Excess comovement in international equity markets: Evidence from cross-border mergers*

Richard A. Brealey**, Ian A. Cooper,*** Evi Kaplanis

First Version: April 2005

This version: October 2005

Abstract

We examine the changes in betas from international mergers. We find that the beta with respect to the acquirer's home market rises and that with respect to the target's home market falls. The effect is large and robust with respect to controls for changes in the operations of the companies involved. Such an effect can occur only if international equity markets are not integrated. We also find that the effect has not reduced over time, that cross-listings do not generally have a significant effect on international betas, and that the U.S. and U.K are more integrated internationally than other markets.

* This is a revised version of an earlier paper entitled 'International sources of risk: Evidence from cross-border mergers'. We thank participants at seminars at London Business School and the 2004 EFMA meetings for comments. We are grateful to Bruno Solnik and Raman Uppal for comments.

** London Business School

*** (corresponding author) London Business School, Sussex Place, Regent's Park, London NW1 4SA, England, +44-207-262-5050, icooper@london.edu

JEL Codes: F23, F36, G12, G15, G34.

Keywords: International mergers, international equity market integration, stochastic discount factors, international betas, segmented markets, primary listing.

1. Introduction

There has recently been increasing interest in examining comovement as a means of testing theories of asset pricing. Campbell and Mei (1993) show that most of the domestic market beta of stocks comes from something other than the behavior of cash flows. One possibility is that it is generated by time-varying discount rates in a frictionless equilibrium. Even if this is the case, it appears that the source of beta matters for asset pricing (Campbell and Vuolteenaho (2004), Bansal, Dittmar and Lundblad (2002)).

Another possibility is that the part of beta not related to cash flows is generated by other factors, such as time-varying liquidity or sentiment. This explanation requires that frictions operate to limit the move of an asset price relative to its frictionless equilibrium value. Barberis, Shleifer and Wurgler (2004) and Greenwood (2005) find that the beta with respect to a domestic index changes a large amount when a stock enters or leaves the index. Index entry is not related to any apparent change in future cash flows, so in a frictionless equilibrium there should be no change in current or future discount rates for the stock. Therefore, the change in beta indicates 'excess comovement'. These authors attribute the excess comovement to 'sentiment'. The friction that permits it is 'limits to arbitrage'.

The international context provides other evidence of excess comovement. Assets that are apparently identical, but traded in different locations, have different betas. Hardouvelis, LaPorta and Wizman (1994) and Bodurtha, Kim and Lee (1995) show

that country funds covary with their market of listing more than do the portfolios of shares underlying the funds. Froot and Dabora (1999) find that each stock in a dual-listed pair covaries with the market in which it is listed more than does its twin.

The differences in comovement resulting from differences in trading location or changes in index membership are large. Barberis et al estimate the change in the beta with respect to the S&P 500 index caused by index entry or exit at about 0.4 to 0.5. Bodurtha et al estimate the increase in beta of the country fund relative to its underlying asset value at about 0.6 for the US beta of foreign funds listed in the US. French and Poterba estimate a difference of about 0.5 in the betas of Royal Dutch and Shell relative to the UK market.

Effects of similar size have been found in the few studies that examine changes in the location of the primary listing of international stocks. Chan et al (2003) find that, for five closely related companies de-listed from Hong Kong and re-listed on Singapore, the beta with respect to the Hong Kong market falls on average from 0.80 to 0.42 and the Singapore beta rises from –0.05 to 0.35. They show that the change in betas is not related to changes in operating cash flows. Bedi et al (2003) find an effect of similar magnitude for a sample of four unifications of dual-listed stocks, where the location of the primary listing of one of the pair of firms changes.

These changes are large by two criteria. They represent a large portion of the systematic risk of these firms. They also imply that the frictions permitting their existence must be large. Using the Royal Dutch/Shell case as an example, the annual standard deviation of the UK stock market index is about 20%. So a difference in

betas of 0.5 corresponds to a difference in prices from this source over a one-year horizon of about 10%.[1] Either the frictions that prevent the prices of dual-listed stocks converging are of this order of magnitude, or there must be fast mean-reversion of the price difference that limits the tendency of the beta difference to push the prices apart. In the absence of fast mean-reversion of the price differential, the finding of a difference in betas caused by location is equivalent to a finding of a lack of integration in the pricing between markets. It also indicates the order of magnitude of the imperfection causing the lack of integration. The results of French and Poterba appear to imply that there are large frictions, because the difference in betas is large and they find relatively slow mean reversion of the price difference for dual-listed stocks.

In contrast to the results on dual-listed stocks and country funds, the evidence on the changes in comovement caused by international cross-listing is mixed. Karolyi (2004) summarises the results of a number of studies:

> 'For U.S firms listing abroad … home market betas actually rose slightly. …. For non-U.S firms listing in the U.S. .. studies either uncovered a significant

[1] Suppose that the UK beta is higher for Shell by 0.5 and the Dutch beta is lower by 0.5. Then the relative price difference caused by the beta difference depends on the correlation between the two indices. If the correlation between the two indices is 0.85, which is the correlation based on weekly data in the period 2000-2005, then the annual standard deviation of the relative price caused by the beta difference is 7.4%. In the case of index entry within a domestic market, the correlation between the returns for the index and non-index stocks will be higher than this, and the level of imperfections required to explain a change in betas correspondingly lower.

decrease in local-market betas with no change in global- or U.S.-market betas or a significant increase in the latter with no change in the former.'

Even where a significant effect of cross-listing on beta is found, it is smaller than the effects discussed above. For instance, Gagnon and Karolyi (2004) estimate that the beta with respect to the home market of a foreign share cross-listed in the U.S rises by 0.16 and the beta with respect to the U.S market does not change as a result of the cross-listing.

Of the international comovement effects, the one with the most important implications for general asset pricing is the effect of primary listing. Studies of country funds and dual-listed stocks stocks provide natural experiments that are highly informative about whether there is an effect of location. However, they also have the disadvantage that strong arbitrage restrictions make it difficult to judge the general effect of listing location on comovement from these studies. The question of how large is the effect of primary listing on betas is unresolved. The studies of Chan et al and Bedi et al suggest that it could be large, but their samples are so small and specific to particular circumstances that it is not possible to generalise from their results.[2] The studies of cross-listing suggest that it is much smaller, but this may be simply because the primary listing remains the same when companies cross-list.

