Cross-Listing, Investment Sensitivity to Stock Price and the Learning Hypothesis

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Comments welcome

Abstract

Using a large sample of U.S. cross-listings, we show that cross-listed firms have a higher sensitivity of corporate investment to stock price than non cross-listed firms. This difference materializes after foreign firms access the U.S. markets (as it does not exist before) and is persistent. These findings are strong and robust to various controls, e.g., whether firms are financially constrained or not. The positive impact of a cross-listing on the sensitivity of investment-to-stock price is significantly smaller for firms incorporated in countries that rank low on measures on governance and disclosure quality. Moreover, this cross-listing effect increases with proxies for the extra information that a U.S. cross-listing generates for firms' managers. We argue that these findings support the hypothesis that a cross-listing enables managers to learn more information from the stock market, which then they use to make their corporate investment decisions.

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1. Introduction

Multiple listings are a widespread and enduring phenomenon. For instance, Gagnon and Karolyi (2010) report that about 3,000 firms had two or more listings in 2008 and highlight that managers' appetite for international cross-listings does not fade, despite increasing market integration. On this ground, an extensive literature analyzes why firms list abroad and seeks to identify the sources of value creation inherent in multi-national listings.[1] This line of research has considerably improved our understanding of international cross-listings. Yet the question of whether and how a foreign listing affects corporate decision-making has received much less attention.

Our contribution to this question is twofold. First, we show empirically that a U.S. cross-listing significantly increases the sensitivity of investment to stock price for cross-listing firms, which suggests that the cross-listing decision has *real* consequences. Second, we argue and provide strong evidence that this effect arises because a U.S. cross-listing enhances the amount of information that managers learn from their stock price.

The idea that managers can extract valuable information from the stock market is not new (see for instance Dow and Gorton (1997) and Subrahmanyam and Titman (1999)). By going public, managers encourage investors to collect a myriad of signals about their firm (e.g., its growth opportunities, the value of a new strategy, etc…). As stock prices aggregate these private signals, they may convey new information to managers. In turn, managers can use this information, in addition to other sources of information, to make more efficient investment decisions. There is growing evidence supporting this link going from the information embedded in prices to firms' investment decisions (see, for instance, Durnev, Morck, and Yeung (2004), Luo (2005), Chen, Goldstein, and Jiang (2007), or Bakke and Whited (2010)).

Foucault and Gehrig (2008) work out the theoretical implications of this idea for cross-listings. In their model, a cross-listing expands the set of investors who collect private information about firms' growth prospects. Indeed, other things equal, unrestricted informed investors have more markets in which they can exploit their private information. Moreover, a cross-listing fosters trading by foreign informed investors who otherwise would not be able to trade the firm's stock because, for instance, of

[1] See Karolyi (2006), Karolyi (2010) and Gagnon and Karolyi (2010) for surveys of this literature.

investment restrictions, trading costs or lack of protection of their property rights. Information from foreign investors can be valuable because they may have a specific expertise in assessing firms' strategy (as in Chemmanur and Fulghieri (2006)) or a privileged access to relevant information about the prospects of firms' foreign (i.e., U.S.) operations (see for instance, Choe, Kho, and Stulz (2005)). For all these reasons, a cross-listing can enhance the private information contained in stock prices that is new to managers and results in more efficient investment decisions if managers use the information conveyed by stock prices.

We refer to this possibility as the "learning hypothesis." A key implication of the learning hypothesis is that a U.S. cross-listing should be associated with an increase in the investment-to-price sensitivity of cross-listing firms. The logic behind this implication is intuitive (see Foucault and Gehrig (2008) for a formal analysis). When deciding on the level of investment that maximizes the expected value of their firms, managers use all available information. Managers' information set includes their own private information as well as investors' private information aggregated in the stock price. As the information impounded into stock price is in part new to them, managers' forecasts of the impact of their investment decision on firm's value depend on both sources of information. Intuitively, these forecasts and thus their final investment decision should put more weight on more informative signals. Accordingly, if a cross-listing enhances the informational content of stock prices for managers, it also makes cross-listed firms' investment more sensitive to this signal.

We test and validate this implication using a large sample of U.S. cross-listings (794 firms) from 38 countries over the period 1989-2007, using a methodology similar to Chen, Goldstein, and Jiang (2007).[2] The investment-to-price sensitivity of cross-listed firms is about twice that of benchmark firms that never cross-list in the U.S. during our sample period (19'565 firms). The economic magnitude of this cross-listing effect is substantial: a one standard deviation increase in price is associated with a 5.4% increase in corporate investment for non-cross-listed firms but an 11.6% increase for cross-listed firms (about 43% of the average level of corporate investment in our sample). Additional specifications show that this effect is robust to various estimation methodologies,

[2] Chen, Goldstein, and Jiang (2007) focus on the investment-to-price sensitivity of U.S. firms exclusively and test whether this sensitivity is higher when stock prices are more likely to contain information new to managers.

as well as a host of alternative definitions of corporate investment. In addition, we check the robustness of our finding to self-selection issues by using Heckman (1979) two-stage estimation procedure. With this approach, both the direction and the magnitude of the positive impact of a U.S. listing on the investment-to-price sensitivity remain.

In a second set of tests, we exploit the temporal dimension of our sample to track the investment-to-price sensitivity in event-time around the cross-listing date. The estimated patterns are striking. Until the cross-listing year, the investment-to-price sensitivity of firms that will cross-list is not significantly different from the investment-to-price sensitivity of benchmark firms but this sensitivity experiences a positive and significant jump after the cross-listing date. Hence, the higher investment-to-price sensitivity of cross-listed firms *follows* the cross-listing decision rather than precedes it, which greatly alleviates concerns about reverse-causality. We also show that the positive effect of cross-listing on the investment-to-price sensitivity is long-lasting. Even ten years after they list on U.S. markets for the first time, cross-listed firms continue to exhibit a higher investment-to-price sensitivity than their domestic peers. For this reason, our results are unlikely to stem from a spurious correlation between investment and stock price due to transient changes in unobservable firms' characteristics (e.g., new growth opportunities) around the cross-listing event.

A basic implication of the learning hypothesis is that stock prices should contain more information relevant to managers after a cross-listing. Reassuringly, Fernandes and Ferreira (2008) find empirically that a cross-listing is indeed associated with an improvement in stock price informativeness, using firm-specific stock return variation as a proxy for price informativeness. We have checked that their finding also holds in our sample (see Appendix A). However, this increase in price informativeness does not necessarily imply that stock prices contain more information *new* to managers after a cross-listing. A test of this prediction is challenging as it requires measuring the component of stock prices orthogonal to other managerial signals. This is difficult as managers' information is not directly observable.[3]

[3] Bakke and Whited (2010) provides an interesting method to isolate the component of stock prices to which managers pay attention.

To sidestep this difficulty, we check whether the positive impact of a cross-listing on the investment-to-price sensitivity is stronger when a cross-listing is more likely to strengthen the informativeness of their stock price for managers. Consistent with this conjecture, we find that the impact of a U.S. cross-listing on firms' investment-to-price sensitivity is magnified when a firm realizes a higher fraction of its sales abroad or when its main business line is more represented in the U.S than in its home country. Arguably, in these cases, U.S. investors are more likely to possess a specific expertise, unavailable in the firm's home country, in assessing the firm's strategy and future prospects. Thus, the stock price of these cross-listed firms is more likely to reflect some information yet unknown to their managers.

From a related perspective, Foucault and Gehrig (2008) also predict that the effect of a cross-listing on the investment-to-price sensitivity should be stronger when the fraction of non-discretionary liquidity traders (i.e., liquidity traders who exclusively trade in their country of origin) is more evenly distributed between the home and the domestic country. Indeed, in this case, it is easier for informed investors to camouflage their trades in both the domestic and the foreign market. This effect magnifies the impact of a cross-listing on the production of information that is new to managers. This prediction is also borne out by our cross-sectional tests. Specifically, we report that the cross-listing effect is stronger when cross-listed firms are owned by more U.S. institutional investors (which can face restrictions on their investment abroad), or when more trading activity takes place on U.S. markets.

A last implication of the learning hypothesis is that firms should make more efficient investment decisions after a cross-listing. Indeed, as managers obtain a more precise signal from their stock prices, they better allocate capital among investment projects. The improvement in investment efficiency should be more pronounced for firms that experience a larger increase in the investment-to-price sensitivity as, other things equal, these are the firms for which the (unobservable) improvement in price informativeness following the cross-listing should be the greatest according to our hypothesis. This is indeed what we find using measures of operating performance (Return on Assets and Sales Growth) as proxies for investment efficiency. An average firm exhibits a 2% (8%) increase in its return-on-assets (sales growth) after it cross-list on U.S. exchanges. However, this improvement in operating performance rises to 3.7% (11.6%) if the U.S. listing also triggers a larger than average increase in the firm's investment-to-price sensitivity.

Our empirical findings are consistent with the learning hypothesis. Of course, other explanations are possible. In particular, a U.S. cross-listing results in a significant improvement in governance standards (e.g., protection of minority shareholders) and disclosure requirements for firms coming from other countries, especially countries with less developed financial markets or emerging countries. This observation led Stulz (1999) and Coffee (1999) to craft the so called "bonding hypothesis" as an explanation for U.S. cross-listings: firms may choose to cross-list in the U.S. to commit themselves to higher governance and disclosure standards.[4] Arguably, improvement in governance and disclosure requirements should strengthen investment efficiency and the correlation between investment and stock prices.

However, a cross-country analysis of the impact of a cross-listing on the investment-to-price sensitivity indicates that the bonding hypothesis alone cannot explain well why cross-listed firms have a relatively high investment-to-price sensitivity. Indeed, using country-level proxies for the quality of corporate governance, we find that the impact of a U.S. cross-listing on firms' investment-to-price sensitivity is more than two times higher for firms incorporated in countries where minority shareholders are well protected, disclosure requirements are more stringent and economic development is advanced. This finding is hard to reconcile with the idea that the increase in the investment-to-price sensitivity of cross-listed firms is due solely to the governance and disclosure improvements associated with a U.S. cross-listing ("bonding"). Indeed, if only stricter governance and disclosure were at work, one would expect the effect of a cross-listing on the investment-to-price sensitivity to be especially large for firms for which the gains in governance and disclosure are substantial. We find the opposite.[5]

Alternatively, several papers have shown that the investment-to-price sensitivity is higher for firms that are more financially constrained (for instance, Baker, Stein, and Wurgler (2003) or

[4] See Karolyi (2010) for a review of the governance implications of U.S. cross-listings.

[5] The bonding hypothesis and the learning hypothesis applied to cross-listings are not mutually exclusive. In fact, improvement in governance may encourage investors to produce information about firms. If this is the case, the improvement in governance following a U.S. cross-listing would also contribute to make stock prices more informative for managers.

Campello and Graham (2007)). Hence, another possible explanation for our findings could be that firms become more financially constrained after they cross-list. However, the literature on cross-listings finds that a U.S. cross-listing usually relaxes financing constraints (see Reese and Weisbach (2002), Lins, Strickland, and Zenner (2005), Khurana, Martin, and Periera (2008) or Hail and Leuz (2009)). Interestingly, we even find that the positive impact of a U.S. cross-listing on firms' investment-to-price sensitivity is stronger when firms face more stringent financial constraints. This pattern is consistent with the learning hypothesis. Indeed, it is probably more difficult for financially constrained firms to exploit stock market signals. By relaxing financial constraints, a U.S. cross-listing may enable firms to better adjust their investment decisions to the information contained in their stock price.

Our paper contributes to two different strands of research. First, it advances the vast literature that analyzes the effects of international cross-listings and their causes. To our knowledge we are first to document the positive impact of a cross-listing on the investment-to-price sensitivity and to relate this effect to managerial learning. In this way, we suggest that improved stock price information might be a new source of value creation associated with cross-listings. Our finding that the effect of a cross-listing on the investment-to-price sensitivity is stronger for firms coming from countries with high governance standards offers an intriguing counter-point to the recent literature on cross-listings. Indeed this literature usually finds that the gain in valuation associated with a U.S. cross-listing is stronger for firms incorporated in poor quality countries (e.g., Doidge, Karolyi and Stulz (2004) or Hail and Leuz (2009)). One conjecture, left for future research, is that improved managerial learning is a driver of value creation for firms coming from developed countries whereas improved governance is of first order importance for firms from emerging countries.

