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ABSTRACT

The reaction of foreign stocks to cross-listing events has been documented in an extensive literature, finding that the betas of these stocks change over time. In this paper, I use stock return data for foreign companies listed on U.S. exchanges to ask whether the betas changed at all and, if so, on what date. While betas for most of these companies indeed change over their sample, the evidence shows that these changes arise from greater integration between their home markets and the U.S. Moreover, of the remaining companies, the betas change significantly after, not during, the cross-listing event.

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The betas of foreign company stock returns change after the company cross-lists its stock in the U.S. market. This finding has been documented in an extensive literature.[1] Moreover, these betas generally increase towards one, suggesting greater co-movement with the U.S. market. Since the purpose of this literature has been to examine the effects of cross-listing events, these studies naturally condition potential changes in betas on the cross-listing date, or in some cases, its announcement. However, the timing of any changes in betas on the U.S market is interesting in its own right. If the betas of these firms move closer to one against the U.S. market, then these foreign stock returns exhibit risk that is closer to the systematic risk of the U.S. market. Moreover, the date of a change in beta indicates when the investors come to view the risk of these companies differently, a date that may be earlier or later than the cross-listing date. For example, if the beta of a foreign firm's stock against the U.S. market increases before cross-listing, the market may already view the foreign company as more closely aligned with a typical U.S. company even before the event.[2] Alternatively, if the beta changes after cross-listing, the market initially prices the company with less risk in common with the U.S. market, and only changes this perspective at a later date.

In this paper, I directly address the question: When do the foreign cross-listed company betas change? For this purpuse, I use the history of stock return data for foreign companies listed on U.S. exchanges at a point in time and ask whether the betas changed and, if so, on what date. For three different company examples, Figure 1 illustrates some potential outcomes using the empirical approach I describe below. The figures depict the estimated

[1] Examples include Foerster and Karolyi (1999) and Sarkissian and Schill (2009). Karolyi (2006) surveys this literature. Furthermore, while this paper focuses on cross-listed stocks in the U.S. market, this phenomenon tends to hold in other countries as well.

[2] Baruch and Saar (2009) make a similar point about domestic firms within the U.S. They posit that these fims choose to list on exchanges with companies that share their risk characteristics. Sarkissian and Schill (2004) consider a similar argument for the countries where companies choose to list.

betas over time with starred triangles to indicate confidence intervals around the break dates and boxes to mark the cross-listing date on the exchange. Figure 1a shows the evolution of beta for a foreign company with a cross-listing date that falls within the estimated break date interval. By contrast, Figures 1b and 1c graph the estimated betas for a company with break dates after and before cross-listing, respectively. Moreover, Figure 1c shows that the estimated betas of some companies may decrease, rather than increase, over time. As such, I also examine the evolution of beta movements.

To investigate these break dates in the data, I study the home market weekly returns of a set of foreign companies with stocks listed on NYSE and NASDAQ. I begin by testing for breaks in their betas against the U.S. market using a variety of statistics. Consistent with the literature, for most companies I reject the hypothesis that their betas against the U.S. market have been constant over time. Using Bai and Perron (1998) break date analysis, I then estimate the dates when these betas appear to change, leading to a striking result: the break dates for most companies occur after cross-listing.

A potential problem with these findings is that the analysis presumes a stable relationship between the returns on the U.S. market and those of the markets of the cross-listed stocks. On the other hand, growing evidence indicates that stock markets have become more integrated over time. Therefore, the covariances between the U.S. market and foreign markets may have changed themselves. If so, these changes may generate apparent shifts in the betas of foreign companies that is simply explained by their home markets. To examine this possibility, I test for breaks between the U.S. market and the home markets of foreign cross-listed companies, indeed revealing evidence of instability in the covariances with the US for the majority of countries. I then evaluate the hypothesis that breaks on the company level are simply explained by breaks on the home country market level. This analysis leads to two main results. (1) For roughly half of the companies that show evidence of breaks in betas, I cannot reject the hypothesis that these breaks arise because of changes in the relationship between their home markets and the U.S. market. (2) For the remaining companies with betas that change independently of their home markets, these changes occur significantly after the cross-listing event, as in the original analysis. Taken together, these two main results suggest that foreign company betas appear to change either because their home market has become more correlated with the U.S market or because U.S. investors learn about the company over time after the cross-listing.

I next examine characteristics of the companies that experience changes in their betas independent of any integration between their home markets and the U.S. market. For this purpose, I study their cross-sectional relationships using logistical regressions to explain the different timing of break behavior. This analysis shows that older companies tend to have breaks at different times than their home markets. Moreover, breaks are more likely to occur significantly after the cross-listing date, rather than during or after. Also those companies with breaks significantly after their cross-listing dates are more likely to have home markets in North America. Inspecting some examples suggests that these companies coming from North America and, Canada in particular, have a longer history with the U.S. market. As a result, they mirror the pattern of integration with the U.S.

These results are based upon the timing of the changes in betas and not the direction of the changes themselves. However, much of the literature finds that the betas against the U.S. market have tended to increase over time. As a robustness check on the analysis, therefore, I examine the estimated behavior of the cross-section of betas against the U.S. I find that these betas typically increase over time, consistent with the literature.

This paper is directly related to the literature on cross-listed companies, as noted above. The results in this paper are also related to those from studies of break-dates in market-level stock returns. For example, Bekaert, Harvey, and Lumsdaine (2002) use the Bai-Perron estimator to test for breaks in asset pricing relationships to date the implicit liberalization events for some emerging market economies. However, the analysis in this paper considers all foreign countries that have U.S. listed stocks, and as such, emerging market countries in my sample are a minority.[3] Furthermore, Bekaert, Harvey, and Lumsdaine (2002) study breaks in market index returns while I do so at the individual company level. To my knowledge, this paper is the first to analyze the potential for asset pricing breaks for a large number of individual stocks.

The paper is organized as follows. Section 1 describes the empirical framework and reports the initial break-date results. Section 2 considers the impact on these results due to shifts in the relationship between home country returns and U.S. returns. It also describes characteristics of companies according to the timing of their listing versus break dates. Section 3 provides evidence on the estimated betas over time and other robustness checks. Section 4 provides concluding remarks. Details of the data, the analysis and further robustness checks can be found in the on-line appendices.

[3] As a robustness check, I show in the appendix that my estimated break dates are comparable with those of Bekaert, Harvey and Lumbdaine (2002) for the subset of emerging markets and sample periods that we have in common.

1 Cross-listing Firm Break Dates

This section provides the groundwork for the analysis on foreign firm break dates. It begins by describing the data and the basic empirical framework used to evaluate the returns of cross-listed companies. I then report the estimated dates for changes in betas.

1.1 Data

Determining the date when foreign stock return betas change requires a set of foreign company returns with a sufficient history after U.S. cross-listing to analyze any potential changes. For this purpose, I choose weekly returns on foreign companies that are listed on the NYSE and NASDAQ in July 2004. Exchange-traded foreign companies are targeted because these stocks are the most liquid and comprise most of the trading volume of cross-listed stocks.[4] In addition, July 2004 is picked as the inclusion date since it implies at least five years of data before the financial crisis.[5] Overall then, the time period begins either at January 1970 or at the earliest date of availability and ends in October 2009. Notably, the set of stocks after 2004 is relatively stable since less than 1% of companies in this sample were delisted by the end of the sample. All return series are measured in US dollars to represent the value from the point of view of a US investor. Companies without a return series history in their home markets or with insufficient numbers of observations were excluded.[6] The number of

[4]In 2004, the market value of foreign stocks on the NYSE and NASDAQ together comprised 98% of the total market value across public exchanges. At the 2000 peak of NASDAQ, the foreign companies hit a maximum of 27% of this total. Thus, the companies listed on NYSE comprise most of the foreign market cap in the US. In 2004, only 10 foreign companies were traded on the AMEX and I exclude them for expositional clarity.

[5]Similarly, Sarkissian and Schill (2009) choose 1999 because they focus upon long run returns after cross-listing up to ten years. Sarkissian and Schill (forthcoming) also consider foreign listings in all world stock exchanges in 2003 and 2006.

[6]Companies that did not have a return series prior to listing in the U.S. generally had China as their home country.

companies after applying these filters is 576. I use the Data Stream Total Return indices and Total Market Return indices to calculate the company returns and the market index returns, respectively. All returns are transformed into excess returns by subtracting the weekly T-bill rate. Finally, cross-listing dates are measured by the date when the company was listed on the current exchange, either the NYSE or NASDAQ.[7]

Table 1 provides summary information about this data set. Panel A reports on the breakdown of firms across exchanges. NYSE has 380 foreign companies with home markets in 39 different countries. By contrast, 196 foreign companies that are domiciled in 28 countries list on NASDAQ. The total number of foreign countries represented on the two exchanges is 42.[8] Finally, Panel A shows that the foreign companies listed on NYSE are generally older than those on NASDAQ. The average number of observations across firms on the NYSE is 1092, or about 21 years, while that same average across firms on NASDAQ is 862, or about 17 years.

Panel B of Table 1 breaks down the information by the home country of the company. The first column gives the date at which the market index data begin for each country, ranging from January 2, 1970 for Switzerland to June 24, 1994 for Portugal. The columns to the right provide more information about the composition of the foreign company presence on each exchange. The home country with the largest number of cross-listed companies is Canada, followed by the United Kingdom. Emerging markets generally have the fewest foreign companies on the exchanges. Moreover, the average number of observations from these

[7]Note that this identifying assumption potentially biases the listing date to be late since some companies may have set up an ADR program in the U.S. earlier on another exchange. Therefore, this assumption biases my results against the finding below that cross-listing tends to occur before the break date.

[8]There are three foreign countries represented on NASDAQ but not NYSE: Malaysia, Singapore, and Sweden.

foreign companies is generally lower. For example, the Phillipines has only two companies on the NYSE and one company on NASDAQ, and across these three companies the average number of weekly observations is 411 or about 8 years.

1.2 Asset Pricing Framework

Standard factor pricing models used in the literature on international stock returns typically relate excess company returns to a set of factors. The cross-listing literature often uses a one or two factor version of this model as the benchmark for conducting event studies as described by Karolyi (2006). For example, Sarkissian and Schill (2009) examine the effects of cross-listings by firms around the world using market models of the following two forms.[9] The first form is the standard closed economy CAPM given by:

$$r_t^{i\ell} = \alpha^{i\ell} + \beta^{i\ell} r_t^{\ell} + e_t^{i\ell} \tag{1}$$

where $r_t^{i\ell}$ is the return on the equity of company i with home market in country ℓ at date t in excess of the risk free rate, $\alpha^{i\ell}$ is a constant parameter, r_t^{ℓ} is the home market return of the cross-listed company and $\beta^{i\ell}$ is a factor loading on that market return. Since all the analysis below requires excess returns, these variables are simply called "returns" throughout the rest of the paper.

The second form is a two factor model that depends upon both the company's home market and the cross-listed market, in this case, the U.S. This version can then be written

[9] Sarkissian and Schill (2009) also consider a third model that substitutes the world market return for the foreign market. Preliminary estimates based upon the world market instead of the US market implied similar results to those reported below.

as:

$$r_t^{i\ell} = \alpha^{i\ell} + \beta^{i\ell} r_t^{\ell} + \beta^{iu} r_t^{u} + e_t^{i\ell} \tag{2}$$

where now the company i stock return is also affected by the U.S. market return, r_t^u, according to its beta against the U.S., β^{iu}.[10]

1.3 Parameter and Break-date Estimator

As noted in the introduction, studies of cross-listing events have considered shifts in pricing parameters at the time of cross-listing, typically finding significant changes. Therefore, I require an empirical strategy that allows the factor loading parameters to shift discretely on given dates. But I also need a framework that does not force the shift to occur at a point in time or even at all. For this purpose, the analysis below uses the break date estimator developed by Bai and Perron (BP) (1998), an estimator designed to detect points in the time series when the parameters are most likely to have changed.[11]

The BP estimator requires specifying a maximum number of breaks in the parameters. I assume for expositional purposes that the number of breaks is simply given as m, although this number will be estimated in the empirical analysis below. Also, to economize on notation for this description, I subsume the firm superscripts and rewrite the asset pricing relationship

[10] While the cross-listing literature has focused upon the parsimonious two factor model, there may be more factors that are important for explaining international stock returns. For example, Karolyi and Wu (2012) examine a multi-factor model of international returns but find the importance of a hybrid model that depends upon "global" and "local" factors. Similarly, Bekaert, Hodrick, and Zhang (2009) show that a factor model that includes additional global and local Fama-French factors best explains the returns of companies that comprise the MSCI World Index. The appendix describes the effects of industry factors on some of the analysis in this paper.

