

**The Impact of Cross-Listing on Stock Liquidity in the
Home Market: A Comparative Study of Indian Companies
Cross-listed in US, UK and Luxembourg**

Markets

by

Tejasvi Dabhane

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Abstract

There is an ongoing debate about the liquidity benefits of cross-listing. Earlier literatures have found mixed evidence of these benefits; however, not much focus has been given to Indian companies cross-listing in overseas market. This paper examines Indian companies that are cross-listed on the LSE, LuSE or NYSE using Depository Receipts (DRs) between 1992 and 2017. To measure stock liquidity, we use four liquidity measure proxies, namely, trading volume, turnover ratio, bid-ask spread and the Amihud illiquidity measure. We also employ a sample of matched domestic companies (Indian companies that do not cross-list on foreign exchanges during the sample period) to examine the benefits of cross-listing using difference-in-difference methodology. We conduct our study in four parts: First, we compare stock liquidity of Indian cross-listed companies in the home (Indian) market before and after the cross-listing. Second, we compare the stock liquidity of Indian cross-listed companies to that of domestic companies (matched sample). Third, we compare the effects on stock liquidity of cross-listing in different locations – LSE, LuSE and NYSE – to examine if the host market plays a critical role in improving liquidity of the cross-listed stocks. Fourth, we compare different time periods to observe if benefits of cross listing differ from one period to another. We find weak evidence of improvement or decline in liquidity for cross-listed stocks. Our results find no support for the liquidity hypothesis that cross-listing improves liquidity for cross-listed stocks. Our findings are in line with Domowitz, Glen and Madhavan (1998) and Levine and Schmukler (2006), who suggest that order flow migration, lack of transparency and insider trading are the major reasons a decrease in, or lack of change in, the liquidity of stocks in the home market.

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Attestation of Authorship:

“I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person (except that explicitly defined in the acknowledgements), nor material which to a substantial extent has been submitted for the award of any other degree or diploma of a university or other institution of higher learning.”

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The Impact of Cross-Listing on Stock Liquidity in the Home Market: A Comparative Study of Indian Companies Cross-listed in US, UK and Luxembourg Markets

1. Introduction

Owing to globalization, the world is coming closer together, hence companies are exploring new ways to increase their market presence and investor base globally. One of the ways to expand business internationally is to cross-list stocks. Cross-listing refers to the listing of companies' shares on foreign stock exchanges. As financial markets are continuously advancing towards global integration, an increasing number of firms have been willing to list their shares in multiple stock markets. Figure 1 provides data on the total number of listings in 16 major foreign stock exchanges from 1995 to 2008. From the chart, we can observe that the number of foreign listings has increased for some stock exchanges such as London Stock Exchange and has decreased for other stock exchanges such as NASDAQ stock exchange over the period. It is important to explore whether the cross-listing is beneficial. Previous researchers have argued that the benefits of cross-listing are that it leads to an increase in the value of the company, a superior investor base by adding a foreign investor component, improved market recognition and greater stock liquidity (Brockman & Chung, 1999; Foerster and Karolyi, 1998; Lang et al., 2003). Other studies have found no impact or a decline in liquidity post-cross-listing (Domowitz et al., 1998; Brockman & Chung, 1999). There is an ongoing debate about cross-listing benefits. However, in the earlier studies, not much focus has been given to emerging market companies that cross-list via Depositary Receipts (DRs).

There are 2 types of DRs which are used extensively: American Depositary Receipts (ADR) and Global Depositary Receipts (GDR). DRs have been a prominent instrument for cross-listing, especially for emerging markets as they allow easy access to international markets with a limited amount of investment. DRs were created in 1927 by J.P. Morgan Chase. If a company lists its own shares it is time-consuming, very costly and requires the company to be exposed to various regulations and disclosures which might not exist in the home country. Hence, companies in emerging markets often cross-list in the form of ADRs and GDRs. More than US\$152 billion was raised globally in 2017 using DRs (Mellon, 2017). BRIC countries constituted 73 percent of new DRs issued on foreign stock exchanges in 2008 (Wójcik, 2010). Figure 2 (in Section 11 of

this paper) provides an outline of companies that raised capital via DRs in 2012. China had the largest share at US\$825.6 billion followed by other countries at US\$81.8 billion and then India holding the third place at US\$74.2 billion.