[2] In contrast, tests of international equity market integration based on asset pricing models do not detect systematic evidence against integration. However, it is possible that this is due to the low power and sensitivity to specification of such tests in comparison with tests based on covariances (Kothari et al (1995)). As an illustration, Chan et al find highly significant evidence of lack of integration using only three years of returns data. Because their test is based on covariances, three years of data give a

In this paper we examine the effect on beta of the only regularly occurring event where the primary listing of a company changes. This is the acquisition of a company by a foreign company. Using international mergers to study the effect of primary listing changes involves the difficulty that the change in listing occurs at the same time as other changes associated with the merger. Observing the effect of the listing change involves separating it from other factors, such as operating changes. Such difficulties are present in all studies of listing changes. For instance, when a company cross-lists in the US it is often a first step to making US acquisitions (Burns (2004)). However, operating changes may be more significant for international mergers, so we develop controls to take account of such changes. The other empirical difficulty is that we do not observe a separate share price for the target firm after the merger. Therefore, we state all our hypotheses in terms of the betas we do observe: the acquirer and target before the merger and the merged company after. Because of these empirical difficulties, we devote some care at the beginning of the paper to developing the hypotheses and tests we use.

On average, we observe a large effect of primary listing location on beta. We find that the changes in betas with respect to the acquirer and target markets are consistent with a model in which countries generate local market risk for companies that have their primary listing there. This implies significant imperfections preventing international equity market integration. The results are robust to a variety of controls for operating

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test with high power. To reject integration based on mean returns for three years would be impossible, because the standard errors of mean equity returns are so large.

changes. The large sample of international mergers also enables us to examine cross-sectional and time-series differences. We do not find that the degree of integration has increased during the period of our sample, 1995-2001. We find that the US appears to be more integrated than other countries. Our results are consistent with the results of Chan et al and Bedi et al. They are much larger than the effect on betas of cross-listings. There is no necessary inconsistency between these results, because the primary listing stays the same when a cross-listing is made.

The paper is organised as follows. Section 2 develops hypotheses about the effects of international mergers on betas, and associated empirical tests. In section 3 we describe the data and the procedures for estimating betas. Section 4 presents the empirical results and section 5 a variety of robustness checks. The conclusions are in section 6.

2. Hypothesis development

2.1. Hypotheses about the changes in betas caused by international mergers

In an international merger, the target combines with the acquirer and in the process its primary listing becomes the same as that of the acquirer. This is the effect that we are trying to measure. In addition, the operating characteristics of both target and the acquirer may also change. Any observed change in betas arises from the combination of these effects. Our tests are further complicated by the fact that before the merger there are two entities with observable betas, the target and the acquirer, whereas after the merger there is one merged company.

We develop hypotheses about the betas with respect to the acquirer and target home countries, denoted A and T respectively. The betas we measure are those of the acquirer, denoted a, the target company, denoted t, the value-weighted pooled pre-merger companies, denoted p, and the merged company, denoted m. Thus the beta of the acquirer before the merger with respect to the target country is β_a^T. The betas for a, t, and p are observed before the merger, and that for m is observed after the merger.

We state our hypotheses in terms of observable betas. Throughout the paper we refer to a market where trading location does not affect valuation as being integrated. We refer to factors that generate comovement on the basis of trading location as market-specific stochastic discount factors. These could be caused by pricing factors that derive from a frictionless equilibrium within each market, or from imperfections such as liquidity effects or sentiment combined with limits to arbitrage. Our tests do not formally distinguish between these alternatives.

Our null hypothesis is that international equity markets are fully integrated and there are no operating changes. Then the operating risks are unaffected by the merger and that time-varying risk premia are integrated across markets. In this case the merger simply pools the systematic risks of the two separate companies.

H0: (Neutrality) $\beta_m^A = \beta_p^A$, $\beta_m^T = \beta_p^T$.

If neutrality is rejected, there are two alternative hypotheses. One is that the betas are affected by the location of the primary listing of the acquirer. The second is that they are affected by changes in operations resulting from the merger.

The hypothesis that the primary listing location of the acquirer matters has a clear implication. The evidence on changes in primary listing, country funds, and twins stocks all suggest that the pooled beta with respect to the acquirer's home market will rise and the beta with respect to the target's home market will fall.

> *H1: (Listing matters) The pooled beta with respect to the target's home falls, the beta with respect to the acquirer's home country rises.* $\beta_m^A > \beta_p^A$, $\beta_m^T < \beta_p^T$.

The effect of operating changes on systematic risks is more complicated. International mergers may affect betas in several ways. The acquirer may seek to grow sales in one or other countries; the acquirer may divert costs to its home country or to the country of the target; there may be synergies in the form of reduced costs realized by the combined entity; the acquisition may give increased growth opportunities in general for the acquirer; and the merger may be accompanied by a change in leverage. Such changes may mask the effect of the change in listing location. The direction of these changes depends on which operating change occurs. For most of them, the predicted impact on betas clearly differs from that of listing location. For instance, increased foreign activity will raise the beta with respect to the target's home country and decrease it with respect to the acquirer's home country, the opposite of the effect predicted by the listing location hypothesis.

One type of operating effect can generate the same pattern of beta changes as the listing hypothesis. This is an increased cash flow in the home country of the acquirer and decreased cash flow in that of the target. We call this acquirer substitution:

H2A: Acquirer substitution hypothesis: $\beta_m^A > \beta_p^A$, $\beta_m^T < \beta_p^T$.

If the acquisition increases the proportion of cash flows in the target country (either by diverting sales to the target country or costs to the acquirer country), then we expect the beta with respect to the target country to rise and the beta with respect to the acquirer market to fall. We call this:

H2B: Increased foreign activity hypothesis: $\beta_m^A < \beta_p^A$, $\beta_m^T > \beta_p^T$.

If there are reduced fixed costs to the merged firm, then we expect the betas with respect to both the acquirer's and the target's home markets to fall as operating leverage is reduced. We call this:

H2C: Cost cutting hypothesis: $\beta_m^A < \beta_p^A$, $\beta_m^T < \beta_p^T$.

If the acquisition signals increased growth opportunities in general for the combination of firms, then it should increase the betas with respect to both markets. We call this:

H2D: Increased growth hypothesis: $\beta_m^A > \beta_p^A$, $\beta_m^T > \beta_p^T$.

An increase in leverage will have the same general effect as increased growth opportunities, raising the equity betas in both countries. A decrease in leverage will have the same general effect as a reduction in fixed costs, reducing betas in both countries. Therefore, we include these as part of hypotheses 2C and 2D.

Table 1 summarises the hypotheses in terms of their implications for the betas of the pooled company relative to the markets of the acquirer and the target. Evidence suggests that acquisitions in foreign countries tend to be followed by further acquisitions (Tomunen and Torstila (2005)). So the 'increased foreign activity' hypothesis might be considered the most plausible of the operating hypotheses on the basis of other evidence.

TABLE 1 approximately here

The only operating hypothesis that might be confused with the 'listing matters' hypothesis is the 'acquirer substitution' hypothesis, whereby the acquiring firm substitutes cash flow generation in its home country for that of the target. However, these two hypotheses have other different implications. The key point in distinguishing them is that the 'listing matters' hypothesis implies that changes in the betas will be related primarily to characteristics of markets, whereas under the 'acquirer substitution' hypothesis they will be related to characteristics of the merging companies.

