THREE ESSAYS ON FINANCIAL ECONOMICS

by

YASEEN SALAH ALHAJ-YASEEN

B.A., Applied Science University, 1999
M.A., Arab Academy for Banking and Financial Sciences, 2001
M.A., Texas Tech University, 2006

AN ABSTRACT OF A DISSERTATION

submitted in partial fulfillment of the requirements for the degree

DOCTOR OF PHILOSOPHY

Department of Economics
College of Arts and Sciences

KANSAS STATE UNIVERSITY
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Abstract

For a unique sample of Israeli stocks that went public in the U.S. and then cross-listed in the home market, Tel Aviv Stock Exchange (TASE), this dissertation consists of three essays examining the dynamics of return spillovers and volume-return interactions across markets and the valuation effect around the event of cross-listing and delisting from the home market. In Chapter II, I investigate the role of trading volume in the information flow and return spillovers between the U.S. and Israeli markets. Findings suggest that the dynamics of volume-return interactions across markets can provide us with valuable information regarding future price movements, which can be a useful tool to predict future returns. I also find the home market to dominate the host market in pricing these stocks, which is consistent with the Home Bias hypothesis. In Chapter III, I analyze the impact of the event of cross-listing on stock returns and risk exposure. The behavior of abnormal returns around the cross-listing date implies that cross-listing in TASE is an effective mechanism in reducing market segmentation between the U.S. and the Israeli capital markets. Risk assessment following the cross-listing suggests a decline firms' overall risk exposure, indicating a higher degree of integration between the two markets due to cross-listing. In Chapter IV, I evaluate changes in the cost-of-capital for Israeli firms after delisting voluntary from TASE, the home market, while maintaining their listing in the U.S., the host market. The results show a significant positive shift in U.S. and negative shift in Israeli market risk exposure after the delisting. These results indicate that firms delisting form their home market (TASE), face greater risk exposure, higher required returns on their stocks and, hence, higher cost-of-capital after delisting.

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For a unique sample of Israeli stocks that went public in the U.S. and then cross-listed in the home market, Tel Aviv Stock Exchange (TASE), this dissertation consists of three essays examining the dynamics of return spillovers and volume-return interactions across markets and the valuation effect around the event of cross-listing and delisting from the home market. In Chapter II, I investigate the role of trading volume in the information flow and return spillovers between the U.S. and Israeli markets. Findings suggest that the dynamics of volume-return interactions across markets can provide us with valuable information regarding future price movements, which can be a useful tool to predict future returns. I also find the home market to dominate the host market in pricing these stocks, which is consistent with the Home Bias hypothesis. In Chapter III, I analyze the impact of the event of cross-listing on stock returns and risk exposure. The behavior of abnormal returns around the cross-listing date implies that cross-listing in TASE is an effective mechanism in reducing market segmentation between the U.S. and the Israeli capital markets. Risk assessment following the cross-listing suggests a decline firms' overall risk exposure, indicating a higher degree of integration between the two markets due to cross-listing. In Chapter IV, I evaluate changes in the cost-of-capital for Israeli firms after delisting voluntary from TASE, the home market, while maintaining their listing in the U.S., the host market. The results show a significant positive shift in U.S. and negative shift in Israeli market risk exposure after the delisting. These results indicate that firms delisting form their home market (TASE), face greater risk exposure, higher required returns on their stocks and, hence, higher cost-of-capital after delisting.

Table of Contents

List of Figures

List of Tables

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Dedication

To my Mom, Dad, Wife, and Daughter, for without your love and support this would never have been achievable.

CHAPTER 1 - Introduction

Raising capital is an essential need for any firm. A firm goes public by selling its initial public offerings (IPOs) in stock exchanges in order to raise required capital to finance its business operations. The majority of firms list their IPOs in their local market exchanges, where it is easy for local investors to obtain information about their businesses, especially if those firms are new in the market. However, if the local market is small, relatively new, and has limited liquidity, then the local market is not sufficient to meet large firms' capital needs. In that situation, firms will bypass their home market and go public abroad by listing their IPOs in foreign stock exchanges. Going public abroad is different from cross-listing; cross-listing means having a stock available in more than one stock exchange for trade. That is, after going public in a stock exchange, the stock can be cross-listed in other exchanges.

The typical case of cross-listing is when a firm goes public in its local market and cross-lists its stocks in other foreign stock exchanges afterword. The atypical case of cross-listing is when a firm goes public abroad in a foreign stock exchange, and further cross-lists its stocks in other stock exchanges abroad or in its own home market's stock exchange. The atypical cross-listing in other stock exchanges, not the home market, indicates that these firms are seeking further growth and expansion in other markets outside the host market[1]. However, cross-listing in the home market does not carry any additional information about further growth or expansion in firms' operations, since these firms were already established in their home markets.

Several benefits of cross-listing are reported in the international cross-listing literature. The main and most important benefit is raising capital. Cross-listing can also reduce the cost of

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[1] Valero et al. (2009) is the first to investigate this trend.

capital when exposing the stock to different market risks and becoming more diversified, reducing its overall risk exposure and expected returns (Foerster and Karolyi, 1999). In addition, cross-listing increases the firm's ability to improve its affiliation with the host market participants, and improves the visibility of its products in the host market (Saudagaran, 1988). Finally, cross-listing helps firms to improve and verify their quality when meeting the higher disclosure requirements and accounting standards mandatory by the host market (Fuerst, 1998).

The literature of international and local typical cross-listing[2] is saturated with studies that evaluate the benefits of the aforementioned cross-listing[3]. These studies also investigate different aspects related to international cross-listing, such as changes in stock prices, overall risk exposure, and the cost-of-capital around the event of cross-listing. In addition, they study the direction of information flow, spillover effect, and the pricing discovery process in the home and the host markets[4]. However, all the attention was directed toward typical cross-listing. The first study that focuses on the atypical cross-listing is Valero et al. (2009). They examine a sample of foreign stocks that went public in the U.S. and later seek further listing in other foreign markets beyond the U.S., but not the home market.

In this thesis I focus on a unique sample of Israeli firms that went public in the U.S. and further cross-list their stocks in the home market, Tel Aviv Stock Exchange (TASE). In the second chapter, I examine the valuation effect of the cross-listing event on the abnormal returns and risk exposure of the cross-listed Israeli stocks. Using a traditional event study approach, I investigate changes in cumulative average abnormal returns (CAARs) for the Israeli stocks for

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[2] International cross-listing is the case in which the firm cross-list its stock in foreign markets, however, the local cross-listing is listing the stock in another stock exchange within the same market.

[3] Alexander et al. (1987), Alexander et al. (1988), Kadlec and McConnell (1994), Bekaert (1995), Bekaert and Harvey (1995), Dharan and Ikenberry (1995), Khan et al. (1995), Ko et al. (1997), Foerster and Karolyi (1998), Miller (1999), Blass and Yafeh (2001), Chan et al. (2003), Doidge et al. (2004), and Doidge et al. (2009).

[4] Refer to Karolyi (1998) for a complete survey of all studies of cross-listing.

different windows around the day of cross-listing. I also use the two-index model[5] to evaluate changes in five different risk measurements before and after cross-listing. Using this model, I find that changes in risk exposure after cross-listing in the home market varies between large and small firms.

In the third chapter of this thesis, I investigate the role of trading volume in the information flow and return spillovers between the U.S. and Israeli markets. Analyzing trading volume and its dynamics with returns can provide information that allows us to distinguish if trading in the home or host markets is motivated by speculative or hedging considerations (Llorente, Michaely, Saar, and Wang, 2002). I use volume-return interactions observed in each of the host and home markets to better understand whether trading in the Israeli and U.S. markets are based on speculative or hedging considerations. In addition, I examine the Home Bias hypothesis that implies that price movements of cross-listed stocks are motivated by information produced in the home market more than the host market. This is done by evaluating the direction and magnitude of return spillovers between the two markets using heterogeneous-agent trading models. Findings of this study support the Home Bias hypothesis and indicate that trading in the home market is motivated by speculative considerations, while trading in the U.S. market is motivated by hedging considerations.

Finally, in the fourth chapter, I evaluate changes in the cost-of-capital for a few Israeli firms after delisting from TASE, the home market, while maintaining their listing in the U.S., the host market. As mentioned above, cross-listing is shown to reduce the cost of raising capital, since it decreases the firm's risk exposure as a result of diversification. However, Karolyi (2006) says, "*After all, the cost-of-capital effect stemming from a global diversification of corporate risk*

[5] The two-index model is used by Howe and Madura (1990) to evaluate changes in overall risk facing Israeli firms around the cross-listing date.

exposures associated with a cross-listing in the U.S. is unlikely to be realized until the firm actually draws from the newly accessible capital market". Four firms of those who cross-list in the home market (TASE) delisted from it while maintaining their listing in the U.S. market. I employ two different models to examine changes in the U.S. and Israeli betas and two other risk measurements to check for changes in the cost-of-capital after delisting from the home market. I find delisting of Israeli firms that was recently cross-listed on TASE to be associated with an increase in the cost-of-capital. In addition, since the delisting is voluntary for all four firms, U.S. investors seem to act in favor of the delisting, increasing the value of the firm.

CHAPTER 2 - Cross-Listing in the Home Market after Going Public in the U.S.

Introduction

For over 80 years now, firms have been using international listing of their stocks as a successful option to raise capital. The earliest cross-listing took place in the U.S., specifically on the NYSE; on December 20, 1928, an iron-ore producer was cross-listed. Raising capital is not the only benefit firms can gain from cross-listing abroad. The literature reports several other benefits like increasing the firm's ability to improve its affiliation with the host market participants and reducing the cost of capital when exposing to different market risks and become more diversified (Karolyi, 1998). These benefits and others have motivated more firms to cross-list their stocks from less organized markets to more organized and developed markets or the other way around, though the latter trend is not as significant.

This international cross-border listing trend has led some firms to bypass their home market and list their IPOs on foreign stock exchanges to distinguish themselves from other locally listed stocks and get the benefits of being listed on major exchanges abroad. These firms are well-established and large in their home countries, and they maintained these characteristics in the host market. Being listed on the major foreign stock exchanges, especially on the U.S., puts these foreign IPOs among the top firms since they met all U.S. stock exchanges' requirements including the high disclosure and regulatory standards (Bruner et al., 2004, Valero et al., 2009). Some of these foreign IPOs, after going public abroad, decided to expand their listing outside the initial host market seeking further growth internationally[6]. On the other hand, some firms decided to cross-list their stocks on their own home market stock exchanges.

For the most part, cross-listing abroad on foreign stock exchanges is interpreted by investors as a trial by firms to further grow and expand their operations in other markets. The literature shows that the majority of cross-listings on other stock exchanges are associated with positive pre-listing returns, reflecting the favorable view of local investors to the firm's plans of growth and international expansion. The post-listing returns, on the other hand, experience a decline due to the post-listing risk-adjustment that is expected to be lower, and as a result decreases the expected returns. These results support the market segmentation theory. This theory implies that due to the elimination of any pre-existing investment barriers between two capital markets, the expected returns and, hence, the equilibrium prices of cross-listed stocks are likely to be different after cross-listing. The theory of market segmentation is proven to hold for local stocks cross-listing on a foreign market, where the movement of international capital flow between the two markets is limited[7]. However, cross-listing in the home market after going public abroad does not offer any valuable information about further growth or expansion in the firm's operations outside the host market, especially since these firms are already established on the home market in which they are trying to cross-list their stocks. In addition, the initial listing of the foreign IPOs abroad is expected to reduce the investment barriers between the home and host markets, and to function as a mechanism to increase the integration between the two markets over time.

In this study I analyze a sample of 34 Israeli stocks that went public on the U.S. major stock exchanges and cross-listed on the home market, Tel Aviv Stock Exchange (TASE),

[6] Valero et al. (2009) is the first to investigate this trend.

[7] Karolyi (1998) comprehensively summarized several studies with focus on the market segmentation theory.

afterword. While the majority of studies in international cross-listing focus on the impact of cross-listing on the price of the underlying shares in the home market, this study focuses on changes in the price of Israeli stocks listed in the U.S. and study their behavior around the event of cross-listing on TASE. Thus, this research analyzes the impact of cross-listing on the Israeli stocks listed on U.S. exchanges. In addition, it examines the changes in five different measurements of risk associated with cross-listing.

Literature Review

The last two decades have witnessed a growing number of studies revolving around cross-listing, most focused on the impact of the cross-listing on stock returns, liquidity, cost of capital, and risk associated with cross-listing abroad[8]. The literature can be classified into two categories: studies that evaluate the non-U.S. stocks listed in the U.S. and studies that evaluate the U.S. stocks listed abroad.

The first category includes several studies that evaluate the impact of cross-listing on the price and liquidity of foreign stocks listed on U.S. stock exchanges. For instance, Jayaraman et al. (1993) examine 95 ADRs cross-listed for the first time on the U.S. stock exchanges between 1983 and 1988. They find a significant positive abnormal return of 0.47% on the day of cross-listing. The volatility of their sample shows a significant increase by 47.83% after cross-listing. The local beta estimated using a two-factor model is decreasing and the foreign beta was increasing, but none of the changes is significant. They interpret their findings to be consistent with the expected gains that the firm can get from having access to a new capital market. They

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[8] Studies in this field include, but not limited to Alexander et al. (1987), Alexander et al. (1988), Kadlec and McConnell (1994), Bekaert (1995), Bekaert and Harvey (1995), Dharan and Ikenberry (1995), Khan et al. (1995), Ko et al. (1997), Foerster and Karolyi (1998), Miller (1999), Blass and Yafeh (2001), Chan et al. (2003), Doidge et al. (2004), and Doidge et al. (2009).

also attribute the increase in the variance to the extended trading hours after cross-listing, which allows for more information revelation. Foerster and Karolyi (1993) analyze 53 Canadian stocks cross-listed in the U.S. between 1981 and 1990. They find a significant positive pre-listing abnormal return of 9.35%, a 1.97% positive abnormal return over the week of cross-listing, and a significant negative post-listing abnormal return of 9.71%. For their full sample they test for changes in the standard deviation and the market betas and find them both decreasing; however, these two changes are insignificant. Their overall findings are consistent with the financial market segmentation between Canada and the U.S., suggesting a positive pre-listing return and a negative post-listing return. On the other hand, Ko et al. (1997) examine 24 Japanese firms listed on the U.S. stock exchanges between 1970 and 1989 and find insignificant positive pre-listing abnormal returns and insignificant negative post-listing abnormal returns starting on the day after cross-listing, suggesting that listing on the U.S. exchanges does not have any significant effect on the value of Japanese stocks.

In the second category, studies follow the same path but focus on U.S. stocks cross-listed overseas, mainly in Canada, Europe, and Tokyo. For example, Lee (1991) examines 141 U.S. stocks cross-listed overseas between 1962 and 1986 and finds an insignificant negative pre-listing abnormal return of 0.52% and an insignificant negative post-listing abnormal return of 0.59%. His finding suggests that overseas listings are not consistently associated with negative abnormal returns over the post-listing period. Thus, the effects of foreign listings appear to be different among various overseas stock exchanges. Next, Lau et al. (1994) study 346 U.S. stocks listed on 23 foreign stock exchanges using an event study methodology. They consider three dates: the application date, the acceptance date, and the first trading day. While results are not significant for the application date and the acceptance date, they find significant positive abnormal returns for the first trading day. Finally, they test for changes in the stock returns' volatility due to cross-listing and find no significant evidence of any changes.

Recently, this topic is approached from another perspective: looking at unseasoned stocks[9] instead of the seasoned stocks addressed in the rest of the literature. Valero et al. (2009) conduct a comprehensive study regarding the behavior of cross-listed unseasoned stocks by analyzing 379 unseasoned foreign stocks from 49 countries that went public in the U.S. between 1980 and 2005. They use a standard event study approach to estimate the market model and found a positive abnormal return of 1.93% on the day before the cross-listing event abroad. The estimation of the post-listing effect of cross-listing is not part of their research, yet their finding is consistent with the rest of the literature regarding the pre-listing positive abnormal returns. Their interpretation is that U.S. investors act in favor of cross-listing abroad, since it indicates further expansion and growth of the firms' operations outside the U.S.

In summary, the previous literature supports the market segmentation hypothesis suggesting a pre-listing increase and post-listing decrease in abnormal returns, and that cross-listing increases the level of integration between the home and host markets. This theory holds for the most part when firms from emerging markets cross-list their stocks in the U.S. or other major capital markets where international capital flows from emerging markets to others are limited and notable investment barriers exist. On the other hand, the theory does not get very much support when U.S. firms cross-list abroad, since such limitations on international capital flow and investment barriers are less binding for U.S. firms. In addition, there is no evidence regarding the success of listing IPOs on foreign capital markets, going public abroad, as a

[9] *Unseasoned stock is a stock that has not been previously traded in the open markets.*

mechanism to reduce market segmentation in the case of emergent markets. The literature also seems to be devoid of studies that evaluate the risk associated with cross-listing on the home market after going public abroad.

The sample used in this study includes 34 Israeli stocks that went public in the U.S. and then cross-listed on the home market (TASE). The majority of these cross-listings appeared after October of 2000, when the TASE launched the Dual-Listing Law. The law allows Israeli stocks listed on the U.S. major stock exchanges (NASDAQ, NYSE, and AMEX) and the London Stock Exchange (LSE) to cross-list on TASE without any additional regulatory requirements. By offering extended trading hours and a wider investor base, the Israeli Security Authority (ISA) encouraged many Israeli stocks that went public in the U.S. and U.K. to cross-list on TASE. The following questions are addressed in this research. How would the abnormal returns behave when securities cross-listed on their home market? What level of risk should they expect after cross-listing? Is cross-listing on TASE an effective mechanism to reduce the market segmentation between the Israeli and U.S. markets? All firms that bypass their local markets and become international by listing their IPOs abroad will face these questions if they want to cross-list their stocks on their home markets, when their local markets become more liberalized like the Israeli market.

Cross-Listing on TASE

On October 2000, the TASE initiated the Dual-Listing Law that enables firms traded on the U.S. stock exchanges to cross-list on TASE with no additional regulatory requirements. Initially, the law was only applied to firms traded on the NYSE, the NASDAQ national market, and the AMEX. The law then was expanded to include firms traded on the London Stock Exchange (LSE) main market and firms listed on the NASDAQ small cap with a market capitalization greater than $30 million. Also, firms that seek to cross-list on TASE under the Dual-Listing Law have to be listed for at least a year on U.S. markets or LSE. The law also includes firms that have traded for less than one year but that maintain a market value exceeding $150 million.

Besides having access to raise capital on TASE, the cross-listed stocks on TASE can benefit from the extended trading hours offered to Israeli investors on the cross-listed stocks. Trading on TASE starts at 10:00 am and the U.S. stock exchanges open at 4:00 pm Israeli time, which is almost when trade ends on TASE. Trade continues in the U.S. market until 11:00 pm Israeli time, giving the Israeli investors the advantage of continuous trading for 13 hours on the cross-listed stocks. Furthermore, Israeli investors can trade the cross-listed stocks on U.S. holidays.

To cross-list on TASE, firms have to submit a simple listing application to TASE and receive TASE’s approval for listing. No other approvals are required, and firms are not required to pay TASE listing fees or annual fees for the first year of cross-listing. After cross-listing, firms are expected to continue filing their quarterly, semi-annually, and annually reports as well as news releases in the U.S., with the Israeli Securities Authority (ISA). In addition, all financial reports must be filed according to the U.S. time schedule. In summary, if a company is originally listed in the U.S. or London exchanges and decides to cross-list on TASE, the firm will not experience any changes in its accounting practices or disclosure requirements. Clearly, the Israeli Security Commission (ISC) eliminated any possible barriers that might impede Israeli firms from cross-listing their stocks on TASE. Finally, to delist from TASE, firms need to give three months’ notice in advance.

Data and Methodology

This section presents the raw data of the research. It also explains the research methodology, focusing on the different models used to answer the research questions.

Data

Initially, 78 Israeli stocks went public in the U.S., only 50 of which cross-listed on the home market exchange (TASE). My sample is identified from the official website of TASE, which offers a complete list of all dual-listed stocks in the U.S. and in other foreign stock exchanges around the world. To include an Israeli stock in the sample, the following three criteria are used:

(1) The Israeli stock is cross-listed on TASE only after going public on one of the major U.S. stock exchanges.

(2) Each Israeli stock has at least 501 days of closing prices on the U.S. stock exchanges, 250 days before cross-listing, and 250 days after cross-listing.

(3) A confirmed date for the day of cross-listing on TASE must be available.

The final sample includes a total of 34 Israeli stocks, 31 of which are listed on the NASDAQ, two on the NYSE, and one on the AMEX. Table 2.1 shows a list of the 34 Israeli stocks that went public on the U.S. stock exchanges and then cross-list on their home market (TASE).

This study uses daily adjusted closing prices for Israeli stocks listed in the U.S. The U.S. data is obtained from the Center for Research in Security Prices (CRSP), while the Israeli data is from the official website of TASE. The first trading day on TASE for cross-listed stock is obtained from the official website of TASE.

