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Abstract

We analyze the IPO discount and the after-market price differential for a sample of international IPOs. We uncover several results: The home and U.S. are greater for emerging market IPOs and those underwritten by reputed underwriters. The US discount is larger for firms traded on Nasdaq as opposed to NYSE. Further, the price differential across the domestic market and the after-market in the U.S. persists, on average, for up to 90 days after the initial offering. The absolute price differential is larger for emerging market offerings than for those from developed countries, and for high tech IPOs relative to IPOs of other industries. We also document differential market factor loadings on a U.S stock index and on a domestic stock index. U.S. returns are more highly correlated with the U.S stock index, whereas home returns are more highly correlated with home market returns. The differing market betas for securities that are claims to essentially identical cash flow streams indicate evidence of mispricing: not all information flows freely across the two markets.

The January 2000 edition of the Economist reported that the ADRs of Taiwan Semiconductor were worth 70% more than they were worth in their home country.[1] The article also reported that this deviation between the home price and the ADR price generally was observed only for stocks from emerging markets, and not for stocks from developed markets. In this study, we examine the phenomenon described in the Economist article for foreign firms that went public in the US market. We examine three pricing issues surrounding foreign IPOs: first, the relationship between the IPO offer price in the U.S and the contemporaneous price in the home country; second, the relationship between the IPO offer price and the price at close on the first day of trading in the U.S; and finally, the relationship between the ADR price and the price in the home country in the period following initial listing in the U.S.

A study of the pricing characteristics of international IPOs is interesting from three perspectives. First, we can study how different degrees of market segmentation affect the relation between the price of a stock in its home market and the price of its ADR in the U.S market. Second, foreign IPOs allow us to test the predictions of the model developed by Subrahmanyam and Titman (1999) (ST), who predict that going public is more favorable for firms with greater uncertainty about product demand, than for firms with greater uncertainty about managerial skills. Lastly, international IPOs allow us to address whether the factors that affect domestic IPOs are the same as those that affect the pricing of foreign IPOs.

Prior studies of market segmentation include studies that test different specifications of asset pricing models (see Bodurtha, Cho, and Senbet (1989); and Heston, Rouwenhorst and Wessels (1992)) and studies that examine price effects of ADR

[1] 'Finance and Economics: Over the Odds', The Economist, January 15, 2000.

listing. The latter set of studies are an indirect test of market segmentation as they rely upon the impact of an ADR listing on the price of the stock in the home market. Foerster and Karolyi (1999) examine stock returns of firms in the home country on the date when the ADR is listed in the U.S and find that returns in the home country around the listing date are positive, but are weakly significant. A second study by Miller (1999) examines stock returns in the home country around the announcement of an ADR listing, rather than around the listing date, and finds that stock returns are positive and statistically significant.

A complicating factor in the study of how market segmentation affects pricing around an ADR listing is that many of these ADR listings are accompanied by a public equity issue. It is well known that in the US market, a public equity issue is associated with a statistically significant negative abnormal announcement return. Therefore, the price impact of an ADR listing incorporates not only the effects of market segmentation, but also incorporates the information conveyed by a public equity issue.

There has been very little study of foreign IPOs that precede an ADR listing. Exceptions are two recent studies by Chaplinsky and Ramchand (1999) and Bruner, Chaplinksy and Ramchand (2000). These studies focus on international IPOs by firms going public in the home market and in the US market simultaneously. They find that foreign IPOs are underpriced to the same extent or to a lesser degree than domestic (US) IPOs. In contrast to these studies, we include IPOs of firms that already trade publicly in the home market.

We document that the average home discount, which is defined as the difference between the contemporaneous dollar price in the home market and the IPO offer price in

the US market expressed as a percent of the IPO price, is 275%. The median discount is considerably lower (1.0%). There is wide cross-sectional dispersion in the median discount, with the discount being higher among firms from emerging markets (4.0%) than among firms from developed markets (0.4%).

As is the case for domestic IPOs (Beatty and Ritter (1986)), international IPOs are also underpriced relative to the price at close on the first day of trading (US discount). The mean underpricing discount for foreign IPOs is 30.1%, and the median discount is 5.4%. The factor that has the biggest impact on the magnitude of the US discount is the reputation of the underwriter. The mean US discount for foreign IPOs underwritten by a reputed underwriter (as classified by Carter and Manaster (1990)) is 35.4%, whereas it is only 12.2% for less reputed underwriters.

The after-market price behavior displays interesting patterns. We document that the price of the ADR in the US market and the price in the home country (expressed in dollars) are not equal; the mean deviation is positive, with the ADR price being higher than the price in the home market, for a period of upto 60 days following listing. After the 60^{th} day, on average, the price difference hovers around zero. The deviation in the two prices is larger and more persistent for firms from emerging markets. The factors affecting the returns of a foreign firm in the US market considerably differ from those affecting returns in the home market. We find that returns in the US market are correlated to a greater extent with the returns to a US stock index, whereas the returns in the home market are correlated more with the returns to a home equity index.[2]

[2] Bodurtha, Kim and Lee (1995) document a similar finding for closed-end country funds.

The rest of the paper is organized as follows. In Section 2, we describe the international IPO data. In Section 3, we study pricing of international IPOs. In Section 4, we study after-market prices and the relation between the ADR price in the US market and the price in the home market. In Section 6, we present our conclusions.