Boosting stock liquidity is one of the major motivations for companies to cross-list in overseas markets. Liquidity helps to reduce bid-ask spread (Brockman & Chung, 1999), increase trading volume (Mittoo, 1997), boost stock returns (Miller, 1999), and so on. Liquidity becomes especially important for emerging market companies as they are dealing with insider trading, lack of transparency and corruption in their home market. Indian markets are no different to these issues.

Previous studies on the effect of cross-listing on stock liquidity have found mixed results, leading to an ongoing debate. Halling, Pagano, Randl & Zechner (2008) found a decline in trading volume in the home market after cross-listing for emerging countries but an increase in trading volume for developed countries. Levine and Schumkler (2006) reported a decrease in turnover ratio post-cross-listing for cross-listed companies from emerging markets. On the other hand, Brockman and Chung (1999) and Foerster and Karoyli (1998) reported a decrease in bid-ask spread post-cross-listing, indicating an increase in liquidity. Though a huge amount of earlier literature has focused on stock liquidity, few have ever been studied cross-listing of Indian companies in overseas markets. This raises our first questions: (1) Is cross-listing beneficial for emerging market companies, in terms of liquidity in the home market? In this paper, we focus on Indian companies that are cross-listed overseas to examine if cross-listing plays a role in boosting liquidity in the home market.

Along with stock liquidity, the location of cross-listing plays an important role in evaluating the benefits of cross-listing. It is important for companies to cross-list in locations that will enable them to maximize their benefits. The location of the cross-listing has always played an important role in developing and expanding a company in a foreign market (Li & Wang, 2014). Dodd and Louca (2012) compared cross-listings by European companies in the US, the UK and within Europe to determine the effect on shareholder's wealth. They reported that shareholders' wealth varies across regions, with the US and UK markets providing higher benefits for cross-listing. Lee (1991) conducted a study of 34 firms from six countries to examine the behaviour of stock returns and concluded that it led to a reduction in returns. Hegde et al. (2010) concluded that stocks listed on NYSE

had a narrower spread compared to NASDAQ, as NYSE is a more liquid market when comparing bid-ask spread for companies that are dual listed. Earlier studies have identified the factors related to the location of cross-listing but not much has been studied about the differences in liquidity benefits when companies from the same country cross-list in different stock exchanges. This raises our second question – (2) Does the location of cross-listing play an important role in increasing the liquidity of stocks?

To answer these two questions, we conduct a study on Indian companies that are cross-listed on the London Stock Exchange (LSE), Luxembourg Stock Exchange (LuSE) and New York Stock Exchange (NYSE). To evaluate the impact of cross-listing on the domestic stock liquidity of Indian companies, we use a sample of 168 Indian companies that are cross-listed on at least one of the three stock exchanges between 1992 and 2017. Supporting the views of earlier literatures that liquidity will decline post cross-listing for cross-listed companies due to order flow migration (Domowitz et al, 1998), insider trading (Smith and Safianos, 1997; Halling et al., 2008) and weak investor protection (Biddle and Saudagaran, 1991), this paper, we study below two hypothesis:

H1: Cross-listing on LSE, LuSE and/or NYSE has a negative impact on the stock liquidity of Indian companies in their home market.

H2: Comparing the benefits of cross-listing for NYSE, LSE, and LuSE, liquidity will decrease for Indian cross-listed companies, irrespective of the location or time period of listing.

For our analysis, we use average daily stock-trading data in the home market for a period of 150 days before and 150 days after the cross-listing of each sample firm. To measure stock liquidity, we use four proxy liquidity measures, namely, trading volume, turnover ratio, bid-ask spread, and the Amihud illiquidity measure. We also employ a sample of matched domestic companies (Indian companies that do not cross-list on foreign exchanges during the sample periods) to examine the benefits of cross-listing using the difference-in-difference methodology.