Methodology

To examine the impact of cross-listing on stock returns, the event study approach, described in Brown and Warner (1980), Brown and Warner (1985), and MacKinlay (1997), are used. The market model is used to calculate the abnormal returns of cross-listed stocks around the event of interest as follows:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it} \quad (1)$$

$$E[\varepsilon_{it}] = 0 \qquad Var[\varepsilon_{it}] = \sigma^2_{\varepsilon_i}$$

where R_{it} is the rate of return of stock *i* at day *t*; R_{mt} is the rate of return of the U.S. market at day *t*; ε_{it} is the error term with expected value of zero. The parameter β_i measures the sensitivity of the i^{th} stock's returns, R_{it}, to the market's returns, R_{mt}. Finally, the S&P500 market index is used to calculate the U.S. market return for this study.

To calculate the abnormal returns, the coefficients, α_i and β_i, are estimated using Ordinary Least Squares over the estimation window from day -250 to day -32, relative to the event of cross-listing at *t=0*. Then I forecast the expected returns for two event windows. The first is an event window around cross-listing with 41 observations, starting from day -20 to day +20 relative to the cross-listing date at *t=0*. The second is a post-listing window starting at day +21 to day +50. The abnormal return is the difference between the observed and the estimated returns as follows:

$$AR_{it} = R_{it} - (\hat{\alpha}_i + \hat{\beta}_i R_{mt}) \ . \quad (2)$$

To assess the daily abnormal returns of the 34 Israeli stocks, I averaged the summation of their daily abnormal returns as follows:

$$AAR_t = \frac{\sum_{i=1}^{N} AR_{it}}{N}$$

where N is the number of stocks, N=34.

Finally, to accumulate the AAR_t through time for a window starting at T_1 and ending at T_2, the cumulative average abnormal returns (CAARs) can be defined as follows:

$$CAAR_{T_1,T_2} = \frac{1}{N}\sum_{i=1}^{N}\sum_{t=T_1}^{T_2} AR_{it}$$

$$\text{or} \quad CAAR_{T_1,T_2} = \sum_{t=T_1}^{T_2} AAR_t \qquad (3)$$

The market segmentation hypothesis tested in this study is detailed below:

> **Hypothesis 1**: If the Israeli and the U.S. capital markets are segmented, cross-listing on the Israeli market should lead to higher abnormal returns around listing and lower post-listing abnormal returns. However, if the two markets are integrated, cross-listing should not affect the stock prices and should not change the expected stock returns.

To calculate the z-Statistic values for the accumulative abnormal returns, the Patell (1976) test is used[10]. The Patell test is considered a standardized abnormal returns test and was used by Linn and McConnell (1983) among others.

This study also employs the single and two-index models, used by Howe and Madura (1990), to estimate changes in the U.S. and Israeli betas around cross-listing. Equations (4) and (5) show the single and two-index models, respectively.

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[10] The method is explained in details in appendix A of Eventus user's guide, version 8 by Arnold R. Cowan, 2007.

$$R_{it} = \alpha_i + \beta_i^{US-Single} R_{mt,US} + \varepsilon_{it} \quad (4)$$

$$R_{it} = \alpha'_i + \beta_i^{US-Two} R_{mt,US} + \beta_i^{ISR-Two} R_{mt,ISR} + \varepsilon'_{it} \quad (5)$$

where R_{it} is the rate of return of stock *i* at day *t*; $R_{mt,US}$ is the rate of return of the U.S. market at day *t*; $R_{mt,ISR}$ is the rate of return of the Israeli market at day *t*; ε_{it} and ε'_{it} are the error terms with an expected value of zero. The parameters $\beta_i^{US-Single}$ and β_i^{US-Two} represent the U.S. market betas, and they measure the sensitivity of the i^{th} stock's returns to the U.S. market's returns, $R_{mt,US}$. The coefficient $\beta_i^{ISR-Two}$ represents the Israeli market beta, and it measures the sensitivity of the i^{th} stock's returns, R_{it}, to the Israeli market's returns, $R_{mt,ISR}$. The market indexes S&P500 and TA100 are used to calculate the U.S. and Israeli market returns, respectively, for this study.

To estimate U.S. and Israeli betas, this study uses a 250-day pre-listing window and a 250-day post-listing window to estimate the U.S. and Israeli betas. The Howe and Madura's (1990) approach is followed in identifying changes in five different risk characteristics due to cross-listing. In addition to both markets' betas, they analyze changes in the standard deviation, R-square, and residual variance around listing.

The hypotheses used to test for risk assessment around cross-listing are as follows:

Hypothesis 2A: If the Israeli and the U.S. capital markets are segmented, cross-listing on TASE should decrease the stock returns' sensitivity to the U.S. market. That is, cross-listing should decrease $\beta_i^{US-Single}$ and β_i^{US-Two}. However, if markets are integrated, cross-listing should not yield any changes in the U.S. betas.

Hypothesis 2B: If the Israeli and the U.S. capital markets are segmented, cross-listing on TASE should increase the stock returns' sensitivity to the Israeli market. That is, cross-listing should increase $\beta_i^{ISR-Two}$ after cross-listing. However, if markets are integrated, cross-listing should not yield any changes in the Israeli beta.

Hypothesis 2C: If cross-listing on TASE results in an increase in the standard deviation of stock returns, then cross-listing increases the uncertainty of future returns and exposes the stock to a higher level of risk[11]. However, if the standard deviation decreases after cross-listing, then cross-listing decreases the level of uncertainty, implying a more diversified investment that carries a lower level of risk.

The value of R-square represents a measurement of how closely the stock's performance correlated with the performance of the market index, and thus a measurement of what proportion of its performance can be ascribed to the performance of the market index. The value of R-square ranges from 0 to 1. A high R-square indicates the security's performance patterns have been in line with the market index, and a low R-square indicates the security's performance does not act much like the market index. Hence, a value for R-square of 0 indicates no correlation between the security's returns and the market index, and value of 1 indicates perfect correlation.

Hypothesis 2D: In the single-index model, equation 4, if R-square declines after cross-listing, showing less correlation between the stock's returns with the U.S. market, then cross-listing created a greater level of integration between the U.S. and Israeli markets. In the two-index model, equation 5, if R-square increases after cross-listing, indicating greater correlation between the stock's returns and the Israeli market index,

[11] Standard Deviation is used here as a measurement of the risk associated with each stock before versus after cross-listing, and it is calculated for each stock individually and then averaged for the full sample.

then cross-listing created a greater level of integration between the U.S. and Israeli markets.

Information asymmetry in cross-listing occurs when investors in one market have an information advantage over investors on the other market. Howe and Madura (1990) suggest that cross-listing is expected to decrease the level of information asymmetry given the same stock is available in both markets because this lowers the cost of obtaining information. As a proxy for information asymmetry, the residual variance has been compared by Demsetz (1986) before and after cross-listing. This study follows the Demsetz's approach and uses the residual variance obtained from the two-index model, equation 5, as a proxy to register changes in the level of the information asymmetry before and after cross-listing.

Hypothesis 2E: If the residual variance decreases after cross-listing, then the level of information asymmetry declines, suggesting a greater level of integration after cross-listing.

Finally, changes in foreign exchange risk are estimated using a multi-factor model, to uncover changes in the stock returns' sensitivity to foreign exchange variation. Several studies report the important influence of foreign exchange rate movements on expected stock returns. For example, Foester and Karolyi (1999) find a post-listing significant increase in the sensitivity of stock returns to the fluctuations in the foreign exchange rate. Equation (6) represents the multi-factor model used in this study.

$$R_{it} = \alpha_i'' + \beta_i^{US-Multi} R_{mt,US} + \beta_i^{ISR-Multi} R_{mt,ISR} + \beta_i^{Exchange} R_{t,ISR-US} + \varepsilon_{it}'' \quad (6)$$

where R_{it} is the rate of return of stock *i* at day *t*; $R_{t,ISR-US}$ is the rate of return of the foreign exchange rate at day *t*. The parameter $\beta_i^{Exchang}$ measures the sensitivity of the i^{th} stock's returns, R_{it}, to the foreign exchange rate returns, $R_{t,ISR-US}$. The same pre-listing and post-listing windows of 250-day, before and after cross-listing, are used to estimate changes in the $\beta_i^{Exchang}$ around the listing date.

The hypothesis used to test for foreign exchange risk exposure follows:

> **Hypothesis 3**: If cross-listing increases the stock returns' exposure to foreign exchange risk, the foreign exchange beta should increase after cross-listing. Otherwise, there should not be any significant change in the foreign exchange beta $\beta_i^{Exchang}$ observed.

Empirical Evidence

For non-U.S. firms, Switzer (1997) finds that the importance of a cross-listing announcement comes from its strong indication of the management's confidence in their firms' global operations. Moreover, the cross-listing application acceptance carries another positive sign, this time by the foreign stock exchange, regarding the firm's ability to compete internationally by cross-listing abroad. Lau at el. (1994) find that price reactions are most likely to happen on the first trading day and not on either the cross-listing application or acceptance dates. Their sample consists of U.S. firms cross-listed abroad, and their findings indicate that, for non-U.S. firms, cross-listing in the U.S. carries important information about the firm's quality and its potential growth internationally. Furthermore, if filing an application for cross-listing carries valuable information, then it is even more important to get accepted, given that cross-listing acceptance refers to the quality of the firms attributed by the host market stock exchange.

However, these findings are not expected to be the same for stocks listed initially in the U.S. and then cross-listed abroad. These stocks are traded in the U.S. by meeting all the U.S. stock exchanges' requirements and their high standards. For unseasoned stocks listed in U.S. and then cross-listed abroad, Valero at el. (2009) analyzed the stocks' behavior around the listing day rather than the announcement dates due to difficulties in identifying the exact announcement dates. Out of 209 cross-listed stocks in their full sample, they identify the exact cross-listing dates for only 46 stocks, finding significant positive average abnormal returns on the day before cross-listing and a significant positive accumulative average abnormal return on the day of cross-listing.

For my sample, cross-listing announcements and application acceptance are found to be unimportant for two reasons. First, the unseasoned Israeli stocks are originally listed in the U.S., and they have met all capital and disclosure requirements required by the U.S. exchanges. This shows that the firms are international, and so a cross-listing announcement on the home market (TASE) will not convey any valuable information about their confidence in their global operations, nor does such an announcement indicate further growth. Second, the Israeli Dual-Listing Law allows all stocks listed on the major U.S. stock exchanges to cross-list on TASE with no further disclosure requirements or changes in their accounting standards. Hence, the acceptance of the cross-listing applications is a consequential result when Israeli firms file the cross-listing application on TASE. Thus, this research focuses on the event of cross-listing, and it measures the evaluation effect around the first trading day on TASE.

Abnormal Return and Market Segmentation

Unlike other studies that use monthly and weekly data to evaluate the effect of cross-listing on the underlying stock prices in the home market, I use daily data in this study. Table 2.2 presents the AAR, CAAR, and z-statistic of an event window (-20, +20). The table also shows the CAAR and z-statistic for various pre-listing windows. Results show that cross-listing of the Israeli stocks on TASE is associated with positive abnormal returns on their counterparts listed in the U.S. market. On the day upon cross-listing, the Israeli stocks gained an AAR of 2.18% with z-statistic of 3.92 and CAAR of 6.8% with z-statistic of 2.36. Ultimately, starting from day -1 all the way through day +20 relative to cross-listing day at $t=0$, CAARs are positive and statistically significant with a 7.3% CAAR on the first day of trading on TASE.

For other pre-listing windows, the AARs are accumulated over different windows of interest. The goal of showing these different windows is to evaluate a portfolio performance that strictly invests in these stocks over different periods of time before and after cross-listing. For instance, for the interval (-5,-1) CAAR is 4.5%, which means that the accumulated AAR starting from day -5 to day -1 yields 4.5%. The same approach is taken to calculate CAARs for the other pre-listing windows shown in table 2.2. Accumulating the average abnormal returns from day -5, -3, or -1, relative to the cross-listing date, yields significant positive CAAR that are all significant at the 1% level. These results suggest that U.S. investors act in favor of cross-listing of Israeli stocks on TASE. Although the Israeli stocks are listed in the U.S., they still can benefit from their popularity on TASE where they are very well-known. This factor plays a major role in cross-listing on TASE where it offers additional opportunity to raise capital.

Previous research has found that a significant decline in stock returns is associated with the period following cross-listing. Table 2.3 shows the daily AAR, CAAR, and z-statistics for the post-listing window (+21, +50). Results show that all CAARs on the post-listing window (+21, +50) are negative, and they are significant for the most part. Starting at day +29, CAARs are negative and statistically significant for almost all the post-listing window through day +50. The same table shows seven other post-listing windows where I accumulated the AAR so as to look at the CAAR on day +50. Again, the CAARs for the different post-listing windows are negative in all of them but are statistically significant for only three windows. These results support the market segmentation theory, suggesting that the listing of the Israeli stocks on TASE is an effective mechanism to reduce market segmentation.

Initially, there was no convincing explanation for the significant post-listing decline of the abnormal returns, although several hypotheses were offered to solve what is called the post-listing anomaly (Baker et al. 1994). One hypothesis argues that the decline in stock prices following cross-listing can be attributed to the increase in the shareholder base. For example, Forster and Karolyi (1999) link the post-listing decline in CAAR to the increase in the shareholder base caused by the new capital raised by the cross-listed stocks. Another hypothesis attributes the post-listing decline to management's timing of cross-listing to follow superior performance in the company's operations; most studies appear to support this hypothesis. Dahran and Ikenberry (1995), as well, argue that firms are most likely to time their cross-listing application to follow their good performance. They show that post-listing decline in stocks' returns is confined to small firms that time their cross-listing with their good performance, which leaves their stocks exposed to a decline after cross-listing. On the other hand, they find that large firms show no evidence of a post-listing decline in their stocks' returns.

To test the management timing hypothesis, the full sample is divided into two subsamples. The first includes large firms, while the other one includes small firms. For a firm to be in the large firm subsample, it has to be listed on the TA100 index, which includes the 100 stocks with the highest market capitalization listed in TASE. The rest of the stocks are classified as small firms. My final sample consists of 15 large firms and 19 small firms. All Israeli stocks included in my subsamples qualified to cross-list on TASE without any further disclosure requirements whether they are large or small firms. Therefore, if a small firm timed its cross-listing to follow a good performance, one would expect a significant decline in its stock returns. However, this decline should not exist or be as large for large firms.

Table 2.4 shows CAARs for the two subsamples for the same post-listing window that I use for the full sample (+21, +50). Small firms have negative CAARs through the whole post-listing window, and for the most part, these CAARs are significantly negative from day +26 through day +50. On the other hand, the post-listing windows of large firms have positive CAARs for days from +21 to +33, but they are insignificant except for day +21 that has 2.4% CAAR. After day +33, large firms started experiencing negative CAARs through day +50, but none of the CAARs is significant. This indicates that the post-listing decline in AAR does not exist for large firms, while it does for small firms.

This finding is consistent with Dahran and Ikenberry (1995) who find that significant decline in CAAR is restricted to small firms only. Results in table 2.4 suggest that, indeed, small Israeli firms time the cross-listing of their stocks on TASE to follow their good performance explaining the significant decline in their post-listing abnormal returns. Finally, Figure (1) shows CAARs starting from day 0 for both large and small firms, where both types of firms experience positive abnormal returns due to cross-listing. However, small firms' stocks lost all their gains on day +12 after cross-listing, while large firms' stocks maintained positive gains for 50 days after cross-listing.

These findings support Foester's and Karolyi's finding that attributed the post-listing decline to "company-specific factors". Thus post-listing decline on the Israeli stock returns is most likely caused by the same factors that created the positive pre-listing returns. Ultimately, a firm's good performance motivates management to cross-list their stocks on other capital markets to gain the most of this temporary outstanding performance. This finding might not apply to large firms, but clearly it does to small firms.

Risk Assessment

Using models (4) and (5), this study estimates five different risk measurements listed in table 2.5: the U.S. and Israeli betas, standard deviation (S.D.), R-square, and residual variance (R.V.) for the full sample before and after cross-listing on TASE. Both U.S. betas from the single- and two-index models decrease by 29.81% and 26.65%, respectively, and both declines are statistically significant, indicating a decline in the stock's returns sensitivity to the U.S. capital market after cross-listing on TASE.

On average, the Israeli betas decrease, indicating a reduction in the sensitivity of the stock's returns to the Israeli market index; however, this decline statistically is insignificant. Furthermore, standard deviation shows a post-listing decline of 24.15% that is statistically significant, and it implies a decrease in the level of uncertainty and risk associated with stock returns after cross-listing. Shifts in R-squares after cross-listing are consistent with the 2D hypothesis, where R-square of the single-index model (R^2-Single) decreases and the two-index model (R^2-Two) increases. However, only changes in R^2-Single are significant, suggesting less correlation of the stock returns to the U.S. market index after cross-listing on TASE, which further supports the market segmentation theory. Finally, the residual variance significantly declines by 41.38%, implying a large reduction in the level of the information asymmetry due to cross-listing.

Above results suggest that cross-listing decreases the overall risk of the stock's returns and reduces the expected return by U.S. investors, which further indicates a reduction in the cost of raising capital. Unfortunately, the post-listing decline of the Israeli beta needs further investigation to uncover the factors behind such a shift. Although the decline is insignificant, changes in the Israeli betas for each firm individually yield ambiguous results[12]. To further investigate the negative change of the Israeli beta or the decline in stocks' average returns sensitivity to the Israeli market, two hypotheses are proposed. The first hypothesis attributes the decline of sensitivity, Israeli beta, to the trading noise around cross-listing day caused by the cross-listing announcement or other signals that it delivers to U.S. investors. As the cross-listing is announced, U.S. investors become informed traders and they act based on it.

To test the trading noise hypothesis, two 100-day windows around the listing date, figure 2, are eliminated, one before and one after the cross-listing date, to remove any possible noise caused by cross-listing or its announcement. Although the announcement dates are not known for my sample, it is reasonable to assume that the cross-listing announcement will take place any time within 100 trading days, almost 4 months, prior to cross-listing date. On the other hand, after 100 trading days, the consequences of the cross-listing action should be minimized, and the stock returns are expected to be driven by the new market factors. The two-index model is regressed over two windows; the first is (-250, -101), and the second is (+101, +250) relative to the cross-listing date at t=0. If the Israeli beta increases, then the sensitivity of the stock returns to TASE will have increased as well, and we can conclude that trading noise theory holds and that cross- listing reduces segmentation and risk exposure.

The results of the above test are presented in table 2.6 where the Israeli beta is still decreasing while the U.S. beta is increasing. Other risk measurements' movements are consistent with my earlier findings where standard deviation is decreasing, R-square is decreasing, and residual variance is decreasing. These results do not support the trading noise hypothesis;

[12] Some of the firms experience an increase, and others experience a decrease but with different magnitudes.

however, the results supports my earlier assumption that cross-listing announcements, for my sample, do not convey any valuable information for which we need to allow.

Another issue that can be considered under the trading noise hypothesis is the inclusion of firms cross-listed during the stock market crash of 2002. Including firms cross-listed in 2002 may cause upward biases in the volatility measurements and in turn might affect the Israeli betas or other risk measurements. So, my full sample is sorted by the year of listing to check for changes in the risk measurements from one year to another.

The results in table 2.7 show the five different risk measurements introduced earlier sorted by the year of cross-listing in TASE[13]. The Israeli beta here is increasing around cross-listing for all years except 2001 and 2002, and it is only decreasing significantly in 2002 by 56.19%, indicating that the stock market crash in 2002 played a major role in changing the sensitivity of the stock returns to TASE. The large significant decline in R-square of the two-index model, in 2002 only, further supports this view.

A second hypothesis offered to interpret the decline in the Israeli beta after cross-listing is that the intention of cross-listing on the home market by the Israeli firms varies between large and small firms, or at least that is how U.S. investors interpret it. As mentioned earlier, one of the main purposes of cross-listing is raising capital; most researchers in this field agree on this as cross-listing provides the firm with access to another capital market. Hence, one can interpret cross-listing as a signal indicating that the firm cannot get all the capital it needs from the market in which it is currently listed, forcing the firm to cross-list abroad to raise the necessary capital.

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[13] One firm was cross-listed in 2007, and hence it is not included as part of our calculations in this table. The number of firms listed in TASE each year between 2000 and 2007 are two, seven, seven, two, five, four, six, and one, respectively.

The intentions are different, though, between large and small Israeli firms cross-listing on TASE. For large Israeli firms, raising capital is most likely not the major goal behind cross-listing at home market as they have the ability to raise capital in the U.S. market. Instead, for them, cross-listing is a smart decision to reach local Israeli investors and have a foot in their home market. Conversely, small firms cross-list because they are striving to get more capital. If they are unable to obtain it from the capital market in which they are listed, they will seek it by cross-listing on other capital markets. The results in section 3.5.1, regarding management's timing of cross-listing, support the hypothesis of the different intentions behind cross-listing by small versus large firms. Thus, U.S. investors read the cross-listing signal of small firms in the Israeli capital market as a failure to raise needed capital in the U.S. market. However, cross-listing reveals positive signal in the case of large firms as they are very well established in both the Israeli and the U.S. markets and raising capital for them is not a priority goal when cross-listing.

