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

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Abstract

Cross-listed firms in the U.S. have a higher investment-to-price sensitivity than firms that never cross-list. This difference is strong, does not exist prior to the cross-listing date, and does not vanish afterward. Moreover, it does not appear to be primarily driven by improvements in governance, disclosure, and access to capital associated with a U.S cross-listing. Instead, we argue that a cross-listing enhances managers' reliance on stock prices because it makes stock prices more informative to them. Consistent with this explanation, U.S. cross-listings that are more likely to strengthen the informativeness of stock prices for managers feature a higher investment-to-price sensitivity.

1. Introduction

Multiple listings of stock is a widespread and enduring phenomenon. For instance, Gagnon and Karolyi (2010) report that about 3,000 firms had two or more listings in 2008, indicating that managers' appetite for international cross-listings is not fading, despite increasing market integration. The motives and valuation effects of cross-listings have been extensively analyzed.[1] In contrast the real consequences of foreign listings (e.g., for corporate investment) have received much less attention.

Our contribution to this question is twofold. First, we show empirically that the investment-to-price sensitivity of firms cross-listed on U.S. exchanges is significantly higher than that of non-cross-listed firms. Second, we argue that this relation holds because a cross-listing enhances the precision of information conveyed by their stock price to managers. In support of this claim, we show that the relation between a U.S. cross-listing and the investment-to-price sensitivity is stronger precisely when firms have characteristics that should encourage the production of new private information when they cross-list.

The idea that managers can extract valuable information from their stock price is not new and has received empirical support (see Bond, Edmans, and Goldstein (2011) for a survey). Investors acquire and receive a myriad of signals about firms (e.g., its growth opportunities, the value of a new strategy, etc…). As they trade on these signals, stock prices contain information. In turn, managers have an incentive to use this information, in addition to other sources of information, in making their decisions.[2]

Foucault and Gehrig (2008) (henceforth FG (2008)) develop the implications of this idea for cross-listings.[3] In their model, a cross-listing enhances managers' ability to identify projects with positive Net Present Values, because it makes a firm's stock price more informative to them. Indeed, a cross-listing expands the set of investors who collect private information about firms' growth

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

[2] For instance, managers may decide to pursue or give up a major investment plan (e.g., a major acquisition, research and development projects, or diversification into new products and markets) after observing the market reaction to the announcement of this plan. Luo (2005) studies empirically the case of merger announcements and show that managers use the information contained in the stock price reaction to these announcements to cancel or consummate the deal.

[3] Their analysis builds upon Subrahmanyam and Titman (1999) who develop a theory of the going public decision based on managers' incentives to learn information from stock prices. Dow (1997), Goldstein and Gümbel (2008), Hennessy (2009), or Dow, Goldstein, and Gümbel (2010) explore other implications of the use of stock price information by managers. .

prospects in two ways. First, informed investors have more trading venues in which they can exploit their private information when the firm is cross-listed. Second, a cross-listing gives access to informed investors located in the host market who cannot (or are not willing) to trade in the firm domestic market because, for instance, of investment restrictions (e.g., foreign ownership limits), prohibitively high trading costs, or lack of transparency. Trades by these investors can impound information new to managers in stock prices because they 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 operations (e.g., as suggested by Titman and Subrahmanyam (1999), a firm's foreign customers may be better positioned to evaluate the foreign demand for a firm's products).

We refer to the hypothesis that a cross-listing affects managerial decisions by enhancing the informativeness of stock prices for managers as the "learning hypothesis."[4] A key implication of this hypothesis is that a U.S. cross-listing should trigger an increase in firms' investment-to-price sensitivity.[5] The intuition is as follows (see FG(2008) for a formal analysis): value-maximizing managers should use all relevant available information to forecast the cash-flows of their investment projects when they make capital allocation decisions. Hence, managers' forecasts will depend both on their own private information and their stock price, insofar as investors possess private information (reflected into stock prices) that is new to managers. Intuitively, these forecasts and the resulting allocation of capital should put more weight on more informative signals. Accordingly, if a cross-listing enhances the informational content of stock prices for managers, it should make cross-listed firms' capital expenditures more sensitive to this signal.

We test this implication using a large sample of foreign firms that cross-list on U.S. exchanges (633 firms from 39 countries) over the period 1989-2006. The investment-to-price

[4] This hypothesis fits within the broader literature showing how a U.S cross-listing affects firms' information environment. Cantale (1996), Fuerst (1998), and Moel (1998) develop theories in which managers' decision to cross-list signals the quality of their investment projects to investors and thereby reduces informational asymmetries between investors and firms. Moreover, Lang, Lins, and Miller (2003) show that a cross-listing enhances analyst coverage and the precision of analyst forecasts. Bailey, Karolyi and Salva (2006) also show that changes in disclosure requirements for U.S. cross-listings (reconciliation with U.S. GAAP) are associated with greater volume and price volatility after earnings announcements.

[5] Another implication is that stock prices should contain more information relevant to managers after a cross-listing. Unfortunately, it is difficult to isolate the component of stock price information that is new to managers since managers' information is not directly observable.

sensitivity of cross-listed firms is about twice as large as that of control firms that never cross-list in the U.S. during the sample period (20,027 firms). This effect appears robust to various estimation methodologies, as well as a host of alternative definitions of corporate investment. Furthermore, its economic magnitude is substantial: a one standard deviation increase in price is associated with a 5.9% increase in corporate investment for non-cross-listed firms against an 11.9% increase for cross-listed firms. In addition, the investment-to-price sensitivity of firms that *will* cross-list on a U.S. exchange is not significantly different from that of control firms *until* the cross-listing year, where it experiences a significant increase. This increase is long-lasting: even ten years after they list on U.S. markets, cross-listed firms continue to exhibit a higher investment-to-price sensitivity than their domestic peers.

In addition, the learning hypothesis implies that the increase in investment-to-price sensitivity associated with a cross-listing should be stronger for firms that, subsequent to a cross listing, experience a relatively high increase in their stock price informativeness for managers. We cannot directly test this prediction because we cannot isolate the information new to managers in stock prices. Instead, we test whether the cross-sectional variation in the investment-to-price sensitivity of cross-listed firms is explained by firm-level characteristics that correlate with stock price informativeness for managers (e.g., a measure of the incremental contribution of the U.S. stock market to information about the firm, developed by Baruch, Karolyi and Lemmon (2007), the fraction of U.S. shares held by U.S institutional investors, or a measure of firm-specific stock return variation). Consistent with the learning hypothesis, for each of seven different proxies, we find that the investment-to-price sensitivity of a cross-listed firm is higher when its cross-listing is more likely to trigger an increase in the production of private information new to managers.

We also exploit the fact that some firms in the sample cross-list on the U.S. OTC market or as Rule 144a (private placements). The market for these cross-listings is much less liquid and should therefore be less conducive to the production of information new to managers. Thus, the learning hypothesis implies that the investment-to-price sensitivity of these cross-listed firms should be smaller than for exchange listed firms. This is exactly what we find in the data.

Another implication of the learning hypothesis is that cross-listed firms should be more likely to select investment projects with positive Net Present Value. Indeed, as managers obtain a more precise signal from their stock prices, they can better identify good investment projects. This improvement in the efficiency of capital allocation should translate into better operating performance and this improvement should be more pronounced for cross-listed firms that experience a larger increase in their investment-to-price sensitivity. Indeed, other things equal, these are the firms for which the (unobservable) improvement in price informativeness for managers should be the greatest according to FG (2008). The data also support this prediction for various measures of operating performance (return on assets and sales growth).

We also explore alternative explanations for our main finding. First, a U.S. cross-listing is a way for firms to commit themselves to higher governance standards (see Stulz (1999), Coffee (1999) and Karolyi (2010) for a review of the governance implications of U.S. cross-listings). The improvement in governance associated with a U.S. cross-listing could in itself strengthen the correlation between investment and stock prices (e.g., it may make managers more responsive to "messages" sent by price movements). If this mechanism plays a role in our findings, one expects this correlation to be especially high for cross-listed firms which experience a substantial improvement in their governance. We do not find support for this prediction. Indeed, using firm and country-level measures for the quality of corporate governance, cross-listed firms that experience the *smallest* improvement in governance tends to have a higher investment-to-price sensitivity.

Another alternative explanation for our finding could be that a cross-listing enhances investors' ability to forecast the cash-flows of new investments. This is plausible since a cross-listing in the U.S. also increases disclosure requirements for firms, enabling investors to form more accurate forecasts. As a result, the correlation between investment and stock prices could be stronger after a cross-listing, not because managers use stock prices as a source of information but because investors can evaluate the net present value of new investments for these firms more precisely. If this mechanism is at work, the investment-to-price sensitivity of cross-listed firms should be particularly high for firms that experience a relatively large increase in disclosure quality or in the accuracy of analyst forecasts following their U.S. listing. Instead, depending on how we measure changes in disclosure quality, we find either an opposite effect or no relationship between measures of disclosure quality and the investment-to-price sensitivity of cross-listed firms.

Last, several studies find that a U.S. cross-listing eases the access to external capital, both in the U.S. and abroad (see Reese and Weisbach (2002), Lins, Strickland, and Zenner (2005), Khurana, Martin, and Periera (2008), Hail and Leuz (2009) and Doidge, Karolyi, and Stulz (2009)). This improvement in firms' access to external capital could also affect the investment-to-price sensitivity of cross-listed firms (see Baker, Stein, and Wurgler (2003)). However, we do not find any significant relationship between the investment-to-price sensitivity of cross-listed firms and proxies for changes in financing constraints around the cross-listing date (e.g., firm-level measures of capital raising activity). This does not support the view that enhancements in access to capital for cross-listed firms primarily drive our results.

This paper contributes to two different strands of research. Firstly, it advances the vast literature on international cross-listings. To our knowledge we are first to show that firms cross-listed in the U.S. have a higher investment-to-price sensitivity than non-cross-listed firms and to explain this effect by managerial learning.[6]

Secondly, the results contribute to the literature that analyzes how stock prices affect corporate investment, pioneered by Barro (1990), Morck, Shleifer and Vishny (1990), and Blanchard, Rhee, and Summers (1993). A key challenge 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. Alternatively, stock prices may play a more active role. Firstly, irrationally high stock prices may induce financially constrained firms to issue shares and undertake new investments with the proceeds (see for instance Stein (1996), Baker, Stein and Wurgler (2003), or Campello and Graham (2007)). Secondly, stock prices could affect investment because they convey new information to managers (see Bond, Edmans and Goldstein (2011) for a survey).

[6] Lins, Stickland, and Zenner (2005) study empirically the effect of a cross-listing on the sensitivity of investment to cash flows and find that this sensitivity declines after a cross-listing because a cross-listing relaxes constraints on access to capital for firms. We are not aware of other studies relating capital expenditures to the cross-listing decision.

A significant research effort is ongoing to identify this "managerial learning channel" (see for instance Durnev, Morck, and Yeung (2004), Luo (2005), Chen, Goldstein, and Jiang (2007), Bakke and Whited (2010), Frésard (2010), or Durnev (2010)). We contribute to this effort in two ways. First, we provide further evidence on the managerial learning channel by exploiting the fact that a cross-listing should foster the production of private information new to managers (FG(2008)). Second, we document the presence of managerial learning in a sample of international firms. Interestingly, we find that the extent to which managers rely on stock prices 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.

Our results are consistent with the idea that a U.S. cross-listing triggers an increase in the sensitivity of firms' investment to their stock price but, admittedly, we cannot rule out the possibility that other omitted factors explain our results: investment-to-price sensitivity and the cross-listing decision may appear correlated because some unobserved variables simultaneously affects firms' decision to cross-list and their investment-to-price sensitivity. Hence, we cannot claim that our results identify a causal effect of a cross-listing on investment-to-price sensitivity. Yet, cross-sectional variations in the intensity of the relation between a cross-listing and investment-to-price sensitivity, as well as the detailed examination of possible alternative explanations support our learning hypothesis.

In the next section, we describe the sample and the empirical methodology. In Section 3, we show that the investment-to-price sensitivity of firms cross-listed in the U.S. is higher than for firms that never cross-list. We also show that the time-series and cross-sectional variations in this relationship are consistent with the learning hypothesis. In Section 4, we probe alternative explanations for these findings. We summarize the main findings and discuss some implications for future research in Section 5. All variables used in the paper are defined in the Appendix. A companion Internet Appendix (available on the authors' web site) provides additional tests that are mentioned in the paper but not reported here for brevity.

2. Data and Methodology

2.1 Sample and Summary statistics

The 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. 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 observations with missing information on market value of equity, total assets, sales and capital expenditures, as well as firms with total assets that are inferior to $10 million and firms with negative sales. To reduce the effect of outliers all the ratios are winsorized at 1% in each tail.

In this sample, we identify the firms that are cross-listed in the U.S. 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, the NYSE, the Nasdaq, firms' annual reports and the Center for Research on Security Prices (CRSP). Information from the various datasets are manually cross-checked. We only consider each firm once per year, regardless of the number of its cross-listed securities in the U.S. (e.g., if a single firm has issued simultaneously ordinary and preferred shares in the U.S., we count it only once). 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.

The sample of cross-listed firms includes all firms that cross-list on U.S. exchanges (NYSE, Nasdaq, or Amex) via Level 2 or 3 American Depositary Receipts (ADRs), ordinary listings, or New York Registered Shares. It also includes Level 1 ADRs, which trade over the counter (OTC) either on the OTC Bulletin Board (OTCBB) or as Pink Sheets, and Rule 144a ADRs, which are privately placed to qualified institutions buyers (see Table 1 in Foerster and Karolyi (1999) for a definition of the various ADR programs). We keep track of changes in listing type for each firm (e.g., upgrades from an OTC to exchange listing) using the information provided by Citibank. We exclude direct listings from the sample, i.e., foreign firms that are listed in the U.S. but not in their home market.