Kumar et al. (2001) conducted a study of 30 Indian companies that are cross-listed from 1996 to 2001, via ADR on the NYSE and GDR on the LSE and LuSE. Kumar et al. (2001) did not find any clear patterns in liquidity for DRs although liquidity for ADR reduced while liquidity for GDR increased. We extend this study by Kumar et al. (2001) and

studied Indian companies cross-listing via DRs on the NYSE, LSE, and LuSE from 1992 to 2017. However, our study differs in four ways from Kumar et al. (2001). (1) We take a sample of cross-listed companies from 1992 to 2017, with a total of 168 Indian companies cross-listed via DRs; (2) we compare the benefits of cross-listing with those Indian companies that do not cross-list, thus providing a better picture of whether liquidity increases for the cross-listed companies or not; (3) we compare the three locations with each other, to evaluate whether the benefits are different for different locations; and (4) we compare different time periods to examine if liquidity differs across different time periods.

We conduct this study in four parts. First, we compare the stock liquidity of Indian cross-listed companies in the home (Indian) market before and after the cross-listing. Second, we compare the stock liquidity of Indian cross-listed companies to domestic companies (matched sample). Third, we compare the effects on the stock liquidity of cross-listing in different locations – LSE, LuSE, and NYSE – to examine if the host market plays a critical role in improving the liquidity of cross-listed stocks. Fourth, we compare different time periods to observe if the benefits differ from one period to another.

Controlling for firm characteristics, industry and year fixed effects for cross-listed stocks, we found insignificant results with low t-stats indicating that stock liquidity in the home market had no impact after cross-listing. Further, controlling for matched sample and other control variables, we find weak evidence of a decline in liquidity for cross-listed stocks as most of these results are insignificant. We further investigated the role of the location of the cross-listing and found that cross-listing was insignificant for all the three locations, but comparing the three exchanges, cross-listings on the NYSE are associated with a greater increase in liquidity post-cross-listing. One explanation for this is the stringent rules and regulations that cross-listed companies must adhere to when listing in NYSE and hence increasing stock liquidity. Our results find no support for the liquidity hypothesis that cross-listing improves liquidity for cross-listed stocks. Further, we compare the different time periods and observe that we do not find any significant results even after considering different time periods. Our findings are in line with Domowitz et al. (1998) and Levine and Schmukler (2006), who suggests that order flow migration, lack of transparency and insider trading are the major reasons for no impact on stock liquidity in the home market.

This study contributes to the literature in the following ways. First, it sheds some light on the ongoing debate about the benefits of cross-listing in the context of Indian companies. Second, it uses the difference in difference analysis to compare the benefits of cross-listing with matched samples which have not been conducted by the researcher in terms of the Indian market. Third, this study compares different locations to examine whether the benefits of cross-listing differ in different locations. Fourth, this study compares different time periods, to observe if the benefit of cross-listing changes over these time periods. This study could be of special interest to managers, policymakers, investors, and finance scholars because it shows that cross-listing does not provide liquidity benefits to Indian companies, supporting the argument by Domowitz et al. (1998) and Indian companies cross-listing may not necessarily aim to increase liquidity.

The remainder of this research study is organized as follows: Section 1.1 distinguishes between LSE, LuSE and NYSE market, Section 2 provides a review of related literature and develops hypotheses, Section 3 and 4 describes the methodology and data used, Section 5 through 8 reports the empirical results and Section 9 provides the conclusion and ideas for future research.

1.1. Differences between three markets: London Stock Exchange, Luxembourg Stock Exchange, and the New York Stock Exchange

All three exchanges work differently and have different regulations, disclosure requirements and costs associated with the listing. A detailed explanation of each of the markets and their regulatory requirements are given in Appendix A.

