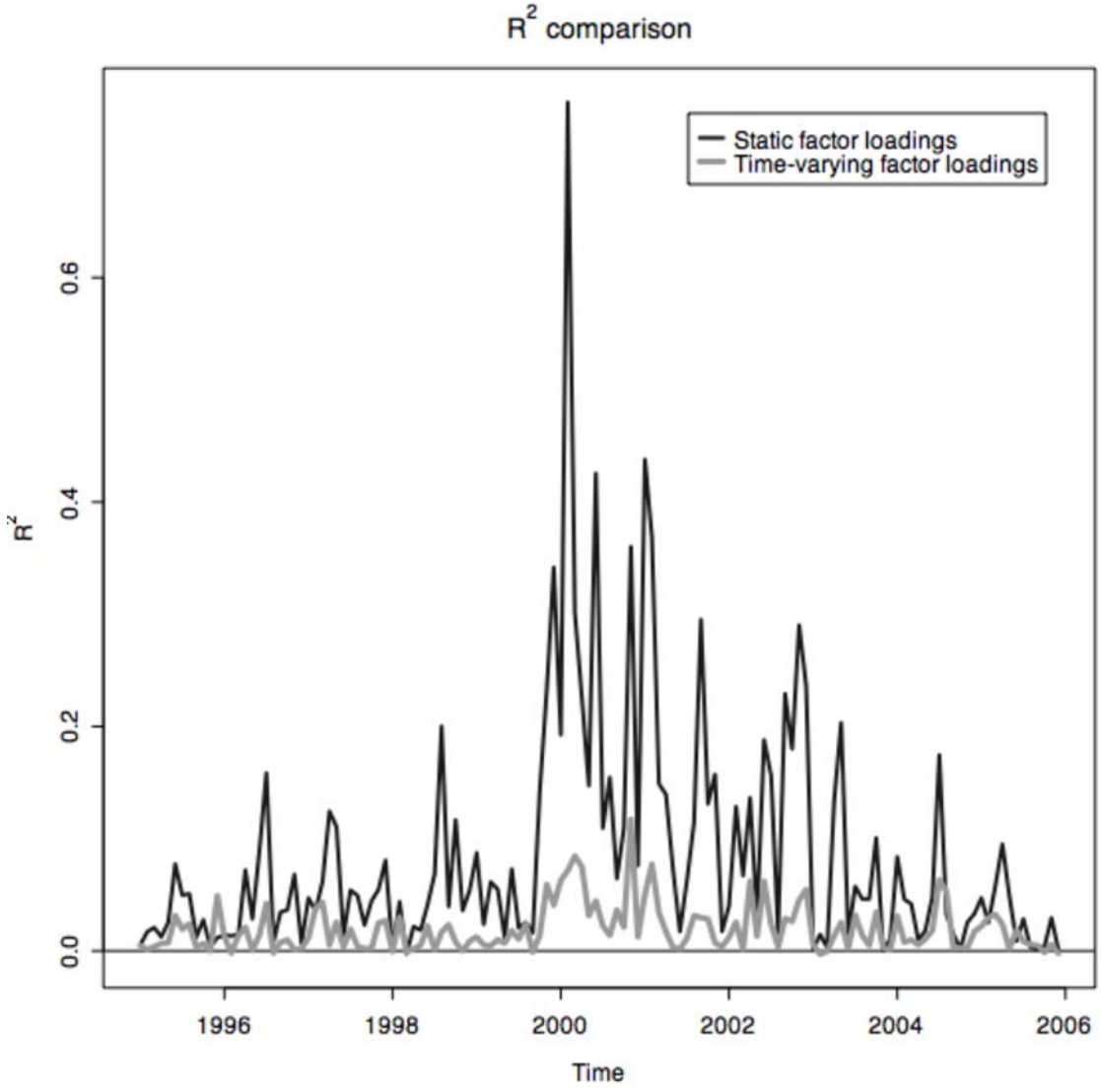
What about the degree of change of exposure within a company? First, I needed to estimate this figure. I decided to estimate it by computing the change in percentage-of-sales for each company, for each industry, from one time period to the next. Since the sum of a company's percentages of sales across each industry must sum to 100% for any given time period, the sum of the change in the company's percentage of sales across all industries must also sum to 100% for a given time period: a company can shift its industry exposures from one industry to another, but the addition to one will be exactly offset by a decline in the other in percentage terms. Therefore, for each company, I added the *absolute value* of the computed change across all industries and across all the time periods I studied. This gave a numerical figure representing the degree to which a company changed its industry exposures, with a lower bound of zero for a company that did not change its industry exposure at all, and an upper bound limited by the number of periods I studied. The highest change score among the 1,994 stocks was 14.26, for US Energy Corp (ticker USEG), a company that has been involved in Mining, Minerals, Commercial Operations, Retail Sales, Oil & Gas, and Construction Operations over the course of its history as reported by Compustat.

The histogram of this change variable is given below:

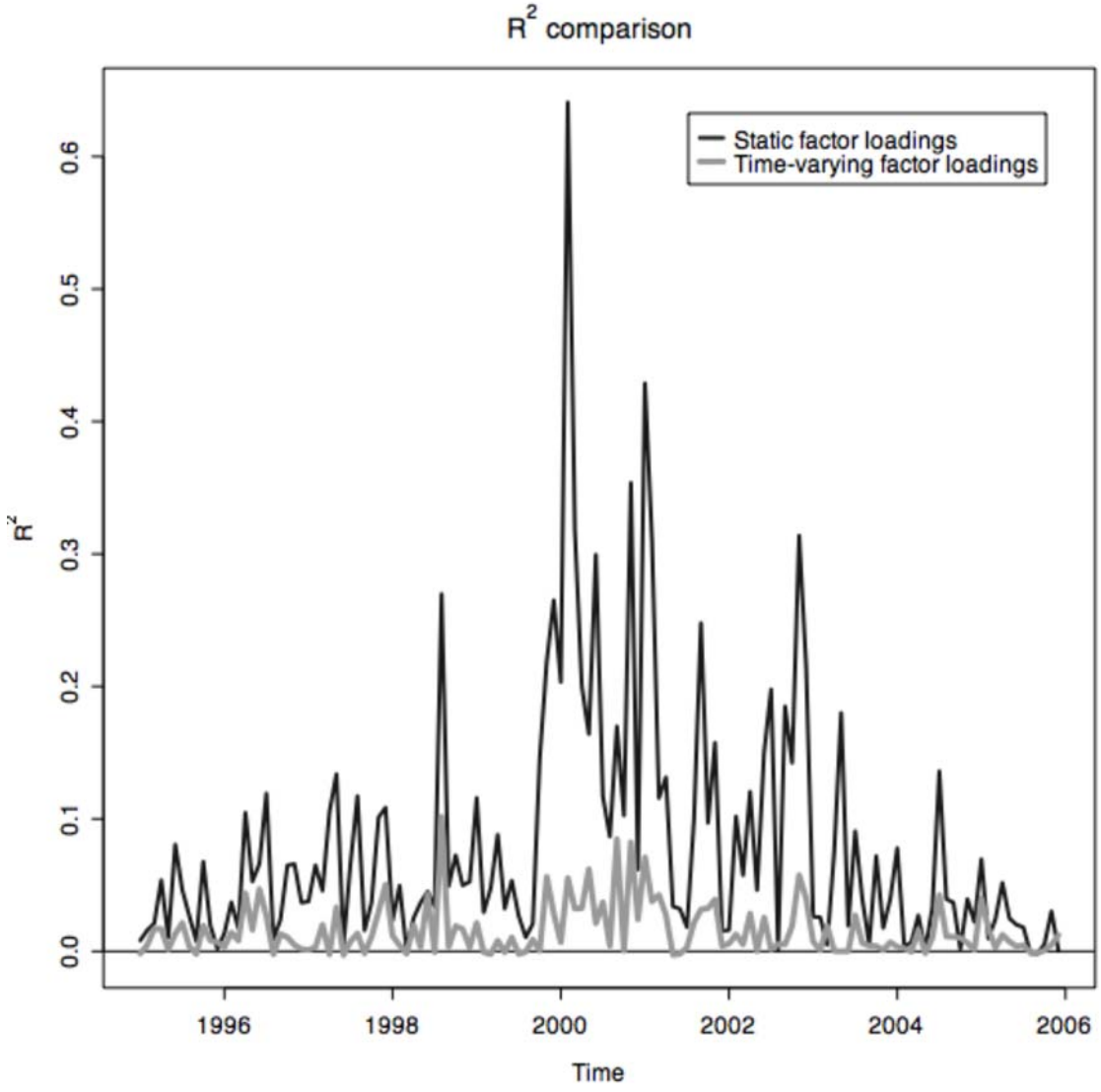
Measure	Value
High	14.26
Low	0.00
Mean	2.07
Median	2.00
Std Deviation	1.79
Skewness	1.40
Kurtosis	7.38



I split the set of companies into two equal-sized groups ranked by the change measure and performed the cross-sectional tests on these two groups. The low-change group had an average change measure of 0.866; the high-change group had an average change measure of 3.279. The corresponding plots of the adjusted R^2s are given below. First, the low-change group:



Next, the high-change group:



These plots again show that the dynamic factor loadings are significantly worse than the static factor loadings. Even more troublesome, the R^2s do not improve for the high-change group, either alone or in comparison to the low-change group. An average of the R^2s for each test is shown below:

Companies with:	Dynamic factor loadings	Static factor loadings
Low change	2.2%	8.9%
High change	1.9%	8.5%

Despite my hypothesis that the amount of change in industry composition will determine whether these dynamic factor loadings will make a difference, I found no evidence even of an improvement in fit for companies that exhibited a higher degree of change over those with a lower degree of change.

VI. Conclusion

Unfortunately, I found no evidence to support my hypothesis. While I predicted that the R^2s of the cross-sectional regressions using the dynamic factor loadings would be significantly greater than those of the regressions using the static factor loadings, they were in fact significantly lower.

There are several possible ways to explain the results I obtained. The first and foremost possibility is that I made one or more errors in my analysis. This could range from something as fundamental as a conceptual idea that I missed to procedural errors, mistyped commands, and data problems I did not address. Alternatively, my hypothesis could just be plain wrong.

A second possibility is that the data are of insufficient quality to support my analysis. The Compustat segment data are reported on a yearly basis, while I am studying monthly returns, a mismatch that forces an estimation procedure in order to proceed with a monthly analysis. Also, the Compustat segment data are self-reported, causing many gaps in the data; potentially, changes in reported segmentation could be reported while the underlying industry exposure remains the same.

Third, the time period I studied, 1995 to 2005, did not see much empire building or destroying activities. It may be interesting to repeat this analysis for periods of higher industry change, like the formation of conglomerates in the 1960s or the break-up of such companies in the 1980s.

Fourth, there was some indication of poor regression fit during the computation of industry returns. As mentioned above, I performed a series of cross-sectional regression of company returns against industry exposure for each month studied. While checking the regression statistics I noticed that the variance inflation factors (VIF) of the first month's regression coefficients were extremely high, even after using the modified model, indicating that there was a high degree of multicollinearity between the independent variables. This means that the regression is unstable: if any of the independent *b* variables changed only slightly, the fitted regression coefficients would change dramatically, indicating that the industry returns derived from these regressions could have been estimated with significant error.

Lastly, my analysis makes the assumption that company returns, on average, are composed of industry returns, weighted by a percentage-of-sales measure. However, this may be an inappropriate methodology for calculating returns, and may have caused errors throughout the analysis.

There are several steps that could be performed to enhance this analysis and potentially obtain evidence in support of the hypothesis. First, the data should be cleaned up, with gaps in reported segmentation closed, dramatic changes in segmentation checked against regulatory filings, and any other data issues resolved. Of course, this would be a very difficult task given the amount of data I used, so a subset of the data may need to be used. Second, as mentioned earlier, tests of equilibrium models traditionally use portfolios of securities to minimize estimation error. Repeating the cross-sectional tests of this study using portfolios of securities may be a better formal test of the hypothesis.

Common Stock PIPE Discounts and Long-Term Performance

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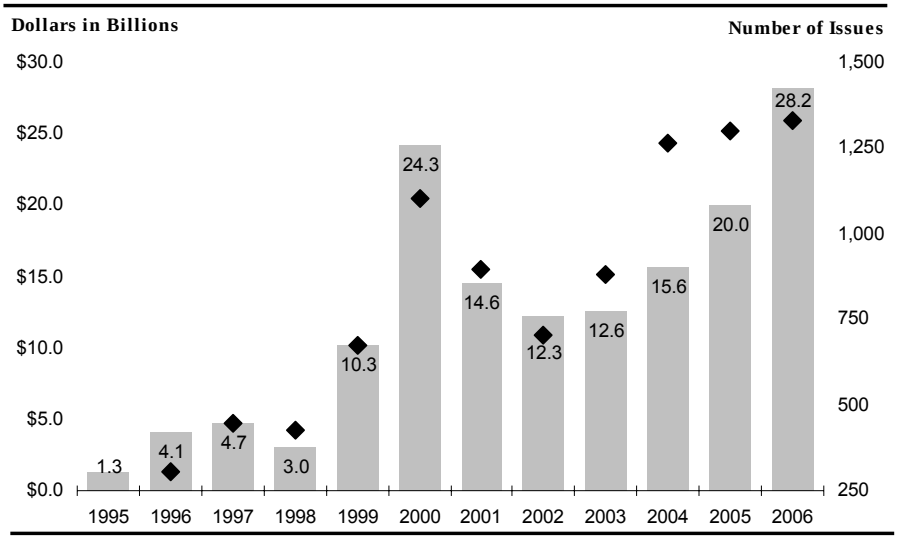
April 2, 2007

I. INTRODUCTION

In recent years, the PIPE, or *Private Investments in Public Equity*, market has displayed robust growth and solidified its claim as a viable alternative for public companies seeking to raise equity capital. While the market's origins can be traced back more than two decades it truly emerged as a legitimate source of financing in the mid-1990s, when SEC Regulation S, and other amendments, allowed public firms to sell unregistered securities which could then be resold to the public market at a later date. By the late-1990s the market had evolved and larger and more mature companies began issuing PIPEs, taking advantage of the securities issuance speed and ease. Between 1995 and 2006 the total amount raised in the PIPE market grew at a 32% compounded annual growth rate (see figure 1). New PIPE offerings initially peaked in 2000 at 1,106 transactions and $24.3 billion raised before falling off dramatically in step with the corrections in the major U.S. stock market indexes. Since then, the PIPE market has rebounded strongly setting new issuance and capital raised records in 2006.

Figure 1 - Total PIPE Market

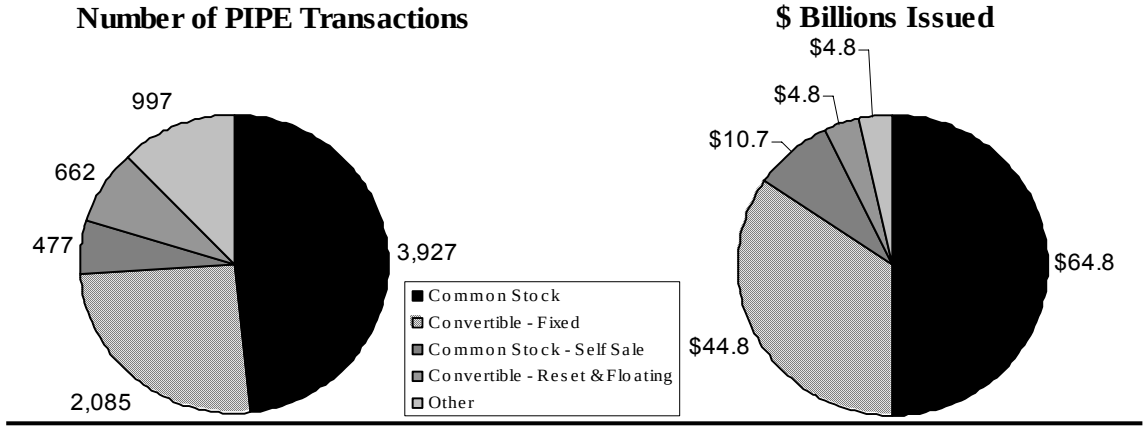


Source: PlacementTracker

The largest segment of the PIPE market by number of transactions and amount issued is the common stock segment (see figure 2). A common stock PIPE is a security with a fixed

number of shares that are issued to investors at a discount or premium to the market price. These securities are restricted from being resold in the public markets until a resale registration statement is filed and declared effective. Also, common stock PIPE issues sometimes include warrants as an added incentive for investors agreeing to participate in the PIPE transaction.

Figure 2 – PIPE Security Mix, 2000 - 2006



Source: PlacementTracker

This paper explores the discounts and abnormal returns found in common stock PIPEs and contrasts it with those found in more traditional private equity placements. The motivation behind my research is to determine whether common stock PIPE issuer's compensate investors with lower discounts and experience higher abnormal returns. Should this be the case, we ought to see more companies turning to common stock PIPEs as a viable private equity financing alternative, especially when the firm's management believes its stock to be undervalued[1].

Academic researchers have examined many critical issues in the PIPE market; however there appears to be no formal evidence on the determinants of common stock PIPE discounts or the long-term performance of common stock PIPEs. As examples, a study by Hillion (2002) focused on structured convertible securities (a.k.a. death spirals) and the negative performance of the issuer's underlying public stock, while a study by Chaplinsky and Haushalter (2003)

[1] For a full discussion of the information hypothesis and its implications on an undervalued firm's financing decision, see Hertzel and Smith (1993).

examined the motivations and returns of firms issuing PIPEs. A study conducted by Brophy, Ouimet, and Sialm (2005) examined the performance of traditional and structured PIPEs. A second study by Brophy, Ouimet, and Sialm (2006) focused on hedge funds and their role in issuers' negative performance.

II. PIPE DATA AND GENERAL OBSERVATIONS

Using PlacementTracker.com I was able to identify 3,174 closed common stock PIPE transactions in the U.S. between January 3rd 2000 and January 30th, 2006. After eliminating issuers where I could not find PERMNOs[2] in the Center for Research in Scientific Prices (CRSP) database, I was left with 2,308 transactions. In addition, I eliminated issuers with less than 26 months of stock return data on CRSP prior to their PIPE issue which left me with 1,651 PIPE transactions. Also, I eliminated issuers that issued warrants and had a closing market price less than two dollars at the time of the PIPE transaction. PIPE issuers with warrants were removed to allow me to better measure liquidity's impact on PIPE discounts. Stocks priced less than two dollars were removed to avoid measurement problems in raw and abnormal returns related to microstructure factors (Ball, Kothari, and Shanken (1995)). Therefore, my final data sample consisted of 711 PIPE transactions.

For each of these 711 transactions I obtained data from PlacementTracker.com, CRSP, and Compustat. Using PlacementTracker.com I obtained premiums/discounts, gross proceeds, market capitalization at closing, investors, and post-deal raw stock returns. Using CRSP I obtained pre-deal raw stock returns and cap-weighted index returns. Finally, balance sheet and income statement data were obtained from Compustat.

[2] The PERMNO is the principal identifier of a stock in the CRSP database and provides a reliable way of tracking stocks over time.

In reviewing the data, several firm specific observations are readily apparent as displayed in Table I. First, firms issuing common stock PIPEs tend to be smaller firms with mean (median) sales and market capitalization of $271.9 million ($29.1 million) and $393.6 million ($150.1 million) respectively. Second, these firms tend to have low profitability with mean (median) EBITDA and net income of $2.97 million (-$1.93 million) and -$31.55 million and (-$8.24 million). Third, issuing firms require immediate financing as signaled by the mean (median) cash burn rate of 8.45 quarters (1.84 quarters). Fourth, issuing firms tend to have minimal debt in their capital structure with median debt-to-assets of 12.59% and debt-to-equity of 1.77%. The presence of minimal debt amongst issuers is not surprising because only 37.5% of the firms sampled had positive EBITDA.

Several noteworthy contract features are also summarized in Table I. First, gross proceeds from common stock PIPE issues are highly variable and ranged from $1 million to $1,232 million. The mean (median) gross proceeds are $28.37 million ($12.69 million). Second, size of offering as a percentage of the issuer's market capitalization is also highly variable and ranged from 0.01% to 338%. The mean (median) offering size is 12.01% (9.13%). Third, the mean (median) participation of hedge funds in a PIPE offering is relatively small at 30.32% (12.75%). Fourth, discounts/premiums are highly variable and ranged from a -78.2% discount to a 92.7% premium. The mean (median) discounts are -9.70% and (-10.13%).

III. DISCOUNT AND PREMIUM ANALYSIS

Several studies suggest discounts in restricted stocks are used to compensate investors for expected monitoring, services and expert advice (Wruck (1989)), lack of liquidity (Silber (1991)), and/or the costs of due diligence (Hertzel and Smith (1993)). However, the presence of discounts to compensate PIPE investors for expected monitoring, services, expert advice and due diligence costs seems unlikely. First, PIPE investors are generally passive and do not appear to

increase firm value through monitoring. Second, in private placements, resale restrictions are onerous (two years or more) and provide a strong incentive for investors to employ their specialized management and operational skills to increase the issuer's public stock price and incur expenses to assess the issuer's future prospects. In contrast, PIPE investors face much shorter resale restrictions (30 to 180 days) and typically do not have access to material non-public information. Third, PIPE issuers generally repay investors' expenses in connection with the transaction and its subsequent registration. Also, it is not uncommon for issuers to repay investors reasonable out-of-pocket expenses. Therefore, the difference in these key attributes between private placements and common stock PIPE issues[3] suggest common stock PIPE discounts may reflect compensation to the purchaser for reduced liquidity.

The average common stock PIPE discount of -9.70% was less than the -33.75% average discount observed in the restricted stock study by Silber (1991). Common Stock PIPE issues should exhibit smaller discounts than restricted stock issues due to significant differences in their resale provisions and hence liquidity. The SEC restricts holders of restricted stock from selling their shares in the open market for a minimum of two-years. In contrast, PIPE issuers negotiate shorter periods, generally between 30 to 180 days, to file and declare effective their resale and registration statement. However, the observed PIPE and restricted stock discounts are not necessarily comparable because the Silber (1991) study analyzed price differences between securities that were *identical in all respects except for resale provisions*. Thus, without reviewing each individual PIPE's SPA I cannot make the same claim. Instead, I reviewed a sub-sample of 20 random common stock PIPE cases and summarized my finding in Appendix I. In the sub-sample I identified several special provisions which may impact the variability in discounts. As an example, in two cases investors were guaranteed a seat on the issuer's board.

[3] The common stock PIPE sample included only those without warrants.