[11] The estimator can also be interpreted as a more gradual change in parameters that cumulates into a significant change at a given time. See Bai and Perron (2003a).

generally as:

$$r_t = \delta' f_t + e_t \tag{3}$$

where r_t is the asset return series, e_t is the residual, δ is the parameter vector and f_t is a vector of factors rewritten to include a constant as the first factor. Clearly, the specifications in equations (1) and (2) can be written within this general framework.

Consider now m potential shifts in the parameter vector δ, so that the model in equation (3) can be rewritten as:

$$r_t = \delta_\tau\text{'} f_t + e_{t,\tau} \tag{4}$$

where δ_τ is a fixed parameter vector for each period τ, $\tau = 1, ..., m+1$ on the intervals implied by: $t = \{1, ..., T_1, T_1+1, ..., T_2, T_2+1, ..., T_3, ..., T_m, ..., T\}$ for $T_0 = 0$ and $T_{m+1} = T$. For instance, $\tau = 1$ corresponds to the subperiod $t = 1, ..., T_1$, $\tau = 2$ corresponds to the subperiod $t = T_1 + 1, .., T_2$, etc. Similarly, $e_{t,\tau}$ is the residual vector corresponding to these subperiods. Note that the constant parameter model in equation (3) is a special case of equation (4) where $m = 0$ and thereby $\tau = 1$ corresponds to the full sample $t = 1, ..., T$.

Bai and Perron (1998) show that unknown breakpoints can be estimated consistently by minimizing over the sum of squared residuals for all possible partitions of the data into $m+1$ different intervals. In other words, $T_1, T_2, ..., T_m$ can be consistently estimated by solving the following minimization:

$$\left\{\widehat{T}_1, \widehat{T}_2, ..., \widehat{T}_m\right\} = \underset{T_1, T_2, ..., T_m}{\arg\min} \left[\sum_{\tau=1}^{m+1} \left(\sum_{t \in \left\{T_{(\tau-1)}, ..., T_\tau\right\}} \left[r_t - \delta_\tau\text{'} f_t\right]^2 \right) \right] \tag{5}$$

Bai and Perron (1998) also derive the limiting distribution of these break point estimates including confidence intervals on the breakpoint estimates.

While the estimation of the break dates requires minimizing the sum of squared residuals for all possible m partitions of the data, Bai and Perron (2003b) show that the estimator can have poor properties when the minimal length of the partition becomes too small. The reason is intuitively clear — finer partitions of the intervals imply fewer observations and, therefore, less precise estimates. Bai and Perron (2003b) propose constraining the minimal length of any partition segment used to calculate the sum of squares in the argmin calculation in equation (5). They define this minimal length as $h \equiv \min(\widehat{T}_{(\tau-1)} + 1, , , \widehat{T}_{\tau})\ \forall\tau$ and specify the parameter as proportional to the total sample size. That is, they define a percentage "trimming" constraint ε to construct the minimal interval length: $\varepsilon = h/T$. Moreover, Bai and Perron (2003a) describe the properties of various break tests against different alternatives. The limiting distribution of these tests depends upon the proportion of the minimal subinterval, measured by ε. Further, as the Monte Carlo studies of Bai and Perron (2003a,b) suggest, assuming partitions that are too small can over-estimate the number of breaks. Therefore, to be conservative, I report the estimates assuming ε is 15% of the sample.[12]

[12] In Monte Carlo simulations, Bai and Perron (2003a,b) find that the maximal value of m for $\epsilon = 0.15$ is 5. Since m is 4 or less in all the analysis in this paper, my choice of ε appears relatively conservative. Nevertheless, the appendix describes some sensitivity analysis with ε as low as 5%.

1.4 Parameter and Break Date Implementation

To implement this estimator for cross-listed stock returns, I first rewrite the two-factor model in equation (2) in the form of equation (4) yielding:

$$r_t^{i\ell} = \alpha_\tau^{i\ell} + \beta_\tau^{i\ell} r_t^\ell + \beta_\tau^{iu} r_t^u + e_{t,\tau}^{i\ell} \quad (6)$$

with number of breaks given by m^i for each company i. Then, the set of parameter vectors for each subperiod τ is given by: $\delta_\tau^i = \left\{\alpha_\tau^{i\ell}, \beta_\tau^{i\ell}, \beta_\tau^{iu}\right\}$ for each subinterval $\tau = 1, ..., m^i + 1$.

Based upon equation (6), I conduct the following analysis for each company stock return i. I first test for the number of breaks, m^i. I then search over all possible combinations of the break dates in order to minimize the sum of squares as given by equation (5). This minimization generates estimates of break dates: $\left\{\widehat{T}_1^i, \widehat{T}_2^i, ..., \widehat{T}_m^i\right\}$ and the corresponding set of parameter vectors, δ_τ^i.

Note that since I conduct analysis on each stock return series separately, the number of parameter shifts, m^i, differ by company. This analysis also includes as a possibility that $m^i = 0$; that is, no breaks. Moreover, the variance of the residual is not restricted to be the same over subperiods. Indeed, the variance will generally change over subperiods and across countries. In the empirical estimates below, the standard errors are also corrected as in White (1980) and Andrews (1991) for general conditional heteroskedasticity.

1.5 Initial Results: Number of Breaks

I first estimate the number of breaks in equation (6) for each company. Although the number of estimated breaks differ across companies, I subsume the dependence on the firm

i for parsimony and simply refer to the number of breaks as m below. Using this estimated number of breaks, I then estimate the asset pricing equation by company. Table 2 reports the results of break-date tests for each of the company return regressions.

The results in Table 2, Panel A demonstrate that breaks in the relationship between the company returns and the market returns are important. The first three columns report the proportions of the companies rejecting the hypothesis of no breaks versus m breaks using the so-called "sup F" test. This tests finds the highest F test for m breaks by considering all the different partitions of subsamples as given in equation (5), subject to the minimum length restriction, h. The first column of Table 2A shows that the hypothesis of no break against the alternative of at least one break is rejected for 77.1% of the companies at a 5% marginal significance level (MSL) and even 67.6% at a 1% marginal significance level. As the second and third columns show, these proportions generally become higher when allowing for even more breaks

While Bai and Perron (2003a,b) advocate using the supF test with given numbers of breaks, they acknowledge that there are circumstances in which the results might be deceptive. For example, for a regime switching model in which the parameters switch back to an initial regime, the test will underestimate the number of breaks. For this reason, they also suggest testing the hypothesis of no breaks against an unknown number of breaks. The last two columns of Panels A report the proportion of companies with stock returns that reject this hypothesis using two versions of the "double maximum" test. The "WD Max" test weights the tests of individual breaks such that the marginal p-values are equal across values of m. By contrast, the "UD Max" test weights all values of m equally. Again, the table shows the proportion of companies with returns that reject the hypothesis of no break is significantly higher than the 5% or 1% MSL used in the test.

Panel B of Table 2 provides summary evidence for the sequential “supF test” given by MSLs of 5% and 1%. In this test, a sequential procedure estimates each break one at a time, and estimation stops when the $\sup F(\tau + 1|\tau)$ test is no longer significant at the given marginal significance level. To identify m, I conduct sequential SupF tests for each company, allowing up to four subperiods.[13] The first column of Panel B reports the proportion of the companies that reject the hypothesis of zero breaks. The last three columns of Panel B report the proportion of companies that show evidence of one break, two breaks and three breaks, respectively, in their stock returns. Companies with one break make up the majority of the cases ranging from about 55% at 5% MSL to 63% at 1% MSL. The number of companies with evidence of 3 breaks is smaller at only 11% or 6%.

Table 2, Panel C shows how the number of breaks evolve over five year subsamples of the time series, using the results based upon the MSL of 5% alone for parsimony. The fewest number of breaks are before 1980 at only 21 estimated breaks while the five year interval with the largest number of breaks is during 2000-2005 at 277. However, there are more foreign companies in existence as time increases. Therefore, in the row "Share of Companies," Panel C also reports the share of total companies exhibiting breaks. As the table shows, the largest percentage of companies with estimated breaks is also the 2000-2005 period although the lowest share is during 1990-1995 at 14%.

Table 2, Panel D reports some summary information about the companies that reject the hypothesis of No Breaks at the 5% MSL. I call these companies "Breakers" and those that

[13] As will be shown below, the company returns show little evidence of more than three breaks anyway, so imposing this maximum number of breaks seems fairly unrestrictive.

do not reject the hypothesis "Non-Breakers." The first column shows that the proportion of "Breakers" among the Developed countries at 76.2% are about the same as the proportion among the Emerging countries at 79.4%. On the other hand, Breakers tend to be somewhat older at 1,063 weeks and have a larger market cap at about 8.3 billion dollars.

1.6 Initial Results: Break Dates Versus Cross-listing Dates

I next compare the break date estimates to each company's U.S. exchange listing date. These companies are then sorted according to whether their cross-listing date was before the first Break ("< Break 1"), within the confidence interval of the first break ("=Break 1"), after the first Break (">Break 1"), within the confidence interval of the second break, if any ("=Break 2"), after the second break, if any ("> Break 2"), and after or during the third break, if any (" $\geq$ Break 3.") Table 2 Panel C reports information about the sorted firms under these headings, respectively.

Several patterns emerge. First, the initial line labeled "Total Share" shows that 66% of the "Breakers" have a cross-listing date that occurs before the first break confidence interval. Second, the proportion of companies with cross-listing dates before the first break date is similar for companies domiciled in Developed and Emerging countries at 49% and 56%, respectively. Third, the firms with cross-listing dates before the first break date tend to be younger with an average age of 886 weeks.

Figure 2 summarizes these relationships by combining the proportion of firms into three groups: (a) those with cross-listing dates before the first break, (b) those with cross-listings within a confidence band of any of the three breaks, and (c) those with cross-listing after any of the three breaks. Figure 2a depicts the proportion for companies with home markets in Developed countries as well as those from Emerging countries. Figure 2b provides the same information but for the proportion of companies with home markets sorted by continents. The highest proportion of companies with cross-listing dates before the first break come from South America, while the lowest proportion are domiciled in Oceania. By contrast, over 20% of cross-listed companies from Oceania show evidence of breaks during cross-listing.

Overall, the initial evidence suggests that the majority of the foreign companies with cross-listed stocks had return betas against the United States market that changed during their history. Of these companies, roughly two-thirds cross-listed their stocks in the U.S. before the first estimated break date. However, this analysis presumes that the relationship between the U.S. market and the companies' respective home markets are stable over time. I consider the potential impact of this assumption in the next section.