Second, our results contributes to the literature that analyzes how stock prices affect corporate investment (see Barro (1990), Morck, Shleifer and Vishny (1990), or Blanchard, Rhee, and Summers (1993) for early contributions and Campello and Graham (2007) or Chen, Goldstein and Jiang (2007) for more recent research). A key challenge in this literature is to identify the source(s) of the positive relation between investment and stock prices. Indeed, this association may arise simply because stock prices passively reflect managers' information about their growth opportunities. Also, as explained previously, investment may correlate with stock prices because financially constrained firms can take advantage of high stock prices to tap the equity market, and use the new funds to finance investment (see for instance Stein (1996), Baker, Stein and Wurgler (2003), Campello and Graham (2007) or Polk and Sapienza (2008)). Last, the correlation between stock prices and investment may occur because managers learn valuable information from their stock price.

Several recent studies provide evidence in favor of managerial learning (e.g., Durnev, Morck, and Yeung (2004), Luo (2005), Chen, Goldstein, and Jiang (2007), Bakke and Whited (2010), Frésard (2010), or Durnev (2010)). Our analysis contributes to this line of research on various dimensions. Tests of managerial learning rely on specific measures of price informativeness (Luo (2005) is one exception). One drawback of this approach is that there is no well accepted measure of private information in stock prices, and it is difficult, if not impossible, to measure the information contained in stock prices that is new to managers. By looking at the effect of a U.S. cross-listing on the sensitivity of investment to stock price, we circumvent these problems. Second, we document the presence of managerial learning in a sample of international firms. Interestingly, our cross-country findings suggest that the extent to which managers rely on stock market feedback is in part determined by the characteristics of their home-market (e.g., its level of financial development). This finding is consistent with Durnev (2010) who finds that in countries where political connections are more important, managers' investment decisions are less guided by their stock price.

In the next section, we describe the sample and our empirical methodology. In Section 3, we document the positive effect of a U.S. cross-listing on firms' investment-to-price sensitivity and show that this result is consistent with improved managerial learning. We explore alternative explanations in Section 4. We present our conclusions and discuss some implications for future research in Section 5.

2. Data and Methodology

2.1 Sample and Summary statistics

Our sample construction starts with all non-U.S. firms covered by Worldscope. For each firm, we collect its market value of equity, total assets, capital expenditures, sales, cash flows, and additional variables that serve as proxies for firm profitability and financial policy for the period 1989-2006. All variables are measured in U.S. dollars and are detailed in Appendix A. We exclude financial firms (SIC codes between 6000 and 6999) and utilities (SIC codes between 9000 and 9999) because their accounting numbers are largely dependent on statutory capital requirements. We also exclude those firms for which information on market value of equity, total assets, sales and capital expenditures is missing, as well as firms with total assets that are inferior to $10 million and firms with negative sales. To reduce the effect of outliers, we trim our sample at 1% in each tail of each variable.

Next, we identify foreign firms that are cross-listed on major U.S. stock exchanges (NYSE, Nasdaq, or Amex). We focus on cross-listings on U.S. exchanges (and voluntarily discard level I OTC cross-listings and Rule 144a private placements) because these firms experience the largest improvement in their informational environment (see, for instance, Bailey, Karolyi and Salva (2006) or Fernandes and Ferreira (2008)), are visible, and actively traded by U.S. investors (e.g. Ammer, Holland, Smith, and Warnock (2008)). We keep track of cross-listings that are created as Level II and Level III (capital raising) ADR programs, ordinary listings as well as New York Registered Shares. We obtain cross-listing information (whether a firm has a foreign listing in the United States at the end of each year and the type of listing) from a variety of sources, including the Bank of New York, JP Morgan, Citibank, NYSE, Nasdaq, and the Center for Research on Security Prices (CRSP).[6] Our initial cross-listing sample comprises around 2,000 cross-listed securities. This number exceeds the actual number of cross-listed firms in our sample since a single firm may have multiple securities (type A, type B, ordinary, preferred shares, etc…) listed on U.S. exchanges. To mitigate concerns about survivorship bias, we keep track of both active and inactive listings using the data provided by Citibank and CRSP. Moreover, we manually check and complete the listing dates and status by searching on Factiva and Lexis/Nexis.

[Insert Table 1 about here]

Table 1 describes the composition of our sample of cross-listed firms and firms that never cross-list ("the benchmark sample"). The sample consists of 794 foreign firms (7,193 firm-years) with

[6]See, for example, www.adrbny.com, www.adr.com and www.citibank.com/adr.

securities listed on U.S. stock exchanges. The benchmark sample contains 19,565 non-cross-listed firms (130,304 firm-years). The sample has considerable geographic dispersion: firms are located in 38 countries, 15 of which are emerging markets according to the classification scheme of the Standard and Poor's Emerging Market Database. Overall our sample comprises 142 cross-listed firms (1,422 firm-years) from emerging markets and 652 (5,771 firm-years) from developed markets.[7] Also, we note that the proportion of firms listed in the U.S. varies widely across countries. Austria, Hungary and Turkey have one firm with a U.S. cross-listing, whereas Canada, Israel and the U.K. have more than 60 cross-listed companies.

[Insert Table 2 about here]

Table 2 presents the mean, median and standard deviation for the main variables used in our study (all variables used in our paper are defined in Appendix A). Consistent with previous studies, we observe that cross-listed firms are almost ten times larger than their non-cross-listed peers. Also, in line with Doidge, Karolyi and Stulz (2004), cross-listed firms have markedly higher valuation and sales growth. While the average Tobin's Q (sales growth) is 1.525 (17.6%) for the sample of cross-listed firms, it is 1.089 (13.4%) for the benchmark sample. The ratio of capital expenditure to fixed assets does not appear to differ between the two sets of firms.

2.2 Measuring the investment-to-price sensitivity

As explained in the introduction, we test whether managers of cross-listed firms rely more on information conveyed by their stock price by studying the effect of a U.S. cross-listing on the sensitivity of firms' investment to their stock price. To this end, we estimate various specifications of the following equation:

$$I_{i,t} = \alpha + \beta_0 Q_{i,t-1} + \beta_1 Crosslist_{i,t-1} + \beta_2 Q_{i,t} \times Crosslist_{i,t-1} + \gamma_1 CF_{i,t-1} + \gamma_2 \log(TA_{i,t-1}) + \varepsilon_{i,t} \qquad (1)$$

[7] The Standard and Poor's Emerging Market Database classifies a market as emerging if it meets at least one of two general criteria: (1) it is located in a low- or middle-income economy as defined by the World Bank, and (2) its investable market capitalization is low in relation to its most recent GNP figures. This yields a few situations in which newly rich countries (such as Taiwan and Korea) are categorized as emerging markets. The classification is based on 1998 data.

where the subscripts i and t represent respectively the firm and the year. The dependent variable $I_{i,t}$ is a measure of corporate investment, which, in our baseline specification, is the ratio of capital expenditures scaled by lagged fixed assets (property, plant and equipment). Variable $Q_{i,t-1}$ is the normalized stock price of firm i in year $t-1$, and is computed as the market value of equity (stock price times the number of shares outstanding) plus the book value of assets minus the book value of equity, scaled by book assets. The variable of interest $Crosslist_{it}$ is a dummy variable that is equal to one if firm i is cross-listed in year t and zero otherwise. In estimating equation (1), our primary interest is on the coefficient β_2, which measures the extent to which the association between investment and price differ for cross-listed firms. If managers learn more information from observing their stock price once cross-listed in the U.S., and incorporate this information into their investment policy, we expect this coefficient to be positive and significant.

To reliably estimate the combined effect of stock price and cross-listing on investment, we control for variables known to affect investment decisions, which may also indirectly correlate with a firm's stock price and its cross-listing status. We account for the possibility that the investment levels of cross-listed firms may systematically differ from those of non-cross-listed firms by including variable $Crosslist_{i,t}$ as a control. We also include the natural logarithm of assets ($\log(TA_{i,t-1})$) to control for the impact of the size of a firm on its corporate investment decisions. Moreover, to account for the well documented relationship between cash flows and investment, we include cash flow ($CF_{i,t-1}$) as an additional control variable. The vector $\boldsymbol{\alpha}$ includes a host of dummy variables that capture time-invariant firm heterogeneity (firm fixed-effects), systematic differences in investment policies across countries (country fixed-effects), industries (industry fixed-effects defined at the 2 digit SIC codes level), and time (year fixed-effects). Finally, we allow the error term in equation (1) to be serially correlated for the same firm. Hence, in all estimations, the standard errors are adjusted for heteroskedasticity and within firm-period clustering as defined in Petersen (2009).

Chen, Goldstein, Jiang (2007) estimates an equation similar to equation (1) but for a large sample of U.S. firms only. They show that the investment-to-price sensitivity of these firms increases with measures of private information in stock prices (namely, firm-specific stock return variation and the PIN measure). In spirit our approach is similar since the learning hypothesis implies that a cross-listing improves the amount of information in stock prices that is new to managers. Thus, variable $Crosslist_{it}$ can be seen as an indicator variable that categorizes firms according to whether their stock price informativeness is high or low. As explained in the introduction, we cannot directly test whether a cross-listing makes stock prices more informative *for managers*.[8] Our test is therefore a test of the joint hypotheses that (i) a cross-listing enhances the information content of stock prices for managers and that (ii) managers use this information for their investment decisions.

3. Empirical Findings

3.1 The impact of cross-listing on the sensitivity of investment to stock price

Table 3 displays the relationship between a U.S. cross-listings and firms' investment-to-price sensitivity. In particular, column (1) presents the results obtained from an OLS estimation of our baseline specification (1). Consistent with previous studies (e.g., Morck, Shleifer and Vishny (1990) or Chen, Goldstein, and Jiang (2007)), firms' investment is positively and significantly related to their stock price. In column (1), the coefficient on Q is 0.064 with a t-statistic of 34.39.

[Insert Table 3 about here]

Importantly, we observe that the interaction between Q and *Crosslist* has a positive coefficient of 0.072 and a t-statistic of 8.22. This estimate implies that the investment of cross-listed firms is about two times more sensitive to their stock price than that of their non-cross-listed peers. The economic magnitude of this effect is substantial. To see this, consider a one standard deviation increase in Q (0.853). This shock raises the investment of non-cross-listed firms and cross-listed firms. However, the effect is much bigger for cross-listed firms since their investment increases by 11.6% (0.853×(0.064+0.072) on average, about 43% of the sample average (26.5%). In contrast, the investment of a non-cross-listed firm increases by only 5.4% (0.853×0.064). Thus, a U.S. cross-listing substantially strengthens the link between investment and stock price.

[8] We have checked (see Appendix B for the details) however, that a cross-listing enhances firm-specific stock return variation, one of the measures of stock price informativeness used by Chen, Goldstein and Jiang (2007). This finding is also obtained by Fernandes and Ferreira (2008) for a different sample of cross-listed firms.

The coefficients on the other variables have the expected sign: firms' cash flows are positively related to investment and bigger firms tend to invest significantly less. A U.S. cross-listing has a significant negative effect on the level of investment, other things equal. However, cross-listed firms have a higher *Q* on average. Accounting for this, the investment of the *average* cross-listed firms is 1.5% larger than that of the average non-cross-listed firms.[9]

We check the robustness of our finding regarding the effect of a cross-listing on the investment-to-price sensitivity in several ways. First, we alter our specification and estimation methodology. In column (2), we re-estimate equation (1) by adding firm fixed-effects to control for time-invariant firm characteristics. The results are virtually identical: the coefficient on the interaction between *Q* and *Crosslist* remains large and statistically significant (0.065 with a t-statistic of 5.88). In column (3), we estimate our investment model using the Fama and Macbeth (1973) approach and in column (4) we re-estimate equation (1) with random country effects. In addition, to rule out the possibility that our results are biased by the comparison of firms with different sizes, columns (5) and (6) display regression results where we consider only firms with total assets greater than \$100 million and \$1,000 million respectively. Our main result is robust across all these alternative specifications: there is a significant and positive effect of a U.S. cross-listing on firms' investment-to-price sensitivity. The estimates range between 0.033 (*t*-statistic of 3.61) to 0.065 (*t*-statistic of 5.88).[10]

Next, we check whether the effect of a cross-listing on the investment-to-price sensitivity is not an episodic phenomenon by estimating equation (1) cross-sectionally, year-by-year. Figure 1 presents the results by plotting the yearly estimates of β_0, i.e., the sensitivity of investment-to-stock price, (dark grey bar) and β_2, the effect of a cross-listing on the sensitivity of investment-to-stock price (light grey bar). The figure shows that there is an upward trend in the investment-to-price sensitivity (β_0) of all firms in our international sample. For an average firm, investment is almost three times more sensitive to stock price after 2004 than before 1994. Importantly, the positive effect of a U.S. cross-listing on the investment-to-price sensitivity is pervasive (and significant) throughout the sample

[9] The marginal effect corresponds to -0.94 + 0.072*1.525 (the average *Q*).
[10] In unreported tables, we show that our results do not reflect the influence of large countries. We obtain qualitatively similar results if we exclude Canadian, U.K. or Japanese firms from our estimations. Full tabulated results are available upon request.

period. Across all years, the investment-to-price sensitivity appears to be around twice larger for cross-listed firms. Overall, Figure 1 shows that the positive impact of cross-listing is an enduring phenomenon.