Understanding the NYSE, LSE and LuSE markets

New York Stock Exchange (NYSE)

The NYSE has more than 2,400 listed companies, out of which approximately 500 are international companies. The market is highly regulated, with its primary aim being to ensure the protection of investors. To list and be able to trade on the NYSE, international companies are required to apply to the Securities and Exchange Commission (SEC) for a Level II or Level III registration. They also need to comply with General Accepted Accounting Principles (GAAP), and they also need to apply to and be accepted by the NYSE board in order to be able to trade.

London Stock Exchange (LSE)

The LSE is one of the world's largest international capital markets with approximately 2,200 companies from 70 countries, out of which more than 500 companies are international. The LSE offers three different markets based on the companies' size and objectives: Main market, AIM and Professional Securities Market (PSM). For listing on the LSE, international companies are required SEAQ – I registration, which is comparable to SEC level I registration for the NYSE. For accounting purposes, companies can use International Financial Reporting Standards (IRFS) or GAAP or the home country accounting standards. They do not need any approval from the government or LSE board.

Luxembourg Stock Exchange (LuSE)

The LuSe ranks first in terms of listed international bonds in Europe (PWC Luxembourg, 2013). LuSE has more than 35,000 listed securities and can list in as little time as 24 hours, according to the information available on the LuSE website. For listing on the LuSE, there is no specific requirement for listing in LuSE. Companies can use IFRS or GAAP or home country-specific accounting standards. Listing on the LuSE is not subject to the approval of the government.

2. Literature Review and Hypotheses Development

Cross listing has been associated with increase in market value, higher liquidity, increase in analyst coverage, lower cost of capital, opportunity to gain access to foreign capital and investor recognition (Miller, 1999; Brockman and Chung, 1999; Lang et al., 2003; Karolyi and Stulz, 2002). Miller (1999) provided empirical evidence that cross listing can mitigate capital flow barrier resulting higher share price and greater market value. Brockman and Chung (1999) reported a significantly lower bid-ask spread for cross-listed companies compared to companies that do not cross-list indicating an increase in liquidity for cross listed firms. Also, cross listing allows companies to enjoy greater analyst coverage and forecast accuracy compared to non-cross-listed companies (Lang et al., 2003). Listing in international market allows company's shares to be accessible to non-resident investors thus reducing the cost of capital and increasing investor recognition (Karolyi and Stulz, 2002).

2.1 Stock Liquidity as Motivation for Cross-listing

Though the benefits of cross-listing are many, an increase in stock liquidity has been a major motivation for companies to cross-list in overseas markets. However, there is an ongoing debate around the liquidity benefits of cross-listing. There has been mixed evidence of the liquidity benefits of cross-listing, for example, reduction in bid-ask spread (Brockman & Chung, 1999; Foerster and Karoyli, 1998; Hegde, Lin & Varshney, 2010) and an increase in trading volume (Sabherwal, 2007; Mitto, 1997). While other studies have contradicted these results as they have found evidence of either a decrease in liquidity or no effect (Domowitz et al., 1998; Berkman & Nguyen, 2010).

A number of studies have examined the impact of cross-listing on the bid-ask spread of stocks from developed and developing markets. When companies cross-list, it increases the trading hours and the number of investors, thereby increasing the competition among traders leading to a potential decrease in the spread. Brockman and Chung (1999) conducted an intraday study of Hong Kong companies cross-listed on the LSE from 1996 to 1997 using a sample of 33 companies. They reported a significantly lower bid-ask spread for cross-listed companies compared to companies that do not cross-list and further concluded that cross-listed companies have a high level of liquidity compared to non-cross-listed companies and thereby lower capital costs. Hegde et al. (2010) studied the bid-ask spread of companies that trade on both NYSE and NASDAQ stock exchanges.