If we fail to reject the 'listing matters' hypothesis, we expect to find a particular pattern of deviations from neutrality. The logic is as follows. Suppose that part of the domestic systematic risk of a stock that has a primary listing in country T comes from a stochastic discount factor that is not integrated across markets. Then, when that company is taken over by a company in country A, with a resulting change in the location of its primary listing, two things will happen

First, the beta of the target company with respect to country A will rise by the amount of systematic risk in country A that is generated by the country-specific stochastic discount factor of country A. Therefore we expect the change in the beta with respect to the acquirer's home market to be related to the characteristics of that market, and not to the characteristics of the home market of the target company. Second, the beta of the target company with respect to country T will fall by the amount of systematic risk in country T that is generated by the country-specific stochastic discount factor of country T. The acquisition of the target by the acquirer removes this amount of risk from the beta of the target with respect to the target country. Therefore we expect the change in the beta with respect to the target's home market to be related to the characteristics of that market, and not to the characteristics of the home market of the acquirer company.

This leads to the following refinements of the 'listing matters' hypothesis:

> *H1A: the change in the beta with respect to the acquirer country depends on the country of the acquirer and not the country of the target.*

H1B: the change in the beta with respect to the target country depends on the country of the target and not the country of the acquirer.

H1C: The listing effect should be greater for countries whose capital markets are less integrated with the global market.

H1D: The size of the change in the beta with respect to the target market should depend on whether a listing is maintained in that market. The change in the beta with respect to the acquirer's home market should not depend on this.

We now discuss the procedure we use to distinguish empirically between the alternative hypotheses.

2.2. Specification of a test

The hypotheses in the previous section are formulated in terms of true betas before and after the merger, but we observe only estimated betas. Our empirical test must allow for the fact that the betas we use are estimates. In particular, estimated betas mean-revert, and the test must incorporate this. In addition, we want to relate the size of any change in betas to characteristics of the companies and markets involved. This section specifies an empirical test that incorporates mean-reversion and cross-sectional variables that should be related to the size of any change in betas. The details are given in the Appendix.

Our test takes the form of the panel regression:

$$(\beta_{mi}^{A} - \beta_{pi}^{A}) = a_0^A + a_1^A(\beta_{pi}^{A} - \overline{\beta}_{p}^{A}) + \underline{a}_2^{A\prime}\underline{X}_i + \underline{a}_3^{A\prime}\underline{Y}_i + a_4^A\left(\beta_{ai}^{A} - \beta_{ti}^{A}\right) + \varepsilon_i^A \qquad (1)$$

where β_{mi}^{A} is the beta of merged company i with respect to the acquirer market, β_{pi}^{A} is the beta of pooled company i with respect to the acquirer market, $\underline{X}_i$ is a vector of variables describing the markets of acquirer and target i, $\underline{Y}_i$ is a vector of variables describing the operating characteristics of acquirer and target i, and $\left(\beta_{ai}^{A} - \beta_{ti}^{A}\right)$ is the difference between the pre-merger betas of acquirer and target i with respect to the acquirer market. There is an equivalent regression for the betas with respect to the target company's home market.

The dependent variable is the difference between the merged beta and the pooled beta before the merger. The first term on the right-hand side is a constant that should be zero under the null hypothesis. On the other hand, if there is a fixed listing effect, we would expect a positive constant in the acquirer market regression and a negative constant in the target market regression. The second term on the right-hand side is a standard beta mean-reversion term for the pooled firm. The third term relates the change in betas to characteristics of markets, that we would expect to be relevant if there is a listing effect. The fourth and fifth terms relate it to the characteristics of companies, that would be relevant in the event of operating effects. The fifth term depends on the difference between the pre-merger betas of the target and acquirer and is included as a control for operating effects. For example, under the acquirer

substitution hypothesis, the target cash flows are partly shifted to the acquirer country and are therefore likely to take on the risk characteristics of the acquiring firm.[3]

The null hypothesis is that there is no average effect of the merger on the betas, which corresponds to the restriction:

$$a_0 = 0 \qquad (2)$$

The hypothesis that there is no listing effect requires (2) and:

$$\underline{a_2} = 0 \qquad (3)$$

and the hypothesis of no operating effect requires (2) and:

$$\underline{a_3} = 0, a_4 = 0 \qquad (4)$$

The parameters $\underline{a_2}$, $\underline{a_3}$, and a_4 depend on the proxies we choose for characteristics of companies and markets that are related to the amount of risk generated by the stochastic discount factor for a particular company in a given country, and the degree to which this factor is country-specific rather than global. In the next section we discuss the characteristics we use to attempt to identify these determinants.

3. Data

3.1. Sample selection

[3] The interpretation of this coefficient is not, however, unambiguous. For example, the elasticity of the target company's returns to a stochastic discount factor in the acquirer country will depend on the duration of the target's cash flows. If acquirer and target cash flows have similar durations, the listing

We examine all cross-border mergers in the SDC Platinum merger file in the period January 1 1995 to December 31 2001. We define a cross-border merger as one where the ultimate parents (as defined by SDC) of the target and acquirer came from different countries. This gave a total of 1385 mergers.

From these we selected a sub-sample that satisfied the following criteria:

-Both target and acquirer were listed,

-Share prices are available on Datastream,

-There was 100% ownership of the target after the merger,

-The target market value four weeks before the announcement date was at least 5% of the pooled value of the two companies at that date.

The first two restrictions are necessary to measure the effect on betas. The third reduces any ambiguity about where is the location of listing, and the fourth removes mergers where the effect we are looking for may be too small to detect.

The resulting sample consisted of 346 mergers, distributed by year as in Table 2. The time profile of the sample is similar to that of all SDC cross-border mergers, and it has a reasonable number in each of the years.

TABLE 2 approximately here

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effect could be sufficient to cause the shift in target betas to be proportionate to the difference between the pre-merger betas of the target and acquirer.

We obtained from *Datastream* weekly returns for the two firms prior to the merger and for the combined firm afterwards, as well as the market capitalisation of their equity four weeks before the merger announcement date. We use weekly data to reduce problems in beta estimation caused by mismatching of time zones and thin trading. Table 3 shows the characteristics of the merging companies. The average size of targets and acquirers is over a billion dollars so their shares are likely to be well traded, reducing problems in the estimation of betas, which we discuss below. The average target is about one fifth the size of the pooled market capitalization of the two companies. The effect we are looking for is the change in beta due to the change in the primary listing of the target, so we have chosen a sample where the target size is a significant proportion of the pooled value. All the mergers end up with the acquirer owning one hundred percent of the target. However, on average there is a pre-merger stake of about seven percent. For those cases with a pre-merger stake, we adjust the definition of the pooled pre-merger beta to take account of this.

TABLE 3 approximately here

Table 4 shows the locations of the acquirers and targets. There are large numbers of both in the US, UK and Canada. We also have a reasonable number of both acquirers and targets from other developed markets, although their representation in our sample is slightly less than in the SDC database, due to the share price data restriction. A similar effect is present for emerging markets companies, where the sample is small and the proportion of exclusions caused by the share price restriction is greater. If this under-representation of companies where share price data is hard to obtain introduces a bias into our test, it is likely to be against finding the listing matters hypothesis. The

companies we have excluded are likely to be those that are less internationally integrated, where the effect of listing would be greater.