The signal sent by firms' management when cross-listing on TASE will be reflected in the movement of the Israeli beta after cross-listing. If the signal is negative, then the U.S. investors do not act in favor of listing the stock on TASE, and hence the Israeli beta should experience a post-listing decrease. The same applies for a positive signal suggesting that U.S. investors indeed act in favor of the cross-listing, and the Israeli beta should show a post-listing increase. To test my hypothesis, the full sample is split into small and large firms, and the single- and two-index models are used to test for the changes in the Israeli betas, $\beta_i^{ISR-two}$.

The results presented in table 2.8 support the hypothesis of differences in the cross-listing intentions between small and large firms. The Israeli betas, on average, are significantly decreasing for small firms but insignificantly increasing for large firms. The declining beta can be attributed to a negative signal sent when cross-listing is done by small firms. As expected, large firms' increase in the beta is not significant, suggesting neutral response, by U.S. investors, to the signal sent when cross-listing on TASE.

Foreign Exchange Risk

In addition to the U.S. and Israeli betas, I analyze changes in the stock return sensitivity to foreign exchange rate fluctuations. Foerster and Karolyi (1999) find that the foreign exchange beta significantly increases for most of their sample of 161 foreign stocks listed in the U.S. Their finding supports the growing amount of evidence in favor of the importance of foreign exchange risk on stock returns when cross-listed abroad.

To test the magnitude of the impact of the foreign exchange rate on the stock returns around cross-listing, a multi-factor model, equation 6, is used to capture changes in the sensitivity of the stock returns to changes in the foreign exchange rate. Hypothesis 3 is tested over a pre-listing window (-250,-1) and a post-listing window (+1, +250) to obtain the results presented in table 2.9. The sensitivity of stock returns to the foreign exchange rate significantly increases following cross-listing, suggesting the importance of foreign exchange risk exposure.

In January 1, 2003 the new Israeli shekel became a freely convertible currency. This shock is expected to have had an effect on the cross-listed stock returns as the floating exchange rate is expected to be more volatile than the fixed exchange rate. To study whether such a shock affects the cross-listed stocks' returns before and after 2003, the full sample is divided into firms cross-listed before and after 2003 and regressed using the multi-factor model, equation 6, over the pre- and post-listing windows[14]. Table 2.10 shows that the foreign exchange rate beta increased by 256.43% pre- versus post-listing for firms cross-listing in TASE after 2003; while

[14] Before 2003, 16 firms cross-listed and 18 firms cross-listed after 2003.

this increase is only 189.63% for firms cross-listed before 2003. This finding suggests that the foreign exchange rate is a major risk factor affecting the stock returns of firms considering cross-listing on their home market

Conclusion

Unlike foreign cross-listing in the U.S., cross-listing of U.S. stocks abroad shows either neutral or slightly positive pre-listing abnormal returns around the cross-listing. However, further cross-listing of stocks that went public in the U.S. show a positive pre-listing market reaction around the cross-listing date. Moreover, post-listing market reaction seems to be negative for all cases of cross-listing, though large firms show less evidence of decline in their post-listing abnormal returns.

Using a sample of Israeli stocks that went public in the U.S. and the cross-listed in their home market, the results show similar price reactions to those of the other stocks when cross-listing abroad. Cross-listing of the Israeli stocks on their home market (TASE) is associated with significant positive accumulative average abnormal returns (CAARs) on the day before cross-listing (6.8%) and on the day of cross-listing (7.3%). This suggests that U.S. investors act in favor of Israeli firms' decisions to cross-list their stocks on TASE, driving up the stocks' prices up.

The post-listing results are consistent with the rest of the literature, where I find significant negative CAARs on the post-listing window of (+21, +50) relative to the day of cross-listing, $t=0$. Such post-listing negative CAARs can be attributed to the increase in the shareholder base after the cross-listing. To uncover other possible explanations of the post-listing decline in the stocks' returns, the full sample is split into large and small firms based on the firm's market capital. Small firms' stocks lost all their gains on day +12 after cross-listing, while large firms' stocks maintained positive gains for 50 days after cross-listing. This finding supports the hypothesis of management timing of cross-listing, where small firms tend to time their cross-listing to follow a superior performance.

Risk associated with cross-listing is evaluated by using different risk measurements used by Howe and Madura (1990). The U.S. betas' significant decline after cross-listing is consistent with prior studies that find a decrease in the stock returns' sensitivity to the U.S. market after cross-listing. In addition, a significant decrease is observed in standard deviation, R-square of the single-index model, and residual variance, implying that cross-listing is an effective mechanism in decreasing market segmentation and reducing the risk exposure. Unfortunately, the shift of the Israeli beta after cross-listing is not consistent with the rest of my findings. One would expect it to increase after cross-listing, but in practice it declines instead.

My findings suggest that firm's market capitalization plays a role in the decline in the Israeli beta. The U.S. investors seem to interpret cross-listing of small firms as a sign of failure to raise capital in the U.S. pushing the firms to cross-list on TASE. Evidence supporting this hypothesis shows that the decline in the Israeli beta is limited to small firms and not large firms. However, there is little evidence to support the contribution of the Israeli market in the stocks' returns movements.

The results of this study are noteworthy for several reasons. First, the importance of this research comes from the fact that most of the foreign IPOs listed in the U.S. and other major capital markets have bypassed their local market in order to certify their quality and internationality. The local stock exchanges that have been bypassed are unorganized for the most part, but eventually they will become more organized and developed. Firms will have to decide whether to go back and cross-list on them or confine their listing abroad. This research provides those firms with a clear expected path of their stock's returns and the level of risk exposure they should anticipate after listing. Small firms, in particular, should expect different interpretation, than that of large firms, by the host market participants when they cross-list their stocks on the home market. Second, this research provides investors with several facts about the behavior of the foreign IPOs when cross-listing on their home markets. These results should be helpful in terms of making the right investment decisions to construct a diversified international investment portfolio.

Table 2.1 List of Israeli IPOs listed in the U.S. and cross-listed on the TASE.

	Israeli IPOs listed in U.S. and cross-listed on TASE	Date of cross-listing on TASE	Industry	U.S. stock exchange
1	ALADDIN	7/28/2004	Technology	NASDAQ
2	ALVARION	7/27/2001	Technology	NASDAQ
3	AMPAL AMER	8/8/2006	Financial	NASDAQ
4	AUDIOCODES	10/22/2001	Technology	NASDAQ
5	BLUE SQUARE ISR	11/20/2000	Services	NYSE
6	BLUEPHOENIX	1/22/2001	Technology	NASDAQ
7	B O S	1/3/2002	Technology	NASDAQ
8	CAMTEK	12/21/2005	Technology	NASDAQ
9	CERAGON	9/13/2004	Technology	NASDAQ
10	COMPUGEN	1/7/2002	Healthcare	NASDAQ
11	EZCHIP	4/1/2002	Technology	NASDAQ
12	FUNDTECH	8/19/2003	Technology	NASDAQ
13	GILAT	2/24/2004	Technology	NASDAQ
14	GIVEN IMAGING	3/25/2004	Healthcare	NASDAQ
15	INCREDIMAIL	11/23/2007	Technology	NASDAQ
16	INTERNET GOLD	3/1/2005	Technology	NASDAQ
17	JACADA	6/18/2001	Technology	NASDAQ
18	MAGAL SYSTEMS	7/2/2001	Services	NASDAQ
19	MAGIC	11/16/2000	Technology	NASDAQ
20	MIND C.T.I.	7/11/2002	Technology	NASDAQ
21	NOVA MEASURING	6/19/2002	Industrial Goods	NASDAQ
22	ORCKIT	5/21/2002	Technology	NASDAQ
23	PARTNER COMM.	7/3/2001	Technology	NASDAQ
24	PERRIGO	3/16/2005	Healthcare	NASDAQ
25	POINTER TLOC	12/19/2006	Services	NASDAQ
26	RADCOM	2/21/2006	Technology	NASDAQ
27	RADVISION	10/21/2002	Technology	NASDAQ
28	RADWARE	5/13/2004	Technology	NASDAQ
29	SAPIENS	3/6/2003	Technology	NASDAQ
30	TAT TECHNO	8/16/2005	Industrial Goods	NASDAQ
31	TOP IMAGE	12/4/2006	Technology	NASDAQ
32	TOWER SEMI.	1/10/2001	Technology	NASDAQ
33	VERIFONE	11/2/2006	Consumer Goods	NYSE
34	XFONE INC	7/24/2006	Technology	AMEX

If the U.S. stock exchanges were closed on the day of cross-listing on TASE, I use the following trading day as a date of cross-listing.

Table 2.2 Abnormal average returns (AAR) and accumulative average abnormal returns (CAAR) around cross-listing date *t=0*.

Event	AAR	z-Statistic	CAAR	z-Statistic	Other pre-listing windows	CAAR	z-Statistic
-20	0.0145**	(1.69)	0.0145*	(1.69)	(-31,-1)	0.0350	(1.26)
-19	0.0019	(0.54)	0.0164	(1.58)	(-20,-1)	0.0680***	(2.36)
-18	0.0120**	(1.99)	0.0285**	(2.44)	(-15,-1)	0.0025	(0.98)
-17	0.0256***	(4.22)	0.0542***	(4.22)	(-10,-1)	0.0210	(0.83)
-16	0.0113**	(1.99)	0.0655***	(4.66)	(-5,-1)	0.0450***	(3.02)
-15	-0.0099	(-1.23)	0.0555***	(3.76)	(-20,0)	0.0740**	(2.43)
-14	-0.0125*	(-1.72)	0.0430***	(2.83)	(-15,0)	0.0082	(0.18)
-13	0.00074	(0.27)	0.0438***	(2.74)	(-10,0)	0.0266	(0.97)
-12	0.00007	(0.07)	0.0437***	(2.61)	(-5,0)	0.0510***	(2.99)
-11	0.0033	(0.09)	0.0470**	(2.51)	(-3,0)	0.0440***	(3.35)
-10	-0.0049	(-1.22)	0.0421**	(2.02)	(-1,0)	0.0280***	(3.18)
-9	0.00065	(0.22)	0.0427**	(1.99)			
-8	-0.0162***	(-2.65)	0.0265	(1.19)			
-7	-0.0073	(-0.98)	0.0192	(0.88)			
-6	0.0035	(0.51)	0.0227	(0.98)			
-5	0.0026	(0.17)	0.0253	(0.99)			
-4	0.0048	(0.47)	0.0301	(1.08)			
-3	0.0157	(1.92)	0.0459	(1.49)			
-2	0.0002	(0.28)	0.0461	(1.52)			
-1	0.0218***	(3.93)	0.0680**	(2.36)			
0	0.0056	(0.57)	0.0737**	(2.43)			
1	0.0021	(0.12)	0.0758**	(2.35)			
2	0.0014	(0.39)	0.0772**	(2.38)			
3	0.0079	(1.01)	0.0852**	(2.53)			
4	0.008	(0.95)	0.0933***	(2.67)			
5	0.0073	(1.34)	0.1006***	(2.88)			
6	-0.0037	(-0.40)	0.0969***	(2.75)			
7	0.0036	(0.59)	0.1006***	(2.81)			
8	-0.0024	(-0.43)	0.0981***	(2.68)			
9	0.0053	(0.80)	0.1034***	(2.78)			
10	0.0045	(0.35)	0.1080***	(2.80)			
11	-0.003	(-0.54)	0.1050***	(2.66)			
12	-0.0161**	(-2.44)	0.0889**	(2.19)			
13	-0.0002	(-0.10)	0.0887**	(2.15)			
14	0.0038	(0.54)	0.0926**	(2.21)			
15	-0.0050	(-1.07)	0.0876**	(1.99)			
16	-0.0019	(-0.62)	0.0856*	(1.87)			
17	0.0046	(0.03)	0.0902*	(1.84)			
18	0.0019	(0.46)	0.0922*	(1.89)			
19	-0.0070	(-0.73)	0.0851*	(1.75)			
20	0.0042	(0.73)	0.0893*	(1.84)			

*,**,*** denotes significance at the 10%, 5%, and 1% levels, respectively.

Table 2.3 Post-listing abnormal returns (AAR) and cumulative average abnormal return (CAAR).

Event	AAR	z-Statistic	CAAR	z-Statistic	Other post-listing windows	CAAR	z-Statistic
21	0.0061	(1.02)	0.0061	(1.02)	(+1,+50)	-0.0422	(-1.16)
22	-0.005	(-0.72)	0.0010	(0.21)	(+5,+50)	-0.0618	(-1.54)
23	0.0038	(0.51)	0.0049	(0.47)	(+10,+50)	-0.0720*	(-1.93)
24	-0.0088	(-0.98)	-0.0038	(-0.08)	(+15,+50)	-0.0611*	(-1.69)
25	-0.0001	(-0.37)	-0.0039	(-0.24)	(+20,+50)	-0.0536	(-1.46)
26	-0.0190**	(-2.61)	-0.0229	(-1.28)	(+25,+50)	-0.0540*	(-1.70)
27	0.0012	(0.45)	-0.0217	(-1.02)	(+30,+50)	-0.0073	(-0.49)
28	-0.0133***	(-2.04)	-0.0351	(-1.67)			
29	-0.0153*	(-1.85)	-0.0504**	(-2.19)			
30	0.0046	(0.69)	-0.0458*	(-1.86)			
31	0.0054	(0.23)	-0.0403*	(-1.70)			
32	0.0044	(1.03)	-0.0359	(-1.33)			
33	-0.010**	(-2.38)	-0.0460*	(-1.94)			
34	-0.0020	(-0.48)	-0.0480**	(-2.00)			
35	0.0019	(0.08)	-0.0460*	(-1.95)			
36	-0.0059	(-0.33)	-0.0520**	(-1.97)			
37	0.0022	(0.42)	-0.0497*	(-1.81)			
38	-0.0002	(-0.44)	-0.0500*	(-1.87)			
39	-0.0068	(-0.66)	-0.0569**	(-1.97)			
40	-0.0052	(-0.64)	-0.0621**	(-2.06)			
41	-0.0083	(-1.09)	-0.0705**	(-2.25)			
42	0.0135*	(1.89)	-0.0569*	(-1.79)			
43	0.0032	(0.40)	-0.0536*	(-1.67)			
44	-0.0052	(-0.72)	-0.0588*	(-1.78)			
45	-0.0031	(-0.77)	-0.0620*	(-1.90)			
46	0.0017	(0.12)	-0.0602*	(-1.84)			
47	0.0018	(0.29)	-0.0583*	(-1.75)			
48	-0.0086	(-1.31)	-0.0670**	(-1.97)			
49	0.0130*	(1.85)	-0.0540	(-1.59)			
50	-0.0037	(-0.26)	-0.0577	(-1.61)			

*,**,*** denotes significance at the 10%, 5%, and 1% levels, respectively.

Table 2.4 Cumulative average abnormal return (CAAR) for small and large firms.

	Small firms		Large Firms	
Event	**CAAR**	**z-Statistic**	**CAAR**	**z-Statistic**
21	-0.0079	(-0.46)	0.0240**	(2.06)
22	-0.0171	(-0.97)	0.0241	(1.41)
23	-0.013	(-0.62)	0.0277	(1.40)
24	-0.0235	(-0.89)	0.0211	(0.89)
25	-0.0228	(-0.91)	0.0199	(0.66)
26	-0.0565**	(-2.18)	0.0194	(0.52)
27	-0.0459	(-1.39)	0.0088	(0.04)
28	-0.0668**	(-2.26)	0.0050	(0.03)
29	-0.0969***	(-3.05)	0.0084	(0.13)
30	-0.0861**	(-2.50)	0.0053	(0.01)
31	-0.0738**	(-2.15)	0.0020	(0.14)
32	-0.0660	(-1.63)	0.0021	(0.16)
33	-0.0827**	(-2.42)	0.0005	(0.19)
34	-0.0792**	(-2.36)	-0.0085	(-0.35)
35	-0.0724**	(-2.23)	-0.0126	(-0.43)
36	-0.0751**	(-2.15)	-0.0227	(-0.55)
37	-0.0696*	(-1.86)	-0.0244	(-0.64)
38	-0.0684*	(-1.89)	-0.0267	(-0.68)
39	-0.0716*	(-1.81)	-0.0382	(-0.92)
40	-0.0693*	(-1.72)	-0.0531	(-1.17)
41	-0.0888**	(-2.03)	-0.0474	(-1.11)
42	-0.0663	(-1.46)	-0.0451	(-1.05)
43	-0.0634	(-1.35)	-0.0413	(-0.99)
44	-0.0645	(-1.36)	-0.0516	(-1.15)
45	-0.0682	(-1.45)	-0.0541	(-1.22)
46	-0.0613	(-1.32)	-0.0589	(-1.28)
47	-0.0583	(-1.25)	-0.0584	(-1.22)
48	-0.0647	(-1.34)	-0.0698	(-1.45)
49	-0.0515	(-1.07)	-0.0571	(-1.19)
50	-0.0594	(-1.19)	-0.0556	(-1.07)

*,**,*** denotes significance at the 10%, 5%, and 1% levels, respectively.

Table 2.5 Comparison of U.S. betas, Israeli betas, Standard Deviations, R-squares, and Residual Variances before and after cross-listing using single and two-index models.

The table summarizes coefficients of equations (4) and (5), U.S. and Israeli betas, $\beta_i^{U.S.-Single}$, $\beta_i^{U.S.-Two}$, and $\beta_i^{ISR-Two}$, standard deviation, S.D., R-squared for the single and two index models, R^2 -Single and R^2 -Two, and the residual variance for the Two-index model, R.V.-Two, before and after the cross-listing day. The pre-listing window is -250 to -1 days and post-listing widow is 0 to +250 days relative to the date of the cross-listing at *t=0.*

$$R_{it} = \alpha_i + \beta_i^{US-Single} R_{mt,US} + \varepsilon_{it}$$

$$R_{it} = \alpha_i' + \beta_i^{US-Two} R_{mt,US} + \beta_i^{ISR-Two} R_{mt,ISR} + \varepsilon_{it}'$$

Coefficients	Average Pre-Listing	Average Post-Listing	Change (%)	t-Statistic (difference)
$\beta_i^{U.S.-Single}$	1.0272	0.7210	-29.81%**	(2.12)
$\beta_i^{U.S.-Two}$	0.8411	0.6169	-26.65%*	(1.70)
$\beta_i^{U.S.-Two}$	0.4747	0.3767	-20.64%	(1.36)
S.D.	0.0524	0.0397	-24.15%***	(4.67)
R^2 -Single	0.0803	0.0698	-13.06%***	(4.13)
R^2 -Two	0.1029	0.1062	3.12%	(-0.16)
R.V.-Two	0.0027	0.0016	-41.38%***	(4.07)

*,**,*** denotes significance at the 10%, 5%, and 1% levels, respectively.

Table 2.6 Five different measurements of risk over two windows (-250,-101) and (+101,+250) to control for trading noise caused by cross-listing or announcement.

The table summarizes coefficients of equation (5), U.S. and Israeli betas $\beta_i^{U.S.-Two}$, and $\beta_i^{ISR-Two}$, standard deviation, S.D., R-squared, R^2, and the residual variance, R.V., before and after the cross-listing day. The pre-listing window is -250 to -101 days and post-listing widow is +101 to +250 days relative to the date of the cross-listing at *t=0*.

$$R_{it} = \alpha_i' + \beta_i^{US-Two} R_{mt,US} + \beta_i^{ISR-Two} R_{mt,ISR} + \varepsilon_{it}'$$

Coefficients	Average Pre-Listing	Average Post-Listing	Change (%)	t-Statistic (difference)
$\beta_i^{U.S.-Two}$	0.8750	0.5522	-36.89%**	(2.27)
$\beta_i^{U.S.-Two}$	0.4844	0.3588	-25.92%	(1.34)
S.D.	0.0539	0.0367	-31.97%***	(5.12)
R^2	0.1142	0.1040	-8.92%	(0.40)
R.V.	0.0029	0.0013	-53.08%***	(4.60)

*,**,*** denotes significance at the 10%, 5%, and 1% levels, respectively.

Table 2.7 Year by year comparison of U.S. betas, Israeli betas, Standard Deviations, R-squares, and the Residual Variance before and after cross-listing using single and two-index models.