They used eight companies from 2004–2007 that traded on both exchanges and concluded that on average bid-ask spread decreases after the company is dually listed, as there are extended trading hours, thereby reducing trading costs and improving liquidity. Also, comparing NYSE and NASDAQ stock exchanges, Hegde et al. (2010) documented that stocks listed on NYSE had a narrower spread compared to NASDAQ, as NYSE is a more liquid market. Foerster and Karoyli (1998) considered a sample of 52 Canadian companies that traded on the Toronto Stock Exchange (TSE) and US exchanges from 1981–1990 and reported that effective spread decreased after cross-listing on the US exchanges, and found a decline in trading costs for those companies that traded in US markets.

Another liquidity measure that has been extensively used as a proxy for liquidity is trading volume. Trading volume increases in the domestic market after cross-listing on international stock exchanges, as the trading hours and the number of traders increases after cross-listing. Foerster and Karoyli (1993) studied a sample of 49 Canadian companies that cross-listed in US markets in the 1980s. They reported that after cross-listing domestic trading volume increased by 26 percent. Another study by Mittoo (1997) compared the impact of cross-listing on the trading volume on the TSE and Vancouver Stock Exchange (VSE) after cross-listing in the US, using stock turnover as a proxy for trading activity. He concluded that after cross-listing trading volume increased by 80 percent for TSE, whereas there was a decline in trading volume for VSE. TSE has 75 percent of the market share, with transparency greater than NYSE and NASDAQ, whereas VSE is a small stock exchange which is largely inhabited venture capital stocks. One possible explanation provided by Mittoo (1997) is that the benefits of dual listing are reduced if one of the markets is less regulated, as they face the risk of insider trading. Similarly, Smith and Safianos (1997) studied the impact of cross-listing on trading among 128 non-US companies cross-listed on NYSE. They found that stocks from developed markets experienced an increase in trading volume by 30 percent, but there was no significant increase in trading volume for stocks from emerging market. This supports the argument of Mittoo (1997) that, if one of the markets less regulated and there is a risk of insider trading, cross-listing could lead to a decline in trading volume in the home market.

There are a few studies that find no improvement in liquidity after cross-listing. There are several arguments why cross-listing provides no improvement in domestic liquidity post-cross-listing. The first one is the order flow migration and spillover argument. This

argument suggests that when companies cross-list, the trading activity may shift from the domestic market to the international market, thereby hurting domestic trading and liquidity. Domowitz et al. (1998) conducted a study on 25 Mexican firms that traded in US from 1989–1993 and argued that when transparency between markets (domestic and foreign) is low, it will lead to diversion of order flow overseas, which will ultimately lead to a decrease in domestic liquidity or will have no impact. Levine and Schmukler (2006) support the view of Domowitz et al. (1998) regarding order flow migration. Levine and Schmukler (2006) studied 2900 firms from 45 emerging economies and reported that liquidity decreases post-cross-listing due to companies' share trading tending to move out of the domestic market and into the cross-listed market. Another study by, Silva and Chávez (2008) analyzed the stock liquidity of Latin American markets on the US stock changes in 1992–2001. They compared the benefits of cross-listing to companies that were not cross-listed and reported that they did not find any significant impact on liquidity for the cross-listed sample and concluded that when inter-market transparency is low, the liquidity impact of cross-listing diminishes.

The second argument is partial fragmentation which is in conjunction with the first argument, suggested by Domowitz et al. (1998). According to this argument, when there are imperfect linkages between cross-listed and domestic markets, this will lead to the effects of cross-listing being concentrated in only certain liquidity measures. For example, spread declines post-cross-listing but all the other liquidity measures decline as well, due to lack of transparency between the markets. Spread declines due to an increase in Intermarket competition or market makers cutting the spread to stop order flow migration. However, the overall liquidity declines due to order flow migration, as investors are now willing to invest in overseas cross-listed markets because of the reduction in costs and better investor protection. Also, Berkman and Nguyen (2010) hand-collected data on 277 non-US stocks from 30 countries that cross-listed in US markets. They compared the stock liquidity of cross-listed stocks to matched stocks and reported that after cross-listing there was a significant increase in liquidity for cross-listed stocks, but liquidity increased for the matched samples as well, indicating that cross-listing was not the cause of the increase in liquidity for cross-listed stocks. This indicates that a significant increase in liquidity measures might not be only due to the cross-listing.