[Insert Figure 1 about here]

Last, in Table 4, we check whether the finding that a cross-listing enhances the sensitivity of investment to stock price is robust to the way investment is measured. In the baseline specification, investment is defined as the ratio of capital expenditure to lagged fixed assets. We reestimate equation (1) with five alternative measures of investment, namely (a) capital expenditure scaled by *contemporaneous* and lagged assets, (b) the sum of capital expenditures and R&D expenses, scaled by either lagged fixed assets, or lagged assets, or contemporaneous assets, and (c) the annual change of total assets, scaled by lagged assets. [11] This last measure of investment accounts for corporate investment that takes the form of acquisitions and divestitures. Irrespective of the definition of investment, we observe positive and significant coefficients on the interaction between Q and *Crosslist*. Thus, the positive effect of a cross-listing on the sensitivity of investment-to-stock price does not depend on how investment is measured.

[Insert Table 4 about here]

3.2 Endogeneity concerns

The previous section establishes that the investment of cross-listed firms is more sensitive to their stock price than the investment of non-cross-listed firms. This finding is consistent with our main hypothesis: managers of cross-listed firms receive more informative signals from their stock price and therefore their investment decisions are more sensitive to price. In this interpretation, a cross-listing has a causal effect on the sensitivity of investment-to-stock price: it makes the sensitivity of investment-to-stock price higher because it enhances stock price informativeness for managers.

Identification of this causal effect is difficult for two reasons. First, the decision to cross-list is endogenous. Thus, samples of cross-listed and non-cross-listed firms are not random, as recognized by recent studies in the cross-listing literature (Doidge, Karolyi and Stulz (2004), Hail and Leuz (2009),

[11] There are many firms in which R&D information is not provided by Worldscope. For these firms, we set R&D to zero.

Lel and Miller (2009) or Frésard and Salva (2010)). In particular, firms with a higher sensitivity of investment to price might be more likely to cross-list shares on U.S. exchanges. If present, this reverse causality will bias our estimate of the effect a cross-listing on the investment-to-price sensitivity. Second, the positive association between a U.S. cross-listing and the investment-to-price sensitivity may arise even if there is no *causal* relation between these variables. Indeed, a U.S. cross-listing is often accompanied by various changes in firms' corporate policies and in their growth opportunities (see for instance Doidge, Karolyi, and Stulz (2009) and Sarkissian and Schill (2009)). These changes are likely to affect both the investment decision of firms and their stock price, working to induce a change in the correlation between these variables, even though the stock price does not directly affect investment. The inclusion of firm-fixed effects or separate intercepts for all cross-listed firms (*Crosslist*) do not adequately control for these changes.

To address these concerns, we first exploit the temporal dimension of our panel and compare the investment-to-price sensitivity for a given firm before and after it cross-lists. By examining whether U.S. cross-listings already have a higher sensitivity of investment *prior to* their U.S. listing, we can directly check whether reverse causality is a problem or not. Moreover, if the effect of a cross-listing on the investment-to-price sensitivity is long lasting, it is unlikely that this effect is driven by one time changes in financing, investment, or operating characteristics that occur contemporaneously with the cross-listing.

To perform this analysis, we need to track the year by year evolution of the investment-to-price sensitivity of each cross-listed firm. To this end, we estimate equation (1) with a set of twenty "event time" dummy variables centered on the cross-listing year (year 0) of each firm and we interact each dummy variable with the firm's normalized stock price.

[Insert Figure 2 about here]

Figure 2 depicts the coefficients on the interaction between Q and the event-time dummy variables, as well as their 95% confidence interval.[12] Several interesting patterns emerge. Prior to the cross-listing date, the investment-to-price sensitivity of firms that will cross-list is not statistically different than the investment-to-price sensitivity of benchmark firms, in general. In contrast, *after* the

[12] Full tabulated results are available upon request.

cross-listing date, the investment-to-price sensitivity of cross-listed firms becomes significantly higher (at the 5% level) than that of non cross-listed firms. This evolution does not support the scenario in which a cross-listing is positively associated with the investment-to-price sensitivity simply because firms that cross-list already had a relatively high sensitivity prior to the cross-listing date.[13]

Figure 2 also shows that the effect of a cross-listing on the investment-to-price sensitivity is persistent: even ten years after their U.S. listing, cross-listed firms continue to exhibit a significantly higher investment-to-price sensitivity than non-cross-listed firms. In contrast, changes in unobservable firms' characteristics (e.g., growth opportunities) are likely to be transient and thus cannot fully explain the persistence in the cross-listing effect documented in Figure 2. We note that these changes may however play a role around the listing date, which maybe explain why the impact of a cross-listing on the investment-to-price sensitivity slightly weakens over the cross-listing life-time.

We also address the concern that self-selection may affect the estimate of the effect of a cross-listing on the investment-to-price sensitivity by implementing Heckman (1979)'s two-step estimation procedure, where the first stage models a firm's decision to cross-list (selection equation) and the second stage refers to our baseline investment equation (1) (outcome equation). For the first-stage (Probit) estimation, we follow prior studies (see for instance Pagano, Roëll and Zechner (2002), Doidge, Karolyi and Stulz, 2004, or Fernandes and Ferreira, 2008). That is, we use both firm characteristics (size, leverage, sales growth, cash-flows, fraction of foreign sales, industry median market-to-book ratio, and dependence on external finance) and the firm's country legal origin and market capitalization as explanatory variables for the decision to cross-list.[14] We also include industry and year fixed effects in our model of the decision to cross-list.

[Insert Table 5 about here]

[13] Note that we do not have the same number of observations for each event-time dummies. We have much more observations in the 6-year window surrounding the cross-listing date. In an unreported analysis where we focus on a smaller sample of cross-listed firms with available observations 3 years before and after their cross-listing, we confirm that the investment-to-price sensitivity only increases *after* the cross-listing date.

[14] We measure the dependence on external finance of a firm (*External Finance*) at the industry level (4 digits SIC codes). As in Rajan and Zingales (1998), the external finance dependence of an industry is the median value for this industry of the difference between capital expenditures and cash flow from operations, divided by capital expenditures over our sample period.

The first column of Table 5 presents the results of the Probit estimation. Overall, the results support the conclusion of previous research. In particular, firms are more likely to cross-list when they are big, with a large fraction of sales realized abroad, and more financially constrained. More importantly, the second column reports the results of the second-stage. The Inverse Mills ratio is not significant, suggesting that self-selection is not an issue in our sample. Accordingly, the effect of a cross-listing on the investment-to-price sensitivity is very similar to that obtained in the baseline model (0.068 vs. 0.072) and remains statistically significant (*t*-statistic of 7.56).

Overall the different tests in the section confirm the robustness of our main finding: a U.S. cross-listing has a positive effect on firms' investment-to-price sensitivity even after accounting for the endogeneity of the cross-listing decision. Moreover, this cross-listing effect can be attributed to the cross-listing as it materializes only after the cross-listing date and is persistent. We now analyze in more details the cross-sectional patterns in the impact of a cross-listing on the sensitivity of investment-to-price and test whether these patterns are consistent with the learning hypothesis.

3.3. The learning hypothesis: Cross-sectional evidence

As explained previously, the increase in the investment-to-price sensitivity following a cross-listing is consistent with our hypothesis that a U.S. cross-listing strengthens managers' ability to learn information new to them from their stock price. If this hypothesis is correct, the effect of a cross-listing on the investment-to-price sensitivity should be stronger when stock prices contain more information new to managers after the cross-listing date. Testing this hypothesis is challenging as we cannot easily isolate the information embedded in stock prices that is new to managers. To overcome this problem, we use various proxies for the magnitude of the informational gains associated with a U.S. listing.

Our first proxy directly derives from Foucault and Gehrig (2008)'s model. In this model, the increase in the precision of the signal conveyed by stock prices to managers following a cross-listing is higher when the fraction of non discretionary liquidity traders (i.e., investors that exclusively trade in their home market) is more evenly distributed between the foreign and the domestic market. As a result, this improvement is higher when trading volume is more evenly distributed between the home and U.S. markets (see Proposition 8 in Foucault and Gehrig (2008)).[15] Thus, we use the fraction of total trades that takes place on U.S. exchanges (*U.S. trading*) as one proxy for the improvement in price informativeness for managers after a U.S. cross-listing. We expect the positive effect of a cross-listing on the investment-to-price sensitivity to be higher when there is more trading on U.S. markets.[16]

Second, regulatory hurdles or trading costs can prevent some U.S informed investors from investing abroad. In this case, a cross-listing is a way to stimulate information production by these investors, which magnifies the positive effect of a cross-listing on price informativeness (see Section 3.3 in Foucault and Gehrig (2008)). Institutional investors are regarded as informed investors but U.S. institutional investors often face restrictions on their investment abroad.[17] Thus, we use the fraction of outstanding shares held by U.S. institutional investors given in 13(f) filings (*Institutions*) as another proxy for the improvement in price informativeness associated with a cross-listing. We expect the positive effect of a cross-listing on the investment-to-price sensitivity to be higher when their stock is owned by more U.S. institutional investors.

In Titman and Subrahmanyam (1999), a fraction of investors receive information about a firm's investment project by luck, at no cost ("serendipitous information"). They argue that these investors could be for instance clients of the firm who learn about the potential demand for its products by consuming it. More serendipitous information will be obtained from investors abroad if a firm realizes a larger fraction of its sales abroad. More generally, investors should have lower cost of information acquisition on the value of projects whose cash-flows are mainly realized in their country. As a result, a U.S. listing should elicit more information that is new to managers if a large fraction of its sales are realized abroad. Based on this reasoning, we consider the fraction of foreign sales (*Foreign Sales*) as an additional proxy for the improvement in the amount of new information conveyed by stock prices to managers.

[15] Indeed, in their model, the market share (in terms of trading volume) of the foreign market is entirely determined by the fraction of non discretionary liquidity traders in this market. Thus, this market share can be used as a proxy for non discretionary liquidity trades in the foreign market.

[16] Baruch, Karolyi, and Lemmon (2007) and Halling, Pagano and Zechner (2008) empirically study the distribution of trading volume between the home and the foreign market for cross-listed firms.

[17] Grinblatt and Keloharju (2000) provide evidence that foreign institutional investors are better informed than local investors.

Chemmanur and Fulghieri (2006) argue that a cross-listing can be a way to access investors with unique expertise in evaluating the firm. Intuitively, the U.S. market is likely to feature more investors with unique expertise in evaluating the firm's strategy when this firm has more peers in the U.S. than in its home country. Consequently, we follow Baruch, Karolyi, and Lemmon (2007) and consider the difference in the percentage of the market capitalization of a firm's industry located in the U.S. and the percentage of industry market capitalization for a firm's industry in its home country (*U.S. Industry Relative*) as a proxy for U.S. based expertise in valuing the firm. We expect managers to receive more informative feedback from stock prices if its industry is relatively more represented in the U.S (i.e., if *U.S. Industry Relative* is high).

Finally, Easley, O'Hara and Paperman (1998) show that the likelihood of informed trading is inversely related to analysts coverage. One possibility is that the presence of analysts reduces the benefit of informed trading and therefore the amount of private information produced about the firm. Hence, we expect the level of analyst coverage to dampen the impact of a cross-listing on the sensitivity of investment-to-price.

For each of these proxies for the size of the informational gain associated with a U.S. cross-listing, we allocate each cross-listed firm in one of two groups (*High* and *Low*), depending on whether the realization of its proxy is above-median (*High*) or below-median (*Low*). Then, we re-estimate our baseline model (1) by interacting *Q* with *Crosslist* and *High* or *Low*. Table 6 (Columns 1 to 4) reports the results.

[Insert Table 6 about here]

Across all specifications, we observe clear patterns. First, we observe that the investment-to-price sensitivity is in general higher for cross-listed firms, irrespective of the group to which they belong. The only exception is when we partition firms based on the fraction of shares held by U.S. institutional investors (in this case, the effect of a U.S. cross-listing is not statistically significant for firms with a relatively low fraction of U.S. institutional investors). Second, as expected, the effect of a cross-listing on the sensitivity of investment to price is higher when a firm belongs to the group for which the informational gain of a cross-listing is likely to be high. The difference is statistically significant (see the *F*-test at the bottom of Table 6). It is also economically large. For instance, the effect of a cross-listing on the investment-to-price sensitivity is 0.039 (with a *t*-statistic of 4.46) for firms with a relatively large fraction of their trading in the U.S. and 0.020 (with a *t*-statistic of 2.00) for firms with a relatively small fraction of their trading in the U.S. Similarly, when a firm realizes a large fraction of its sales abroad, a cross-listing raises the sensitivity of investment to price by 0.083 (*t*-stat of 3.79) against 0.050 (*t*-stat of 5.34) when a firm realizes a small fraction of its sales abroad.