Also, investors' resale provisions varied between 35 and 180 days. However, overall the common stock securities issued pursuant to the PIPE offerings *did appear identical* to the issuer's public common stock.

III.1 Determinants of Discount and Premium Variability

The determinants behind the significant variability in common stock PIPE issuer's discounts warrant a closer investigation. In this section, I examine the discounts in common stock PIPEs and some of their likely predictor variables. For the remainder of this paper I replaced "discounts" with "premiums" to allow for logarithmic transformation in my regression analysis. Premium is defined as [(Purchase Price Per Share) / (Closing Stock Price)] x 100. As an example, a discount of -35% is equivalent to a premium of 65. The predictor variables I expect will explain the majority of the variability in premiums includes the issuer's (i) public stock illiquidity, (ii) interaction between stock return volatility and illiquidity, (iii) under/over valuation, (iv) cash reserves, (v) recent stock performance, and (vi) investors who are hedge funds.

I expect the issuer's public common stock *illiquidity* will be inversely related to the PIPE issue's premium. Once the resale registration statement is declared effective, the higher the common stock's illiquidity the more difficult it will be for investors to dispose of their shares. However, a positive relationship between the issuer's common stock illiquidity and the PIPE issue's premium may also exist. If the PIPE issuer's public common stock is already illiquid, then an investor does not lose much by holding a PIPE with resale restrictions; hence, the greater the illiquidity the larger the premium. In my analysis I used the *Average Relative Bid-Ask Spread* as my proxy for illiquidity. The relative bid-ask spread is measured as the dealer's closing bid-ask spread divided by the average of the closing bid-price and ask-price. The

average is based on the last trading day of each of the immediate five months prior to the closing date of the transaction.

I expect the interaction between the issuer's *stock return volatility and illiquidity* to be inversely related to its PIPE issue premium. The greater the stock return's volatility the higher investors should value the stock's liquidity. The PIPE issue's risk is magnified when a stock's illiquidity is high because the investor will have difficulty disposing of their shares and/or hedging their position through selling the stock short. Thus, in my analysis I use the variable *Risk*Illiquidity* to account for the interaction between an issuer's stock return volatility and its illiquidity. Risk*Illiquidity is defined as (Standard Deviation of Returns) x (Average Relative Bid-Ask Spread). The Standard Deviation of Returns is calculated using the 60 monthly returns immediately prior to PIPE transaction's closing date. For stocks where 60 monthly returns were not available, I used available returns as long as they were greater than or equal to 26 months.

I expect the issuer's *book-to-market ratio* to be positively related to the issue's premium. A previous study has suggested private placement discounts reflect informed investors' appraisals of true (lower) firm value (Hertzel, Lemmon, Linck and Rees (2002), hereafter referred to as HLLR). The evidence in the study is based on the three year post-announcement abnormal underperformance of restricted stocks. If I use book value as a proxy for the firm's true value, then the higher the firm's book-to-market ratio the less overvalued the firm's stock market price and the higher the premium investors should be willing to pay. This hypothesis may not be as relevant to PIPEs because most PIPE investors want to maintain their trading flexibility and thus appraise the firm's value with only public information. In the event a PIPE investor receives material nonpublic information the investor may not conduct any transactions in the issuer's securities until such information becomes public. Therefore, the premium should

not reflect an investors' appraisal of the firm's true value because efficient market hypothesis asserts the price of the traded common stock should already reflect all public information. However, certain PIPE investors with longer-term investment horizons are willing to have their trading ability restricted; thus, this variable may still explain some of the variability in common stock PIPE premiums.

I expect the *cash-to-market ratio* to be positively related to the issuer's premium. An issuer with a high ratio of cash to their market value of equity has the option to postpone a financing if it does not like the negotiated premium. Alternatively, companies with a low ratio of cash to their market value of equity typically have fewer financing alternatives, less leverage in negotiating discount terms and may be forced to issue common stock PIPEs with a smaller premium.

I expect an issuer's *six month stock price performance prior to its PIPE transaction* to be positively related to the issuer's premium. Positive pre-issue stock price performance may signal the market expects improvements in the Company's financial results. Thus, investors may offer higher premiums to companies whose financial results are expected to improve.

I expect the presence of *hedge fund investors* in a PIPE issue to be associated with smaller premiums. Hedge funds investing in PIPEs use a myriad of trading strategies to hedge their risk. As an example, a hedge fund can invest in a common stock PIPE issue, and after the PIPE transaction has been announced, can short the issuer's public shares (assuming short selling is permitted within the SPA). If the issuer's common stock declines, the investor's short-selling gains can be used to offset losses from its long position via the PIPE issue and vice versa. The SEC's investigations into insider-trading by hedge funds and the media's attention on hedge funds roles in depressing issuers' stock prices, may have contributed to PIPE issuers preferring

investors that are restricted from short selling, such as mutual funds. Thus, the presence of hedge funds may signal the issuer has fewer interested investors and has to offer a smaller premium (larger discount) to entice investors to participate in the financing.

I included *closing stock price* as an independent variable to determine whether removing stocks priced below two dollars could impact my results. I do not expect an issuer's closing stock price to have a relationship to the issuer's premium.

III.2 Regression Analysis and Results

To gain a better understanding of the factors that best explain the premiums' variability in common stock PIPE issues, I ran a regression analysis. All else equal, I should expect higher premiums (smaller discounts) for issuers with low illiquidity, low Risk*Illiquidity, high book-to-market ratios, high cash-to-asset ratios, good pre-issue stock price performance, and the absence of hedge fund investors participating in their PIPE offering. Furthermore, I do not expect the relationship between stock prices and premiums to be statistically significant.

Table II reports the results of my regression analysis. To mitigate the effect of outliers, I trimmed (i.e., left out of the regression) the highest and lowest 1% issuer discounts and their associated independent variables. My results show the overall significance of the regression is strong as indicated by an F-statistic of 21.4. In addition, each of the independent variables, except for Risk*Illiquidity and Closing Stock Price, are statistically significant at the one percent level[4]. Surprisingly, the pre-issue stock performance does not have the same sign as proposed by my hypothesis. The issuer's pre-issue stock performance appears inversely related to the issuer's premium. Thus, holding all other variables constant, issuer's whose stocks have performed better during the six months leading up to a PIPE transaction have smaller premiums. This unexpected result may be due to the method of how premiums are measured in my analysis (see detailed

[4] The Book-to-Market ratio is significant at the 5% level.

explanation in Appendix II). Finally, the regression has a relatively low R^2 (20.5%) which suggests there is considerable unexplained variability in the PIPE premiums not captured by my independent variables.

IV. Return Analysis

Differences in abnormal returns following announcements of Seasoned Equity Offerings (SEOs), private placements and PIPEs have been widely documented. Specifically, SEO announcements are followed by *negative* abnormal returns[5]. In contrast, several empirical studies have found private equity issues are associated with *positive* abnormal returns during 10 day event windows around the announcement date[6]. However, companies issuing private placements see their performance reverse over a longer time period. HLLR (2002) results show mean three-year abnormal returns following a private placement ranging from -45.2% to -23.8%.

Abnormal returns of companies issuing traditional[7] and unprotected[8] PIPEs resemble private placements. Brophy, Ouimet, and Sialm (2005) found traditional PIPE issuers experience *positive* average abnormal returns of 5.6% during a ten-day event window around the announcement date and -8.4% the year following the issue. Chaplinsky and Haushalter (2003) found unprotected PIPEs also experience *positive* average abnormal returns of 3.34% during a two-day event window around the announcement date and -9.3% the year following the issue. Brophy, Ouimet, and Sialm (2005) suggest hedge fund investors may play a negative role in the PIPEs poor long term performance through their hedging activities (discussed earlier). The study found the stocks of companies issuing traditional PIPEs where hedge funds are the major investors experienced significant negative mean abnormal one-year returns of -12.89%.

[5] Smith (1986), Asquith and Mullin (1986), Masulis and Kowar (1986), Mikkelson and Partch (1986), Shyam-Sunder (1991), and Cornett and Tehranian (1994).
[6] Wruck (1989), and Brophy, Ouimet and Sialm (2004).
[7] Includes common stock and fixed convertible securities.
[8] Includes common stock and structured equity lines.

Evidence of a stock price reversal in traditional and unprotected PIPEs is surprising as market efficiency suggests a stock price correction due to the composition of investors would occur at the time of the announcement.

In the following sections, I analyze the performance of common stocks issuing PIPEs. I am interested in whether the post-issue long term abnormal returns of common stock PIPEs are negative, such as those found in private placements, traditional PIPEs, and unprotected PIPEs, as well as the determinants of common stock PIPEs long-term performance.

IV.1 Return Observations

Table III reports the raw and abnormal returns of companies issuing PIPEs one-month, three-months, six-months, and twelve-months after the close of their PIPE issue. The Cumulative Abnormal Return (CAR) is calculated as (raw return – market return * beta), where the market return is a portfolio of NASDAQ, AMEX or NYSE cap-based decile 10 firms (micro-caps) according to the market of the issuer. Surprisingly, common stock PIPEs display *positive* mean abnormal returns the year following the issue which is in contrast to the negative abnormal returns seen in traditional and unprotected PIPEs. The *t*-statistic indicates that all of these abnormal returns are statistically significant at the one percent level. The one-month and three-month mean and (median) CAR for PIPE issuers were 8.07% (4.11%) and 8.92% (2.97%). Over longer event windows, PIPE issuers still had positive abnormal returns. The six-month and twelve-month CAR mean and (median) return for PIPE issuers were 10.08% (3.41%) and 11.14% (0.11%). Furthermore, the proportion of firms with positive abnormal returns in the one-month, three-month, six-month, and twelve-month periods were 58.09%, 54.47%, 53.33% and 50% respectively. These results are statistically significant over all measurement periods, except for the 12-month window.

Panel A and B in Table IV reports the raw and abnormal returns of companies issuing common stock PIPEs with and without hedge fund investors. The abnormal returns for companies with and without hedge funds as investors are positive. The *t*-statistic indicates all of these abnormal returns are statistically significant at the one percent level[9]. However, the abnormal returns in all event windows are higher for those PIPEs without hedge fund investors than those with hedge fund investors. Panel C in Table IV reports the differences in abnormal returns for those PIPEs without hedge fund investors versus those PIPEs with hedge fund investors are statistically significant during the one-month, three-month, and twelve-month event windows. These results are consistent with Brophy, Ouimet, and Sialm (2005) findings that long-term abnormal returns are lower for PIPE issuers with hedge funds as investors.

IV.2 Determinants of Long Term Performance Variability

In the previous section, I found evidence that common stock PIPEs with hedge funds as investors performed worse than PIPEs without hedge funds as investors. In addition to hedge funds, I am interested in determining what other variables contribute to common stock performance. In this section, I examine the likely determinants of common stock PIPEs' performance which are then used in a series of regression models. Each model examines a separate independent variable, specifically the one-month, three-month, six-month, and twelve-month CAR. The predictor variables are (i) premium, (ii) relative size of offering, (iii) presence of hedge fund investors, (iv) beta, (v) book-to-market ratio, (vi) pre-issue stock performance, (vii) Risk*Illiquidity, and (viii) closing stock price.

Hertzel and Smith (1993) suggest private placement discounts and stock price performance reflect the resolution of asymmetric information about the issuer's value. The positive abnormal returns displayed in common stock PIPEs may then reflect the investors'

[9] Excluding the twelve month CAR for PIPEs with hedge fund investors, which is significant at the 5% level.

assessments of the issuer's true (higher) firm value. Thus, I would expect the PIPE *premium* to be positively related to the issuer's returns.

The information hypothesis developed by Myers and Majluf (1984) demonstrates the announcement of a public equity issue conveys management's belief the firm is overvalued. Hertzel and Smith (1993) extend the information hypothesis by demonstrating that undervalued firms who decline to issue publicly and do not have financial slack, can still pursue their positive NPV projects through a private placement. Thus, management's private placement decision conveys their private information (i.e., the firm is undervalued) to the marketplace. Also, the positive information effect should be higher where the potential degree of undervaluation is high. Hertzel and Smith's (1993) evidence shows a higher information effect where the firm's investment opportunities are large relative to their assets in place. The subsequent positive stock performance reflects the resolution of asymmetric information. I used the *relative size of the offering* as a proxy for investment opportunities relative to assets in place and expect it to be positively related to the issuer's returns.

I expect the *presence of hedge fund investors* in a PIPE offering to be inversely related with returns. As discussed earlier, hedge fund investors trading strategies may have a negative affect on PIPEs long-term performance. Furthermore, I expect the common stock's *beta* to be positively related to the issuer's returns. According to the Capital Asset Pricing Model (CAPM), expected asset returns are determined by their systematic risk.

There has been considerable research on the relationship between an issuer's pre-issue stock performance and its post-issue performance[10]. Results show that both SEOs and private placement issues are preceded by run-ups in the stock prices of the issuers. In contrast to SEOs,

[10] Asquith and Mullin (1986), Korajczyk, Lucas, and McDonald (1990), Loughran and Ritter (1997), Hertzel, Lemmon, Linck and Rees (2002).

private placement issues follow periods of relatively poor operating performance. HLLR (2002) show evidence that investors are overly optimistic about the issuer's potential to improve their operating performance. Moreover, HLLR (2002) suggest low book-to-market ratios prior to private placement issues are consistent with this investor over-optimism. Thus, the negative post-issue stock price performance reflects investor disappointment about the issuer's failure to reverse their poor operating performance. I expect a PIPE issuer's *pre-issue abnormal performance* to be inversely related to its three, six, and twelve-month post-issue abnormal performance. Also, I expect a PIPE issuer's *book-to-market ratio* to be positively related to the issuer's post-issue abnormal performance.

I expect the *Risk*Illiquidity* variable to be positively related to the issuer's common stock returns. Where Risk*Illiquidity is defined as (Standard Deviation of Returns) x (Average Relative Bid Ask Spread). Friend, Westerfield, and Granito (1978) found a positive relationship between an assets expected return and its residual risk due to imperfect diversification. Amihud and Mendelson (1986) found a positive relationship between an assets expected return and its percentage bid-ask spread (i.e., illiquidity). Stoll (1978) showed evidence that the interaction of risk and illiquidity is evident when market makers charge a higher spread on securities with higher volatility as compensation for the risk of their stock positions.

Finally, I do not expect an issuer's *closing stock price level prior to its PIPE transaction* to have a relationship to the issuer's returns. However, I included closing stock price as an independent variable to determine whether removing stocks priced below two dollars could impact my results.

IV.3 Regression Results

Table V reports the results of my regression analysis. My results suggest the issue premium and relative size of the offering are statistically significant and their signs are as predicted for all the event windows studied[11]. Not surprisingly, companies with higher premiums (smaller discounts) perform better than companies with smaller premiums over all event windows. In addition, companies with larger offerings relative to their market capitalization perform better than companies with smaller offerings over all event windows.

The pre-issue CAR is also significantly related to the one-month and six-month CAR after the issue. Consistent with my hypothesis, a PIPE issuer's pre-issue abnormal performance is associated with a negative one-month CAR. However, the statistically significant positive relationship in the six-month CAR post-issue is inconsistent with my hypothesis. My hypothesis of an inverse relationship between an issuer's pre and post-issue stock price performance implies expected improvements in the issuer's operating performance fails to materialize. However, this result may suggest the issuer's operating performance actually exceeds investors' expectations six-months after the issue. Unfortunately, my research did not specifically look at operating performance trends post-issue and this alternative hypothesis can not be proven.

The variable *Risk*Illiquidity* is statistically significant at the five percent level during the one-month event window. Thus, riskier and less liquid issuers experience higher abnormal returns during the one-month window. This result is consistent with my hypothesis that a security's expected return must reflect its residual risk adjusted for its illiquidity.

Finally, the *closing stock price* is statistically significant at the five percent level during the one and three-month event windows. The inverse relationship suggests lower priced stocks outperform higher priced stocks during one and three-month event windows. While this is an unexpected finding, if a positive relationship exists between closing stock price and firm value,

[11]Excluding the relative size of offering for three month CARs which is not significant.

the information hypothesis may be a plausible explanation. Hertzel and Smith's (1993) study show high information asymmetry is found in small firms. Also, a study by Barth, Kasznik and McNichols (2001) found firm size was positively related with analyst coverage and thus information asymmetry. Specifically, the process of managers communicating to investors during road shows and management presentations should resolve some of these asymmetric information issues and lead to positive abnormal returns. As expected, a regression analysis confirms a statistically significant positive relationship at the one percent level between an issuer's stock price and its market value during the one and three-month windows[12].

V. Conclusion

I found the impact of illiquidity on common stock PIPEs in my sample was -9.7%. In addition, discounts tend to be larger for issuer's with higher illiquidity, lower book-to-market ratios, lower cash reserves, higher pre-issue performance, and hedge funds as investors. These results suggest common stock PIPE issuers may be able to reduce discounts and lower their cost of equity capital by offering shorter resale restrictions and attracting financing from non-hedge fund investors. Also, the relatively modest discounts found in common stock PIPEs suggest firms contemplating a private placement may turn to common stock PIPEs as a viable financing alternative. Furthermore, I found common stock PIPEs demonstrate positive abnormal returns over a one-year period, in contrast to the negative abnormal returns found in traditional and unprotected PIPEs. The differences in abnormal returns are likely due to the presence of fewer hedge funds found in common stock PIPE offerings and confirm that hedge funds should be investors of last resort. Also, the subsequent positive stock performance seems to reflect in large part the resolution of asymmetric information, thus confirming the benefits of adopting a strategy of increased transparency.

[12] For brevity, the regression analysis is not included in this paper.

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Appendix I – Review of Security Purchase Agreements and Registration Rights Agreement

The following table provides a summary of my detailed review of 20 randomly selected common stock PIPE Security Purchase Agreements (SPA) and/or Registration Rights Agreements (RRA). For each transaction I obtained the following items: *Hedge Fund %* is defined as the percentage of the issuer's offering funded by hedge fund investors. *Effective RRS* are the number of days after the SPA is executed that the issuer agrees to have the registration rights statement declared effective. *Info Access* is whether the issuer has agreed to provide material non-public information to their investor(s). *Hedging Restrictions* is whether the investor is restricted from hedging securities sold in the PIPE offering. *Expenses Reimbursed* is the expenses the issuer has agreed to repay the investor. *Reg. Fees* are legal expenses repaid in connection with the subsequent registration. *OP≤$25K* are out-of-pocket expenses no greater than $25,000 that the issuer has agreed to reimburse. All issuers that repaid out-of-pocket expenses also repaid registration expenses. *Board Seat* is whether the issuer guarantees the investor a seat on its board of directors. To verify changes to the board's composition, I also reviewed the issuer's definitive 14A proxy's one-year prior and one-year after the transaction.

Ticker Symbol	Closing Date	Discount/ Premium	Hedge Fund %	Effective RRS	Info Access	Hedging Restrictions	Expenses Reimbursed	Board Seat
PRFT	2/4/2000	-35.63%	7.50%	83	N/A	N/A	N/A	No
SFO	2/8/2000	-19.92%	7.00%	180	N/A	No	N/A	No
CYRO	4/20/2000	7.26%	43.18%	N/A	N/A	N/A	N/A	No
CERS	8/25/2000	-8.99%	0.00%	90	N/A	No	Reg. Fees	No
ISCO	10/20/2000	10.00%	100.00%	N/A	N/A	N/A	N/A	No
EPIQ	12/29/2000	-9.09%	0.00%	180	No	No	Reg. Fees	No
UAG	2/27/2001	10.82%	0.00%	N/A	N/A	N/A	N/A	1
AMLN	5/11/2001	1.01%	74.47%	70	N/A	No	Reg. Fees	No
SANG	6/20/2001	-16.98%	69.69%	120	Yes	No	OP ≤ $25K	No
DAVE	11/12/2001	-21.77%	43.55%	N/A	N/A	N/A	N/A	No
LESR	12/13/2001	-11.31%	0.00%	N/A	N/A	N/A	N/A	N/A
WLSN	1/10/2002	-13.73%	95.02%	120	No	No	OP ≤ $25K	No
EPAY	1/15/2002	-17.00%	0.00%	60	Yes	1yr restriction	Reg. Fees	1
ULTI	5/12/2004	-9.09%	0.00%	90	No	No	Reg. Fees	No
MLR	5/26/2004	5.51%	0.00%	35	No	No	Reg. Fees	No
COBH	9/29/2004	-0.73%	0.00%	N/A	N/A	N/A	Reg. Fees	No
ETC	2/11/2005	-0.93%	0.00%	N/A	Yes	N/A	N/A	No
CNVR	7/1/2005	-7.98%	0.00%	N/A	N/A	N/A	N/A	No
PPX	8/8/2005	-10.87%	0.93%	180	N/A	No	OP ≤ $25K	No
ENG	9/29/2005	-13.15%	100.00%	90	N/A	N/A	N/A	No

Summary of Findings: The effective registration rights timing varied, ranging between 35 to 180 days. Also, in the seven SPA's where information disclosure was mentioned four SPA's included a covenant that the issuer would not provide the investor with material non-public information. Moreover, in one SPA investors were restricted from hedging transactions for a one-year period. Also, in the ten SPA's where expense reimbursement was mentioned all ten issuers agreed to pay for subsequent registration, whereas only three issuers agreed to pay for the investors out-of-pocket expenses no greater than $25,000. In addition, two issuers granted one board seat to their PIPE investors. In the UAG transaction the investor was a corporate investor, whereas in the EPAY transaction the investor was a private equity firm. Finally, the only non-standard provisions observed included the LESR transaction where the investor was entitled to designate a replacement CEO, and the PPX transaction where the investors had a 180 day lock-up period during which the investors could not sell their shares.

Appendix II – Premium Calculation and its Relationship to Pre-Issue Returns

This appendix outlines my hypothesis on the inverse relationship between a stock's pre-issue performance and its post-issue performance. The first paragraph outlines several important definitions and the second paragraph outlines the hypothesis and provides an example.

The *PIPE Premium* is defined as (Purchase Price Per Share) / (Closing Stock Price). The *Purchase Price Per Share* is the amount of money the investor pays for each share of common stock. In a common stock PIPE transaction the *Purchase Price Per Share* is a negotiated discount to the *Market Price*. The *Market Price* is the closing bid price or volume weighted average price from one to 20 days prior to executing the purchase agreement. The *Closing Stock Price* is the closing price of the common stock of the Company on the trading day immediately prior to the *Closing Date* of the transaction. The *Closing Date* was obtained from PlacementTracker.com and can *either* be the date that the purchase agreement for the private placement transaction was signed by both parties (Closing Date #1) and/or the date that the actual funding of the private placement took place (Closing Date #2), depending on what information was provided by the Company in its public filings (see a typical PIPE transaction time-line in figure 3).