[Insert Table 1 about here]

Table 1 describes the composition of the sample of cross-listed firms and firms that never cross-list ("the control sample"). The sample of cross-listed firms has 633 firms (6,345 firm-years) cross-listed on U.S. stock exchanges, 665 OTC listed firms (6,946 firm-years), and 170 private placements (1,879 firm-years). The control sample contains 20,027 non-cross-listed firms (130,960 firm-years). The sample has considerable geographic dispersion: firms are located in 39 countries, 17 of which are emerging markets according to the classification scheme of the Standard and Poor's Emerging Market Database.[7] Overall the sample comprises 418 cross-listed firms from emerging markets (131 exchange listings, 146 OTC listings, and 141 Rule 144a listings) and 1,050 firms from developed markets (502 exchange listings, 519 OTC listings, and 29 Rule 144a listings). The number of firms cross-listed in the U.S. varies widely across countries. Austria and Belgium have one and respectively two firms with a U.S. cross-listing, while Canada, the U.K., and Hong Kong have more than 100 cross-listed companies. The distribution of cross-listed firms in the sample by type or country of origin closely matches that of Fernandes and Ferreira (2008) (their sample period is 1980 - 2003; see their Table 2) or Doidge, Karolyi and Stulz (2007a) (their sample period is 1990-2005; see their Table 3).[8]

[Insert Table 2 about here]

Table 2 presents the mean, median and standard deviation of the main variables used in the study (all variables used in the paper are expressed in U.S. dollars when relevant and are defined in the Appendix). Consistent with previous studies, we observe that cross-listed firms are bigger than non cross-listed firms (e.g., the average of total assets for exchange listings is almost ten times that of non-cross-listed firms). Also, in line with Doidge, Karolyi, and Stulz (2004), cross-listed firms have

[7] The Standard and Poor's Emerging Market Database classifies a market as emerging if it meets at least one of two criteria: (a) it is located in a low- or middle-income economy as defined by the World Bank, and (b) its investable market capitalization is low in relation to its most recent GNP figures. This classification 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.

[8] We have slightly fewer cross-listing firms than in Doidge, Karolyi, and Stulz (2007a) because we use different filters on accounting variables (we eliminate observations when 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).

markedly higher valuation and sales growth. For instance, the average Tobin's Q (sales growth) is 1.531 (17.9%) for firms that are cross-listed on a U.S. exchange against 1.121 (14.4%) for the control firms. Last, investment (the ratio of capital expenditure to fixed assets) is higher for cross-listed firms (0.287 for cross-listed firm vs. 0.278 for control firms). The difference is statistically significant (*t*-stat of 2.03) but not economically large.[9]

Disclosure requirements and trading mechanisms differ significantly for firms cross-listed on U.S exchanges on the one hand and Level 1 or Rule 144a ADRs on the other hand. Specifically, disclosure requirements to the SEC and compliance with U.S. GAAP are much more stringent for exchange listed firms. Moreover, the OTC Bulletin Board or the Pink sheets markets do not provide the centralized matching services that exchanges do. As a result they are much less liquid than exchanges (see Harris, Panchapagesan, and Werner (2008)) and firms cross-listed on these markets are less actively traded by U.S. investors (see, for instance, Ammer, Holland, Smith, and Warnock (2012)). Hence, we expect the impact of a cross-listing on the informational content of stock prices for managers to be smaller, if not insignificant, for firms cross-listed as Level 1 or Rule 144a ADRs. For this reason, we conduct the main tests on the subsample of firms cross-listed on U.S. exchanges and in Section 3.4, we test whether the investment-to-price sensitivity of Level 1 and Rule 144A ADRs is lower than for other cross-listed firms.

2.2 Measuring the investment-to-price sensitivity

Our tests require a measure of the difference between the investment-to-price sensitivity of firms that are cross-listed in the U.S. and firms that are not. To this end, throughout the paper, we estimate various specifications of the following equation:

$$I_{i,t} = \boldsymbol{\alpha} + \beta_0 Q_{i,t-1} + \beta_1 Exchange_{i,t-1} + \beta_2 Q_{i,t-1} \times Exchange_{i,t-1} + \gamma_1 CF_{i,t-1} + \gamma_2 \log\left(TA_{i,t-1}\right) + \varepsilon_{i,t}, \quad (1)$$

[9] This is in line with findings in Lins, Strickland, and Zenner (2005). In their sample, cross-listed firms do not have a significantly higher ratio of capital expenditure after the cross-listing decision, even after controlling for other variables affecting this ratio (see their Tables 3 and 4).

where subscripts i and t represent respectively the firm and the year. The dependent variable $I_{i,t}$ is a measure of corporate investment in year t, which, in the baseline specification, is the ratio of capital expenditures in that year scaled by lagged fixed assets (property, plant and equipment). 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), or time (year fixed-effects). The variable of interest, $Exchange_{i,t}$, is a dummy variable that is equal to one if firm i is cross-listed on a U.S. exchange in year t and zero otherwise. 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 baseline regression includes control variables known to affect investment decisions. First, 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 the variable *Exchange* 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. Last, 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 clustering as defined in Petersen (2009). As the sample includes multiple firms from the same country, clustering on the firm level may still underestimate standard errors. As shown in the Internet Appendix (see Table C3 in this appendix), the findings however are robust to other forms of clustering (e.g., clustering at the firm and country level).

According to equation (1), the marginal effect of a U.S. cross-listing ($Exchange_{i,t-1} = 1$) on the investment of firm i is given by:

$$\frac{\partial I_{i,t}}{\partial Exchange_{i,t-1}} = \beta_1 + \beta_2 \times Q_{i,t-1}\,. \qquad (2)$$

The learning hypothesis has no clear implication for this effect. In fact, according to this hypothesis, the level of investment may increase or decrease after a cross-listing depending on whether stock prices convey positive or negative information to managers. In contrast, the learning hypothesis has a non-ambiguous prediction regarding the investment-to-price sensitivity: this sensitivity should increase after a cross-listing. Hence, in estimating equation (1), the primary interest is in coefficient β_2, which measures the extent to which the association between investment and price differs between exchange-listed and control firms. If managers learn more information from observing their stock price once cross-listed in the U.S., and use this information for investment decisions, we expect this coefficient to be positive and significant.

Chen, Goldstein, and Jiang (2007) estimate 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 as suggested by Roll (1988) and the PIN measure developed by Easley, Kiefer, and O'Hara (1997)). Our methodology is similar in spirit to their approach since the learning hypothesis implies that a U.S. cross-listing improves the amount of information in stock prices that is new to managers.

3. Empirical Findings

3.1 U.S. cross-listing and the sensitivity of investment to stock price

Table 3 displays the relationship between a U.S. exchange cross-listing and firms' investment-to-price sensitivity. In particular, column (1) presents the results obtained from an OLS estimation of the baseline specification (1) with country, industry, and year fixed effects.[10]

Consistent with previous studies (e.g., Morck, Shleifer and Vishny (1990), Baker, Stein and Wurgler (2003), or Chen, Goldstein, and Jiang (2007)), firms' investment is positively and significantly related to their stock price. In column (1), the coefficient on $Q_{i,t-1}$ is 0.066 with a *t*-statistic of 34.04. In line with the univariate results in Table 2, the marginal effect of a U.S. cross-listing on investment is positive on average and equal to $\beta_1+\beta_2\times$Average(Q)=-0.082

[10] In the baseline regressions, the control sample excludes firms that are cross-listed via OTC and private placements. The Internet Appendix (Table C1) presents results where we include these firms in the control sample. The results are identical.

+(0.066×1.531)=0.019. Hence, other things equal, the investment of the *average* exchange-listed firm is 1.9% larger than that of the average non-cross-listed firms.

[Insert Table 3 about here]

As explained previously, the main variable of interest is the coefficient on the interaction between $Q_{i,t-1}$ and $Exchange_{i,t-1}$, i.e., β_2. This coefficient is positive and equal to 0.066 with a *t*-statistic of 7.26. This estimate implies that, on average, the investment of cross-listed firms is about two times more sensitive to their stock price than that of non-cross-listed firms. The economic magnitude of this incremental investment-to-price sensitivity for cross-listed firms is substantial. To see this, consider a one standard deviation increase in *Q* (0.920). This shock is associated with a greater investment for both non-cross-listed firms and cross-listed firms. However, this association is much bigger for cross-listed firms since their investment increases by 11.90% ((β_0+β_2) ×sd(Q)=(0.066+0.066)×0.920) on average, about 43% of the sample average ratio of capital expenditures (which is 0.27, see Table 2). In contrast, the investment of non-cross-listed firms increases by only 5.95% (0.066×0.920) on average. 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 as a percentage of fixed assets.

We check the robustness of the above results in several ways. First, we alter the baseline specification and estimation methodology. In column (2), we re-estimate equation (1) by replacing country and industry fixed effects with firm fixed effects to control for unobserved, time-invariant firm characteristics. The main result is virtually identical: the coefficient on the interaction between *Q* and *Exchange* remains large and statistically significant (0.057 with a *t*-statistic of 5.06). As the inclusion of firm fixed effects does not significantly change the magnitude of coefficient β_2, we use pooled OLS regressions in the rest of the analysis to preserve the efficiency of the estimates (see Roberts and Whited (2011), p. 94). Results from the baseline specification are driven both by within- and between-firm effects. To isolate the role of the between-firm effect, we estimate the investment model using the Fama and Macbeth (1973) approach in Column (3). Last in Column (4) we re-estimate equation (1) with random country effects. Again, with these approaches, the direction and magnitude of the relationship between the investment-to-price sensitivity of a firm and its cross-listing status remain very similar to those obtained in the baseline specification.

As observed in Table 2, cross-listed firms are significantly bigger than control firms. Hence, one concern is that the dummy variable $Exchange_{i,t\text{-}1}$ simply picks the effect of firm size on the investment-to-price sensitivity. We address this concern by restricting the control sample to firms that are similar in size to cross-listed firms in the sample. Specifically, for each cross-listed firm-year observation, we find the firm-year observation from the same country, industry and year that is the closest in term of size (logarithm of total assets in $). The matched control sample is restricted to these matched observations. In this way, the distribution of firms' size in the control group is similar to the distribution of firms' size in the cross-listed group (as confirmed by a Kolmogorov-Smirnov test).[11] We then re-estimate the baseline specification on the sample of cross-listed firms and the matched control sample. The results, reported in Column (5) of Table 3, are unaffected, despite the smaller number of observations. With the matched control sample, we find that the coefficient on *Q×Exchange* is 0.073 (*t*-statistic of 7.51) against 0.066 (*t*-statistic of 7.26) in the baseline specification.

Cross-listed firms tend to grow faster than non-cross-listed firms (see Table 2) and could therefore need more capital than non-cross-listed firms. Thus, cross-listed firms might be more financially constrained than control firms. As several studies find that financially constrained firms have a higher investment-to-price sensitivity (e.g., Baker, Stein and Wurgler (2003) or Campello and Graham (2007)), the dummy variable $Exchange_{i,t\text{-}1}$ may capture the effect of financial constraints on the investment-to-price sensitivity. To address this concern, we use two proxies for financial constraints: (i) the Whited and Wu (2006) (WW) index for financial constraints (a larger value of this index indicates that a firm faces more severe financing constraints) and (ii) firms' dividend payout (financially constrained firms have a lower payout as shown by Fazzari, Hubbard, Petersen (1988), among others). Then, for each cross-listed firm-year observation, we find a non-cross-listed firm from the same country, industry, and year that is the closest in term of size and either the Whited and Wu

[11] With this matching procedure, the average size of the cross-listed firms (log(TA) = 7.384) is very close to that of the control firms (log(TA) = 7.374).

Index or dividend payout.[12] We restrict the control sample to these matched observations. The results with this approach are reported in Columns (6) and (7) of Table 3. Again, the estimate for β_2 is similar to that obtained in the baseline regression.[13]

Finally, to further alleviate concerns that coefficient β_2 might capture cross-sectional differences between cross-listed and control firms, we re-estimate the baseline regression (1) with only cross-listing firms. In this case, the control sample only contains firms that will cross-list at some point. Results with this approach are reported in Column (8) of Table 3. They show that the investment-to-price sensitivity is significantly higher when firms are cross-listed than when they are not. The magnitude and significance of the effect are again very similar to the baseline case.[14]

Our panel estimation approach imposes the restriction that the coefficients on the explanatory variables in the regressions are identical for all firms in all years. This approach enhances the statistical power of the tests. A drawback however is that the estimates measure the average effects (across all firms and years) of the explanatory variables. Hence, this approach potentially masks time variations or cross-country variations in the relationship between firms' investment-to-price sensitivity and their cross-listing status. To further characterize the results, we estimate the baseline regression year-by-year and country-by-country.

Figure 1 displays the yearly estimates of β_0, i.e., the sensitivity of investment-to-stock price, (dark grey bar) and β_2, the incremental investment-to-stock price sensitivity of cross-listed firms in our sample (light grey bar). This 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 higher investment-to-price sensitivity of cross-listed firms is pervasive throughout the sample period: over all years, their investment-to-price sensitivity is about twice as large as that of non-cross-listed firms. The effects of

[12] According to Hadlock and Pierce (2010), larger firms are generally much less financially constrained than smaller firms.

[13] We have also estimated the baseline regression by including an interaction term between Q and firm size or Q and the WW index for financial constraints in addition to $Q \times Exchange$. Across all specifications, the investment-to-price sensitivity of cross-listed firms continues to be significantly higher than that of non-cross-listed firms. To preserve space, we report the results of these additional tests in Table C2 of the Internet Appendix.

[14] In the Internet Appendix, we also check that the results are unchanged when we exclude from the sample cross-listings from countries that account for a large fraction of the cross-listings, namely Canada, UK, Japan, Israel, and the Netherlands (see Table C4). Moreover, Table C3 in the Internet Appendix indicates that our inference is robust to various forms of standard error clustering.

the passage of the Sarbanes-Oxley act (SOX) in 2002 on cross-listings are much debated (see Doidge, Karolyi and Stulz (2009, 2010) and Zingales (2007)). On Figure 1, there is no significant change in the investment-to-price sensitivity of cross-listed firms around the passage of SOX (we checked this formally by running the baseline regressions separately before and after 2002).

[Insert Figure 1 about here]

Figure 2 displays the country-by-country estimates of β_0, i.e., the sensitivity of investment-to-stock price, (dark grey bar) and β_2 (light grey bar). Although we lose considerable statistical power due to the small number of cross-listed firms in some countries (e.g. Austria, Hungary, Poland, or Turkey), the investment-to-price sensitivity of cross-listed firms from a given country is higher than that of other firms from the same country in 22 countries (out of 39). This represents 69.5% of the cross-listing sample (440 firms).

[Insert Figure 2 about here]

In Table 4, we check that the findings are 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 re-estimate 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.[15] This last measure of investment accounts for acquisitions and divestitures (Kumar and Ramchand (2008) find that more than 40% of cross-listed firms in their sample acquire a U.S. firm after they cross-list). Irrespective of the definition of investment, we observe positive and significant coefficients on the interaction between *Q* and *Exchange*.