The table summarizes coefficients of equations (4) and (5), U.S. and Israeli betas, $\beta_i^{U.S.-Single}$, $\beta_i^{U.S.-Two}$, and $\beta_i^{ISR-Two}$, standard deviation, S.D., R-squared for the single and two index models, R^2 -Single and R^2 -Two, and the residual variance for the Two-index model, R.V.-Two, before and after the cross-listing day. The pre-listing window is -250 to -1 days and post-listing widow is 0 to +250 days relative to the date of the cross-listing at *t=0*. This table lists the coefficients for firms cross-listed on each year from 2000 to 2007. One firm was cross-listed in 2007, and hence it is not included as part of my calculations in this table. The number of firms listed in TASE each year between 2000 and 2007 are two, seven, seven, two, five, four, six, and one, respectively.

$$R_{it} = \alpha_i + \beta_i^{US-Single} R_{mt,US} + \varepsilon_{it}$$

$$R_{it} = \alpha_i' + \beta_i^{US-Two} R_{mt,US} + \beta_i^{ISR-Two} R_{mt,ISR} + \varepsilon_{it}'$$

Coefficients	2000	2001	2002	2003	2004	2005	2006
$\beta_i^{U.S.-Single}$	-45.68%	-59.48%**	-58.84%***	264.92%**	-10.86%	-4.27%	80.33%
	(1.03)	(3.29)	(4.02)	(-6.56)	(0.29)	(0.40)	(-0.81)
$\beta_i^{U.S.-Two}$	-61.23%	-60.64%**	-55.25%**	335.08%**	-8.06%	-4.48%	84.43%
	(1.54)	(2.54)	(3.23)	(-6.34)	(0.22)	(0.51)	(-0.77)
$\beta_i^{U.S.-Two}$	37.48%	-19.31%	-56.19%*	2.04%	4.13%	39.63%	29.06%
	(-0.62)	(0.79)	(2.22)	(-0.07)	(-0.06)	(-1.21)	(-1.02)
S.D.	-19.91%***	-28.80%**	-22.70%**	-15.30%	-41.57%***	-6.07%	-22.64%
	(14.75)	(2.43)	(2.95)	(2.27)	(4.05)	(0.32)	(1.67)
R^2 -Single	-0.35%	-21.74%	-65.34%**	317.81%**	12.62%	17.3%	88.26%
	(0.004)	(0.62)	(3.46)	(-7.73)	(-0.23)	(-1.61)	(-1.21)
R^2 -Two	111.32%	5.17%	-65.08%***	132.42%***	5.77%	41.75%*	104.78%
	(-0.59)	(-0.14)	(4.12)	(-12.50)	(-0.10)	(-2.72)	(-1.34)
R.V.-Two	-26.27%*	-47.05%*	-33.40%*	-32.40%	-67.54%**	-12.92%	-48.23%
	(3.78)	(2.16)	(2.24)	(1.66)	(2.89)	(0.33)	(1.44)

*,**,*** denotes significance at the 10%, 5%, and 1% levels, respectively. Also, t-stats reported parenthetically.

Figure 2.1 Cumulative Average Abnormal Returns (CAARs) for large and small firms for the post-listing window (0, +50).

Figure 2.2 Time line shows the pre-listing and post-listing windows used to control for trading noise caused by cross-listing and its announcement.

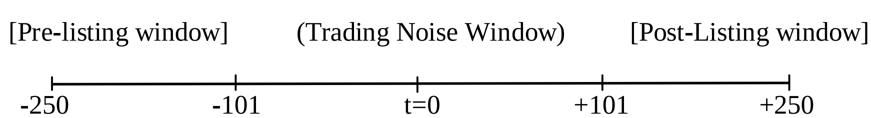

Table 2.8 Comparison of U.S. betas, Israeli betas, Standard Deviations, R-squares, and the Residual Variance for Small and Large firms using the single and Two-index models.

The table summarizes changes in coefficients of equations (4) and (5), U.S. and Israeli betas, $\beta_i^{U.S.-Single}$, $\beta_i^{U.S.-Two}$, and $\beta_i^{ISR-Two}$, standard deviation, S.D., R-squared for the single and two index models, R^2-Single and R^2-Two, and the residual variance for the Two-index model, R.V.-Two, before and after the cross-listing day. The pre-listing window is -250 to -1 days and post-listing widow is 0 to +250 days relative to the date of the cross-listing at *t=0.*

$$R_{it} = \alpha_i + \beta_i^{US-Single} R_{mt,US} + \varepsilon_{it}$$

$$R_{it} = \alpha_i' + \beta_i^{US-Two} R_{mt,US} + \beta_i^{ISR-Two} R_{mt,ISR} + \varepsilon_{it}'$$

Coefficients	Small Firms	Large Firms
$\beta_i^{U.S.-Single}$	-38.66%*	-20.33%
	(1.76)	(1.15)
$\beta_i^{U.S.-Two}$	-33.77%	-19.72
	(1.29)	(1.07)
$\beta_i^{U.S.-Two}$	-40.45%*	12.37%
	(2.05)	(-0.59)
S.D.	-16.81%**	-34.69%***
	(2.25)	(5.60)
R^2-Single	-40.74%*	18.59%
	(1.66)	(-0.83)
R^2-Two	-34.07%	48.48%
	(1.54)	(-1.60)
R.V.-Single	-30.98%**	-57.10%***
	(2.22)	(4.19)
R.V.-Two	-30.46%**	-58.21%***
	(2.15)	(4.18)

*,**,*** denotes significance at the 10%, 5%, and 1% levels, respectively. Also, t-stats reported parenthetically.

Table 2.9 Comparison of U.S. betas, Israeli betas, Foreign Exchange betas, R-squares, and Residual Variances before and after cross-listing using the multi-factor model.

The table summarizes coefficients of equation (6), U.S., Israeli, and foreign exchange rate betas, $\beta_i^{U.S.-Multi}$, $\beta_i^{ISR-Multi}$, and $\beta_i^{Exchange}$, respectively, standard deviation, S.D., R-squared, R^2, and the residual variance, R.V., before and after the cross-listing day. The pre-listing window is -250 to -1 days and post-listing widow is 0 to +250 days relative to the date of the cross-listing at *t=0*.

$$R_{it} = \alpha_i'' + \beta_i^{US-Multi} R_{mt,US} + \beta_i^{ISR-Multi} R_{mt,ISR} + \beta_i^{Exchange} R_{t,ISR-US} + \varepsilon_{it}''$$

Coefficients	Average Pre-Listing	Average Post-Listing	Change (%)	t-Statistic (difference)
$\beta_i^{U.S.-Multi}$	0.848182	0.620527	-26.84%*	(1.73)
$\beta_i^{ISR-Multi}$	0.47281	0.36058	-23.74%	(1.56)
$\beta_i^{Exchange}$	-0.227254	0.25311	211.38%**	(-2.25)
R^2	0.10917	0.112398	2.96%	(-0.16)
R.V.	0.002752	0.001615	-41.31%***	(4.02)

*,**,*** denotes significance at the 10%, 5%, and 1% levels, respectively.

Table 2.10 Comparison of U.S. betas, Israeli betas, Foreign Exchange betas, Standard Deviations, R-squares, and the Residual Variance before and after 2003 when the new Israeli shekel became a freely convertible currency, using the multi-factor model.

The table summarizes changes in the coefficients of equation (6), U.S., Israeli, and foreign exchange rate betas, $\beta_i^{U.S.-Multi}$, $\beta_i^{ISR-Multi}$, and $\beta_i^{Exchange}$, respectively, standard deviation, S.D., R-squared, R^2, and the residual variance, R.V., before and after the cross-listing day. The pre-listing window is -250 to -1 days and post-listing widow is 0 to +250 days relative to the date of the cross-listing at *t=0*. The analysis is performed for firms cross-listed before 2003 versus after 2003. Before 2003, 16 firms cross-listed and 18 firms cross-listed after 2003.

$$R_{it} = \alpha_i'' + \beta_i^{US-Multi} R_{mt,US} + \beta_i^{ISR-Multi} R_{mt,ISR} + \beta_i^{Exchange} R_{t,ISR-US} + \varepsilon_{it}''$$

Before vs. after 2003	Before 2003	After 2003
$\beta_i^{US-Multi}$	-57.68%***	23.25%
	(4.45)	(-0.81)
$\beta_i^{ISR-Multi}$	-35.82%*	1.74%
	(2.05)	(-0.06)
$\beta_i^{Exchange}$	189.63%*	256.43%
	(-1.93)	(-1.23)
S.D.	-25.21%***	-22.67%**
	(4.02)	(2.64)
R^2	-13.53%	38.08%
	(0.58)	(-1.41)
R.V.	-39.32%***	-44.88%**
	(3.29)	(2.38)

*,**,*** denotes significance at the 10%, 5%, and 1% levels, respectively. Also, t-stats reported parenthetically.

CHAPTER 3 - The Dynamics of Return Spillovers and Volume-Return Interactions across Markets

Introduction

Trading volume and stock returns are two major components around which technical analysis revolves. While stock returns impart all public information available in the market, trading volume signals the direction of these returns in the future. Llorente, Michaely, Saar, and Wang (LMSW) (2002) argue that trading in the stock market is motivated by either speculative (informational) or hedging (allocational) reasons. Trading for speculative reasons exists to speculate on private information. Therefore, one would expect returns associated with it to continue in the future as private information is further reflected in the price. Trading for hedging purposes, on the other hand, exists to rebalance investment portfolios, implying that returns associated with such trading will reverse in the future. It follows that analyzing the dynamics of volume-return interactions in the market can further refine the accuracy of predicting future price movements. This analysis is also useful in understanding stock markets' microstructures and, hence, fundamentals driving returns in these markets.

In the international cross-listing market, where stocks are traded in more than one stock exchange, Gagnon and Karolyi (2009) hypothesize that informative traders will speculate on their private information when they trade on the market, suggesting that returns associate with such a trade from one market will continue in the subsequent period on the other market, as stock prices reflect the private information. In contrast, non-informative traders will trade for hedging reasons, suggesting that returns associate with such a trade from one market will reverse in the subsequent period on the other market, since non-informative traders are offsetting exposure to price fluctuations in the opposite direction. Consistent with LMSW's finding, Gagnon and

Karolyi (2009) find that returns associated with speculative (hedging) trades, originating in one market, continue (reverse) the next trading day on the other market. Using a modified multimarket version of LMSW's model, Gagnon and Karolyi (2009) provide more evidence to support LMSW's theory and the Home Bias hypothesis. The Home Bias hypothesis suggests that the home market is the dominant market in producing important information that determines future price movements. In addition, Gagnon and Karolyi find that stocks characterized by a lower degree of information asymmetry[15] have a tendency to reverse their returns following high trading volume days, while stocks with higher degree of information asymmetry have a tendency to continue their returns following high trading volume days. Their results are consistent with LMSW's findings that with low (high) degree of information asymmetry, trading for hedging (speculative) considerations dominates and returns associated with positive volume shocks will have greater tendency to reverse (continue) in the future. Furthermore, they find that return-spillovers originating from the home market are stronger than those originating from the host market.

While Gagnon and Karolyi (2009) focus on stocks that went public in their home market and cross-listed afterward in the U.S. capital markets, I focus on Israeli firms that went public in the U.S. and then cross-listed on their home market, Tel Aviv Stock Exchange (TASE). Given that these Israeli stocks have gone public in the U.S. and have access to the U.S. capital market[16], one would expect that the U.S. market would serve as a home market and play a major role in pricing these Israeli stocks. However, one cannot ignore the important role of the home

[15] Information asymmetry in cross-listing occurs when investors in one market have an information advantage over investors on the other market. Stocks with low degree of information asymmetry are exposing to less risk of information asymmetry, while stocks with high information asymmetry are exposing to a higher risk of information asymmetry.

[16] The U.S. capital market is known as the most liquid market; hence, it is expected to provide the Israeli stocks with more liquidity than the Israeli market.

market, Israel, as a source of valuable information that determines future price movements, as implied by the Home Bias hypothesis.

Using Gagnon and Karolyi's model, I investigate the volume-return interactions and direction of information flow and return spillovers between the Israeli and U.S. markets. In this research, my contribution to the literature of international cross-listing is by pointing out the importance of volume-return interactions in the atypical international cross-listing framework and within different information environments or degrees of information asymmetry. This study provides new evidence supporting the Home Bias hypothesis, suggesting that price movements of cross-listed stocks are motivated by information produced in the home market more than the host market. My contribution is to show whether this theory holds if the stock initially went public abroad and then cross-listed in the home market afterward.

This study argues that in a relatively young, recently liberalized market17, like the Israeli market, one would expect the information originating from the home market to be more valuable in determining future price movements, while information originating from the U.S. market (host market) to have an insignificant effect on future price movements. Similarly, I expect trades originating from the home market to be more informative and motivated by speculative considerations, implying that returns associated with such trades have a greater tendency to continue in the U.S. market. Conversely, trades originating from the U.S. market are expected to be non-informative and motivated by liquidity or hedging considerations, implying that returns associated with such trades have a greater tendency to reverse in the Israeli market. The

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[17] On October 2000, the TASE initiated the Dual-Listing Law that enables firms traded on the U.S. stock exchanges to cross-list on TASE with no additional regulatory requirements. Initially, the law was only applied to firms traded on the NYSE, the NASDAQ national market, and the AMEX. The law then was expanded to include firms traded on the London Stock Exchange (LSE) main market and firms listed on the NASDAQ small cap with a market capitalization greater than $30 million. Also, firms that seek to cross-list on TASE under the Dual-Listing Law have to be listed for at least a year in U.S. markets or on the LSE. The law also includes firms that have traded for less than one year but that maintain a market value exceeding $150 million.

empirical evidence of this paper is consistent with the predictions of my model, returns associated with trading volume shocks seem to reverse themselves when originating from the U.S. market and continue themselves when originating from the Israeli market. In addition, return spillovers from Home-to-U.S. are significantly positive and much stronger than those from U.S.-to-Home.

Theoretical Background

In developing the testable hypothesis, I rely on several studies that investigate the relationship between trading volume and predictable returns patterns[18]. For example, Campbell, Grossman, and Wang (CGW) (1993) investigate the relationship between volume and returns' serial correlation. In their model, they have two kinds of investors, liquidity or non-informational traders and risk-averse or market makers. When stock prices fall this could be due to either public information that can be thought of as a negative shock to the stock market in general, or significant selling by non-informational traders who sell stocks for exogenous reasons. The first case suggests that there will be no change in future expected returns on the stock market. However, the second case implies that market makers, who bought stocks today will expect a high return tomorrow that will be transformed to an increase in stock prices in subsequent days. CGW (1993) suggest that trading volume can be used to distinguish between the two cases. While it is not reasonable to expect a high trading volume when public information is revealed, significant selling by non-informational traders is more likely to create a

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[18] Beside the studies I discuss in details in this study, other studies have contributed to the literature of this field i.e. Karpoff (1986), Karpoff (1987), Eun and Shim (1989), Hamao et al. (1990), Holthausen and Verrecchia (1990), Koch and Koch (1991), Duffee (1992), Conrad et al. (1994), Kandel and Pearson (1995), Ammer and Mei (1996), Lee and Swaminathan (2000), Lo and Wang (2000), Gervais et al. (2001), Eun and Sabherwal (2003), Chordia et al. (2005), Baruch et al. (2007), and Brunnermeier and Pedersen (2009).

considerable trading volume shock. Hence, their model with heterogeneous investors suggests that "price change accompanied with high volume will tend to be reversed".

Another study by Blume, Easley, and O'Hara (BEO) (1994) consider a simplified rational expectations model, developed by Brown and Jennings (1989) and Grundy and McNichols (1989) in which investors use previous stock prices and trading volume to learn about these stocks. They argue that investors do not really know with certainty the real value of the asset because of the common error term, which is hard to capture. Meanwhile, volume-price interaction provides traders with all available information in the market about the stock. Therefore, the only way to obtain all this information is by analyzing the sequences of price and volume. This analysis is really valuable because it helps traders deduce all the information available in the market. Also, BEO's model suggests that smaller and less widely followed stocks will have greater uncertainty about their future prospects and lower prior precision. Hence, those stocks will be more influenced by private rather than public information.

Wang (1994) extends CGW's (1993) model and presents two kinds of investors, informed and non-informed investors. Informed investors trade stocks based on some private information, while non-informed investors use realized dividends, prices, and public information available in the market about the traded stocks. Both kinds of investors trade competitively in the stock market. The informed investors base their trades on information about the stock's future cash flows, giving rise to their informational trading. They also can trade to rebalance their portfolio, giving rise to their non-informational trading. On the other hand, non-informed investors trade in the stock market solely for non-informational reasons. Therefore, trade will exist between the two parties since informed investors can trade for non-informational as well as informational reasons.

Wang's model analyzes the dynamics of trading volume and stock returns and how they interact with the degree of information asymmetry in the market. He argues that the ability of non-informed investors to identify the reasons behind the informed investor's transactions in the market is very limited. Hence, the risk of information asymmetry arises, decreasing the trading volume as the non-informed investors refrain from trading. Also, Wang's model suggests that trading volume is positively correlated with the absolute change in stock prices, and this correlation increases with the degree of information asymmetry.

Two other noteworthy suggestions of Wang (1994) that uncover the predictability power of his model regarding the future stock returns. The first is that high returns accompanied by high volume implies high future returns when there is informational trading, while the second suggests that high returns accompanied by high volume implies low future returns when there is non-informational trading. Therefore, it is clear that the degree of information asymmetry, which determines the informational and non-informational trading, controls the dynamic relation between trading volume and returns.

A more recent study by LMSW (2002) also extends CGW's (1993) model. However, their starting point is that hedging or non-informational trades generate negatively auto-correlated returns, and speculative or informational trades generate positively auto-correlated returns. They argue that trading volume provides valuable information and helps determine periods with non-informational and informational trades which in turn can help predict the future movement of stock prices. In high volume periods, if trading is motivated by speculative purposes, then it should exhibit positive return autocorrelation. However, if trading is motivated by hedging purposes, then it should exhibit negative return autocorrelation.

LMSW's model suggests that "return, volume, and future returns depend on the relative significance of speculative trade versus hedging trade". That is, if speculative trades for a stock dominate, then returns associated with high trading volume are more likely to continue in the future. In contrast, if hedging dominates trading of a stock, then returns associated with high trading volume are most likely to reverse in the future.

LMSW's model is a less complicated version of the model developed by Wang (1994). They empirically examined a sample of all commonly traded stocks on NYSE and AMEX for a period of six years, from January 1, 1993 to December 31, 1998. They use firms' market capitalization and bid-ask spreads as proxies for the degree of information asymmetry for each individual stock at each period of time. Their results are consistent with the prediction of their model; they find small firms' stocks with high bid-ask spreads exhibit a tendency for return continuation following high-volume shocks. In contrast, large firms' stocks with low bid-ask spreads exhibit a tendency for return reversal following high-volume shocks.

The most recent study in this field is Gagnon and Karolyi (2009). They modified LMSW's model to a multimarket international setting to examine the volume-return dynamics of cross-listed stocks in the home and U.S. market, and how these dynamics are correlated with the degree of information asymmetry. Their sample consists of 556 U.S. cross-listed pairs from 36 countries, and they use several proxies for the firm-level information asymmetry; i.e. market capitalization[19], illiquidity, institutional ownership, and analysts following[20]. They find that returns of stocks with a low-degree of information asymmetry, i.e. large firms, have a tendency

[19] Market capitalization refers to the market value of the firm.

[20] Brennan and Subrahmanyam (1995) and Easley, O'Hara, and Paperman (1998) find the degree of information asymmetry to be lower among firms that are followed by larger number of analysts. Both studies find the number of analysts following firms and the degree of information asymmetry to be negatively correlated. Data about the number of analyst following obtained from IBES (Institutional Brokers Estimate System).

to reverse in one market following high-volume days in the other market. In contrast, returns of stocks with a high-degree of information asymmetry, i.e. small firms, have a tendency to continue in one market following high-volume days in the other market. Another thing they examine is return spillovers. They find return spillover to be positive for the full sample, on average, and its magnitude is greater when originating from the home market than those originating from the host market.

Data

My sample consists of Israeli stocks that went public in the U.S. and then cross-listed in the Israeli market (TASE). Initially, 78 Israeli stocks went public in the U.S., only 50 of which cross-listed on their home country stock exchange market (TASE). The sample is identified from the official website of TASE that offers a complete list of all Israeli stocks dually-listed in the U.S. and on other foreign stock exchanges around the world. To include an Israeli stock in the sample, the following two criteria are used:

(1) The Israeli stock is cross-listed on TASE only after going public initially in one of the major U.S. stock exchanges.

(2) Each Israeli stock has at least 250 days of closing prices on both the U.S. and Israeli markets.

The final sample includes 38 stocks and covers the period from November 1, 2001 to December 31, 2009. I used daily adjusted close prices for Israeli stocks traded in the U.S. and their counterparts' cross-listed stocks in the Israeli market as well. The U.S. data is obtained from the Center for Research in Security Prices (CRSP), while the Israeli data is from the official website of TASE. The daily outstanding shares and daily trading volume are obtained from the same sources.

Methodology and Testable Hypothesis

The main goal of this paper is to understand the dynamics of returns' auto-correlation and cross-correlation, spillovers, for cross-listed stocks, in the home and the host market. I investigate whether the directions and the magnitudes of return spillovers from Home-to-U.S. or U.S.-to-Home linked to the degree of information asymmetry? Are trades in the home and U.S. markets motivated by speculative or hedging considerations? Do comovements between returns of Israeli stocks listed in the U.S. and their cross-listed counterparts vary with the degree of information asymmetry? I focus my investigation on a special case of atypical international cross-listing, in which stocks have first gone public in foreign exchanges and then cross-listed in the home market. In addition, I want to determine how these dynamics differ across stocks with different degrees of information asymmetry. I implement the multimarket version of LMSW's model developed by Gagnon and Karolyi (2009).