2 The Impact of Changing Country Market Betas

Understanding the company beta estimates is complicated by the relationship between returns at the aggregate level between the U.S. and the foreign company stock markets. Clearly, the two factor model presumes a stable relationship between the U.S. and foreign markets. By contrast, a number of studies have found that the relationships between market indices have changed over time. For example, time-variation in betas of emerging market indices relative to the world has been used to understand liberalization.[14] Even among developed countries, there is growing evidence of changing patterns of co-movement in market

[14] For example, see Bonser-Neal, et al (1990), Bekaert and Harvey (1997,2000), and Henry (2000).

returns, suggesting greater integration.[15]

These changing patterns of betas across country-level market returns can potentially generate instability between foreign company returns and the U.S. market, even if the company returns are stable relative to each market. To see why, recall that the equation for foreign company returns is given by (2), repeated here for convenience: $r_t^{i\ell} = \alpha^{i\ell} + \beta^{i\ell} r_t^{\ell} + \beta^{iu} r_t^{u} + e_t^{i\ell}$. One approach often used to capture the joint behavior of markets is a standard world CAPM.[16] This approach relates country market returns to a world market similar to the CAPM relationship in equation (1) between company returns and their respective home market. Thus, according to this world CAPM, country market returns are related according to:

$$r_t^{\ell} = \alpha^{\ell} + \beta^{\ell} r_t^{u} + u_t^{\ell}. \tag{7}$$

where here the world market return has been substituted out using the world CAPM for the U.S. market return.[17] Further substituting the country relationship in equation (7) into the company return framework in equation (2) implies:

$$\begin{aligned} r_t^{i\ell} &= \alpha^{i\ell} + \beta^{i\ell}\left[\alpha^{\ell} + \beta^{\ell} r_t^{u} + u_t^{\ell}\right] + \beta^{iu} r_t^{u} + e_t^{i\ell} \\ &= a^{i\ell} + b^{i\ell} r_t^{u} + \varepsilon_t^{i\ell} \end{aligned} \tag{8}$$

where $b^{i\ell} = \beta^{i\ell}\beta^{\ell} + \beta^{iu}$, and similarly, $a^{i\ell}$ and $\varepsilon_t^{i\ell}$ incorporate the combined interactions of the

[15] For example, Longin and Solnik (2001) show greater correlation among market indices during crisis times. Christoffersen et al (2012) show that the correlations among market returns have increased over time for both developed and emerging markets.

[16] Examples include early papers such as Solnik (1974), Stehle (1977) and Dumas and Solnik (1995).

[17] This equation obtains by specifying each country's return as a CAPM against the world market and then substituting out the world return using the US market return equation.

international market returns and the company returns.[18] Thus, if the relationship between the foreign markets and the US market change over time, β^{ℓ} will vary. In this case, the dependence of company returns on the U.S. will appear to be unstable even if $\beta^{i\ell}$ and β^{iu} are constant over time.

Therefore, in this section, I begin by testing for parameter stability between the returns of foreign markets and the US given by equation (7). I then estimate any breaks in this relationship, allowing for possible parameter shifts as above. This modification gives:

$$r_t^{\ell} = \alpha_{\varsigma}^{\ell} + \beta_{\varsigma}^{\ell} r_t^u + u_{t,\varsigma}^{\ell}, \ \text{ for } \varsigma = 1, ..., m+1 \tag{9}$$

where the subscript ς denotes subperiods with stable parameters between the country market returns. Note that these subperiods may differ from the company level subperiods indexed by τ. As a result, I also test for whether the break dates in the country market return relationships correspond to those of the company return relationships. That is, I test for the stability of the company betas, $\{\beta^{i\ell}, \beta^{iu}\}$, conditioning on the country market return equation (7), including any potential changes in β^{ℓ}. Finally, this section studies the characteristics of any remaining companies with unstable company betas.

2.1 Country Market Results: Break Date Estimates

Table 3 reports the results of break tests based upon the country regressions in equation (9). The results in Panel A indeed suggest that breaks in the relationship between the US and foreign markets are important. The first three columns report the proportions of the

[18] In particular, $a^{i\ell} \equiv \alpha^{i\ell} + \beta^{i\ell}\alpha^{\ell}$ and $\varepsilon_t^{i\ell} \equiv \beta^{i\ell} u_t^{\ell} + e_t^{i\ell}$.

42 country index returns that reject the hypothesis of no breaks versus the hypothesis of m breaks using the "sup F" test. The first column of Table 3A shows that the hypothesis of no break against the alternative of at least one break is rejected for 85.7% of the country indices at a 5% marginal significance level and for 81% of the countries at a 1% marginal significance level. These proportions generally become higher when allowing for $m = 2$ and $m = 3$, respectively. The last two columns of Panels A report the proportion of countries that rejected this hypothesis using the "WD Max" and the "UD Max" test. Overall, the proportion of countries that reject the hypothesis of no break ranges from 78.6% to 90.5%.

Panel B of Table 3 summarizes the distribution of the number of breaks estimated for each country using sequential SupF test at the 5%, and 1% MSLs. The first column of Panel B reports the proportion of the countries that rejected the hypothesis of zero breaks while the last three columns of Panel B report the proportion of countries that show evidence of one break, two breaks and three breaks. Countries with one break make up the majority of the cases ranging from 75% at 5% MSL to 85% at 1% MSL. By contrast, only 8% and 3% of the countries show evidence of having three breaks at a 5% and 1% MSL, respectively.

I next estimate the break date equations for each country return series. Figure 3a plots the break-point estimates for each year by country along with its confidence intervals for the 5% marginal significance case. The confidence interval for each country excludes the upper and lower 5% of the estimated break date distribution. The figure shows two main relationships. First, except for a few notable exceptions, the confidence intervals around the breaks are contained within two to three years.[19] Second, most of the breaks occur in

[19] Exceptions are the breaks in the late 1970s to early 1980s of Denmark and Ireland and the single break for Taiwan in the 2000s. For countries with more than one break, subsequent break dates are generally more tightly estimated.

the early 2000s. Indeed, the peak of the frequency distribution occurs around 2004. The high proportion of breaks in the latter period is consistent with the view that changes in integration have been more recent for most countries. I show in Section 3 that the direction of the parameter changes correspond to greater co-movement across countries.

2.2 Are Company Returns Explained by Country Market Changes?

I now return to the company-level asset pricing relationship to determine whether the instability in the country-level market returns can explain the apparent shifts in company stock return betas found above. Substituting the shifting country return process r_t^ℓ from (9) into the company return in (2) implies:

$$\begin{aligned} r_t^{i\ell} &= \alpha^{i\ell} + \beta^{i\ell}\left[\alpha_\varsigma^\ell + \beta_\varsigma^\ell r_t^u + u_{t,\varsigma}^\ell\right] + \beta^{iu} r_t^u + e_t^{i\ell} \\ &= a_t^{i\ell} + b_t^{i\ell} r_t^u + \varepsilon_t^{i\ell} \end{aligned} \tag{10}$$

Where $a_t^{i\ell} = \alpha^{i\ell} + \beta^{i\ell}\alpha_\varsigma^\ell$, $b_t^{i\ell} = \beta^{i\ell}\beta_\varsigma^\ell + \beta^{iu}$, and $\varepsilon_t^{i\ell} \equiv \beta^{i\ell} u_{t,\varsigma}^\ell + e_t^{i\ell}$ and where, as above, ς indexes the subinterval in which foreign market indices are stable against the US market return. This equation shows that even if the betas of the foreign stocks on the local market, $\beta^{i\ell}$, and the U.S. market, β^{iu}, are not time-varying, an estimate of the parameters in a regression of foreign stocks on the US market, $b^{i\ell}$, would be. This time-variation results from the shifting factor loadings of the local market on the US, α_ς^ℓ and β_ς^ℓ.

To consider whether there are shifts in the relationship between cross-listed stocks and the US market beyond those induced by market level changes, I implement the following two steps. First, I constrain the parameters in the company return equations (10) using the estimated parameters of the home country in equation (9), and test whether there are any additional breaks using the sequential sup(F) tests.[20] If rejected, I next ask whether the rejection arises from instability in local betas or US betas.

Table 4 reports summary statistics of foreign market breaks and company tests conditioned on these breaks. Panel A of the table provides a summary of the number and proportion of firms that are domiciled in countries with One Break ($m = 1$), Two Breaks ($m = 2$), and Three Breaks ($m = 3$). The final column labeled "All" shows the proportion of firms with home markets that reject stable parameters for $m \geq 1$. Since this proportion is about 95%, only about 5% of the firms come from countries with no evidence of structual instability against the US. Another 62% come from countries with one break, while only 9% of the firms come from countries that show evidence of two breaks. On the other hand, 24% of the firms come from countries with three breaks. This latter result is largely due to Canada which has the largest number of foreign companies in the US, but also has three breaks, potentially arising from its longer process of integration with the US.

Panel B of Table 4 shows the results of the test for breaks in the company stock returns after conditioning on any country breaks. In particular, the table reports the proportion of firms that reject the sequential sup(F) test for breaks after conditioning on the estimated market return parameters, $\alpha_{\varsigma}^{\ell}$ and β_{ς}^{ℓ}. Strikingly, the column labeled "No Breaks" indicates that 277 firms or about 49% of the firms did not show evidence of breaks beyond the country level. This number only includes the firms that previously rejected constancy out of the total. As such, it represents a lower bound on the number of firms with no break.

[20] By conditioning the estimation on the first stage country regression parameter estimates, this second stage may suffer from a generated regressions problem that will understate the true standard errors thereby potentially biasing the Wald tests toward rejection. To mitigate this possibility, I allow for general conditional heteroskedasticity in the Wald tests.

The remaining three columns of Table 4 B show that the returns from those firms that did reject the hypothesis of no additional breaks appeared to have only one break. In particular, data from 231 firms could not reject the hypothesis of more than one break while 55 firms appeared to have two breaks. The returns from only about 1% of the firms indicated three breaks beyond the country level.

For the firms rejecting no parameter instability beyond the country level, Panel C examines the source of instability. Using the definition for the estimated parameters in equation (10), I identify the firm level parameters over the country subintervals as:$\left\{\beta_{\varsigma}^{i\ell}, \beta_{\varsigma}^{iu}\right\}$ and then test a series of Wald tests for each firm. The first two columns report the number of rejections of the hypotheses that each of the two betas are zero for each stock. If the beta on the company's home market is zero, i.e., $\beta_{\varsigma}^{i\ell} = 0$, then there is no local effect on the stock return during the period. Alternatively, when the beta on the US market is zero, $\beta_{\varsigma}^{iu} = 0$, the stock depends only on the home market effects. In this case, the return from company i depends upon the US market return only indirectly through its beta with the home market, $\beta^{i\ell}\beta_{\varsigma}^{\ell}$, since its home stock market in turn depends upon the US stock market.

As the first two columns of Panel C show, the zero beta restriction is rejected for both the local and US betas for most of the firms. However, the proportion of those rejections differ markedly. About 85% of the firms reject the zero local beta effect while only 58% of the firms reject the zero US beta effect. The same pattern carries over to the next two columns that report tests for the hypothesis that local and US effects are constant over the sub-periods. Sixty-three percent of the firms reject the hypothesis that the local effects are constant over time while 44% of the firms reject the test that US effects are stable.

2.3 Company Break Dates After Conditioning on Country Breaks

Since about half of the companies exhibit additional parameter instability after conditioning on changes in the home market, I estimate the independent break dates for these companies using equation (10) while constraining the market level process to follow equation (9) The appendix provides details of this estimation.

These break date estimates and their confidence intervals are plotted in Figure 3b, where the firms are arrayed according to the firm with the earliest first break through the firm with the latest first break date. Generally, the dates are tightly estimated within one to three years as with the country estimates. However, there are some outliers when these intervals exceed eight years.

The first column of Panel D of Table 4 summarizes information about the companies that show evidence of independent breaks, "Breakers," compared to those that did not, "Non-Breakers." Strikingly, the pattern observed in Table 2 for the unconditional results is essentially reversed. "Breakers" now account for only about 28% while "Non-Breakers" are in the majority at about 72%. This new pattern arises because the roughly half of firms that now show no evidence of breaks beyond their home market become "Non-Breakers" and are added to the initial "Non-Breaker" companies from Table 2.