[Insert Table 4 about here]

3.2 Event-time analysis

The previous section establishes that the investment of cross-listed firms is more sensitive to their stock price than that of non-cross-listed firms. If this observation results from the fact a cross-

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

listing enhances the informativeness of stock prices for managers, as implied by the learning hypothesis, then it should materialize only *after* the cross-listing date, not before. In this section, we check whether this basic implication of the learning hypothesis is satisfied.

To perform this test, we need to track the year-by-year evolution of the investment-to-price sensitivity around the cross-listing date. To this end, we consider for each firm a time window that starts ten years before and finishes ten years after the cross-listing year, with year 0 being the cross-listing year. We then define a set of event-time dummies, $Exchange_{i,t}[\tau]$ and $Exchange_{i,t}[-\tau]$, for τ = 0,1,…,+10. The dummy variable $Exchange_{i,t}[-\tau]$, (respectively $Exchange_{i,t}[\tau]$), is equal to one for firm *i* in year *t* if year *t* is such that the number of years until (respectively since) the listing date is τ. We re-estimate equation (1) with these dummy variables in place of the dummy variable *Exchange*. In this way, we obtain an estimate of the investment-to-price sensitivity of cross-listed firms for each year over a twenty years window centered on the cross-listing date.[16]

[Insert Figure 3 about here]

Figure 3 depicts the coefficients on the interaction between *Q* and the event-time dummy variables, as well as their 95% confidence interval. 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 control firms. In contrast, *after* the 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.

Hence, in line with the learning hypothesis, the investment-to-price sensitivity of a firm increases *after* the cross-listing date. Moreover, as shown in Figure 3, this increase is persistent. Indeed, the investment-to-price sensitivity of cross-listed firms remain higher than that of non-cross-listed firms even 10 years after the cross-listing date (even though the size of the initial effect tends to decline after the cross-listing date). This persistence suggests that the increase in the investment-to-price sensitivity associated with a cross-listing is not entirely driven by one-shot transitory events

[16] It is worth stressing that we do not have the same number of observations for each event-time dummy. In particular, we have a smaller number of firm-year observations far before or far after the cross-listing date. We have checked the robustness the conclusions by replicating the analysis with a balanced sample of cross-listed firms for which we have three years of observations before and after the cross-listing date. The results are unchanged with this sample: the investment-to-price sensitivity of cross-listed firms increases only *after* the cross-listing date (see Figure C1 in the Internet Appendix).

occurring contemporaneously with the cross-listing. We offer a more detailed analysis of this concern in Section 4.

3.3. The learning hypothesis: Cross-sectional evidence

The results so far show that the sensitivity of investment to stock price is higher for cross-listed firms than for non-cross-listed firms. Our hypothesis is that this effect is – at least in part – driven by the fact that a cross-listing stimulates the production of private information that otherwise would not be available to managers. As investors trade on this information, it is impounded into stock prices, which therefore become a more reliable source of information for managers after a cross-listing. As a result, their investment decisions are more sensitive to stock prices than those of managers in non-cross-listed firms.

If this mechanism plays a role, the correlation between firms' investment-to-price sensitivity and their cross-listing status should be greater for firms whose stock prices convey more information to managers after their firm cross-lists. Testing this proposition is not straightforward as there is no accepted way to isolate the private information in stock prices that is new to managers. We circumvent this problem in two ways.

The first approach consists, as in Chen, Goldstein and Jiang (2007), in using a direct proxy for the private information contained in stocks prices, namely firm-specific stock return variation (ψ).[17] 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. To the extent that some of this information is new to managers, we expect the investment-to-price sensitivity of cross-listed firms to be increase with their firm-specific stock return variation. [18]

[Insert Table 5 about here]

[17] We provide more details on the construction of this variable in the Internet Appendix (Section A).
[18] Fernandes and Ferreira (2008) find empirically that a cross-listing is associated with an improvement in stock price informativeness, using firm-specific stock return variation as a proxy for price informativeness and their finding also holds in the sample (see Table A1 in the Internet Appendix). However, Dasgupta, Gan and Gao (2010) obtain the opposite finding for another sample of U.S. cross-listings.

We test this prediction as follows. For each year, we allocate cross-listed firms in one of two groups (*High* and *Low*), depending on whether the realization of its proxy for price informativeness is above-median (*High*) or below-median (*Low*). Then, we re-estimate the baseline model (1) by interacting *Q* with *High* and *Low* (instead of *Exchange*).[19] Table 5 (Columns (1) and (2)) reports the results. In line with the findings in Table 3, the investment-to-price sensitivity is higher for cross-listed firms, irrespective of the group to which they belong. Moreover, as expected, cross-listed firms belonging to the group for which price informativeness is high display a higher investment-to-price sensitivity. The difference in the investment-to-price sensitivity between the two groups of firms is large in economic terms (about 17% of the average investment-to-price sensitivity of cross-listed firms) and statistically significant at the 10% level (see the *F*-tests at the bottom of Table 5).

This proxy for price informativeness may not fully capture the information conveyed by prices to managers. Hence, in a second set of tests, we use firm-level characteristics that should encourage or discourage the production of information new to managers by investors after a U.S. cross-listing. To identify these characteristics, we use the guidance provided by FG(2008). In this model, a cross-listing expands the number of informed investors in a stock, and thereby enhances the informativeness of stock prices for managers, via two channels. Firstly, a cross-listing in the U.S. is a way to reach U.S investors who otherwise would not be able (or willing) to invest in a firm stock because, for instance, of regulatory hurdles or high trading costs. In our case, the effect of these investors on price informativeness might be particularly large when they possess unique private information (“expertise”) about the U.S component of firms’ cash-flows (as argued by Chemmanur and Fulghieri (2006)). Secondly, a cross-listing increases the return that unconstrained investors (i.e., investors who can invest in the firm home market whether it is cross-listed or not) can obtain by acquiring private information about the firm. These two channels can operate in isolation or jointly (in

[19]The scale and units of measure of the proxies in Table 5 are very different. For this reason, for each proxy, we have chosen to partition firms in two groups depending on whether their proxy is high or low relative to the median. This binary classification facilitates the comparison of the estimates across different proxies for the magnitude of the informational gain associated with a cross-listing. One concern is that our methodology may miss effects that can be detected only with a finer partition of cross-listed firms. To address this issue, we also estimated regression (1) with an interaction term between the variable *Exchange* and each proxy used in this section. The results are qualitatively similar to those obtained here (see Table C11 in the Internet Appendix).

the baseline version of FG(2008), only the second channel operates).[20] In any case, they have distinct testable implications regarding what firm characteristics should strengthen the relation between cross-listing and the sensitivity of corporate investment to stock prices.

Consider the first channel. 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. In line with this hypothesis, Halling, Pagano, Randl, and Zechner (2007) find that the fraction of total trading activity that takes place in the U.S. is higher for small and technology oriented cross-listings due to the greater ability of U.S. investors to evaluate these firms. Consequently, we consider the difference in the percentage of the market capitalization of a firm's industry in the United States and 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 their industry accounts for a relatively larger fraction of market capitalization in the U.S than in their home market (i.e., if *U.S. Industry Relative* is high).

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. Hence, more serendipitous information will be obtained from U.S. investors if a firm realizes a larger fraction of its sales in the U.S. We therefore expect the investment-to-price sensitivity of cross-listed firms to increase with their fraction of sales in the U.S. We use the fraction of sales abroad (*Foreign Sales*) as a proxy for this fraction. Arguably, this is imperfect but, unfortunately, Worldscope does not provide the geographical breakdown of firms' sales abroad. For a subsample of 189 cross-listed firms (1,022 firm-year observations from 24 countries over 1998-2006),

[20] Empirical findings suggest that both channels can play a role in reality. For instance Ammer, Holland, Smith and Warnock (2012) find that a firm that cross-lists in the U.S. experiences a twofold (or more) increase in the amount of U.S. investment. This suggests that a U.S. cross-listing is effectively a way for a firm to attract U.S. investors who otherwise would not invest in the firm, as implied by the first channel. Moreover, they show that some U.S. investors acquire shares of cross-listed firms both in their domestic market and in the form of ADRs in the U.S. Hence, in line with the second channel, some investors do engage in multi-market trading, presumably because this brings benefits that cannot be achieved by trading in one market only. Last, it is worth stressing that the first channel may also operate for countries that are well integrated with the U.S. such as Canada. For instance, King and Segal (2009) show that the mean percentage holdings (as a percentage of shares outstanding) of U.S. institutional investors in a Canadian cross-listed firm increases from about 0% to about 16% after it cross-lists (see Figure 1, Panel B in their paper). If both channels play a role for Canadian cross-listed firms, it is therefore not surprising that, even for these firms, their investment-to-price sensitivity is significantly higher than that of non-Canadian cross-listed firm (β_2 for Canadian cross-listed firms is 0.083; see Figure 2).

we manually retrieved the fraction of sales in the U.S. Results for this subsample are similar to those obtained with *Foreign Sales* for a larger sample (see the Internet Appendix, Table C9 for this robustness check).

We also use the "U.S. information factor" (*BKL*) developed by Baruch, Karolyi, and Lemmon (2007) to better isolate the contribution of the U.S. market to stock price informativeness. The "U.S. information factor" is constructed as the difference in R^2 of a two-index factor model including the home and U.S. indices (S&P 500) as factors and a single index factor model with just the home index as a factor, adjusted for degrees of freedom (using U.S.-dollar denominated returns for each stock and each home index). As explained by Baruch, Karolyi and Lemmon (2007) (see their Section B), *BKL* measures the relative informativeness of U.S. market movements for a cross-listed stock relative to its home market movements. Hence, we expect the investment-to-price sensitivity of firms with a higher value of *BKL* to be larger.

Lastly, institutional investors are regarded as informed investors but U.S. institutional investors often face restrictions on their investment abroad. A cross-listing in the U.S. is a way to overcome this barrier and thereby increase the number of investors collecting private information about the firm. Hence the learning hypothesis implies that the association between a firm's cross-listing status and the investment-to-price sensitivity should be stronger when the fraction of outstanding shares held by U.S. institutional investors given in 13(f) filings (*Inst. Holdings*) is higher.

Now consider the second channel: a cross-listing enhances the informativeness of price for managers by increasing the number of unconstrained investors with an incentive to acquire information. In FG(2008), this increase is stronger when the fraction of "non-discretionary liquidity traders" (i.e., investors constrained to trade only in their home market) is more evenly distributed between the foreign and the domestic market. As a result, the improvement in price informativeness is higher when trading volume is more evenly distributed between the home and U.S. markets (see Proposition 8 in FG(2008)).[21] Hence, the greater the fraction of total trades that takes place on U.S.

[21] 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.

exchanges (*U.S. trading*) for a cross-listed firm, the higher should be its investment-to-price sensitivity according to the learning hypothesis.

Lang, Lins, and Miller (2003), and Bailey, Karolyi, and Salva (2006) show that a cross-listing generates more coverage by sell-side analysts. Intuitively, other things equal, this effect should have a negative impact on investors' incentives to collect private information about cross-listed firms. Indeed, sell-side analyst forecasts are often public information, which reduces the returns that informed investors can expect by trading on private information. In support of this "crowding out" hypothesis, Easley, O'Hara and Paperman (1998) show that the likelihood of informed trading (evaluated with the PIN measure) is inversely related to analysts coverage. Hence, the amount of private information in stock prices that is new to managers should be inversely related to the level of analyst coverage (*Coverage*). In this case, the learning hypothesis implies that the investment-to-price sensitivity of cross-listed firms with high analyst coverage or firms that experience a larger increase in analyst coverage after a cross-listing should be smaller than for other non-cross-listed firms.

For each of these proxies, we allocate cross-listed firms in one of two groups (*High* and *Low*) as we did for the direct measure of price informativeness. Then, we re-estimate the baseline model (1) by interacting *Q* with *High* and *Low* and report the results in Table 5 (Columns (3) and (6)). For each proxy, the investment-to-price sensitivity is 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: when this fraction is low the investment-to-price sensitivity of firms cross-listed in the U.S. is not statistically higher than that of non-cross-listed firms.

In line with the learning hypothesis, the difference in the investment-to-price sensitivity between the two groups of cross-listed firms is significant and economically large. For instance, when a cross-listed firm has significantly more peers in the U.S. than in its home country (i.e., when it ranks High on *U.S. Industry Relative*), its investment-to-price sensitivity is 0.022 higher than for other cross-listed firms (0.022 is the difference in the estimate of the investment-to-price sensitivity of cross-listed firms in the *High* and the *Low* groups).

As expected, the investment-to-price sensitivity of cross-listed firms with high analyst coverage is smaller than for firms with low analyst coverage (see Column (6)). As explained previously, this finding is consistent with the notion that the production of public information by analysts reduces the incentives of investors to acquire private information. As a result, stock prices are less informative for managers of firms with relatively high analyst coverage and accordingly managers put less weight on these signals.

None of the firm level characteristic considered so far is directly related to investment (according to theory, they affect change in price informativeness around a cross-listing and thereby, indirectly, investment). Yet, if the learning hypothesis holds, it is natural to expect that managers of cross-listed firms where investment plays a relatively more important role should also rely relatively more on stock prices as a source of information. Hence, the investment-to-price sensitivity of cross-listed firms should be relatively higher for firms where investment is relatively more important.[22] We have checked that this was indeed the case using two measures of the importance of investment for a firm (a measure of the impact of investment on future sales growth and a measure of the capital intensity in the industry to which a firm belongs). For brevity, we report the corresponding tests in the Internet Appendix (Table C15)).

Overall, the results in this section show that the relation between a cross-listing and investment-to-price sensitivity varies across groups of cross-listed firms in the way predicted by the learning hypothesis: firms with characteristics that should encourage the production of private information new to managers after a cross-listing also feature a relatively higher investment-to-price sensitivity when they are cross-listed.

3.4. The role of cross-listing types

So far the analysis has focused on firms that are cross-listed on U.S. *exchanges*. As explained in Section 2.1, there are other types of cross-listings, namely Level 1 OTC listings or Rule 144a private placements. The market for these types of cross-listings is much less liquid than the market for exchange listings. High trading costs in these markets are likely to reduce the incentive of informed investors to acquire private information. In line with this conjecture, Fernandes and Ferreira (2008) show that the effect of an OTC or Rule 144a listing on price informativeness is not significant (see

[22] We thank an anonymous referee for this suggestion.

their Table 8, Column (11)). Hence, the learning hypothesis predicts that the investment-to-price sensitivity of OTC and Rule 144a listings should be smaller than that of exchange cross-listed firms.