Last, column (5) of Table 6 reports the regression results when we partition cross-listed firms based on the number of analysts that have issued earnings forecasts during the previous year (*Coverage*). As expected, a cross-listing has a smaller effect on the sensitivity of investment-to-price for firms with high analyst coverage than for firms with low analyst coverage. This suggests that the amount of new information impounded into stock prices after a cross-listing is smaller for firms with high analyst coverage. In line with this interpretation, Fernandes and Ferreira (2008) find that the positive effect of a cross-listing on stock price informativeness is smaller for firms with high analyst coverage.

3.4. Investment efficiency

If a cross-listing improves the information content of their stock price for managers, it should ultimately enhance the efficiency of their investment decisions. As we said above, we cannot directly measure how much new information is obtained by managers from their stock price after a cross-listing. However, the improvement in the investment-to-price sensitivity of a given firm should be higher when prices convey more precise information to managers after they cross-list. Thus, we expect the improvement in investment efficiency following a cross-listing to be positively related to the increase in the investment-to-price sensitivity associated with a cross-listing.

To test this prediction, we need to measure both investment efficiency and the improvement in the investment-to-price sensitivity at the firm level. More efficient investment decisions should eventually translate into better operating performance. Hence, we follow Chen, Goldstein, and Jiang (2007) and Durnev (2010) and we measure investment efficiency by firms' future annual returns on assets (*ROA* defined as earnings before interests, taxes and depreciation to total assets) or sales growth (Δ*Sales*).

We also need to measure the impact of a cross-listing on the investment-to-price sensitivity for each firm individually. However, our pooled regression (1) does not provide such measure as it does not provide an estimate of β_2 firm by firm. One possibility would be to run separate regressions with an dummy variable for the time at which a firm becomes cross-listed but the number of time-series observations per firm is too small to obtain reliable estimates with this approach. Hence, we take another approach inspired from Durnev (2010). In a first step, we re-estimate our baseline regression (1) without controlling for the interaction between *Q* and *Crosslist* and collect the residuals of this regression for each cross-listed firm in each year. As a first approximation, cross-listed firms with positive (negative) residuals are those for which investment becomes more (less) sensitive to stock price than the *average* cross-listed firm after a U.S. cross-listing. Thus, in a second step, we construct two dummy variables denoted by *Pos* and *Neg*. The variable *Pos* is equal to one for firms with positive residuals while the variable *Neg* is equal to one for firms with negative residuals. We then proxy for the *change* in the true unobserved investment-to-price sensitivity (i.e., β_{2i}) of a given firm by the dummy variables *Pos* and *Neg*.

In Appendix C, we check in two different ways whether this approach performs well in signing the true (unobservable) direction of the change in the investment-to-price sensitivity of a given firm after it cross-lists. First, we re-estimate our baseline investment equation (1) with dummy variables *Pos* and *Neg* instead of *Crosslist*. If our approach performs well, we should find that the investment-to-price sensitivity is large when *Pos* equals one and small when *Neg* equals one. This is exactly what we observe (see Appendix C). Second, we assess the performance of our method by generating artificial changes in the sensitivity of investment-to-price for the firms in our sample and running Monte-Carlo simulations (see Appendix C for a detailed description of these simulations). In these simulations, our method correctly identifies the true direction of the artificially generated change in the sensitivity of investment-to-price in about 80% of the cases.

Armed with these firm-level proxies for investment efficiency and the impact of a cross-listing on the investment-to-price sensitivity, we run pooled regressions of measures of performance of each firm in our sample (cross-listed or not) in year *t+1* on a set of control variables, including *Pos* and *Neg* observed in year *t*. If, as we conjecture, the improvement in investment efficiency following a cross-listing is positively related to the increase in the investment-to-price sensitivity associated with a cross-listing, we should observe that the coefficient on *Pos* is significantly higher than the coefficient on *Neg* (i.e., cross-listed firms that experience a relatively large increase in their investment-to-price sensitivity on the cross-listing date perform better than cross-listed firms that experience a relatively small increase in their investment-to-price sensitivity).

[Insert Table 7 about here]

Panel A of Table 7 reports the results. We first run our regressions by including a simple dummy that indicates whether a firm is cross-listed or not (*Crosslist*). A cross-listing has a positive effect on the future operating performance of a firm in line with findings in Charitou and Louca (2009). Then, we distinguish the effect of a cross-listing on future operating performance between firms that experience a relatively large improvement in their investment-to-price sensitivity and firms for which this improvement is low. To this end, we replace *Crosslist* by the dummy variables *Pos* and *Neg*. In line with our prediction, the coefficient estimate on *Pos* is much higher than the coefficient estimate on *Neg* (about twice as big) and the difference between the coefficient estimates on these two variables is statistically significant. Interestingly, this difference largely explains the positive effect of a cross-listing on firm future operating performance. For instance, an average cross-listed firm exhibits an annual growth in sales that is 8% larger than that of non-cross-listed firm. However, this growth rate jumps to 11.6% when its investment-to-price sensitivity is higher than average after cross-listing on a U.S. exchange.

In Panel B of Table 7, we perform the same estimation but, in year *t*, we measure future operating performance by the average annual values of *ROA* and Δ*Sales* over the next three years (t+1 to t+3). In this way, we account for the fact that a change in investment efficiency may take time to materialize into superior performance. The conclusions are identical to those obtained in Panel A: cross-listed firms that experience a relatively large increase in their investment-to-price sensitivity perform better subsequently.

Overall the results in this section support our conjecture that a cross-listing results in more efficient investment decisions because they receive more informative signals from stock prices after they cross-list.

4. Alternative explanations

Our results so far are consistent with the hypothesis that a cross-listing improves the amount of stock price information new to managers. Of course, there might be other plausible explanations for our findings. In this section we study two other possible mechanisms through which a cross-listing could change the investment-to-price sensitivity and investment efficiency, namely (i) an improvement in corporate governance and (ii) a relaxation of financing constraints.

4.1. The impact of better governance and disclosure

Cross-listed firms in the U.S. must subject themselves to the regulatory oversight of the SEC and U.S. securities laws, which involve better legal protection for minority shareholders. Also, they have to adopt most U.S. disclosure and reporting requirements (e.g., they must disclose the identity of majority shareholders and reconcile their net income statement with U.S. GAAP). Thus, one potential benefit of a U.S. cross-listing is that it "bonds" firms to more effective governance and disclosure standards (Stulz (1999) or Coffee (1999)). In this way, the firms can then raise capital at cheaper cost. This "bonding hypothesis" has received some empirical support (see for instance Reese and Weisbach (2002), Doidge, Karolyi and Stulz (2004, 2009), King and Segal (2009), Hail and Leuz (2009), Lel and Miller (2009) and Karolyi (2010) for a survey).

The bonding hypothesis and the learning hypothesis are not mutually exclusive. In fact, as suggested by Fernandes and Ferreira (2008), an improvement in governance may stimulate the incentives to collect private information and works to make stock prices more informative. Moreover, an improvement in governance may induce managers to pay more attention to the efficiency of their investment decisions and to rely more on the stock market as a source of information. In turn, an improvement in price informativeness may be one channel through which a cross-listing attenuate agency problems between managers and shareholders.[18] Thus, although the bonding hypothesis and

[18] For instance, Lel and Miller (2009) finds that cross-listed firms originating from countries in which stock prices are more informative are more likely to change their CEOs after a poor performance.

the learning hypothesis describe distinct mechanisms by which a cross-listing can enhance firm value, these two mechanisms may operate simultaneously and reinforce each other.

However, an improvement in firms' governance and disclosure environment could strengthen their investment-to-price sensitivity even if managers do not rely on stock market prices to make their decisions. For instance, a stricter governance could induce managers to make investment choices that are more in line with their firm's growth opportunities, and less guided by the extraction of private benefits (as found for instance in Bohren, Cooper, and Priestley (2009) or Frésard and Salva (2010)). A U.S. cross-listing could then increase the correlation between firms' investment and their stock price since a firm's stock price carries information about growth opportunities. Alternatively, the association between price and investment could be higher after a cross-listing because more stringent disclosure requirements enable investors to better forecast the cash-flows implications of firms' investment decisions.

If these explanations play a role, the impact of a cross-listing on the investment-to-price sensitivity should be higher for cross-listed firms for which the bonding effect is stronger, i.e. firms incorporated in countries with weaker regulations for corporate governance and transparency. To test whether this is the case, we split cross-listed firms in two groups according to various measures of the quality of governance in their country of origin. First, we use the anti-self dealing index defined by Djankov, La Porta, Lopez-de-Silanes, and Shleifer (2008) (a measure of minority shareholders protection against consumption of private benefits by controlling shareholders) and we split firms according to whether their primary listing is in a country where the index is below or above its median value. We also use the index of disclosure requirements defined by La Porta, Lopez-de-Silanes, and Shleifer (2006)) to partition firms in two groups according to whether this index is above or below the median. Prior research shows that countries with a common law legal tradition offer stronger investor protection than countries with a civil-law legal tradition. Thus, we also partition cross-listed firms according to their country legal tradition (La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1997)). Last, we proceed similarly to partition countries based on their level of economic and financial development by using country's GDP per capital and stock market capitalization.

[Insert Table 8 about here]

We re-estimate equation (1) for each group of firms separately. Table 8 presents coefficient estimates, *t*-statistics and significance tests across subsamples. Irrespective of the country-level variable and partitioning, we continue to observe a positive and significant effect of a U.S. cross-listing on the sensitivity of firms' investment to their stock price. Strikingly, however, the magnitude of the cross-listing effect varies considerably across subgroups. More precisely, the cross-listing effect is more than two times higher for firms ranking high on measures of governance quality or incorporated in countries with developed financial markets and high GDP per capita. Across the different specifications, the coefficients on the interaction between *Q* and *Crosslist* range between 0.030 and 0.045 for the groups of firms incorporated in countries with low standards in terms of corporate governance whereas they vary between 0.072 to 0.087 for firms incorporated in countries with high governance standards. The *F*-tests confirm that the differences between these coefficients are statistically significant.

Unambiguously, Table 8 reveals that the positive effect of a U.S. cross-listing on the investment-to-price sensitivity is higher when cross-listed firms originate from countries where minority shareholders are well protected, disclosure requirements are high, and financial and economic development is advanced. These patterns do not support the notion that a U.S. cross-listing enhances the investment-to-price sensitivity simply because it improves firms' governance and disclosure environment. In contrast, they do not invalidate the hypothesis that managers obtain more precise signals from their stock price after a cross-listing and make therefore their decision more sensitive to their stock price. For instance, firms from countries with high governance standards might be better able to exploit the positive signals coming from the U.S. cross-listing because of better financing ability or superior managerial skills. From a different perspective, the differential effects we uncover could indicate that managers from certain countries rely relatively less on stock market feedbacks to decide on investment due to cultural or incentive differences.[19]

In any case, it is interesting to note that the results in Table 8 stand in sharp contrast with previous research. Indeed, the cross-listing literature traditionally documents that a U.S. listing mainly

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[19] Consistent with this possibility, Durnev (2010) reports that managers' investment decisions are less guided by their stock prices in countries where political connections are more prevalent.

benefits to firms incorporated in emerging countries with a poor environment in terms of governance and transparency. In particular, Doidge, Karolyi and Stulz (2004) and Hail and Leuz (2009) report that firms incorporated in these countries achieve that largest valuation gains after they cross-list on U.S. exchanges. In contrast, the impact of a cross-listing on the investment-to-price sensitivity appears much lower for these firms. Thus, if our explanation for this effect is correct, it provides a rationale for why so many firms from countries with similar levels of development and institutional quality to the U.S. decide to cross-list on U.S. stock exchanges. A full examination of this conjecture is beyond the scope of this paper but it points to an interesting direction for future research on cross-listings.

4.2 The role of financing constraints

Financing constraints can induce a positive association between investment and prices (see Baker and Wurgler (2002) and Baker, Stein, and Wurgler (2003)). Indeed, if stock prices deviate too much from fundamentals, overvalued firms can take advantage of irrationally low discount rates to issue securities at a cheaper price. Firms facing financial constraints are more likely to have unexploited projects with positive NPVs and therefore to channel the newly issued funds into investment. Thus, the combination of mispricing and financial constraints generates a positive linkage between stock prices and corporate investment. Consistent with this hypothesis, Baker, Stein, and Wurgler (2003) report that firms facing more stringent financing constraints exhibit higher investment-to-price sensitivities.