On the other hand, the relationships between cross-listing dates remain or become even more pronounced. Now over 70% of the companies that do show evidence of breaks cross-list before the breakdate. Furthermore, these patterns are extremely similar for Developed and Emerging markets. Also, the tendency for the "Breakers" to be older and have higher market cap remains. As in Table 2, most of the companies cross-listed before the first break and are younger than companies that cross-listed during or after the first break date.

2.4 Characteristics of Companies: Breaks and Cross-listing Dates

These results naturally raise important questions: What features characterize the new "Breaker" companies that exhibit instability beyond their country market breaks? Moreover, what are the features of those that have breaks significantly after their cross-listing events? To answer these questions, I estimate logistic regressions across companies.

Table 5 reports the results of binomial logistic regressions of Breaker versus non-Breaker companies. For explanatory variables, these regressions use the logarithms of firm age and of the average market cap over time as well as dummies for whether the home country is an emerging market or North America.

Panel A shows the results treating the dependent variable as a dummy if the company had a break after conditioning on country breaks. The columns show versions of the logit regression excluding various dummies. In all cases, the constant is significantly negative, demonstrating the tendency for firms to show no evidence of breaks beyond those at the country level. Moreover, in all cases, the coefficient is positive on age and significantly so for some specifications. This finding suggests that older firms generally come from developed markets and also have a longer history so that they are less likely to have breaks that correspond to their home markets. Therefore, to consider the effects of developed versus emerging markets, Column 2 shows results for a specification with a dummy for emerging markets. The negative coefficient for emerging markets indeed indicates that companies from these markets are less likely to exhibit breaks other than those of their home countries. However, this coefficient is insignificantly different from zero. Similarly, Column 3 demonstrates that North American firms are significantly less likely to have breaks. To investigate this relationship further, the following columns report estimates for Canada and Mexico separately. As the evidence shows, companies from both countries are less likely to show changing betas beyond the country level. However, this effect is only significant for Mexican companies.

Why are North American companies less likely to have beta that shift independently from their home markets? The answer appears to differ depending upon the country. For Mexico, Figure 2b shows that the estimated break in its relationship with the US market occurred relatively late, at around 2004. Leading up to this year, there were several commercial and financial deregulation policy changes as well as increased privatization. As a result, the Mexican stock market capitalization incrased by 23% in 2005 and 44% were held by foreign investors. At around the same time, many Mexican companies that were cross-listed also began to co-move more closely with the U.S. market. Since both the general Mexican market and the Mexican cross-listed stocks became more integrated at the same time, these companies were less likely to show evidence of breaking at different times.

In contrast to Mexico, Canadian companies have had a longer history of integration with the United States. As Figure 2b shows, there are three estimated break dates between Canada and the U.S., the first one as early as the 1970s. It is therefore more likely that changes in Canadian company asset pricing relationships materialize during the overall changes in the Canadian market.

These results do not explain characteristics of firms that break after cross-listing, however. To address this issue, I next omit the firms that show no evidence of breaks and condition on the new "Breakers." Panel B reports the results of multinomial logit regressions for the likelihood that the "Breaker" companies cross-listed before the first break, during one of the breaks, or after the first break. The omitted case is the latter so that the coefficients reflect the odds relative to cross-listing after the first break. In all cases, Panel B shows that the constant coefficient for the odds that a firm will cross-list before the first break is positive and significant at the 95% level, reflecting the earlier finding that firms tend to have breaks in beta significantly after cross-listing. Moreover, in all the regressions, age is significantly negative for the odds that cross-listing is before the breaks. That is, younger "Breaker" firms are more likely to have breaks after cross-listing.

Column 2 of Table 5B shows that companies from emerging markets are less likely to cross-list before the break and more likely to cross-list during the break with negative and positive coefficients, respectively. However, in neither case are the coefficients significant.

Previously in Panel A, I found that North American firms are less likely to have breaks beyond those at the country level and therefore become "Breakers." For those North American companies that do become "Breakers," however, I include a dummy in the multinomial logit regressions. The results are reported in Column 3 in Table 5B. Notably, the coefficients are significantly positive indicating that these North American firms are significantly more likely to cross-list before the first company beta break. To see if the results are sensitive to the Mexican firms, the final columns report results including only the Canadian firms. In this case, the coefficients are very similar to the overall North American results. Since only five companies from Mexico indicate changing betas beyond the country level and all of these cross-list before their break-dates, the Mexican companies only reinforce the Canadian company findings.

Overall, the results in Table 5 indicate that companies that are younger or are from North

American tend to have breaks in their relationship with the US that coincide with those of their home markets. North American company breaks appear to move more closely with the general integration patterns of their home markets, consistent with the general proximity to the US, both geographically and through trade patterns. On the other hand, for those minority of companies that do exhibit breaks that differ from their home markets, on-average these individual breaks occur significantly after the cross-listing date. For these companies, it appears that investors take some time to recognize them. Interestingly, the characteristics of companies with these delayed beta responses tend to be opposite of the characteristics of companies that are "Breakers" to begin with. That is, younger companies are less likely to have breaks that do not coincide with country breaks (Panel A), but of those that do, they are more likely to cross-list before their breaks (Panel B). Similarly, North American companies are less likely to have breaks not explained by the general relationship between the US and Canadian or Mexican markets (Panel A). However, of those companies that do show individual breaks, they are more likely to have cross-listed before the individual breaks. In the next subsection, I consider some examples of this behavior.

2.5 Company Examples

To get a sense of the range of results by company described above, I show some more detailed information for some company examples. For these examples, Table 6 reports their cross-listing dates, estimated break dates and those of their home countries. The top panel highlights some companies with breaks that are explained by the country breaks. Canada has had a long history of cross-listing in the US along with the most number of breaks. So even though Canadian companies tend to have breaks against the U.S. market, they tend to correspond to the same timing as general Canadian market movements. This relationship is true for companies like Northgate with a very early cross-listing date in 1970 and break in U.S. market betas in the 1980s, as well as companies like Shaw Communications with a more recent history in the US market. This panel also illustrates this relationship for a Mexican company, Televisa. The estimated breakdates for Televisa are insignificantly different from the Mexican market breakdate of November 2004.

The lower Panel B of Table 6 provides similar results for selected companies that have estimated break dates significantly different from their home market. These examples include companies ranging from early cross-listing dates such as Fuji Photos to more recent crosslistings such as Brazil Telecom. As the table shows, the betas for Fuji changes in 1995 while the betas for the Japanese market as a whole change in 1981, coinciding with the Japanese market liberalization. By contrast, the betas of the Dutch company Buhrmann changes in the mid 1980s, well before the changes in the market as a whole.

Some companies cross-list during periods that are quite close to the general market changes. For example, Brazil Telecom cross-listed in November of 2001 while the general market shifted in October of 2002. Nevertheless, both of these events took place significantly before the change in Brazil Telecom's betas in 2004 to 2006.

Overall, these results highlight the importance of conditioning on the changes at the market level when considering the effects of betas. In the next section, I examine the changes in betas more directly to verify that these beta changes correspond to the general trend toward integration that has been found in the existing literature.

3 The Impact of Changing Company Betas

In the analysis so far, I have focused upon potential breaks in stock return betas and characteristics of their associated companies without considering the direction of changing betas. At the same time, the literature suggests that these betas against the U.S. market are likely to have increased over time. As noted earlier, the event studies of cross-listing events have typically pooled all stock returns together and found that the betas against the U.S. market tend to increase toward one after the event. Similarly, research on market level returns tend to find that these returns have become more correlated over time, implying that international diversification benefits are likely diminishing.

To check the reasonableness of the breakdates above, therefore, I next examine the direction of changes in estimated betas. In this section, I find that betas against the U.S. market have indeed increased toward one after cross-listing and over time. Moreover, the implied market returns have become more correlated. As a further robustness check, I conduct a Monte Carlo experiment and show that the international diversification benefits have declined over time, consistent with the literature.[21] All of these cases continue to demonstrate that the estimated shifts in parameters are plausible and support the break date estimates above.

3.1 Changing Beta Estimates over Breaks

Table 7 summarizes parameter estimates across individual country level return equations (9), reported in Panel A, and across individual company level return equations (10), reported in

[21] In the appendix, I also report on other sensitivity analysis.

Panels B and C. To provide measures of these distributions, I aggregate the estimates into portfolios across country returns and across company returns using two different weighting methods: (a) Market-Weighted and (b) Equally-Weighted.[22] For each portfolio, I sort the country and company parameters into bins during which parameters are stable at the 5% MSL.[23] For example, in Panel A, the column labeled "Period 1" corresponds to country level statistics over the intervals when $\beta^{\ell} = \beta_1^{\ell}$, "Period 2" corresponds to $\beta^{\ell} = \beta_2^{\ell}$, and so forth through "Period 4." Note that these intervals will differ across countries and companies and therefore do not necessarily incorporate common points in time.[24] Also, for return series that do not show instability, parameters are reported under "Period 1" throughout the sample, implying more observations in that bin. Similarly, fewer countries and companies show evidence of three breaks. As such "Period 4" has fewer observations.

For each portfolio in Panel A of Table 7, the table reports the cross sectional mean of the beta estimates using equation (9), their standard errors and their correlations with the US market, labeled β^{ℓ} Mean, Std Err Mean, and $Corr(r^{\ell}, r^{u})$, respectively. It also gives the cross-sectional standard deviation of the beta estimates given in the row referenced by β^{ℓ} Std Dev, and the number of countries in the bin. Three main features can be seen across these columns. First, the mean betas generally increase over the periods toward one. The market weighted portfolio beta mean is only about 0.35 in Period 1, but is about 0.80 for Period 2. While there are fewer countries with two and three breaks, the means over these later periods increase as well. A similar pattern holds for the Equally Weighted Portfolio. Second, the

[22] The appendix also reports the same summary statistics for portfolios disaggregated into emerging versus developed markets and into different world regions, with similar results.

[23] For the MSLs of 1% and 10% the estimates are virtually identical.

[24] To illustrate time-dependence in this relationship, I construct a yearly measure of the aggregated betas below.

correlations of these country returns with the US also increase over the periods beginning at about 0.20 for period 1 to 0.36 in period 2 and 0.44 in period 3. Third, the standard error means have stayed relatively low, generally not exceeding 0.06 so that the hypothesis of beta equal to zero can typically be rejected. Taken together, these parameters are consistent with the general view that markets have become more correlated and integrated over time.

Panels B and C of Table 7 report the same information for the firm return local market beta $\beta^{i\ell}$ and the US market beta β^{iu}, respectively. The local market betas in Panel B show little change over time. In particular, the market weighted betas increase from subperiod one to two from 0.66 to 0.75 while the equally weighted portfolio betas are essentially flat at around 0.7. These estimates do show some tendency to increase in subperiod three and four, although there are fewer companies in these bins.

Panel C of Table 6 reports the same summary statistics for the company US market betas. For these portfolio parameters, the means increase more sharply. For the market-weighted portfolio, the US market betas in Period 1 are only 0.455 but increases to 0.792 in Period 2. These mean betas increase even more over the following two periods, peaking at 0.995 by Period 4, although for a small number of companies. A similar but more attenuated pattern appears to hold for the Equally Weighted portfolio. Interestingly, the correlation between cross-listed company returns and the US market increases over sub-periods. Across all countries, the mean correlation increases from 0.16 in period 1 to 0.32 in period 4.

Taken together, the parameter results in Table 6 suggest that, even after controlling for the apparent shift toward integration of market indices, the set of cross-listed companies as well as their home markets have become more correlated with the US. First, the indirect relationship with the US market has increased. That is, Panels A and B show that both the local market indices and the local market betas have increased toward one. As a results, the product of these betas $\beta^{i\ell}\beta^{\ell}$ has increased. Second, the direct relationship with the US market has increased as well. Panel C demonstrates that US market betas have moved toward one and the mean correlations with the US have also risen. The parameter results are therfore consistent with the literature, further corroborating the break date analysis above.