Insert Table 6 about here]

To test this additional prediction, we re-run the baseline regression (1) on the entire sample of cross-listed firms allowing the investment-to-price sensitivity of cross-listed firms to differ according to the type of cross-listings. Table 6 reports the results. In line with expectation, the investment-to-price sensitivity of Rule 144 and OTC listings is significantly smaller than the investment-to-price sensitivity of exchange cross-listings. Moreover, the investment-to-price sensitivity of OTC–listings is significantly higher than that of non-cross-listed firms in only two specifications while the investment-to-price sensitivity of Rule 144a listings is not significantly different from that of control firms.

3.5. Investment-to-price sensitivity and firm operating performance

If a U.S. cross-listing improves the information content of stock prices for managers, it should increase the likelihood that managers identify projects with high positive NPV. Hence, ex-post measures of firms' operating performance (a proxy for managers' ability to select successful investment projects, as in Chen, Goldstein, and Jiang (2007) and Durnev (2010)) should be significantly higher for cross-listed firm. Moreover this relationship should be stronger when stock prices are more informative for managers. As explained above, we cannot directly measure how much new information is obtained by managers from their stock price after a cross-listing. However, the learning hypothesis implies that 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 firm's performance following a cross-listing to be positively related to the increase in the investment-to-price sensitivity associated with a cross-listing.

To investigate this claim we need a firm-level measure of β_2, that is, the component of a firm's investment-to-price sensitivity that we attribute to its cross-listing status. This is challenging since, in general, we have too few observations per firm to measure β_2 separately for each firm. Hence we follow another approach, similar to that used in Durnev (2010). To identify firms whose investment-to-price sensitivity is large after they cross-list, we re-estimate the baseline regression (1) without controlling for the interaction between stock prices (*Q*) and the cross-listing dummy (*Exchange*) and we collect the regression residuals for every cross-listed firm in every year. Intuitively, other things equal, cross-listed firms with positive (negative) residuals are those for which investment is more (less) related to stock price.[23] Based on this intuition, in each year *t*, we define a dummy variable *Pos* which is equal to one for firm-year observations with positive residuals, and zero otherwise. Similarly, we define a dummy variable *Neg* which is equal to one for firm-year observations with negative residuals, and zero otherwise. We expect cross-listed firms for which *Pos* = 1 to have a better ex-post operating performance than firms for which *Neg = 1* since the former should have on average a higher investment-to-price sensitivity.

[Insert Table 7 about here]

To test this proposition, we measure firms' operating performance in year *t+1* and we regress it on *Pos* and *Neg* in year *t* and a set of control variables. We use two measures of operating performance: firms' returns on assets (*ROA* defined as earnings before interests, taxes and depreciation to total assets) and their sales growth (Δ*Sales*). Table 7 reports the results. As a benchmark, Columns (1) and (3) provides estimates of the correlation between a U.S. cross-listing (*Exchange*) and firms' return on assets and sales growth. In line with Charitou and Louca (2009), these estimates show that the average cross-listed firm exhibits a higher performance than control firms (however the effect is statistically significant only for sales growth). In columns (2) and (4), we replace *Exchange* by the two dummy variables *Pos* and *Neg*. Consistent with the learning hypothesis the coefficient estimate on *Pos* is positive and significant for both measures of operating performance. Moreover, it is much greater than the coefficient estimate on *Neg* (about twice as big) and the difference is statistically significant. Interestingly, this difference largely explains the positive effect of a U.S. cross-listing on firm operating performance. All else equal, an average cross-listed firm exhibits an annual growth in sales that is 6.9% higher than that of control firms (see Column (3)).

[23] In the internet Appendix (Section B), we conduct Monte-Carlo simulations that support this claim.

However, this growth rate jumps to 10.9% when cross-listed firms experience a large increase in their investment-to-price sensitivity after cross-listing on a U.S. exchange (Column (4)).

In Panel B of Table 7, we perform a similar analysis but we measure operating performance after year *t* by the average annual values of *ROA* and Δ*Sales* over the next three years. In this way, we account for the fact that investment decisions in a given year may take time to materialize into superior performance. The conclusions are virtually identical to those obtained in Panel A: cross-listed firms that display a relatively strong investment-to-price sensitivity after cross-listing appear to perform better.

4. Self-selection issues and alternative explanations

In Section 3, we have established that cross-listed firms have a higher investment-to-price sensitivity than non-cross-listed firms. Moreover, this difference materializes after the cross-listing date, is persistent, and is stronger for firms with characteristics that are associated with an improvement in the informational content of prices for managers.

All these findings are consistent with the learning hypothesis. However, there could be other, non-mutually exclusive, explanations for these results. Indeed, the decision to cross-list is endogenous, so that the sample of cross-listed firms is not random. As a result, there may be variables, not included as controls in the baseline regression, that simultaneously affect the decision to cross-list (the variable *Exchange*) and firms' investment decisions. This is not a problem if these omitted variables are fixed over time since the results in Table 2 are robust to the inclusion of firm fixed-effects. However, a cross-listing is often associated with important *changes* in firms' characteristics. The higher investment-to-price sensitivity of cross-listed firms may simply reflect in part or in whole the effects of these changes if we fail to control for them.

In this section, we assess this concern. As a first stab, in Section 4.1, we use the two-stage Heckman estimation procedure (as in Doidge, Karolyi and Stulz (2004), Bailey, Karolyi and Salva (2006) or Fernandes and Ferreira (2008)) to gauge the extent to which the estimate of the incremental investment-to-price sensitivity of cross-listed firms (β_2) is affected by self-selection issues. Then, in subsequent sections, we more directly control for additional factors that could explain why cross-listed firms have a higher investment-to-price sensitivity, namely changes in (i) governance, (ii) investors' ability to forecasts future cash-flows, and (iii) access to external capital, induced by a cross-listing.

4.1. Assessing the impact of self-selection

As firms self-select into U.S. cross-listings, some factors may simultaneously affect the decision to cross-list and investment decisions. If we do not control for these factors, the error term in the baseline regression (1) may be correlated with the variable *Exchange*, thereby introducing biases in the estimates of β_1 and β_2. For instance firms could cross-list in anticipation of changes in their characteristics that also affect their investment-to-price sensitivity. Under this scenario, the estimate of the incremental investment-to-price sensitivity for cross-listed firms, β_2, may be biased.

In order to gauge the sensitivity of our estimate for β_2 to this problem, we estimate equation (1) using a standard Heckman (1979) two-stage procedure as it is one way to detect the presence of self-selection and cope with this problem (see Li and Prabhala (2007) for a survey). As a first stage, we model the cross-listing decision as a function of *observable* characteristics (the first-stage "selection" equation) and estimate this model with a Probit regression. Following other studies on cross-listings (e.g., Reese and Weisbach (2002), Doidge, Karolyi and Stulz (2004), Fernandes and Ferreira (2008), and Doidge, Karolyi, Lins, Miller, and Stulz (2009)), we use both firm-level characteristics (size, leverage, annual sales growth, return on assets, foreign sales, the median market-to-book ratio of the firm's industry, and the dependence on external finance of the firm's industry) and country-level variables (the legal origin and the market capitalization of the firm's home country) to explain the cross-listing decision. As shown in the first column of Table 8, the effects of these explanatory variables on the cross-listing decisions are identical to those found in earlier studies. In particular, and in line with Table 2, firms are more likely to cross-list when they are large, grow faster (measured by sales growth), realize a higher fraction of their sales (expressed as a fraction of their total assets) abroad and rely more on external capital (measured as in Rajan and Zingales (1998) by the ratio of capital expenditures minus cash flows from operations to capital expenditures at the industry level).[24]

[Insert Table 8 about here]

The second column of Table 8 reports the estimates for the baseline regression (the "outcome equation") when we add as additional control in this regression the Inverse Mills ratio, that is, a non-linear function of the residual in the first-stage equation. Reassuringly, the coefficient on the Inverse Mills ratio is not significant. As a result, the estimate of β_2 obtained with the Heckman approach is very similar to that obtained in the baseline model (0.063 vs. 0.066) and remains statistically significant (*t*-statistic of 6.64). In the Internet Appendix (Table C5), we show that this conclusion is robust to various specifications of the Probit model of the cross-listing choice (i.e., the first stage of the Heckman procedure).

Hence, our baseline finding is robust to a standard approach to control for self-selection. Of course, the two stage approach used here is not without limitations since it relies on a bivariate normality assumption for residuals in the selection and outcome equations and can be plagued by multicollinearity problems (see Li and Prabhala (2007) for a discussion). Hence, in the rest of the paper, we more directly study and control for other factors that could account for the higher investment-to-price sensitivity of U.S. cross-listed firms.

4.2. Changes in governance environment

Firms that are cross-listed on U.S. exchanges must subject themselves to the regulatory oversight of the SEC and U.S. securities laws, which often involve better legal protection for minority shareholders. Thus, one potential benefit of a U.S. cross-listing is that it "bonds" firms to more effective governance standards (Stulz (1999) or Coffee (1999)). This "bonding hypothesis" has received strong empirical support (see for instance Reese and Weisbach (2002), Doidge, Karolyi and

[26] The measure of external dependence is measured at the industry level for each country in the sample, rather than in the U.S. as in Rajan and Zingales (1998).

Stulz (2004, 2009), Hail and Leuz (2009), Lel and Miller (2009), King and Segal (2009) and Karolyi (2010) for a survey) but is still debated.[25]

Arguably, improvements in the governance of a firm could increase its investment-to-price sensitivity. Indeed, stricter governance should induce managers to make investment choices that are more in line with their firm's fundamentals (e.g. 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)). In addition, managers' investment decisions might be more responsive to stock price movements because these movements constitute one way through which shareholders express their discontent or contentment about the firm's strategy. If the variable *Exchange* only captures this mechanism, cross-listed firms ranking relatively high on measures of governance quality before the cross-listing year should also feature a relatively smaller investment-to-price sensitivity since they experience the smallest improvement in their governance when they cross-list. We study whether this is the case using both country and firm-level tests.

For our country-level tests, we partition firms according to the quality of governance in their country of origin measured by the anti-self-dealing index from Djankov, La Porta, Lopez-de-Silanes, and Shleifer (2008), where a higher value of the index indicates better protection of minority investors. We assign firms into two groups (High and Low) based on whether the governance index for their country of origin is above or below the cross-country median value of this index. Governance rules are also stricter in countries with a common law legal tradition than countries with a civil-law legal tradition (La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1997)). Hence, we also use country legal tradition to partition firms in two groups (the High group featuring firms from countries with a common law legal tradition).[26] Similarly, we partition firms in two groups based on the level of

[25] See Karolyi (2010), Section 3 for a review of dissent empirical findings.

[26] By classifying firms using measures of governance quality for their *country of origin*, we ignore the possibility that a firm may cross-list in another foreign country before cross-listing in the U.S. We do not think this is a problem here because there is no evidence that the bonding hypothesis applies for cross-listings occurring on other markets than the U.S. For instance Doidge, Karolyi and Stulz (2009) do not find evidence of a cross-listing premium for foreign firms cross-listed in the U.K. and conclude that "*firms that list in London do so for reasons other than for a governance benefit*." In addition, Sarkissian and Schill (2010) do not find a stronger cross-listing premium for firms with secondary listings in countries with better investor protection than in their home country (see their Table 8). In any case, the firm-level tests below do not face this classification problem.

economic and financial development of the country for their primary listing (measured by the country's GDP per capital and stock market capitalization, respectively).

For each of these four country characteristics, we re-estimate equation (1) for each group separately using a Seemingly Unrelated Regression (SUR) system. In this way, we can obtain the joint variance-covariance matrix for the β_2 of each group and then test whether this estimate is smaller for the group of cross-listed firms coming from countries ranking high on measures of governance. Panel A of Table 9 presents the results of these tests. The investment-to-price sensitivity of cross-listed firms is higher, whether firms come from countries that rank low or high on each proxy for governance or financial development. However, firms incorporated in countries with better institutions, developed financial markets and high GDP per capita have an investment-to-price sensitivity that is twice as large as other cross-listed firms.[27] For each country characteristic, the difference in the investment-to-price sensitivity of each group of firms is statistically significant and economically large. A one standard deviation increase in Q is associated with an increase in investment that ranges between 2.9% and 4.1% for the groups of cross-listed firms incorporated in countries with low governance standards, whereas it ranges between 6.7% and 8.9% for the cross-listed firms incorporated in countries with high governance standards.[28] Overall, Panel A of Table 9 shows that the association between investment-to-price sensitivity and cross-listing status is higher for firms that are the *less* likely to benefit from an improvement in governance.[29]

[Insert Table 9 about here]

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[27]As for the tests in Section 3.3, we have checked that the conclusions are unchanged when we run the regressions interacting the dummy variable *Exchange* with each measure of governance quality used in this section. For brevity we report the results of this robustness check in the Internet Appendix (see Table C12 in the Internet Appendix).

[28]The standard deviation of Q within each group of firms varies according to the country characteristic used to classify cross-listed firms. We account for this in the calculations. That is, for each group of firms, the effect of a one standard deviation increase in Q is obtained by multiplying the coefficient (β_2) on the interaction between Q and the dummy variable *Exchange* by the standard deviation for Q within this group.

[29] Countries ranking low on the country-level measures of governance or financial development may also have relatively illiquid financial markets. Hence, failing to control for measures of liquidity, may affect our inferences here. However, we have checked, using two country-level measures of market liquidity (the annual turnover ratio and one minus the proportion of zero daily returns over the year in each country (as in Bekaert, Harvey and Lunblad (2007)) that the correlations between our country-level measures of governance and liquidity are low. We also checked that the conclusions obtained from Table 9 persist when we control for market liquidity (see Table C6 in the Internet Appendix). Interestingly, the investment-to-price sensitivity of cross-listed firms coming from countries with relatively more illiquid markets is higher than for cross-listed firms coming from countries with relatively liquid markets. This observation is consistent with the learning hypothesis since illiquidity reduces investors' incentives to acquire private information. Hence, for these firms, the impact of a U.S cross-listing on the number of informed investors and thereby price informativeness should be larger, as we find (see Table C6 in the Internet Appendix).

As noted by Aggarwal, Erel, Stulz and Williamson (2010), governance depends on both country- and firm-level mechanisms. Hence, the country characteristics considered in Panel A may not capture well changes in corporate governance that occur when a firm cross-lists in the U.S. To overcome this limitation, we design a firm-level test using data provided by RiskMetrics (formerly Institutional Shareholder Services, ISS). RiskMetrics compiles governance attributes from firms' annual reports, web sites, and regulatory filings. These attributes are used and described in Doidge, Karolyi and Stulz (2007b), Aggarwal, Erel, Stulz, and Williamson (2010) and Aggarwal, Erel, Ferreira and Matos (2010). They are available for non-U.S firms since 2003 and for a subset of countries (22, including the U.S.). As a result, we can obtain firm-level governance attributes only for a sub-sample of 222 cross-listed firms and 1,045 control firms over the period 2003-2006. We refer to this restricted sample as the "RiskMetrics sample" and provide the geographical breakdown of firms in this sample in the Internet Appendix (Table C10). In contrast to the unrestricted sample, almost all firms in the RiskMetrics sample come from developed countries.