TABLE 4 approximately here

The size of the effect of listing changes on betas depends on the amount of systematic risk generated by country-specific stochastic discount rates. For a particular merger, this depends on the characteristics of the companies and countries involved. We use a number of proxies to try to identify the cross-sectional variation in the listing effect. These are:

1. The home country of the acquirer.
2. The home country of the target.
3. The difference between the pre-merger betas of the acquirer and target.
4. The size of the acquirer, measured by the log of its market value.
5. The number of international listings of the acquirer, measured by the number of equity market listings reported by Bloomberg.
6. Whether the acquirer maintains a cross-listing in the target country after the merger, as reported by Bloomberg.

Segmentation by country allows us to test whether any effect differs between markets of different size, liquidity, and maturity. The inclusion of company characteristics such as size, number of international listings and the maintenance of a cross-listing in the target country gives the possibility of identifying the factors that cause variation between companies in the listing effect.

We expect the operating effects causing beta changes to differ depending on the characteristics of the companies involved. We attempt to control for operating changes by including variables that we expect to be related to the operating effects. These are:

1. The difference between the acquirer and target betas.
2. Industry.
3. Whether the target and acquirer are in the same industry.

The industry classifications we use in the regression are financial, manufacturing, natural resources and services. We conjecture that industries where assets have a relatively fixed location, such as natural resources, will have limited operating effects. When it is more difficult to shift operations between countries, the listing effect should dominate. We also include a dummy variable for the target and the acquirer being in the same industry. In this case, we expect the potential for operating effects to be greater.

3.2. Beta estimation

We obtained from *Datastream* weekly returns for the two firms prior to the merger and for the combined firm afterwards, as well as the market capitalisation of their equity four weeks before the merger announcement date. We use weekly returns to minimize problems caused by thin trading and mismatching of the closing times of different markets. We later test the robustness of our results to different estimation

procedures. We use two years of data as a compromise between statistical significance of betas and the effect of using a longer window that would reduce our sample and incorporate stale data into the betas.

We also collected from *Datastream* matching weekly returns for the Datastream Country Indices of the home countries of the acquirer and target, and for the exchange rates between the currencies of the home countries acquirer and the target.[4] We calculated weekly returns for each stock as $\ln(P_{jt} + D_{jt}) - \ln(P_{jt-1})$, where P_{jt} is the stock price at the end of week t and D_{jt} is the dividend paid in week t, expressed in terms of US dollars.[5] We used national index returns from the Datastream value-weighted country indices expressed in US dollars.

The date of the merger is defined in terms of its announcement date, T_a, and completion date, T_c. The average period between announcement and completion is 106 calendar days. We measure γ_t, the proportion of the merged value that is contributed by the target, using the market capitalisations of the two companies four weeks prior to the announcement date. We estimate pre-merger betas using two years of weekly data from the period ending at date T_a, and post-merger betas using two years of weekly data beginning on date T_c.

We define variables as follows:

[4] We define home country as the home country of the ultimate parent companies, as defined by SDC. We examined each merger to check that these correspond to the primary listing locations.

[5] The choice of currency is arbitrary. Our results are essentially unaffected if returns are stated in any other currency, such as the local currency.

$R_{a\tau}$ pre-merger return to the separate acquirer company in period τ

$R_{t\tau}$ pre-merger return to the separate target company in period τ

$R_{p\tau}$ pre-merger return to the pooled companies in period τ

$R_{m\tau}$ post-merger return to the merged company in period τ

The pooled return is the value-weighted average of the acquirer and target returns, where the weights are (1- γ_t) and γ_t respectively.

To estimate betas, we regress these returns on the market returns for the acquirer and target markets:

R_{τ}^{A} return to the market of the acquirer in period τ

R_{τ}^{T} return to the market of the target in period τ

We estimate betas with respect to the acquirer and target markets using the regression:

$$R_{k\tau} = \alpha + \beta_k^A R_{\tau}^A + \beta_k^T R_{\tau}^T + \varepsilon \qquad (5)$$

where k= a, t, p, m. The standard errors of the estimates are S_k^A for β_k^A and S_k^T for β_k^T.

4. Results

4.1. Average changes in betas arising from international mergers

Table 5 shows the average betas for the acquirer, target and pooled companies before the merger, and the merged companies after the merger. On average, the beta of the pooled company with respect to the acquirer market rises from 0.624 to 0.739, and that relative to the target market falls from 0.236 to 0.157. We test whether the betas for the merged company are the same as those for the pooled company by calculating a t-statistic for each merger and then pooling these across mergers, assuming independence between mergers.[6] We conclusively reject neutrality for both acquirer market and target market betas. The beta with respect to the acquirer country rises and that with respect to the target country falls. We also test whether the merged betas are significantly different from the acquirer betas before the merger, and detect no significant difference. Thus, on average, the results are consistent with a large part of beta risk being generated by market-specific time-varying discount rates, rather than integrated market risks.

TABLE 5 approximately here

Although we cannot observe a separate target beta after the merger, to give an indication of what these changes imply, we calculate what would have to be the change in the betas of the target company, assuming that the acquirer's betas remain constant. The post-merger implied target betas are, on average, a beta with respect to the acquirer market of 0.72 and with respect to the target market of 0.20. They are similar to the average betas of acquirers, implying that the merger is potentially

[6] We assume that the errors in the estimated betas before and after the merger are independent. The Z-statistic is the same as that used by Bartov et al (1996).

having a large effect on the risk characteristics of the target. The implied changes in the betas of the target are an increase of 0.63 in its acquirer market beta and a decrease of 0.43 in its beta with respect to the target market. These average effects are similar in magnitude to those estimated by Chan et al for their small sample of primary listing changes.

Table 6 shows the results segmented by country. In all cases where the changes are significant, they go in the direction predicted by the 'listing matters' hypothesis. The change in the acquirer country beta when there is a US acquirer is insignificant. The effect for the UK, though significant, is relatively small. The effect is largest and significant for Canada, and other developed and emerging countries. These results are consistent with the hypothesis that the US and UK are more integrated with world markets than other countries, including Canada.

TABLE 6 approximately here

The results for the betas with respect to the target's home market are more mixed. All changes are negative, but the main significant difference is that US targets have a larger fall in their beta. This may reflect the fact that the US target is having its primary listing removed from an integrated market and put into a less integrated one.

In the next section we test whether we these results are due to mean reversion in betas or operating effects. However, the strength and robustness of the results suggests that this is unlikely. As far as mean reversion is concerned, the average beta with respect to the acquirer market is less than one. If our betas were estimated with a univariate

beta regression, these betas might be expected to rise over time as they revert to an unconditional mean value of one. Our betas are estimated in a multivariate regression, so it is not clear what is the correct unconditional mean to which they should revert. Moreover, the betas with respect to the target market are even lower and fall rather than rise, as would happen if mean reversion were the cause of the changes.