2. Data

International IPOs were identified using SEC's Edgar Database available online at www.edgar-online.com. This database has a listing by country of all international companies that filed with the SEC to issue equity in the U.S. The database is updated every six months. Our sample consists of 139 observations and covers the period from January 1996 to April 2000. The database includes information on the offering such as filing date, pricing date, offer price, identity of lead underwriter and auditors, number of shares offered, over-allotment option as well as information on the financials and management composition. Not all the firms in the database ultimately issued equity; there are 12 firms that cancelled their equity issue. We are able to identify such issuers as the pricing date and the offer price are missing for these firms. After eliminating such firms, our sample consists of 113 firms.

We obtained information on ADRs using data compiled by the Bank of New York. Table 1 is a description of the data. In Panel A, we present the yearly distribution of our sample. Panel A also presents data on the number of IPOs that had never been traded publicly before even in their home country. There are 76 firms that are going public for the first time in both their home and in the US market. In Panel B, we present information on the exchange listing of the ADRs. Miller (1999) finds that exchange

listing is a measure of the reputation of the ADR, with NYSE listed ADRs earning the highest announcement return in their home country. In our sample, there is 1 ADR that is a registered 144A offering. 144A ADRs are privately placed offerings (see Miller (1999) for more details on the different kinds of ADRs). There are 57 ADRs that are listed on the Nasdaq and an identical number on the NYSE. There is 1 ADR that is listed on the OTC market. In Panel C, we present data on the number of IPOs that were issued by firms from emerging markets, and the number issued by firms from developed markets. We used the International Finance Corporation's Emerging Markets Handbook to classify firms into emerging and developed markets. There were 37 IPOs that were issued by firms from emerging markets and 78 IPOs from developed markets. We also determined the number of firms in each market, emerging or developed, that were taken public by reputed underwriters. An underwriter was classified as reputed if the Carter and Manaster study (1990) assigned a ranking of 8.0 or higher to the firm. Since there has been consolidation in the underwriting industry, we assigned the same ranking for the firm in the Carter and Manaster (1990) study to its subsidiaries or to its parent. Panel C of Table 1 shows that a majority of foreign IPOs use the services of a reputed underwriter. Among firms from emerging markets, 89.2% used a reputed underwriter, while among developed market IPOs, 71.8% used a reputed underwriter.

In Panel D of Table 1, we present the industry distribution of the ADRs. The telecommunications industry accounted for the largest number of IPOs with 23 observations (20.3% of the sample), followed by the electrical equipment and manufacturing industry which accounted for 22 IPOs (19.5% of the sample).

In Panel E, we present statistics on the size of the IPO. Size of the IPO is the dollar amount of proceeds raised through the IPO. The mean IPO size is $72.30 million, and the median is $9.1 million. Both the mean and median issue sizes are comparable to those for domestic (US) IPOs (Beatty and Kadiyala (2000)).

In the next section, we examine pricing of foreign IPOs relative to the price in the home market as well as relative to the price in the US market.

2.1 IPO offer price and price in the home market

In this section we examine the relation between the IPO offer price and the price in the home market for the sample of international IPOs that were already trading in their home markets. We calculate a quantity called the home discount, which is defined as the difference between the domestic price on the pricing date and the IPO offer price, expressed as a percentage of the IPO offer price. If the stock did not trade in the home market on the pricing date of the IPO, we used the closing price as of the previous trading day to calculate the home discount. Data on domestic prices is from Datastream, which reports price in the local currency as well as in dollars.

There were 38 firms in our sample that were already trading in their home market and were going public in the U.S market for the first time. On the other hand, there were 75 firms in our sample that were going public for the first time in both their home and in the US market, and for these firms we did not compute the home discount.

Table 2 provides the statistics for the home discount. For the sample of 38 firms, the mean and the median home discount are positive, which indicates that the IPO offer price is below the price in the home market. There are significant cross-sectional

differences in the magnitude of the home discount. For firms from emerging markets, the median home discount is 4%, which is larger than the median home discount for the entire sample (1%). IPOs from developed markets have a much smaller home discount with a median value of 0.4%. The mean home discount is in fact negative, suggesting that for these IPOs the offer price is set above the home price. The mean and the median difference of the magnitudes of the home discounts for emerging market and developed market IPOs are statistically significant at the 5% level.

The difference in the magnitude of the home discount among emerging market IPOs and developed market IPOs suggests that market segmentation affects the uncertainty surrounding the stock's true value as reflected in the home market price. The reliability of the home market price as a true indicator of value, in turn, affects how the IPO offer price is set relative to the home market price. For firms from emerging markets, the home market price does not appear to be fully informative about true value, since the IPO offer price is set below the home market price.

Another factor that should affect the relation between the home market price and the IPO price is the underwriter. For domestic (U.S) IPOs, Tinic (1988) documents that reputed underwriters underprice to a greater extent. Tinic (1988) explains this evidence using the lawsuit avoidance theory which holds that a higher offer price increases the probability that an investor who buys the IPO at the offer price suffers subsequent losses. The losses can lead an investor to file a lawsuit against the underwriter, which can potentially lead to a loss in the reputation capital of the underwriter. Since the value of reputation capital is higher for reputed underwriters, underpricing should be higher for these underwriters. If we extend this argument to international IPOs, we should expect

the home discount to be larger for IPOs underwritten by reputed underwriters. Table 2 confirms that foreign IPOs underwritten by reputed underwriters have a large home discount than foreign IPOs underwritten by less-reputed underwriters. The median home discount for reputed underwriter IPOs is 3.8% while the median home discount for less-reputed underwriters is –15.3%. The difference in median home discounts is statistically significant at the 5% level.