Following Aggarwal, Erel, Ferreira, and Matos (2010), we use 41 firm-level governance attributes to compute a governance index (*GOV*) for each firm in the RiskMetrics sample. These attributes cover four broad categories (see Aggarwal, Erel, Ferreira, and Matos (2010) for a description of these categories and the corresponding attributes): (i) board (24 attributes), (ii) audit (3 attributes), (ii) anti-take-over provisions (six attributes), and (iv) compensation and ownership (8 attributes). For each attribute, we assign a score of one to a firm if it meets minimally acceptable requirements on this attribute and zero otherwise. A firm's governance index is the sum of the score received on each attribute normalized by the number of attributes (41). We then classify cross-listed firms in two groups depending on whether (i) their governance index (*GOV*) or (ii) the average change of this index (ΔGOV) over the period 2003-2006 is above or below the median value over all cross-listed firms. Finally, we run the baseline regression with an interaction term between Q and a dummy variable (*Low* or *High*) for each group of firms. Panel B of Table 9 reports the results for these regressions.

For both classification schemes, the investment-to-price sensitivity of cross-listed firms is higher than for non-cross-listed firms, whether firms rank high or low on their governance index.

Moreover, there is no statistically significant difference in the investment-to-price sensitivity of both groups of firms. In contrast, the last column of Table 9 (Panel B) shows that the group of cross-listed firms exhibiting the *smallest* increase in their governance index has also the highest investment-to-price sensitivity.

Overall, the country-level and firm-level tests in this section point in the same direction. The higher investment-to-price sensitivity of cross-listed firms is either unrelated or negatively related with proxies for improvements in governance that follow a U.S. listing. Hence, the bonding hypothesis cannot be the only mechanism explaining why cross-listed firms exhibit a higher investment-to-price sensitivity than non-cross-listed firms. We cannot exclude however that *both* the learning hypothesis and the bonding hypothesis play a role in this effect since these hypotheses are not mutually exclusive. Indeed, as suggested by Fernandes and Ferreira (2008), an improvement in governance could stimulate investors' incentives to collect private information and can thereby work to make stock prices more informative. Conversely, an improvement in price informativeness may be one channel through which a cross-listing attenuates agency problems between managers and shareholders.[30]

4.3. Investors' ability to forecast future investment

A U.S. cross-listing is associated with a significant improvement in a firm's informational environment (see, for instance, Lang, Lins and Miller (2003) and Bailey, Karolyi and Salva (2006)). Indeed, firms cross-listed in the U.S. have to adopt most U.S. disclosure and reporting requirements (e.g., they must reconcile their income statement with U.S. GAAP). Furthermore, they attract more analyst and media coverage (see Lang, Lins, and Miller (2003)). These improvements in firms' informational environment may provide investors with more public information, allowing them to better evaluate the impact of firms' investment decisions on *future* cash-flows. This effect could mechanically strengthen the correlation between investment and stock prices, even if managers do not use stock prices as a source of information for their investment decisions. If this is the case, we expect

[30] 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 investment-to-price sensitivity of cross-listed firms experiencing the largest improvement in their informational environment to be stronger than that of other cross-listed firms.

We test this proposition using various country- and firm-level variables that proxy for the quality of firms' informational environment. Arguably, the enhancement in firms' informational environment triggered by a U.S. cross-listing is more pronounced for firms coming from countries where disclosure quality is low (see Bailey, Karolyi, and Salva (2006)). Hence, we first partition cross-listed firms in two groups depending on whether the level of disclosure quality in their country of origin, measured either with the disclosure index of Djankov, La Porta, Lopez de Silanes, Shleifer and Vishny (2008) or the disclosure index developed by Jin and Myers (2006), is above or below the median level of disclosure across countries.[31] We then compare the investment-to-price sensitivity of both groups of firms by estimating the baseline regression (1) separately for each group of firms. Results are reported in Panel A of Table 10. Cross-listed firms in both groups have a higher investment-to-price sensitivity than non-cross-listed firms. However, for both indices of disclosures, firms originating from countries with a relatively high disclosure index feature a higher investment-to-price sensitivity. This result suggests that improvement in investors' ability to forecast the cash-flows implications of firms' decisions is not the primary driver behind the higher investment-to-price sensitivity of cross-listed firms.[32]

[Insert Table 10 about here]

In Panel B of Table 10, we confirm this conclusion using firm-level measures of disclosure quality. First, we use the Standard & Poor's (S&P) index of corporate disclosure practices to obtain a measure of disclosure quality for each cross-listed firm in the sample. This index ranges from 0 to 91, with higher values of the index being associated with a higher level of disclosure quality (see Khanna, Palepu, and Srinivasan (2004) or Doidge, Karolyi, and Stulz (2007b) for a detailed description of this

[31] As explained by Jin and Myers (2006), this index is constructed using The Global Competitive Reports for 1999 and 2000. It is only available for 34 out of the 39 countries of the sample. Missing countries are Brazil, Greece, Israel, Italy, and Poland.

[32] As for the tests regarding the effect of governance, we have checked that the conclusions obtained from Table 10 are robust when we control for country-level measures of market liquidity (see Table C8 in the Internet Appendix). Moreover, Table C7 in the Internet Appendix shows that the conclusions obtained from Table 10 are also robust when we control for countries level of economic development.

index). Unfortunately, this index is available only for 147 cross-listed firms in 2000 and 2001. Thus, we estimate the baseline regression only for these cross-listed firms and these two years, replacing the variable *Exchange* by two dummy variables *High* or *Low*, depending on whether the S&P index of disclosure quality for a firm is higher or smaller than the cross-sectional median for this index. In contrast to the country-level tests, we find that cross-listed firms ranking high on the S&P index display a slightly *lower* investment-to-price sensitivity than firms ranking low on this index. However, the difference in the investment-to-price sensitivity of the two groups of firms is not significantly different from zero. This result suggests again that cross-sectional differences in disclosure practices among cross-listed firms do not explain well differences in their investment-to-price sensitivity.

Finally, we use a direct measure of investors' ability to forecast a firm's future cash-flows, namely the precision of analysts' forecasts. Lang, Lins, and Miller (2003) show that a U.S. cross-listing has a positive impact on the accuracy of analysts' forecasts. Following their approach, we measure the accuracy of analysts' forecasts (*Accuracy*) in a given year by taking the annual average of the negative of the absolute forecast error (absolute value of the difference between the estimated earnings and the actual earnings, divided by the actual earnings) using the IBES database. As for the S&P disclosure index, we then split cross-listed firms in two groups each year, depending on whether their analysts' forecast accuracy is above (*High*) or below (*Low*) its median value across all cross-listed firms. As shown in the second column of Panel B in Table 10, there is no significant difference in the investment-to-price sensitivity of cross-listed firms in each group. In the last column of Table 10, we refine this test by focusing on the *change* in forecast accuracy around the cross-listing event. Specifically, in each year, we assign firms to the *High* and the *Low* groups depending on whether they experience an increase or a decrease in analysts forecast accuracy over the three years that follows their cross-listing compared to the three years that precedes it. Again, we find no significant difference in investment-to-price sensitivity between the two groups.

Taken as a whole, the results in Table 10 suggests that there is no systematic relationship between the investment-to-price sensitivity of cross-listed firms and measures of improvements in disclosure quality that follow their U.S. cross-listing. Moreover, if there is a relationship (as in the country-tests), it goes opposite to the idea that firms experiencing the greatest improvement in disclosure quality should also display the highest investment-to-price sensitivity. Thus, it is unlikely that the relatively high investment-to-price sensitivity of cross-listed firms only reflects investors' better ability to forecast future cash-flows, due to increased disclosure, after a U.S. cross-listing.

4.4. Access to external finance

Extant research shows that a U.S. cross-listing triggers enhancements in firms' access to external finance. Cross-listed firms benefit from a lower cost of capital (e.g. Hail and Leuz (2009), or Ball, Hail, and Vasvari (2009)) and raise more external funds after they enter the U.S. markets (e.g. Reese and Weisbach (2002), Lins, Strickland, and Zenner (2005), or Doidge, Karolyi, and Stulz (2009)). Easier access to external capital could in itself strengthen the investment-to-price sensitivity of cross-listed firms by raising investment when new growth opportunities arise on the one hand and stock prices on the other hand, as the latter should reflect the net present value of new growth opportunities. If this mechanism plays a role in our findings, cross-listed firms that benefit the most from an easier access to external capital should also have a higher investment-to-price sensitivity.

We check whether this is the case in three ways. First, we compare the investment-to-price sensitivity of Level 2 and Level 3 ADR programs (treating ordinary listings as Level 3 ADRs). Indeed, *only* firms complying with Level 3 ADRs can issue shares on U.S. exchanges. Hence, firms with Level 3 ADRs (220 firms out of 633 in the sample) have easier access to U.S. capital than firms with Level 2 ADRs.[33] Yet, as shown by the first column of Table 11, the investment-to-price sensitivity of firms with Level 3 ADRs (for which the "*High*" dummy variable in Table 11, Column (1), is set to one) is not significantly higher than that of firms with Level 2 ADRs (for which the "*Low*" dummy variable is set to one). This result does not support the view that the improvement in access to external capital associated with a U.S. cross-listing drives the higher investment-to-price sensitivity of cross-listed firms. In contrast, it is in line with the learning hypothesis since the effect of

[33] Figure C2 in the Internet Appendix confirms that Level 3 firms grow faster than Level 2 firms (after their cross-listing).

a cross-listing on the production of information new to managers should a priori be similar for Level 2 and Level 3 ADRs.[34]

[Insert Table 11 about here]

Reese and Weisbach (2002) show that foreign firms increase both the number and the size of their securities issues in their home markets and other markets after cross-listing on U.S. exchanges. Hence, a U.S. cross-listing eases access to capital for all types of cross-listings, not only Level 3 ADRs. For this reason, as a second test, we consider the *actual* financing activity of cross-listed firms as a proxy for the improvement in access to external capital after a cross-listing. To this end, we gather information about security issuance from the Securities Data Corporation (SDC). As we are interested in changes in issuance activity around the cross-listing date, we focus on issuances within 3 years of the cross-listing date. Moreover, we measure issuance activity by considering all capital raising activity (all public and private equity and debt issued at home, in the U.S., as well as in other markets). We then partition the sample of cross-listed firms in two groups: the group of cross-listed firms that increase their issuance activity after the cross-listing date (296 firms) and the group of cross-listed firms that does not expand its issuance activity after the cross-listing date. As shown by Column (2) of Table 11, firms issuing more capital after cross-listing (for which the "*High*" dummy variable in Table 11, Column (2), is set to one) have a slightly higher investment-to-price sensitivity than other cross-listed firms (0.074 vs. 0.059). However, an *F*-test reveals that this difference is not significant (*p*-value of 0.16).

In Section 3.1, we have shown that the higher investment-to-price sensitivity of cross-listed firms was not simply capturing differences in financial constraints between cross-listed firms and non cross-listed firms. Arguably, by easing access to external capital, a cross-listing may relax financial constraints and change the characteristics that we have used to measure these constraints (e.g., the dividend payout ratio). Hence, we also check whether *changes* in the proxies for financial constraints (size, the Whited and Wu index, payout policy) help explain the link between firms' investment-to-

[34] In support for this conjecture, Table A1 (Column (7)) in the Internet Appendix shows that price informativeness, measured by firm specific return variation, is identical for Level 2 and 3 ADRs.

price sensitivity and their cross-listing status. Columns (3) to (5) in Table 11 reveal that this is not the case.

In all, the results in Table 11 suggest that the magnitude of the investment-to-price sensitivity of cross-listed firms is not related to changes in access to external capital and financial constraints that occur around the cross-listing date. We conclude that these changes cannot alone explain why cross-listed firms have a higher investment-to-price sensitivity.

5. Conclusion

In this paper, we test the hypothesis that a U.S. cross-listing enables managers to obtain more informative feedback from the stock market in order to make value-enhancing investment decisions. Consistent with such a learning hypothesis, we find that the investment of cross-listed firms is significantly more sensitive to their stock price than that of non-cross-listed firms. This finding is economically strong and robust to a host of estimation procedures. In addition, the time-series and cross-sectional patterns in the investment-to-price sensitivity of cross-listed firms are consistent with the learning hypothesis: (i) cross-listed firms feature a higher investment-to-price sensitivity only *after* they cross-list in the U.S. but not before, and (ii) the investment-to-price sensitivity of cross-listed firms is significantly stronger when firms have characteristics that should encourage the production of private information new to managers after they cross-list.

These findings offer a new perspective on cross-listings. They suggest that a cross-listing can enhance firm value by allowing managers to obtain more informative feedback from their stock prices. For U.S. markets, this mechanism could play simultaneously with the reduction in agency costs associated with a U.S. cross-listing. Yet, the learning hypothesis does not specifically apply to U.S. cross-listings. Hence, in future work, it would be interesting to analyze whether this hypothesis explains firms' choices of cross-listing venues globally. Pagano, Roell, and Zechner (2002) find that industry characteristics are a primary driver of cross-listing location, while Sarkissian and Schill (2004) show that geographic, cultural, and economic proximity play a dominant role in the choice of overseas venue. According to the learning hypothesis, managers' need to obtain private information from investors based in their *host* stock market should be another determinant of their cross-listing location.[35] In addition, if the learning hypothesis explains the decision of firms to cross-list on other foreign markets, we would also expect these firms to have a higher investment-to-price sensitivity independently of the geographical location of their foreign listings.

One could also investigate whether the learning hypothesis helps to explain foreign firms' decision to leave the U.S. markets. The number of foreign firms listed in the U.S. that voluntarily deregister from the SEC has spiked in 2007 after the new Exchange Act rule 12h-6 made it easier for firms to deregister (see Doidge, Karolyi and Stulz (2010)). Doidge, Karolyi and Stulz (2010) find that deregistering firms have poor growth opportunities and little need for external capital, as implied by the bonding hypothesis. In addition, the learning hypothesis suggests that firms may delist from U.S. markets because the gain in terms of stock price informativeness has decreased. If this is the case, we expect no significant change in the investment-to-price sensitivity of firms after their delisting. A test of this conjecture is an interesting venue for future research.