For operating changes to be the cause, the 'acquirer substitution' effect would have to dominate all other operating changes in the entire sample, and in all sub-samples that we examine. Acquirer substitution is only one of a number of possible operating effects, and it is unlikely to be the most common. The changes in betas are consistent with the 'listing matters' hypothesis regardless of the way that we segment the data.

4.2. Cross-sectional relationships

Table 7 shows the result of running the panel regression (1) for betas with respect to the acquirer market. We use generalized least squares, and assume a diagonal covariance matrix with the residual standard deviation for each merger proportional to the standard error of the estimate of the estimated difference between the merged beta and the pre-merger pooled beta. The dummy variables for country are set equal to zero for the 'other country' (developed plus emerging) category, so that the constant term measures the effect for this group and the other country dummies measure the incremental effect for other countries. The dummy variables for the operating controls are set equal to zero for those cases where we expect the operating effects to be limited, and where the merger is between companies from different industries.

TABLE 7 approximately here

The first regression includes all the independent variables that may be related to the beta change. The coefficient of the pre-merger beta is significant and suggests that estimated betas regress approximately 60 percent of the way towards their mean.

The constant term is significantly positive, indicating that mergers where both the acquirer and target come from the 'other country' category exhibit an increase in the target country beta due to the listing effect. The sum of the constant and the US dummy is insignificantly different from zero, indicating that there is no listing effect when the acquirer comes from the US. The country dummy for UK acquirers is also negative, indicating that the effect of listing may be smaller for UK acquirers than for 'other country' acquirers. The dummies for the location of the target are insignificant, as is the dummy for whether the acquirer maintains a listing in the target country and the number of listings of the acquirer. Under the 'listing matters' hypothesis, we expect these variables to affect the change in beta with respect to the target market, but not that with respect to the acquirer market.

The only operating control variable that is significant is the dummy that measures whether the acquirer and target come from the same industry. The same industry dummy is negative, indicating that mergers within an industry give a lower increase in betas with respect to the acquirer country. This suggests that any operating changes are inconsistent with the asset-substitution hypothesis and that we are unlikely to be confusing listing effects with operating effects. Note also that the dummy for natural resource companies is very small and insignificant, which suggests

that the shift in betas is apparent even in an industry where a switch in the location of activity is unlikely.

The time dummies for the earlier years are negative, but none is individually significant. If we are measuring an effect caused by lack of market integration, there is no sign that it has decreased over the 1990's.

The other two regressions test the robustness of these results. The second omits the listing variables, which are insignificant, so that we can use the full sample. The third regression also omits the target country dummies, the time dummies, and the industry dummies. The results remain essentially the same. In the third regression we detect a significantly negative dummy for UK acquirers. This is a further indication that the degree of the listing effect for UK acquirers is intermediate between the zero effect we observe for US acquirers and the significant effect we observe for other countries and Canada.

Table 8 shows the results for the betas with respect to the target market. The first regression includes all variables. The second omits the listing variables, so that we can use the entire sample, and the third omits acquirer country, time and industry dummies.

TABLE 8 approximately here

We find no significant constant term, indicating that we do not detect a listing effect for mergers between 'other countries'. We find, as predicted by the listing-matters

hypothesis, that the location of the target company matters, but the location of the acquirer does not. One interesting result here is the strong negative coefficient on the U.S. target dummy. It appears that where U.S. companies are the target, the beta relative to the U.S. market falls sharply.

Consistent with the listing-matters hypothesis, we find that maintaining a listing in the target market results in a smaller fall in the target country beta, although the coefficient is insignificant.

To investigate further the structure of the effect, Table 9 shows the same regressions with dummies for country pairs rather than individual countries for the acquirer and the target. The first regression shows the results for acquirer market betas and the second for the target market betas. In these regressions, Canada is pooled with 'other countries' since the earlier results detect no significant differences between them.

TABLE 9 approximately here

The results are very similar to those using individual country dummies, but they give additional insight into the structure of the listing effect. Table 10 summarises the impact of listing on betas. For non-US acquirers the change in listing resulting from an international merger causes a rise in the local market beta of the pooled company. This effect is not present for US acquirers. For non-US acquirers acquiring US companies, there is a fall in the US beta of the pooled company. For non-US acquirers acquiring other non-US companies, there is no such fall in the target country beta of the pooled company.

TABLE 10 approximately here

These results indicate that the US is different from other markets in terms of the listing effect it generates. It appears to be more integrated, in the sense that switching the listing of a company into the US has no significant effect on international betas. In contrast, switching the listing into another country generates a change in betas. This change depends on whether the target is from the US or from another country, and so is more complex than simply an increase in acquirer market risk and a decrease in the target market risk. It does not appear to be related to either the relative or absolute size of the US acquirers, both of which are similar to those for other countries.

5. Robustness of the results

5.1. Biases caused by different opening hours of markets and thin trading

A possible bias in our results is caused when the home markets of the acquirer and target have different opening hours. In that case, the beta of the separate target before the merger will be based on data where the returns to the target and the returns to the target market are measured over the same time intervals, but the returns to the acquirer market are measured over a different (but overlapping) time interval. In contrast, the returns to the acquirer and the merged company will be based on data where the intervals for the company and the acquirer market are the same, but that for the target market is different. For any case where the intervals are different, the pooled pre-merger beta with respect to the acquirer market will be biased downwards.

The size of the bias will depend on the degree of overlap of the time intervals. The maximum difference is one working day, which, with weekly data, will bias the beta in an efficient market downwards by twenty percent. Thus a beta of 1.0 would be measured as a beta of 0.8 in such a case.

We have three reasons for dismissing this bias as a possible cause of our results. First, the key result is that the post-merger beta with respect to the acquirer market implied for the target is considerably higher than the pre-merger beta. The average pre-merger beta for the target with respect to the acquirer market is 0.06. Even if this is biased downwards by twenty percent, the true value is, on average, only 0.07 and such a difference has no effect on our results. The bias in the pooled pre-merger beta with respect to the acquirer market, which averages 0.62, is marginal.

Second, to test more formally for a bias caused by different opening hours of markets or thin trading, we estimated Dimson betas including two weekly leads and lags for all three markets. This estimation procedure also includes any possible effects of thin trading. We estimated the coefficients for each merger and then counted how many of the coefficients for each index at each lead and lag were significant at the 5% and 10% level. We tested whether the number of significant coefficients was different from the number that would be generated randomly, using the distribution of a binomial variable. The only coefficients that had significant incidence of significant coefficients were the contemporaneous coefficients for each of the three markets. All other leads and lags for all markets had a frequency that could have been generated by chance.