3.2 Changing Beta Estimates Before and After Cross-listing

The results suggest that the correlations among cross-listed company returns in the U.S. have increased over time, and are therefore consistent with the empirical literature that finds diminishing diversification potentials. However, as shown above, the breaks in these relationships do not generally occur at the same time as cross-listing. As such, they are silent about whether the evidence is consistent with the cross-listing literature that finds higher betas against the U.S. market after cross-listing.

To address how betas change before and after cross-listing, I sort the parameters into periods before and after cross-listing. For companies, these cross-listing dates are simply the same cross-listing dates as above. For countries, I use an approach common in the emerging market liberalization literature. This approach analyzes changes based upon the timing of the first cross-listed stock from that market.[25] For this reason, I use the listing date of the company that was the earliest to cross-list from that home market.[26]

Table 8 reports summary statistics before, after, and during cross-listing for all three

[25] For example, Henry (2000) uses the earliest date at which a company cross-lists in the economy as a measure of openness. And Bekaert, Harvey and Lumsdaine (2002) examine these events to corroborate their liberalization dating estimates.

[26] Note that this measure is biased to be later than the earliest listing date of the company since some companies may have listed on another exchange before 2004. As such, my results are conservative as they are biased against the general finding that cross-listings occur before changes in betas.

betas estimates. Panel A gives the statistics for the country level regressions. To calculate these statistics, I first array the beta coefficients on the US market, β^{ℓ}, by year and then sort the parameters into bins depending upon whether these estimates are "Before Listing" (first column) or "After Listing" (second column). I also report the averages including the listing period, given under the column labeled "After and During Listing."

A basic pattern is clear from these estimates. For both the Market-Weighted and Equally-Weighted portfolios, the average betas increase dramatically after listing. When the "During Listing" period is included in the last column, this increase is attenuated, but is still significantly higher than the "Before Listing" period. Moreover, the pattern in the betas is mirrored in the correlations. The mean correlations increase from around 0.2 before listing to almost 0.4 in the later period excluding listing and is about 0.3 if the listing period is included.

Panel B of Table 8 shows the corresponding breakdown by company betas for the local market, $\beta^{i\ell}$, and the US market, β^{iu}. While the local market betas show some slight tendency to increase, the difference is not pronounced and is in fact rather flat at around 0.7 for the Equally Weighted portfolio. Furthermore, the correlation of the cross-listed companies with their home markets does not show any real trend, hovering at around 0.2

By contrast, the statistics for company returns relative to the US market show a more pronounced relationship. The mean of company betas against the US increases from about 0.49 before cross-listing to 0.97 for firms that show evidence of parameter breaks after cross-listing. Although this mean drops to 0.74 when the listing period is included, it remains considerably higher than the mean before cross-listing. The correlation with the US also follows this pattern.

Taken together, these parameter estimates are consistent with the pattern found in the cross-listing literature using pooled samples of cross-listed stock returns. In particular, the betas of these stock returns on the U.S. market increase after cross-listing while the betas on the home market are relatively flat. Moreover, the betas and correlations of market returns tend to increase toward one after cross-listing, similar to findings in the liberalization lterature. Overall, the pattern of the parameter estimates demonstrates that the break date analysis above generates results consistent with the cross-listing literature.

3.3 Changing Beta Estimates Over Time

The summary of the parameter estimate distributions describe how the individual countries and company returns shift over time. However, they do not indicate how the parameters change in calendar time. Therefore, I next sort the country and company estimates by year and form annual market-weighted portfolios to determine whether they are consistent with the literature on market integration.

For this purpose, I recalculate the factor loadings of foreign companies on US returns. As noted above, changes in the US returns affect foreign companies both directly through their own betas and indirectly through the home market beta on the US. These individual company parameters are then market-weighted annually to provide an aggregate measure of portfolio parameters.

Figure 4a plots the parameter estimates over time. As the figure shows, the portfolio beta on the local market $\beta^{i\ell}$ is relatively unchanged over time at around 0.8. However, there is a significant increase over time in both the betas of the country returns and the foreign companies on the US, β^{ℓ} and β^{iu}, respectively. As a result, the combined effect is a strong increase in betas against the US.

This increase is betas against the US suggests a decrease in international diversification potential. To determine whether this conjecture is valid, I consider the following thought experiment. Using the estimated parameters and residual variance-covariance matrix, I construct the minimum-variance portfolio of a US investor who has a choice between three different portfolios: (a) the US market portfolio, (b) a market-weighted portfolio of foreign companies listed on the US exchanges, and (c) a market-weighted portfolio of foreign market indices that have companies listed on the US exchanges.[27]

Figure 4b shows the impact of these parameters and variances on the minimum variance portfolio allocations. Through the 1980s, investment in foreign securities provides a useful hedge for the US market. The combined betas of the foreign market indices are less than one and even a sharp increase in the residuals after 1987 does not diminish the attractiveness of foreign investment. However, beginning in the 1990s, the increasing betas of foreign market indices and foreign companies both push down the desired allocation in foreign assets. Interestingly, the pattern of desired allocation into foreign companies in the US tends to mirror that of foreign markets. The reduced diversification potentil implied by the paramter estimates is consistent with research finding diminishing international diversification, and, as such, provides another robustness check.

[27] Details are provided in the appendix. There I also describe analysis for an alternative when US investors cannot hold the foreign market indices, also finding evidence for diminishing diversification potential.

4 Conclusions

An important literature has studied the stock return behavior of firms around their cross-listing dates. Studies in this literature generally find that the betas on the U.S. market of these companies tend to increase after cross-listing. In this paper, I have used stock returns of a set of foreign companies to independently test whether their betas change and, if so, on what date. The results of this study are striking. While most companies show evidence of changes in their betas, these changes can largely be attributed to variation in betas at the market level, not the company level. Moreover, for those companies that do appear to have shifts in US beta not attributable to their home market, these changes occur significantly later than the cross-listing date. Logistical regressions suggest that companies that tend to cross-list earlier than any changes in their betas tend to be younger or else have home markets that are in North America with a longer history of U.S. integration. Furthermore, the changes in betas appear to be consistent with evidence that markets are becoming integrated.

Nevertheless, taken together the evidence suggests that much of the observed increases in company betas over time may be due to integration of markets, not just firm behavior. In addition, since companies tend to cross-list before any independent increases in correlations with the US market, it appears to take time for stock returns to take on more systematic US risk. This transition period may result either because US investors are learning about the company or else foreign managers are changing their management practices to better align with US shareholders. As such, the results in this paper point to interesting questions for future research.

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Table 1: Summary Statistics for Foreign Companies Listed in US Exchanges

Panel A: Summary Information about Foreign Firms Listed by Exchange and Total				
Stock Exchange	Market Begin Data	No. of Firms	No. of Countries	Average Firm Observations
NYSE	Jan 2, 1970	380	39	1092
NASDAQ	Feb 8, 1971	196	28	862
Both Exchanges	–	576	42	977
Panel B: Summary Information about Foreign Firms Listed by Country				
Country	Market Begin Data	No. of Firms-NYSE	No. of Firms NASDAQ	Average Firm Observations
Argentina	Aug 6, 1993	9	3	733
Australia	Jan 5, 1973	12	8	1324
Austria	Jan 5, 1973	2	0	466
Belgium	Jan 5, 1973	1	0	1917
Brazil	Jul 8, 1994	35	1	676
Canada	Jan 5, 1973	57	63	1009
Chile	Jul 7, 1989	17	0	457
China	Jul 30, 1993	12	5	527
Colombia	Mar 13, 1992	1	0	764
Denmark	Jan 5, 1973	2	2	1401
Finland	Mar 25, 1988	4	0	1055
France	Jan 5, 1973	22	10	921
Germany	Jan 5, 1973	15	3	869
Greece	Jan 5, 1990	3	1	760
Hong Kong	Jan 5, 1973	7	5	579
Hungary	Jun 21, 1991	1	0	620
India	Jan 5, 1990	8	3	772

Table 1: Summary Statistics for Foreign Companies Listed in US Exchanges (cont.)

Panel B: Summary Information about Foreign Firms Listed by Country (cont)				
Country	Market Index Begin Date	No.of Firms: NYSE	No. of Firms: NASDAQ	Average Firm Observations
Indonesia	Jan 5, 1990	2	0	376
Ireland	Jan 5, 1973	3	8	1348
Israel	Jan 1, 1993	2	6	671
Italy	Jan 5, 1973	10	0	908
Japan	Jan 5, 1973	18	12	1585
Korea	Sep 11, 1987	5	3	708
Luxemburg	Jan 3, 1992	2	1	644
Malaysia	May 12, 1989	0	1	729
Mexico	Jan 5, 1973	24	2	796
Netherland	Jan 8, 1988	16	7	1182
New Zealand	Jan 4, 1980	1	0	475
Norway	Jan 7, 1994	4	3	794
Peru	Sep 11, 1987	2	0	947
Philippines	Jan 5, 1990	2	1	411
Portugal	Jun 24, 1994	3	0	841
Russia	Jan 5, 1973	3	0	641
Singapore	Mar 6, 1987	0	2	511
South Africa	Jan 5, 1973	6	5	1149
Spain	May 6, 1988	6	1	773
Sweden	Jan 8, 1988	0	7	989
Switzerland	Jan 2, 1970	10	2	948
Taiwan	Jan 5, 1990	5	2	793
Turkey	Aug 6, 1993	1	0	483
United Kingdom	Jan 5, 1973	46	29	1160
Venezuela	Jan 5, 1973	1	0	671

Table 2 Firm Return Break Tests

Panel A reports the proportion of foreign company returns rejecting the hypothesis that there are less than one, two, three and unknown breaks in the regression: $r_t^{i\ell} = \alpha^{i\ell} + \beta^{i\ell} r_t^{\ell} + \beta^{iu} r_t^{u} + e_t^{i\ell}$, where r_t^{ℓ} is the excess return of country ℓ's equity return, r_t^{u} is the excess return of the US. Panel B gives the results of the sequential Sup(F) test. Panel C reports shares, age, and market cap means for firms categorized by cross-listing date relative to break dates.

Panel A: Proportion of Companies Rejecting No Breaks

MSL[a]	Sup F test of No Break vs:			Tests of No Break vs Unknown Number of Breaks	
	m=1	m=2	m=3	UD Max	WD Max
5%	0.771	0.799	0.802	0.807	0.806
1%	0.676	0.734	0.715	0.709	0.736

Panel B: Distribution of Breaks by Number

MSL[a]	Proportion of Total Companies[b]	Proportional # of Breaks[c] over		
	Rejecting Ho: No Breaks	1 Break	2 Breaks	3 Breaks
5%	0.772	0.546	0.347	0.107
1%	0.678	0.630	0.310	0.059

Panel C: Distribution of Breaks by Subsample[d]

Break Date	< 1980	>1980, < 1985	>1985, < 1990	>1990, < 1995	>1995, < 2000	>2000, < 2005	>2005
Number of Breaks	21	46	27	42	174	277	106
Share of Companies	0.186	0.348	0.145	0.140	0.377	0.519	0.201

Panel D: Relationship to Cross-Listing Dates[d]

	Breakers/ Non-Breakers	Crosslisting Date is: < Break 1	= Break 1	> Break 1	= Break 2	> Break 2	≥ Break 3
Total Share[e]	0.772/0.228	0.660	0.091	0.166	0.032	0.045	0.004
Developed Share[e]	0.762/0.238	0.488	0.074	0.118	0.033	0.041	0.003
Emerging Share[e]	0.794/0.206	0.556	0.061	0.150	0.006	0.022	0.000
Age (weeks)[f]	1,063/768	886	1,210	1,406	1,417	1,719	1,916
Market Cap ($ billion)[f]	8,285/5,065	7,949	7,413	9,148	11,786	9,418	7,640

[a]Marginal significance levels for the test of no structural break and the sequential sup(F) test. [b]Ratio of the number of companies that reject the test of no structural break over the total number of firms. [c]Ratio of the number of companies that reject the sequential test of a given number of breaks plus one over the total number of companies that reject the supF test of no structural break. [d]For number of breaks estimated with MSL of 5%. [e] Under Breakers/Non-Breakers, the ratio of firms that reject/ don't reject the hypothesis of no breaks over the number of firms by group (Total, Developed, Emerging). Remaining columns report the ratio of the number of firms with cross-listing dates in a given time category over the number of firms rejecting the hypothesis of no break. [f] Average per group.