The third argument relates to insider trading and weak investor protection. The argument is that if domestic markets have higher insider trading, then there is a reduction in liquidity

after cross-listing, or no impact because there is a lot of noise in the market and some investors may have insider information on the company, creating an advantage for them. Halling et al. (2008) examined companies that cross-listed on the NYSE, NASDAQ, and AMEX between 1980 and 2001, including companies from both developed and developing markets. Halling et al. (2008) found domestic trading volume was higher for developed countries and was lower or insignificant for developing countries. On further analysis, Halling et al. (2008) concluded that, for emerging market companies, the benefits of liquidity diminish in the home market if the home market has poor protection against insider trading, which threatens liquidity in emerging markets. The weak investor protection argument does not support the bonding theory that suggests there is an improvement in liquidity post-cross-listing for companies from countries with weak investor protection. According to the weak investor protection argument, when there is weak investor protection in the domestic market, there is an outward flow of trading activity towards the foreign market that requires stringent disclosure and provides better investor protection, thereby reducing liquidity in the domestic market (Biddle and Saudagaran, 1991).

To summarize, earlier studies focussed more on the US market as a destination for cross-listing. More recent studies compared the consequences of cross-listing for companies from emerging markets to developed markets. For developed markets, evidence in most cases supports liquidity theory, as those markets are liquid with strong governance and laws in place. However, for emerging markets, it can be observed that in most cases there is either no change or a decline in liquidity in the domestic market. The main explanation provided by previous studies is order flow migration, insider trading and weak investor protection (Domowitz et al., 1998; Levine & Schmukler, 2006; Halling et al., 2008).

As Indian markets have not been given the desired attention in terms of liquidity, in this paper we provide empirical evidence regarding liquidity in the Indian market. We hypothesize as follows:

H1: Cross-listing on LSE, LuSE and/or NYSE has a negative impact on the stock liquidity of Indian companies in their home market.

2.2. Role of Location in Cross-listing

In order to obtain maximum benefits from cross listing, destination market or location of cross listing often plays an important role. Li and Wang (2014) have concluded that the location of cross listing is critical in developing and expanding a company in a foreign market. The study of location in previous literatures is divided in two parts, i.e., first comparing different cross listing locations to identify which one is better and second identifying if a certain cross-listing location has benefits or not. Comparing different locations have always been a topic of interest. Li and Wang (2014) compared the benefits of cross-listing when Chinese companies cross-list in the US and Hong Kong and concluded that location plays an important role; they found that the US market has more perks in terms of information and institutional environments compared to Hong Kong markets. Dodd and Louca (2012) compared cross-listings by European companies in the US, UK and within Europe to determine the effect on shareholder's wealth. They reported that shareholders' wealth varied across regions, with the US and UK markets providing higher benefits from cross-listing. On the other hand, some other literatures has focussed on the second part of identifying if cross listing benefits exist or not. Eng et al. (2008) studied non-US firms listed on US stock exchanges to understand the impact whether cross-listing in US market will boost liquidity or not. They observed that companies from markets with poor information environments benefit more from cross-listing on US stock exchanges in terms of investor recognition and increases in liquidity. Another study by Abdallah and Goergen (2008) found that the choice of location is based on shareholder investor protection. They used a sample of 175 companies that cross-listed in 19 different foreign stock exchanges during the period 1990–2000. They reported that companies that have many shareholders with control benefits are more likely to cross-list in a market that has better investor protection. Additionally, Lang and Yau (2006) found that the information environment plays a critical role in cross-listing. They studied 237 Chinese firms that cross-listed in other countries and argued that emerging market companies are more likely to cross-list due to the availability of the information environment, which reduces external financing rather than increasing cash flow.