Domestic Tests

First, I employ LMSW's model to examine return auto-correlation and volume-return interactions within the U.S. and Israeli markets independently. This will help us understand how stock returns are correlated in each market, isolated from the effect of the international framework, and how these correlations vary with different degrees of information asymmetry. For each firm-month, I use daily stock returns to estimate the following two time-series regressions for each individual stock in my sample for each month as follows

$$R_{i,t}^{U.S.} = C_{0i} + C_{1i} \cdot R_{i,t-1}^{U.S.} + C_{2i} \cdot V_{i,t-i}^{U.S.} \cdot R_{i,t-1}^{U.S.} + e_{i,t} \quad (1)$$

$$R_{i,t}^{ISR} = C_{0i} + C_{1i} \cdot R_{i,t-1}^{ISR} + C_{2i} \cdot V_{i,t-i}^{ISR} \cdot R_{i,t-1}^{ISR} + e_{i,t} \quad (2)$$

where $R_{i,t}^{U.S.}$ is firm *i*'s return on day *t* traded in the U.S., and $R_{i,t}^{ISR}$ is firm *i*'s return on day *t* traded in Israel. $R_{i,t-1}^{U.S.}$ and $R_{i,t-1}^{ISR}$ are the firm *i*'s return on day *t*-1 traded in the U.S. and Israeli markets, respectively, and $V_{i,t-i}$ is the volume innovation of firm *i*'s return on day *t*-1. The coefficient C_{0i} is a constant, C_{1i} is the firm's return auto-correlation, C_{2i} is the firm's volume-return interaction.

In the first stage, I use daily data to run the above time-series regressions for each month of each firm. The main goal of this approach is to collect monthly coefficients, C_{2i}, and regress them in the second stage on different proxies of information asymmetry to understand the dynamics of the returns autocorrelations with different degrees of information asymmetry. In total, I ran 2579 regressions for each of the above two equations for 38 firms in my sample. The number of months available for each firm is not identical, and it varies between 26 to 84 months.[21]

To calculate the volume innovation, I use the stock's daily turnover, calculated as the daily trading volume divided by the number of outstanding shares for each stock each day. I use the logarithm of the turnover series, since these series are non-stationary, and detrend them by subtracting the 50-day moving average of the log-turnover after adding a small constant (0.00000255) to avoid the problems with zero trading volumes as follows:

$$V_t = Log(Turnover_t) - 1/50 \sum_{s=-50}^{-1} \log(Turnover_{t+s})$$

[21] The number of years is not identical for each firm in my sample. For example, if a firm has two years worth of daily data, I ran equations (1) and (2) for each month in the two years. Hence, the total number of regressions ran for this firm is 24 regressions using equation (1) and 24 regressions using equation (2). The total number of coefficients, C_{2i}, obtained is be 48, 24 from the equation (1) and another 24 from equation (2). In total, I ran each one of the two equations 2579 and obtained 2579 coefficients that I used in the second stage regressions.

where

$$Log(Turnover_t) = Log(Turnover + 0.00000255)$$

The volume-return interaction coefficient, C_{2i}, identifies the type of trade in the market. If the trade is motivated by allocational or hedging considerations, then I expect to be negative and statistically significant indicating that stock returns associated with positive volume shocks originating from any of the two markets (Israel or U.S.) will be reversed the next day in that market. On the other hand, I expect C_{2i} to be positive and statistically significant if the trade is informational or motivated by speculative considerations. That is, stock returns associated with positive volume shocks originating from any of the two markets (Israel or U.S.) will be continued the next day in the same market.

In the second stage regression, using Fama and MacBeth's (1973) method[22], I employ a cross-sectional regression to regress the C_{2i} coefficients of each firm-month that I collect from the previous time-series regressions, equations (1) and (2), on information asymmetry. This helps us to understand the dynamics of returns' autocorrelation with the level of information asymmetry as follows.

$$C_{2i} = a + b \cdot A_i + e_i \qquad (3)$$

Here, A_i is the degree of information asymmetry that I use several proxies for. The first proxy of information asymmetry used in this study is *Ln (Market Value)*, which is natural logarithm of the firms' market value. I expect market capitalization to be negatively correlated with the level of information asymmetry. This implies a higher level of information asymmetry

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[22] In Fama and MacBeth (1973) method we first run time-series regression and then use the coefficients obtained from the time-series regression in the second stage cross-sectional regression.

for firms with lower market capitalization and a lower level of information asymmetry in firms with higher market capitalization.

The second proxy for information asymmetry is *U.S. Illiquidity* and *Home Illiquidity* measures developed by Amihud (2002).

$$ILLIQ_{im} = \frac{1}{D_{im}} \sum_{t=1}^{D_{im}} [|R_{imd}|/VOLD_{imd}]$$

where D_{im} is the number of days for which data are available for a stock in month (*m*), $|R_{imd}|$ is the absolute value of stock (*i*)'s return on day (*d*) of month (*m*), and $VOLD_{imd}$ is the daily volume in dollars of stock (*i*)'s return on day (*d*) of month (*m*). Since more information asymmetry facing the firm implies lower liquidity or higher illiquidity, I expect the illiquidity measure to be positively related to the degree of information asymmetry.

The third proxy used for information asymmetry is *U.S. Share of Turnover* and *Home Share of Turnover* measures used by Levine and Schmukler (2007).

$$Turnover_{it} = \frac{Daily\ Volume_{it}}{Outstanding\ Stocks_{it}}$$

U.S. Share of Turnover captures the proportion of the firm's aggregate turnover in the U.S. market, while *Home Share of Turnover* captures the proportion of the firm's aggregate turnover in the home market. The market share of turnover is expected to be negatively correlated with the information asymmetry in the same market. That is, if *Home Share of Turnover* is increasing, then information asymmetry in the home market is decreasing, and the same relationship applies in the U.S. market, for the *U.S. Share of Turnover*.

International Tests

To test for the return spillovers and the dynamics of volume-return interactions across the two markets, I implement the two-stage empirical estimation strategy that Gagnon and Karolyi (2009) develop based on LMSW's model. For each firm-month, I use daily stock returns to estimate the following two time-series regressions for each individual stock in my sample for each month as follows:

$$R_{i,t}^{U.S.} = C_{0i} + C_{1i} \cdot R_{i,t-1}^{U.S.} + C_{2i} \cdot V_{i,t-1}^{U.S.} \cdot R_{i,t-1}^{U.S.} + C_{3i} \cdot R_{i,t-1}^{ISR} + C_{4i} \cdot V_{i,t-1}^{ISR} \cdot R_{i,t-1}^{ISR} + \beta_{i,U.S.} R_{U.S.,t-1} + \beta_{i,ISR} R_{ISR,t-1} + e_{i,t} \quad (4)$$

$$R_{i,t}^{ISR} = C_{0i} + C_{1i} \cdot R_{i,t-1}^{ISR} + C_{2i} \cdot V_{i,t-1}^{ISR} \cdot R_{i,t-1}^{ISR} + C_{3i} \cdot R_{i,t-1}^{U.S.} + C_{4i} \cdot V_{i,t-1}^{U.S.} \cdot R_{i,t-1}^{U.S.} + \beta_{i,U.S.} R_{U.S.,t-1} + \beta_{i,ISR} R_{ISR,t-1} + e_{i,t} \quad (5)$$

where C_{0i}, C_{1i}, and C_{2i} have the same interpretation as discussed in equations (1) and (2). In equation (4), C_{3i} captures the returns' autocorrelation across markets of trading shares in the Israeli market in the preceding period, $R_{i,t-1}^{ISR}$, that can spillover to the U.S. market return, $R_{i,t}^{U.S.}$. C_{4i}, in the same equation, captures the volume-return interaction originating from the Israeli market that can spillover to the stock's returns listed in the U.S. market. The interpretation of C_{3i} and C_{4i} in equation (5) are the same as equation (4), but the return and volume-return interaction are originating from the U.S. and can spillover to the returns of cross-listed stocks in the Israeli market. Following Gagnon and Karolyi's (2009) methodology, I add home market index returns $R_{ISR,t-1}$ and U.S. market index returns $R_{U.S.,t-1}$ on the right-hand side of equations (4) and (5) to control for aggregate shocks that might influence return spillovers. In total, I ran 2579 regressions for each one of the above two equations for 38 firms in my sample. The number of months available for each firm is not identical, and it varies between 26 to 84 months.

Gagnon and Karolyi (2009) suggest that speculative or informative trades originating in the home (U.S.) market have a greater tendency to continue in the U.S. (home) market. On the contrary, hedging or non-informative trades originating in the home (U.S.) market have a greater tendency to reverse in the U.S. (home) market. Hence, C_{4i} is expected to be positive if speculative trades dominate and negative if hedging trades dominate.

In the second stage regression of the international tests, I use a cross-sectional regression described in equation (3). However, my focus will be on C_{3i} and C_{4i} in equation (3) instead of C_{2i}. If the above hypothesis holds, I expect C_{3i}, return spillovers, to be positively related to the degree of information asymmetry. That is, return spillovers from Home-to-U.S. are expected to be stronger when the U.S. traders are less informed then the Israeli traders. I also expect C_{4i} to be positively related to the degree of information asymmetry. That is, as the degree of information asymmetry increases (decrease), returns associated with positive volume shocks originating in one market will have a greater tendency to continue (reverse) in the other market.

Empirical Evidence

Domestic Tests

In this section I report results of time-series and cross-sectional regressions for the Israeli shares listed in the U.S. and their cross-listed counterparts in the Israeli market. In tables 3.1.a and 2.1.b, I show a summary of equations (1) and (2) coefficients, C_0, C_1, and C_2, t-statistics, R^2, and F-test results. Also, I report the number of months for which the coefficients are negative, N, the percentage of negative coefficients relative to the total number of coefficients, %N, and the total number of months for which I ran regressions over. In addition, I list the mean of *t*-statistics for each of the coefficients along with number of *t*-statistics that are statistically significant at the

10% level (with absolute value above 1.64). Following Gagnon and Karolyi (2009), I provide all these statistics for the whole sample as well as for three groups of firms, small, medium, and large.

In table 3.1.a that focuses on the Israeli shares listed in the U.S. market, I observe a negative mean of C_2, volume-return interaction, with a value of -0.0402. This means that returns associated with positive volume shocks originating in the U.S. market have a tendency to reverse the following trading day in the same market. This implies that trading of these Israeli shares listed in the U.S. is most likely to be non-informative or allocational, based on hedging considerations. The theory suggests that the reversal tendency of returns associated with positive volume shocks should be greater among large firms, while the continuation tendency of returns associated with positive volume shocks should be greater among smaller firms. That is, as firms get larger, then the degree of information asymmetry gets smaller, and trades are more likely to be motivated by allocational or hedging purposes. The mean value of C_2 is -0.0272, -0.0664, and -0.0514 for small, medium, and large firms, respectively. Unexpectedly, I do not observe monotonic increase in the magnitude of C_2 with the size of firms, but one still can conclude that the magnitude of C_2 is smallest among small firms and gets greater among medium and large firms.

Table 3.1.b, on the other hand, focuses on the cross-listed Israeli shares in the home market, Israel. It shows that the mean value of this C_2 is positive, on average, with a value of 0.1855. This indicates that trading in the Israeli market is more likely to be informative or motivated by speculative purposes. Thus, returns associated with positive volume shocks originating from the home market have greater tendency of continuation in the future. The values of C_2 coefficients are 0.5518, 0.017, and 0.0374 for small, medium, and large firms, respectively.

The continuation tendency of returns of cross-listed shares in the Israeli market seems to be greater among small firms than large firms. This finding is reasonable since Israeli traders are more likely to speculate on their private information when a firm is small and have a higher information asymmetry relative to large firms with lower information asymmetry.

In the cross-sectional analysis, I regress the volume-return interaction, C_2, collected from equations (1) and (2), over five different firm-level proxies for information asymmetry, *Market Value, Home Share of Turnover, U.S. Share of Turnover, Home Illiquidity, and U.S. Illiquidity*. Table 3.1.c summarizes the test statistics of equation (3) using the five different proxies for information asymmetry. Using *Market Value* as a proxy of information asymmetry, I find that the slope coefficient, b, is negative and statistically significant at the 1% level for both the U.S. and Israeli markets. The slope coefficient is -0.0064 and -0.1094 with t-statistics of 3.33 and 2.90 for the U.S. and Israeli markets, respectively. This finding is consistent with Gagnon and Karolyi (2009) and LMSW (2002), and it indicates that as the degree of information asymmetry increases the stock returns associated with the positive volume shocks will have a greater tendency to continue.

For *Home Share of Turnover* and *U.S. Share of Turnover,* I expect a negative relationship between the degree of information asymmetry and share of turnover in each market. That is, when the home market's share of trading is increasing, the slope coefficient is expected to be negative for the home market. Conversely, when the U.S. market's share of trading is increasing, the slope coefficient is expected to be negative for the U.S. market. The coefficient of *Home Share of Turnover* is negative for the home market and positive for the U.S. market and statistically significant for both markets. For *U.S. Share of Turnover*, the coefficients are positive for both markets, however, they are statistically insignificant.

The same conclusion can be drawn from the *Home Illiquidity and U.S. Illiquidity* coefficients. The positive relationship between shares' illiquidity and information asymmetry suggests that these coefficients should be positive. Consistent with Gagnon and Karolyi's (2009) finding, coefficients of these information asymmetry proxies are all positive and statistically significant for both proxies in U.S. but only for one of them in the home market. An overall conclusion I can draw from the domestic tests is that my findings are consistent with LMSW's prediction regarding the importance of volume-return interaction in each market in predicting the future returns. Also, domestic tests reveal a strong pattern of the volume-return interactions with the degree of information asymmetry, which is consistent with LMSW's model. That is, as the degree of information asymmetry increases, returns associated with positive volume shocks have greater tendency of continuation.

International Tests of Home-to- U.S. Spillovers

In this section my focus turns to international returns' auto-correlation and volume-return interactions, C_3 and C_4, that can spillover from the Home-to-U.S markets. Table 3.2.a summarizes the test statistics of the coefficients from equation (4) along with the mean of *t*-statistics, R^2, and F-test results.

In table 3.2.a, return spillovers, C_3, are positive, on average, with a mean of 0.6152. I also find return spillovers to be negatively correlated with the degree of information asymmetry. Return spillovers are 0.5332, 0.6134, and 0.7151 for small, medium, and large firms, respectively. They are monotonically increasing with size of firms and the quality of the informational environment in the market. This finding is consistent with Gagnon and Karolyi (2009), and it implies that any change in prices of stocks listed in the home market are most likely to be followed by the next day with a change in the same direction in stock prices listed in the U.S. market. The magnitude of this tendency increases as the size of firms gets larger. That is, price changes in the home market are more likely to continue in the same direction in the U.S. market when trading in the home market is informational.

The second coefficient of interest in table 3.2.a is the volume-return interaction, C_4, that can spillover from home-to-U.S. The coefficient C_4 is positive, on average, with mean of 0.0303. This implies that positive volume shocks originating in the home market have tendency to continue in the U.S. market, and also it indicates that trading in the home market is more likely to be motivated by speculative considerations. The value of C_4 is 0.0651, 0.0346, and 0.0007 for small, medium and large, respectively. Thus, C_4 is monotonically decreasing with firm size and increasing with degree of information asymmetry facing traders in both markets. The magnitude of volume-return interaction is greater for smaller firms where speculative trading is more likely to dominates, while it is smaller for large firms where allocational trading is more likely dominates.

Results of the cross-sectional analysis are shown in table 3.2.b; I also report the statistical tests of equation (4) using Fama and MacBeth's (1973) method. In this analysis, I regress C_3, the return autocorrelation in the home market that can spillover to the U.S. market, and C_4, the volume-return interactions in the home market that can spillover to the U.S. market, on the five different firm-level proxies of information asymmetry *Market Value, Home Share of Turnover, U.S. Share of Turnover, Home Illiquidity, and U.S. Illiquidity*.

Results in table 3.2.b indicate a stronger return spillover from home-to-U.S. when U.S. traders have less informational advantage over home traders. The table shows that return spillovers, C_3, home-to-U.S. is positively correlated with the *Market Value* and *Home Share of Turnover* and negatively correlated with *U.S. Share of Turnover* and *Home Illiquidity*. The coefficients of *Market Value* and *Home Share of Turnover* are positive of 0.0124 and 61.508, respectively, and they are statistically significant at the 5% and 1% levels, respectively. *U.S. Share of Turnover* and *Home Illiquidity* coefficients are negative of -0.0002 and -1.4245, respectively, and they are statistically significant at the 10% and 5% levels, respectively. That is, if the firm size or the home market's share of turnover gets larger, then return spillovers from the Home-to-U.S. are stronger. In addition, if the U.S.'s share of turnover or share illiquidity in the home market gets larger, then return spillovers from the Home-to-U.S. turn out to be weaker.

For the volume-return interaction, C_4, table 3.2.b shows that returns associated with positive volume shocks originating in the home market have more tendency to continue in the U.S. market when U.S. traders have less of an informational advantage over home traders. I observe a significant negative relationship between *Market Value* and C_4, indicating that the likelihood of returns continuing from Home-to-U.S. is greater among small firms or when trading is less informative or with high degree of information asymmetry. The same conclusion can be drawn when looking at the *Home Share of Turnover*. The coefficient of *Market Value* is -0.08459, which is significant at the 1% level, while *Home Share of Turnover* coefficient is 103.18, which is significant at the 10% level.

In summary, results listed in tables 3.2.a and 3.2.b demonstrate the connections among the degree of information asymmetry and return spillovers and volume-return interactions across markets. I find positive return spillovers from Home-to-U.S., and the magnitude of these spillovers are greater among large firms and more liquid stocks. I also observe a high tendency of continuing for the home market returns in the U.S. conditional on high-volume shocks originating in the home market. This indicates that trading in the home market is more likely to be informative or motivated by speculative considerations. This finding is different than Gagnon and Karolyi (2009) who find returns associated with positive volume shocks originating in the home market are more likely to reverse in the U.S., indicating that trading in the home market is more likely to be motivated by allocatioinal considerations in their study. My finding suggests that returns originating from the home market and associated with positive volume shocks are more likely to continue in the U.S market when U.S. investors are facing a greater informational disadvantage than the Israeli investors in the home market. That is, stock returns associated with positive volume shocks originating from the home market are more likely to continue in the U.S. when the degree of information asymmetry is high.

International Tests of U.S.-to-Home Spillovers

I now turn to examine the dynamic of the return spillovers and the volume-return interactions in the other direction, U.S.-to-Home. Table 3.3.a summarizes the coefficients of equation (5) along with the mean of *t*-statistics, R^2, and F-test results. My focus will be on international returns' autocorrelation and volume-returns interactions, C_3 and C_4, respectively, that can spillover from the U.S. to the home market.

The return spillover from U.S.-to-Home, C_3, is positive, on average, but it is weaker than spillovers originating from the Home-to-U.S. For the full sample, return spillover from U.S.-to-Home market is 0.4879; while for return spillovers from Home-to-U.S. market is 0.6152, as reported in table 3.2.a. This implies that U.S. traders are more influenced by price changes in the home market than home market traders are about price changes that they observe in the U.S. Also, this implies that more information about the cross-listed stocks is produced at the home market than in the U.S. market. This finding is consistent with the literature, and it supports the Home Bias hypothesis suggesting that price movements of cross-listed stocks are motivated by information produced in the home market more than the host market (Gagnon and Karolyi, 2006). On the other hand, the magnitude of the return spillover is monotonically increasing with firm size, implying stronger return spillovers for large firms with less information asymmetry than small firms with higher information asymmetry. The values of C_3 are 0.4451, 0.5012, and 0.5096 for small, medium, and large firms, respectively, which is monotonically decreasing with the degree of information asymmetry.

Unlike the case of Home-to-U.S., the volume-return interaction in the U.S. market, C_4, is negative, on average. Earlier, I find returns associated with positive volume shocks originated in the home market have a tendency to continue in the U.S.; however, results in table 3.3.a show that returns associated with positive volume shocks that originated in the U.S. market have a tendency to reverse themselves in the home market. Although one might think that this finding is inconsistent with the theory, it is logical. Positive shocks originating in the home market are more likely to be speculative and based on private information observed by local traders in the Israeli market, and thus it makes sense that these returns exhibit a tendency to continue in the U.S. market. However, positive volume shocks originating in the U.S. market are more likely to be allocational and based on public information observed in the U.S. market. Thus it is reasonable to see these returns reversing in the Israeli market. Hence, I can conclude that trades at the U.S. market are motivated by allocational or hedging considerations.

The mean value of C_4 is -0.0933 and the reversal tendency of returns associated with positive volume shocks is stronger for larger firms, where trading for hedging considerations is more likely to dominates, and weaker for smaller firms, where trading for hedging considerations is less likely to dominates. That is, as firms get larger, the degree of information asymmetry decreases and the trading becomes more allocational or motivated by hedging purposes, which has reversal tendency in the other market as suggested by LMSW (2002). The values of C_4 for small, medium, and large firms are -.0406, -0.1004, and -0.1606, respectively, and it is monotonically decreasing with the degree of information asymmetry facing traders.

In table 3.3.b, I complete my examination of the U.S.-to-Home spillovers by looking at the cross-sectional analysis. Following the earlier international test of Home-to-U.S. spillovers, I regress C_3 and C_4 over the five different proxies of information asymmetry. Return spillovers, C_3, from U.S.-to-Home are statistically significant and larger for large firms with a slope of 0.0498 and *t*-statistic of 2.53. Return spillovers also are statistically significant and larger when the U.S. share of trade is greater and when shares are more liquid in the U.S. market. These results imply a stronger return spillover from U.S.-to-Home when Israeli traders have less of an informational advantage over U.S. traders. That is, when *Market Value* and the *U.S. share of Turnover* increase, the degree of information asymmetry decreases. Thus, return spillovers from U.S.-to-Home increase when the degree of information asymmetry decreases. Conversely, return spillovers from U.S.-to-Home increase as the *Home share of Turnover* and *U.S. Illiquidity* decrease, and the degree of information asymmetry decreases.