A natural extension of the evidence presented above is to examine how the home discount is related to a combination of the two factors, namely, the reputation of the underwriter and the country of origin of the IPO. Therefore, we divided our sample into four sub-samples: the first sub-sample includes emerging market IPOs that were underwritten by reputed underwriters, the second sub-sample includes emerging market IPOs issued by less-reputed underwriters, the third sub-sample includes developed market IPOs issued by reputed underwriters and the last sub-sample includes developed market IPOs issued by less-reputed underwriters.

Based on the evidence presented above, we should expect that foreign IPOs from emerging markets that are underwritten by reputed underwriters should have the largest home discount. We should also expect that developed market IPOs issued by less-reputed underwriters should have the smallest home discount. Indeed, Table 2 shows that the median home discount for emerging market IPOs underwritten by a reputed underwriter is the highest among the four sub-samples. The median home discount for the first sub-sample is 4.3%, while the median home discount for the last sub-sample is -15.3%. We run a Hotelling's T^2 test to determine if the magnitudes of the four home discounts are

identical. Based on this test, we reject the hypothesis that the home discounts are identical.

In summary, we document a unique effect of market segmentation on stock prices; we show that market segmentation affects how the IPO offer price is set relative to the home country price. We provide an out-of-sample test of Tinic's (1988) hypothesis and find that reputed underwriters behave conservatively by discounting the home-market price to a greater extent when setting the IPO offer price.

2.2 IPO offer price and first-day price in the U.S market

Several studies (Beatty and Ritter (1986), Beneveniste and Spindt (1989)) have shown that IPOs in the U.S market are underpriced relative to their closing price on the first day of trading. The underpricing has been explained using several signalling models such as that of Rock (1986). In this section, we examine the underpricing issue for foreign firms going public in the U.S market for the first time.

We shed further light on the Bruner, Chaplinsky and Ramchand (2000) evidence that foreign IPOs are also underpriced to the same extent as domestic IPOs. The Bruner et al. study focused only on foreign IPOs that were not publicly traded in their home country prior to the IPO, and we extend their study by including foreign IPOs in our sample that are already trading in their home markets.

In Table 3, we present statistics on the U.S discount. We calculate the US discount as the difference between the closing price on the first day of trading in the U.S market and the IPO offer price, expressed as a percent of the IPO offer price. The closing price on the US exchange is obtained from the CRSP database. There were 25 firms in

our sample which we could not match with CRSP. For these firms, we obtained US pricing and return data in the US market from Bloomberg.

Table 3 shows that the mean (30.1%) and the median (5.4%) US discounts are positive. The magnitude of the mean U.S discount is higher than that reported by Bruner, Chaplinksy and Ramchand (2000).

We also present the magnitude of the US discount separately for firms that are currently trading in their home markets and foreign IPOs that have never traded publicly before. The mean US discount is 59.2% for foreign IPOs that had never been publicly traded before, while it is considerably lower (14.3%) for firms that were trading in their home market. The median US discounts are more comparable for the two samples; they are 5.7% and 5.3% respectively.

Next, we examine how market segmentation affects the magnitude of the US discount. The effect of market segmentation on the US discount is ambiguous. Table 3 shows that while the mean US discount for foreign IPOs from emerging markets is lower than the mean US discount for foreign IPOs from developed markets (19.9% versus 35.4%), the median US discounts go in the opposite direction.

While there is no reliable evidence that market segmentation affects the magnitude of the US discount, the reputation of the underwriter appears to be strongly related to the US discount. Table 3 shows that the magnitude of the US discount is higher (32.8%) for reputed underwriters relative to the magnitude of the US discount for less-reputed underwriters (12.2%). This is consistent with the evidence in Tinic (1988) for domestic IPOs.

Table 3 shows that the magnitude of the US discount is unrelated to whether the foreign firm is from a developed or an emerging market. But this result could be due to the confounding influence of other factors on the US discount. So, we next estimate OLS regressions to sort out the factors that affect the magnitude of the US discount.

We estimate a cross-sectional regression of the US discount. Our first set of independent variables are proxies for the level of asymmetric information. Rock's signalling hypothesis predicts that IPOs are underpriced because of asymmetric information between issuers and investors. Asymmetric information should similarly affect foreign IPOs. So we should expect that the underpricing discount is higher for foreign IPOs with a greater level of asymmetric information. Issue size is a natural proxy for the level of information asymmetry. Unal and Maksimovic (1993) show that gross proceeds raised at the IPO are negatively related to the magnitude of the underpricing discount. Country of origin is another proxy for the level of asymmetric information. Bruner et al. (2000) document weak evidence that firms from emerging markets are underpriced to a greater extent.

We also include the volatility of the foreign exchange rate in the 90 days prior to the IPO as an independent variable. Greater currency volatility implies greater uncertainty about the IPO offer price denominated in dollars. We should expect underwriters to buy insurance against currency fluctuations by underpricing the IPO to a greater extent.

Based on Tinic's (1988) lawsuit avoidance hypothesis, we include a dummy variable for the reputation of the underwriter. We also include a set of independent variables to proxy for investor recognition. Greater investor recognition that a foreign

firm receives through listing in the U.S market should affect the underpricing discount. The underpricing discount should be lower if greater investor recognition implies a higher offer price. Yet, greater investor recognition could also lead to a higher underpricing discount through its effect on the closing price on the first day of trading. Subrahmanyam and Titman (1999) develop a model that shows that the traded price should reflect not only publicly available information, but also information that is obtained by small investors serendipitously. Greater investor recognition implies that the traded price reflects serendipitous information which is not reflected in the offer price. Our proxies for investor recognition are the ratio of total sales accounted for by sales in non-domestic markets, an industry dummy variable that takes a value of 1 for firms that belong to the computer and telecommunication industries, and an exchange dummy for the U.S exchange where the firm's shares are listed for trading. The exchange dummy takes a value of 2 if the firm's shares are listed on the NYSE, it takes a value of 1 if the firm's shares are traded on Nasdaq and takes a value of 0 if the firm's shares are traded on the OTC market.