The third piece of evidence that the result is not caused by time differences is that the results are robust to segmenting the data into mergers that are in the same time zone and those that are between companies in different time zones. The average changes in the acquirer market beta are 0.153 and 0.089 respectively, which are both significantly positive and not significantly different from each other. The changes in the target market betas are -0.095 and –0.066, both significantly negative and not significantly different from each other.

5.2. Other robustness checks

We repeated the results with a world index in the beta regression. To avoid problems caused by colinearity, for each merger we defined a world index by adjusting the Datastream world index to leave out the components due to indices of the home countries of the merging companies. The results are robust to this alternative specification.

6. Conclusion

In this paper we study a large sample of international mergers where the target company is a significant proportion of the size of the acquirer. We show that, on average, the beta with respect to the country of the target company falls after the merger and the beta with respect to the acquirer's country increases. The result is generally large and robust to different partitions of the data and a variety of controls for operating changes of the companies involved. We find that the result is smaller for

the US, and possibly the UK, than for other countries, consistent with these markets being more internationally integrated.

The measure of location that matters for systematic risk is the location of the primary listing. We find that cross-listings generally have an insignificant effect on international betas, consistent with the mixed results of direct tests of the effect of cross-listings. Our findings are consistent with those of Chan et al (2003), who examine a small sample of companies that changed their primary listing. The result is also consistent with evidence from country funds and twins stocks, which suggests that location of international equity market listing has a large effect on betas.

One structure of the international equity market that is consistent with the result is where each domestic market is integrated, but a significant part of systematic risk is generated by time-varying discount rates and these are not integrated between countries. Another is where location of trading generates excess comovement because of imperfections such as liquidity effects or sentiment combined with limits to arbitrage. The result is inconsistent with tests of international equity market integration based on expected returns that often fail to reject market integration. A possible explanation is that such tests generally have low power. Our test is based on covariances, which are easier to estimate accurately.

There is a possibility that the result we have found is a statistical artefact of some type that we have not tested for. We have checked the impact of including or excluding a world index from beta estimation, timing differences of markets, thin trading, mean-

reversion in betas, various proxies for operating effects, and various ways of partitioning the data. None of these seems to be the explanation.

The result implies quite a high degree of international equity market segmentation for some markets, and this has potentially important implications in a variety of areas including international asset pricing, international capital budgeting, international portfolio theory and international event studies. It also potentially explains why it is hard to detect the international diversification benefits of international firms.[7] It suggests several possible areas for further study, including the cross-sectional relationship between comovement in international markets and structural features of markets, as well as the serial correlation structure of excess comovement.[8]

[7] Agmon and Lessard (1977), Jacquillat and Solnik (1978) and Fatemi (1984).

[8] For the case of index entry, these features have been studied by Barberis, Shleifer and Wurgler (2004), Greenwood and Sosner (2004), and Greenwood (2005).

Appendix

This appendix develops the empirical tests we use. We define stand-alone betas as the separate company betas before the merger, and the unobservable betas that the two separate companies would have had after the merger if they had not merged. The analysis that follows is for betas measured relative to the acquirer market, and there is an equivalent set of expressions for betas relative to the target market. We assume that the stand-alone betas mean-revert:

$$\hat{\beta}_a^{\,A} = \psi \beta_a^{\,A} + (1-\psi)\,\overline{\beta}_a^{A} \qquad \text{(A1)}$$

$$\hat{\beta}_t^{\,A} = \psi \beta_t^{\,A} + (1-\psi)\,\overline{\beta}_t^{A} \qquad \text{(A2)}$$

Where:

β_a^A and β_a^A are the pre-merger betas with respect to the acquirer market,

$\overline{\beta}_a^A$ and $\overline{\beta}_t^A$ are the levels they revert to,

$\hat{\beta}_a^{\,A}$ and $\hat{\beta}_t^{\,A}$ are the values they would have as stand-alone companies after the merger date,

ψ is a mean-reversion parameter.

We assume that the actual beta of the target company, once it is acquired, consists of three parts. The first is the stand-alone beta it would have if there were no effect of the merger. The second is the effect resulting from the change of the primary listing of the target company as it is acquired and re-listed through the acquirer. The third is a move of the target beta towards the acquirer beta:

$$\hat{\hat{\beta}}_t^{A} = \hat{\beta}_t^{A} + \phi_{LM}^{A}(\underline{X}) + [\phi_{OC}^{A}(\underline{Y}) + \theta_{OC}^{A}\left(\beta_a^{A} - \beta_t^{A}\right)] \qquad \text{(A3)}$$

where:

$\hat{\bar{\beta}}_t^A$ is the beta of the target company once it is acquired

$\phi_{LM}^A(\underline{X})$ is a parameter that measures the effect of the listing change and depends on $\underline{X}$, which measures the characteristics of markets

$\phi_{OC}^A(\underline{Y})$ and θ_{OC}^A are parameters that measure the effect of operating changes and depend on $\underline{Y}$, which measures the characteristics of the merging companies.

We assume that the acquirer beta is unchanged by the merger and that the merged beta is a weighted average of the acquirer and target post-merger betas:[9]

$$\beta_m{}^A = \gamma_t \hat{\bar{\beta}}_t^A + (1-\gamma_t)\hat{\beta}_a^A \qquad \text{(A4)}$$

where γ_t is the proportion of the merged value that is contributed by the target. We define β_p^A as the pooled beta before the merger, and $\bar{\beta}_p^A$ as the average pooled beta before the merger:

$$\beta_p^A = \gamma_t \beta_t^A + (1-\gamma_t)\beta_a^A \qquad \text{(A5)}$$

$$\bar{\beta}_p^A = \gamma_t \bar{\beta}_t^A + (1-\gamma_t)\bar{\beta}_a^A \qquad \text{(A6)}$$

Substitution leads to the specification of a cross-sectional relationship that we use as the basis of our tests:

$$\beta_m^A - \beta_p^A = (1-\psi)(\beta_p^A - \bar{\beta}_p^A) + \phi_{LM}^A(\underline{X})\gamma_t + \phi_{OC}^A(\underline{Y})\gamma_t + \theta_{OC}^A(\underline{Y})\gamma_t\left(\beta_a^A - \beta_t^A\right) \qquad \text{(A7)}$$

[9] This is equivalent to defining the target company's post-merger beta as its incremental contribution to the merged company beta, assuming that the acquirer company beta is unchanged, apart from mean reversion. Since the target company's beta is unobservable after the merger, and the hypotheses that we are testing concern the merged company's beta, this definition of the target company post-merger beta is simply for convenience in deriving the hypotheses.

The sum of the first two terms is the pooled pre-merger beta adjusted for mean reversion. This is the expectation of the merged beta under the null hypothesis. The other terms measure the effect of the merger. The third term measures the effect of the listing change. The fourth and fifth terms measure the effect of operating changes.