For the volume-returns interactions, C_4, that can spillover from U.S.-to-Home, I observe a statistically significant pattern of continuation as firms get smaller and when home and U.S. illiquidity get larger. That is, as the risk of information asymmetry facing U.S. traders increases, the continuation tendency of returns associated with positive volume shocks originating in the U.S. market gets stronger.

To summarize the U.S.-to-Home findings, I find positive return spillovers from U.S.-to-Home; however, they are weaker than return spillovers originating from Home-to-U.S. suggesting that more information about the cross-listed stocks is produced at the home market than in the U.S. market. Returns associated with high-volume shocks originating in the U.S.

market have a tendency to reverse in the Israeli market, indicating that the U.S. market is less informative than the Israeli market and trades in it are motivated by allocational or hedging purposes. This reversal tendency gets stronger when U.S. traders are more informed or when the risk of information asymmetry facing U.S. traders decreases.

Conclusion

The main goal of this paper is to understand the dynamics of return auto-correlation and cross-correlation (spillovers) for cross-listed stocks in the home and host markets, using trading volume as an indicator of the dynamic interplay between informed and non-informed traders. This approach was developed by Wang (1994) and Llorente, Michaely, Saar, and Wang (2002). They show that cross-sectional variation in the relation between volume and return autocorrelation is related to the extent of informed trading. That is, returns of firms with greater risk of information asymmetry have a greater tendency to continue rather than reverse across markets.

This approach was used recently by Gagnon and Karolyi (2009) to examine the dynamic volume-return interactions for a large sample of international firms from several countries whose shares are traded in their home market and in the U.S. They test whether the sign and the magnitude of return spillovers from the home (U.S.) market to the U.S. (home) market are linked to the extent of information asymmetry as LMSW predict. They find that stock returns associated with positive volume shocks originating from one market are likely to continue on the other market when the degree of information asymmetry is high. They also find that return spillovers originating from the home market are stronger than those originating from the U.S. market, which supports the Home Bias hypothesis.

In this paper, I examine a unique sample of 38 Israeli stocks that went public in the U.S. and then cross-listed in the home market, on the Tel Aviv Stock Exchange (TASE). Although going public in the U.S. first might suggest that the host market (U.S.) might serve as the home market, I find that the home market is more important in pricing Israeli cross-listed stocks across both markets, consistent with Gagnon and Karolyi's (2009) findings. Return spillovers from Home-to-U.S. are stronger than those of U.S.-to-Home, and they continue in the U.S. when associated with high-volume shocks originating in the home market. Meanwhile, returns associated with high-volume shocks originating from the U.S. tend to reverse in the home market. This implies that trading in the home market is informative or motivated by speculative considerations, while trading in the U.S. market is non-informative or motivated by hedging considerations.

My findings suggest that return movements of Israeli shares listed in the U.S. correlate more strongly with the return movements of their counterpart cross-listed in the Israeli market, and the magnitude of this correlation is weaker for firms facing greater risk of information asymmetry. In addition, I find that the dynamics of volume-return interactions across markets can provide us with valuable information regarding future price movements, which can be a useful tool to predict future returns.

Table 3.1 Trading Volume Influence on Stock Return Autocorrelation for Different Levels of Information Asymmetry in the U.S. market.

This table summarizes the coefficients C_0, C_1, and C_2, t-statistics, R^2, and F-test results of the following equation.

$$R^{U.S.}_{i,t} = C_{0i} + C_{1i} \cdot R^{U.S.}_{i,t-1} + C_{2i} \cdot V^{U.S.}_{i,t-1} \cdot R^{U.S.}_{i,t-1} + e_{i,t}$$

The equation examines return auto-correlation and volume-return interactions for Israeli shares listed in the U.S. market. I use daily stock returns and estimate the time-series regression for each firm-month. The table also includes the number of months for which the coefficients are negative, N, the percentage of negative coefficients relative to the total number of coefficients, %N, and the total number of months for which I ran regressions over. In addition, I list the mean of *t*-statistics for each of the coefficients along with number of *t*-statistics that are statistically significant at the 10% level.

Market	**Size**	**Statistic**	C_0 #<0	C_1 #<0	C_2 #<0	t_{C_0} |#|>1.64	t_{C_1} |#|>1.64	t_{C_2} |#|>1.64	R^2	**F-stat.**
U.S.	**Small**	**Mean**	-0.0013	0.1365	-0.0272	-0.0592	0.4047	-0.0143	0.15	1.29
		N	463	567	440	95	135	92		
		N %	52%	44%	50%	11%	15%	10%		
		Firm-Months	885	885	885	885	885	885		
	Medium	**Mean**	-0.0002	0.0659	-0.0664	-0.0094	0.221	-0.0348	0.13	1.11
		N	471	538	462	98	119	113		
		N %	50%	57%	49%	10%	13%	12%		
		Firm-Months	950	950	950	950	950	950		
	Large	**Mean**	0.0004	0.0641	-0.0514	0.128	0.2211	-0.034	0.14	1.17
		N	330	427	373	80	94	100		
		N %	44%	57%	50%	11%	13%	13%		
		Firm-Months	744	744	744	744	744	744		
	All	**Mean**	-0.0004	0.0896	-0.0402	0.0131	0.2841	-0.0285	0.14	1.19
		N	1264	1532	1275	273	348	305		
		N %	49%	51%	49%	11%	14%	12%		
		Firm-Months	2579	2579	2579	2579	2579	2579		

Table 3.2 Trading Volume Influence on Stock Return Autocorrelation for Different Levels of Information Asymmetry in the Home market.

This table summarizes the coefficients C_0, C_1, and C_2, t-statistics, R^2, and F-test results of the following equation.

$$R_{i,t}^{ISR} = C_{0i} + C_{1i} \cdot R_{i,t-1}^{ISR} + C_{2i} \cdot V_{i,t-1}^{ISR} \cdot R_{i,t-1}^{ISR} + e_{i,t}$$

The equation examines return auto-correlation and volume-return interactions for Israeli shares cross-listed at the home market, Israel. I use daily stock returns and estimate the time-series regression for each firm-month. The table also includes the number of months for which the coefficients are negative, N, the percentage of negative coefficients relative to the total number of coefficients, %N, and the total number of months for which I ran regressions over. In addition, I list the mean of *t*-statistics for each of the coefficients along with number of *t*-statistics that are statistically significant at the 10% level.

Market	Size	Statistic	C_0 #<0	C_1 #<0	C_2 #<0	t_{C_0} |#|>1.64	t_{C_1} |#|>1.64	t_{C_2} |#|>1.64	R^2	F-stat.
Home	**Small**	**Mean**	-0.0018	0.0509	0.5518	-0.0848	0.1522	0.0258	0.14	3.22
		N	483	498	466	101	107	107		
		N %	55%	56%	53%	11%	12%	12%		
		Firm-Months	885	885	885	885	885	885		
	Medium	**Mean**	-0.0021	0.0466	0.017	-0.0272	0.2221	0.0063	0.14	2.74
		N	483	535	481	108	128	149		
		N %	51%	56%	51%	11%	14%	16%		
		Firm-Months	950	950	950	950	950	950		
	Large	**Mean**	0.0002	0.0257	0.0374	0.147	0.1106	0.0103	0.14	1.32
		N	325	396	365	71	87	113		
		N %	44%	53%	49%	10%	12%	15%		
		Firm-Months	744	744	744	744	744	744		
	All	**Mean**	-0.0013	0.042	0.1855	0.0032	0.1659	0.0135	0.14	2.49
		N	1291	1429	1312	280	322	369		
		N %	50%	55%	51%	11%`	13%	14%		
		Firm-Months	2579	2579	2579	2579	2579	2579		

Table 3.3 Cross-Sectional Regression Analysis for the Domestic Tests.

In this table I employ a cross-sectional regression to regress the C_{2i} coefficients of each firm-month that I collect from the previous time-series regressions, equations (1) and (2), on information asymmetry using Fama and MacBeth's (1973) method.

$$C_{2i} = a + b \cdot A_i + e_i$$

A_i is the degree of information asymmetry that I use the following proxies for *Market Value, Home Share of Turnover, U.S. Share of Turnover, U.S. Illiquidity* ,and *Home Illiquidity*.

	U.S.			**Home**		
	C_2			C_2		
	Constant	**Slope**	R^2	**Constant**	**Slope**	R^2
ln(Market Value)	-0.1029	-0.0064***	< 0.0000	-1.9406	-0.1094***	0.0003
	(-0.27)	(-3.33)		(-0.82)	(-2.90)	
Home share of Turnover	0.0625	26.879*	0.0011	0.1383	-25.908***	< 0.0000
	(1.63)	(1.67)		(0.57)	(-3.25)	
U.S. share of Turnover	0.0191	0.0001	0.0001	0.1813	0.0002	< 0.0000
	(0.66)	(0.36)		(0.99)	(0.11)	
Home Illiquidity	0.0201	0.3966**	< 0.0000	0.1796	2.4132	< 0.0000
	(0.7)	(2.14)		(0.99)	(1.13)	
U.S. Illiquidity	0.0233	1754.5***	0.0003	0.1821	1662.9***	< 0.0000
	(0.8)	(2.83)		(0.99)	(3.12)	

*,**,*** indicate significance at the 10, 5, and 1 percent levels, respectively. Also, t-stats reported parenthetically.

Table 3.4 Trading Volume Influence on Home-to- U.S. Stock Returns Spillovers for Different Levels of Information Asymmetry.

This table summarizes the coefficients C_0, C_1, C_2, C_3, and C_4, t-statistics, R^2, and F-test results of the following equation.

$$R_{i,t}^{U.S.} = C_{0i} + C_{1i}\cdot R_{i,t-1}^{U.S.} + C_{2i}\cdot V_{i,t-1}^{U.S.}\cdot R_{i,t-1}^{U.S.} + C_{3i}\cdot R_{i,t-1}^{ISR} + C_{4i}\cdot V_{i,t-1}^{ISR}\cdot R_{i,t-1}^{ISR} + \beta_{i,U.S.}R_{U.S.,t-1} + \beta_{i,ISR}R_{ISR,t-1} + e_{i,t}$$

The equation examines international returns' auto-correlation and volume-return interactions, C_2 and C_4, across the two markets. I use daily stock returns and estimate the time-series regression for each firm-month. The table also includes the number of months for which the coefficients are negative, N, the percentage of negative coefficients relative to the total number of coefficients, %N, and the total number of months for which I ran regressions over. In addition, I list the mean of *t*-statistics for each of the coefficients along with number of *t*-statistics that are statistically significant at the 10% level.

Size	Statistic	C_0 #<0	C_1 #<0	C_2 #<0	C_3 #<0	C_4 #<0	t_{C_0} |#|>1.64	t_{C_1} |#|>1.64	t_{C_2} |#|>1.64	t_{C_3} |#|>1.64	t_{C_4} |#|>1.64	R^2	F-stat.
Small	**Mean**	-0.001	-0.2958	0.148	0.5332	0.0651	-0.1119	-0.8836	0.0026	1.8372	0.0179	0.59	4.74
	N	484	686	348	152	367	92	213	139	426	174		
	N %	55%	78%	39%	17%	41%	10%	24%	16%	48%	20%		
	Firm-Months	885	885	885	885	885	885	885	885	885	885		
Medium	**Mean**	-0.001	-0.3083	0.106	0.6134	0.0346	-0.1144	-0.866	0.0366	2.1492	0.054	0.63	4.68
	N	515	741	450	114	434	87	251	133	525	196		
	N %	54%	78%	47%	12%	46%	9%	26%	14%	55%	20%		
	Firm-Months	950	950	950	950	950	950	950	950	950	950		
Large	**Mean**	-0.0001	-0.2359	-0.0028	0.7151	0.0007	0.0425	-0.7688	0.0561	2.7614	0.0298	0.67	5.72
	N	357	562	448	46	467	76	171	104	509	130		
	N %	48%	76%	60%	6%	63%	10%	23%	14%	69%	17%		
	Firm-Months	744	744	744	744	744	744	744	744	744	744		
All	**Mean**	-0.0007	-0.2831	0.0807	0.6152	0.0303	-0.0682	-0.844	0.0306	2.2187	0.0346	0.62	5
	N	1356	1989	1246	312	1268	255	635	376	1460	500		
	N %	53%	77%	48%	12%	49%	10%	25%	15%	57%	19%		
	Firm-Months	2579	2579	2579	2579	2579	2579	2579	2579	2579	2579		

Table 3.5 Cross-Sectional Regression Analysis for the Domestic Tests.

In this table I employ a cross-sectional regression to regress the C_{3i} and C_{4i} coefficients of each firm-month that I collect from the previous time-series regressions, on information asymmetry, using Fama and MacBeth's (1973) method.

$$C_{3i} = a + b \cdot A_i + e_i$$

$$C_{4i} = a + b \cdot A_i + e_i$$

A_i is the degree of information asymmetry that I use the following proxies for *Market Value, Home Share of Turnover, U.S. Share of Turnover, U.S. Illiquidity* ,and *Home Illiquidity*.

	C_3			C_4		
	Constant	**Slope**	R^2	**Constant**	**Slope**	R^2
ln(Market Value)	0.3688**	0.0124***	0.0002	-1.6173	-0.0849***	0.0005
	(2.22)	(2.453)		(-1.199)	(-3.224)	
Home share of Turnover	0.5119***	61.508***	0.0277	-0.1435	103.18*	0.0012
	(29.32)	(8.38)		(-0.99)	(1.71)	
U.S. share of Turnover	0.6113***	-0.0002*	0.0014	0.0187	0.0001	< 0.0000
	(45.83)	(-1.84)		(0.17)	(0.01)	
Home Illiquidity	0.6090***	-1.4245**	0.0005	0.0189	-0.0997	< 0.0000
	(45.88)	(-2.08)		(0.17)	(-0.01)	
U.S. Illiquidity	0.6090***	-141.08	< 0.0000	0.0104	47.91	0.0001
	(45.5)	(-0.15)		(0.1)	(0.6)	

*,**,*** indicate significance at the 10, 5, and 1 percent levels, respectively. Also, t-stats reported parenthetically.

Table 3.6 Trading Volume Influence on U.S.-to-Home Stock Returns Spillovers for Different Levels of Information Asymmetry.

This table summarizes the coefficients C_0, C_1, C_2, C_3, and C_4, t-statistics, R^2, and F-test results of the following equation.

$$R_{i,t}^{ISR} = C_{0i} + C_{1i} \cdot R_{i,t-1}^{ISR} + C_{2i} \cdot V_{i,t-1}^{ISR} \cdot R_{i,t-1}^{ISR} + C_{3i} \cdot R_{i,t-1}^{U.S.} + C_{4i} \cdot V_{i,t-1}^{U.S.} \cdot R_{i,t-1}^{U.S.} + \beta_{i,U.S.} R_{U.S.,t-1} + \beta_{i,ISR} R_{ISR,t-1} + e_{i,t}$$

The equation examines international returns' auto-correlation and volume-return interactions, C_3 and C_4, across the two markets. I use daily stock returns and estimate the time-series regression for each firm-month. The table also includes the number of months for which the coefficients are negative, N, the percentage of negative coefficients relative to the total number of coefficients, %N, and the total number of months for which I ran regressions over. In addition, I list the mean of *t*-statistics for each of the coefficients along with number of *t*-statistics that are statistically significant at the 10% level.

Size	Statistic	C_0 #<0	C_1 #<0	C_2 #<0	C_3 #<0	C_4 #<0	t_{C_0} |#|>1.64	t_{C_1} |#|>1.64	t_{C_2} |#|>1.64	t_{C_3} |#|>1.64	t_{C_4} |#|>1.64	R^2	F-stat.
Small	**Mean**	-0.0017	-0.1529	0.5441	0.4451	-0.0406	-0.0675	-0.4696	0.0139	1.1916	-0.0165	0.52	3.43
	N	458	555	438	203	424	103	176	146	336	156		
	N %	52%	63%	50%	23%	48%	12%	20%	17%	38%	18%		
	Firm-Months	885	885	885	885	885	885	885	885	885	885		
Medium	**Mean**	-0.0022	-0.2043	0.476	0.5012	-0.1004	-0.0044	-0.5736	0.0382	1.1777	-0.0057	0.54	3.27
	N	470	626	476	204	470	92	209	160	360	150		
	N %	49%	66%	50%	21%	49%	10%	22%	17%	38%	16%		
	Firm-Months	950	950	950	950	950	950	950	950	950	950		
Large	**Mean**	0.0002	-0.2706	0.1574	0.5096	-0.1606	0.1055	-0.6001	0.0443	1.0095	-0.0089	0.52	2.49
	N	335	512	372	169	385	78	153	125	240	120		
	N %	45%	69%	50%	23%	52%	10%	21%	17%	32%	16%		
	Firm-Months	744	744	744	744	744	744	744	744	744	744		
All	**Mean**	-0.0013	-0.2058	0.3486	0.4879	-0.0933	0.0055	-0.5455	0.006	1.1339	-0.0061	0.52	3.1
	N	1263	1693	1286	576	1279	273	538	431	936	426		
	N %	49%	66%	50%	22%	50%	11%	21%	17%	36%	17%		
	Firm-Months	2579	2579	2579	2579	2579	2579	2579	2579	2579	2579		

Table 3.7 Cross-Sectional Regression Analysis for the International Tests.

In this table I employ a cross-sectional regression to regress the C_{3i} and C_{4i} coefficients of each firm-month that collect from the previous time-series regressions, on information asymmetry, using Fama and MacBeth's (1973) method.

$$C_{3i} = a + b \cdot A_i + e_i$$

$$C_{4i} = a + b \cdot A_i + e_i$$

A_i is the degree of information asymmetry that I use the following proxies for *Market Value, Home Share of Turnover, U.S. Share of Turnover, U.S. Illiquidity* ,and *Home Illiquidity*.

	C_3			C_4		
	Constant	**Slope**	R^2	**Constant**	**Slope**	R^2
ln(Market Value)	1.4512***	0.0498**	0.0026	-0.205	-0.0099**	<0.0000
	(3.80)	(2.53)		(-0.14)	(-2.13)	
Home share of Turnover	0.5379***	-22.915*	0.0008	0.0425	-17.409	<0.0000
	(13.65)	(-1.88)		(0.29)	(-0.28)	
U.S. share of Turnover	0.5022***	0.145***	<0.0000	0.0172	-0.0002	<0.0000
	(16.9)	(4.14)		(0.15)	(-0.18)	
Home Illiquidity	0.5021***	-1.522	0.0001	0.0143	3.8341**	<0.0000
	(16.99)	(-0.52)		(0.13)	(2.35)	
U.S. Illiquidity	0.5082***	-365.59*	0.0012	0.0147	217.93***	<0.0000
	(17.07)	(-1.69)		(0.13)	(3.03)	

*,**,*** indicate significance at the 10, 5, and 1 percent levels, respectively. Also, t-stats reported parenthetically.

CHAPTER 4 - Voluntary Delisting from the Home Market While Maintaining a Listing in the U.S.

Introduction

International cross-listing was a significant trend in the 80's and 90's due to rapid capital market integration across the world. However, the last several years have witnessed a new trend in international capital markets, international delisting. Karolyi (2006) reports a significant drop in the number of cross-listed stocks by almost 50% between 1997 and 2002. Harris et al., (2008) also report that almost one in five Nasdaq-listed foreign firms delisted every year between 1998 and 2004. Previous literature identifies several benefits of cross-listing such as: accessing new capital markets, increasing the shareholder base, and enhancing affiliation with the host market participants (Karolyi, 1998). However, if anticipated benefits from cross-listing have not been observed or vanished after cross-listing, then delisting would most likely be the fate of cross-listed stocks.

Delisting can be voluntary or involuntary. Voluntary delisting occurs when cross-listing does not yield its anticipated benefits mentioned above. Involuntary delisting, however, takes place when a firm violates the stock exchange's listing requirements. The involuntary delisting is most likely to affect the firm's quality and reputation in the market, especially if the firm is forced to delist from a market with high listing standards and requirements, i.e. U.S. market. Delisting from such markets sends strong signals regarding the poor quality of the firm as it could not meet the market's high listing standards and requirements. On the other hand, voluntary delisting should work to the advantage of delisted firms. It enhances their value and polishes their image, since delisting took place because cross-listing has not yielded its anticipated benefits. Unfortunately, both kinds of delisting, voluntary and involuntary, would result in losing the access to raise capital in the market from which they delist their stocks. This implies an increase in their risk exposure and required returns, which will increase the cost of raising capital after delisting.