In Table 4, we present cross-sectional regressions with the U.S. discount as the dependent variable. We estimated three regression specifications. In the first specification, none of the coefficients are statistically significant. In the second regression, only the coefficients on the emerging market dummy, and the foreign sales ratio are statistically significant. The emerging market coefficient is negative (-0.207) indicating that foreign IPOs from emerging markets are underpriced to a greater extent. Bruner et al. (2000) did not find similar significance for the emerging markets dummy in their study. We suspect that this difference arises because our study includes foreign

IPOs that have never been publicly traded as well as foreign IPOs that are currently trading in their home market.

The coefficient on the ratio of total sales accounted for by sales in all non-domestic markets is positive (0.237). The significance of the coefficient on the sales ratio indicates that greater level of investor recognition leads to a higher underpricing discount. Finally in the last regression specification, we include currency volatility as an independent variable. We find that currency volatility in the home country is positively related to the underpricing discount. The positive coefficient suggests that underwriters are insuring themselves by setting a low offer price when confronted with exchange rate volatility. The coefficient on the emerging market dummy continues to be significant.

Interestingly, in this regression, the coefficient on the U.S exchange dummy is negative and statistically significant. The negative coefficient suggests that the US discount is lower for firms listed on the NYSE and is higher for firms listed on the Nasdaq or on the OTC market.

In the next section, we examine the last pricing issue with ADRs, namely, the relationship between the after-IPO price in the home country and the after-IPO price of the ADR in the US market.

3. After-market pricing in the home country and in the U.S

3.1 Price Difference

The Economist article described at the beginning of this paper suggests that for the Taiwanese stock, the price in the U.S market is higher than the price in the home market. In this section, we study the extent of deviation between the home price and the U.S price following initial listing of the ADR in the U.S market. We should expect that

any pricing discrepancy between the home market and the U.S market should be arbitraged away. But if markets are not fully integrated, pricing discrepancies can persist.

A similar pricing discrepancy has been documented by Bodurtha, Kim and Lee (1995) for closed-end country funds. They document that the share price of a closed-end country fund in the U.S market differs from the net asset value in the home market. They argue that in a segmented market, where asset prices are affected by a common set of global risk factors, as well as by country-specific risk, changes in the country fund premium capture the time-varying optimism or pessimism of U.S investors relative to their foreign counterparts.

As we argued earlier, the price differential in the two markets should be more pronounced among IPOs from emerging markets. Emerging markets are more likely to be segmented markets, and in such markets the information of U.S investors will not be completely reflected in the price in the home market. This should be especially true for firms in 'hot' industries. If U.S investors are more sophisticated in valuing stocks in these emerging industries, then the price differential between the home and the U.S market should be larger for firms in such industries. Likewise, if the primary market for the firm's products is the U.S market, then we should expect that U.S investors have better information about future demand for the product than do investors in the home country.

Another reason for the price differential between the two markets could be due to underwriter activities. In the U.S market, IPOs are characterised by underwriter price support in the after-market. Underwriters support the price for a period following the IPO in the US market, whereas there is no such price support in the home market.

Therefore, the price differential between the US and the home market could be due to underwriter activities.

In Table 5, we present the mean and median price difference (measured by the difference between the US price and the home market price) for various sorts of the sample. For each firm in our sample that had 90 days of pricing data, we calculate the daily price difference in the two markets for a period of 90 days following the IPO. We then calculate the mean and median price difference across all firms, for each day. In the table we report the mean of the mean and median daily price difference over the 90 days. In Table 5, we also report the mean and median values of the absolute value of the price difference. The absolute price difference is a better measure of the magnitude of the price difference across firms, since the actual price difference might be positive for some firms and negative for others.

Table 5 shows that the absolute mean and median price difference is larger for foreign IPOs from emerging markets. The magnitude of the price difference is of an economically significant magnitude for foreign IPOs from emerging markets. Even at the median, the price difference is about $2.00 per day. In Table 5, we also present the price difference for different sub-sorts of our sample. The reputation of the underwriter does not seem to have an impact on the median absolute price difference; the median absolute price difference for IPOs by reputed underwriters is $0.41, whereas that for IPOs by non-reputed underwriters is $0.39. But the industry to which an IPO belongs does seem to somewhat affect the price difference. For firms from the computers and telecommunication industries, the median absolute price difference is $0.387, while the firms from other industry groups have a median absolute price difference of $0.346.

In Figure 1, we plot the time series of the absolute daily price difference for a period of 90 days following initial listing. In each figure, the bold lines represents the average daily difference in price, while the shaded lines represent the median daily price difference. Figure 1a shows that the price difference is not transitory, it lasts for a period of at least 60 days following initial listing. Figure 1b shows that the price difference persists even for foreign IPOs from developed markets. But the price difference for this sub-sample decreases significantly after about the 60^{th} day following initial listing. The 60-day window hints that underwriter activities in the after-market might be an explanation for this price differential. Figure 1c shows that the price difference persists even up to the 90^{th} day for foreign IPOs from emerging markets.