Extant research shows that a U.S. cross-listing tends to relax financing constraints. For instance, Reese and Weisbach (2002), and Lins, Strickland, and Zenner (2005) report that cross-listed firms increase their capital raising activity following their U.S. cross-listing. In a similar spirit, Hail and Leuz (2009) and Ball, Hail, and Vasvari (2009) show that cross-listed firms benefit from a lower cost of capital. As a result, if financing constraints alone explain the relation between investment and stock prices, one should expect firms' investment-to-price sensitivity to *decrease* following their U.S. cross-listing. But we observe the exact opposite, which suggests that another mechanism is at work for the effect of a cross-listing on the investment-to-price sensitivity.

To further understand the relation between financing constraints, managerial learning and a U.S. cross-listing, we examine how the positive effect of a cross-listing on the investment-to-price sensitivity depends on firms' access to external finance. Firm-level data on the actual use and cost of external financing is typically not available in international samples. Hence, we define a measure of dependence on external finance (*External Finance*) at the industry level (4 digits SIC codes) and we use this measure as a proxy for firms' access to external funds. As in Rajan and Zingales (1998), the external finance dependence of an industry (4 digits SIC codes) is the median value for this industry of the difference between capital expenditures and cash flow from operations, divided by capital expenditures over our sample period. A larger value of this variable for an industry means that firms in this industry are more dependent on external finance and therefore more likely to be financially constrained.

We then assign each firm to quintiles based on its industry measure of external dependence as in Baker, Stein and Wurgler (2003). Finally, we assess the sensitivity of our results to financial constraints by estimating equation (1) for each quintile separately. Table 9 reports the results.

[Insert Table 9 about here]

First, we observe that the investment-to-price sensitivity generally increases across quintiles from 0.054 (Q1) to 0.071 (Q5). Thus, Baker, Stein, and Wurgler (2003)' results holds in our international dataset. More importantly for our purpose, the coefficient estimate for the interaction between *Q* and *Crosslist* remains positive and significant across all quintiles. This estimate ranges from 0.06 in the fourth quintile to 0.083 in the third quintile.

Interestingly, the positive effect of cross-listing on the investment-to-price sensitivity is particularly strong (coefficient of 0.080 with a t-statistic of 8.21) for firms in industries that are more financially constrained (fifth quintile). Again, this finding can be explained by the learning hypothesis. Intuitively, financing constraints prevent firms from fully exploiting information conveyed by their stock prices.[20] Hence, firms that are the most financially constrained before a cross-listing will

[20] In line with this intuition, Chen, Goldstein and Jiang (2007) find that the impact of an improvement in price informativeness on the investment-to-price sensitivity is smaller when firms are more financially constrained. In our framework, a cross-listing enhances price informativeness and relaxes financial constraints simultaneously. If managers learn information from price, we conjecture that easing financing constraints strengthen the investment sensitivity-to-price as it enables managers to be more responsive to market signals.

experience a large change in their investment-to-price sensitivity after a cross-listing as a cross-listing eases financial constraints and enables firms to better respond to market signals.

All in all, the results in Table 9 show that the positive effect of a cross-listing on firms' investment-to-price sensitivity is largely independent of financial constraints, and if anything, stronger for firms that are more financially constrained. This finding does not preclude the possibility that, other things equal, the lessening of financing constraints following a cross-listing does exert a negative effect on the investment-to-price sensitivity of cross-listed firms. But the increase in investment-to-price sensitivity due to the accrued reliance of firms' managers on market prices as a source of information dominates this effect.

5. Conclusion

The main message of this paper is that a U.S. cross-listing enables managers to obtain more informative feedback from the stock market, which then they use to improve their investment decisions. Indeed, using a large sample of U.S. cross-listings from 38 countries over the period 1989-2007, we find that cross-listed firms have a higher sensitivity of corporate investment to stock price than non cross-listed firms. Moreover, this difference in the sensitivity of investment to stock price materializes after the cross-listing (as it does not exist before) and it is long-lasting. These findings are strong and robust to various controls, e.g., whether firms are financially constrained or not. Moreover, the impact of a U.S. cross-listing on the investment-to-price sensitivity increases with proxies for the extra information that managers can glean from their stock price after they access the U.S. markets. Also, we find suggestive evidence that this heightened managerial learning allows managers to make more efficient investment decisions.

These findings offer a new perspective on U.S. cross-listings and raise several questions for future research, two of which we outline here. First, the recent period has witnessed a substantial deceleration of the U.S. cross-listing activity as a large number of foreign firms have decided to delist from the U.S. markets. Analyzing this phenomenon, Doidge, Karolyi and Stulz (2010) report that firms terminate their U.S. cross-listing mainly because they no longer have valuable growth opportunities to finance. In light of our results, it would be interesting to also examine whether firms delist because their need to learn from the stock market has decreased.

From a related perspective, it would of interest to explore whether our results could be related to the location on which firms decide to cross-list. Pagano, Roell, and Zechner (2002) indicate that the choice of cross-listing market primarily reflects industry specificities. Sarkissian and Schill (2004) document that geographic, cultural, and economic proximity play a dominant role in the choice of overseas venue. According to our findings, an additional determinant could be related to the desire of managers to obtain specific information feedback from their *host* stock market. These and other related questions we leave to future research.

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Figure 1: The effect of cross-listing on the investment-to-price sensitivity year-by-year

This figure reports results from year-by-year regressions of the effect of a cross-listing on the investment-to-price sensitivity (equation (1)). The dark-grey bars correspond to the estimated investment-to-price sensitivity for all firms in our sample (β_0). The light-grey bars correspond to the estimated extra investment-to-price sensitivity for cross-listed firm (β_2). The sample period is from 1989 to 2006. All estimations include country, year and industry fixed effects. The standard errors used to compute the confidence bounds are robust to heteroskedasticity and serial correlation.

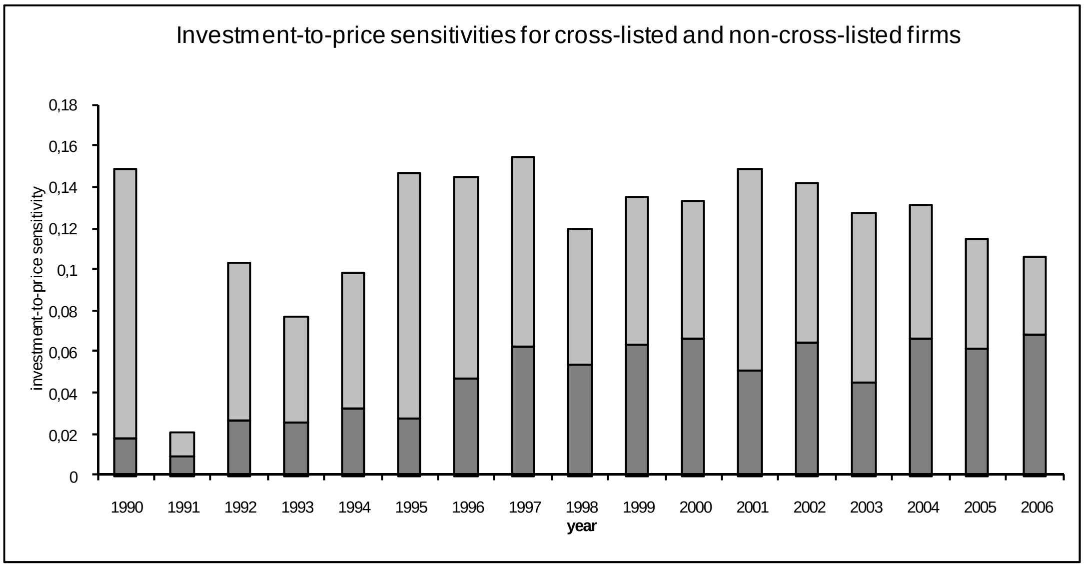

Figure 2: The effect of cross-listing on the investment-to-price sensitivity in event time

This figure reports results from an event-time analysis of the effect of cross-listing on the investment-to-price sensitivity. Specifically, we create a set of "event time" dummy variables where the event year (year 0) represents the cross-listing year for a given firm. We consider a window that comprises ten years before and respectively ten years after the cross-listing. Then, to track the evolution of the investment-to-price sensitivity around the cross-listing event, we re-estimate the baseline specification (1) in Table 3, but replace *Crosslist* by the set of event time dummies. This figure displays the coefficient estimates on each event-time dummy as well as their 95% confidence interval. The sample period is from 1989 to 2006. All estimations include country, year and industry fixed effects. The standard errors used to compute the confidence bounds are robust to heteroskedasticity and serial correlation.

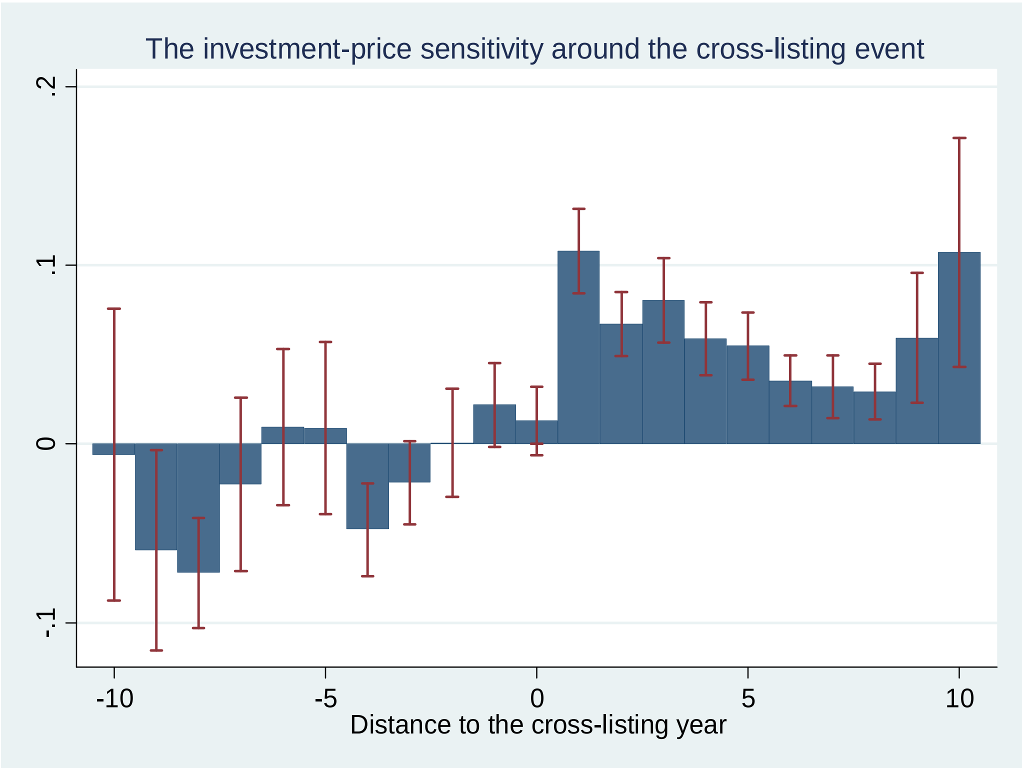

Table 1: Sample Description

This table describes the number of cross-listed and non-cross-listed firms in our sample classified by the country of origin. For each country, we report the number of firms and the number of firm-years available. Cross-listed firms are firms that are listed on a U.S. exchange (Level 2 and 3 ADRs and ordinary listings). The sample period is from 1989 to 2006. + denotes a country designated as an emerging market by Standard and Poor's Emerging Market Database.

	All firms		Non-Cross-Listed firms		Cross-Listed firms	
	Firms	Firm-years	Firms	Firm-years	Firms	Firm-years
Argentina+	70	498	63	421	7	77
Australia	938	4,959	915	4,765	23	194
Austria	122	994	121	988	1	6
Belgium	138	1,196	135	1,162	3	34
Brazil+	310	2,183	289	1,967	21	216
Canada	1,348	8,050	1,067	5,837	281	2,213
Chile+	138	1,271	125	1,102	13	169
China+	1,416	6,203	1,403	6,118	13	85
Denmark	186	1,795	182	1,744	4	51
Finland	162	1,465	156	1,412	6	53
France	998	7,515	966	7,148	32	367
Germany	853	7,114	829	6,891	24	223
Greece+	257	853	254	836	3	17
Hong Kong	718	4,907	707	4,819	11	88
Hungary+	36	237	35	228	1	9
India+	602	3,873	593	3,781	9	92
Ireland	89	729	80	645	9	84
Israel	157	799	96	495	61	304
Italy	316	2,479	307	2,376	9	103
Japan	3,820	28,335	3,790	27,918	30	417
Korea+	961	6,170	953	6,105	8	65
Mexico+	138	1,083	108	763	30	320
Netherland	246	2,163	211	1,861	35	302
NewZeeland	109	751	102	694	7	57
Norway	250	1,607	244	1,545	6	62
Peru+	71	463	69	439	2	24
Philipines+	133	992	130	952	3	40
Portugal	85	639	83	619	2	20
Russia+	53	187	47	153	6	34
Singapore	568	3,491	562	3,448	6	43
South Africa+	400	2,587	385	2,420	15	167
Spain	188	1,708	183	1,649	5	59
Sweden	356	2,537	343	2,398	13	139
Switzerland	244	2,264	236	2,186	8	78
Taiwan+	1,352	6,746	1,345	6,674	7	72
Turkey+	194	1183	193	1,177	1	6
UK	2,316	17,326	2,240	16,452	76	874
Venezuela+	21	145	18	116	3	29
All countries	**20,359**	**137,497**	**19,565**	**130,304**	**794**	**7,193**

Table 2: Descriptive statistics

This table reports the mean, median and standard deviation of the main variables used in the following analysis. All the variables are defined in Appendix A. We provide these statistics separately for all the firms in the sample, for cross-listed firms as well as for non-cross-listed firms. Cross-listed firms are firms that are listed on a U.S. exchange (Level 2 and 3 ADRs and ordinary listings). The sample period is from 1989 to 2006.