Table 3 Country Return Break Tests

Panel A reports the proportion of foreign country returns rejecting the hypothesis that there are less than one, two, three and unknown breaks in the regression: $r_t^\ell = \alpha^\ell + \beta^\ell r_t^u + u_t^\ell$, where r_t^ℓ is the excess return of country ℓ's equity return, r_t^u is the excess return of the US. Panel B gives the results of the sequential Sup(F) test. Panel C reports means and standard errors of the break dates.

Panel A: Proportion of Countries Rejecting No Breaks					
MSL[a]	Sup F test of No Break vs:			Tests of No Break vs Unknown Number	
	m=1	m=2	m=3	UD Max	WD Max
5%	0.857	0.857	0.905	0.881	0.905
1%	0.810	0.810	0.857	0.833	0.786

Panel B: Distribution of Break Categories				
MSL[a]	Proportion of Total Countries[b]	Proportional # of Breaks[c] over		
	Rejecting Ho: No Breaks	1 Break	2 Breaks	3 Breaks
5%	0.857	0.750	0.167	0.083
1%	0.810	0.853	0.118	0.029

[a]Marginal significance levels for the test of no structural break and the sequential sup(F) test. [b]Ratio of the number of countries that reject the test of no structural break over the total number of countries. [c]Proportion of countries that reject sequential test of a given number of breaks plus one over the number that reject the supF test of no structural break.

Table 4 Summary Statistics of Foreign Market Breaks and Restrictions on Foreign Firm Pricing

Panel A reports the number and proportion of foreign stocks listed in the US domiciled in home countries with number of breaks as in Table 2. Panel B reports the number and proportion of the firms that reject the hypothesis that the estimates are stable in the equation system: $r_t^{i\ell} = \alpha^{i\ell} + \beta^{i\ell}\alpha_\zeta^\ell + \left(\beta^{iu} + \beta^{i\ell}\beta_\zeta^\ell\right) r_t^u + \beta^{i\ell} u_{t,\zeta}^\ell + e_t^{i\ell}$ and $r_t^\ell = \alpha_\zeta^\ell + \beta_\zeta^\ell r_t^u + u_{t,\zeta}^\ell$ for each firm i and domicile country ℓ, and interval $\zeta = 1..., m^\ell$ where m^ℓ is the estimated number of breaks for country ℓ. The first equation regresses the excess return of firm i from home country ℓ on the local market excess return and the US market return. The second equation is the market equity excess return regression. Panel C reports the number and proportion of firms that reject the hypothesis that the parameters are equal to zero or constant.

Panel A: Firms Decomposed by Country Break Category

Statistic	One Break m=1	Two Breaks m=2	Three Breaks m=3	All
Proportion of Firms[a]	0.620	0.089	0.238	0.946
No of Firms	357	51	137	545

Panel B: Distribution of Break Categories Using Sequential Test

Tests for Breaks Beyond country level	No Breaks	One Break	Two Breaks	Three Breaks
Proportion of Firms[a]	0.487	0.406	0.097	0.011
No of Firms	277[b]	231	55	6

Panel C: Firms Rejecting Parameter Constancy

Null Hypothesis	No Local Effect $Ho: \beta_\zeta^{i\ell} = 0, \forall\zeta$	No US Effect $Ho: \beta_\zeta^{iu} = 0, \forall\zeta$	Local Effect Constant $Ho: \beta_\zeta^{i\ell} = \beta^{i\ell}, \forall\zeta$	World Effect Constant $Ho: \beta_\zeta^{iu} = \beta^{iu}, \forall\zeta$
Proportion of Firms[c]	0.849	0.579	0.634	0.445
No of Firms	248	169	185	130

Panel D: Relationship to Cross-Listing Dates (at MSL 5%)

	Breakers/	Crosslisting Date is:					
	Non-Breakers	$<$ Break 1	$=$ Break 1	$>$ Break 1	$=$ Break 2	$>$ Break 2	$\geq$ Break 3
Total Share[d]	0.284/0.716	0.716	0.136	0.105	0.019	0.019	0.006
Developed Share[d]	0.284/0.716	0.703	0.135	0.117	0.018	0.027	0.000
Emerging Share[d]	0.283/0.717	0.745	0.137	0.078	0.020	0.000	0.020
Age (weeks)[e]	1,045/952	917	1,339	1,379	1,228	1,620	1,793
Market Cap ($ bill)[e]	8,365/6,838	8,246	3,854	10,867	8,406	14,089	1,793

[a]Proportion out of total number of firm = 569 [b]Includes 34 companies for which there was no break at the country level [c]Proportion out of number of firms rejecting no breaks beyond country level = 292 [d] Under Breakers/Non-Breakers, the ratio of firms that reject/don't reject, respectively, the hypothesis of no breaks over the number of firms by group (Total,Developed, Emerging). Remaining columns report the ratio of the number of firms with cross-listing dates in a given time category over the number of firms rejecting the hypothesis of no break. [f]Average per.

Table 5 Firm Characteristic Regressions for Break Events

Panel A reports the coefficient estimates and standard errors for a logit regression where the dependent variable is one if a firm's beta changes over the sample period. Panel B reports the coefficient estimates and standard errors for a multinomial logit regression where the dependent variable is the timing of the beta break date relative to the cross-listing date for the firms that break. This dependent variable is: (a) cross-listing is before first break; (b) cross-listing is during one of the breaks; or (c) cross-listing is after the first break.The omitted event is (c). Panel C gives the North American company breakdown.

Panel A: Logit Regressions for Firms that Break Independent of Country Effects

Independent Variable	1. Base Case	2. Emerging	3. N America	4. Can	5. Mex
Constant	-2.483**	-2.071**	-2.310**	–2.440**	-2.277*
	(1.186)	(1.231)	(1.188)	(1.186)	(1.187)
Age	0.263	0.217	0.289*	0.283	0.247
	(0.176)	(0.180)	(0.177)	(0.177)	(0.176)
Market Cap Mean	0.043	0.039	0.0127	-0.027	0.036
	(0.046)	(0.046)	(0.0472)	(0.047)	(0.046)
Emerging		-0.231			
		(0.193)			
North America			-0.472**		
			(0.212)		
Canada or Mexico				-0.2773	-1.049**
				(0.2231)	(0.507)
Ho: All Coeff = 0	<0.000	<0.000	<0.000	<0.000	<0.000

Panel B: Logit Regressions for Firms that Cross-list Before, During, After Break

	1. Base Case		2. Emerging		3. N America		4. Canada only	
Timing from Cross-listing	Before	During	Before	During	Before	During	Before	During
Constant	15.094**	0.915	16.720**	0.872	14.873**	0.599	15.053**	0.679
	(2.881)	(4.143)	(3.232)	(4.565)	(2.871)	(4.075)	(2.879)	(4.098)
Age	-1.911**	0.021	-2.095**	0.026	-1.983**	0.033	-1.984**	0.025
	(0.420)	(0.605)	(0.453)	(0.642)	(0.425)	(0.600)	(0.425)	(0.604)
Market Cap Mean	-0.050	-0.207	-0.072	-0.207	0.012	-0.182	-0.005	-0.186
	(0.106)	(0.140)	(0.109)	(0.143)	(0.108)	(0.138)	(0.107)	(0.139)
Emerging			-0.642	0.038				
			(0.471)	(0.643)				
North America					1.470**	0.414		
					(0.655)	(0.877)		
Canada only							1.332**	0.445
							(0.657)	(0.875)
Ho: All Coeff = 0	<0.000		<0.000		<0.000		<0.000	

**Significant at 95% confidence level *Significant at 90% confidence level. Standard errors in parentheses.

Table 5 Firm Characteristic Regressions for Breaks (cont.)

Panel C: Decomposing North American Firms					
	Dependent Variable				
	Break			Timing from Cross-listing	
Model	Canada	Mexico	Both		
Indep Variable				Before	During
Constant	–2.440**	-2.277*	-2.207*	15.053**	0.679
	(1.186)	(1.187)	(1.188)	(2.879)	(4.098)
Age	0.283	0.247	0.270**	-1.984**	0.025
	(0.177)	(0.176)	(0.177)	(0.425)	(0.604)
Market Cap Mean	-0.027	0.036	0.015	-0.005	-0.186
	(0.047)	(0.046)	(0.015)	(0.107)	(0.139)
Canada	-0.2773		-0.347	1.332**	0.445
	(0.2231)		(0.225)	(0.657)	(0.875)
Mexico		-1.049**	-1.136**		
		(0.507)	(0.510)		
Ho: All Coeff = 0	<0.000	<0.000	<0.000	<0.000	

**Significant at 95% confidence level *Significant at 90% confidence level.

Standard errors in parentheses.

Table 6 Selected Company and Home Country Break Dates

Panel A reports the following dates for selected companies with breaks explained by the home country break dates: the company cross-listing date, the estimated breakdates without conditioning on country breaks, and the estimated country break dates. Panel B reports the following dates for selected companies with breaks not explained by the the home country break dates: the company cross-listing date, the estimated breakdates after conditioning on country breaks, and the estimated country break dates.

Panel A: Companies with Breaks Explained by Country Breaks							
Company	CL Date[a]	Company		Country			
		Break Bounds		Name	Breakdates		
		Lower	Upper		First	Second	Third
Northgate Minerals	Feb 1970	June 1984	Mar 1986	Can	Sep 1979	May 1985	Dec 2003
Shaw Communications	July 1998	Dec 2000	Nov 2002	Can	Sep 1979	May 1985	Dec 2003
Televisa	Dec 1991	Feb 2005	Dec 2005	Mex	Nov 2004	–	–

Panel B: Companies with Breaks Not Explained by Country Breaks							
Company	CL Date[a]	Company		Country			
		Break Bounds		Name	Breakdates		
		Lower	Upper		First	Second	Third
Fuji Photos	Dec 1970	Oct 1995	Nov 1995	Japan	Sep 1981	–	–
Buhrmann	Feb 1993	Feb 1985	Oct 1987	Neth	Aug 2001	–	–
Brazil Telecom	Nov 2001	Jun 2004	Jan 2006	Brazil	Oct 2002	–	–

[a]CL date = Cross-listing date

Table 7 Summary Statistics for Beta Estimates

Panel A reports the means, standard error means, and cross-sectional standard deviations of β^{ℓ} in the regression: $r_t^{\ell} = \alpha^{\ell} + \beta^{\ell} r_t^u + u_t^{\ell}$ where r_t^{ℓ} is the excess return of country ℓ's equity return, r_t^u is the excess return of the US market. Panels B and C report the means, standard error means, and cross-sectional standard deviations of $\beta^{i\ell}$ and β^{iu}, respectively, in the joint regressions: (i) $r_t^{\ell} = \alpha^{\ell} + \beta^{\ell} r_t^u + u_t^{\ell}$; and (ii) $r_t^{i\ell} = \alpha^{i\ell} + \beta^{i\ell} r_t^{\ell} + \beta^{iu} r_t^u + e_t^{i\ell}$ where r_t^{ℓ},r_t^u, and $r_t^{i\ell}$ are the excess returns of the local market, US market, and firm i from country ℓ, respectively, and where $\left\{\alpha^{\ell}, \beta^{\ell}, \alpha^{i\ell}, \beta^{i\ell}, \beta^{iu}\right\}$ are parameters for country ℓ and firm i. "Periods" are defined as the interval over which a parameter is stable and therefore correspond to different event times for each country and firm.