Next, we identify the factors that affect the pricing differential in the two markets. We measure the pricing differential as the average over the 90-day period of the absolute value of the daily price difference. If markets are segmented, we should expect the price differential to be larger for foreign IPOs from emerging markets. Investor recognition should also affect the price differential. Greater investor recognition implies that more information is incorporated into the U.S price than is incorporated into the domestic price. Further, greater investor recognition also implies higher demand for the security in the U.S market, which in turn implies a higher price in the U.S market.

Another factor that could influence the price difference is exchange listing. Firms listed on the NYSE should benefit from greater investor recognition and should trade at a higher price relative to their home-market price. The reputation of the underwriter should also affect the pricing differential, through the after-market support provided by the underwriter. Finally, the price differential should be higher for firms from countries

whose currency is volatile. Currency volatility increases the riskiness of the stock for U.S investors if the firm is from a segmented market. Therefore the US price should be lower relative to the home market price for such stocks.

We test the significance of the factors described above by estimating OLS regressions. Our dependent variable is the average of the absolute price difference. The independent variables are (i) an exchange listing dummy that takes a value of 2 if the firm is listed on the NYSE, a value of 1 if the firm is listed on the Nasdaq, and a value of 0 if the firm is listed on the OTC market, (ii) an industry dummy that takes a value of 1 if the firm belongs to the computer or telecommunications industry, (iii) an emerging markets dummy that takes a value of 1 if the firm is from a developed market and a value of 0 if the firm is from an emerging market, (iv) a rank dummy that takes a value of 1 if the firm is underwritten by a reputed underwriter and a value of 0 otherwise.

The results are presented in Table 6. In the first regression, the coefficients on the emerging market dummy and underwriter dummy are significant. The coefficient on emerging markets is negative suggesting that emerging market IPOs tend to have a higher pricing differential. The negative coefficient on the rank dummy indicates that IPOs by less-reputed underwriters tend to have a bigger price differential. It is not clear why this is the case. But in the second regression, the answer becomes clear. The underwriter dummy is correlated with the volatility of the currency in the home market. With the inclusion of currency volatility, the significance of the rank dummy disappears.

Surprisingly, the coefficients on industry dummy and exchange listing are not significant. We surmise that the industry dummy might be a crude approximation for the

attractiveness of the industry at a particular point in time. In the next version, we propose to use the cumulative return to each industry group in the six-months prior to the IPO.

3.2 Stock returns in the U.S market and in the home market.

In this section we examine the market betas of the U.S. and domestic return series. If a common set of factors affect stock prices in the home country and in the U.S market, the factor loadings of the U.S. and domestic returns on a common market index should be identical. Non-identical market factor loadings for U.S and home market returns hints at a pricing anomaly.

We test the calculate market factor loadings for the two return series by regressing the daily stock returns in both the countries on the U.S market return and on the local market return. For the U.S market, we used the return on the S&P 500 index as our proxy for the market return. In Appendix 1, we list the indexes for each home market.

The results are reported in Table 7. For the entire sample, the beta of US returns with respect to the U.S market factor is 0.507. The beta of home returns with respect to the US market factor is –0.027. Thus, home returns are virtually unrelated to the US market factor. Likewise, there is a difference in factor loadings on the home market factor. US returns have a beta of 0.472 with respect to the home market return, whereas home returns have a much higher beta of 0.804. Thus, US returns are more sensitive to the US market factor, and home returns are more sensitive to the home market factor. This provides suggestive evidence of mispricing, because securities traded in the U.S. and in the home country are both claims to an identical series of cash flows.

In Table 7, we present results from estimating the regressions separately for firms from emerging markets and for firms from developed markets. For both emerging market and developed market IPOs, US returns continue to be more sensitive to the US factor and home returns continue to be more sensitive to the home market factor. The difference between the two samples appears in the sensitivity of US returns to the home market factor. For developed market IPOs, the beta of US returns with respect to the home market factor is 0.535, whereas for emerging market IPOs, the beta of US returns with respect to the home market factor is only 0.239. In other words, market segmentation has a clear effect on the returns in the two countries in that for emerging market IPOs, US returns are much less sensitive to the home market factor.

4. Conclusions

We present novel evidence on the effect of market segmentation on stock prices. With our focus on foreign firms going public in the US market, we are able to document how market segmentation affects IPO pricing as well as pricing in the after-market. Our principal results are as follows:

- The home discount (the difference between the IPO price and the home market price) is greater for emerging market IPOs and those underwritten by reputed underwriters than for IPOs from developed markets and those underwritten by less-reputed underwriters. The results also hold for the U.S. discount (the difference between the IPO price and the U.S. price at the close of the first trading).

- The US discount is larger for firms traded on Nasdaq as opposed to NYSE. Currency volatility has a marginal positive effect on the U.S. discount. Similarly, the foreign sales ratio (the ratio of foreign sales relative to total sales) also has a marginal positive effect on the U.S. discount.
- The price differential across the domestic market and the after-market in the U.S. persists, on average for up to 90 days after the initial offering. The absolute price differential is larger for emerging market offerings than for those from developed countries. There is also weaker evidence that high tech IPOs have a greater absolute price differential than IPOs of other industries.
- We also document differential market factor loadings on a U.S stock index and on a domestic stock index. US returns are more highly correlated with the U.S stock index, whereas home returns are more highly correlated with home market returns. The differing market betas for securities that are claims to essentially identical cash flow streams indicate evidence of mispricing: not all information flows freely across the two markets.

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Table 1

Descriptive Statistics of the Sample

Panel A: Yearly distribution of international IPOs. The sample of international IPOs is from SEC's Edgar Database.