Last, the cross-listing literature usually finds that the benefits of a U.S. cross-listing are higher for firms incorporated in countries with poor quality of institutions or in countries that rank low on measures of economic and financial development. In particular, these firms experience larger valuation gains when they cross-list on U.S. exchanges compared to other firms (see, for instance, Doidge, Karolyi and Stulz (2004) and Hail and Leuz (2009)). In contrast, the impact of a cross-listing on the investment-to-price sensitivity appears much higher for firms coming from countries with high governance standards and developed financial markets. This observation suggests that the learning hypothesis may provide an explanation for why firms from countries with similar levels of development and institutional quality as the United States find a U.S cross-listing attractive. A full examination of this conjecture is beyond the scope of this paper but it points to a promising direction for future research.

[35] For instance, European or U.S. firms realizing a large fraction of their sales in Asia could choose to cross-list in Singapore or Hong-Kong to glean private information from Asian retail investors.

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Figure 1: U.S. cross-listing and firms' investment-to-price sensitivity: Year-by-year estimations

This figure reports the results from year-by-year OLS regressions of the association between a U.S. cross-listing and firms' investment-to-price sensitivity (equation (1)). The dark-grey bars correspond to the investment-to-price sensitivity for all firms in the sample (β_0). The light-grey bars correspond to the incremental investment-to-price sensitivity for firms that are cross-listed on a U.S. exchange (β_2). The sample period is from 1989 to 2006. All estimations include country and industry fixed effects.

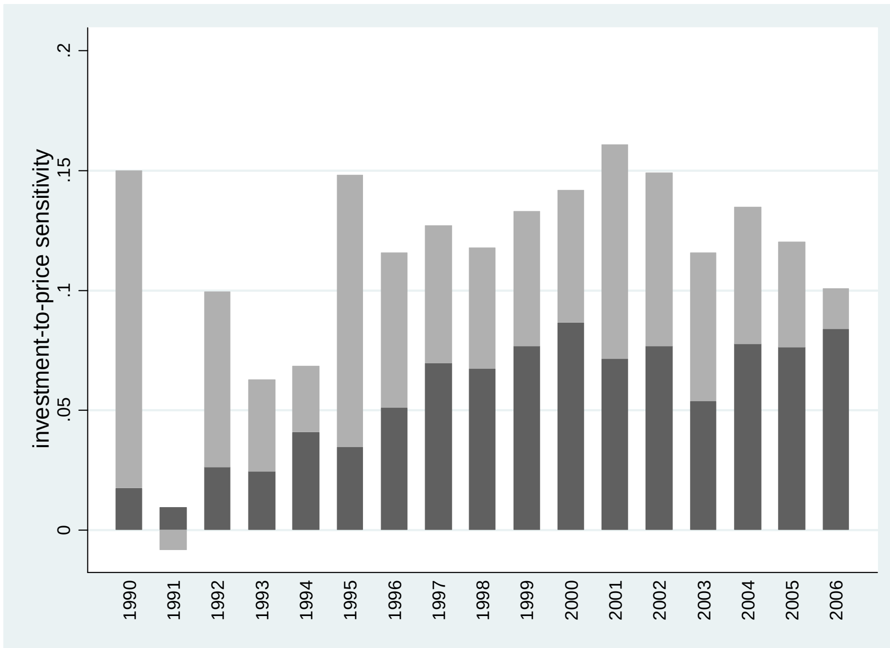

Figure 2: U.S. cross-listing and firms' investment-to-price sensitivity: Country-by-country estimation

This figure reports the results from country-by-country OLS regressions of the association between a U.S. cross-listing and firms' investment-to-price sensitivity (equation (1)). The dark-grey bars correspond to the investment-to-price sensitivity for all firms in the sample (β_0). The light-grey bars correspond to the incremental investment-to-price sensitivity for firms that are cross-listed on a U.S. exchange (β_2). The sample period is from 1989 to 2006. All estimations include year and industry fixed effects.

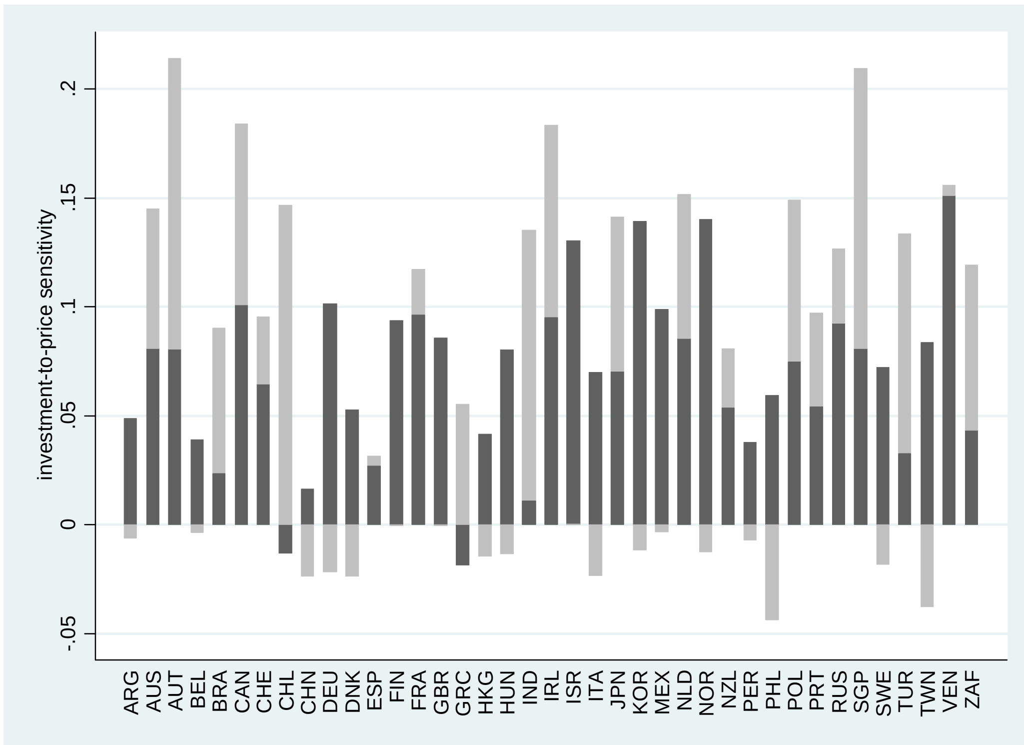

Figure 3: U.S. cross-listing and firms' investment-to-price sensitivity in event time

This figure reports results from an event-time analysis of the association between a U.S. cross-listing and firms' investment-to-price sensitivity. Specifically, we re-estimate the investment model given in equation (1) by replacing the dummy variable *Exchange* with a set of dummy variables that keep track of the number of years until or since the cross-listing date for each cross-listed firm in our sample. These dummy variables are defined over a time window of twenty-years centered on the cross-listing year (year 0) for a given firm. The figure reports the coefficient estimates on the interaction between *Q* and each dummy variable 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 adjusted for heteroskedasticity and within-firm clustering.

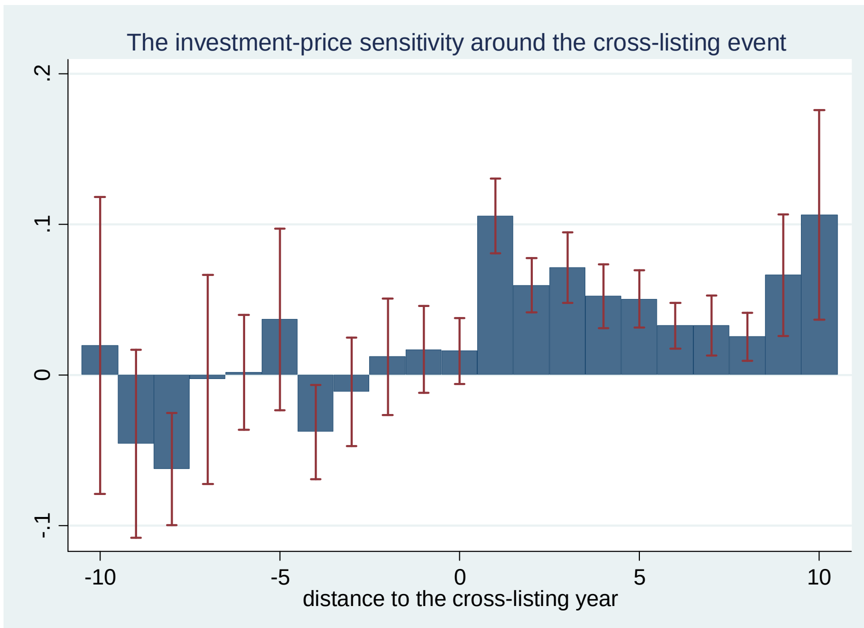

Table 1: Sample Description

This table describes the number of cross-listed firms ("#firms") and the number of firm-year observations ("obs.") in our sample classified by country of origin and type of cross-listing. It also reports the number of firms and firm-year observations in the control sample. Exchange firms are firms that are listed on a U.S. exchange (Level 2 and 3 ADRs and ordinary listings). OTC firms are firms that are listed over-the-counter as Bulletin Board or Pink Sheet issues. Rule 144a firms are firms that are listed via Rule 144a (private placement). Control firms are firms that never had stocks cross-listed in the U.S. The sample period is from 1989 to 2006. Symbol $^{+}$ denotes a country designated as an emerging market by Standard and Poor's Emerging Market Database.

	Exchange		OTC		Rule 144a		Control	
	#Firms	obs.	#Firms	obs.	#Firms	obs.	#Firms	obs.
Argentina+	7	78	1	12	5	57	57	370
Australia	20	184	10	71	3	36	931	4,830
Austria	1	7	3	11	0	0	124	1,020
Belgium	2	26	0	0	0	0	140	1,219
Brazil+	21	223	3	18	3	35	298	1,972
Canada	184	1,590	148	1,265	0	0	1,076	5,476
Chile+	12	163	6	62	1	14	123	1,096
China+	12	86	20	186	4	42	1,510	7,165
Denmark	4	53	2	30	0	0	184	1,768
Finland	3	36	4	53	2	30	162	1,447
France	29	359	25	350	2	25	1,003	7,349
Germany	23	236	30	367	3	41	851	6,948
Greece+	2	15	2	10	3	19	250	826
Hong Kong	11	90	90	989	2	17	638	4,057
Hungary+	1	10	5	48	3	27	29	185
India+	9	94	5	32	45	523	572	3,396
Ireland	7	81	7	60	0	0	77	615
Israel	54	294	4	30	0	0	106	528
Italy	8	97	4	52	6	70	322	2,441
Japan	29	408	42	535	1	8	3,857	28,117
Korea+	7	66	5	32	12	131	960	6213
Mexico+	29	316	23	257	5	66	90	584
Netherland	31	306	19	207	1	4	221	1862
NewZeeland	4	53	8	80	2	26	263	1608
Norway	5	52	1	6	0	0	105	727
Peru+	2	25	3	27	1	14	66	424
Philipines+	3	41	6	80	5	62	122	842
Portugal	2	22	4	46	2	24	79	575
Poland+	1	7	3	26	5	44	172	725
Russia+	6	38	25	127	2	11	40	82
Singapore	6	44	17	210	0	0	568	3,450
South Africa+	11	144	26	295	4	48	376	2,232
Spain	5	60	3	33	1	10	185	1,652
Sweden	9	113	9	115	1	12	363	2,519
Switzerland	8	83	5	76	1	17	240	2,188
Taiwan+	7	75	12	83	38	398	1,380	6,927
Turkey+	1	6	1	5	5	52	190	1151
UK	54	734	76	977	1	8	2,286	16,327
Venezuela+	3	30	8	83	1	8	11	47
All countries	**633**	**6,345**	**665**	**6,946**	**170**	**1,879**	**20,027**	**130,960**

Table 2: Descriptive statistics

This table reports the mean, median and standard deviation of the main variables used in the analysis. All variables are defined in the Appendix. We provide these statistics separately for Exchange, OTC, Rule 144a firms and control firms. Exchange firms are firms that are listed on a U.S. exchange (Level 2 and 3 ADRs and ordinary listings). OTC firms are firms that are listed over-the-counter as Bulletin Board or Pink Sheet issues. Rule 144a firms are firms that are listed via Rule 144a (private placement). Control firms are firms that never had stocks cross-listed in the U.S. The sample period is from 1989 to 2006.

	Exchange			
Variables	Mean	Median	Std Dev	Firm-year
Total Assets (TA)	10,860.489	2,008.245	25,048.135	6,345
Q	1.531	1.136	1.219	6,345
Capex/PPE(t-1)	0.287	0.197	0.354	6,345
CF/TA	0.105	0.122	0.144	6,345
Δ*Sales*	0.179	0.108	0.449	6,086

	OTC			
Variables	Mean	Median	Std Dev	Firm-year
Total Assets (TA)	6,430.973	1,656.225	14,020.308	6,976
Q	1.241	0.972	0.949	6,976
Capex/PPE(t-1)	0.248	0.169	0.331	6,976
CF/TA	0.111	0.116	0.115	6,976
Δ*Sales*	0.147	0.093	0.410	6,293

	Rule 144a			
Variables	Mean	Median	Std Dev	Firm-year
Total Assets (TA)	3,588.729	1,088.569	8,735.453	1,879
Q	1.197	0.926	0.868	1,879
Capex/PPE(t-1)	0.264	0.169	0.340	1,879
CF/TA	0.128	0.124	0.082	1,879
Δ*Sales*	0.169	0.111	0.383	1,838

	Control			
Variables	Mean	Median	Std Dev	Firm-year
Total Assets (TA)	951.151	176.195	4,163.270	130,960
Q	1.121	0.854	0.920	130,960
Capex/PPE(t-1)	0.278	0.158	0.412	130,960
CF/TA	0.095	0.100	0.119	130,960
Δ*Sales*	0.144	0.080	0.419	128,968

Table 3: U.S. cross-listing and firms' investment-to-price sensitivity: Main results

This table presents the estimation of equation (1) with various estimation techniques. The dependent variable is investment, defined as capital expenditures divided by lagged property, plant and equipment (PPE). *Exchange* is a dummy variable that is equal to one if the firm is cross-listed on a U.S. exchange, and zero otherwise. Other explanatory variables are defined in the Appendix. In column (1), we estimate equation (1) with pooled OLS regressions with country, year and industry fixed effects. In column (2), we reestimate equation (1) with firm fixed effects and without country and industry fixed effects. In column (3), we estimate equation (1) using Fama and MacBeth (1973)'s methodology. In column (4), we estimate equation (1) by including country random effects. In columns (5) to (7), we include only cross-listed firms and their matches as defined in Section 3. In column (8), we include only cross-listing firms (before and after they cross-list). The sample period is from 1989 to 2006. The standard errors used to compute the *t*-statistics (in brackets) are adjusted for heteroskedasticity and within-firm clustering. Symbols ** and * indicate statistical significance at the 1% and 5% levels, respectively.