Previous studies have done a good job distinguishing between the impacts of voluntary and involuntarily delisting on stock prices, risk, and liquidity. Liu and Stowe's (2005) study is identified as the earliest study in the international delisting field[23] (You et al., 2008). For a sample of U.S. firms that voluntary delisted from Tokyo Stock Exchange (TSE), they find no significant changes in returns on the day of the delisting announcement or the actual delisting day. Another comprehensive study by Liu (2004), where he examines a sample of 158 foreign firms that have been involuntarily delisted from U.S. stock exchanges, finds a significant average price drop of 4.5% upon the delisting announcement. Liu, in both studies, employs an event study approach to evaluate changes in the abnormal returns around actual delisting and its announcement. Both studies do not evaluate changes in the risk and subsequent change in the cost-of-capital. Harris et al. (2008) examine a sample of 1,098 firms that have been involuntarily delisted from Nasdaq, over the three-month period between the delisting announcement date and the actual delisting date. They observe a significant decline in stock prices and a large increase in volatility. Finally, You et al. (2008) conduct a comprehensive study on the valuation effect around cross-listing and subsequently delisting from foreign stock exchanges. They report significant negative returns in the month of actual delisting; however, this loss is temporary. In their sample, changes in risk around delisting vary, but it increases for the majority of the sample. In summary, for involuntary delisting, studies observe significant drop in stock returns around delisting, however, studies report no changes in returns around delisting for voluntary

[23] Other earlier studies focus on the local delisting i.e. Clyde et al. (1997).

delisting. On the other hand, all studies in this field suggest that firms will encounter an increase in their risk exposure after delisting.

The above findings seem to be consistent with the international cross-listing theory that suggests cross-listing should enhance the value of the cross-listed firm and reduce their risk exposure as a result of diversification, thereby, reducing the cost-of-capital. However, Karolyi (2006) says, "*After all, the cost-of-capital effect stemming from a global diversification of corporate risk exposures associated with a cross-listing in the U.S. is unlikely to be realized until the firm actually draws from the newly accessible capital market*". Therefore, when firms delist their stocks from an international market they lose access to raise capital in that market, which should increase their risk exposure and expected returns on their stocks, and hence increases the cost of their capital afterward.

In this paper I shed light on a new aspect of the international delisting topic. I investigate the impact of voluntary delisting of Israeli stocks from their own home market, Tel Aviv Stock Exchange (TASE), on stock returns, risk, and the cost-of-capital around the delisting announcement and the actual delisting. All firms in my sample have gone public in the U.S. stock exchanges and were cross-listed in their home market (TASE) afterword. Thus, unlike the rest of the literature[24], I focus on firms delisting from their home market after they recently access it, while maintaining their listing on the host market (U.S.). I use the two different models to evaluate changes in U.S., Israeli, and global betas and other risk measurements around the delisting. I also calculate abnormal returns using the traditional event study approach to evaluate changes in stock's returns around the delisting.

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[24] All studies I found focus on international delisting from the host market while maintaining their listing in the home market.

The rest of the paper proceeds as follows. Section 4.2 contains the discussion of the different models used to evaluate returns and risk around the actual delisting and its announcement. The data and sampling criteria are described in section 4.3. Empirical results and conclusions are in sections 4.4 and 4.5, respectively.

Data

Initially, 78 Israeli stocks went public in the U.S., only 50 of which cross-listed on the home market, TASE. Four out of the 50 firms delisted from TASE afterword, and the delisting reason cited for all four firms is low trading volumes and extra listing fees charged by TASE. The sample is identified from the official website of TASE, which offers a complete list of all dual-listed stocks in the U.S. and on other foreign stock exchanges around the world. The exact dates for delisting announcements are identified from Lexis/Nexis which also includes the official delisting 20-F Form[25] for each firm in my sample. The four firms are listed as technology firms, and they maintain their listing on the NASDAQ after delisting from TASE. Table 4.1 shows a list of the firms in my sample with the date of the delisting announcement, the firm's industry, and the stock exchange at which each stock is listed in the U.S.

The majority of cross-listings in TASE by the Israeli stocks took place after the implementation of the Dual Listing Law on October of 2000. This law allows companies that are initially listed on one of the major U.S. stock exchanges (AMEX, NASDAQ, and NYSE) or the LSE to cross-list on the TASE without any additional regulatory burdens. After cross-listing, firms need to submit the same financial statements and other disclosures that they submit abroad,

[25] A Securities and Exchange Commission form that is used by foreign companies to file annual reports that must be filed within six months of the end of the company's fiscal year. The Form 20-F also may be used as a registration statement to comply with other requirements, and is used by domestic companies to report a change in their fiscal year.

and the financial statements have to be submitted according to the schedule that applies abroad. That is, if a company is originally listed in the U.S. or London and decides to cross-list on TASE, the firm will not experience any changes in accounting practices or disclosure requirements. Consequently, when delisting from TASE, none of the accounting standards or disclosure requirements is changing.

Methodology

To evaluate the risk around delisting, I first estimate the two-factor international asset pricing model (IAPM) based on the intersection and the time series of each firm's returns, including the U.S. market, and the world index returns. This methodology is developed by Schipper and Thompson (1983) and employed by Foerster and Karolyi (1999) to measure changes in the abnormal returns and risk around cross-listing. In the two-factor IAPM model, Foerster and Karolyi (1999) regress stock returns on the U.S. market index and the global market index to take in account shifts in U.S. and Global markets' risks. In addition to Foerster and Karolyi's approach, I include the home market index to capture shifts in the Israeli market after delisting. Therefore, I estimate the two-factor IAPM model but with replacing the global market index with the Israeli market index. This helps evaluating risk shifts around the delisting originating from the host market (U.S.), home market (Israel), and the global market as follows.

$$\begin{aligned} R_{it} &= \alpha_i^{\Pr e} + \beta_{i,U.S.}^{\Pr e} R_{mt}^{U.S.} + \beta_{i,W}^{\Pr e} R_{mt}^{W} + \alpha_i^{Announ} D_t^{Announ} \\ &+ \alpha_i^{Post} D_{it}^{Post} + \beta_{i,U.S.}^{Post} R_{mt}^{U.S.} D_{it}^{Post} + \beta_{i,W}^{Post} R_{mt}^{W} D_{it}^{Post} + \varepsilon_{it} \end{aligned} \quad (1)$$

$$\begin{aligned} R_{it} &= \alpha_i^{\Pr e} + \beta_{i,U.S.}^{\Pr e} R_{mt}^{U.S.} + \beta_{i,ISR}^{\Pr e} R_{mt}^{ISR} + \alpha_i^{Announ} D_t^{Announ} \\ &+ \alpha_i^{Post} D_{it}^{Post} + \beta_{i,U.S.}^{Post} R_{mt}^{U.S.} D_{it}^{Post} + \beta_{i,ISR}^{Post} R_{mt}^{ISR} D_{it}^{Post} + \varepsilon_{it} \end{aligned} \quad (2)$$

where R_{it} is the *i*'th stock return at time *t* and, α_i are constants (explained as abnormal returns). $\beta_{i,U.S.}$ are coefficients of the U.S. market index returns ($R_{mt}^{U.S.}$). $\beta_{i,W}$ and $\beta_{i,ISR}$ are coefficients of the global and home market indexes returns, R_{mt}^{W} and R_{mt}^{ISR}. D_{it}^{Announ} is a dummy variable that equals one on the announcement day and zero otherwise, and D_{it}^{Post} is a dummy variable that equals one on the post-announcement days and zero otherwise. Both equations are estimated over a window of 501-day around the day of delisting announcement, 250-day pre-delisting window and 250-day post-listing window.

The coefficients $\beta_{iU.S.}^{\mathrm{Pr}e}$, $\beta_{iW}^{\mathrm{Pr}e}$, and $\beta_{i,ISR}^{\mathrm{Pre}}$ capture the stock returns' sensitivity to local and global markets prior to delisting, and $\beta_{iU.S.}^{Post}$, β_{iW}^{Post}, and $\beta_{i,ISR}^{\mathrm{Pre}}$ capture the changes in stock returns' sensitivity to U.S., global, and Israeli markets, respectively, following the delisting announcement.

Following Foerster and Karolyi's (1999) approach, I interpret $\alpha_i^{\mathrm{Pr}e}$ as pre-delisting abnormal return, $\alpha_i^{\mathrm{Pr}e} + \alpha_i^{Announ}$ as the abnormal return on the day of the delisting announcement, and $\alpha_i^{\mathrm{Pr}e} + \alpha_i^{Post}$ as post-delisting abnormal returns.

I use the S&P500 for the U.S. market index, MSCI EAFE (Morgan Stanley Country Index-Europe, Australasia, Far East) for the world market index, and TA-100 for the Israeli market index. The MSCI EAFE is an aggregate index of 21 individual country indices. It is a market capitalization weighted index that is broadly accepted as a benchmark of non-American shares and is used by most international mutual funds to measure their performance. Table 4.2 shows a full list of all countries with market capitalization weight included in the index. Although, the MSCI EAFE index excludes the U.S. market and other major stock exchanges in North and South Americas, it includes all other major stock exchanges in the rest of the world.

This index provides a precise measure of the world's stock exchanges outside the U.S., and I use it in this paper's models to capture changes in global risk outside the U.S. markets.

One unique feature of the IAPM model is that it adjusts for the U.S., global, and Israeli markets covariance risks while evaluating the abnormal returns before and after the delisting announcement. This model also helps to discover the abnormal returns patterns around delisting, providing further evidence to support the market segmentation theory. The disadvantage of this methodology, as Foerster and Karolyi (1999) point out, is that when we pool stock returns series for all firms, U.S., global, and Israeli betas will be averaged. Therefore, I perform a separate univariate regression for each firm and compare those results to the cross-sectional results to eliminate any biases that might occur because of the pooled cross-sectional estimation. I also calculate the adjusted R-square and a robust t-statistic using the Newey-West standard error for heteroscedasticity and serial correlation.

Evaluating only changes in U.S., global, and Israeli betas around delisting does not provide sufficient results to measure the net impact of delisting on the cost-of-capital. Changes in betas imply how sensitive stock returns are to a specific market around delisting and they measure changes in risk exposure; however they do not capture changes in the overall risk exposure, i.e. volatility and information asymmetry. Hence, I use the two-Index model to evaluate changes in the host, home, and global market betas around delisting, as well as, changes in standard deviation and information asymmetry. The two-index model is used by Howe and Madura (1990), and it captures changes in five different risk characteristics due to a certain event. However, I evaluate changes in only four risk characteristics around delisting announcement and the actual delisting. The model equations are:

$$R_{it} = \alpha_i + \beta_i^{U.S.} R_{mt,U.S.} + \beta_i^{W} R_{mt,W} + \varepsilon_{it} \tag{3}$$

$$R_{it} = \alpha_i + \beta_i^{U.S.} R_{mt,U.S.} + \beta_i^{ISR} R_{mt,ISR} + \varepsilon_{it} \tag{4}$$

where R_{it} is the rate of return of stock *i* at day *t*; $R_{mt,U.S.}$, $R_{mt,W}$, and $R_{mt,ISR}$ are the market's returns of U.S., global, and Israeli markets, respectively, at day *t*; ε_{it} are the error terms with expected value of zero. The parameters $\beta_i^{U.S.}$, β_i^{W}, and β_i^{ISR} represent the U.S., global, and Israeli markets betas, and they measure the sensitivity of the i^{th} stock returns, R_{it}, to the U.S., global, and Israeli market returns, $R_{mt,U.S.}$, $R_{mt,W}$, and $R_{mt,ISR}$, respectively. The S&P500, MSCI EAFE, and TA-100, are used to calculate the U.S., global, and Israeli market returns, respectively, for this model. To estimate U.S., global, and Israeli betas, this study uses a 250-day pre-delisting window and a 250-day post-delisting window. In addition to market betas, I analyze changes in the standard deviation and residual variance around the delisting announcement day, *t=0*.

Delisting is expected to increase the U.S. beta, β_i^{US}, as the stock returns become more sensitive to the U.S. market movements after delisting from TASE. In addition, if delisting from the Israeli market results in an increase in standard deviation of stock returns, then delisting increases the uncertainty of future returns and exposes the stock to a higher level of risk[26]. However, if standard deviation decreases after delisting, then delisting decreases the level of uncertainty, indicating a more diversified security that carries a lower level of risk.

Information asymmetry in cross-listing occurs when investors in one market have an information advantage over investors in another market. Howe and Madura (1990) suggest that cross-listing is expected to decrease the level of information asymmetry given the same stock is

[26] Standard Deviation here is used as a measurement of the risk associated with each stock before vs. after delisting and it is calculated for each stock individually and then averaged for the full sample.

available in both markets, which lowers the cost of obtaining information if the firm's reporting standards change due to cross-listing. Therefore, I expect information asymmetry to increase after delisting, because obtaining information from the home market will be costly after delisting from it. This study follows Demsetz's approach and uses the residual variance obtained from the two-index model as a proxy to register changes in the level of the information asymmetry before and after the delisting announcement.

Finally, I use the event study approach to evaluate changes in abnormal returns around the delisting announcement by calculating the accumulative average abnormal returns (CAAR). Using the market model, I forecast the expected returns for the event window (-50, +250) relative to the delisting announcement day, $t=0$, as shown in figure (4.1).

Empirical Evidence

In table 4.3, I summarize the cross-section and univariate estimates of equation (1). The average of the U.S. betas before delisting announcement is 0.775, while the average of global betas is 0.559, both are statistically significant. After the delisting announcement, U.S. betas, on average, experienced a significant increase of 0.079, while global betas, on average, experienced an insignificant increase of 2.3. These results suggest that after delisting from the Israeli market, the U.S. market risk exposure is greater, but global risk exposure has not changed significantly. This finding is consistent with my expectation that the U.S. market risk exposure increases after the delisting announcement, suggesting an increase in the cost-of-capital.

The same estimation, equation (1), is performed for each firm to further identify changes in the U.S. and global betas. All firms show a significant positive change in their U.S. betas after the delisting announcement but one; Radcom. However, this negative shift, that Radcom experiences, is not significant. Global betas also increased for three firms only, two of which is significant. Univariate tests for each firm yield results that are robust with the cross-sectional results.

Results presented in table 4.3 also suggest that pre-delisting announcement abnormal returns are significantly negative, with an average of -0.375% a day, measured by α_i^{PRE}. On the day of the delisting announcement, the average abnormal returns are positive among all firms, with an average gain of 1.2% a day, measured by $\alpha_i^{PRE} + \alpha_i^{LIST}$. Post-listing abnormal returns are positive with an average of 0.034% a day, measured by $\alpha_i^{PRE} + \alpha_i^{POST}$.

Now, I evaluate shifts in risk exposure for the U.S. and Israeli markets. Table 4.4 shows the estimated coefficients of equation (2). The U.S. betas, on average, experience a significant increase after the delisting announcement, while the Israeli betas experience a significant drop, on average. Univariate tests also support my finding for the significant increase in U.S. betas and significant decrease in Israeli betas.

Evaluation of abnormal returns around the delisting announcements using equation (2) yields similar results to those from equation (1). Table 4.4 shows negative abnormal returns, on average, prior to delisting announcement of 0.37% a day, and 1.2% positive abnormal return on the day of the delisting announcement. Post-delisting announcement results shows a positive abnormal return of 0.13% a day. To this point, results indicate a greater risk exposure to the U.S. market and less risk exposure to the Israeli market, implying an increase in the overall risk facing Israeli firms and their cost-of-capital after delisting from the Israeli market. Abnormal returns, on the other hand, increase on the day of delisting announcement and maintain a weak increase afterword.

I now turn my focus to evaluate changes in U.S., global, and Israeli betas along with other risk measurements using the two-index model, equations (3) and (4). In tables 4.5 and 4.6, I summarize all estimated coefficients from equations (3) and (4). I compare the U.S., global, and Israeli betas, standard deviation, and residual variance before and after the delisting announcement, day *t=0*.

Table 4.5 shows a large positive shift in U.S. risk exposure, $\beta_i^{U.S.}$, from 0.305 to 0.695 on average, after the delisting announcement; U.S. betas are both significant for the majority of firms. Similarly, exposure to global risk increases after the delisting announcement, but the change is only significant for one firm. These results support my earlier findings, from table 4.3, when evaluating changes in the U.S. and global betas around the delisting announcement. Exposure to U.S. risk is significantly increasing after announcing delisting from the Israeli market, and exposure to global market risk does not significantly change. Greater exposure to U.S. risk indicates a higher cost-of-capital for firms delisting from the Israeli market. Standard deviation increases for all firms indicating a higher level of uncertainty about future returns and a greater level of risk exposure. The last measure of risk in table 4.5 is residual variance (R.V.), which represents the level of information asymmetry around the delisting announcement. Residual variance increases for all firms, implying a higher level of information asymmetry after the delisting announcement. This finding is consistent with the rest of the literature that find information asymmetry to be decreasing after cross-listing, and hence, one should expect it to increase when delisting. Information asymmetry should increase, especially for those firms that are delisting from the home market, making the cost of obtaining information higher after delisting.

The estimated coefficients of equation (4) are presented in table 4.6, for all four firms. Here I evaluate changes in U.S. and Israeli betas around the delisting announcement along with changes in standard deviation and residual variance. The U.S. betas are increasing, on average, from 0.328 to 0.683 after the delisting announcement. All firms experience this positive change in their U.S. betas after the delisting announcement, and they are all significant except Radcom. On the other hand, Israeli betas are decreasing, on average, and this change is significant for all firms except Optibase. This finding further supports my earlier finding that delisting from the Israeli market increases stock return risk exposure to the U.S. market and decreases it for the Israeli market. The other two measures of risk exposure, S.D. and R.V., are increasing for all firms, and they add more supporting evidence to my hypothesis, suggesting an overall increase in overall risk exposure after the delisting announcement.

I further investigate changes in all four risk measurements in equation (4) around the actual delisting date, instead of only the delisting announcement day. I estimate equation (4) over three windows. The first window is for the 250-days before delisting until the day before the delisting announcement, (-250, -1). The second is from the day of the delisting announcement, *t=0*, until the day before the actual delisting, (0, Actual Delisting Day-1). The third window is from the day of actual delisting until 250-day after the actual delisting. I do so because actual delisting takes place at least three months after the announcement date. Actual delisting in my sample takes between 59 to 65 trading days after the delisting announcement date, *t=0.* With this analysis I should be able to capture any changes in risk associated with the announcement and actual delisting while avoiding any noise caused by the delisting announcement or actual delisting.

In table 4.7, I report the estimated coefficient of equation (4) over the three windows of interest (-250, -1), (0, Actual Delisting Day-1), and (Actual Delisting Day, +250). The U.S. beta increases gradually in each of the three windows, starting from the pre-delisting announcement window and ending in the post-actual delisting window. The same pattern can be observed about the Israeli beta, but it decreases instead. This increasing (decreasing) beta suggests an increase (decrease) in stock returns sensitivity to the U.S. (Israeli) market right after the delisting announcement. Standard deviation (S.D.), on the other hand, increased significantly after the delisting announcement but dropped after the actual delisting. This finding is consistent for all firms. On average, S.D. increased from 0.0407 to 0.07504 after the announcement and dropped to 0.05619 after the actual delisting. This increase of S.D. after the delisting announcement is most likely caused by the high volatility after the announcement as a result of the Israeli liquidation of soon-to-be delisted stocks from the TASE. One can also think of this decrease in S.D., after the actual delisting, as a result of a decrease in volatility around the announcement. However, S.D. after actual delisting is higher than what it used to be in the pre-delisting announcement window. This implies that delisting of Israeli stocks from TASE is associated with a higher degree of risk and, in turn, a higher cost-of-capital. This finding is consistent with the previous studies that suggest an increase in the level of risk exposure after delisting. Finally, the R.V. experiences a positive shift, but it is moderate after the delisting announcement and large after the actual delisting. This is most likely caused by the fact that firms are still traded in TASE after the delisting announcement, however, they are not after the actual delisting, and hence, R.V. experiences a large increase afterword.

In addition, I plot a graph for accumulative average abnormal returns (CAARS) for a window (-50, +250) around the delisting announcement day, *t=0*. Figure (2) shows that CAARs increase on the day of the delisting announcement and the actual delisting day. As implied by results in table 4.7, the graph shows a large drop in abnormal return right after the delisting announcement and a large increase around the actual delisting day.

Finally, given that the size of the sample in this study is very small and since the desisting of all four firms delisted from TASE within a year[27], I cannot generalize the conclusions of this study on all voluntary delisted stocks. A generalized conclusion should be based on a lager sample of delisted stocks from several markets that is stretched over a longer period of time.

Conclusion

Previous research has found that cross-listing on other capital markets yields a significant decrease of the cost-of-capital due to the elimination of the risk premium that exists before cross-listing. However, Karolyi (2006) doubts that changes in the cost-of-capital due cross-listing can be realized until firms delist their stocks from the capital market they recently accessed. My finding suggests that when firms voluntary withdraw their listing from a capital market they accessed recently, delisting will offset any reduction in the cost-of-capital that they might encounter initially because of cross-listing.

For a sample of four Israeli firms that went public in the U.S. and cross-listed on their home market (TASE) afterword, I examine changes in their returns and risks after they voluntary delist from the home market (TASE) while maintaining their listing in the U.S. The results show a significant positive shift in U.S. and negative shift in Israeli market risk exposure after the delisting. I identify a greater exposure to the U.S. market's risk and a lower exposure to the Israeli market's risk. However, evaluation of exposure to global market risk does not yield any significant changes after delisting. These results indicate that firms delisting from their home market (TASE), face greater risk exposure, higher required returns on their stocks and, hence, higher cost-of-capital after delisting.