	# of observations	
Year of IPO	International IPOs that currently trade in their home country	International IPOs that have not been traded in their home country
1996	10	12
1997	10	23
1998	4	11
1999	9	19
2000	5	11
Total	38	76

Panel B: Exchange listing of ADRs: This table lists the US stock exchanges where the international IPOs were listed. Data on exchange listing is from Bank of New York.

Exchange	# of observations
144A	1
Nasdaq	57
NYSE	57
OTC	1
Not known	0

Panel C: Distribution of international IPOs by whether the home country is an emerging market or a developed market. Classification into emerging and developed markets is based on the International Finance Corporation's Emerging Markets Handbook. International IPOs are also classified on the basis of the reputation of the underwriter. Underwriters are classified as reputed based on the rankings in Carter and Manaster (1990). Numbers in parentheses are the proportion of IPOs in each category that are underwritten by reputed or non-reputed underwriters, expressed in %.

	Observations	Non-reputed underwriter	Reputed underwriter
IPOs from Emerging Markets	37	4 (10.8%)	33 (89.2%)
IPOs from Developed markets	78	22 (38%)	56 (71.8%)

Panel D: Industry Distribution of international IPOs. Numbers in parentheses are the proportion of all IPOs in a certain industry group.

Industry	Number of observations
Transportation (autos, rail, trucking)	11 (9.7%)
Food, beverage and tobacco	2 (1.8%)
Bio-Technology	1 (0.9%)
Financial Services, Insurance and Real Estate	10 (8.9%)
Chemicals, Plastics and Photo Developing	4 (3.5%)
Basic Materials (coal, ceramics, steel and mining)	3 (2.7%)
Computers (computer equipment, computer peripherals, semiconductors, software)	9 (8.0%)
Construction and Housing	2 (1.8%)
Drugs and Pharmaceuticals	6 (5.3%)
Electrical Equipment and Manufacturing	22 (19.5%)
Retail (household consumer goods, luxury goods and apparel)	6 (5.3%)
Paper	1 (0.9%)
Telecommunications	23 (20.4%)
Media and Entertainment	7 (6.2%)
Utilities (Gas and Electric)	1 (0.9%)
Petroleum, Oil and Natural Gas	1 (0.9%)
Others (business services, hospitality)	4 (3.5%)

Panel E: Characteristics of international IPOs. Issue size is the number of shares offered at the IPO times the IPO offer price.

Characteristics	Mean	Median
Issue Size	$72.30 Million	$9.1 Million

Table 2
Home Discount

Panel A: Univariate statistics for home discount. Home discount is the difference between the price in the home market at close of trading on the IPO pricing date and the IPO offer price, expressed as a percent of the IPO offer price. Data on home market prices is obtained from Datastream. For firms with no pricing information on Datastream, we use Bloomberg.

	Number of observations	Mean (%)	Median (%)
Home discount	38	275.0	1.0
Home discount for IPOs from emerging markets	13	833.9	4.0
Home discount for IPOs from developed markets	25	-13.5	0.4
Home discount for IPOs underwritten by reputed underwriters	30	356.5%	3.8%
Home discount for IPOs underwritten by non-reputed underwriters	8	-29.5	-15.3
Home discount for emerging market IPOs underwritten by reputed underwriters	11	990.43%	4.33%
Home discount for emerging market IPOs underwritten by non-reputed underwriters	18	-7.94%	3.13%
Home discount for developed market IPOs underwritten by reputed underwriters	2	-26.8%	-26.8%
Home discount for developed market IPOs underwritten by non-reputed underwriters	6	-30.3%	-15.3%

Table 3
U.S. Discount

U.S discount is calculated as the difference between the price of the ADR as of close of trading in the US market and the IPO offer price, expressed as a percent of the IPO offer price. The IPO offer price is from the SEC Edgar Database and the closing price in the U.S market is from CRSP. For firms for which there was no data on CRSP, we used Bloomberg.

	Number of observations	Mean (%)	Median (%)
U.S discount	105	30.1	5.4
U.S discount for IPOs that have never been publicly traded before	69	41.6	7.8
U.S discount for IPOs that are already trading in their home country	36	8.17	1.99
U.S discount for IPOs by firms from emerging markets	34	19.9	7.6
U.S discount for IPOs by firms from developed markets.	70	35.4	2.9
U.S discount for IPOs by reputed underwriters	81	35.4	5.8
U.S discount for IPOs by non-reputed underwriters	24	12.2	3.8

Panel B: US discount by the U.S stock exchange. Data on the exchange where the ADR is listed in the U.S is obtained from Bank of New York.

Exchange	# of observations	Mean (%)	Median (%)
Nasdaq	53	37.6	18.9
NYSE	52	22.4	2.6
Over-the-Counter	-	-	-

Table 4

Cross-sectional OLS Regressions of US discount

A cross-sectional OLS regression is estimated with the US discount as the dependent variable. The U.S discount is calculated as the difference between the price of the ADR as of close of trading in the US market and the IPO offer price, expressed as a percent of the IPO offer price.

The independent variables are: 1) Rank: a dummy variable equal to 1 if the IPO is issued by a reputed underwriter, 2) OECD: a dummy equal to 1 for developed markets and equal to 0 for emerging markets, 3) foreign-sales: the ratio of foreign sales to total sales for the IPO firm in the fiscal year ending the year in which the IPO was issued, 4) Exchange: exchange is set to 2 if the IPO was listed on the NYSE, it is set to 1 if the IPO was listed on the Nasdaq and is set to 0 if the IPO was listed on the OTC market, 5) Industry: a dummy equal to 1 if the IPO is from the computer and telecommunications sectors, 6) currency volatility is the volatility of the exchange rate in the home market in the 90 days prior to the IPO issue. The exchange rate is calculated by taking the ratio of the price of the stock in the local currency and the price in dollars.