	All firms			
Variables	Mean	Median	Std Dev	Firm-year
Total Assets (TA)	1,577.666	206.007	7,357.145	137,497
Q	1.112	0.853	0.904	137,071
Capex/PPE	0.265	0.156	0.388	137,497
CF/TA	0.653	0.320	2.022	137,497
	Cross-listed firms			
Variables	Mean	Median	Std Dev	Firm-year
Total Assets (TA)	9,604.440	1,560.716	23,622.382	7,193
Q	1.525	1.123	1.214	7,170
Capex/PPE	0.290	0.196	0.363	7,193
CF/TA	0.440	0.341	1.758	7,193
	Non-Cross-listed firms			
Variables	Mean	Median	Std Dev	Firm-year
Total Assets (TA)	1,134.575	193.191	4,750.069	130,304
Q	1.089	0.842	0.878	129,901
Capex/PPE	0.264	0.154	0.389	130,304
CF/TA	0.665	0.319	2.035	130,304

Table 3: The impact of cross-listing on the investment-to-price sensitivity

This table presents the results of regressions of the effect of a U.S. cross-listing on firms' investment-to-price sensitivity (equation (1)). The dependent variable is investment, defined as capital expenditures divided by lagged property, plant and equipment (PPE). *Crosslist* is a dummy variable that is equal to one if the firm is cross-listed on a U.S. exchange, and zero otherwise. The control variables are defined in Appendix A. In column (1), we provide baseline cross-sectional pooled OLS results. In column (2), we include firm fixed effects. In column (3), we use the Fama and MacBeth (1973) methodology to estimate equation (1). In column (4), we estimate equation (1) by including country random effects. In columns (5) and (6), we include only firms with total assets (*TA*) greater than 100$ mio and respectively $1,000 mio. The sample period is from 1989 to 2006. All estimations include industry fixed effects. We report heteroskedasticity and serial correlation robust t-statistics in brackets. Symbols ** and * indicate statistical significance at the 1% and 5% levels, respectively.

	Investment (capex over lagged PPE)					
	Baseline	Firm FE	F-M	Country RE	TA>100$	TA>1,000$
	(1)	(2)	(3)	(4)	(5)	(6)
Crosslist	-0.094**	-0.084**	-0.059**	-0.061**	-0.065**	-0.035**
	[8.08]	[4.11]	[5.54]	[7.00]	[5.62]	[3.09]
Q	0.064**	0.048**	0.055**	0.074**	0.058**	0.030**
	[34.39]	[19.20]	[7.95]	[68.57]	[21.62]	[5.62]
Q × Crosslist	0.072**	0.065**	0.064**	0.061**	0.056**	0.033**
	[8.22]	[5.88]	[7.63]	[12.06]	[6.51]	[3.61]
CF/TA	0.320**	0.433**	0.433**	0.319**	0.435**	0.517**
	[21.74]	[23.00]	[10.31]	[42.27]	[20.26]	[11.49]
log(TA)	-0.024**	-0.074**	-0.027**	-0.027**	-0.026**	-0.027**
	[25.20]	[16.75]	[10.67]	[45.56]	[21.40]	[10.48]
Country FE	Yes	No	Yes	No	Yes	Yes
Industry FE	Yes	No	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	No	Yes	Yes	Yes
Firm FE	No	Yes	No	No	No	No
# Firm-years	136,673	136,673	136,673	136,673	92,448	27,036
R^2	0.15	0.48	0.09	0.21	0.17	0.18

Table 4: The impact of cross-listing on the investment-to-price sensitivity (Robustness)

This table presents the results of various regressions of the effect of a U.S. cross-listing on firms' investment-to-price sensitivity (equation (1)) where we modify the definition of investment. In columns (1) and (2) investment is defined as capex divided by lagged, respectively contemporaneous assets. In columns (3) investment is defined as capex plus R&D expenses divided by lagged PPE. In columns (4) and (5) investment is defined as capex plus R&D expenses divided by lagged, respectively contemporaneous assets. Finally, in column (6) investment is defined as changed in assets divided by lagged assets. Across all specifications, *Crosslist* is a dummy variable that is equal to one if the firm is cross-listed on a U.S. exchange, and zero otherwise. The control variables are defined in Appendix A. The sample period is from 1989 to 2006. All estimations include country, year and industry fixed effects. We report heteroskedasticity and serial correlation robust t-statistics in brackets. ** and * indicate statistical significance at the 1% and 5% levels, respectively.

	Investment (various measures)					
	(1)	(2)	(3)	(4)	(5)	(6)
Crosslist	-0.019**	-0.010**	-0.186**	-0.019**	-0,005	-0.049**
	[5.54]	[4.09]	[4.39]	[4.18]	[1.51]	[4.36]
Q	0.007**	0.004**	0.175**	0.015**	0.010**	0.050**
	[15.43]	[11.52]	[26.26]	[22.57]	[20.14]	[28.15]
Q × *Crosslist*	0.012**	0.006**	0.244**	0.021**	0.011**	0.038**
	[4.75]	[3.59]	[6.11]	[6.27]	[4.51]	[4.14]
CF/ TA	0.159**	0.089**	-0.315**	0.123**	0.048**	0.867**
	[45.86]	[35.58]	[6.52]	[26.05]	[13.24]	[69.78]
log(TA)	-0.002**	-0.000*	-0.043**	-0.003**	-0.001**	-0.018**
	[9.50]	[2.20]	[21.57]	[10.10]	[3.05]	[29.31]
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
# Firm-years	142,228	142,228	136,673	142,228	142,228	154,770
R^2	0.22	0.2	0.17	0.2	0.17	0.23

Table 5: The impact of cross-listing on the investment-to-price sensitivity: self-selection

This table presents the results of the effect of a U.S. cross-listing on firms' investment-to-price sensitivity using the Heckman (1979) two-stage estimator. The first column reports the results of the (first-stage) probit estimation where the dependent variable *Crosslist*, a dummy variable that is equal to one if the firm is cross-listed on a U.S. exchange, and zero otherwise. The second column reports the (second-stage) OLS results of the baseline investment equation (1) where we add the *Inverse Mills Ratio* computed using the probit estimates. The dependent variable is investment, defined as capital expenditures divided by lagged property, plant and equipment (PPE). The variables used in both estimations are defined in Appendix A. The sample period is from 1989 to 2006. We report heteroskedasticity and serial correlation robust t-statistics in brackets. ** and * indicate statistical significance at the 1% and 5% levels, respectively.

	Heckman	
	(First-stage) Probit	Second stage
Crosslist		-0.099**
		[4.72]
Q		0.062**
		[32.96]
Q × Crosslist		0.068**
		[7.56]
CF / TA	-0.611**	0.355**
	[9.17]	[24.25]
log(TA)	0.377**	-0.022**
	[69.19]	[21.09]
Debt / TA	-0.552**	
	[8.88]	
External Dependence	0.003**	
	[3.78]	
Sales Growth	0.035	
	[1.72]	
Median Industry Q	1.788**	
	[34.76]	
Foreign Sales / TA	0.868**	
	[30.11]	
Common Law	-0.114	
	[0.33]	
Country Market Capitalization	-0.432	
	[1.46]	
Inverse Mills Ratio		0.008
		[0.91]
Country, Industry and Year FE	Yes	Yes
# Firm-years	163,157	135,214
PseudoR2/R2	*0.38*	0.15

Table 6: Managerial learning and the impact of cross-listing on the investment-to-price sensitivity

This table evaluates the role of managerial learning on the positive effect of cross-listing on the investment-to-price sensitivity. The dependent variable is investment, defined as capital expenditures divided by lagged property, plant and equipment (PPE). *Crosslist* is a dummy variable that is equal to one if the firm is cross-listed on a U.S. exchange, and zero otherwise. The control variables are defined in Appendix A. Then we use five different firm-level variables that proxy for the degree with which cross-listed firms benefit from large informational gains upon cross-listing. Foreign sales measures the fraction of sales realized abroad. Inst.Holdings is the fraction of U.S. institutional holdings to total shares outstanding. U.S. trading is the fraction of trading that takes place on U.S. exchanges. U.S. Rel.Ind is the difference in the percentage of the market capitalization of a firm's industry located in the U.S. and the percentage of industry market capitalization for a firm's industry in its home country. Coverage refers to the average number of analysts issuing forecasts over a given year. For each of these five proxies, we construct dummy variables based on whether the proxies have above (*High*) or below median (*Low*) values. Then we interact *High* and *Low* with *Crosslist*. We report a F-test that evaluates whether the coefficients on Q × *Crosslist* × *High* and Q × *Crosslist* × *Low* are equal. The sample period is from 1989 to 2006. All estimations include country, year and industry fixed effects. We report heteroskedasticity and serial correlation robust t-statistics in brackets. ** and * indicate statistical significance at the 1% and 5% levels, respectively.

	Investment (capex over lagged PPE)				
	Foreign Sales (1)	Ins. Holdings (2)	U.S. Trading (3)	U.S. Rel.Ind. (4)	Coverage (5)
Crosslist	-0.065**	-0.013	-0.042**	-0.040**	-0.089**
	[4.91]	[0.92]	[3.37]	[4.80]	[6.87]
Q	0.064**	0.063**	0.063**	0.065**	0.064**
	[34.15]	[33.23]	[33.63]	[35.23]	[34.28]
Q × *Crosslist* × *Low* (§)	0.050**	-0.001	0.020*	0.037**	0.073**
	[5.34]	[0.13]	[2.00]	[3.68]	[6.24]
Q × *Crosslist* × *High* (¥)	0.083**	0.034*	0.039**	0.062**	0.042**
	[3.79]	[2.46]	[4.46]	[6.11]	[3.74]
CF/ TA	0.325**	0.335**	0.332**	0.320**	0.323**
	[21.78]	[22.06]	[22.20]	[21.74]	[21.75]
log(TA)	-0.023**	-0.023**	-0.023**	-0.024**	-0.024**
	[24.65]	[23.84]	[24.34]	[25.19]	[24.91]
Country FE	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
# Firm-years	134,700	131,599	134,306	136,673	135,844
R^2	0.15	0.15	0.15	0.15	0.15
F-test: (§)-(¥) (*p*-value)	0.09	0.01	0.01	0.04	0.03

Table 7: Investment-to-price sensitivity and future performance

This table presents the results of various regressions of the effect of a U.S. cross-listing on firms' future performance. Performance is defined as one year ahead (three years ahead) return on asset (*ROA*) or sales growth (Δ*Sales*). *Crosslist* is a dummy variable that is equal to one if the firm is cross-listed on a U.S. exchange, and zero otherwise. *Pos* (*Neg*) is a dummy variable that equals one if cross-listed firms experience an increase (decrease) in their investment-to-price sensitivity after their U.S. cross-listing. Appendix B details the computation of these two dummy variables. The control variables are defined in Appendix A. The sample period is from 1989 to 2006. All estimations include year and firm fixed effects. We report heteroskedasticity and serial correlation robust t-statistics in brackets. ** and * indicate statistical significance at the 1% and 5% levels, respectively.