The potential inconsistency in recorded closing dates affects the relationship between a PIPE issuer's pre-issue and post-issue performance. Specifically, for issuers within my sample with Closing Date #2 in their premium's denominator, I would expect the pre-issue stock performance to be inversely related to the issuer's premium. As an example, the purchase price (i.e., the numerator) is set on Day 0 and if the issuer's stock price (i.e., the denominator) subsequently appreciates leading up to Closing Date #2 (i.e., the actual funding date) then the denominator will have increased while the numerator remains fixed, thus decreasing the premium.

Figure 3 – PIPE Transaction Time-Line

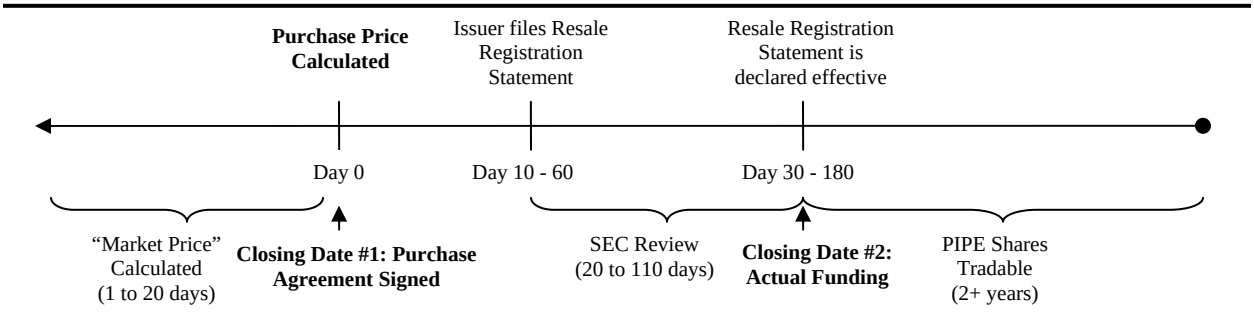

Table I - Sample Characteristics

Premium is defined as [(Purchase Price Per Share) / (Closing Stock Price) – 1] x 100%. *Standard Deviation of Returns* is calculated using the 60 monthly returns immediately prior to PIPE transaction's Closing Date[13]. For stocks where 60 monthly returns were not available, I used available returns as long as they were greater than or equal to 26 months. *Illiquidity* is defined as the average relative bid-ask spread. The bid-ask spread is measured as the dealer's closing bid-ask spread divided by the average of the closing bid-price and ask-price. The average is based on the last trading day of each of the immediate five months prior to the closing date of the transaction. *Gross Proceeds* is the dollar amount of the PIPE offering. *Market Capitalization at Closing* is defined as (number of shares outstanding that is reported by the Company in the 10-K or 10-Q most recently filed prior to the Closing Date) x (the Company's stock price on the trading day immediately prior to the Closing Date of the transaction). *Relative Size of Offering* is defined as (Gross Proceeds) / (Market Capitalization at Closing). *Hedge Fund %* is defined as the percentage of the issuer's offering funded by hedge fund investors. *Book-to-Market Ratio* is defined as (most recent quarter's book value of equity) / (Market Capitalization at Closing). *Cash-to-Assets Ratio* is defined as (most recent quarter's cash and marketable securities) / (most recent quarter's total assets). *Cash Burn Rate* is defined as (most recent quarter's cash and marketable securities) / (most recent quarter's EBITDA). The Cash Burn Rate was only measured for firms with negative EBITDA. *Debt-to-Assets* is defined as (most recent quarter's book value of long-term debt) / (most recent quarter's total assets). *Debt-to-Equity* is defined as (most recent quarter's book value of long-term debt) / (Market Capitalization at Closing).

	N	Mean	Median	SD	Max	Min
Premium	711	-9.70%	-10.13%	18.06%	92.73%	-78.18%
Standard Deviation of Returns	711	26.11%	24.21%	12.47%	94.51%	4.36%
Illiquidity	711	2.23%	1.48%	2.38%	15.16%	0.00%
Gross Proceeds ($MM)	711	28.37	12.69	76.04	1,232.25	1.00
Market Cap at Closing ($MM)	711	393.6	150.1	1,102.3	19,907.2	6.1
Size of Offering	711	12.01%	9.13%	18.55%	338.08%	0.01%
Hedge Fund %	711	30.32%	12.75%	35.75%	100.00%	0.00%
Sales TTM ($MM)	652	271.9	29.1	1,278.9	14,784.8	0.0
EBITDA TTM ($MM)	652	2.97	-1.93	77.26	1,423.27	-372.07
Net Income TTM ($MM)	652	-31.55	-8.24	199.21	788.60	-3,752.21
Book-to-Market Ratio	652	40.13%	21.48%	68.68%	948.54%	-1.41
Cash-to-Assets Ratio	640	31.25%	20.58%	29.45%	98.97%	0.00%
Cash Burn Rate (Quarters)	404	8.45	1.84	48.44	857.65	0.00
Debt-to-Assets	624	21.50%	12.59%	25.56%	200.00%	0.00%
Debt-to-Equity	648	29.57%	1.77%	85.49%	858.63%	0.00%

[13] The Closing Date was provided by PlacementTracker.com and can either be the date that the Purchase Agreement for the private placement transaction was signed by both parties and/or the date that the actual funding of the private placement took place, depending on what information was provided by the Company in its public filings.

Table II – Regression Analysis of PIPE Premiums

The dependent variable, *Premium*, is defined as [(Purchase Price Per Share) / (Closing Stock Price)] x 100. The independent variables include: *Illiquidity* is defined as the average "relative bid-ask spread". The bid-ask spread is measured as the dealer's closing bid-ask spread divided by the average of the closing bid-price and ask-price. The average is based on the last trading day of each of the immediate five months prior to the closing date of the transaction. *Risk*Illiquidity* is defined as (Standard Deviation of Returns) x (Relative Bid Ask Spread). *Book-to-Market Ratio* is defined as (most recent quarter's book value of equity) / (Market Capitalization at Closing). *Cash-to-Market* is defined as (most recent quarter's cash and marketable securities) / (Market Capitalization at Closing). *6 Month Pre-Issue Raw Return* is a raw return and measures the 6 month period prior to the PIPE transaction's Closing Date. *Hedge Fund* is a dummy variable and is a 0 for PIPE issues without a hedge fund investor and a 1 for PIPE issues with a hedge fund investor. *Closing Stock Price* is the closing price of the common stock of the Company on the trading day immediately prior to the Closing Date of the transaction. In regression b, I trimmed the highest and lowest 1% issuer discounts and their associated independent variables. '*', '**', and '***' denote statistical significance at the 10%, 5%, and 1% confidence levels, respectively.

Dependent Variable: Premium LN					
		a) Original Regression		**b) Trimmed at ±1% Level**	
Independent Variable	**Expected Sign**	**Coefficient**	**T-Stat**	**Coefficient**	**T-Stat**
Intercept		4.499		4.367	
Illiquidity LN	**(--) or (+)**	-0.027**	-2.59	-0.035***	-3.99
Risk*Illiquidity LN	**(--)**	-3.734**	-2.26	0.060	0.04
Book-to-Market LN	**(+) or NA**	0.002	0.33	0.012**	2.03
Cash-to-Market LN	**(+)**	0.013**	2.38	0.013***	3.00
6 Month Pre-Issue Raw Return	**(+)**	-0.020***	-3.40	-0.010***	-3.75
Hedge Fund (Dummy)	**(--)**	-0.095***	-6.20	-0.091***	-7.27
Closing Stock Price LN	***NA***	-0.037*	-1.94	-0.010	-1.26
R^2		17.1%			20.5%
Adjusted R^2		16.1%			19.6%
F		17.40			21.42
N		599			588

Note: LN refers to the variables natural logarithm.

Table III – Returns to Common Stocks of Companies issuing PIPEs

The Cumulative Abnormal Return CAR is calculated as (raw return – market return * beta), where the market return is a portfolio of NASDAQ, AMEX or NYSE cap-based decile 10 firms (micro-caps) according to the market of the issuer. The -6 Month CAR measures the 6 month period prior to the PIPE transaction's closing date. The +1, +3, +6, +12 Month CAR's measures the period immediately after the PIPE transactions closing date to the end of the specified period, or until the firm is acquired. The mean, median, standard deviation, % Pos±, Max and Min are expressed in percentage terms. '*', '**', and '***' denote statistical significance at the 10%, 5%, and 1% confidence levels, respectively.

All Investors

	N	Mean	Median	SD	*T*-Stat	% Pos±	*T*-Stat	Max	Min
-6 Month CAR	697	60.34	22.38	132.99	11.98***	70.88	11.02***	1,155.63	-124.25
-6 Month Raw Return	697	65.49	19.05	150.05	11.52***	67.86	-5.72***	1,388.32	-93.64
+1 Month CAR	701	8.07	4.11	27.43	7.79***	58.09	-10.84***	170.29	-99.31
+1 Month Raw Return	707	7.03	2.54	29.68	6.30**	55.73	1.54*	171.84	-91.74
+3 Month CAR	694	8.92	2.97	44.14	5.32***	54.47	2.32**	449.77	-120.19
+3 Month Raw Return	707	3.52	-2.92	46.61	2.01**	46.54	-1.84**	445.40	-94.35
+6 Month CAR	675	10.08	3.41	52.19	5.02***	53.33	1.73**	337.08	-118.54
+6 Month Raw Return	706	2.25	-4.97	56.00	1.07	45.75	-2.26**	321.59	-99.96
+12 Month CAR	642	11.14	0.11	71.06	3.97***	50.00	0.00	589.00	-194.65
+12 Month Raw Return	694	-3.17	-15.28	74.79	-1.12	39.05	-5.77***	660.00	-100.00

Table IV – Returns to Common Stocks of Companies issuing PIPEs

The Cumulative Abnormal Return CAR is calculated as (raw return – market return * beta), where the market return is a portfolio of NASDAQ, AMEX or NYSE cap-based decile 10 firms (micro-caps) according to the market of the issuer. The -6 Month CAR measures the 6 month period prior to the PIPE transaction's closing date. The +1, +3, +6, +12 Month CAR's measures the period immediately after the PIPE transactions closing date to the end of the specified period, or until the firm is acquired. The mean, median, standard deviation, % Pos±, Max and Min are expressed in percentage terms. '*', '**', and '***' denote statistical significance at the 10%, 5%, and 1% confidence levels, respectively.

Panel A: PIPEs without Hedge Fund Investors

	N	Mean	Median	SD	*T*-Stat	% Pos	*T*-Stat	Max	Min
-6 Month CAR	304	35.44	14.05	100.86	6.13***	65.46	5.39***	900.47	-124.25
-6 Month Raw Return	304	37.03	9.66	115.89	5.57***	58.88	3.10***	970.41	-85.34
+1 Month CAR	303	10.74	4.76	32.34	5.78***	63.94	4.88***	170.29	-99.31
+1 Month Raw Return	306	10.36	4.49	33.54	5.40***	58.82	3.09***	171.84	-91.74
+3 Month CAR	299	12.85	3.75	53.14	4.18***	55.18	1.79**	449.77	-120.19
+3 Month Raw Return	306	7.81	-1.08	54.87	2.49***	48.69	-0.46	445.40	-94.35
+6 Month CAR	295	12.69	4.05	56.26	3.87***	55.59	1.92**	337.08	-118.54
+6 Month Raw Return	306	5.38	-1.04	58.90	1.60*	48.69	-0.46	321.59	-99.96
+12 Month CAR	284	15.29	5.26	70.48	3.66***	55.28	1.78**	589.00	194.65
+12 Month Raw Return	302	0.32	-11.44	76.05	0.07	42.05	-2.76***	660.00	-100.00

Panel B: PIPE's with Hedge Fund Investors

	N	Mean	Median	SD	*T*-Stat	% Pos	*T*-Stat	Max	Min
-6 Month CAR	393	79.60	32.27	150.62	10.48***	75.06	9.94***	1,155.63	-83.43
-6 Month Raw Return	393	87.50	34.18	168.76	10.28***	74.81	9.84***	1,388.32	-93.64
+1 Month CAR	398	6.05	3.72	22.84	5.28***	57.54	3.01***	117.76	-63.05
+1 Month Raw Return	401	4.48	1.47	26.12	3.43***	53.37	1.35*	125.52	-72.59
+3 Month CAR	395	5.95	2.51	35.64	3.32***	53.92	1.56*	192.26	-71.07
+3 Month Raw Return	401	0.25	-4.76	38.92	0.13	44.89	-2.05**	224.05	-82.99
+6 Month CAR	380	8.04	1.51	48.78	3.21***	51.58	0.62	216.45	-100.20
+6 Month Raw Return	400	-0.15	-6.52	53.63	-5.59***	43.50	-2.60***	213.97	-90.67
+12 Month CAR	358	7.85	-3.47	71.44	2.08**	45.81	-1.59*	504.67	-115.40
+12 Month Raw Return	392	-5.85	-18.05	73.80	-1.57*	36.74	-5.25***	580.20	-97.69

Panel C: Abnormal Returns

	-6 Month CAR	+1 Month CAR	+3 Month CAR	+6 Month CAR	+12 Month CAR
No Hedge Funds	35.44	10.74	12.85	12.69	15.29
- Hedge Funds	79.60	6.05	5.95	8.04	7.85
Abnormal Returns	-44.16	4.69	6.90	4.65	7.44
T-Statistic	-4.484***	2.283**	2.085**	1.151	1.318*

Table V – Regression Analysis of PIPE Returns

The dependent variable is the natural logarithm of the PIPE's CAR. The independent variables include: *Premium* is defined as [(Purchase Price Per Share) / (Closing Stock Price)] x 100. *Relative Size of Offering* is defined as (Gross Proceeds) / (Market Capitalization at Closing). *Hedge Fund* is a dummy variable and is a 0 for PIPE issues without a hedge fund investor and a 1 for PIPE issues with a hedge fund investor. *Beta* is calculated using the 60 monthly stock returns immediately prior to PIPE transaction. For stocks where 60 monthly returns were not available, I used available returns as long as they were greater than or equal to 26 months. The Beta's benchmark is a portfolio of NASDAQ, AMEX or NYSE cap-based decile 10 firms (micro-caps) matched to the market of the issuer. *-6 Month CAR* measures the 6 month period prior to the PIPE transaction's closing date. *Book-to-Market* is defined as (most recent quarter's book value of equity) / (Market Capitalization at Closing). *Closing Stock Price* is the closing price of the common stock of the Company on the trading day immediately prior to the Closing Date of the transaction. *Risk*Illiquidity* is defined as (Standard Deviation of Returns) x (Relative Bid Ask Spread). '*', '**', and '***' denote statistical significance at the 10%, 5%, and 1% confidence levels, respectively.

		One-Month		**Three-Month**		**Six-Month**		**Twelve-Month**	
Independent Variable	**Expected Sign**	**Coefficient**	**T-Stat**	**Coefficient**	**T-Stat**	**Coefficient**	**T-Stat**	**Coefficient**	**T-Stat**
Intercept		-0.857		-0.960		-2.061		-3.462	
Premium LN	**(+)**	0.221***	3.63	0.268**	2.56	0.456***	3.78	0.746***	4.42
Size of Offering LN	**(+)**	0.024*	1.89	0.034	1.52	0.063**	2.44	0.075**	2.05
Hedge Fund (Dummy)	**(--)**	-0.017	-0.70	-0.057	-1.34	-0.004	-0.08	-0.014	-0.19
Beta LN	**(+)**	0.008	0.70	0.018	0.88	0.014	0.57	-0.003	-0.08
-6 Month CAR	**(--)**	-0.018*	-1.90	0.025	1.44	0.034*	1.75	0.032	1.16
Book –to-Market LN	**(+)**	-0.007	-0.67	-0.007	-0.36	0.012	0.58	0.013	0.42
Risk*Illiquidity LN	**(+)**	4.262**	2.19	-0.839	-0.25	0.302	0.08	7.242	1.30
Closing Stock Price LN	***NA***	-0.037**	-2.42	-0.072***	-2.67	-0.027	-0.85	-0.005	-0.10
R^2		8.2%		4.2%		4.5%		5.1%	
Adjusted R^2		6.9%		2.8%		3.1%		3.6%	
N		565		559		541		513	

Note: LN refers to the variables natural logarithm

Terror-Related Events and Stock Returns

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I. INTRODUCTION

On July 28, 2003, the U.S. Defense Advanced Research Projects Agency (DARPA) unveiled its Policy Analysis Market (PAM). PAM would have created a place for individuals to trade futures contracts linked to political events in the Middle East. Within a day, the project, which would have included contracts for terrorist attacks and assassinations, was cancelled under extreme political pressure. However, despite this setback, prediction markets have continued to grow over time. Some markets, such as Tradesports.com, offer contracts based on political events in both the U.S. and the Middle East. For example, prior to and during the war in Iraq, Tradesports offered contracts linked to the capture of Saddam Hussein. Many of these contracts take the form of "all-or-nothing" options that pay a set amount if and only if the stated event occurs before expiration.

While prediction markets have become more popular, their trading volume is low compared with that of major exchanges. However, according to Wolfers and Zitzewitz (2006), "some envision prediction markets as the first step toward markets where participants could hedge their exposure to political and economic events." For instance, contracts similar to those intended for the failed DARPA project could be used to hedge against terrorism and other political events. In order to gauge the potential viability of such contracts, this study seeks to determine the risk exposure of two industries, airlines and defense firms, to terrorist attacks and other related events. Specifically, the hypothesis to be tested is that airline stocks are subject to abnormal negative returns on the date of such events, while defense firms experience abnormal positive returns.

II. PREVIOUS RESEARCH

Since the attacks of September 11, 2001, several studies have explored the effects of terrorism on financial markets. The previous work has focused primarily on terrorist

incidents which meet the criteria, defined by Title 22 of the United States Code, Section 2656f(d), as "premeditated, politically-motivated violence perpetrated against non-combatant targets by subnational groups or clandestine agents, usually intended to influence an audience."

Karolyi and Martell (2006) performed an event study consisting of 75 separate attacks targeting publicly traded companies. They found that even when September 11 is excluded, the target firms experienced an abnormal return of -0.83% on the day of the attack (or subsequent trading day). In addition to examining companies that were targeted by the attack, they also studied peer firms in the same industry and found no significant abnormal returns, leading them to conclude that either "investors do not believe that growth opportunities lost by targeted firms…are captured by competitors within the same industry" or benefits to competitors (positive effect) are offset by a perception of higher terror risk within the industry (negative effect).

Berrebi and Klor (2006) focused specifically on the Israeli-Palestinian conflict and its effect on Israeli companies. Their results show no significant effect on the overall stock market as a result of terrorist attacks. However, they looked beyond this result and analyzed the effects of terrorism on different industries. They found that the second Palestinian uprising accounted for abnormal returns of +7% for defense firms and -5% for all other companies between September 29, 2000 and September 10, 2001.

While our study analyzes the same themes and uses similar techniques as previous work, it is unique in two ways. First, like Berrebi and Klor, we attempt to determine the effects of terrorism on specific industries, but the focus is on U.S. companies. Second, our research expands beyond perpetrated attacks and studies the impact of other exogenous terror-related events, specifically changes in the Department of Homeland Security's (DHS)

National Threat Advisory System and taped messages released by al-Qaida leader Osama bin Laden.

Such events are of interest because they may contain information about potential attacks and therefore may impact financial markets. Their inclusion in the study is consistent with Karolyi and Martell's assertion that a company's stock price might react to attacks due to "the fact that costs incurred by the firm in the continuation of its normal activities differ from those before the attack(s)." One might expect that official warnings or threats from terrorist groups could have similar consequences. For instance, an elevation in the threat level may result in more extensive and costly security procedures or lower revenues from decreased passenger traffic.

The inclusion of non-attack events is also consistent with the decision to study entire industries rather than specific firms. While a specific company may be targeted in an attack, this is often not the case with terror threats and warnings. Therefore, it is more appropriate to study the impact of such occurrences on entire industries.

III. INDUSTRY SELECTION

This study focuses on the stock price reactions to terror-related events for firms in the airline and defense sectors. These particular industries have been chosen because they are perceived to have a significant exposure to such events.[1]

Airlines

The airline industry, in particular, has been a focus of numerous terrorist attacks and related events. While the September 11 attacks are the most notable example, commercial airliners have been targets in past attacks, and the industry has continued to be the focus of

[1] Though this study focuses on just two industries, a number of sectors may be disproportionately affected by terrorism, including hotels, travel, and tourism.

terrorist threats and DHS warnings in recent years. Most recently, a plot to attack ten transatlantic flights to the U.S. was uncovered in London in August 2006.

With each incident analysts have speculated about the impact on the airline industry. For example, a Salomon Smith Barney Industry Note following the "unprecedented" attacks of September 11 warned of a potential year-long effect on revenues and more permanent changes to airlines' cost structures due to increased security precautions. The note also speculated that the magnitude and nature of the attacks would result in a more widespread geographic impact than previous events, such as the bombing of Pan Am flight 103 and the first Gulf War, which primarily affected transatlantic travel. However, this report also noted that the impact of terrorism is often overshadowed by other factors, as was the case when airlines outperformed the S&P 500 in the twelve months following the 1988 Pan Am bombing on the strength of record revenues and earnings.

A 2006 report from Cathay Financial posits that attacks since September 11 have had an increasingly smaller effect on airline traffic over time. After repeatedly viewing images of terrorism and war, travellers may become desensitized to threats, helping to explain the limited effects of terrorism on air traffic.

Finally, an equity research report from Credit Suisse downplays the long-term affects of non-attack events, such as elevations in the DHS threat level. According to the report, on average, airline stock prices were down only 1% on the day of such announcements and recovered quickly thereafter. The report concludes that factors such as fuel prices and the overall economic outlook have a bigger effect on the sector than do fears about terrorism. Like Cathay Financial, this report also notes a possible desensitization to terror warnings over time, as exhibited by smaller negative reactions with each successive warning.

Defense

While airlines may face increased risk from terrorism, the defense industry has been identified as a sector that may benefit from such events. This was the finding of Berrebi and Klor (2006) when examining Israeli defense stocks. Analysts have also considered the potential impact on this sector. Following the foiled London-based airline plot in 2006, reports from Jefferies & Company and Prudential Equity Group noted the potential effect on defense firms. The Prudential report speculated that the plot, which involved the use of explosive agents hidden in liquid carry-on containers, exposed a potential gap in current detection technology and therefore could lead to increased spending on upgraded equipment. However, the Jefferies report cautions that such an impact could be minimal, as increased security spending had been in the pipeline for some time before the plot was discovered.