Dependent Variable	US_discount (77)	US_discount (27)	US_discount (16)
Intercept	-0.28 (-0.40)	0.31 (0.81)	0.11 (0.64)
Rank	0.33 (0.96)	-0.17 (-1.18)	-0.08 (-1.04)
OECD	0.22 (0.72)	-0.41 (-3.15)	-0.21 (-2.74)
Foreign-sales			0.24 (1.92)
Exchange	0.04 (0.12)	-0.35 (-2.65)	-0.03 (-0.46)
Industry	-0.34 (-1.06)	-0.16 (-1.24)	-0.04 (-0.37)
Currency volatility		0.28 (1.88)	
Newfirm dummy	-0.48 (-1.41)	0.17 (1.17)	-0.003 (-0.03)
Log(size)	0.05 (0.81)	0.06 (1.59)	0.007 (0.37)
Adj. R^2 (%)		29.5	12.35

Figure 1

After-market difference between ADR price and home market price

Figure 1(a)

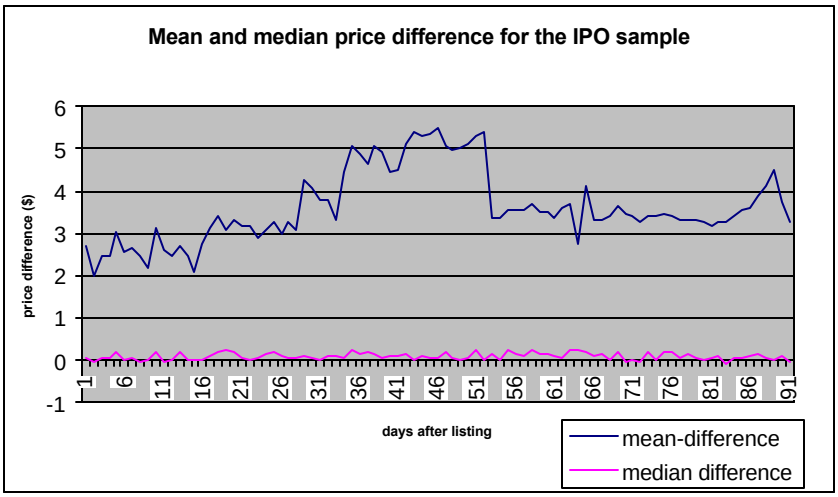

Figure 1(b)

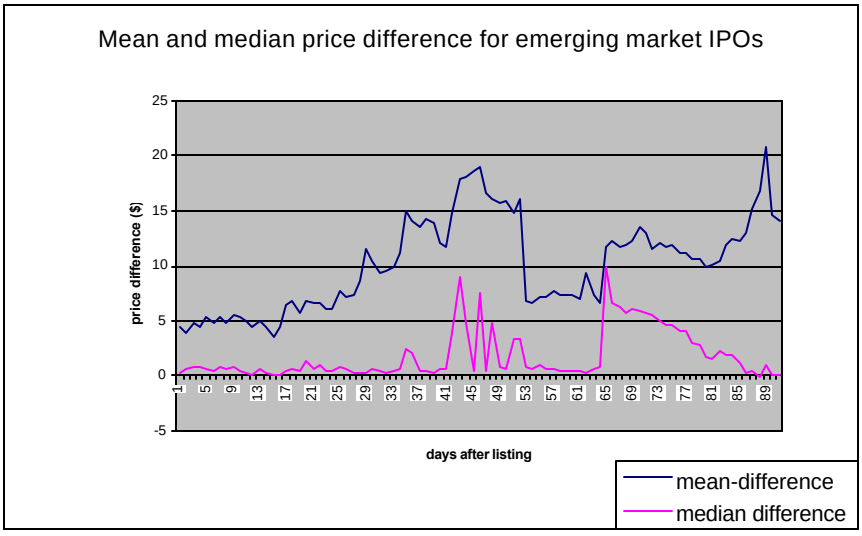

Figure 1(c):

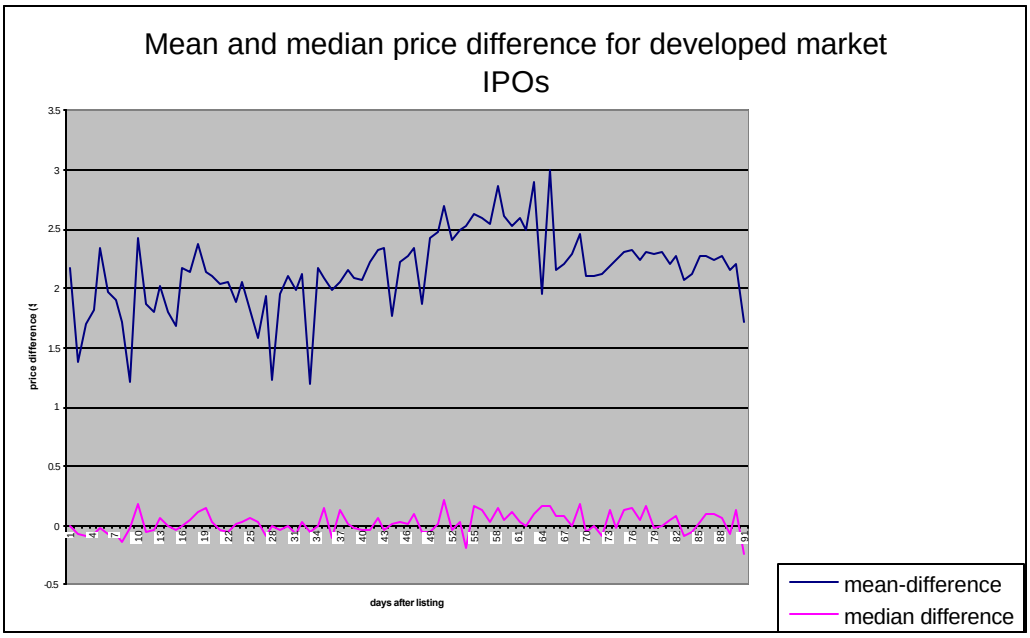
Mean and median price difference for developed market IPOs
price difference (
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
days after listing
mean-difference
median difference