	Panel A: Next year Performance				Panel B: Next 3-years Performance			
	ROA		Δ*Sales*		*ROA*		Δ*Sales*	
Crosslist	0.020**		0.080**		0.013*		0.046**	
	[4.02]		[4.09]		[2.56]		[3.19]	
Pos (§)		0.037**		0.116**		0.018**		0.069**
		[6.27]		[5.01]		[3.14]		[4.25]
Neg (¥)		0.01		0.058**		0.010*		0.032*
		[1.95]		[2.86]		[1.96]		[2.22]
log(TA)	-0.029**	-0.029**	-0.151**	-0.151**	-0.033**	-0.033**	-0.177**	-0.177**
	[25.32]	[25.33]	[34.93]	[34.93]	[29.45]	[29.45]	[50.79]	[50.81]
LT Debt / TA	-0.017**	-0.016**	-0.026	-0.025	0.027**	0.027**	-0.003	-0.003
	[4.18]	[4.09]	[1.72]	[1.67]	[7.30]	[7.33]	[0.32]	[0.28]
Cash /TA	0.064**	0.063**	0.128**	0.128**	0.035**	0.035**	0.170**	0.170**
	[10.89]	[10.85]	[5.58]	[5.56]	[6.55]	[6.52]	[10.83]	[10.80]
PPE /TA	-0.003	-0.003	-0.067**	-0.067**	0.014**	0.014**	-0.038*	-0.038*
	[0.48]	[0.47]	[3.01]	[3.01]	[2.79]	[2.79]	[2.15]	[2.15]
Firm and year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
# Firm-years	169,568	169,568	170,378	170,378	124,799	124,799	126,545	126,545
R^2	0.55	0.55	0.33	0.33	0.74	0.74	0.6	0.6
F-test: (§) = (¥) (*p*-value)		0.00		0.00		0.02		0.00

Table 8: The impact of cross-listing on the investment-to-price sensitivity: Cross-country evidence

This table presents the results of regressions of the effect of a U.S. cross-listing on firms' investment-to-price sensitivity (equation (1)) separately for different groups of countries. The dependent variable is investment, defined as capital expenditures divided by lagged property, plant and equipment (PPE). *Crosslist* is a dummy variable that is equal to one if the firm is cross-listed on a U.S. exchange, and zero otherwise. The control variables are defined in Appendix A. We partition countries based on the following five variables: the Anti-self-dealing, disclosure and legal origin indices from Djankov, La Porta, Lopez-de-Silanes, Shleifer, and Vishny (2008), the GDP per capital and the market capitalization from the Worldbank. For each variable, we assign a country in the *Low* group if it has a value below the sample median and in the *High* group if it has value above the sample median. We estimate baseline investment equation (1) via a seemingly unrelated regression (SUR) system that combines the *Low* and *High* subgroups. The SUR estimation provides the joint-variance-covariance matrix that we use to construct F-tests to compare cross-equation restrictions. The sample period is from 1989 to 2006. All estimations include industry fixed effects. We report heteroskedasticity and serial correlation robust t-statistics in brackets. ** and * indicate statistical significance at the 1% and 5% levels, respectively.

	Quality of institutions						**Economic and financial development**			
	Anti-Self-Dealing		Disclosure		Legal Origin		GDP per capita		Market Capitalization	
	Low	High	Low	High	Code Law	Common Law	Low	High	Low	High
Crosslist	-0.049**	-0.111**	-0.048**	-0.111**	-0.055**	-0.110**	-0.069**	-0.094**	-0.047**	-0.103**
	[3.40]	[9.83]	[3.47]	[9.63]	[4.29]	[8.61]	[4.16]	[9.16]	[3.30]	[9.07]
Q	0.063**	0.063**	0.064**	0.068**	0.059**	0.064**	0.040**	0.069**	0.053**	0.069**
	[37.32]	[42.49]	[36.37]	[44.84]	[41.93]	[35.17]	[18.60]	[53.06]	[33.63]	[44.30]
Q × *Crosslist*	0.034**	0.085**	0.034**	0.087**	0.039**	0.087**	0.045**	0.073**	0.030**	0.081**
	[3.52]	[14.31]	[3.88]	[14.23]	[4.54]	[13.30]	[4.18]	[12.98]	[3.22]	[13.26]
CF / TA	0.410**	0.266**	0.361**	0.254**	0.470**	0.185**	0.574**	0.253**	0.450**	0.255**
	[34.09]	[26.98]	[29.75]	[25.24]	[45.43]	[16.08]	[39.22]	[28.56]	[38.37]	[25.33]
log(TA)	-0.019**	*-0.028***	*-0.023***	-0.025**	-0.017**	-0.037**	-0.015**	-0.025**	-0.017**	-0.030**
	[22.30]	[31.03]	[24.75]	[28.91]	[22.41]	[32.92]	[11.20]	[35.75]	[18.64]	[33.94]
Country, industry and Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
# Firm-years	66,490	70,144	63,660	66,353	89,642	46,992	34,496	102,138	64,331	72,303
R^2	0.18	0.13	0.16	0.15	0.17	0.13	0.14	0.16	0.16	0.15
F-test: *Low* - *High* (Q)	0.73		0.16		0.06		0.00		0.00	
F-test: *Low* - *High* (Q × Crosslist)	0.00		0.00		0.00		0.02		0.00	

Table 9: Cross-listing, the investment-to-price sensitivity and financing constraints

This table presents the results of regressions of the effect of a U.S. cross-listing on firms' investment-to-price sensitivity (equation (1)) for different sub-samples based on firms' dependence on external finance. The dependent variable is investment, defined as capital expenditures divided by lagged property, plant and equipment (PPE). Δ*Sales* is a dummy variable that is equal to one if the firm is cross-listed on a U.S. exchange, and zero otherwise. The control variables are defined in Appendix A. The sub-samples are based on quintiles of external dependence, which is the industry technological dependence on external finance based on Rajan and Zingales (1998). The first quartile (Q1) comprises firms from industries that do not rely on external finance, while the fifth quartile (Q5) comprises firms from industries that rely extensively on external finance. The sample period is from 1989 to 2006. All estimations include country, year and industry fixed effects. We report heteroskedasticity and serial correlation robust t-statistics in brackets. ** and * indicate statistical significance at the 1% and 5% levels, respectively.

	Investment (capex over lagged PPE)				
	Q1	Q2	Q3	Q4	Q5
Crosslist	-0.079**	-0.086**	-0.071**	-0.063**	-0.123**
	[3.03]	[4.19]	[3.83]	[3.21]	[7.26]
Q	0.054**	0.059**	0.048**	0.075**	0.071**
	[21.70]	[27.14]	[18.07]	[28.46]	[25.83]
Q × *Crosslist*	0.067**	0.062**	0.083**	0.060**	0.080**
	[5.31]	[5.96]	[6.51]	[4.88]	[8.21]
CF / TA	0.358**	0.263**	0.461**	0.385**	0.266**
	[18.82]	[16.59]	[27.27]	[22.72]	[15.86]
log(TA)	-0.024**	-0.017**	-0.017**	-0.020**	-0.038**
	[13.51]	[13.57]	[14.31]	[15.54]	[25.00]
Country FE	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
# Firm-years	27,048	27,619	27,531	27,857	26,561
R^2	0.16	0.15	0.14	0.16	0.15

Appendix A: Definitions and sources of the variables

This table provides definitions and sources of all the variables used in the analysis.

Variable	Definition	Source
Crosslist	Dummy variable that takes one if a firm is cross-listed on a U.S. exchange (level 2 and 3 ADR and ordinary listings) and zero otherwise	Various sources (see our sample construction)
Capex	Capital expenditures (in million USD)	Worldscope
(Tobin's) Q	(Book value of assets – book value of equity + market value of equity) / book value of assets	Worldscope
PPE	Property, Plant and Equipment	Worldscope
Total assets (TA)	Book value of total assets	Worldscope
CF/TA	Cash flows from operations over total assets	Worldscope
Δ*Sales*	Percentage change in (inflation-adjusted) sales over year *t-2* to *t*	Worldscope
ROA	Sum of earnings before interest, taxes, depreciation, and amortization over total assets	Worldscope
R&D	R&D expenses. Set to zero if missing	Worldscope
External Dependence	Industry technological dependence on external finance based on Rajan and Zingales (1998). Following their methodology, the external finance dependence measure is computed as the industry (4 digits SIC codes) median value of the difference between capital expenditures and cash flow from operations, divided by capital expenditures	Worldscope
Coverage	Number of analysts issuing at least one earnings forecasts over the year	I/B/E/S International summary files
Foreign Sales	Proportion of sales generated from operations in foreign countries over total sales	Worldscope
Ins. Holdings	Proportion of shares held by U.S. institutions as a fraction of common shares outstanding	CDA/Spectrum (SEC 13(f) filings)
U.S. Trading	Proportion of the total volume that takes place on U.S. markets defined as the trading volume ($) on U.S. exchange divided by the total (domestic and U.S.) volume ($)	Datastream and CRSP
U.S. Rel. Ind.	Difference in the percentage of the market capitalization of a firm's industry located in the U.S. and the percentage of industry market capitalization for a firm's industry in its home country	Worldscope

$\psi_{i,t}$	A measure of stock price informativeness defined as as $\psi_{i,t} = \ln[(1-R^2_{i,t})/ R^2_{i,t}]$, where $R^2_{i,t}$ represents the R^2 from a regression of firm *i* weekly returns on both the local and U.S. market returns in year t. The local and U.S. market indices are value-weighted and exclude the firm in question. Used in Appendix B.	Datastram
MarketCap	Market capitalization (number of shares outstanding multiplied by end of year price)	Worldscope
LT Debt/TA	Long term debt divided by total assets	Worldscope
Book-to-Market	Book value of total assets divided by (the book value of assets – book value of equity + market value of equity)	Worldscope
ROE	Return on equity	Worldscope
Emerging	Dummy variable that takes the value of one if a foreign country is classified as an emerging market by the Standard and Poor's Emerging Market Database (1998 edition)	S&P Emerging Market Database

Appendix B: Cross-listings and stock price informativeness

As explained in the introduction, the learning hypothesis rests on the idea that a U.S. cross-listing is associated with an increase in the amount of information contained in stock prices and relevant for managers. In a recent study, Fernandes and Ferreira (2008) empirically establish that cross-listed firms enjoy more informative stock prices than their non-cross-listed peers. This appendix checks whether Fernandes and Ferreira's (2008) results hold in our sample. To this end, we borrow their methodology and use firm-specific stock return variation as a proxy for price informativeness.[21] The idea (due to Roll (1988)) is that informed trades based on firm specific information increase the idiosyncratic risk of a stock. Therefore, a higher idiosyncratic risk for a stock indicates that its stock price contains more private information.

Based on this reasoning, as in Durnev, Morck, and Yeung (2004) and Fernandes and Ferreira (2008), we measure the stock price informativeness of a firm by $\psi_{i,t} = \ln[(1-R^2_{i,t})/ R^2_{i,t}]$, where $R^2_{i,t}$ represents the R^2 from a regression of firm *i* weekly returns on both the local and U.S. market returns in year *t*. The local and U.S. market indices are value-weighted and exclude the firm in question. Then, to check whether a U.S. cross-listing enhances the informativeness of stock prices, we regress firm-specific return variation ($\psi_{i,t}$) on firms' cross-listing status, as well as factors that are likely to be related to firm-specific return variation, i.e. firm's size, book-to-market value, leverage and return-on-equity. In addition and to keep with Fernandes and Ferreira (2008)'s baseline specification, we further add country, industry, and year fixed effects. This specification is identical to their main regression.[22]

[Insert Table B1 about here]

The results are reported in Table B1 and are in line with those of Fernandes and Ferreira (2008) (Table 3, page 225). In column (1), we observe a positive and significant coefficient on *Crosslist*. All else equal, cross-listed firms display a higher firm-specific return variation than similar non-cross-listed firms. In columns (2) and (3) we add year and firm fixed effects to the baseline

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[21] This measure of stock price informativeness is used for instance by Roll (1988), Wurgler (2000), Durnev, Morck, Yeung and Zarowin (2003), Jin and Myers (2006), and Chen, Goldstein and Jiang (2007). Chen, Goldstein and Jiang (2007) provide a detailed survey of the literature supporting the idea that high firm-specific return variation is a valid proxy for firm-specific information. Durnev, Morck, Yeung and Zarowin (2003) offer support for this measure by showing that stocks for which this measure of stock price informativeness is high also exhibit a high correlation between current returns and future earnings.

[22] See their specification (3) on page 224.

regression. The results are unchanged. Next, we study whether the effect of a cross-listing on price informativeness depends on whether a cross-listting firm is incorporated in an emerging market or a developed market. To this end, we interact the variable *Crosslist* with a dummy variable, *Emerging*, which is equal to one if a firm is from an emerging market. Column (4) reveals that the coefficient on the interaction between *Crosslist* and *Emerging* is negative and marginally significant. Thus, the net effect of a cross-listing on price informativeness is no distinguishable from zero for firms from emerging country. Overall, as in Fernandes and Ferreira (2008), the positive effect of a U.S. cross-listing on price informativeness is present only for firms from developed market firms in our sample. A similar picture emerges when we further control for year, firm, and respectively country fixed effects (see Colums (5) and (6)).