IV. DATA

Events

For this study, a total of 34 events were selected and classified in the following three categories. See Table A-1 in the appendix for a list of events in each category.

1) Major terror attacks or plots targeting American interests, either within the U.S. or abroad. These events were selected from *The World Almanac and Book of Facts* list of Notable Terrorist Incidents beginning with the bombing of Pan Am flight 103 in 1988. This category also includes other significant airline-related events, including thwarted attacks and crashes that were initially perceived to be related to terrorism. (twelve events)

2) Elevations in the DHS National Threat Advisory System, including elevations targeting specific geographic regions or transportation sectors.[2] Official warnings that did not result in a threat elevation were also included. The list was compiled from official press releases issued by the DHS or The White House. (ten events)
3) Releases of taped messages by al-Qaida leader Osama bin Laden. A timeline of these recordings, along with a summary of the message, was taken from the English-language website of the Al Jazeera network. (twelve events)

Securities

Security prices for U.S.-based commercial air travel and defense firms that were publicly traded at any point during 1988-2006 (the timeline encompassing all of the selected events) were obtained from the CRSP database. Air travel companies with a SIC code classification of 4510, 4511, 4512, or 4520 were selected. No distinction was made between domestic-only carriers and those with international routes. This seemed appropriate given that the September 11 attacks targeted domestic routes within the U.S., demonstrating that all airlines are exposed to terror-related risk. The list of defense firms was compiled from those highlighted in the Jefferies and Prudential analyst reports. A full list of companies included in the study is found in Table A-2 in the appendix.

V. METHODOLOGY

In an attempt to determine the precise impact of the selected events on airline and defense firms, we have performed a series of event studies. The goal of an event study is to measure abnormal returns for one or more stocks as a result of a particular event.

[2] While this study considers only threat elevations, one might expect that reductions in the DHS threat level would have the opposite effect of increasing returns for airlines and decreasing them for defense firms. However, this effect could be mitigated by the fact that the perception of the general threat level may have diminished even before the official reduction, which would then be a formality.

Market Model Estimation

The first step is to estimate expected returns based on stock price data during a window of time prior to the event. Returns during this *estimation window* are regressed against the overall market to obtain the following equation:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it}$$

where R_{it} and R_{mt} are the returns on security i and the market, respectively, in period t. α_i and β_t are the parameters of the market model. ε_{it} is the zero mean disturbance term. Dates during the *event window* are indexed using the symbol τ, with the event date itself at $\tau = 0$. The abnormal return for security i on a given day τ during the event window is denoted by $AR_{i\tau}$, which takes the place of the disturbance term in the previous equation. Solving for $AR_{i\tau}$ we have:

$$AR_{i\tau} = R_{i\tau} - \hat{\alpha}_i - \hat{\beta}_i R_{m\tau}$$

where $R_{i\tau}$ and $R_{m\tau}$ are the actual returns for the security and market, respectively. The hats above the market model parameters indicate that they are approximated from the estimation window observations using ordinary least squares (OLS). Under the null hypothesis the expected value for $AR_{i\tau}$ is zero. For more information regarding event study methodology, see MacKinlay (1997) or Karolyi and Martell (2006).

Study Parameters

The Eventus software provided by Wharton Research Database Services (WRDS) was used to perform the studies described in this paper. An estimation window of 255 days, ending 21 days prior to the event, was used to obtain the market model parameters, with the S&P 500 serving as the benchmark index. If an event occurred after the markets closed in the U.S. or on a non-trading day, the subsequent trading day was used as the event date. For each event date, Eventus analyzed only those firms with a sufficient amount of stock return data

over the estimation and event windows. For example, JetBlue was not included in the analysis of the Pan Am flight 103 bombing, while Pan Am was excluded when looking at the more recent changes in the DHS threat level.

Test Statistics

The potential for cross-sectional correlation of the returns was of concern in interpreting the results. A benefit of observations with non-overlapping estimation and event windows is that idiosyncratic stock price movements that occur during the estimation and event windows are "washed out," leaving "abnormal returns that truly capture the economic impact of the event on stock prices" (Karolyi and Martell, 2006). However, in this study the effect of a particular event on all firms in a single industry is considered. As a result, all observations for the event have coinciding estimation and event windows, leading to a high correlation of returns between firms. Collins and Dent (1984) show that ignoring this effect produces results in which the computed test statistic is larger than it would have been if the returns are independent. This may result in a bias towards rejection of the null hypothesis. This issue was addressed within the constraints of the WRDS Eventus software by relying on the Crude Dependence Adjustment (CDA) test statistic, which, according to the software manual, "avoids the potential problem of cross-sectional correlation of security returns."

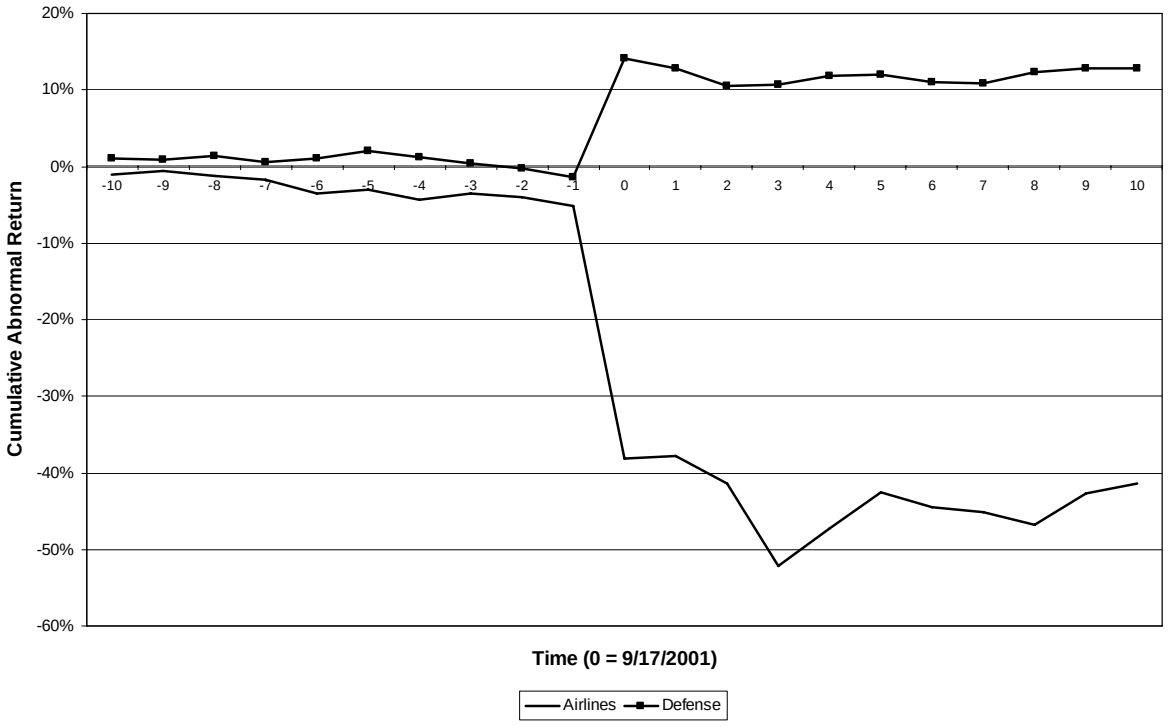
VI. SUMMARY OF RESULTS

The studies were done in two stages. In the first, the events were aggregated in single studies for each of the three categories. The goal was to determine if these types of events have a statistically significant impact on returns. In the second stage, a separate study was done for the each individual event. The purpose of looking at each event on its own was to judge if abnormal returns are related to the precise nature of an individual event or threat. Factors that may influence the magnitude of abnormal returns are the severity of an event or a

specific focus on air travel or the U.S. homeland. One may expect that events of this nature would have a bigger impact, particularly on airline stocks. This approach may also determine if the abnormal returns are diminishing over time as Americans become desensitized to terrorism.

Due to the magnitude of the September 11 attacks, they were not included in the study of successful terrorist attacks (Category 1). Instead, a separate study was done to determine the abnormal returns associated with this event. The results are in line with the hypothesis that a terrorist attack would cause abnormal negative returns for airlines stocks and positive returns for defense stocks. On the first trading day following the attacks, September 17, 2001, airline stocks posted an abnormal return of -33.0%, while defense stocks had an abnormal return of +15.5%. Both numbers are significant at the 0.1% level. The following graph depicts the cumulative abnormal returns over an event period beginning ten days before and extending ten days after the event date.

Figure VI-1: Effects of September 11, 2001 Attacks on Airline and Defense Stocks



Category-Level Results

The following table summarizes the mean abnormal returns for each industry on the event date for each event category. Boldface type indicates abnormal returns that are significant at at least a 5% level and have the expected sign (negative for airlines; positive for defense). The results indicate statistically significant abnormal returns on the event date in certain categories.

Table VI-1: Event Date Abnormal Returns for Aggregated Event Categories

	Airlines		*Defense*	
Category	Mean Abnormal Return ($\tau = 0$)	Portfolio Time-Series (CDA) t	Mean Abnormal Return ($\tau = 0$)	Portfolio Time-Series (CDA) t
(1) Terrorist Attacks	***-0.73%***	***-1.692****	0.11%	0.318
(2) Threat Elevations	***-1.03%***	***-1.652****	0.12%	0.395
(3) al-Qaida Warnings	-0.15%	-0.263	-0.45%	-1.62$

The symbols $,*,@, and # denote statistical significance at the 0.10, 0.05, 0.01 and 0.001 levels, respectively, using a 1-tail test.

As expected, on the dates of terrorist attacks and threat elevations, firms in the airline industry earned negative abnormal returns that were significant at the 5% level. The results also show abnormal returns for defense stocks on dates when taped al-Qaida warning messages were released. However, these returns were negative rather than positive. Further, an examination of all days in the event windows for the categories reveals significant abnormal returns on days other than the event date. For example, airline stocks exhibit an abnormal return of +1.86% on the eleventh day ($\tau = +11$) following the release of messages by al-Qaida while defense stocks had an abnormal return of -1.14% fourteen days ($\tau = -14$) prior to terrorist attacks. Both results are significant at the 0.1% level. (See Table A-3 in the appendix for a complete listing of abnormal returns and t statistics for each day in the event

window.) Because the timing of these returns relative to the event date is arbitrary and because each category contains a small number of events, it is possible that a single abnormal return for one of the events influenced the results of the entire category. The next section will further discuss abnormal returns for each individual event observation.

Event-Level Results

In order to determine the source of unexpected returns within the category-level results, a separate study was done for each individual event. This will also provide information regarding the pattern of abnormal returns for specific events rather than just categories of events. Such an approach may be more appropriate when dealing with terrorism because each event is unique. For instance, terrorist attacks may differ in location, target, and scale. Elevated threat levels and al-Qaida warning messages may also differ in their subject and tone. As a result, it may be problematic to combine all events in a particular category into a single study. Considering each separately may allow us to make determinations regarding the impact of different events based on content and across time.

Attacks and Other Significant Events

In addition to the September 11 attacks, eleven major terrorist attacks or airline crashes were studied. The crashes were included because their causes were initially suspicious. The thwarted shoe bombing of a Paris-to-Miami flight in December 2001 is also included in this set of events. The following table shows abnormal returns for each event date. Again, boldface type indicates observations that are statistically significant at a 5% level and have the expected sign.

Table VI-2: Event Date Abnormal Returns for Individual Terror Attacks

	Airlines		*Defense*	
Event Date[1]	Mean Abnormal Return ($\tau = 0$)	Portfolio Time-Series (CDA) t	Mean Abnormal Return ($\tau = 0$)	Portfolio Time-Series (CDA) t
12/22/1988	-0.41%	-0.450	-0.53%	-0.528
2/26/1993	0.91%	0.677	0.38%	0.371
4/19/1995	2.16%	1.756*	-0.32%	-0.361
11/13/1995	-0.06%	-0.045	-0.36%	-0.462
6/25/1996	-1.58%	-1.362$	0.44%	0.644
7/18/1996	-1.30%	-1.165	0.57%	0.845
8/7/1998	2.23%	2.011*	***1.47%***	***2.023****
11/1/1999	-0.37%	-0.232	-1.71%	-1.717*
10/12/2000	-1.95%	-1.569$	0.80%	0.588
11/12/2001	***-5.67%***	***-2.168****	-0.61%	-0.422
12/24/2001	-2.68%	-0.965	0.82%	0.555

The symbols $,*,@, and # denote statistical significance at the 0.10, 0.05, 0.01 and 0.001 levels, respectively, using a 1-tail test.

[1]If the event occurred while the U.S. financial markets were closed, the subsequent trading day was used as the event date.

For airlines, the only significant negative abnormal return occurred following the crash of American flight 587 on November 12, 2001. This crash occurred shortly following September 11, and terrorism was initially considered as a possible cause. Airline stocks rebounded in the following days when the probable cause was determined to be structural.

Four of the events in this group are specifically associated with air travel: the bombing of Pan Am flight 103 on December 21, 1988, the crash of TWA flight 800 on July 17, 1996, the crash of American flight 587, and the attempted shoe bombing on December 22, 2001. All four resulted in negative abnormal returns for airlines, though only the American crash was statistically significant.

Among defense stocks, only the simultaneous bombings of U.S. embassies in Kenya and Tanzania on August 7, 1998 resulted in significant positive abnormal returns.

Overall, this group of events does not support the hypothesis that terrorist attacks result in abnormal returns that are negative for airlines and positive for defense firms. Only two out of 22 total observations exhibit such returns.

DHS Threat Elevations and Warnings

Since unveiling the DHS Threat Advisory System on March 12, 2002, the government has raised the threat level from Elevated to High several times and has also issued official warnings on other occasions. Ten such events were analyzed for both airlines and defense stocks. The following table summarizes the results.

Table VI-3: Event Date Abnormal Returns for Individual Threat Elevations

	Airlines		*Defense*	
Event Date[1]	Mean Abnormal Return ($\tau = 0$)	Portfolio Time-Series (CDA) t	Mean Abnormal Return ($\tau = 0$)	Portfolio Time-Series (CDA) t
9/10/2002	-1.28%	-0.461	-1.21%	-0.806
2/7/2003	-1.15%	-0.550	0.05%	0.041
3/17/2003	0.08%	0.038	1.56%	1.318$
5/20/2003	-1.36%	-0.591	-0.97%	-0.828
12/22/2003	-1.58%	-0.755	-0.62%	-0.728
5/26/2004	0.20%	0.118	0.18%	0.241
7/8/2004	-2.47%	-1.544$	0.52%	0.683
8/2/2004	-2.35%	-1.527$	0.77%	0.995
7/7/2005	-0.90%	-0.592	0.22%	0.277
8/10/2006	0.83%	0.566	0.76%	1.218

The symbols $,*,@, and # denote statistical significance at the 0.10, 0.05, 0.01 and 0.001 levels, respectively, using a 1-tail test.

[1]If the event occurred while the U.S. financial markets were closed, the subsequent trading day was used as the event date.

None of these events resulted in abnormal returns that are significant at the 5% level for either airlines or defense firms. However, two of the threat elevations resulted in negative returns for airlines that were significant at the 10% level. Further, airlines had negative returns for seven of the events, which may explain why the category-level study for DHS warnings resulted in significant negative abnormal returns.

These results were mixed regarding the impact of threat elevations that specifically mention air transportation as a potential target. Of the four such events (December 22, 2003, May 26, 2004, July 8, 2004, and August 10, 2006) two had positive abnormal returns, while two were negative.

These observations also do not reveal a clear pattern of abnormal returns over time. The largest abnormal returns for airlines came in the summer of 2004, nearly three years after September 11.

Taped Messages from al-Qaida

Since the attacks of September 11, al-Qaida leader Osama bin Laden has released several video and audio recordings. A summary of abnormal returns following the release of twelve such messages is shown in the table below.

Table VI-4: Event Date Abnormal Returns for Individual al-Qaida Messages

	Airlines		*Defense*	
Event Date[1]	Mean Abnormal Return ($\tau = 0$)	Portfolio Time-Series (CDA) t	Mean Abnormal Return ($\tau = 0$)	Portfolio Time-Series (CDA) t
12/13/2001	0.74%	0.269	0.28%	0.187
10/7/2002	-1.25%	-0.433	-0.58%	-0.381
2/12/2003	1.12%	0.541	-0.32%	-0.269
4/7/2003	5.84%	2.880@	-0.25%	-0.212
9/10/2003	-0.28%	-0.116	-0.82%	-0.760
1/5/2004	-2.18%	-1.050	-0.13%	-0.158
4/15/2004	-1.32%	-0.658	-0.06%	-0.077
5/6/2004	-1.20%	-0.651	-0.76%	-0.999
10/29/2004	***-3.34%***	***-2.221****	-1.30%	-1.763*
12/16/2004	-0.28%	-0.174	-0.52%	-0.700
12/27/2004	1.66%	1.033	-1.02%	-1.379$
1/19/2006	-0.62%	-0.479	0.09%	0.127

The symbols $,*,@, and # denote statistical significance at the 0.10, 0.05, 0.01 and 0.001 levels, respectively, using a 1-tail test.

[1]If the event occurred while the U.S. financial markets were closed, the subsequent trading day was used as the event date.

These results reveal only one observation that supports our hypothesis, an abnormal return of -3.34% for airline stocks following a taped message on October 29, 2004 that is significant at the 5% level. This particular message referenced the September 11 attacks but made no specific threats against air travel. On this same date, defense stocks also have a significant abnormal return of -1.30%, which does not support our hypothesis.

No other observations exhibit abnormal returns with the expected sign, though airline stocks did register a positive abnormal return that was significant at the 1% level after bin Laden's April 7, 2003 message urging attacks against U.S. and British interests.

Once again, these event studies do not show any patterns that would indicate a diminishing impact of terrorism over time.

In many of the event-level studies, the results are further complicated by large abnormal returns that occur several days either before or after the event date. For example, in the case of the October 29, 2004 message from Osama bin Laden, airline stocks had an abnormal return of -3.34% on the event date ($\tau = 0$) and an abnormal positive return of 5.52% eleven days ($\tau = +11$) after the tape was released. While the former return is significant at the 5% level, the latter is significant at the 0.1% level. This observation was largely responsible for the previously mentioned significant abnormal return of +1.86% on day eleven for the category-level study of al-Qaida messages. (See Tables A-4 – A-9 in the appendix for a listing of daily abnormal returns and test statistics for each individual event.) The eleventh trading day following October 29, 2004 was November 15, 2004. On that day, when the S&P 500 was down -0.03%, airline stocks rose sharply as crude-oil prices fell to their lowest level in two months. Even the cause of the abnormal return on the event date of October 29 is debatable. While a message from bin Laden was released on that day, the days preceding October 29 had been marked by increases in airline stocks that resulted from falling crude oil

prices and Delta Air Lines' efforts to avoid bankruptcy. The negative returns on the event date may have been more a reversal of previous gains than a reaction to the taped message.

VII. CONCLUSIONS

Impact of Terror-Related Events on Stock Returns

Given the results of the studies performed both at the category-level and event-level it is not possible to reject the null hypothesis that terrorist attacks or threats do not lead to abnormal returns in the airline and defense industries. The most compelling argument in favor of rejecting the null hypothesis for the airline industry is the fact that category-level studies showed statistically significant negative abnormal returns on the event date for Category 1 (attacks and other significant events) and Category 2 (DHS threat elevations.) However, further analysis at the event-level does not support the alternate hypothesis that terrorism has a consistent and significant impact on returns in the airline and defense sectors.

The relatively small number of events in each category makes it possible that a single event could influence the overall results. For example, in the case of the results for Category 1, a large negative return for airlines on November 12, 2001, the day of the first major incident following September 11, seems to have skewed the results for the entire category. Thus, the insufficient number of observations makes it difficult to measure the generic impact of terrorist attacks, DHS threat elevations, or messages from al-Qaida.

The case of the October 29, 2004 al-Qaida message demonstrates the impact of events unrelated to terrorism on the study. Here, a separate factor, the price of crude-oil, impacted the returns for airlines within the event window. This shows the pitfalls of studying a single event. Because all observations are centered on a single calendar date, idiosyncratic price movements are not "washed out" as Karolyi and Martell suggest. While this is a limitation of the study, in may help to disprove the theory that terrorism-related events result in abnormal

stock returns. If the presence of large abnormal returns on random days in the event window indicates that airline prices are sensitive to exogenous factors, such as the price of oil, then the lack of significant abnormal returns on nearly all of the actual event days seems to suggest that terrorism is not such a factor.

Implications for Terror-Linked Futures Contracts

Our results indicate that futures contracts linked to terrorism would not be viable as widely-traded hedging instruments. According to Black (1986), several factors are necessary to make a commodity futures contract successful. These same characteristics can be applied here. First, there must be large variations in the price of the asset of being hedged, in this case, airline and defense stocks. Otherwise, there would be little need to insure against price changes. Second, the cash market for these assets must be large enough to attract an adequate number of participants. Finally, use of the contract must provide an efficient "cross hedge" that reduces risk exposure enough to compensate for liquidity costs.

While publicly traded airline and defense stocks are likely to meet the first two criteria of price volatility and cash market size, we have shown that contracts linked to broad categories of terror-related events likely would not provide a significant hedge against risk for these sectors. In addition, these events are heterogeneous, with each attack, threat elevation, or warning message having different characteristics. This makes it difficult to design a standardized contract that captures the relationship between terrorism and stock returns. On the other hand, contracts that are tailored to industries, locations, or types of terrorism may provide a better hedge against specific types of risk but would be less liquid.

There are several other obstacles for futures contracts linked to terrorism. First, it is difficult to measure the costs of terror or to determine if an event has even occurred in the first place. Must an attack pass a certain threshold of human or property loss in order for the event to be triggered? Should an official warning from the Department of Homeland Security

trigger an event, even if the threat level is not elevated? When an event does occur, it may be difficult for firms to determine their exposure. For example, airlines must consider not only property loss, but also decreased revenues and increased security costs resulting from an attack or threat elevation. However, such costs are entirely dependent on the nature of the event. These unknowns would make it difficult to price the contracts or determine how many contracts were needed to hedge an exposure. An interesting counter-example is that of weather derivatives, which have become widely traded on major exchanges such as the Chicago Mercantile Exchange (CME). Like terrorism, weather poses a risk to many different sectors of the economy. However, in the case of weather derivatives, it has been possible to base contracts on an easily measurable statistic: the deviation of actual temperatures from a predetermined average. Further, companies are able to measure the effect of abnormal temperatures on their business.