Portfolio	Estimate	Period 1	Period 2	Period 3	Period 4
Panel A: Foreign Country Beta Estimates					
Market Weighted	β^{ℓ} Mean	0.348	0.802	0.866	1.109
	Std Err Mean	0.047	0.049	0.039	0.038
	$Corr(r^{\ell}, r^u)$	0.198	0.355	0.436	0.471
	β^{ℓ} St Dev	0.248	0.315	0.341	0.234
	No. of Countries	42	35	9	2
Equally Weighted	β^{ℓ} Mean	0.378	0.843	0.799	0.973
	Std Err Mean	0.063	0.066	0.053	0.047
	$Corr(r^{\ell}, r^u)$	0.198	0.355	0.436	0.471
	β^{ℓ} St Dev	0.248	0.315	0.341	0.234
	No. of Countries	42	35	9	2
Panel B: Foreign Firm Local Beta Estimates					
Market Weighted	$\beta^{i\ell}$ Mean	0.659	0.754	0.879	0.922
	Std Err Mean	0.079	0.094	0.095	0.082
	$Corr(r^{\ell}, r^u)$	0.223	0.187	0.214	0.236
	$\beta^{i\ell}$ St Dev	0.523	0.646	0.592	0.472
	No. of Firms	570	435	222	52
Equally Weighted	$\beta^{i\ell}$ Mean	0.698	0.717	0.821	0.800
	Std Err Mean	0.125	0.132	0.116	0.097
	$Corr(r^{\ell}, r^u)$	0.223	0.187	0.214	0.236
	$\beta^{i\ell}$ St Dev	0.523	0.646	0.592	0.472
	No. of Firms	570	435	222	52

Table 7 Summary Statistics for Beta Estimates (cont.)

Portfolio	Estimate	Period 1	Period 2	Period 3	Period 4
Panel C: Foreign Firm US Beta Estimates					
	β^{iu} Mean	0.455	0.792	0.858	0.995
Market	Std Err Mean	0.127	0.128	0.077	0.065
Weighted	$Corr(r^i, r^u)$	0.156	0.224	0.257	0.315
	β^{iu} St Dev	0.555	0.678	0.554	0.552
	No. of Obs	570	435	222	52
	β^{iu} Mean	0.624	0.858	0.862	0.882
Equally	Std Err Mean	0.131	0.121	0.106	0.086
Weighted	$Corr(r^i, r^u)$	0.156	0.224	0.257	0.315
	β^{iu} St Dev	0.555	0.678	0.554	0.552
	No. of Obs	570	435	222	52

Table 8 Foreign Company and Market Return Estimates Before and After Cross-Listing

Parameter estimate means, standard error means, and cross-sectional standard deviations before and after cross-listing. Panel A gives results for the country market return regressions aggregated into portfolios before, during and after cross-listing: $r_t^\ell = \alpha^\ell + \beta^\ell r_t^u + u_t^\ell$; Panel B gives results for the company return regressions: $r_t^{i\ell} = \alpha^{i\ell} + \beta^{i\ell} r_t^\ell + \beta^{iu} r_t^u + e_t^{i\ell}$. The columns headed "Before Listing," "Only After Listing," and "After/During Listing" give, respectively, statistics performed on parameter averages across subperiods before cross-listing, across subperiods that break after cross-listing, and across the subperiod during cross-listing and the subperiods after cross-listing.

Portfolio	Estimate	Before Listing	Only After Listing	After/During Listing
Panel A: Foreign Country Beta Estimates				
Market Weighted	β^ℓ Mean	0.348	0.830	0.594
	Std Err Mean	0.047	0.047	0.047
	$Corr(r^\ell, r^u)$	0.198	0.375	0.289
	β^ℓ St Dev	0.248	0.260	0.199
	No. of Obs	42	35	35
Equally Weighted	β^ℓ Mean	0.378	0.882	0.634
	Std Err Mean	0.063	0.063	0.062
	$Corr(r^\ell, r^u)$	0.198	0.375	0.289
	β^ℓ St Dev	0.248	0.260	0.199
	No. of Obs	42	35	35

Table 8 Foreign Company and Market Return Estimates Before and After Cross-Listing (cont.)

Portfolio	Estimate	Before Listing	Only After Listing	After/During Listing
Panel B: Foreign Firm Beta Estimates				
Market Weighted	$\beta^{i\ell}$ Mean	0.647	0.758	0.766
	Std Err Mean	0.079	0.095	0.088
	$Corr(r^i, r^\ell)$	0.220	0.179	0.220
	$\beta^{i\ell}$ St Dev	0.527	0.563	0.492
	No. of Obs	570	368	390
	β^{iu} Mean	0.486	0.970	0.740
	Std Err Mean	0.085	0.078	0.080
	$Corr(r^i, r^u)$	0.168	0.288	0.227
	β^{iu} St Dev	0.514	0.544	0.388
	No. of Obs	570	368	390
Equally Weighted	$\beta^{i\ell}$ Mean	0.696	0.691	0.723
	Std Err Mean	0.125	0.124	0.124
	$Corr(r^i, r^\ell)$	0.220	0.179	0.220
	$\beta^{i\ell}$ St Dev	0.527	0.563	0.492
	No. of Obs	570	368	390
	β^{iu} Mean	0.639	0.967	0.800
	Std Err Mean	0.128	0.110	0.117
	$Corr(r^i, r^u)$	0.168	0.288	0.227
	β^{iu} St Dev	0.514	0.544	0.388
	No. of Obs	570	368	390

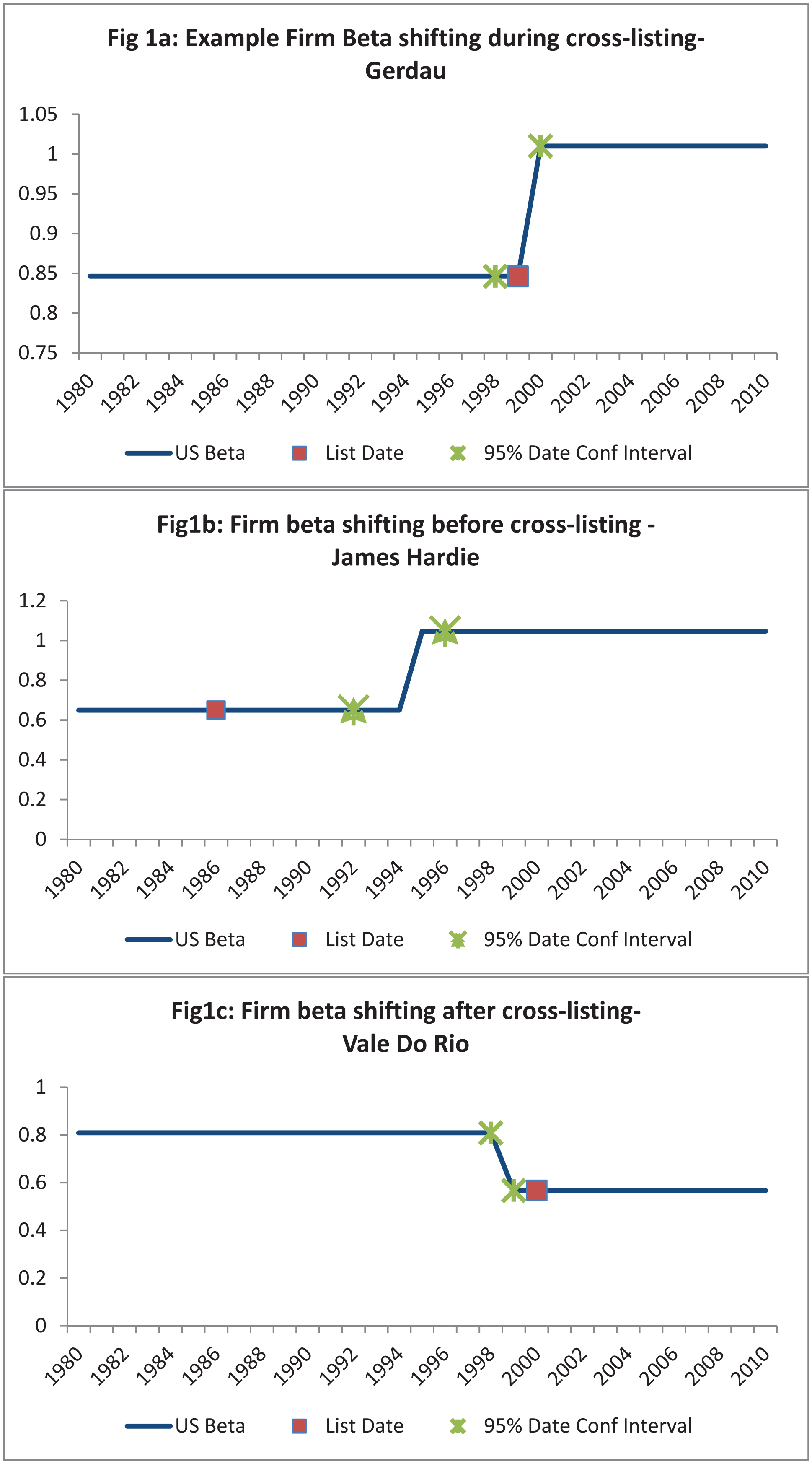
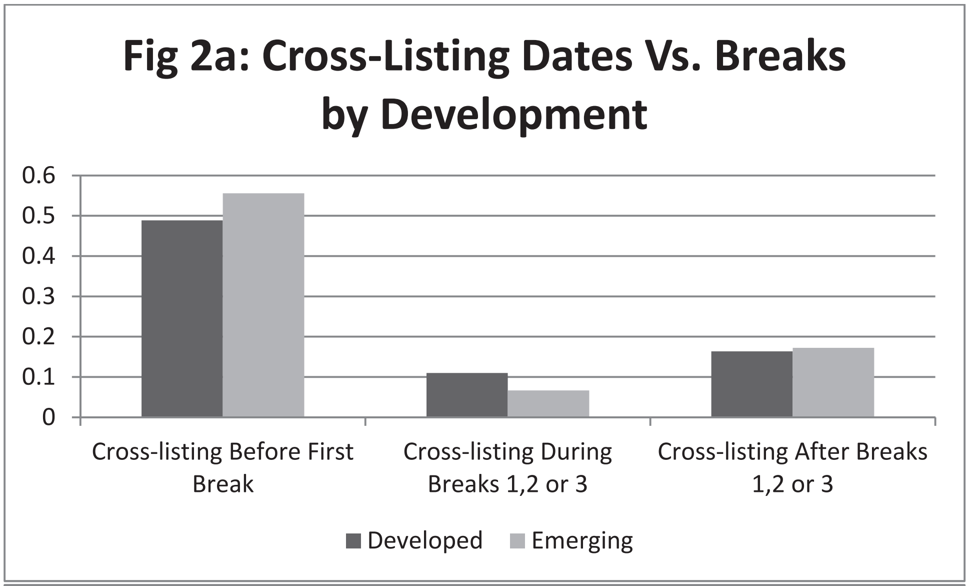
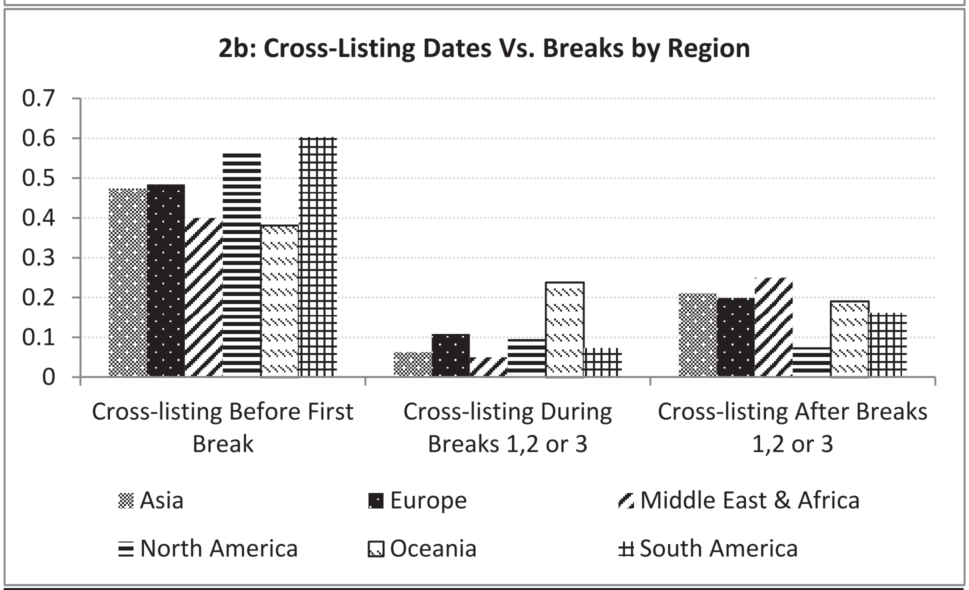