The last three terms include the variable, γ_t, which measures the proportion of the target firm value. This also appears in the calculation of the pooled beta. To avoid spurious results caused by this, we run (7) as a regression in the form:

$$(\beta_{mi}^{A} - \beta_{pi}^{A}) = a_0^{A} + a_1^{A}(\beta_{pi}^{A} - \overline{\beta}_{p}^{A}) + \underline{a}_2^{A\prime}\underline{X}_i + \underline{a}_3^{A\prime}\underline{Y}_i + a_4^{A}\left(\beta_{ai}^{A} - \beta_{ti}^{A}\right) + \varepsilon_i^{A} \quad \text{(A8)}$$

The dependent variable is the difference between the merged beta and the pooled beta before the merger. The first term on the right-hand side is a constant that should be zero under the null hypothesis. The second is a standard beta mean-reversion term for the pooled firm. The third term relates the change in betas to characteristics of markets, as we would expect from a listing effect. The fourth and fifth terms relate it to the characteristics of companies, as we would expect from operating effects. The fifth term arises from operating effects and depends on the difference between the pre-merger betas of the target and acquirer.[10] There is an equivalent regression for the betas with respect to the target company's home market.

[10] This is one of the methods we use to control for operating effects. It is possible that this control is too severe, because changes in betas that are related to the difference in pre-merger betas could also be generated by listing effects. It might be, for instance, that the pre-merger acquirer beta primarily reflects its exposure to a segmented stochastic discount factor. Then a move of the target beta towards the acquirer beta could be generated by the listing effect.

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Table 1: Implications of international mergers for changes in the pooled company's betas

The table indicates the directions of changes in the betas of companies that undergo an international merger implied by various hypotheses. The changes are measured for the merged betas with respect to the two home countries of the companies involved in the merger relative to the betas for the value-weighted pooled company prior to the merger.

Hypothesis	Beta with respect to acquirer home market	Beta with respect to target home market
H0: Neutrality	NO CHANGE	NO CHANGE
H1: Listing matters	UP	DOWN
H2A: Acquirer substitution	UP	DOWN
H2B: Increased foreign activity	DOWN	UP
H2C: Cost cutting	DOWN	DOWN
H2D: Increased growth	UP	UP

Table 2: Distribution over time of the sample

The table gives the number of international mergers in the SDC international merger dataset and in our sample, categorized by the year of announcement.

Year	Full SDC sample	Our sample	Sample %
1995	111	23	20.7%
1996	132	27	20.5%
1997	181	31	17.1%
1998	244	58	23.8%
1999	278	88	31.7%
2000	273	79	28.9%
2001	168	40	23.8%
Total	*1388*	*346*	*24.9%*

Table 3: Characteristics of the merging companies

The table shows descriptive statistics for the equity market value of the acquirers in US dollars, the equity market value of the targets in US dollars, the market value of the target four weeks before the announcement date as a percentage of the combined market value, and the percentage of shares of the target acquired in the transaction.

	Mean	Min	25%	Median	75%	Max
Acquirer MV $millions	7,426	0.14	399	1,501	6,963	180,785
Target MV $millions	1,714	0.45	92	321	1,410	38,205
Target value % of pooled	19.6%	5.0%	8.4%	13.9%	26.3%	98.5%
% Bought	93.1%	6.0%	100.0%	100.0%	100.0%	100.0%

Table 4: Locations of acquirers and targets

The table shows the location of the acquirers and targets in our sample, and in the SDC international merger dataset. The definition of developed and emerging countries is from Standard and Poor's. Other developed countries are Austria, Australia, Belgium, Denmark, Finland, France, Germany, Greece, Hong Kong, Ireland, Italy, Japan, Norway, Netherlands, New Zealand, Singapore, Spain, Sweden, and Switzerland. Emerging countries are Argentina, Brazil, Bolivia, Estonia, Ghana, India, Israel, Jamaica, Korea, Kuwait, Latvia, Lithuania, Malaysia, Mexico, Morocco, Oman, Papua New Guinea, Peru, Philippines, Poland, Puerto Rico, South Africa, Taiwan, Turkey, and Zimbabwe.

	Target						
Acquirer	US	UK	Can.	Other devel.	Emerg	*Total sample*	*Total SDC*
US		33	32	14	3	*82*	*353*
UK	40		4	14	7	*65*	*219*
Canada	33	3		5		*41*	*108*
Other developed	66	34	7	32	3	*142*	*584*
Emerging	8	2	1	5		*16*	*67*
Total sample	*147*	*72*	*44*	*70*	*13*	*346*	
Total SDC	*448*	*245*	*180*	*344*	*114*		*1331*

Table 5: Average betas before and after merger

The table shows average betas with respect to the home countries of the acquirer and target before and after international mergers. The pooled pre-merger betas are value-weighted averages of the two companies. The implied post-merger betas for the target assume that the acquirer beta is unchanged. Z-statistics are the sum of t-statistics for individual mean differences divided by the square root of the number of mergers. We calculate the standard errors assuming that the errors in the estimates of beta before and after the merger are independent. We aggregate these into a test statistic for all mergers by assuming that the t-values for different mergers are independent. ** denotes 1% significance, * 5% significance.

	Beta with respect to:	
	Acquirer country	Target country
Pre- merger:		
Acquirer	0.741	0.151
Target	0.088	0.629
Pooled	0.624	0.236
Post-merger:		
Merged company	0.739	0.157
Implied target beta	0.721	0.203
Changes:		
Merged minus pooled	0.115	-0.079
Z-statistic	(6.746)**	(-6.037)**
Merged minus acquirer	-0.002	0.006
Z-statistic	(-0.182)	(-0.086)

Table 6: Average beta changes for country sub-samples

The table shows the average change in betas with respect to the home countries of the acquirer and target as a result of international mergers. The difference is between the merged betas and the pooled pre-merger betas. The pooled pre-merger betas are value-weighted averages of the two companies. Z-statistics are the sum of t-statistics for individual mean differences divided by the square root of the number of mergers. We calculate the standard errors assuming that the errors in the estimates of beta before and after the merger are independent. We aggregate these into a test statistic for all mergers by assuming that the t-values for different mergers are independent. ** denotes 1% significance, * 5% significance.

	Change in acquirer country beta	Z-statistic	Change in target country beta	Z-statistic
Segmentation by country of acquirer:				
US acquirers	-0.020	(-0.969)	-0.048	(-1.581)
UK acquirers	0.099	(2.735)**	-0.065	(-3.897)**
Canada acquirers	0.255	(4.487)**	-0.206	(-3.045)**
Other acquirers	0.151	(6.554)**	-0.064	(-3.801)**
Emerging acquirers	0.282	(4.383)**	-0.282	(-3.096)**
Segmentation by country of target:				
US targets	0.191	(7.139)**	-0.090	(-4.676)**
UK targets	-0.005	(0.644)	-0.039	(-1.730)
Canada targets	0.197	(2.849)**	-0.086	(-2.585)**
Other targets	0.044	(1.650)	-0.091	(-2.758)**
Emerging targets	-0.065	(0.353)	0.126	(-1.590)

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Table 7: A test of the relationship between merged betas and pooled pre-merger betas with respect to the acquirer's home market

The dependent variable is the difference between the post-merger beta with respect to the acquirer market and the pooled pre-merger beta with respect to the acquirer market. The explanatory variables are defined in section IIA. Estimation is by GLS, with a diagonal covariance matrix and residual standard deviations proportional to the estimated standard error of the difference in betas before and after the merger. ** denotes 1% significance, * 5% significance.