Second, as the failure of DARPA's Policy Analysis Market shows, the moral dilemma associated with terror-linked contracts cannot be ignored. Should such contracts become widely traded as hedging instruments, it is likely that others would use them to speculate on the occurrence of terrorism. In fact, according to Black, speculators help to provide the liquidity necessary for successful contracts. However, she also notes that both hedgers and speculators are reluctant to participate in a market that is easily manipulated. There is a concern here insofar as widely traded terror contracts could be used by the terrorists themselves to profit from their actions.

While the ability of prediction markets and terror-related contracts to foresee future events remains a popular topic, the lack of a clear link between terrorism and stock returns and the challenges involved in contract design make it unlikely that these contracts would be successful on major derivatives exchanges.

APPENDIX

Table A-1: Terror-Related Events

Date	Event Date[1]	Description	Air Travel[2]	Homeland[3]
		(1) Attacks and Other Significant Events[4]		
12/21/1988	12/22/1988	Bombing of Pan Am flight 103; linked to Libya	Yes	No
2/26/1993	2/26/1993	Truck bombing of World Trade Center; linked to al-Qaida	No	Yes
4/19/1995	4/19/1995	Truck bombing of Federal Building in Oklahoma city bombed; linked to domestic terrorism	No	Yes
11/13/1995	11/13/1995	Bombing of U.S. military compound in Saudi Arabia; linked to Islamic Movement of Change	No	No
6/25/1996	6/25/1996	Truck bombing of U.S. military complex in Dhahran, Saudi Arabia	No	No
7/17/1996	7/18/1996	Crash of TWA flight 800; terrorism suspected, but crash was determined to be an accident	Yes	Yes
8/7/1998	8/7/1998	Simultaneous bombings of U.S. embassies in Kenya and Tanzania; linked to al-Qaida	No	No
10/31/1999	11/1/1999	Crash of EgyptAir flight 990 after takeoff from JFK; suspected pilot suicide	Yes	Yes
10/12/2000	10/12/2000	Bombing of USS Cole while docked in Yemen; linked to al-Qaida	No	No
9/11/2001	9/17/2001	September 11 attacks on New York, Washington, DC, and Pennsylvania	Yes	Yes
11/12/2001	11/12/2001	Crash of AA flight 587 after takeoff from JFK; cause later determined to be mechanical	Yes	Yes
12/22/2001	12/24/2001	Attempted shoe-bombing of flight bound for Miami from Paris	Yes	Yes
		(2) DHS Threat Elevations and Warnings[5]		
9/10/2002	9/10/2002	Raised around the first anniversary of 9/11/2001	No	Yes
2/7/2003	2/7/2003	Raised due to threats against hotels, apartment buildings, and other "soft" targets around the end of Hajj	No	Yes
3/17/2003	3/17/2003	Beginning of U.S. military actions in Iraq; fears of retaliation worldwide by Iraqi agents and sympathizers	No	Yes
5/20/2003	5/20/2003	Raised in response to Riyadh and Casablanca bombings and belief that al-Qaida has entered "operational" period worldwide, including possibly within the U.S.	No	Yes
12/21/2003	12/22/2003	Raised due to intelligence suggesting large-scale attacks around the holiday season; al-Qaida's interest in aircraft highlighted	Yes	Yes
5/26/2004	5/26/2004	Official warning based on-specific intelligence of threats against homeland and intent to affect 2004 presidential election	No	Yes
7/8/2004	7/8/2004	Official warning citing credible evidence of terrorist intent to affect 2004 presidential election; Los Angeles airport is mentioned as a possible target	Yes	Yes

Date	Event Date[1]	Description	Air Travel[2]	Homeland[3]
8/1/2004	8/2/2004	Raised in response to a reported plot against financial institutions in NY, NJ, and DC with car or truck bombs	No	Yes
7/7/2005	7/7/2005	Raised for mass transit systems only following London Tube bombings though there was no "specific, credible information suggesting imminent attack"	No	Yes
8/10/2006	8/10/2006	Raised to High for all domestic and international flights to or from U.S.; elevated threat level remains in effect as of April 2007	Yes	Yes
		(3) Taped Messages from al-Qaida Leader Osama bin Laden[6]		
12/13/2001	12/13/2001	The U.S. defense department releases a video of bin Laden in Afghanistan in November 2001 in which he says that the destruction of the 11 September attacks exceeded even his "optimistic" calculations	No	Yes
10/6/2002	10/7/2002	Al Jazeera broadcasts an audio tape in which a voice attributed to bin Laden says the "youths of God" are planning more attacks against the U.S.	No	Yes
2/11/2003	2/12/2003	Bin Laden calls on Iraqis to carry out bombing attacks against Americans and defend themselves against a U.S. attack in a tape broadcast on Al Jazeera	No	No
4/7/2003	4/7/2003	In an audio tape obtained by The Associated Press in Pakistan, bin Laden exhorts Muslims to rise up against Kuwait, Saudi Arabia and other governments he says are agents of America, and calls for bombers to attack U.S. and British interests	No	No
9/10/2003	9/10/2003	Two taped messages and an accompanying video were released. In one, a voice purporting to be bin Laden's praises the "great damage to the enemy" on 11 September and mentions five hijackers by name. In the other, a voice said to be that of al-Zawahiri threatens more attacks	No	Yes
1/4/2004	1/5/2004	Bin Laden says on an audio tape broadcast on Al Jazeera that the U.S.-led war in Iraq is the beginning of the occupation of Arab Gulf states for their oil. He calls on Muslims to keep fighting in the Middle East	No	No
4/15/2004	4/15/2004	Bin Laden offers a truce to European countries that do not attack Muslims. He vows revenge against the United States for the Israeli assassination of Hamas founder Shaikh Ahmed Yassin	No	No
5/6/2004	5/6/2004	In an online audio tape released on Islamic forums, bin Laden offers rewards of gold for the killing of U.S. and U.N. officials	No	No
10/29/2004	10/29/2004	Al Jazeera broadcasts a video of bin Laden saying the U.S. can avoid another attack like those of 11 September 2001, if it stops threatening the security of Muslims	No	Yes
12/16/2004	12/16/2004	In an audio tape posted on an website, bin Laden exonerates fighters of responsibility for violence in Saudi Arabia and calls on them to stop the flow of oil to the West	No	No

Date	Event Date[1]	Description	Air Travel[2]	Homeland[3]
12/27/2004	12/27/2004	In an audio tape, the al-Qaida leader calls on Iraqis to boycott the January 2005 elections and names as his Iraq deputy Abu Musab al-Zarqawi, a Jordanian blamed for major anti-U.S. attacks in Iraq	No	Yes
1/19/2006	1/19/2006	In excerpts of an audio tape aired by Al Jazeera, bin Laden says al-Qaida is making preparations for attacks in the United States and offers a truce on "fair" but undefined conditions		

[1]If the event occurred while the U.S. financial markets were closed, the subsequent trading day was used as the event date.
[2]The Air Travel column indicates whether the attack, threat level, or warning message was directed at air travel.
[3]The Homeland column indicates whether the attack, threat level, or warning message was directed at the U.S. homeland.
[4]Source: *The World Almanac and Book of Facts, 2007*, Notable Terrorist Incidents
[5]Source: Wikipedia entry for Homeland Security Advisory System, Department of Homeland Security, The White House
[6]Source: Al Jazeera, http://english.aljazeera.net/English/archive/archive?ArchiveId=18162

Table A-2: Firms Included In the Study

Air Travel		Defense
Air LA	Mesa Air Group	Alliant Techsystems
Air Wisconsin	Metro Airlines	Armor Holdings
AirTran	Midway Airlines	Ceradyne, Inc
Alaska Air	Midwest Air	Curtiss Wright
America West	Northwest Airlines	Curtiss Wright
American Airlines	Pan Am	Diagnostic Retrieval Systems, Inc
ASA Holdings	Pinnacle Airlines	DRS Technologies
ATA Airlines	Presidential Airways	FLIR Systems, Inc
Braniff	Priceline.com	General Dynamics
CC Air, Inc	Reno Air	Goodrich Corp.
Comair	Republic Airways Holdings	Harris Corp.
Continental Airlines	SkyWest	L-3 Communications
Delta Air	Southwest Airlines	Lockheed Martin
ExpressJet	States West Airlines	Northrop Grumman
Florida West Airlines	Tower Air	Orbital Sciences
FLYi, Inc	TWA	Raytheon
Frontier Airlines	United Airlines	Raytheon
Great Lakes Aviation	USAir	Rockwell Collins
HAL, Inc	Vanguard Airlines	Taser International
Hawaiian Airlines	WestAir Holdings	
JetBlue	Western Pacific Airlines	
Mair Holdings	WorldCorp, Inc	

Note: All traded securities for each company listed were included in the study.

Table A-3: Daily Abnormal Returns by Industry and Event Category

	Airlines						*Defense*					
	(1) Terrorist Attacks		(2) Threat Elevations		(3) al-Qaida Warnings		(1) Terrorist Attacks		(2) Threat Elevations		(3) al-Qaida Warnings	
Date (τ)	Mean Abnormal Return	CDA t-statistic	Mean Abnormal Return	CDA t-statistic	Mean Abnormal Return	CDA t-statistic	Mean Abnormal Return	CDA t-statistic	Mean Abnormal Return	CDA t-statistic	Mean Abnormal Return	CDA t-statistic
-20	0.16%	0.370	-0.93%	-1.493$	-0.16%	-0.285	0.18%	0.540	-0.10%	-0.319	-0.01%	-0.019
-19	0.16%	0.368	-0.16%	-0.252	-0.18%	-0.313	-0.31%	-0.914	-0.25%	-0.826	0.06%	0.208
-18	-0.52%	-1.219	-0.73%	-1.173	-0.12%	-0.217	-0.30%	-0.906	-0.63%	-2.072*	0.44%	1.582$
-17	-0.53%	-1.242	-0.26%	-0.415	0.26%	0.452	-0.08%	-0.250	-0.42%	-1.386$	0.20%	0.731
-16	0.06%	0.136	0.78%	1.242	0.24%	0.433	0.04%	0.118	0.47%	1.538$	0.05%	0.188
-15	-0.58%	-1.338$	-0.99%	-1.580$	0.00%	0.007	-0.15%	-0.446	0.07%	0.213	0.00%	0.013
-14	0.30%	0.687	-0.41%	-0.652	0.29%	0.508	-1.14%	-3.394#	-0.07%	-0.214	-0.40%	-1.431$
-13	0.52%	1.213	-0.12%	-0.199	0.27%	0.484	-0.23%	-0.669	-0.23%	-0.760	0.21%	0.745
-12	-0.20%	-0.465	0.22%	0.348	0.28%	0.496	0.68%	2.017*	-0.14%	-0.463	-0.44%	-1.575$
-11	0.03%	0.078	-0.60%	-0.954	0.53%	0.934	-0.13%	-0.375	-0.37%	-1.220	0.05%	0.167
-10	0.75%	1.751*	0.39%	0.621	-0.02%	-0.028	-0.21%	-0.617	0.26%	0.842	0.18%	0.647
-9	0.01%	0.017	-0.78%	-1.254	-0.43%	-0.759	-0.13%	-0.384	-0.07%	-0.236	-0.01%	-0.052
-8	-0.62%	-1.438$	-0.44%	-0.705	-0.89%	-1.578$	-0.43%	-1.290$	-0.09%	-0.286	0.16%	0.574
-7	-0.49%	-1.140	-0.10%	-0.162	-0.40%	-0.704	0.22%	0.663	0.15%	0.495	-0.15%	-0.529
-6	-0.18%	-0.408	0.83%	1.325$	-0.33%	-0.588	0.09%	0.281	0.10%	0.338	0.13%	0.464
-5	0.30%	0.692	0.22%	0.354	0.75%	1.326$	-0.25%	-0.729	-0.40%	-1.306$	0.09%	0.340
-4	-0.21%	-0.498	-0.95%	-1.519$	0.43%	0.759	-0.28%	-0.845	0.21%	0.700	-0.18%	-0.645
-3	-0.47%	-1.097	-0.66%	-1.049	0.33%	0.586	-0.65%	-1.921*	0.19%	0.614	-0.70%	-2.520@
-2	-0.28%	-0.662	0.00%	0.002	0.11%	0.190	-0.04%	-0.115	0.13%	0.425	-0.01%	-0.040
-1	0.55%	1.269	-0.41%	-0.662	0.76%	1.337$	0.35%	1.042	-0.19%	-0.608	-0.38%	-1.365$
0	-0.73%	-1.692*	-1.03%	-1.652*	-0.15%	-0.263	0.11%	0.318	0.12%	0.395	-0.45%	-1.620$
1	-0.24%	-0.557	-0.57%	-0.913	-0.81%	-1.428$	-0.30%	-0.900	-0.08%	-0.259	-0.11%	-0.378
2	-0.09%	-0.214	0.37%	0.597	-0.24%	-0.416	-0.44%	-1.316$	0.17%	0.549	-0.53%	-1.893*
3	0.24%	0.566	-0.58%	-0.923	-0.31%	-0.542	-0.05%	-0.143	-0.22%	-0.717	-0.18%	-0.651
4	0.60%	1.407$	0.70%	1.118	0.13%	0.229	0.08%	0.240	-0.40%	-1.310$	0.34%	1.202
5	0.87%	2.019*	-0.34%	-0.551	0.02%	0.038	0.58%	1.736*	-0.44%	-1.434$	0.16%	0.573
6	0.23%	0.539	-0.38%	-0.614	0.10%	0.185	0.36%	1.077	-0.09%	-0.283	-0.21%	-0.762
7	0.75%	1.756*	0.09%	0.139	-0.39%	-0.684	-0.18%	-0.531	-0.13%	-0.425	0.23%	0.837
8	-0.28%	-0.651	0.01%	0.014	0.71%	1.256	0.13%	0.380	-0.08%	-0.277	-0.19%	-0.672
9	0.18%	0.416	-0.47%	-0.749	0.25%	0.448	0.43%	1.285$	-0.07%	-0.221	-0.01%	-0.018
10	-0.44%	-1.014	0.16%	0.252	-0.11%	-0.190	0.13%	0.377	-0.04%	-0.146	0.26%	0.926
11	-0.25%	-0.588	-0.42%	-0.672	1.86%	3.294#	0.16%	0.485	-0.02%	-0.052	-0.43%	-1.528$
12	0.15%	0.340	1.10%	1.754*	0.39%	0.695	-0.01%	-0.016	-0.02%	-0.056	-0.19%	-0.688
13	-0.91%	-2.118*	-0.88%	-1.399$	-0.11%	-0.197	0.02%	0.058	0.03%	0.112	0.49%	1.757*
14	-0.28%	-0.640	0.47%	0.755	0.06%	0.110	-0.19%	-0.565	-0.01%	-0.032	-0.35%	-1.243
15	0.71%	1.660*	0.91%	1.455$	-0.30%	-0.539	0.22%	0.662	0.42%	1.356$	-0.24%	-0.848
16	-0.87%	-2.028*	-0.23%	-0.361	-0.38%	-0.668	0.06%	0.185	0.10%	0.323	0.11%	0.382
17	0.54%	1.262	0.19%	0.300	0.26%	0.459	-0.41%	-1.229	0.09%	0.300	-0.29%	-1.045
18	-0.01%	-0.027	-0.88%	-1.403$	0.73%	1.299$	0.08%	0.252	-0.21%	-0.699	0.18%	0.658
19	-0.15%	-0.348	-0.19%	-0.308	-0.57%	-1.015	-0.32%	-0.938	-0.06%	-0.210	-0.23%	-0.811
20	-0.42%	-0.987	0.61%	0.978	0.12%	0.215	0.16%	0.461	-0.39%	-1.260	-0.11%	-0.382

The symbols $,*,@, and # denote statistical significance at the 0.10, 0.05, 0.01 and 0.001 levels, respectively, using a 1-tail test.

Note: The table above shows average daily abnormal returns aggregated for:

(1) Terrorist Attack events

(2) Department of Homeland Security Threat Elevation events

(3) al-Qaida Warning events

over the period December 22, 1988 to August 10, 2006

Table A-4: Daily Abnormal Returns for Airline Stocks and Terror Attacks

Date	12/22/1988		2/26/1993		4/19/1995		11/13/1995		6/25/1996		7/18/1996		8/7/1998		11/1/1999		10/12/2000		9/17/2001		11/12/2001		12/24/2001	
(τ)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
-20	0.89%	0.976	-0.95%	-0.700	0.00%	-0.001	1.15%	0.919	0.20%	0.175	0.06%	0.057	-1.49%	-1.340$	1.08%	0.682	0.47%	0.375	-0.49%	-0.362	0.26%	0.099	-0.33%	-0.118
-19	-0.82%	-0.905	2.81%	2.084*	-0.18%	-0.144	-0.72%	-0.575	0.83%	0.712	-1.11%	-0.992	0.52%	0.469	1.19%	0.749	0.51%	0.412	-0.83%	-0.612	0.01%	0.005	-0.24%	-0.087
-18	-0.11%	-0.120	2.06%	1.524$	-0.83%	-0.678	-1.09%	-0.873	-1.38%	-1.184	0.45%	0.405	1.20%	1.077	0.35%	0.219	-1.45%	-1.163	-0.70%	-0.521	-2.50%	-0.955	-2.30%	-0.828
-17	-0.46%	-0.502	-0.69%	-0.510	1.72%	1.396$	-2.33%	-1.863*	-0.67%	-0.577	0.64%	0.576	-1.94%	-1.743*	2.23%	1.410$	-1.13%	-0.905	-0.27%	-0.198	-4.27%	-1.630$	0.59%	0.213
-16	-0.37%	-0.404	-0.23%	-0.169	3.61%	2.936@	0.32%	0.252	0.42%	0.358	-1.51%	-1.358$	-2.13%	-1.914*	0.02%	0.010	-0.70%	-0.565	-0.49%	-0.366	-0.62%	-0.238	2.32%	0.837
-15	-0.02%	-0.022	1.96%	1.451$	-2.57%	-2.087*	-0.27%	-0.219	0.44%	0.379	-0.58%	-0.520	-1.16%	-1.047	-1.31%	-0.826	-1.21%	-0.970	-0.84%	-0.621	-0.20%	-0.076	-0.45%	-0.162
-14	-0.18%	-0.200	0.35%	0.262	3.55%	2.887@	-0.25%	-0.199	0.02%	0.013	-1.96%	-1.763*	0.22%	0.200	-0.50%	-0.315	-0.35%	-0.281	-1.15%	-0.850	2.49%	0.950	0.57%	0.206
-13	0.77%	0.844	-0.19%	-0.140	2.72%	2.215*	0.06%	0.046	0.48%	0.417	1.57%	1.405$	-0.31%	-0.281	0.75%	0.475	0.35%	0.285	-0.43%	-0.318	1.10%	0.419	-2.39%	-0.862
-12	-0.71%	-0.778	0.12%	0.086	-0.03%	-0.024	-0.49%	-0.391	-1.14%	-0.984	-0.20%	-0.180	0.25%	0.226	0.06%	0.039	-0.32%	-0.260	-2.47%	-1.826*	0.03%	0.013	0.65%	0.234
-11	-0.02%	-0.024	0.03%	0.019	-2.22%	-1.803*	-0.26%	-0.209	0.46%	0.392	-0.23%	-0.209	-0.80%	-0.720	-0.35%	-0.224	-0.57%	-0.460	0.80%	0.590	0.36%	0.137	5.05%	1.820*
-10	-0.40%	-0.442	-0.15%	-0.110	5.42%	4.406#	0.98%	0.784	0.66%	0.564	-0.44%	-0.396	-1.89%	-1.698*	0.73%	0.459	0.46%	0.370	-0.99%	-0.733	1.11%	0.423	2.11%	0.760
-9	0.30%	0.327	1.07%	0.795	-1.28%	-1.039	0.60%	0.479	0.28%	0.244	0.56%	0.504	-1.32%	-1.190	-0.19%	-0.122	0.74%	0.597	0.45%	0.336	-1.07%	-0.410	0.85%	0.307
-8	-1.10%	-1.208	-1.52%	-1.124	1.35%	1.096	-0.41%	-0.331	-1.43%	-1.232	-1.06%	-0.951	-0.52%	-0.472	-1.90%	-1.199	-2.10%	-1.691*	-0.67%	-0.495	1.35%	0.514	0.82%	0.295
-7	-0.59%	-0.651	-2.05%	-1.520$	-0.51%	-0.411	1.45%	1.158	-1.09%	-0.938	-0.30%	-0.272	-1.44%	-1.295$	-0.55%	-0.350	-0.16%	-0.132	-0.43%	-0.319	-1.31%	-0.500	0.74%	0.266
-6	2.19%	2.404@	-1.32%	-0.979	-1.27%	-1.032	0.16%	0.131	-0.29%	-0.254	-2.92%	-2.620@	2.36%	2.126*	0.11%	0.070	0.65%	0.522	-1.88%	-1.391$	-1.12%	-0.429	-1.07%	-0.385
-5	1.38%	1.520$	-0.82%	-0.607	4.41%	3.587#	1.79%	1.430$	-1.76%	-1.514$	-1.01%	-0.907	-1.38%	-1.244	0.40%	0.255	-0.79%	-0.637	0.52%	0.389	3.47%	1.324$	-2.53%	-0.913
-4	1.01%	1.106	-0.48%	-0.356	0.59%	0.481	-1.08%	-0.863	-0.01%	-0.005	-0.92%	-0.828	-0.94%	-0.846	0.25%	0.157	1.49%	1.199	-1.21%	-0.899	-2.75%	-1.052	0.39%	0.139
-3	0.18%	0.199	0.26%	0.195	0.80%	0.647	0.66%	0.527	-1.17%	-1.010	-2.41%	-2.165*	-2.08%	-1.876*	0.65%	0.410	-0.85%	-0.682	0.77%	0.572	0.68%	0.260	-1.22%	-0.441
-2	1.37%	1.498$	-0.23%	-0.167	-1.44%	-1.168	-0.88%	-0.701	0.41%	0.350	-0.90%	-0.810	-0.41%	-0.368	-1.02%	-0.646	1.09%	0.876	-0.46%	-0.339	0.87%	0.333	-1.99%	-0.718
-1	0.24%	0.265	2.61%	1.931*	-0.29%	-0.233	1.66%	1.327$	0.58%	0.501	2.26%	2.024*	-0.90%	-0.807	-0.43%	-0.273	-2.01%	-1.611$	-1.09%	-0.810	0.40%	0.154	2.78%	1.001
0	-0.41%	-0.450	0.91%	0.677	2.16%	1.756*	-0.06%	-0.045	-1.58%	-1.362$	-1.30%	-1.165	2.23%	2.011*	-0.37%	-0.232	-1.95%	-1.569$	-33.03%	-24.455#	-5.67%	-2.168*	-2.68%	-0.965
1	-0.15%	-0.159	0.48%	0.353	-1.27%	-1.034	-2.45%	-1.958*	-0.67%	-0.577	-0.82%	-0.738	0.45%	0.406	0.46%	0.288	-1.13%	-0.912	0.37%	0.270	2.38%	0.908	1.17%	0.421
2	-0.86%	-0.940	2.01%	1.489$	2.36%	1.920*	-1.66%	-1.329$	-2.01%	-1.729*	-0.69%	-0.620	-2.78%	-2.506@	1.11%	0.701	-0.16%	-0.128	-3.58%	-2.654@	3.62%	1.381$	0.11%	0.038
3	-0.98%	-1.074	-0.15%	-0.109	-1.75%	-1.426$	-0.29%	-0.232	1.51%	1.295$	1.43%	1.284$	1.39%	1.248	-1.13%	-0.715	-0.51%	-0.413	-10.83%	-8.020#	3.64%	1.392$	-0.70%	-0.254
4	-0.61%	-0.672	0.42%	0.312	4.45%	3.618#	-0.08%	-0.064	-0.24%	-0.208	-2.28%	-2.049*	-2.06%	-1.856*	0.89%	0.561	-1.80%	-1.444$	4.90%	3.626#	3.84%	1.467$	6.18%	2.230*
5	-1.33%	-1.457$	-0.91%	-0.676	2.46%	2.001*	0.96%	0.772	-0.31%	-0.271	-0.51%	-0.454	-0.11%	-0.097	1.48%	0.933	1.30%	1.044	4.76%	3.526#	6.73%	2.570@	0.31%	0.113
6	1.65%	1.816*	-0.62%	-0.459	2.04%	1.661*	-0.93%	-0.745	-0.52%	-0.444	0.43%	0.387	-0.42%	-0.378	-0.74%	-0.467	-0.19%	-0.156	-1.91%	-1.414$	-0.96%	-0.366	2.94%	1.058
7	0.41%	0.453	1.37%	1.016	0.63%	0.512	2.31%	1.849*	0.41%	0.354	-0.72%	-0.644	1.64%	1.474$	-0.78%	-0.493	0.56%	0.449	-0.72%	-0.534	0.40%	0.153	2.72%	0.979
8	0.66%	0.729	0.01%	0.007	0.75%	0.607	0.00%	0.003	-1.16%	-0.993	-0.84%	-0.752	-3.03%	-2.729@	-0.64%	-0.407	0.51%	0.407	-1.58%	-1.173	1.71%	0.655	-0.15%	-0.054
9	0.97%	1.069	0.53%	0.396	-0.83%	-0.672	0.31%	0.247	-0.36%	-0.310	1.00%	0.897	-1.25%	-1.130	0.73%	0.459	0.01%	0.007	4.10%	3.033@	-0.36%	-0.138	1.63%	0.587
10	-0.56%	-0.611	-0.53%	-0.392	2.50%	2.035*	-1.65%	-1.318$	-2.98%	-2.563@	0.08%	0.069	-2.61%	-2.354@	-0.44%	-0.280	2.70%	2.166*	1.27%	0.941	-0.15%	-0.056	-0.42%	-0.151
11	-0.25%	-0.271	0.59%	0.440	0.13%	0.104	0.07%	0.056	-1.14%	-0.978	0.12%	0.104	-1.04%	-0.940	-0.39%	-0.246	2.20%	1.764*	5.64%	4.173#	-2.32%	-0.887	-0.46%	-0.164
12	-0.07%	-0.077	-1.46%	-1.083	-1.06%	-0.861	0.84%	0.668	-0.99%	-0.850	0.66%	0.589	1.02%	0.920	-0.90%	-0.570	3.61%	2.896@	3.98%	2.948@	0.67%	0.255	-1.35%	-0.488
13	-0.14%	-0.155	1.55%	1.146	-1.45%	-1.178	-0.76%	-0.605	-2.57%	-2.213*	-0.97%	-0.875	-3.17%	-2.858@	-2.29%	-1.451$	1.43%	1.148	-3.15%	-2.334@	2.22%	0.850	-2.04%	-0.737
14	-0.12%	-0.131	0.44%	0.326	-0.53%	-0.434	-0.91%	-0.731	-0.98%	-0.842	0.59%	0.532	-2.19%	-1.975*	-0.67%	-0.425	0.29%	0.233	-2.65%	-1.963*	-0.48%	-0.183	2.56%	0.922
15	0.15%	0.164	1.15%	0.852	0.33%	0.267	0.39%	0.309	2.22%	1.907*	0.47%	0.419	1.22%	1.097	-1.08%	-0.681	0.85%	0.686	-1.51%	-1.121	0.67%	0.257	1.65%	0.595
16	0.97%	1.070	-1.56%	-1.157	1.35%	1.094	-0.59%	-0.476	-1.31%	-1.129	-0.91%	-0.813	-1.73%	-1.558$	1.24%	0.782	-2.43%	-1.953*	-1.61%	-1.192	-2.07%	-0.793	-3.43%	-1.237
17	0.93%	1.025	5.20%	3.850#	1.34%	1.090	-0.64%	-0.510	-0.92%	-0.790	-0.80%	-0.717	0.94%	0.846	-1.28%	-0.808	0.86%	0.689	5.44%	4.026#	0.61%	0.234	2.37%	0.854
18	-0.15%	-0.169	0.23%	0.168	-0.52%	-0.421	0.63%	0.502	-0.79%	-0.677	-0.66%	-0.590	-1.89%	-1.701*	0.24%	0.152	-0.89%	-0.712	3.74%	2.771@	4.76%	1.821*	-0.04%	-0.013
19	-0.16%	-0.179	0.02%	0.016	0.36%	0.296	-0.53%	-0.422	1.32%	1.136	-0.60%	-0.539	-5.11%	-4.600#	0.25%	0.161	1.49%	1.195	-4.14%	-3.064@	1.77%	0.678	0.47%	0.170
20	-0.91%	-1.002	1.55%	1.147	-1.67%	-1.358$	0.62%	0.497	-2.35%	-2.024*	-1.31%	-1.174	-0.64%	-0.572	0.79%	0.501	-1.00%	-0.804	0.13%	0.097	0.85%	0.325	0.94%	0.338