Figure plots beta and break dates for three companies using method in Section 1. Break date confidence intervals indicated by starred triangles. Cross-listing dates indicated by rectangles.





Figures provide bar charts of the proportion of firms in the sample that had a cross-listing date before the first break date confidence interval lower bound , during one of the break date confidence intervals, or after one of the break date confidence interval upper bound. All bounds estimated at the 95% confidence level using 5% marginal significance thresholds for breaks.

Figure 3a: Break Point Estimates by Country

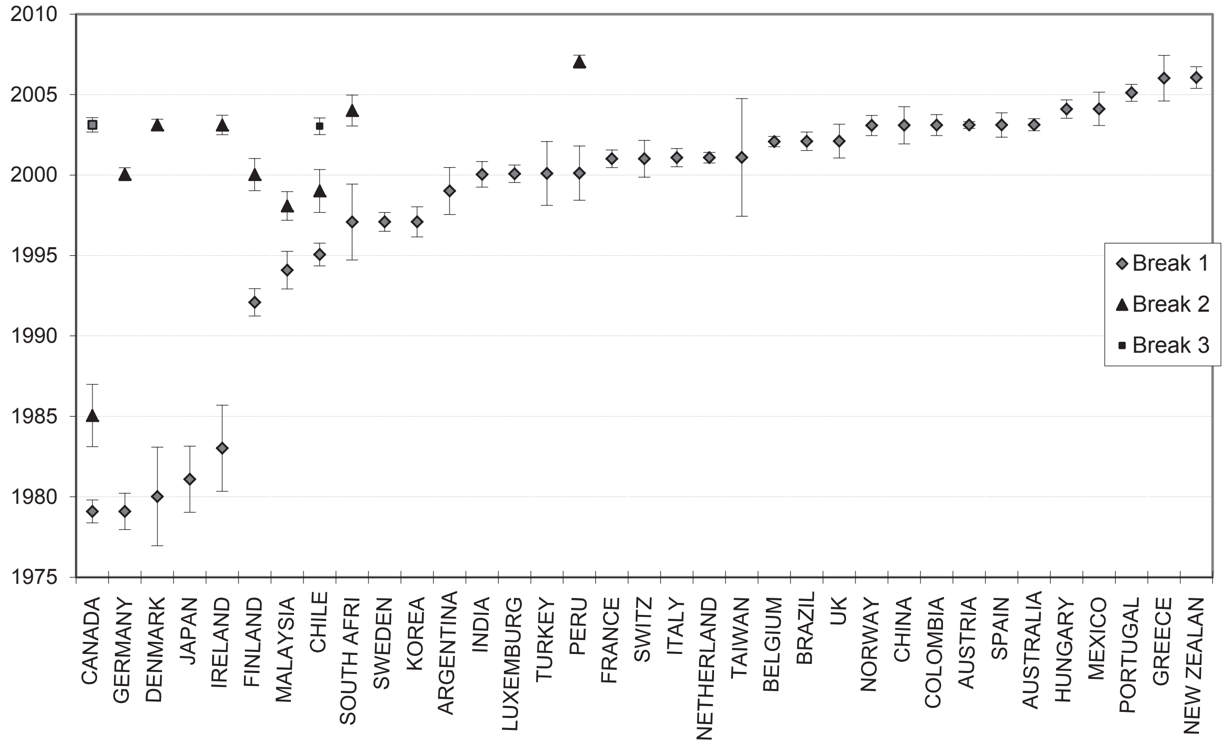


Figure 3b: Break Point Estimates by Firm

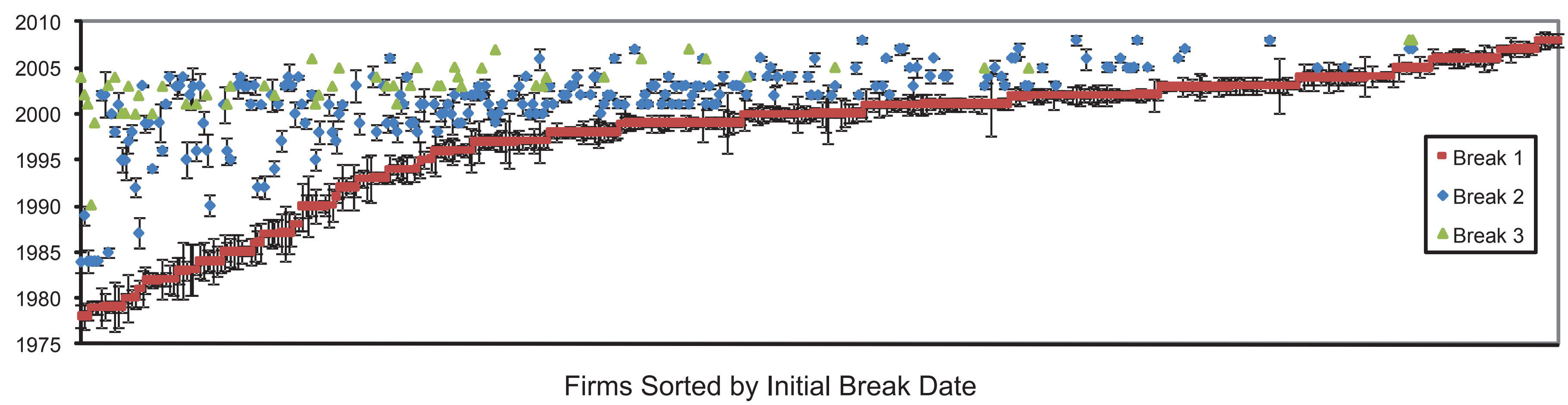
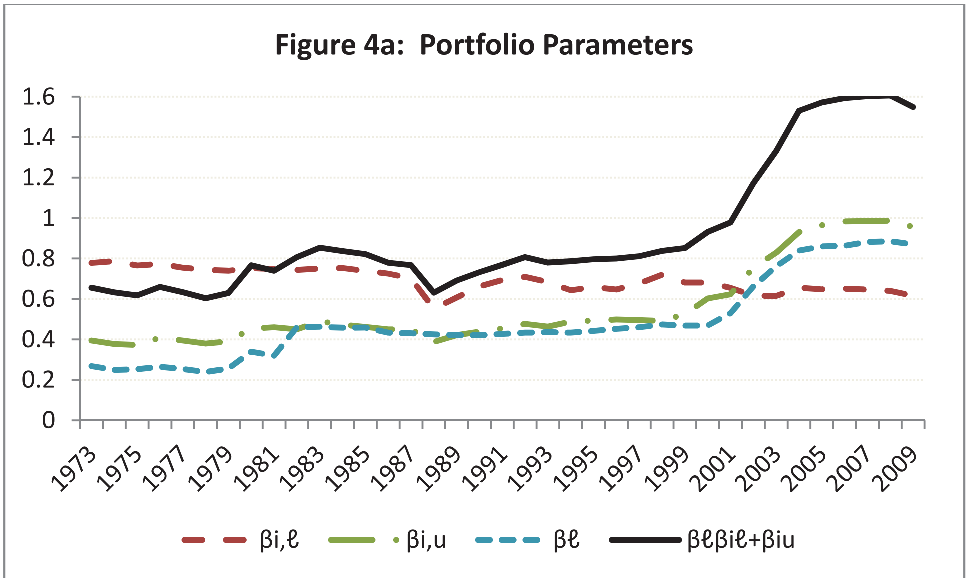


Figure 3a reports the break date intervals and confidence intervals for betas estimated from country market returns regressed on US market returns. Figure 3b reports the break date intervals and confidence intervals for betas estimated from firm returns regressed on US market returns after conditioning on home market return beta breaks. Boxes and triangles plot the point estimates while the cross-bars indicate the confidence intervals.



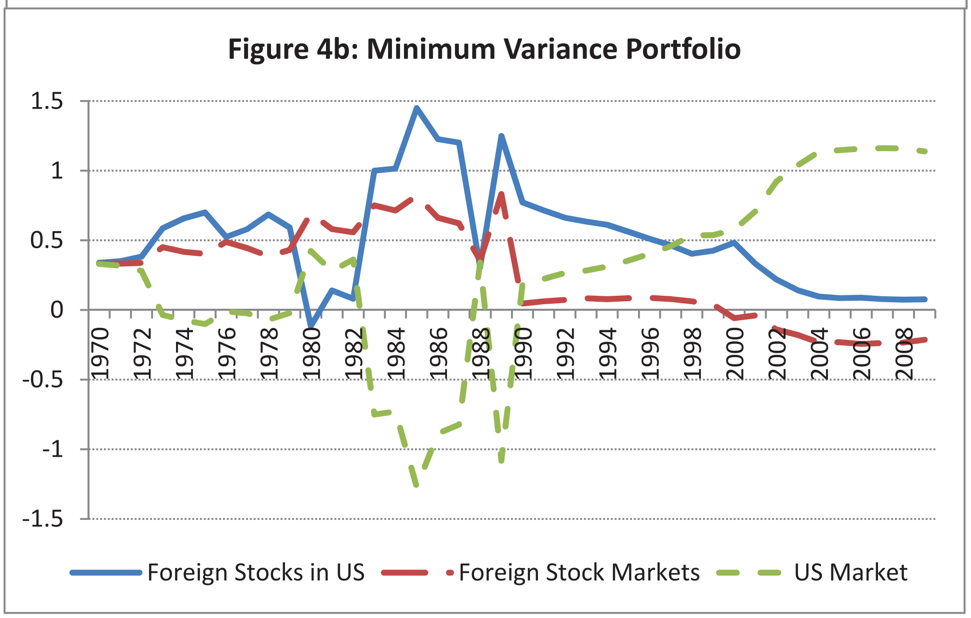


Figure 4a plots the value-weighted average of the estimated betas for firms on their local market ($\beta^{i,l}$), on the US market ($\beta^{i,u}$) and for country markets on the US market (β^{l}) and of the combined loading of firms on the US market (($\beta^{l}\beta^{i,l} + \beta^{i,u}$). Figure 4b plots the implied minimum variance portfolio allocation shares for a three asset portfolio of the US market, a market-weighted portfolio of cross-listed stocks, and a market-weighted portfolio of foreign market indices. (Construction details provided in the appendix.)