Regression	(1)		(2)		(3)	
Independent Variables	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat
Constant	0.373	2.87**	0.345	2.87**	0.245	2.68**
Pre-merger beta	-0.387	-5.67**	-0.424	-6.96**	-0.393	-6.96**
Acquirer minus target beta	-0.023	-0.17	-0.008	-0.06	-0.009	-0.07
Log target market value	0.023	1.14	0.013	0.90	0.011	0.81
Country dummies: Acquirer						
UK	-0.110	-1.46	-0.101	-1.60	-0.130	-2.26*
Canada	0.095	0.86	0.092	1.00	0.084	0.94
US	-0.298	-3.51**	-0.250	-3.35**	-0.306	-4.74**
Country dummies: Target						
UK	-0.128	-1.76	-0.105	-1.55		
Canada	0.064	0.50	0.065	0.58		
US	-0.035	-0.55	-0.020	-0.38		
Time dummies						
1995	-0.032	-0.33	-0.005	-0.05		
1996	-0.016	-0.16	0.024	0.25		
1997	-0.012	-0.12	0.002	0.02		
1998	-0.034	-1.04	-0.039	-1.21		
1999	-0.058	-0.79	-0.052	-0.76		
2000	0.024	0.32	0.029	0.41		
Dummy for same industry	-0.166	-2.68**	-0.149	-2.60**	-0.154	-2.98**
Industry dummies						
Financial	0.094	0.86	0.010	0.10		
Manufacturing	-0.052	-0.61	-0.110	-1.34		
Natural resources	-0.043	-0.34	-0.122	-1.07		
Services	-0.052	-0.57	-0.122	-1.41		
Number of listings	-0.007	-1.26				
Target listing maintained	-0.048	-0.69				
N	289		343		343	
R^2	0.237		0.244		0.214	

Table 8: A test of the relationship between merged betas and pooled pre-merger betas with respect to the target's home market

The dependent variable is the difference between the post-merger beta with respect to the target market and the pooled pre-merger beta with respect to the target market. The explanatory variables are defined in section IIA. Estimation is by GLS, with a diagonal covariance matrix and residual standard deviations proportional to the estimated standard error of the difference in betas before and after the merger. ** denotes 1% significance, * 5% significance.

Regression	(1)		(2)		(3)	
Independent Variables	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat
Constant	0.027	0.27	0.035	0.39	0.021	0.37
Pre-merger beta	-0.563	-8.67**	-0.581	-10.25**	-0.547	-8.81**
Acquirer minus target beta	-0.178	-1.27	-0.241	-2.19	-0.234	-1.74
Log target market value	0.000	-0.04	0.009	1.49	-0.002	-0.27
Country dummies: Acquirer						
UK	-0.059	-1.11	-0.052	-1.19		
Canada	-0.077	-0.87	-0.036	-0.49		
US	0.035	0.51	0.030	0.50		
Country dummies: Target						
UK	-0.080	-1.22	-0.110	-1.90	-0.085	-1.42
Canada	-0.076	-0.78	-0.136	-1.63	-0.032	-0.37
US	-0.168	-2.91**	-0.162	-3.73**	-0.205	-3.89**
Time dummies						
1995	-0.046	-0.53	-0.078	-1.01		
1996	-0.089	-1.02	-0.105	-1.32		
1997	-0.039	-0.47	-0.041	-0.57		
1998	-0.050	-2.01*	-0.049	-2.12*		
1999	0.002	-0.03	-0.032	-0.62		
2000	-0.031	-0.51	-0.023	-0.42		
Dummy for same industry	-0.019	-0.36	-0.004	-0.09	0.047	1.27
Industry dummies						
Financial	0.107	1.18	0.050	0.62		
Manufacturing	0.060	0.82	0.047	0.69		
Natural resources	0.181	1.72	0.152	1.63		
Services	0.049	0.63	0.047	0.66		
Number of listings	0.000	-0.08			0.000	-0.07
Target listing maintained	0.092	1.58			0.087	1.62
N	289		343		289	
R^2	0.307		0.348		0.284	

Table 9: The source of beta changes by country pairs

The dependent variables are the difference between the post-merger beta and the pooled pre-merger beta with respect to (1) the acquirer market and (2) the target market. The explanatory variables are defined in section IIA. Estimation is by GLS, with a diagonal covariance matrix and residual standard deviations proportional to the estimated standard error of the difference in betas before and after the merger. ** denotes 1% significance, * 5% significance.

Regression	(1) Acquirer market betas		(2) Target market betas	
Independent Variables	Coeff.	t-stat	Coeff.	t-stat
Constant	0.409	3.17**	-0.003	-0.03
Pre-merger beta	-0.391	-5.74**	-0.561	-8.55**
Acquirer minus target beta	-0.039	-0.29	-0.168	-1.19
Log target market value	0.025	1.18	0.001	0.08
Country pair dummies:				
UK acquires US	-0.094	-0.93	-0.211	-2.65**
US acquires UK	-0.462	-4.34**	-0.013	-0.15
UK acquires Other	-0.209	-1.57	0.013	0.15
Other acquires UK	-0.129	-1.51	-0.053	-0.69
US acquires Other	-0.282	-2.29**	0.034	0.38
Other acquires US	-0.045	-0.65	-0.121	-1.97*
Time dummies				
1995	-0.044	-0.47	-0.057	-0.68
1996	-0.029	-0.30	-0.082	-0.97
1997	-0.012	-0.12	-0.041	-0.52
1998	-0.043	-1.29	-0.046	-1.93
1999	-0.073	-1.01	-0.004	-0.16
2000	0.002	0.03	-0.027	-0.48
Dummy for same industry	-0.169	-2.72**	-0.015	-0.29
Industry dummies				
Financial	0.101	0.93	0.102	1.12
Manufacturing	-0.058	-0.67	0.057	0.77
Natural resources	-0.017	-0.14	0.155	1.48
Services	-0.065	-0.70	0.053	0.67
Number of listings	-0.008	-1.45	-0.001	-0.34
Target listing maintained	-0.062	-0.88	0.081	1.41
N	289		289	
R^2	0.235		0.301	

Table 10: Summary of the listing effects of international mergers

The table indicates the directions of changes in the betas caused by the change in listing of companies that undergo an international merger. The changes are measured for the merged betas with respect to the two home countries of the companies involved in the merger relative to the betas for the value-weighted pooled company prior to the merger.

Acquirer location	Target location	Beta with respect to acquirer home market	Beta with respect to target home market
US	Non-US	NONE	NONE
Non-US	US	UP	DOWN
Non-US	Non-US	UP	NONE