The symbols $,*,@, and # denote statistical significance at the 0.10, 0.05, 0.01 and 0.001 levels, respectively, using a 1-tail test.

Note: This table shows daily abnormal returns (column a) and test statistics (column b) beginning 20 days before and extending 20 days after the event date, which is centered at $\tau = 0$

Table A-5: Daily Abnormal Returns for Airline Stocks and Threat Elevations

Date	9/10/2002		2/7/2003		3/17/2003		5/20/2003		12/22/2003		5/26/2004		7/8/2004		8/2/2004		7/7/2005		8/10/2006	
(τ)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
-20	-6.19%	-2.227*	-1.12%	-0.536	-0.39%	-0.185	-2.44%	-1.062	2.54%	1.214	0.24%	0.139	1.75%	1.090	-0.50%	-0.328	-0.24%	-0.157	-3.43%	-2.341@
-19	0.06%	0.023	-0.92%	-0.440	0.45%	0.216	3.29%	1.431$	0.90%	0.430	-1.10%	-0.638	0.01%	0.008	-0.73%	-0.474	-1.44%	-0.952	-2.17%	-1.479$
-18	-5.70%	-2.051*	1.51%	0.727	-0.59%	-0.282	1.32%	0.575	0.91%	0.432	-1.41%	-0.818	-3.47%	-2.170*	-1.44%	-0.937	1.62%	1.068	0.44%	0.301
-17	-2.12%	-0.765	0.69%	0.333	0.29%	0.140	1.16%	0.505	-0.64%	-0.307	0.08%	0.049	1.00%	0.624	-2.37%	-1.542$	-0.90%	-0.595	0.41%	0.282
-16	4.42%	1.591$	1.08%	0.518	-0.90%	-0.428	1.89%	0.823	1.49%	0.712	-0.81%	-0.471	0.54%	0.339	-0.98%	-0.634	-0.45%	-0.299	1.84%	1.254
-15	-2.45%	-0.882	-0.59%	-0.285	0.30%	0.142	-1.05%	-0.456	-1.46%	-0.696	-0.37%	-0.213	-0.54%	-0.339	-0.31%	-0.203	-1.73%	-1.137	-1.91%	-1.305$
-14	1.89%	0.681	-0.37%	-0.178	-1.42%	-0.675	3.02%	1.314$	-2.47%	-1.176	-1.15%	-0.666	-0.06%	-0.035	-2.63%	-1.710*	0.17%	0.115	-1.01%	-0.690
-13	6.22%	2.239*	-1.45%	-0.699	0.31%	0.149	1.88%	0.817	-2.63%	-1.256	-1.52%	-0.881	0.33%	0.209	-2.10%	-1.366$	-2.80%	-1.844*	0.69%	0.470
-12	3.75%	1.350$	-4.80%	-2.304*	-1.99%	-0.947	9.13%	3.968#	-3.03%	-1.447$	-1.07%	-0.621	0.34%	0.214	0.34%	0.221	0.15%	0.098	-0.47%	-0.323
-11	-0.65%	-0.234	1.51%	0.727	-1.66%	-0.792	1.67%	0.724	-3.68%	-1.755*	0.15%	0.088	-0.96%	-0.599	-2.23%	-1.447$	0.75%	0.491	-0.85%	-0.579
-10	-0.74%	-0.265	0.18%	0.085	4.76%	2.265*	0.95%	0.414	-0.39%	-0.188	-0.25%	-0.146	-0.15%	-0.096	0.02%	0.013	-0.04%	-0.026	-0.55%	-0.375
-9	-0.02%	-0.007	-1.04%	-0.502	-1.79%	-0.853	-3.16%	-1.373$	-2.12%	-1.013	0.10%	0.060	-0.56%	-0.350	0.90%	0.586	-1.01%	-0.665	0.81%	0.552
-8	-1.09%	-0.393	1.41%	0.675	0.65%	0.309	-0.46%	-0.200	-1.51%	-0.720	-1.20%	-0.698	1.96%	1.224	-1.35%	-0.877	-0.90%	-0.595	-2.32%	-1.582$
-7	0.66%	0.236	-1.14%	-0.545	0.34%	0.163	0.47%	0.205	2.91%	1.390$	0.17%	0.100	0.80%	0.499	-1.11%	-0.722	-2.45%	-1.614$	-1.73%	-1.180
-6	-0.11%	-0.038	-0.46%	-0.219	1.40%	0.665	0.18%	0.078	2.10%	1.000	1.73%	1.005	0.15%	0.095	0.43%	0.281	2.98%	1.963*	-0.17%	-0.119
-5	3.15%	1.134	-2.21%	-1.061	-0.63%	-0.300	0.21%	0.091	-1.29%	-0.618	0.15%	0.089	-0.50%	-0.313	-0.23%	-0.146	0.79%	0.522	3.20%	2.182*
-4	0.75%	0.269	-2.98%	-1.433$	-4.96%	-2.359@	-0.43%	-0.186	0.44%	0.208	1.29%	0.747	0.04%	0.027	-2.06%	-1.336$	-0.84%	-0.551	-0.61%	-0.417
-3	-2.91%	-1.047	0.63%	0.304	-1.13%	-0.540	-1.24%	-0.539	-0.81%	-0.389	1.09%	0.634	-0.60%	-0.376	-0.23%	-0.147	0.00%	-0.002	-1.56%	-1.063
-2	0.11%	0.041	2.75%	1.323$	-1.98%	-0.940	-0.48%	-0.209	-0.18%	-0.086	-0.17%	-0.101	-0.83%	-0.517	2.76%	1.791*	-2.09%	-1.379$	-0.02%	-0.011
-1	-2.02%	-0.729	1.46%	0.699	2.57%	1.224	-1.28%	-0.556	-1.05%	-0.500	-0.06%	-0.037	-1.54%	-0.962	-1.09%	-0.711	0.94%	0.618	-2.33%	-1.591$
0	-1.28%	-0.461	-1.15%	-0.550	0.08%	0.038	-1.36%	-0.591	-1.58%	-0.755	0.20%	0.118	-2.47%	-1.544$	-2.35%	-1.527$	-0.90%	-0.592	0.83%	0.566
1	0.30%	0.107	-0.19%	-0.093	0.72%	0.342	-1.19%	-0.519	1.72%	0.820	-1.38%	-0.801	-1.08%	-0.672	-1.92%	-1.245	1.02%	0.672	-4.06%	-2.764@
2	0.98%	0.352	0.05%	0.024	0.25%	0.118	2.13%	0.926	-0.86%	-0.411	-1.13%	-0.657	-0.41%	-0.257	1.43%	0.930	0.54%	0.357	0.85%	0.576
3	-2.50%	-0.901	1.11%	0.533	-0.75%	-0.357	2.31%	1.002	0.07%	0.033	-1.48%	-0.861	-2.73%	-1.706*	0.21%	0.135	-1.81%	-1.194	0.17%	0.115
4	-2.28%	-0.822	-5.09%	-2.447@	11.00%	5.238#	0.30%	0.129	-0.99%	-0.473	2.55%	1.479$	-2.20%	-1.375$	0.09%	0.056	2.11%	1.391$	1.75%	1.194
5	0.84%	0.302	-0.44%	-0.210	-2.65%	-1.262	-1.51%	-0.657	-0.18%	-0.085	-1.48%	-0.862	0.24%	0.151	-1.60%	-1.038	3.16%	2.085*	0.10%	0.070
6	-3.33%	-1.197	0.40%	0.194	2.90%	1.380$	1.14%	0.494	-1.13%	-0.540	0.64%	0.369	-2.33%	-1.452$	0.18%	0.115	-0.90%	-0.592	-1.28%	-0.870
7	0.86%	0.309	-0.67%	-0.323	-0.57%	-0.273	-1.74%	-0.758	1.49%	0.710	-1.10%	-0.636	-0.08%	-0.049	2.48%	1.614$	1.33%	0.878	-1.54%	-1.050
8	-2.70%	-0.971	0.21%	0.101	-3.57%	-1.700*	2.92%	1.270	-2.42%	-1.155	1.96%	1.136	0.80%	0.501	0.55%	0.355	1.50%	0.987	0.72%	0.489
9	-3.28%	-1.181	-0.96%	-0.460	-1.55%	-0.736	-0.34%	-0.150	2.58%	1.232	-0.02%	-0.014	-1.45%	-0.904	-1.90%	-1.238	1.70%	1.117	0.98%	0.667
10	-2.37%	-0.854	0.20%	0.098	3.50%	1.665*	3.92%	1.704*	1.19%	0.568	-3.68%	-2.138*	-1.21%	-0.756	2.16%	1.402$	-0.61%	-0.399	-1.38%	-0.938
11	-2.06%	-0.741	-1.48%	-0.712	2.52%	1.200	2.52%	1.093	-4.50%	-2.147*	1.06%	0.618	0.33%	0.208	-0.24%	-0.153	-1.79%	-1.179	-0.56%	-0.381
12	4.15%	1.493$	0.22%	0.108	3.65%	1.735*	-0.04%	-0.016	-1.72%	-0.821	0.65%	0.379	-0.32%	-0.202	2.25%	1.460$	0.18%	0.118	2.05%	1.399$
13	-2.42%	-0.871	-2.05%	-0.984	1.83%	0.871	-1.48%	-0.642	-1.34%	-0.640	-0.65%	-0.378	-2.16%	-1.346$	-2.16%	-1.401$	1.03%	0.677	1.31%	0.891
14	2.66%	0.959	-1.73%	-0.832	2.32%	1.103	-0.07%	-0.031	-0.07%	-0.035	-0.03%	-0.019	-0.32%	-0.203	1.25%	0.814	-0.54%	-0.353	1.55%	1.059
15	-3.06%	-1.101	4.68%	2.247*	5.81%	2.768@	-1.60%	-0.697	-0.18%	-0.086	0.17%	0.100	2.66%	1.660*	1.30%	0.843	-0.49%	-0.325	-0.12%	-0.083
16	2.98%	1.071	-1.88%	-0.903	-4.04%	-1.924*	0.02%	0.010	-1.10%	-0.527	0.39%	0.225	-1.19%	-0.745	1.53%	0.997	1.72%	1.136	-1.30%	-0.885
17	0.69%	0.250	0.59%	0.282	1.69%	0.807	1.22%	0.530	0.13%	0.063	-1.08%	-0.628	-2.45%	-1.529$	-0.31%	-0.205	0.74%	0.490	1.15%	0.785
18	-0.22%	-0.080	0.26%	0.124	-2.72%	-1.295$	-0.25%	-0.108	-0.17%	-0.079	-0.04%	-0.022	-2.01%	-1.258	0.48%	0.313	-2.23%	-1.469$	-2.22%	-1.510$
19	-1.21%	-0.435	1.33%	0.640	-1.22%	-0.582	1.73%	0.754	1.54%	0.734	-0.65%	-0.376	1.33%	0.832	-3.27%	-2.122*	-1.12%	-0.737	-0.26%	-0.175
20	-2.40%	-0.863	-0.73%	-0.351	0.53%	0.255	4.00%	1.740*	3.61%	1.723*	2.15%	1.250	0.11%	0.069	0.93%	0.606	-0.84%	-0.556	-1.21%	-0.822

The symbols $,*,@, and # denote statistical significance at the 0.10, 0.05, 0.01 and 0.001 levels, respectively, using a 1-tail test.

Note: This table shows daily abnormal returns (column a) and test statistics (column b) beginning 20 days before and extending 20 days after the event date, which is centered at $\tau = 0$