[27] All four stocks were delisted from TASE on the second half of 2008 and the first half of 2009.

Unlike Liu and Stowe (2005), I find delisting to be associated with positive abnormal returns that are statistically and economically significant. Delisting in my sample is voluntary and firms are delisting from their home market (TASE) while maintaining their listing on the host market (U.S.). The results of this research suggest that voluntary's delisting from a market that is recently accessed, when cross-listing has not yielded its anticipated benefits, most likely increases the value of the firm.

Table 4.1 List of Israeli Firms that delisted from the Israeli market (TASE) while maintaining their listing on the U.S. market.

	Delisted Israeli Firms	Date of Delisting Announcement from TASE	Industry	U.S. stock exchange
1	B O S	02/11/2009	Technology	NASDAQ
2	OPTIBASE	06/25/2008	Technology	NASDAQ
3	RADCOM	03/31/2009	Technology	NASDAQ
4	RADWARE	12/09/2009	Technology	NASDAQ

Table 4.2 List of countries included in the MSCI EAFE as of May 2010 [(a)]

Country	Weight	Country	Weight
Japan	23.40%	Singapore	1.60%
United Kingdom	21.30%	Finland	1.10%
France	9.90%	Denmark	1.00%
Australia	8.20%	Belgium	1.00%
Germany	7.80%	Israel	0.90%
Switzerland	7.60%	Norway	0.80%
Spain	3.40%	Austria	0.30%
Italy	2.90%	Greece	0.30%
Sweden	2.80%	Portugal	0.30%
Netherlands	2.60%	Ireland	0.30%
Hong Kong	2.40%	New Zealand	0.10%

(a) Data in this table is taking directly from MSCI EAFE web page.

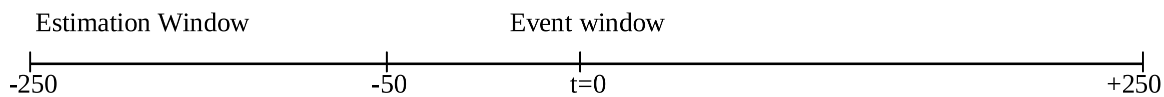


Figure 4.1 Time line with delisting announcement at t=0.

Table 4.3 U.S. and World betas and abnormal returns before and after the delisting-announcement.

The table summarizes the coefficients of equation (1), U.S. and world betas before delisting, $\beta_{i,U.S.}^{PRE}$ and $\beta_{i,W}^{PRE}$, changes in U.S. and world betas after delisting, $\beta_{i,U.S.}^{POST}$ and $\beta_{i,W}^{POST}$, pre-listing abnormal returns, α_i^{PRE}, abnormal return on the day of delisting, $\alpha_i^{PRE} + \alpha_i^{Announ}$, abnormal returns post-delisting, $\alpha_i^{PRE} + \alpha_i^{POST}$, and adjusted R^2. The pre-delisting window is -250 to -1 days and the post-delisting window is +1 to +250 days relative to the delisting announcement date at *t=0*.

$$R_{it} = \alpha_i^{\text{Pre}} + \beta_{i,U.S.}^{\text{Pre}} R_{mt}^{U.S.} + \beta_{i,W}^{\text{Pre}} R_{mt}^{W} + \alpha_i^{List} D_t^{List} + \alpha_i^{Post} D_{it}^{Post} + \beta_{i,U.S.}^{Post} R_{mt}^{U.S.} D_{it}^{Post} + \beta_{i,W}^{Post} R_{mt}^{W} D_{it}^{Post} + \varepsilon_{it}$$

	Pre-Delisting Announcement (-250,-1)			**Delisting Announcement Day (*t*=0)**	**Post-Delisting Announcement (+1,+250)**			
	α_i^{PRE}	$\beta_{i,U.S.}^{PRE}$	$\beta_{i,W}^{PRE}$	α_i^{Announ}	α_i^{POST}	$\beta_{i,U.S.}^{POST}$	$\beta_{i,W}^{POST}$	**Adj. R^2**
All Firms	-0.0037*	0.7750***	0.5596***	0.0165***	0.0040***	0.0792***	2.3059	0.0723
	(-1.88)	(3.38)	(2.7)	(5.45)	(3.35)	(3.53)	(1.01)	
B.O.S.	-0.0055**	1.0005**	1.1377**	0.0482***	0.0076**	0.5515**	1.9361*	0.0847
	(-2.46)	(2.22)	(2.34)	(9.77)	(2.4)	(2.44)	(1.77)	
OPTIBASE	-0.0039*	0.0380	0.2288	0.0277***	0.0052	0.2830**	1.6293	0.0627
	(-1.84)	(0.14)	(0.79)	(6.12)	(1.47)	(2.35)	(0.59)	
RADCOM	-0.0037	0.4134*	0.4733	0.0315***	0.0132***	-0.3891	-2.0447	0.0475
	(-0.57)	(1.75)	(0.74)	(2.89)	(4.48)	(-1)	(-1.34)	
RADWARE	-0.0017*	0.1490***	0.3199**	0.0150***	0.0031**	0.1021***	3.1159*	0.1501
	(-1.73)	(4.07)	(2.04)	(5.04)	(2.36)	(4.93)	(1.94)	

*,**,*** denotes significance at the 10%, 5%, and 1% levels, respectively. Also, t-stats reported parenthetically.

Table 4.4 U.S. and Israeli betas and abnormal returns before and after the delisting-announcement.

The table summarizes the coefficients of equation (2), U.S. and Israeli betas before delisting, $\beta^{PRE}_{i,U.S.}$ and $\beta^{PRE}_{i,ISR}$, changes in U.S. and world betas after delisting, $\beta^{POST}_{iU.S.}$ and β^{POST}_{iW}, pre-listing abnormal returns, α^{PRE}_{i}, abnormal return on the day of delisting, $\alpha^{PRE}_{i} + \alpha^{Announ}_{i}$, abnormal returns post-delisting, $\alpha^{PRE}_{i} + \alpha^{POST}_{i}$, and adjusted R^2. The pre-delisting window is -250 to -1 days and the post-delisting window is +1 to +250 days relative to the delisting announcement date at *t=0*.

$$R_{it} = \alpha_i^{\text{Pre}} + \beta_{i,U.S.}^{\text{Pre}} R_{mt}^{U.S.} + \beta_{i,ISR}^{\text{Pre}} R_{mt}^{ISR} + \alpha_i^{List} D_t^{List} + \alpha_i^{Post} D_{it}^{Post} + \beta_{i,U.S.}^{Post} R_{mt}^{U.S.} D_{it}^{Post} + \beta_{i,ISR}^{Post} R_{mt}^{ISR} D_{it}^{Post} + \varepsilon_{it}$$

	Pre-Delisting Announcement (-250,-1)			Delisting Announcement Day (*t*=0)	Post-Delisting Announcement (+1,+250)			
	α^{PRE}_{i}	$\beta^{PRE}_{i,U.S.}$	$\beta^{PRE}_{i,ISR}$	α^{Announ}_{i}	α^{POST}_{i}	$\beta^{POST}_{i,U.S.}$	$\beta^{POST}_{i,ISR}$	**Adj. R^2**
All Firms	-0.0036*	0.4456***	0.0630***	0.0157***	0.0050***	0.1674***	-7.0261***	0.1069
	(-1.86)	(3.54)	(2.81)	(7.37)	(2.73)	(4.99)	(-5.91)	
B.O.S.	-0.0049**	0.0293	0.3373*	0.0351***	0.0052***	0.7206***	-4.6348	0.0658
	(-2.31)	(0.13)	(1.88)	(4.95)	(5.05)	(2.7)	(-1.1)	
OPTIBASE	-0.0039*	0.2577***	0.0432***	0.0271***	0.0073***	0.3165***	-11.1272***	0.1032
	(-1.85)	(3.54)	(3.35)	(11.51)	(4.96)	(3.46)	(-3.4)	
RADCOM	-0.0039	0.9142***	0.0425	0.0257***	0.0084**	-0.3533	-2.6053***	0.0377
	(-0.61)	(3.3)	(1.19)	(3.36)	(2.03)	(-0.76)	(-3.1)	
RADWARE	-0.0018**	0.4521***	0.0041**	0.0169***	0.0043*	0.0228***	-1.6383**	0.0892
	(-2.18)	(7.4)	(2.06)	(8.26)	(1.88)	(7.17)	(-2.16)	

*,**,*** denotes significance at the 10%, 5%, and 1% levels, respectively. Also, t-stats reported parenthetically.

Table 4.5 Comparison of U.S. betas, World betas, standard deviations, and residual variances before and after Delisting using the two-index model.

The table summarizes equation (3) coefficients, U.S. and World betas, $\beta_i^{U.S.}$ and β_i^{W}, standard deviation, S.D., and residual variance, R.V., before and after the delisting announcement. The pre-delisting window is -250 to -1 days and post-delisting widow is 0 to +250 days relative to the date of delisting announcement at *t=0*.

$$R_{it} = \alpha_i + \beta_i^{U.S.} R_{mt,US} + \beta_i^{W} R_{mt,W} + \varepsilon_{it}$$

	Pre-Delisting Announcement (-250,-1)				**Post-Delisting Announcement (0,+250)**			
	$\beta_i^{U.S.}$	β_i^{W}	**S.D.**	**R.V.**	$\beta_i^{U.S.}$	β_i^{W}	**S.D.**	**R.V.**
B.O.S.	0.4014**	0.4098	0.0575	0.0033	1.90147*	3.0354	0.0861	0.0070
	(2.02)	(1.17)			(1.86)	(1.25)		
OPTIBASE	0.0664***	0.1933	0.0336	0.0011	0.3295*	0.2212	0.0627	0.0036
	(3.22)	(0.59)			(1.88)	(0.62)		
RADCOM	0.4629	0.8019	0.0808	0.0065	0.2173	0.4133	0.1045	0.0103
	(1.58)	(0.89)			(0.27)	(0.45)		
RADWARE	0.2906***	0.0921	0.0265	0.0005	0.3350**	0.7350**	0.0269	0.0006
	(1.96)	(0.46)			(3.09)	(2.37)		
Average	0.3053	0.3743	0.0496	0.0028	0.6958	1.1012	0.0700	0.0054

*,**,*** denotes significance at the 10%, 5%, and 1% levels, respectively. Also, t-stats reported parenthetically.

Table 4.6 Comparison of U.S. betas, Israeli betas, standard deviations, and residual variances before and after Delisting using the two-index model.

The table summarizes equation (3) coefficients, U.S. and Israeli betas, $\beta_i^{U.S.}$ and β_i^{ISR}, standard deviation, S.D., and residual variance, R.V., before and after the delisting announcement. The pre-delisting window is -250 to -1 days and post-delisting widow is 0 to +250 days relative to the date of delisting announcement at *t=0*.

$$R_{it} = \alpha_i + \beta_i^{U.S.} R_{mt,US} + \beta_i^{ISR} R_{mt,ISR} + \varepsilon_{it}$$

	Pre-Delisting Announcement (-250,-1)				**Post-Delisting Announcement (0,+250)**			
	$\beta_i^{U.S.}$	β_i^{ISR}	**S.D.**	**R.V.**	$\beta_i^{U.S.}$	β_i^{ISR}	**S.D.**	**R.V.**
B.O.S.	0.0234***	0.0719***	0.0575	0.0033	0.8871**	0.0313**	0.0861	0.0070
	(2.10)	(4.47)			(2.26)	(1.96)		
OPTIBASE	0.2529***	0.0091	0.0336	0.0011	0.5831***	-0.0751	0.0627	0.0036
	(2.61)	(0.06)			(3.06)	(-0.39)		
RADCOM	0.6157***	0.9149***	0.0450	0.0010	0.9074	0.2156***	0.0763	0.0028
	(3.96)	(6.34)			(1.51)	(4.57)		
RADWARE	0.422149***	0.0314***	0.0265	0.0005	0.3579***	-0.0514***	0.0269	0.0006
	(7.62)	(2.48)			(4.65)	(-5.50)		
Average	0.3285	0.2568	0.0407	0.0015	0.6839	0.0301	0.0630	0.0035

*,**,*** denotes significance at the 10%, 5%, and 1% levels, respectively. Also, t-stats reported parenthetically.

Table 4.7 Comparison of U.S. betas, Israeli betas, standard deviations, and residual variances for three different windows using the two-index model.

The table summarizes equation (3) coefficients, U.S. and Israeli betas, $\beta_i^{U.S.}$ and β_i^{ISR}, standard deviation, S.D., and residual variance, R.V., before and after the delisting announcement. The pre-delisting announcement window is -250 to -1 days relative to the date of delisting announcement at *t=0,* (-250, -1). The post-delisting announcement widow is 0 to one day before the actual delisting relative to the date of delisting announcement at *t=0,* (0, Actual Delisting Day-1). The post-actual delisting window is from the day of actual delisting to +250 days relative to the date of delisting announcement at *t=0,* (Actual Delisting Day,+250). Actual delisting takes place at least three months after the delisting announcement date. Actual delisting in my sample takes between 59 to 65 trading days after the delisting announcement date, *t=0*.

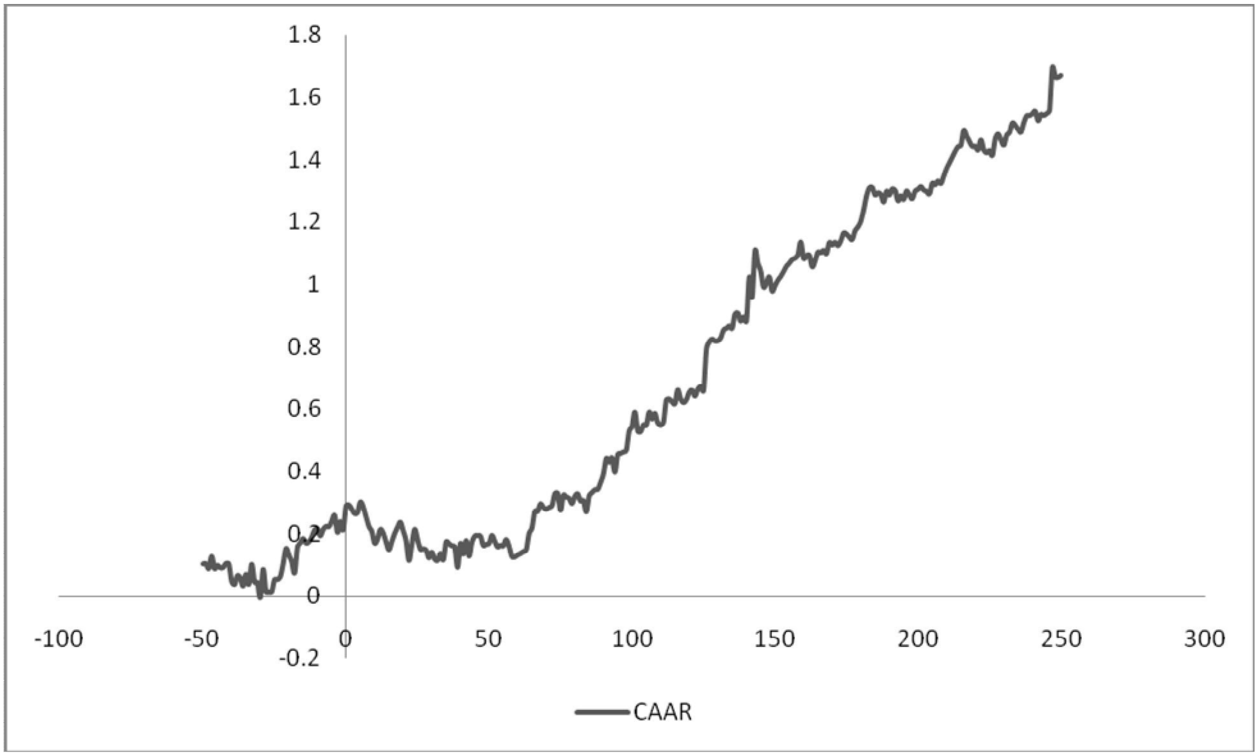
$$R_{it} = \alpha_i + \beta_i^{U.S.} R_{mt,US} + \beta_i^{ISR} R_{mt,ISR} + \varepsilon_{it}$$

	Pre-Delisting Announcement (-250,-1)				**Post-Delisting Announcement (0, Actual Delisting Day-1)**				**Post-Actual Delisting (Actual Delisting Day,+250)**			
	$\beta_i^{U.S.}$	β_i^{ISR}	**S.D.**	**R.V.**	$\beta_i^{U.S.}$	β_i^{ISR}	**S.D.**	**R.V.**	$\beta_i^{U.S.}$	β_i^{ISR}	**S.D.**	**R.V.**
B.O.S.	0.0234**	0.0719***	0.0575	0.0033	0.4754***	0.0627***	0.1043	0.0045	1.0270***	0.0225***	0.0745	0.0081
	(2.10)	(4.47)			(2.69)	(3.74)			(3.41)	(3.12)		
OPTIBASE	0.2529***	0.0091	0.0336	0.0011	0.2908***	0.0012***	0.0773	0.0019	0.6799***	-0.0618**	0.0612	0.0045
	(2.61)	(0.06)			(3.60)	(4.14)			(5.20)	(-2.26)		
RADCOM	0.6157***	0.9149***	0.0450	0.0010	0.6899***	0.4482*	0.0860	0.0011	1.1398	0.1937***	0.0646	0.0034
	(3.96)	(6.34)			(4.55)	(1.95)			(1.07)	(3.13)		
RADWARE	0.4221***	0.0314***	0.0265	0.0005	0.4458***	0.0081***	0.0324	0.0006	0.3362***	-0.0914***	0.0243	0.0006
	(7.62)	(2.48)			(4.66)	(3.00)			(5.10)	(-4.09)		
Average	0.3285	0.2568	0.0407	0.0015	0.4755	0.1301	0.0750	0.0020	0.7957	0.0157	0.0561	0.0042

*,**,*** denotes significance at the 10%, 5%, and 1% levels, respectively. Also, t-stats reported parenthetically.

Figure 4.2 Cumulative average abnormal returns (CAARs) for a window (-50, +250) around delisting announcement day t=0.

Actual delisting in the sample takes between 59 to 65 trading days after the delisting announcement date, *t=0*.



CHAPTER 5 - Conclusion

For a unique sample of Israeli stocks that went public in the U.S. and pursue further listing in their own home market (TASE), I find also that cross-listing is associated with a positive abnormal return of 0.0218 on the day upon cross-listing, which is statistically and economically significant. Using different windows to calculate the cumulative average abnormal returns (CAARs) yields positive results that are all significant on the day of cross-listing and around it. However, evaluating abnormal returns over the post-listing window shows that small firms lose all their gains 12 days after cross-listing, while large firms maintain positive CAARs 50 days after cross-listing. This indicates that small firms time their cross-listing to follow a superior performance allowing them to take advantage of their overpriced stocks and raise capital at a low cost. Evaluation of changes in the risk exposure around cross-listing yields results that are consistent with the rest of the literature, such that I find a significant decrease in risk in Israeli cross-listed stocks after cross-listing. However, the decrease in the Israeli beta is puzzling. Further investigation suggests that this decrease is limited to small firms suggesting that U.S. investors in small Israeli firms do not act in favor of cross-listing these stocks on TASE as it signals their striving for additional capital that they could not raise in the U.S. market.

For the same sample, I find the home market to dominate the host market in pricing these stocks, which is consistent with the Home Bias hypothesis. In addition, I find trading in the home market (TASE) to be more informative or driven by speculative consideration, while trading in the U.S. market is non-informative or driven by hedging consideration. This implies that returns associated with positive trading volume shocks originating from the home market have greater tendency to continue themselves on the U.S. market on the following trading day. Also, the returns associated with positive trading volume shocks originating from the U.S. market have greater tendency to reverse themselves on the home market on the following trading day. These results suggest that the dynamics of volume-return interactions across markets can provide us with valuable information regarding future price movements, which can be a useful tool in predicting future returns.

Finally, I examine a small sample of four Israeli firms that went public in the U.S., cross-listed in TASE afterword, and then delisted from it while maintaining their listing in the U.S. market. I find a significant increase in their overall risk exposure after the delisting announcement and the actual delisting day. This implies that the expected return on these stocks by U.S. investors will increase to compensate for the greater risk involved after delisting. This should increase the cost of raising capital for all four firms after delisting from the Israeli market.

Findings of this research are important and noteworthy for policy makers and investors. From the policy maker viewpoint, understanding the mechanism of cross-listing in the home market should be taken into account when evaluating the possibility of liberalizing small local markets. Typical cross-listing abroad opens a door for firms to raise capital abroad and access other foreign capital markets. The same thing can be said about the atypical cross-listing, as it opens a door for local firms to raise capital in their home market. In both cases, cross-listing frees the flow of international capital between markets; this can be a critical issue, especially for small and new liberalized economies.

On the other hand, investors almost always seek diversification in their portfolios, and one of the most common diversification techniques is to include foreign stocks, listed in the investor's local market. This technique provides a way to diversify their investments against local market risk exposure. Therefore, they need to distinguish between different kinds of cross-listing, typical and atypical, and how further cross-listing abroad or delisting might affect these stocks returns and, hence, the yield of their portfolios.

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