	Investment (capex over lagged PPE)							
	Baseline	Firm FE	F-M	Country RE	Match Size	Match WW	Match Div	Cross-listings
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Exchange	-0.082**	-0.063**	-0.047**	-0.051**	-0.100**	-0.091**	-0.056**	-0.109**
	[6.75]	[3.19]	[4.69]	[5.33]	[7.84]	[6.52]	[4.28]	[5.26]
Q	0.066**	0.051**	0.057**	0.076**	0.061**	0.061**	0.076**	0.726**
	[34.04]	[19.74]	[8.28]	[69.01]	[9.70]	[8.97]	[11.53]	[5.95]
Q × Exchange	0.066**	0.057**	0.060**	0.055**	0.073**	0.063**	0.056**	0.063**
	[7.26]	[5.06]	[7.74]	[10.08]	[7.51]	[5.87]	[5.60]	[4.79]
CF/TA	0.312**	0.425**	0.425**	0.311**	0.241**	0.438**	0.278**	0.169**
	[20.77]	[22.07]	[9.87]	[40.23]	[5.34]	[8.76]	[6.74]	[3.01]
log(TA)	-0.024**	-0.076**	-0.028**	-0.028**	-0.025**	-0.031**	-0.030**	-0.031**
	[24.44]	[16.81]	[10.41]	[43.86]	[9.93]	[12.06]	[10.84]	[6.29]
Country FE	Yes	No	Yes	No	Yes	Yes	Yes	Yes
Industry FE	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
Firm FE	No	Yes	No	No	No	No	No	No
# Firm-years	131,463	131,479	131,479	131,479	11,404	10,938	11,320	5,645
R^2/*Pseudo* R^2	0.15	0.49	0.09	*0.2*	0.22	0.22	0.23	0.31

Table 4: U.S. cross-listing and firms' investment-to-price sensitivity: Robustness

In this table we estimate equation (1) using various measures of investment with pooled OLS regressions. In columns (1) and (2) investment is defined as capital expenditures divided by lagged and contemporaneous total assets, respectively. In columns (3) investment is defined as capital expenditures plus R&D expenses divided by lagged PPE. In columns (4) and (5) investment is defined as capital expenditures plus R&D expenses divided by lagged and contemporaneous total assets, respectively. Finally, in column (6) investment is defined as the annual change in total assets divided by lagged total assets. Across all specifications, *Exchange* is a dummy variable that is equal to one if the firm is cross-listed on a U.S. exchange, and zero otherwise. All other explanatory variables are defined in the Appendix. The sample period is from 1989 to 2006. All estimations include country, year and industry fixed effects. The standard errors used to compute the *t*-statistics (in brackets) are adjusted for heteroskedasticity and within-firm clustering. Symbols ** and * indicate statistical significance at the 1% and 5% levels, respectively.

	Investment (various measures)					
	(1)	(2)	(3)	(4)	(5)	(6)
Exchange	-0.016**	-0.009**	-0.171**	-0.016**	-0.004	-0.042**
	[4.23]	[3.25]	[3.70]	[3.20]	[0.98]	[3.33]
Q	0.007**	0.004**	0.176**	0.015**	0.010**	0.050**
	[15.52]	[11.56]	[26.50]	[22.67]	[20.03]	[28.39]
Q × *Exchange*	0.011**	0.006**	0.247**	0.022**	0.011**	0.038**
	[4.05]	[3.07]	[5.62]	[5.65]	[4.13]	[3.73]
CF/ TA	0.157**	0.089**	-0.309**	0.123**	0.049**	0.859**
	[44.61]	[34.88]	[6.45]	[25.80]	[13.28]	[68.69]
log(TA)	-0.002**	-0.000*	-0.045**	-0.003**	-0.001**	-0.019**
	[9.32]	[2.00]	[20.81]	[10.37]	[3.34]	[29.20]
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	136,899	136,899	131,463	136,899	136,899	149,353
R^2	0.22	0.20	0.17	0.20	0.17	0.23

Table 5: Managerial learning, U.S. cross-listing and firms' investment-to-price sensitivity sensitivity

In this table we estimate investment equation (1), with pooled OLS regressions, adding two interaction terms between Q and two dummy variables *Low* and *High*. The dependent variable is investment, defined as capital expenditures divided by lagged property, plant and equipment (PPE). *Exchange* is a dummy variable that is equal to one if the firm is cross-listed on a U.S. exchange, and zero otherwise. *Low* (resp. *High*) is a dummy variable equal to one in year *t* for a cross-listed firm if the value of a proxy that measures the informational content of stocks prices for managers is below (resp. above) the median value of this proxy for all cross-listed firms. We use seven different firm-level variables as proxies of the informational content of stock prices for managers of cross-listed firms: (1) ψ is firm-specific return variation; (2) *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; (3) *Foreign sales* measures the fraction of sales realized abroad; (4) *BKL* is the "U.S. information factor" developed by Baruch et al. (2007); (5) *U.S. trading* is the fraction of trading that takes place on U.S. exchanges; (6) *Coverage* is the average number of analysts issuing forecasts over a given year; (7) *Inst.Holdings* is the fraction of U.S. institutional holdings to total shares outstanding. In the last line of the table, we report the p-value of a *F*-test that evaluates whether the coefficients on *Q* × *Low* and *Q* × *High* are equal. The sample period is from 1989 to 2006. All other explanatory variables are defined in the Appendix. All estimations include country, year and industry fixed effects. The standard errors used to compute the *t*-statistics (in brackets) are adjusted for heteroskedasticity and within-firm clustering. Symbols ** and * indicate statistical significance at the 1% and 5% levels, respectively.

	Investment (capex over lagged PPE)						
	ψ	U.S. Rel.Ind.	Foreign Sales	BKL	U.S. Trading	Coverage	Ins. Holdings
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Exchange	-0.078**	-0.077**	-0.079**	-0.078**	-0.042**	-0.097**	-0.023
	[6.46]	[6.79]	[6.81]	[6.24]	[3.37]	[6.61]	[1.76]
Q	0.065**	0.066**	0.065**	0.066**	0.065**	0.065**	0.065**
	[34.02]	[34.02]	[34.07]	[33.94]	[33.52]	[33.72]	[33.13]
Q × *Low* (a)	0.056**	0.055**	0.057**	0.056**	0.021*	0.080**	0.004
	[5.62]	[6.02]	[6.71]	[5.44]	[2.08]	[6.09]	[0.55]
Q × *High* (b)	0.071**	0.077**	0.076**	0.070**	0.040**	0.035**	0.038**
	[6.87]	[7.42]	[6.46]	[6.94]	[4.62]	[3.18]	[2.85]
CF/ TA	0.312**	0.312**	0.312**	0.310**	0.318**	0.316**	0.321**
	[20.74]	[20.71]	[20.76]	[20.57]	[20.87]	[20.77]	[20.72]
log(TA)	-0.024**	-0.024**	-0.024**	-0.024**	-0.024**	-0.024**	-0.024**
	[8.39]	[24.34]	[24.27]	[24.32]	[23.94]	[24.19]	[23.50]
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
# Firm-years	131,324	131,469	131,463	131,116	130,199	130,588	127,703
R^2	0.15	0.15	0.15	0.15	0.15	0.15	0.15
(a)=(b) (*p*-val.)	0.08	0.02	0.05	0.07	0.01	0	0.01

Table 6: U.S. cross-listing and firms' investment-to-price sensitivity: Cross-listing types

In this table we estimate investment equation (1) adding two interaction terms between Q and two dummy variables *OTC* and *144a* to assess whether the effect of a cross-listing on the investment-to-price sensitivity depends on the cross-listing type. The dependent variable is investment, defined as capital expenditures divided by lagged property, plant and equipment (PPE). *Exchange* is a dummy variable that is equal to one if a firm is cross-listed on a U.S. exchange and zero otherwise. *OTC* is a dummy variable that is equal to one if a firm is cross-listed on the U.S. OTC market and zero otherwise. *144a* is a dummy variable that is equal to one if a firm is cross-listed in the U.S. via a Rule 144a placement. All other variables are defined in the Appendix. In column (1), we estimate equation (1) with pooled OLS regressions with country, year and industry fixed effects. In column (2), we reestimate equation (1) with firm fixed effects and without country and industry fixed effects. In column (3), we estimate equation (1) using Fama and MacBeth (1973)'s methodology. In column (4), we estimate equation (1) by including country random effects. In columns (5) to (7), we include only cross-listed firms and their matches as defined in Section 3. In column (8), we include only cross-listing firms (before and after they cross-list).The sample period is from 1989 to 2006. We report *F*-tests that evaluate whether the coefficients on *Q×Exchange*, *Q×OTC*, or *Q×144a* are equal. The standard errors used to compute the *t*-statistics (in brackets) are adjusted for heteroskedasticity and within-firm clustering. Symbols ** and * indicate statistical significance at the 1% and 5% levels, respectively.

	Investment (capex over lagged PPE)							
	Baseline	Firm FE	F-M	Country RE	Match Size	Match WW	Match Div	Cross-listings
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Exchange	-0.082**	-0.065**	-0.048**	-0.051**	-0.088**	-0.094**	-0.074**	-0.115**
	[6.82]	[3.29]	[4.81]	[5.43]	[7.43]	[7.45]	[6.20]	[7.13]
OTC	-0.027**	-0.044*	0.002	-0.021	-0.041**	-0.051**	-0.031**	-0.085**
	[2.60]	[2.15]	[0.03]	[1.72]	[3.59]	[4.37]	[2.77]	[4.82]
144a	0.031*	-0.032	-0.032	0.038*	0.014	0.001	0.031*	-0.025
	[2.07]	[0.70]	[0.58]	[2.45]	[0.92]	[0.11]	[2.02]	[1.23]
Q	0.066**	0.050**	0.057**	0.077**	0.065**	0.056**	0.062**	0.063**
	[34.65]	[19.59]	[8.16]	[70.51]	[13.33]	[11.09]	[13.47]	[7.35]
Q × *Exchange* (a)	0.065**	0.058**	0.059**	0.054**	0.064**	0.067**	0.067**	0.066**
	[7.19]	[5.25]	[7.51]	[10.03]	[6.94]	[6.76]	[7.24]	[60.9]
Q × *OTC* (b)	0.019*	0.038**	-0.003	0.012	0.022*	0.024**	0.024**	0.031**
	[2.19]	[3.09]	[0.34]	[1.29]	[2.34]	[2.57]	[2.59]	[2.69]
Q × *144a* (c)	-0.001	0.005	0.007	-0.008	-0.006	-0.001	-0.001	-0.001
	[0.13]	[0.24]	[0.92]	[0.73]	[0.55]	[0.09]	[0.06]	[0.12]
CF/TA	0.315**	0.426**	0.429**	0.314**	0.332**	0.428**	0.340**	0.274**
	[21.34]	[22.61]	[10.04]	[41.59]	[9.21]	[11.59]	[10.97]	[6.44]
log(TA)	-0.024**	-0.076**	-0.027**	-0.027**	-0.026**	-0.026**	-0.026**	-0.033**
	[24.91]	[17.15]	[10.79]	[44.92]	[13.76]	[14.09]	[13.48]	[9.68]
Country FE	Yes	No	Yes	No	Yes	Yes	Yes	Yes
Industry FE	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
Firm FE	No	Yes	No	No	No	No	No	No
# Firm-years	137,142	137,158	137,158	137,158	22,768	22,202	22,767	11,384
R^2	0.15	0.49	0.09	0.21	0.19	0.19	0.19	0.24
(a)=(b) (p-val.)	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00
(a)=(c) (p-val.)	0.00	0.03	0.01	0.00	0.00	0.00	0.00	0.00
(b)=(c) (p-val.)	0.16	0.21	0.36	0.16	0.04	0.07	0.08	0.00

Table 7: Investment-to-price sensitivity and ex-post performance

This table presents the results of OLS regressions of the relationship between a U.S. cross-listing and firms' ex-post performance. Performance is defined as one year ahead (three years ahead) return on asset (*ROA*) or sales growth (Δ*Sales*). *Exchange* 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 is equal to one if a cross-listed firm experiences a relatively large (small) increase in its investment-to-price sensitivity after cross-listing in the U.S.. The text and the Internet Appendix details the computation of these two dummy variables. All other variables are defined in the Appendix. The sample period is from 1989 to 2006. We report the *F*-tests that evaluate whether the coefficients on *Pos* and *Neg* are equal. All estimations include year and firm fixed effects. The standard errors used to compute the *t*-statistics (in brackets) are adjusted for heteroskedasticity and within-firm clustering. Symbols ** and * indicate statistical significance at the 1% and 5% levels, respectively.

	Panel A: Performance (next year)				**Panel B: Performance (average of next 3 years)**			
	ROA		Δ*Sales*		*ROA*		Δ*Sales*	
	(1)		(2)		(3)		(4)	
Exchange	0.012		0.069**		0.012		0.037*	
	[1.94]		[3.09]		[1.82]		[2.15]	
Pos (a)		0.032**		0.109**		0.017*		0.064**
		[4.45]		[4.03]		[2.32]		[3.27]
Neg (b)		0.002		0.048*		0.009		0.022
		[0.26]		[2.07]		[1.40]		[1.30]
log(TA)	-0.030**	-0.030**	-0.145**	-0.145**	-0.036**	-0.036**	-0.175**	-0.175**
	[20.94]	[20.97]	[27.21]	[27.22]	[24.03]	[24.03]	[39.62]	[39.65]
Debt / TA	-0.009	-0.009	-0.028	-0.027	0.037**	0.037**	0.011	0.011
	[1.86]	[1.77]	[1.54]	[1.49]	[7.69]	[7.72]	[0.78]	[0.83]
Cash /TA	0.072**	0.071**	0.149**	0.149**	0.034**	0.034**	0.168**	0.168**
	[9.78]	[9.74]	[5.45]	[5.43]	[4.61]	[4.60]	[8.33]	[8.31]
PPE /TA	0.005	0.005	-0.023	-0.023	0.022**	0.022**	-0.008	-0.008
	[0.74]	[0.75]	[0.86]	[0.85]	[3.45]	[3.45]	[0.38]	[0.38]
Firm/Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
# Firm-years	131,153	131,153	130,089	130,089	124,799	124,799	126,545	126,545
R^2	0.56	0.56	0.35	0.35	0.74	0.74	0.60	0.60
(a) = (b) (*p*-val.)		0.00		0.00		0.05		0.00

Table 8: U.S. cross-listing and firms' investment-to-price sensitivity: Self-selection

In this table we estimate the investment equation (1) with the Heckman (1979) two-stage estimation procedure. The first column reports the results of the (first-stage) probit estimation where the dependent variable is *Exchange*, 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 estimates of equation (1) in which the dependent variable is investment defined as capital expenditures divided by lagged property, plant and equipment (PPE) and in which we include the *Inverse Mills Ratio* computed using the first-stage probit estimates to account for self-selection. All other explanatory variables are defined the Appendix. The sample period is from 1989 to 2006. The standard errors used to compute the *t*-statistics (in brackets) are adjusted for heteroskedasticity and within-firm clustering. Symbols ** and * indicate statistical significance at the 1% and 5% levels, respectively.