Table A-6: Daily Abnormal Returns for Airline Stocks and al-Qaida Messages

Date	12/13/2001		10/7/2002		2/12/2003		4/7/2003		9/10/2003		1/5/2004		4/15/2004		5/6/2004		10/29/2004		12/16/2004		12/27/2004		1/19/2006	
(τ)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
-20	3.71%	1.357$	-2.00%	-0.694	0.71%	0.344	-0.64%	-0.316	-1.20%	-0.502	-2.94%	-1.421$	0.81%	0.405	0.51%	0.279	0.52%	0.348	-1.31%	-0.813	-0.32%	-0.197	0.09%	0.068
-19	3.87%	1.416$	-1.26%	-0.438	1.09%	0.525	-5.16%	-2.541@	1.86%	0.773	-3.52%	-1.700*	-1.07%	-0.535	-0.89%	-0.484	1.78%	1.183	0.36%	0.221	1.32%	0.821	-0.72%	-0.554
-18	4.47%	1.635$	0.30%	0.103	-0.58%	-0.277	-0.82%	-0.402	0.48%	0.201	-0.49%	-0.234	0.72%	0.358	-2.53%	-1.374$	-2.74%	-1.817*	-1.27%	-0.789	0.89%	0.552	0.32%	0.247
-17	6.12%	2.239*	0.92%	0.320	-0.36%	-0.172	-1.62%	-0.797	-0.65%	-0.273	-1.92%	-0.925	-1.32%	-0.660	-0.05%	-0.028	0.67%	0.448	-0.99%	-0.611	1.44%	0.893	0.67%	0.519
-16	-0.47%	-0.172	-2.50%	-0.865	-1.44%	-0.695	2.92%	1.439$	0.57%	0.237	-1.49%	-0.717	0.77%	0.384	1.10%	0.598	-1.85%	-1.228	1.56%	0.968	2.95%	1.835*	1.23%	0.945
-15	0.12%	0.043	-2.28%	-0.791	-4.78%	-2.303*	0.32%	0.157	1.42%	0.591	2.79%	1.347$	-0.43%	-0.214	-1.31%	-0.709	1.06%	0.706	1.21%	0.751	0.01%	0.007	2.37%	1.827*
-14	2.15%	0.785	0.80%	0.276	1.54%	0.741	0.93%	0.459	0.39%	0.164	2.17%	1.048	1.55%	0.775	-1.77%	-0.963	-0.85%	-0.563	-0.31%	-0.193	-2.35%	-1.459$	-0.88%	-0.678
-13	-0.23%	-0.085	-3.34%	-1.156	0.18%	0.088	0.35%	0.172	1.63%	0.679	-1.24%	-0.600	2.51%	1.253	-1.51%	-0.820	1.57%	1.041	1.32%	0.821	1.03%	0.640	1.15%	0.889
-12	-0.21%	-0.075	0.79%	0.275	-1.03%	-0.497	-0.50%	-0.248	-0.05%	-0.023	0.40%	0.194	-0.49%	-0.243	2.13%	1.155	2.43%	1.617$	0.89%	0.553	-1.07%	-0.663	-0.17%	-0.128
-11	-2.31%	-0.845	-2.69%	-0.933	1.43%	0.689	11.45%	5.644#	-1.63%	-0.681	-0.82%	-0.396	-1.89%	-0.944	2.42%	1.313$	3.83%	2.543@	1.45%	0.897	-1.63%	-1.014	-3.62%	-2.790@
-10	0.71%	0.258	-3.31%	-1.147	-1.11%	-0.536	-2.95%	-1.453$	0.78%	0.325	-0.12%	-0.057	2.15%	1.076	0.15%	0.080	-2.25%	-1.494$	2.96%	1.831*	1.21%	0.751	1.72%	1.324$
-9	2.39%	0.873	-2.41%	-0.835	-0.45%	-0.215	3.05%	1.501$	0.00%	0.000	-0.91%	-0.437	-0.01%	-0.006	-2.10%	-1.140	-2.51%	-1.666*	0.02%	0.010	-1.85%	-1.153	0.21%	0.160
-8	-0.42%	-0.153	-2.00%	-0.695	-2.18%	-1.052	-0.57%	-0.280	0.63%	0.261	-1.65%	-0.799	1.43%	0.716	-0.34%	-0.184	-2.30%	-1.526$	-2.34%	-1.450$	0.14%	0.085	-0.91%	-0.704
-7	0.70%	0.255	4.19%	1.451$	-2.96%	-1.426$	-3.76%	-1.855*	0.49%	0.205	1.80%	0.871	-0.74%	-0.368	-0.53%	-0.288	-3.87%	-2.569@	1.03%	0.638	-0.50%	-0.314	-0.80%	-0.618
-6	-2.23%	-0.815	-2.49%	-0.863	0.65%	0.311	-1.73%	-0.852	1.21%	0.506	-0.81%	-0.390	0.69%	0.347	0.19%	0.105	2.46%	1.633$	-1.06%	-0.656	-0.29%	-0.178	-0.88%	-0.680
-5	0.70%	0.257	2.63%	0.912	2.77%	1.334$	3.63%	1.787*	2.87%	1.197	0.04%	0.019	0.53%	0.265	-1.15%	-0.625	1.64%	1.088	-1.62%	-1.006	0.53%	0.328	-3.92%	-3.017@
-4	5.08%	1.860*	-2.97%	-1.030	1.47%	0.708	3.11%	1.534$	-0.45%	-0.188	-1.00%	-0.481	-0.90%	-0.449	-1.46%	-0.794	2.81%	1.867*	1.21%	0.751	-0.95%	-0.591	-0.91%	-0.699
-3	2.10%	0.770	2.92%	1.014	-1.13%	-0.545	4.30%	2.118*	1.81%	0.753	-0.16%	-0.076	-2.56%	-1.280	0.02%	0.012	-1.01%	-0.669	-1.84%	-1.143	0.66%	0.408	-0.76%	-0.587
-2	0.91%	0.332	0.67%	0.232	-0.17%	-0.083	1.86%	0.918	0.11%	0.047	-1.05%	-0.506	-0.01%	-0.005	-0.87%	-0.472	2.01%	1.336$	0.14%	0.089	1.96%	1.220	-4.96%	-3.820#
-1	0.89%	0.324	-0.27%	-0.094	0.07%	0.031	2.35%	1.157	-1.17%	-0.489	1.35%	0.650	1.10%	0.549	-0.43%	-0.231	3.18%	2.111*	-0.50%	-0.309	-0.59%	-0.370	3.46%	2.661@
0	0.74%	0.269	-1.25%	-0.433	1.12%	0.541	5.84%	2.880@	-0.28%	-0.116	-2.18%	-1.050	-1.32%	-0.658	-1.20%	-0.651	-3.34%	-2.221*	-0.28%	-0.174	1.66%	1.033	-0.62%	-0.479
1	-0.99%	-0.361	-2.36%	-0.818	-5.08%	-2.444@	-4.01%	-1.977*	1.47%	0.613	2.43%	1.173	-1.80%	-0.901	-1.57%	-0.850	2.19%	1.455$	0.53%	0.329	-0.24%	-0.152	-0.59%	-0.452
2	-2.42%	-0.886	-5.15%	-1.784*	-0.41%	-0.196	1.73%	0.853	1.16%	0.482	1.02%	0.491	-1.52%	-0.762	-1.12%	-0.607	3.89%	2.586@	-0.95%	-0.586	0.22%	0.140	0.95%	0.733
3	0.49%	0.178	-2.29%	-0.795	0.43%	0.208	-2.69%	-1.327$	1.59%	0.661	-4.61%	-2.226*	2.17%	1.088	0.09%	0.048	-2.97%	-1.970*	0.67%	0.412	0.77%	0.480	3.19%	2.457@
4	-1.13%	-0.413	0.92%	0.319	-0.66%	-0.316	-1.19%	-0.587	-0.52%	-0.215	-1.51%	-0.728	2.39%	1.196	-0.31%	-0.168	1.24%	0.826	1.97%	1.219	-0.44%	-0.274	0.56%	0.430
5	-1.96%	-0.716	-0.66%	-0.230	0.23%	0.108	0.56%	0.274	1.03%	0.428	-1.36%	-0.657	0.09%	0.043	0.05%	0.025	0.97%	0.642	-0.59%	-0.365	3.25%	2.021*	-1.45%	-1.116
6	2.86%	1.047	4.57%	1.584$	-0.93%	-0.448	2.42%	1.191	-1.33%	-0.553	-0.03%	-0.013	-2.11%	-1.056	-1.26%	-0.683	0.50%	0.330	1.66%	1.031	-3.07%	-1.910*	-2.22%	-1.706*
7	-2.61%	-0.955	-1.84%	-0.638	0.22%	0.104	2.52%	1.241	-0.97%	-0.406	0.12%	0.058	-0.33%	-0.166	0.12%	0.067	1.31%	0.872	-0.24%	-0.146	-3.74%	-2.324*	1.32%	1.015
8	1.25%	0.459	4.87%	1.688*	-1.46%	-0.703	7.33%	3.615#	0.32%	0.133	-0.97%	-0.467	-0.55%	-0.274	1.67%	0.906	-3.59%	-2.387@	0.23%	0.143	-1.75%	-1.090	1.61%	1.236
9	0.20%	0.074	0.41%	0.143	0.24%	0.115	-0.12%	-0.060	1.28%	0.532	0.09%	0.044	0.23%	0.118	0.10%	0.054	1.46%	0.971	0.78%	0.482	-0.04%	-0.026	-1.88%	-1.448$
10	-0.62%	-0.227	4.43%	1.536$	-2.02%	-0.975	-2.18%	-1.073	0.36%	0.150	-0.17%	-0.082	-1.13%	-0.566	1.23%	0.668	-1.67%	-1.108	-0.43%	-0.270	-1.76%	-1.097	3.08%	2.372@
11	6.20%	2.269*	4.05%	1.402$	-1.71%	-0.824	3.46%	1.707*	-2.22%	-0.925	1.64%	0.791	-1.45%	-0.725	1.03%	0.561	5.52%	3.668#	3.25%	2.015*	2.08%	1.295$	0.10%	0.077
12	0.41%	0.149	3.78%	1.310$	4.69%	2.260*	1.37%	0.677	-3.15%	-1.311$	3.50%	1.689*	-0.02%	-0.011	-0.23%	-0.125	0.11%	0.074	-3.07%	-1.903*	-1.71%	-1.063	-1.37%	-1.052
13	3.04%	1.114	2.42%	0.838	-1.87%	-0.900	1.17%	0.577	-1.01%	-0.420	0.68%	0.328	-0.88%	-0.443	-0.13%	-0.072	-1.24%	-0.825	-3.73%	-2.313*	-0.16%	-0.097	0.48%	0.371
14	2.81%	1.028	-0.87%	-0.303	0.61%	0.294	2.13%	1.051	0.44%	0.182	-3.29%	-1.589$	-0.44%	-0.220	0.15%	0.079	0.43%	0.287	-1.75%	-1.082	-0.21%	-0.129	1.00%	0.770
15	-0.11%	-0.040	-0.17%	-0.059	0.27%	0.132	-0.92%	-0.451	-1.37%	-0.572	2.02%	0.973	-1.18%	-0.592	-1.44%	-0.782	-1.18%	-0.782	-0.04%	-0.023	-0.09%	-0.054	0.60%	0.458
16	1.68%	0.615	-1.03%	-0.359	1.36%	0.653	3.13%	1.541$	0.62%	0.259	-2.50%	-1.208	-1.52%	-0.762	-1.19%	-0.645	-0.92%	-0.609	-1.76%	-1.089	-1.20%	-0.744	-1.08%	-0.830
17	-0.37%	-0.136	0.25%	0.087	-0.72%	-0.349	1.98%	0.978	1.55%	0.644	-0.04%	-0.020	-1.09%	-0.544	-1.54%	-0.836	1.64%	1.090	2.09%	1.292$	-0.43%	-0.265	-0.10%	-0.079
18	-0.38%	-0.140	1.78%	0.619	-5.02%	-2.418@	9.35%	4.607#	2.49%	1.037	-2.68%	-1.293$	0.05%	0.026	2.49%	1.352$	1.28%	0.853	-1.70%	-1.054	-1.04%	-0.645	3.05%	2.349@
19	-1.33%	-0.486	0.55%	0.191	-1.18%	-0.569	1.75%	0.861	0.14%	0.059	-3.10%	-1.495$	-0.32%	-0.162	-1.54%	-0.833	-0.23%	-0.155	-0.15%	-0.096	-2.34%	-1.458$	1.31%	1.008
20	-2.01%	-0.734	3.73%	1.294$	-1.97%	-0.951	1.12%	0.553	0.03%	0.012	-2.41%	-1.164	0.04%	0.020	0.57%	0.312	1.41%	0.936	-0.20%	-0.123	2.60%	1.614$	-1.68%	-1.296$

The symbols $,*,@, and # denote statistical significance at the 0.10, 0.05, 0.01 and 0.001 levels, respectively, using a 1-tail test.

Note: This table shows daily abnormal returns (column a) and test statistics (column b) beginning 20 days before and extending 20 days after the event date, which is centered at $\tau = 0$

Table A-7: Daily Abnormal Returns for Defense Stocks and Terror Attacks

Date	12/22/1988		2/26/1993		4/19/1995		11/13/1995		6/25/1996		7/18/1996		8/7/1998		11/1/1999		10/12/2000		9/17/2001		11/12/2001		12/24/2001	
(τ)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
-20	-0.71%	-0.705	-1.45%	-1.404$	-0.05%	-0.056	0.47%	0.606	1.04%	1.538$	-0.89%	-1.307$	-0.40%	-0.556	0.41%	0.408	1.28%	0.945	-0.43%	-0.420	1.76%	1.223	-0.16%	-0.107
-19	-0.73%	-0.721	0.08%	0.078	-0.58%	-0.661	0.57%	0.739	0.92%	1.359$	-1.03%	-1.509$	-0.38%	-0.525	-1.07%	-1.075	-0.82%	-0.606	-0.51%	-0.493	0.11%	0.080	-0.40%	-0.267
-18	-0.15%	-0.149	-0.16%	-0.151	0.17%	0.191	-0.50%	-0.644	0.69%	1.021	-0.14%	-0.207	-0.51%	-0.699	-0.67%	-0.669	0.27%	0.202	-0.59%	-0.575	-2.53%	-1.762*	0.48%	0.325
-17	-0.85%	-0.841	1.29%	1.250	-0.22%	-0.252	-0.52%	-0.667	0.91%	1.342$	0.02%	0.032	0.39%	0.535	0.31%	0.315	-1.28%	-0.944	0.60%	0.586	-0.76%	-0.526	-0.09%	-0.058
-16	0.47%	0.461	-0.93%	-0.896	-0.66%	-0.749	1.33%	1.714*	-1.04%	-1.533$	0.41%	0.598	-0.65%	-0.900	-1.15%	-1.156	-0.10%	-0.075	-0.06%	-0.057	1.86%	1.297$	0.63%	0.424
-15	-0.17%	-0.170	0.78%	0.751	0.62%	0.706	-0.38%	-0.483	0.61%	0.903	-0.42%	-0.624	-1.06%	-1.456$	0.05%	0.049	0.65%	0.476	-0.34%	-0.333	-1.74%	-1.210	-0.16%	-0.110
-14	-0.50%	-0.492	-0.80%	-0.770	0.51%	0.583	-0.52%	-0.672	1.09%	1.605$	-1.82%	-2.681@	0.15%	0.208	-8.23%	-8.272#	0.19%	0.139	0.31%	0.305	-2.25%	-1.567$	0.29%	0.198
-13	0.66%	0.657	-0.89%	-0.863	1.02%	1.168	-1.81%	-2.324*	-1.00%	-1.481$	1.02%	1.497$	-0.08%	-0.113	-2.16%	-2.173*	0.29%	0.217	-1.04%	-1.007	0.90%	0.629	-0.32%	-0.215
-12	-0.31%	-0.303	2.26%	2.187*	2.72%	3.112#	0.27%	0.346	0.11%	0.165	-0.43%	-0.626	-0.53%	-0.726	1.07%	1.076	0.89%	0.656	0.78%	0.760	2.08%	1.445$	-0.61%	-0.414
-11	-0.58%	-0.571	-0.83%	-0.803	-0.30%	-0.346	-1.08%	-1.394$	-0.34%	-0.501	2.17%	3.187#	-1.52%	-2.101*	-0.35%	-0.349	0.67%	0.496	-0.21%	-0.207	0.86%	0.598	-0.30%	-0.200
-10	-0.98%	-0.971	-0.19%	-0.187	-2.91%	-3.330#	-0.32%	-0.410	0.10%	0.146	0.72%	1.053	-0.52%	-0.719	0.99%	0.994	0.96%	0.707	0.88%	0.859	0.15%	0.105	-0.70%	-0.472
-9	-0.69%	-0.687	0.09%	0.084	-0.07%	-0.074	0.73%	0.943	-0.02%	-0.023	-1.11%	-1.638$	-1.75%	-2.418@	-1.57%	-1.583$	3.47%	2.555@	-0.27%	-0.264	-1.21%	-0.839	0.55%	0.372
-8	-0.34%	-0.339	-1.08%	-1.044	1.19%	1.362$	-0.82%	-1.055	0.38%	0.556	-1.06%	-1.553$	-1.12%	-1.550$	-1.15%	-1.154	-2.79%	-2.050*	0.37%	0.358	1.25%	0.870	0.60%	0.408
-7	-0.39%	-0.381	-0.47%	-0.450	0.49%	0.562	-0.18%	-0.238	0.57%	0.837	0.28%	0.414	-0.47%	-0.654	0.33%	0.333	2.16%	1.591$	-0.78%	-0.758	-0.29%	-0.204	0.16%	0.110
-6	-0.17%	-0.164	-2.24%	-2.167*	0.06%	0.063	1.10%	1.420$	-0.22%	-0.328	-1.30%	-1.915*	0.27%	0.369	0.14%	0.143	0.13%	0.096	0.33%	0.317	1.99%	1.384$	0.46%	0.310
-5	0.67%	0.659	0.28%	0.268	0.75%	0.859	0.18%	0.227	-0.95%	-1.404$	-1.58%	-2.321*	0.29%	0.405	-0.57%	-0.568	-0.93%	-0.682	0.72%	0.696	0.13%	0.093	-0.63%	-0.423
-4	-0.97%	-0.965	-0.34%	-0.326	-0.42%	-0.478	-0.44%	-0.563	-0.86%	-1.272	-0.62%	-0.908	-0.69%	-0.948	1.84%	1.854*	-0.92%	-0.675	-0.95%	-0.923	-0.49%	-0.341	0.30%	0.204
-3	-1.58%	-1.560$	-0.03%	-0.028	-0.47%	-0.542	-0.17%	-0.223	-1.00%	-1.476$	-0.93%	-1.367$	-0.57%	-0.788	-0.31%	-0.311	0.22%	0.164	-0.93%	-0.898	-1.03%	-0.718	-1.31%	-0.887
-2	0.14%	0.135	0.60%	0.581	1.91%	2.184*	-0.13%	-0.171	-0.11%	-0.169	-1.29%	-1.899*	-0.69%	-0.951	0.20%	0.199	0.72%	0.531	-0.67%	-0.651	-0.80%	-0.555	-0.59%	-0.397
-1	-0.02%	-0.023	1.58%	1.529$	-1.27%	-1.451$	-0.16%	-0.210	0.05%	0.074	2.52%	3.702#	-0.42%	-0.577	-1.64%	-1.649*	1.16%	0.856	-1.29%	-1.249	1.51%	1.052	0.53%	0.360
0	-0.53%	-0.528	0.38%	0.371	-0.32%	-0.361	-0.36%	-0.462	0.44%	0.644	0.57%	0.845	1.47%	2.023*	-1.71%	-1.717*	0.80%	0.588	15.55%	15.087#	-0.61%	-0.422	0.82%	0.555
1	1.67%	1.655*	0.16%	0.156	-1.47%	-1.684*	-0.01%	-0.012	-0.39%	-0.584	-0.31%	-0.456	-0.98%	-1.354$	1.56%	1.569$	1.52%	1.121	-1.52%	-1.473$	-4.08%	-2.839@	-0.15%	-0.101
2	-0.20%	-0.202	1.18%	1.140	-0.22%	-0.247	-0.80%	-1.036	-1.80%	-2.657@	-0.21%	-0.315	-1.00%	-1.378$	-1.05%	-1.052	-0.77%	-0.570	-2.37%	-2.300*	-0.75%	-0.522	0.84%	0.567
3	-0.19%	-0.186	-0.91%	-0.877	0.29%	0.332	0.69%	0.885	1.05%	1.547$	-1.70%	-2.503@	1.35%	1.866*	-0.72%	-0.724	-1.66%	-1.221	0.09%	0.083	-0.17%	-0.120	1.14%	0.771
4	0.52%	0.515	-0.25%	-0.241	0.45%	0.514	0.15%	0.197	-0.40%	-0.590	-1.11%	-1.634$	-1.01%	-1.392$	-0.23%	-0.232	-0.29%	-0.217	1.09%	1.058	1.55%	1.080	1.18%	0.797
5	1.50%	1.481$	1.42%	1.372$	0.78%	0.889	-0.68%	-0.878	2.20%	3.249#	0.46%	0.677	0.48%	0.662	-0.23%	-0.229	0.79%	0.584	-0.19%	-0.187	1.91%	1.329$	-1.48%	-1.001
6	0.81%	0.800	-0.92%	-0.892	-0.39%	-0.446	0.24%	0.311	0.75%	1.102	0.01%	0.021	-0.68%	-0.931	0.70%	0.707	0.79%	0.584	-1.03%	-1.000	0.74%	0.518	1.53%	1.030
7	0.53%	0.528	-0.30%	-0.287	-0.16%	-0.184	-0.79%	-1.016	-1.08%	-1.598$	-0.09%	-0.131	0.30%	0.416	-0.03%	-0.030	1.50%	1.104	-0.33%	-0.321	-0.93%	-0.647	-0.77%	-0.520
8	0.04%	0.042	0.48%	0.462	0.20%	0.226	0.46%	0.587	-1.03%	-1.518$	0.12%	0.182	0.34%	0.468	0.66%	0.662	-0.10%	-0.073	1.25%	1.209	0.18%	0.127	0.01%	0.004
9	0.12%	0.120	0.97%	0.934	-0.47%	-0.538	-0.51%	-0.661	0.31%	0.458	0.60%	0.887	0.76%	1.055	1.07%	1.074	1.34%	0.985	0.28%	0.269	-0.26%	-0.182	0.62%	0.418
10	0.16%	0.161	-0.82%	-0.795	-0.04%	-0.041	1.08%	1.392$	-1.27%	-1.885*	-0.34%	-0.504	-1.18%	-1.629$	2.18%	2.190*	0.70%	0.515	-0.26%	-0.256	-0.49%	-0.340	1.02%	0.690
11	-0.06%	-0.061	0.37%	0.357	-0.14%	-0.158	1.12%	1.447$	-1.55%	-2.288*	1.21%	1.775*	-0.45%	-0.618	0.16%	0.159	-0.09%	-0.063	1.29%	1.255	0.77%	0.536	0.35%	0.235
12	-0.73%	-0.720	-0.73%	-0.707	0.31%	0.357	0.86%	1.109	-0.59%	-0.871	0.29%	0.427	-0.01%	-0.017	1.67%	1.676*	0.07%	0.055	2.57%	2.498@	-0.02%	-0.015	-1.28%	-0.865
13	-0.28%	-0.277	0.10%	0.092	1.90%	2.169*	-0.91%	-1.175	-0.90%	-1.325$	0.85%	1.247	-2.22%	-3.062@	0.81%	0.816	1.21%	0.887	-0.50%	-0.489	0.76%	0.529	-0.98%	-0.662
14	0.91%	0.904	0.77%	0.746	-0.27%	-0.314	-0.48%	-0.616	-1.26%	-1.868*	0.10%	0.148	-2.70%	-3.728#	1.68%	1.690*	-0.66%	-0.489	0.44%	0.430	-0.12%	-0.082	0.28%	0.190
15	0.07%	0.066	-1.43%	-1.384$	0.12%	0.134	-0.16%	-0.210	2.54%	3.764#	0.97%	1.429$	0.68%	0.937	-0.40%	-0.403	0.39%	0.285	2.79%	2.708@	0.18%	0.128	-0.45%	-0.304
16	1.92%	1.901*	-0.23%	-0.219	-0.45%	-0.519	-0.86%	-1.103	0.60%	0.887	-0.78%	-1.143	0.04%	0.061	0.79%	0.792	-0.92%	-0.679	-0.43%	-0.414	-0.43%	-0.298	1.21%	0.816
17	-1.81%	-1.796*	0.23%	0.220	-0.50%	-0.566	0.15%	0.194	-0.28%	-0.414	-0.30%	-0.437	-1.22%	-1.677*	-1.39%	-1.394$	0.45%	0.333	-1.78%	-1.728*	-0.65%	-0.455	0.42%	0.287
18	0.23%	0.232	1.11%	1.073	0.86%	0.983	0.15%	0.190	-0.18%	-0.272	0.04%	0.065	0.83%	1.148	-0.09%	-0.090	-2.04%	-1.500$	-2.15%	-2.082*	-0.32%	-0.225	0.62%	0.419
19	-0.24%	-0.242	0.87%	0.839	0.66%	0.757	-1.89%	-2.431@	-1.67%	-2.473@	-0.07%	-0.104	-0.62%	-0.856	-0.72%	-0.728	0.28%	0.206	-0.46%	-0.445	-0.77%	-0.533	0.64%	0.430
20	-1.23%	-1.220	-0.91%	-0.882	0.50%	0.577	0.05%	0.065	-1.08%	-1.602$	-0.09%	-0.138	-1.10%	-1.512$	0.11%	0.106	0.35%	0.254	1.83%	1.773*	0.40%	0.275	3.43%	2.316*

The symbols $,*,@, and # denote statistical significance at the 0.10, 0.05, 0.01 and 0.001 levels, respectively, using a 1-tail test.