Fernandes and Ferreira (2008) show that the difference between the effect of a cross-listing on price informativeness for firms from emerging markets and developed markets disappears once they control for the level of analysts coverage. Indeed, for emerging markets, the positive effect of a cross-listing on price informativeness is counter-balanced by the negative effect of the increase in analyst coverage on price informativeness.[23] When one does not control for analyst coverage, the net effect is that a cross-listing seems to have no effect on the investment-to-price sensitivity for firms from emerging countries.

[23] The reason is that the level of analysts of coverage is negatively associated with price informativeness and that a cross-listing generates additional analyst coverage (see for instance Lang, Lins and Miller (2003)).

Table B1: The impact of cross-listing on stock price informativeness

This table presents the results of OLS regressions of the effect of a U.S. cross-listing on firms' stock price informativeness. The baseline specification (column (1)) is similar to that of Fernandes and Ferreira (2008, p. 224). The dependant variable is firm specific return variation ($\psi_{i,t}$) and serves as a proxy for stock price informativeness. *Crosslist* is a dummy variable that is equal to one if the firm is cross-listed on a U.S. exchange, and zero otherwise. The control variables are the same as in Fernandes and Ferreira (2008) and are defined in Appendix A. The sample period is from 1989 to 2006. All estimations include country and industry fixed effects. We report heteroskedasticity and serial correlation robust t-statistics in brackets. ** and * indicate statistical significance at the 1% and 5% levels, respectively.

	Firm specific return variation ($\psi_{i,t}$)					
	(1)	(2)	(3)	(4)	(5)	(6)
Crosslist	0.114**	0.115**	0.137*	0.160**	0.161**	0,123
	[2.73]	[2.75]	[2.05]	[3.32]	[3.35]	[1.61]
log(MarketCap)	-0.032**	-0.032**	0,021	-0.032**	-0.032**	0,021
	[6.07]	[6.11]	[1.77]	[6.06]	[6.10]	[1.77]
LT Debt / Assets	-0,067	-0,069	-0,071	-0,065	-0,067	-0,071
	[1.31]	[1.35]	[1.15]	[1.28]	[1.32]	[1.16]
log(Book-to-Market)	-0.030**	-0.032**	0,024	-0.030**	-0.032**	0,024
	[3.33]	[3.52]	[1.68]	[3.33]	[3.52]	[1.68]
ROE	0,024	0,013	-0,027	0,024	0,013	-0,027
	[0.73]	[0.39]	[0.78]	[0.74]	[0.40]	[0.78]
Emerging				-0.516**	-0.512**	-0.498**
				[3.26]	[3.23]	[2.12]
Crosslist×Emerging				-0,171	-0,171	-0.058
				[1.91]	[1.91]	[0.37]
Country FE	Yes	Yes	No	Yes	Yes	No
Industry FE	Yes	Yes	No	Yes	Yes	No
Firm FE	No	Yes	Yes	No	Yes	Yes
Year FE	No	No	Yes	No	No	Yes
# Firm-years	135,347	135,347	135,347	135,347	135,347	135,347
R^2	0.01	0.01	0.40	0.01	0.01	0.40

Appendix C: Identification of firm-level investment-to-price sensitivity

As explained in Section 3.4, we need a firm-level measure of the impact of a cross-listing on the investment-to-price sensitivity, i.e., a measure of $\beta_{2,i,}$. In this appendix we explain how we build this proxy and we provide empirical support for our method. Our methodology, inspired by Durnev (2010), is as follows. First, we estimate our baseline investment-*q* equation (1) without the interaction variable between *Q* and *Crosslist*. That is, we estimate the following regression on the whole sample:

$$I_{i,t} = \alpha + \beta_0 Q_{i,t-1} + \beta_1 Crosslist_{i,t-1} + \gamma_1 CF_{i,t-1} + \gamma_2 \log(TA_{i,t-1}) + \varepsilon_{i,t} \tag{2}$$

where all the variables are identical to those defined in section 2.2. By construction the average residual is zero. However, the average value of the residuals for cross-listed firms is positive and equal to 0.011. This is expected since cross-listed firms have on average a higher sensitivity of investment-to-stock price and the regression does not allow for this possibility. Thus, this effect appears in the residual. This observation suggests to classify cross-listed firms in two groups in each year *t*: the group of firms for which the residual in equation (2) is positive and the group of firms for which the residual is negative. To keep track of the group to which a firm belongs in a given year, we define two dummy variables, Pos_{it} and Neg_{it}. Pos_{it} (resp. Neg_{it}) is equal to one if firm *i* has a positive (resp. negative) residual in year *t*.

Our hypothesis is that firms for which Pos_{it} equal one are cross-listed firms that have a higher than average sensitivity of investment-to-stock price in year *t* whereas cross-listed firms for which Neg_{it} equal one are those that have a smaller than average sensitivity of investment to stock price (in year *t*). We therefore use these variables as a proxy for the investment-to-price sensitivity of each cross-listed firms in each year.

We assess the validity of this approach in two ways. First, we check whether our classification of cross-listed firms really identifies distinct patterns of their investment-to-price sensitivity. To this end, we simply re-estimate our baseline investment equation (1) but we replace the variable *Crosslist* by *Pos* and *Neg*. If our approach performs well, we should observe that *Pos* has a significantly positive and higher effect than *Neg* on the investment-to-price sensitivity. This is exactly what we observe. The first column of Table C.1 reveals that the coefficient on the interaction between *Q* and *Pos* is large and highly significant (coefficient of 0.126 with a t-statistic of 15.46). In contrast, the coefficient on the interaction between *Q* and *Neg* turns out to be significantly negative (coefficient of -0.039 with a t-statistic of 8.71). In the second column, we refine the construction of *Pos* and *Neg* by only considering firms in the top and bottom quartile of the estimated residuals ($\varepsilon_{i,t}$). The results are virtually similar.

To further gauge the validity of our identification strategy, we use a Monte Carlo analysis. The idea is to artificially shock the investment-to-price sensitivity of a random set of firms in our sample and then assess whether our approach can accurately identify the sign of the shocks. To do so, we use the following procedure:

1. From the whole sample of (cross-listed and non-cross-listed) firms we randomly select 794 firms (this corresponds to the number of cross-listed firms in the sample) that we label the "treated" group. We define a dummy variable *Treated* which is equal to one if a firm belongs to the treated group and zero otherwise.

2. For each firm-year observation in the treated group, we draw an artificial investment-to-price sensitivity β_2^* from a normal distribution with mean μ and variance σ^2. In the baseline simulation we parameterize the distribution of β_2^* to match the characteristics of our estimate of β_2 in Table 3 (a mean μ of 0.072 and a variance σ^2 of 0.080).

3. For each firm-year observation, we create an artificial level of investment (capital expenditures over lagged PPE) I^* using the draw for its investment-to-price sensitivity at the previous step if the firm is in treated group. Specifically, we define :

$$I_{i,t}^* = \begin{cases} I_{i,t} + \beta_{2,i,t}^* \times Q_{i,t-1} & \text{if } Treated_i = 1 \\ I_{i,t} & \text{if } Treated_i = 0 \end{cases} \tag{3}$$

4. We estimate the following investment-*q* regression on the whole sample:

$$I_{i,t}^* = \alpha + \beta_0 Q_{i,t-1} + \beta_1 Treated_{i,t-1} + \gamma_1 CF_{i,t-1} + \gamma_2 \log(TA_{i,t-1}) + \nu_{i,t} \tag{4}$$

and collect the estimated residuals ($\hat{v}_{i,t}$) for firms that belong to the treated group.

5. To assess whether the sign of $\hat{v}_{i,t}$ correctly identifies the sign of $\beta^*_{2,i,t}$ we compute the percentage of times where we observe that the sign of the residual ($\text{sign}(\hat{v}_{i,t})$) is equal to the sign of the true value of the investment-to-price sensitivity for firm *i* in year *t* ($\text{sign}(\beta^*_{2,i,t})$). We call this percentage *Detection*.

We repeat this procedure 1,000 times and compute the average value of *Detection*. Panel A of Table C.2 reports the results of the Monte-Carlo procedure with various parameterization for the distribution of β_2^*. Across different specifications, the rate of detection of the correct sign of $\beta^*_{2,i,t}$ ranges between 66% and 88%. For the baseline specification in which the mean and the variance of the distribution from which we draw β_2^* match the estimates of these moments in the data (a mean μ of 0.072 and a variance σ^2 of 0.080), we observe that the rate of detection of our the correct sign of $\beta^*_{2,i,t}$ is 75%.

In Panel B, we refine the Monte-Carlo procedure by also considering the unconditional effect of belonging to the treated group (i.e. being cross-listed) on investment. So, in step 2, we generate an artificial β_1^* from a normal distribution with a mean and a variance that match the estimates of Table 3 (a mean of -0.094 and a variance of 0.011). Then in step 3, the artificial investment is defined as $I^*_{i,t} = I_{i,t} + \beta^*_{1,i,t} + \beta^*_{2,i,t} \times Q_{i,t-1}$ for treated firms. The detection rate turns out to be higher in this case as the average identification rate ranges between 80% and 88%. Overall, the Monte-Carlo analysis indicates that our approach to identify firms that experience a relatively large (small) increase in their investment-to-price sensitivity after a U.S. cross-listing should perform reasonably well.

Table C1: The impact of cross-listing on the investment-to-price sensitivity: *Pos* and *Neg*

This table presents the results of regressions of the effect of a U.S. cross-listing on firms' investment-to-price sensitivity (equation (1)). The dependent variable is investment, defined as capital expenditures divided by lagged property, plant and equipment (PPE). *Crosslist* is a dummy variable that is equal to one if the firm is cross-listed on a U.S. exchange, and zero otherwise. *Pos* and *Neg* are two dummy variables that are equal to one for firms that *a priori* experience an increase and decrease in their investment-to-price sensitivity after the U.S. cross-listing (as defined in the text). The control variables are defined in Appendix A. The sample period is from 1989 to 2006. All estimations include industry fixed effects. We report heteroskedasticity and serial correlation robust t-statistics in brackets. ** and * indicate statistical significance at the 1% and 5% levels, respectively.

	Investment (capex over lagged PPE)	
	Median cutoff	75 & 25 pct cutoff
	(2)	(1)
Crosslist	-0.042**	-0.034**
	[5.61]	[7.73]
Q	0.063**	0.063**
	[34.27]	[34.84]
Q × Crosslist × Pos	0.126**	0.145**
	[15.46]	[17.43]
Q × Crosslist × Neg	-0.039**	-0.113**
	[8.71]	[21.54]
CF/TA	0.325**	0.326**
	[22.25]	[22.29]
log(TA)	-0.023**	-0.023**
	[25.39]	[25.48]
Country FE	Yes	Yes
Industry FE	Yes	Yes
Year FE	Yes	Yes
Observations	136,661	136,662
R-squared	0.15	0.16

Table C2: Detection rate from the Monte-Carlo simulations

This table presents the results of the Monte-Carlo simulations that are used to assess the performance of the indirect methodology to infer the unobserved firm-year investment-to-price sensitivities ($\beta_{2,i,t}$). In the simulations, the (firm-year) investment-to-price sensitivities are normally distributed with mean μ and variance σ^2. The detection rate corresponds to the number of times our indirect approach identifies the sign of the (true) investment-to-price sensitivities (obtain by averaging the detection rate over 1000 simulations). Panel A presents the results when we only simulate the unobserved firm-year investment-to-price sensitivities ($\beta_{2,i,t}$). Panel B presents the results when we simulate both the unobserved firm-year investment-to-price sensitivities ($\beta_{2,i,t}$) and the unconditional effect of being cross-listed on investment (($\beta_{1,i,t}$). The sample period is from 1989 to 2006. We report the standard deviation of the detection rate in brackets.

Panel A	**Detection rate**		
	μ = 0.040	μ = 0.072	μ = 0.100
σ^2 = 0.004	66.15%	75.90%	81.85%
	[0.9%]	[0.6%]	[0.4%]
σ^2 = 0.008	66.14%	**75.60%**	82.01%
	[0.6%]	**[0.5%]**	[0.37%]
σ^2 = 0.010	66.25%	75.68%	81.90%
	[0.6%]	[0.5%]	[0.6%]

Panel B	**Detection rate**		
	μ = 0.040	μ = 0.072	μ = 0.100
σ^2 = 0.004	80.50%	85.56%	88.75%
	[0.3%]	[0.3%]	[0.3%]
σ^2 = 0.008	80.51%	**85.41%**	88.85%
	[0.4%]	**[0.3%]**	[0.4%]
σ^2 = 0.010	80.45%	85.34%	88.50%
	[0.3%]	[0.3%]	[0.3%]