	Heckman	
	(First-stage) Probit	Second stage
Exchange		-0.087**
		[4.25]
Q		0.064**
		[32.61]
Q × Exchange		0.063**
		[6.64]
CF / TA		0.348**
		[23.14]
log(TA)	0.359**	-0.023**
	[64.05]	[20.83]
Debt / TA	-0.197**	
	[3.05]	
External Dependence	0.002*	
	[2.37]	
Δ*Sales*	0.057**	
	[2.69]	
Median Industry Q	-3.894**	
	[3.68]	
ROA	-0.348**	
	[5.07]	
Foreign Sales	1.101**	
	[39.07]	
Common Law	0.790**	
	[35.96]	
Market Capitalization	-0.360**	
	[20.00]	
Inverse Mills Ratio		0.007
		[0.77]
Industry and Year FE	Yes	Yes
# Firm-years	156,982	131,221
PseudoR2/R2	*0.41*	0.15

Table 9: Alternative explanation: Change in governance quality

This table presents estimates of the link between a U.S. cross-listing and firms' investment-to-price sensitivity (equation (1)) for different levels of governance quality. The dependent variable is investment, defined as capital expenditures divided by lagged property, plant and equipment (PPE). *Exchange* is a dummy variable that is equal to one if the firm is cross-listed on a U.S. exchange, and zero otherwise. In **Panel A**, we partition countries based on four proxies for governance quality and financial development: the Anti-self-dealing and legal origin indices from Djankov, La Porta, Lopez-de-Silanes, Shleifer, and Vishny (2008), GDP per capital and market capitalization from the Worldbank. For each variable, we assign a country to the *Low* group if the value of the proxy for this country us below the sample median for this proxy and to the *High* group otherwise. We estimate the investment equation (1) via a seemingly unrelated regression (SUR) system that combines the *Low* and *High*. The SUR estimation provides the joint-variance-covariance matrix that we use to test the cross-equation restrictions that appear at the bottom of the table (we report the p-value of these tests). The sample period is from 1989 to 2006. In **Panel B**, we partition cross-listed firms using firm-level measures from the RiskMetrics database. *GOV* is a governance index built using 41 governance attributes from the RiskMetrics database (see the text). Δ*GOV* represents the average change of *GOV* over the period 2003-2006. *Low* (resp. *High*) is a dummy variable equal to one in year *t* for a cross-listed firm if the value of *GOV* or Δ*GOV* is below (resp. above) the median value of this proxy for all cross-listed firms. In the last line of the table, we report the p-value of an *F*-test that evaluates whether the coefficients on $Q \times Low$ and $Q \times High$ are equal. The sample period is from 2003 to 2006. All explanatory variables are defined in the Appendix. All estimations include country, year and industry fixed-effects as well as *CF/TA* and *log(TA)* as control variables. The standard errors used to compute the *t*-statistics (in brackets) are adjusted for heteroskedasticity and within-firm clustering. ** and * indicate statistical significance at the 1% and 5% levels, respectively.

	Panel A: Country-level tests								**Panel B: Firm-level tests**	
	Anti-Self-Dealing		Legal Origin		GDP per capita		Market Capitalization		GOV	ΔGOV
	Low (a)	High (b)	Low (a)	High (b)	Low (a)	High (b)	Low (a)	High (b)		
Exchange	-0.048**	-0.099**	-0.055**	-0.098**	-0.067**	-0.082**	-0.055**	-0.089**	-0.094**	-0.080**
	[3.27]	[7.92]	[4.16]	[6.79]	[3.84]	[7.39]	[3.75]	[7.03]	[2.97]	[2.71]
Q	0.066**	0.064**	0.061**	0.066**	0.041**	0.071**	0.056**	0.070**	0.047**	0.050**
	[37.91]	[42.27]	[42.59]	[34.83]	[18.30]	[53.65]	[34.20]	[43.86]	[5.05]	[5.44]
$Q \times$ *Exchange*	0.032**	0.080**	0.040**	0.081**	0.043**	0.068**	0.036**	0.075**		
	[3.27]	[12.17]	[4.51]	[11.02]	[3.84]	[11.03]	[3.72]	[11.02]		
$Q \times$ *Low* (a)									0.060*	0.086*
									[2.40]	[2.82]
$Q \times$ *High* (b)									0.075**	0.044*
									[2.82]	[2.00]
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country/industry/ year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
# Firm-years	63,749	67,056	86,559	44,246	32,781	98,688	61,470	69,335	3,799	3,799
R^2	0.18	0.13	0.17	0.13	0.13	0.16	0.16	0.15	0.22	0.22
Q: (a) = (b)	0.43		0.14		0.00		0.00			
$Q \times$ *Exchange*: (a) = (b)	0.00		0.00		0.06		0.00			
(a) = (b)									0.37	0.04

Table 10: Alternative explanation: Change in investor's ability to predict future investment

This table of the link between a U.S. cross-listing and firms' investment-to-price sensitivity (equation (1)) for different measures of information quality. The dependent variable is investment, defined as capital expenditures divided by lagged property, plant and equipment (PPE). *Exchange* is a dummy variable that is equal to one if the firm is cross-listed on a U.S. exchange, and zero otherwise. In **Panel A**, we partition countries based on two indices of disclosure quality: the disclosure index from Djankov, La Porta, Lopez-de-Silanes, Shleifer, and Vishny (2008) (Disclosure DLSV) and the disclosure index from Lin and Myers (2007) (Disclosure (JM). For each index, we assign a country to the *Low* group if it has a value below the sample median for this variable and to the *High* group otherwise. We estimate the investment equation (1) via a seemingly unrelated regression (SUR) system that combines the *Low* and *High*. The SUR estimation provides the joint-variance-covariance matrix that we use to test the cross-equation restrictions that appear in the two last lines of the table (we report the p-value of these tests). The sample period is from 1989 to 2006. In **Panel B**, we partition cross-listed firms based on three firm-level proxy for their informational environment. The *S&P Score* measures corporate disclosure practice to measure firm-level disclosure quality from Standard & Poor's (available only in 2000 or 2001). *Accuracy* measures the precision of analyst forecasts. *ΔAccuracy* measures the change in forecast accuracy around the cross-listing event (three years before and after the cross-listing). In the last line of the table, we report the p-value of an *F*-test that evaluates whether the coefficients on $Q \times Low$ and $Q \times High$ are equal. All explanatory variables are defined in the Appendix. All estimations include country, year and industry fixed-effects as well as *CF/TA* and *log(TA)* as control variables. The standard errors used to compute the *t*-statistics (in brackets) are adjusted for heteroskedasticity and within-firm clustering. ** and * indicate statistical significance at the 1% and 5% levels, respectively.

	Panel A: Country-level tests				**Panel B: Firm-level tests**		
	Disclosure (DLSW)		Disclosure (JM)		S&P Score	Accuracy	ΔAccuracy
	Low (a)	High (b)	Low (a)	High (b)			
Exchange	-0.050**	-0.095**	-0.059**	-0.082**	-0.117**	-0.069**	-0.094**
	[5.07]	[7.35]	[3.80]	[6.19]	[3.46]	[4.85]	[3.45]
Q	0.066**	0.069**	0.048**	0.071**	0.058**	0.065**	0.064**
	[27.51]	[45.21]	[31.77]	[42.72]	[19.52]	[33.71]	[33.20]
$Q \times$ *Exchange*	0.039**	0.076**	0.045**	0.069**			
	[4.72]	[11.19]	[4.19]	[9.74]			
$Q \times$ *Low* (a)					0.072**	0.067**	0.050*
					[4.44]	[5.64]	[2.19]
$Q \times$ *High* (b)					0.060*	0.045**	0.082**
					[2.02]	[4.07]	[2.79]
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country/industry/ year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
# Firm-years	61,167	63,401	57,657	68,028	19,162	130,323	127,274
R^2	0.16	0.15	0.14	0.14	0.21	0.15	0.14
Q: (a) = (b)	0.24		0.01				
$Q \times$ *Exchange*: (a) = (b)	0.00		0.03				
(a) = (b)					0.57	0.11	0.16

Table 11: Alternative explanation: Change in firms' access to external finance

In this table we estimate the investment equation (1) with pooled OLS regressions adding interaction terms between Q and two dummy variables *High* and *Low* that measure the change in the intensity of financial constraints for cross-listed firms. The dependent variable is investment, defined as capital expenditures divided by lagged property, plant and equipment (PPE). *Exchange* is a dummy variable that is equal to one if the firm is cross-listed on a U.S. exchange, and zero otherwise. In column (1), *High* is a dummy variable equals to one for Level 3 ADR firms. In column (2), firms that do augment their capital issuance around the cross-listing are in the *High* group. In column (3), firms whose size increases are in the *Low* group. In column (4), firms whose Whited and Wu index decreases are in the Low group. In column (5), firms whose dividend payout increases are in the *High* group. In the last line of the table, we report the p-value of a *F*-test that evaluates whether the coefficients on *Q* × *High* and *Q* × *Low* are equal. All variables are defined in the Appendix. All estimations include country, year and industry fixed effects. The standard errors used to compute the *t*-statistics (in brackets) are adjusted for heteroskedasticity and within-firm clustering. ** and * indicate statistical significance at the 1% and 5% levels, respectively.

	Investment (capex over lagged PPE)				
	Lev. 2 vs 3	Cap. Raising	ΔSize	ΔWW	ΔDIV
	(1)	(2)	(3)	(4)	(5)
Exchange	-0.079**	-0.082**	-0.102**	-0.102**	-0.096**
	[6.79]	[6.64]	[7.40]	[7.42]	[7.12]
Q	0.065**	0.065**	0.065**	0.065**	0.065**
	[34.07]	[34.06]	[33.71]	[33.71]	[33.69]
Q × *Low* (a)	0.064**	0.059**	0.074**	0.061**	0.058**
	[7.11]	[6.47]	[6.56]	[3.36]	[5.23]
Q × *High* (b)	0.074**	0.074**	0.063**	0.074**	0.073**
	[4.45]	[5.97]	[4.49]	[6.53]	[6.25]
Control variables	Yes	Yes	Yes	Yes	Yes
Country/industry/ year FE	Yes	Yes	Yes	Yes	Yes
# Firm-years	131,363	131,363	129,271	129,271	129,271
R^2	0.15	0.15	0.15	0.15	0.14
F-test: (a)-(b) (*p*-val.)	0.49	0.16	0.38	0.36	0.18

Appendix: Definitions and sources of the variables

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

Variables	Definition	Source
<u>Firm-level variables</u>		
Exchange	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 Section 2)
OTC	Dummy variable that takes one if a firm is cross-listed over-the-counter (level 1 ADR) and zero otherwise	Various sources (See Section 2)
144a	Dummy variable that takes one if a firm is cross-listed via a Rule 144a (Private placement) and zero otherwise	Various sources (See Section 2)
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
R&D	R&D expenses. Set to zero if missing	Worldscope
Debt	Total debt (long term plus short term)	Worldscope
Cash	Sum of cash and short term investments	Worldscope
ROA	Sum of earnings before interest, taxes, depreciation, and amortization over total assets	Worldscope
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
BKL	"U.S. information factor" developed by Baruch, Karolyi, and Lemmon (2007)	Datastream and CRSP
Coverage	Number of analysts issuing at least one earnings forecasts over the year	I/B/E/S International summary files
ψ	Firm specific return variation computed as $\psi_{i,t}$ = ln[(1-	Datastream

	$R^2_{i,t}$)/ $R^2_{i,t}$], 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.	
GOV	Governance index based on 41 attributes on board, audit, anti-takeover, compensation and ownership developed by Aggarwal, Erel, Stulz, and Williamson (2009)	RiskMetrics (sample restricted to the 2003-2006 period)
Δ*GOV*	Average annual change in *GOV* for cross-listed firms over the 2003-2006 period	
S&P Score	Index that counts whether a firm discloses information that would be relevant to investors (ranges from 0 to 91)	Standard & Poor's (sample restricted to the 2000-2001 period)
Accuracy	Annual average of the negative of the absolute forecast error (absolute value of the difference between the estimated earnings and the actual earnings, divided by the actual earnings)	I/B/E/S International detail files
Δ*Accuracy*	Difference between the average *Accuracy* over the three years that follow the cross-listing and the average *Accuracy* over the three years that precede it.	I/B/E/S International detail files
Capital Raising	Difference between to total capital raised over the three years that follow the cross-listing (including all public and private equity and debt issued at home, in the U.S., as well as in other markets) and the total capital raised over the three years that precede it.	Securities Data Corporation (SDC)
WW	Index measuring the severity of financial constraints developed by Whited and Wu (2006)	Worldscope
DIV	Dummy variable that equals one if a firm pays dividend and zero otherwise	Worldscope
Industry-level variables		
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
Median Industry Q	(Country) Industry (2digit SIC code) median of *Q*	Worldscope
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
Country-level variables		
Common Law	Dummy variable that equals one for common law countries and zero otherwise	Djankov et al. (2008)
Market Capitalization	Total market capitalization	The Worldbank

Anti-Self-Dealing	Index measuring shareholder rights. The index ranges from 0 to 6.	Djankov et al. (2008)
Disclosure (DLSV)	Index measuring the reliability of accounting numbers. The index ranges from 0 to 90.	Djankov et al. (2008)
Disclosure (LM)	Index measure the quality of firms' disclosure	Lin and Myers (2007)
GDP per capita	Domestic growth domestic product per capital	The Worldbank