Note: This table shows daily abnormal returns (column a) and test statistics (column b) beginning 20 days before and extending 20 days after the event date, which is centered at $\tau = 0$

Table A-8: Daily Abnormal Returns for Defense Stocks and Threat Elevations

Date	9/10/2002		2/7/2003		3/17/2003		5/20/2003		12/22/2003		5/26/2004		7/8/2004		8/2/2004		7/7/2005		8/10/2006	
(τ)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
-20	-0.54%	-0.363	-0.52%	-0.438	-1.45%	-1.224	1.67%	1.429$	0.31%	0.366	-0.23%	-0.294	0.58%	0.763	-0.22%	-0.280	-0.57%	-0.717	-0.05%	-0.087
-19	-2.75%	-1.836*	1.16%	0.970	-1.77%	-1.501$	0.34%	0.287	0.61%	0.715	0.28%	0.366	-0.13%	-0.170	0.01%	0.018	0.24%	0.307	-0.51%	-0.819
-18	-1.60%	-1.071	-1.70%	-1.426$	0.22%	0.189	-0.33%	-0.278	0.19%	0.219	-1.81%	-2.357@	-0.56%	-0.741	-0.61%	-0.795	0.77%	0.979	-0.84%	-1.357$
-17	-1.61%	-1.078	-0.45%	-0.374	-0.65%	-0.552	-0.12%	-0.104	0.05%	0.064	-1.13%	-1.468$	-0.41%	-0.535	0.50%	0.653	0.06%	0.070	-0.46%	-0.748
-16	0.71%	0.475	1.31%	1.102	0.03%	0.021	1.30%	1.112	0.22%	0.257	0.23%	0.298	0.51%	0.673	0.60%	0.777	-0.20%	-0.254	-0.08%	-0.128
-15	-0.03%	-0.019	0.10%	0.082	-1.06%	-0.898	0.90%	0.766	0.76%	0.888	-0.05%	-0.070	0.34%	0.452	-0.30%	-0.388	0.13%	0.169	-0.15%	-0.244
-14	-0.81%	-0.542	-0.41%	-0.343	0.09%	0.078	1.91%	1.630$	0.15%	0.171	-0.73%	-0.954	-0.57%	-0.741	0.06%	0.076	-0.47%	-0.592	0.11%	0.174
-13	0.42%	0.278	-0.48%	-0.406	-0.15%	-0.131	-0.62%	-0.533	-0.99%	-1.151	-0.29%	-0.376	1.12%	1.471$	-1.15%	-1.490$	-0.47%	-0.590	0.31%	0.497
-12	-0.89%	-0.597	-2.01%	-1.685*	-0.19%	-0.160	0.77%	0.656	1.69%	1.971*	-1.72%	-2.244*	0.64%	0.834	-0.12%	-0.155	-0.38%	-0.477	0.84%	1.360$
-11	-1.27%	-0.846	-0.96%	-0.809	-0.47%	-0.397	0.08%	0.064	-0.31%	-0.364	0.40%	0.524	-0.11%	-0.144	0.35%	0.447	0.20%	0.256	-1.68%	-2.708@
-10	-1.08%	-0.722	0.98%	0.818	-0.18%	-0.151	0.13%	0.108	1.25%	1.454$	0.47%	0.614	1.08%	1.422$	-0.81%	-1.050	0.24%	0.303	0.52%	0.839
-9	-0.26%	-0.174	-0.96%	-0.804	0.94%	0.798	0.63%	0.539	0.33%	0.382	0.55%	0.713	0.55%	0.719	-1.44%	-1.860*	-0.27%	-0.341	-0.85%	-1.370$
-8	0.00%	0.002	1.48%	1.243	-1.74%	-1.476$	-0.45%	-0.388	-1.08%	-1.262	-0.08%	-0.103	1.72%	2.262*	-0.02%	-0.023	-0.61%	-0.766	-0.14%	-0.225
-7	0.78%	0.520	-0.60%	-0.505	0.51%	0.436	1.65%	1.405$	1.99%	2.322*	-0.85%	-1.105	-0.51%	-0.664	-0.77%	-0.997	-0.19%	-0.245	-0.56%	-0.900
-6	0.05%	0.031	-0.37%	-0.314	-0.70%	-0.590	0.60%	0.510	-0.21%	-0.242	-0.30%	-0.390	0.33%	0.437	-0.10%	-0.126	1.66%	2.096*	0.17%	0.278
-5	-1.36%	-0.910	0.81%	0.682	-1.15%	-0.975	0.67%	0.574	-1.78%	-2.078*	0.60%	0.788	0.55%	0.723	-1.67%	-2.164*	0.75%	0.944	-1.41%	-2.280*
-4	1.55%	1.038	-1.71%	-1.435$	-0.53%	-0.451	0.63%	0.536	0.13%	0.151	-0.51%	-0.665	1.57%	2.059*	0.87%	1.123	0.47%	0.599	-0.34%	-0.549
-3	0.74%	0.496	1.47%	1.233	-0.54%	-0.460	0.28%	0.237	0.49%	0.574	-0.24%	-0.308	-0.20%	-0.263	-0.01%	-0.009	0.28%	0.357	-0.43%	-0.694
-2	1.39%	0.927	-0.56%	-0.472	0.98%	0.832	-0.75%	-0.639	0.66%	0.775	0.06%	0.081	0.03%	0.041	0.47%	0.609	-0.45%	-0.574	-0.61%	-0.981
-1	0.62%	0.413	-0.59%	-0.492	1.48%	1.254	-0.97%	-0.824	-0.70%	-0.815	0.30%	0.387	-0.60%	-0.786	-0.05%	-0.064	-0.33%	-0.413	-1.09%	-1.759*
0	-1.21%	-0.806	0.05%	0.041	1.56%	1.318$	-0.97%	-0.828	-0.62%	-0.728	0.18%	0.241	0.52%	0.683	0.77%	0.995	0.22%	0.277	0.76%	1.218
1	-0.40%	-0.265	0.15%	0.126	0.51%	0.430	0.44%	0.378	-0.06%	-0.074	-0.38%	-0.489	0.61%	0.805	-1.25%	-1.619$	-0.28%	-0.349	-0.16%	-0.265
2	0.80%	0.534	0.54%	0.451	0.67%	0.571	-0.14%	-0.119	0.54%	0.625	-0.05%	-0.062	-0.29%	-0.374	-0.22%	-0.289	-0.47%	-0.597	0.27%	0.437
3	-0.75%	-0.503	-0.33%	-0.274	-1.43%	-1.214	0.43%	0.368	0.05%	0.053	0.25%	0.328	0.07%	0.095	-0.44%	-0.572	-0.32%	-0.401	0.30%	0.485
4	0.72%	0.479	-0.52%	-0.436	-2.56%	-2.172*	0.05%	0.041	0.65%	0.762	-0.34%	-0.447	-1.13%	-1.487$	-1.44%	-1.860*	-0.35%	-0.443	1.01%	1.621$
5	-2.76%	-1.847*	-1.53%	-1.280	1.86%	1.574$	0.08%	0.064	-0.93%	-1.081	-0.45%	-0.586	-0.10%	-0.136	-0.68%	-0.883	-0.24%	-0.306	0.43%	0.699
6	0.35%	0.232	-1.85%	-1.552$	-0.53%	-0.445	1.21%	1.028	-1.11%	-1.292$	0.46%	0.601	0.36%	0.474	0.42%	0.541	0.00%	0.005	-0.18%	-0.291
7	0.49%	0.328	0.17%	0.144	-0.22%	-0.190	0.69%	0.585	-0.19%	-0.217	-0.30%	-0.393	-0.80%	-1.044	-0.51%	-0.658	-0.25%	-0.319	-0.40%	-0.650
8	0.93%	0.619	-0.70%	-0.588	1.30%	1.103	-0.04%	-0.030	-0.10%	-0.121	0.57%	0.746	-1.42%	-1.867*	-0.93%	-1.200	-0.35%	-0.446	-0.12%	-0.200
9	-0.02%	-0.015	-0.05%	-0.039	0.81%	0.682	-0.92%	-0.786	0.35%	0.408	-0.18%	-0.233	0.00%	0.001	-0.82%	-1.067	0.63%	0.797	-0.45%	-0.724
10	0.07%	0.044	-1.10%	-0.922	0.20%	0.171	0.57%	0.486	0.70%	0.820	-0.56%	-0.734	-0.76%	-0.992	-0.07%	-0.086	1.20%	1.517$	-0.66%	-1.069
11	-0.48%	-0.323	0.03%	0.022	1.12%	0.952	0.91%	0.779	-0.37%	-0.433	-0.46%	-0.598	-0.08%	-0.104	-0.17%	-0.220	-0.43%	-0.539	-0.27%	-0.439
12	0.60%	0.402	-0.20%	-0.167	-1.35%	-1.143	0.61%	0.518	0.94%	1.102	0.52%	0.677	-1.66%	-2.171*	-0.59%	-0.767	0.56%	0.706	0.45%	0.733
13	-1.01%	-0.673	-0.26%	-0.217	-0.44%	-0.374	-0.33%	-0.283	0.52%	0.611	0.33%	0.436	0.88%	1.151	0.19%	0.247	0.43%	0.549	0.05%	0.074
14	-0.43%	-0.287	-0.53%	-0.446	-1.39%	-1.180	0.88%	0.748	0.32%	0.372	-0.58%	-0.762	0.01%	0.010	1.59%	2.066*	-0.15%	-0.190	0.20%	0.317
15	-1.64%	-1.094	-0.23%	-0.193	-0.31%	-0.260	1.20%	1.022	2.17%	2.528@	1.12%	1.455$	0.48%	0.634	-0.01%	-0.008	0.91%	1.151	0.49%	0.789
16	-1.81%	-1.211	0.90%	0.755	0.03%	0.025	1.39%	1.185	-0.49%	-0.570	0.61%	0.789	-0.04%	-0.046	-0.46%	-0.593	0.95%	1.204	-0.05%	-0.081
17	0.54%	0.358	-1.81%	-1.519$	0.50%	0.422	-1.01%	-0.862	0.32%	0.379	-0.11%	-0.145	0.78%	1.025	0.22%	0.288	0.63%	0.801	0.94%	1.511$
18	-2.16%	-1.442$	0.47%	0.390	-0.64%	-0.543	0.88%	0.747	0.98%	1.142	1.10%	1.434$	-1.23%	-1.617$	-0.96%	-1.246	-0.63%	-0.803	0.06%	0.096
19	-0.65%	-0.435	-0.76%	-0.641	0.06%	0.052	0.94%	0.806	0.06%	0.064	0.52%	0.681	-0.21%	-0.273	0.01%	0.008	-0.58%	-0.733	-0.06%	-0.099
20	-4.41%	-2.946@	-1.18%	-0.993	0.12%	0.104	1.50%	1.281	-0.74%	-0.865	1.69%	2.202*	-0.42%	-0.553	-0.01%	-0.015	-0.14%	-0.173	-0.24%	-0.395

The symbols $,*,@, and # denote statistical significance at the 0.10, 0.05, 0.01 and 0.001 levels, respectively, using a 1-tail test.

Note: This table shows daily abnormal returns (column a) and test statistics (column b) beginning 20 days before and extending 20 days after the event date, which is centered at $\tau = 0$

Table A-9: Daily Abnormal Returns for Defense Stocks and al-Qaida Messages

Date	12/13/2001		10/7/2002		2/12/2003		4/7/2003		9/10/2003		1/5/2004		4/15/2004		5/6/2004		10/29/2004		12/16/2004		12/27/2004		1/19/2006	
(τ)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
-20	-0.62%	-0.416	0.63%	0.413	-0.44%	-0.368	-1.13%	-0.964	1.05%	0.972	1.67%	1.985*	0.42%	0.508	1.25%	1.642$	-0.47%	-0.633	-0.91%	-1.236	-0.70%	-0.952	-0.87%	-1.262
-19	-0.04%	-0.025	-1.19%	-0.782	1.32%	1.101	-0.49%	-0.416	-0.14%	-0.134	-0.30%	-0.359	-0.09%	-0.110	-0.76%	-0.991	0.35%	0.476	-0.03%	-0.046	1.65%	2.238*	0.44%	0.634
-18	1.60%	1.081	-0.36%	-0.240	0.10%	0.085	-0.48%	-0.410	1.14%	1.058	1.23%	1.453$	0.68%	0.828	0.05%	0.063	-0.26%	-0.353	-0.44%	-0.596	0.96%	1.295$	1.13%	1.642$
-17	1.92%	1.298$	0.88%	0.579	-0.40%	-0.337	1.09%	0.927	0.26%	0.240	0.34%	0.400	0.17%	0.205	-0.57%	-0.748	-1.01%	-1.364$	-0.26%	-0.350	-0.76%	-1.028	0.83%	1.206
-16	0.79%	0.535	-0.73%	-0.479	-0.48%	-0.400	1.54%	1.314$	0.46%	0.425	-1.09%	-1.287$	-0.06%	-0.070	-0.38%	-0.502	-0.49%	-0.666	0.71%	0.955	-0.33%	-0.441	0.73%	1.050
-15	-0.82%	-0.558	0.75%	0.490	-2.00%	-1.673*	1.66%	1.418$	0.15%	0.137	1.96%	2.325*	-0.03%	-0.033	-0.08%	-0.109	-1.02%	-1.379$	-0.34%	-0.456	-0.34%	-0.462	0.17%	0.248
-14	0.30%	0.204	-2.69%	-1.770*	-0.96%	-0.801	0.57%	0.487	-0.35%	-0.328	-0.22%	-0.259	-0.14%	-0.170	0.37%	0.486	-0.14%	-0.187	-0.71%	-0.965	-0.84%	-1.131	0.03%	0.050
-13	-0.09%	-0.059	0.39%	0.256	0.98%	0.819	0.74%	0.634	0.41%	0.381	-1.78%	-2.105*	0.85%	1.029	0.42%	0.556	0.30%	0.402	1.64%	2.222*	-1.15%	-1.555$	-0.25%	-0.365
-12	-0.30%	-0.203	0.58%	0.384	-0.95%	-0.796	-1.37%	-1.172	-0.58%	-0.533	0.11%	0.131	0.97%	1.171	-2.28%	-2.997@	-0.81%	-1.095	0.95%	1.279	-1.44%	-1.955*	-0.13%	-0.191
-11	0.60%	0.405	0.95%	0.627	1.49%	1.241	-2.48%	-2.111*	-0.14%	-0.129	0.48%	0.573	0.82%	0.998	1.04%	1.362$	0.15%	0.204	-0.77%	-1.036	-0.24%	-0.322	-1.45%	-2.093*
-10	-0.02%	-0.016	0.04%	0.025	-0.60%	-0.499	1.87%	1.593$	-0.85%	-0.785	0.64%	0.754	-0.17%	-0.204	0.64%	0.844	-0.27%	-0.366	-0.34%	-0.455	0.44%	0.596	0.83%	1.206
-9	0.71%	0.481	0.13%	0.088	-0.37%	-0.308	-0.45%	-0.385	0.82%	0.756	-0.70%	-0.833	0.99%	1.195	0.45%	0.585	-1.45%	-1.958*	-0.35%	-0.475	0.37%	0.505	-0.34%	-0.492
-8	-0.06%	-0.043	-0.50%	-0.331	0.82%	0.683	-0.17%	-0.149	0.36%	0.334	-0.64%	-0.756	0.53%	0.644	0.80%	1.056	1.25%	1.686*	-0.85%	-1.145	-0.03%	-0.041	0.44%	0.632
-7	0.35%	0.236	0.60%	0.392	-1.71%	-1.425$	1.36%	1.158	0.47%	0.436	-0.07%	-0.089	0.31%	0.375	-0.66%	-0.865	-1.50%	-2.034*	-1.16%	-1.572$	-0.63%	-0.850	0.94%	1.353$
-6	-0.28%	-0.189	-0.91%	-0.598	1.47%	1.232	0.85%	0.729	0.12%	0.110	0.53%	0.632	0.72%	0.871	-0.28%	-0.374	0.63%	0.857	-1.45%	-1.966*	-0.51%	-0.686	0.69%	0.995
-5	-0.52%	-0.355	-0.37%	-0.242	-0.56%	-0.466	0.23%	0.200	0.31%	0.289	0.04%	0.043	1.19%	1.440$	0.25%	0.326	0.09%	0.120	-0.25%	-0.334	0.71%	0.965	0.01%	0.011
-4	-0.20%	-0.134	-1.69%	-1.109	-0.58%	-0.486	1.20%	1.022	-0.13%	-0.123	0.62%	0.739	-0.75%	-0.914	-1.83%	-2.408@	0.20%	0.277	0.43%	0.582	0.46%	0.627	0.13%	0.184
-3	-0.59%	-0.395	-1.73%	-1.139	0.05%	0.045	-1.26%	-1.072	-0.79%	-0.732	-0.93%	-1.106	0.12%	0.143	-1.09%	-1.428$	-1.06%	-1.440$	0.37%	0.494	-1.42%	-1.923*	-0.08%	-0.119
-2	0.64%	0.431	0.59%	0.387	0.16%	0.130	-0.39%	-0.333	0.32%	0.292	-1.12%	-1.324$	-0.71%	-0.862	0.24%	0.309	-0.52%	-0.702	-0.04%	-0.053	1.22%	1.657*	-0.54%	-0.788
-1	0.69%	0.463	-2.08%	-1.368$	0.54%	0.453	-1.33%	-1.136	-0.46%	-0.426	-0.19%	-0.220	-0.38%	-0.464	-0.05%	-0.061	-0.59%	-0.805	-0.64%	-0.862	-0.13%	-0.176	0.07%	0.105
0	0.28%	0.187	-0.58%	-0.381	-0.32%	-0.269	-0.25%	-0.212	-0.82%	-0.760	-0.13%	-0.158	-0.06%	-0.077	-0.76%	-0.999	-1.30%	-1.763*	-0.52%	-0.700	-1.02%	-1.379$	0.09%	0.127
1	0.53%	0.361	-4.41%	-2.900@	-0.52%	-0.430	0.08%	0.072	-0.04%	-0.037	0.34%	0.405	0.44%	0.533	-0.35%	-0.456	0.65%	0.877	0.70%	0.948	0.43%	0.588	0.92%	1.337$
2	-0.56%	-0.381	-2.25%	-1.481$	-1.52%	-1.270	0.54%	0.457	0.02%	0.020	0.69%	0.820	0.45%	0.543	-1.77%	-2.320*	-1.20%	-1.625$	0.45%	0.613	-0.75%	-1.014	-0.44%	-0.638
3	0.37%	0.250	0.16%	0.105	-1.85%	-1.541$	-0.57%	-0.490	0.09%	0.081	-0.39%	-0.459	-2.45%	-2.961@	0.43%	0.569	2.15%	2.905@	-1.43%	-1.932*	-0.08%	-0.105	1.47%	2.133*
4	-1.24%	-0.839	0.68%	0.450	0.18%	0.148	0.11%	0.096	0.51%	0.467	0.96%	1.133	1.11%	1.344$	0.48%	0.627	0.10%	0.139	1.21%	1.644$	-0.34%	-0.463	0.27%	0.396
5	-0.49%	-0.330	-0.66%	-0.432	-0.70%	-0.581	0.21%	0.176	1.57%	1.453$	0.51%	0.603	0.81%	0.985	0.54%	0.712	0.13%	0.177	-0.14%	-0.190	-1.81%	-2.455@	2.05%	2.970@
6	0.61%	0.410	-0.92%	-0.605	-0.04%	-0.035	0.87%	0.743	0.27%	0.247	0.32%	0.383	0.46%	0.563	-0.08%	-0.108	0.74%	1.000	-1.03%	-1.393$	-2.53%	-3.423#	-1.29%	-1.865*
7	0.90%	0.611	-1.02%	-0.669	-1.09%	-0.914	1.13%	0.963	-0.12%	-0.110	2.14%	2.542@	0.77%	0.929	-0.89%	-1.173	0.32%	0.434	0.43%	0.577	0.40%	0.536	-0.18%	-0.258
8	-0.07%	-0.050	-1.38%	-0.909	0.03%	0.026	1.23%	1.049	-0.37%	-0.341	-0.50%	-0.589	-0.62%	-0.752	-0.27%	-0.356	0.81%	1.101	-0.76%	-1.027	-1.03%	-1.389$	0.72%	1.049
9	0.91%	0.614	-1.14%	-0.752	-0.19%	-0.162	0.94%	0.806	-1.42%	-1.314$	0.31%	0.362	-0.43%	-0.517	0.59%	0.778	0.51%	0.685	-0.09%	-0.118	-1.36%	-1.838*	1.39%	2.017*
10	1.22%	0.823	2.34%	1.537$	-0.25%	-0.212	1.65%	1.406$	-0.56%	-0.521	0.97%	1.155	0.18%	0.212	-0.51%	-0.668	-0.60%	-0.808	-0.35%	-0.477	-0.71%	-0.966	-0.29%	-0.420
11	1.28%	0.868	0.22%	0.145	-0.53%	-0.440	0.32%	0.274	-1.46%	-1.347$	0.03%	0.041	-1.89%	-2.287*	-0.22%	-0.289	-0.15%	-0.196	-1.83%	-2.471@	-2.17%	-2.939@	1.35%	1.957*
12	-1.41%	-0.953	2.36%	1.551$	-0.22%	-0.188	-0.33%	-0.279	-0.80%	-0.743	-0.74%	-0.879	-0.97%	-1.178	0.07%	0.090	0.50%	0.671	-2.54%	-3.439#	1.08%	1.469$	0.76%	1.104
13	1.59%	1.074	-0.09%	-0.059	0.90%	0.756	-0.12%	-0.102	0.92%	0.851	-0.02%	-0.029	0.27%	0.325	0.36%	0.478	-0.93%	-1.256	0.38%	0.521	1.87%	2.527@	0.77%	1.121
14	-0.70%	-0.472	-1.88%	-1.234	-1.81%	-1.508$	1.28%	1.092	0.29%	0.265	1.70%	2.012*	-0.01%	-0.018	0.19%	0.251	-0.06%	-0.080	-1.03%	-1.400$	-0.84%	-1.133	-1.36%	-1.964*
15	0.10%	0.068	-1.44%	-0.947	0.47%	0.393	0.89%	0.756	0.19%	0.174	-0.47%	-0.553	-0.82%	-0.998	-0.35%	-0.462	-0.49%	-0.669	-1.37%	-1.851*	-0.08%	-0.105	0.58%	0.839
16	0.71%	0.478	2.11%	1.387$	-0.76%	-0.634	1.90%	1.624$	0.19%	0.179	-0.89%	-1.051	-0.49%	-0.592	-0.05%	-0.067	-0.27%	-0.369	-0.72%	-0.978	-0.95%	-1.284$	0.52%	0.753
17	1.11%	0.753	0.77%	0.505	-1.18%	-0.984	-0.63%	-0.540	0.16%	0.150	-1.31%	-1.558$	-1.87%	-2.268*	0.25%	0.332	0.68%	0.916	-2.18%	-2.953@	-0.10%	-0.131	0.87%	1.254
18	0.43%	0.289	0.14%	0.091	-0.58%	-0.483	0.75%	0.638	0.80%	0.736	-0.52%	-0.614	0.53%	0.644	-0.33%	-0.432	-0.36%	-0.481	1.08%	1.456$	-0.09%	-0.119	0.37%	0.535
19	-1.18%	-0.797	-0.80%	-0.524	-0.60%	-0.502	0.07%	0.059	-0.22%	-0.204	0.26%	0.308	0.51%	0.616	-0.48%	-0.632	-0.74%	-1.000	1.85%	2.508@	-1.33%	-1.806*	-0.05%	-0.070
20	-0.89%	-0.598	-3.78%	-2.487@	0.89%	0.746	0.11%	0.094	1.03%	0.952	-0.32%	-0.380	0.55%	0.662	0.48%	0.633	1.61%	2.173*	-0.85%	-1.144	0.14%	0.195	-0.27%	-0.391

The symbols $,*,@, and # denote statistical significance at the 0.10, 0.05, 0.01 and 0.001 levels, respectively, using a 1-tail test.

Note: This table shows daily abnormal returns (column a) and test statistics (column b) beginning 20 days before and extending 20 days after the event date, which is centered at $\tau = 0$

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