Table 5
Average and Median price difference in the After-market

The table presents the mean and median price difference in the after-market for the entire sample of foreign IPOs and for sub-sorts of the sample. The daily price difference is calculated for each firm for a period of 90 days following initial listing. The mean and median price difference is calculated across for all firms for each day over the 90-day period. Finally, the mean and median are averaged over the 90 days. The mean and median for the absolute price difference are calculated similarly except that we use the absolute value of the daily price difference.

	Mean Price Difference ($)	Median Price Difference ($)	Mean Absolute Price Difference ($)	Median Absolute Price Difference ($)
All foreign IPOs	3.62	0.08	4.06	0.39
Foreign IPOs from emerging markets	10.16	1.78	10.45	2.21
Foreign IPOs from developed markets	2.15	0.02	2.63	0.35
Foreign IPOs underwritten by reputed underwriters	6.39	0.11	6.66	0.41
Foreign IPOs underwritten by non-reputed underwriters	2.61	0.08	3.10	0.39
Foreign IPOs from computer and telecommunication industries	2.27	-0.017	2.94	0.387
Foreign IPOs from all other industries	2.877	0.091	3.22	0.346

Table 6
Cross-sectional OLS Regressions of After-Market Difference in Stock Prices

The difference in stock prices in the US market and in the home market is measured using a variable called 'price_diff', which is the average absolute difference between the daily closing price in the US market and the daily closing price in the home market (expressed in $) computed over a period of 90 days following initial listing on the US market.

The independent variables are: 1) Rank: a dummy variable equal to 1 if the IPO is issued by a reputed underwriter, 2) OECD: a dummy equal to 1 for developed markets and equal to 0 for emerging markets, 3) Exchange: exchange is set to 2 if the IPO was listed on the NYSE, it is set to 1 if the IPO was listed on the Nasdaq and is set to 0 if the IPO was listed on the OTC market, 4) Industry: a dummy equal to 1 if the IPO is from the computer and telecommunications sectors, 5) currency volatility is the volatility of the exchange rate in the home market in the 90 days prior to the IPO issue. The exchange rate is calculated by taking the ratio of the price of the stock in the local currency and the price in dollars.

Dependent Variable	Absolute Price difference	Aboslute price difference
Observations	53	40
Intercept	20.42 (3.40)	27.22 (3.54)
Rank	-5.45 (-1.72)	-5.02 (-1.35)
OECD	-8.30 (-2.55)	-13.28 (-2.84)
Exchange	-3.61 (-1.34)	-4.26 (-1.20)
Industry	0.12 (0.04)	1.15 (0.30)
Currency volatility		-1.61 (-0.45)
Adj. R^2 (%)	9.81	16.26

Table 7
Difference in factor loadings on a US stock index and on a home country index

The table reports the mean factor loadings obtained from an OLS regression. A separate OLS regession is estimated for the daily returns to a foreign IPO in the US market and for the daily returns to a foreign IPO in the home market. Each OLS regression is estimated using 90 daily returns following the listing of the ADR in the US market. The independent variables in the regression are the daily returns to a US stock index (S&P 500 index or the CRSP value-weighted index) and the daily returns to a home country stock index. S&P 500 index and CRSP value-weighted index returns are obtained from CRSP. Home country index returns are from Datastream.

Panel A: The US stock index is the S&P 500 index.

	Dependent variable = US market returns		Dependent variable = Home market returns	
	Factor loading on US stock index	Factor loading on home country stock index	Factor loading on US stock index	Factor loading on home country stock index
All foreign IPOs	0.507	0.472	-0.027	0.804
IPOs by non-reputed underwriters (RANK=0)	0.142	0.519	-0.131	0.599
IPOs by reputed underwriters (RANK=1)	0.629	0.456	0.008	0.872
Emerging market IPOs (OECD=0)	0.536	0.239	0.032	0.777
Developed market IPOs (OECD=1)	0.499	0.535	-0.043	0.811

Panel B: The US stock index is the CRSP value-weighted index.

	Dependent variable = US market returns		Dependent variable = Home market returns	
	Factor loading on US stock index	Factor loading on home country stock index	Factor loading on US stock index	Factor loading on home country stock index
All foreign IPOs	0.600	0.447	-0.005	0.796
IPOs by non-reputed underwriters (RANK=0)	0.163	0.517	-0.140	0.591
IPOs by reputed underwriters (RANK=1)	0.692	0.424	0.040	0.864
Emerging market IPOs (OECD=0)	0.387	0.210	0.019	0.777
Developed market IPOs (OECD=1)	0.607	0.511	-0.012	0.801