Though there is considerable literature on location-based cross-listing, not much focus has been given to emerging market like India where cross-listing plays an important role in marking their presence in the world market and maintaining a strong investor base. Previous studies on India have more focused on the legal and regulatory environment when Indian companies are cross-listed. The study by Madhani (2016) compared the

regulatory environment of the host market when Indian companies cross-list in the US, UK, and Luxembourg with domestic companies. She found that the companies that cross-list voluntarily adopt higher disclosures that would apply in both the host and the home country. Another study by Khurana et al. (2007) concluded that cross-listing in a US market helps to improve access to lower cost external financing, as cross-listing in the US enables more investor recognition and there is a commitment by the company to follow the stringent rules. Milelli et al. (2010) in their paper to some extent have provided some important insights on why India prefers to choose a European market rather than the US market. For example, Europe offers an environment with limited regulatory requirements compared to the US. Listing on the LSE gives access to other European markets and hence it becomes easy for the company to expand its investor base. Also, Europe is a large market in terms of size and status. Kumar et al. (2001) conducted a study of 30 Indian companies that are cross-listed from 1996 to 2001, via ADR on the NYSE and GDR on the LSE and LuSE. They did not find any clear patterns in liquidity for DRs although liquidity for ADR reduced while liquidity for GDR increased. As this study did not provide any clear patterns, we would like to extend this study taking a larger sample and a large period to evaluate whether the location has an impact on liquidity or not.

The LuSE and LSE are dominant exchanges for cross-listing via GDR; on the other hand, NYSE is a leading exchange for cross-listing via ADR. As discussed earlier in section 1.1, cross listing in LSE, LuSE and NYSE is different due to differences in disclosure requirement, cost associated with listing and different regulates and laws that needs to be followed. For example, for listing in NYSE, the companies need to apply to SEC and comply to GAAP whereas for listing in LSE, they require only SEAQ-I registration and can use either IRFS or GAAP and for LuSE, there is no specific requirement as required by earlier two exchanges and can use IRFS, GAAP or event home country-specific accounting standards. As not much has been discussed earlier comparing these 3 markets, especially with regards to Indian market, we would focus on this aspect.

Hence our second hypothesis is as follows:

H2: Comparing the benefits of cross-listing for NYSE, LSE, and LuSE, liquidity will decrease for Indian cross-listed companies, however, NYSE will have lower decrease compared to LSE and LuSE cross-listed companies.

To test these two hypotheses, we use two approaches, which we will discuss further in the Methodology section.

3. Methodology

In order to test our first hypothesis that Indian companies that are cross-listed in the US, UK and Luxembourg will decrease in liquidity, we use two approaches: First, we compare the stock liquidity for before and after the cross-listing event for cross listed companies in the home (Indian) market. We expect that the liquidity of Indian companies will decrease after the cross-listing event due to order flow migration and insider trading. For our second approach, we use difference-in-difference methodology. We compare the liquidity of Indian companies that are cross-listed in the LSE, LuSE or NYSE from 1992–2017 to the liquidity of domestic companies (matched sample) that are not cross-listed during the cross-listing event. We expect that cross-listed company's stocks will decline in terms of liquidity in the home market after cross-listing and we expect to observe no impact on the matched samples. To test the second hypothesis, we again use difference-in-difference analysis. We examine if the host market of the cross-listing plays a critical role in improving the liquidity of the cross-listing firms. We expect that companies that are cross-listed via ADR on the NYSE will be same in terms of liquidity compared to companies that cross-list via GDR on the LSE or LuSE. We also expect that companies cross-listing across different time periods will decline in liquidity.

To test these hypotheses, we estimate several measures of stock liquidity in the home (Indian) market. For our analysis, we consider stock trading activity in the home market for a period of 150 days before and 150 days after the cross-listing of each sample firm as well as the matched firm. To proxy liquidity, we use four liquidity measures, namely, trading volume, turnover ratio, bid-ask spread and amihud illiquidity.

We use daily data to estimate the following four liquidity measures:

- A.) Trading volume
- B.) Turnover ratio
- C.) Bid-ask spread
- D.) Amihud illiquidity

A.) Trading volume

When a company cross-lists in an international stock exchange, it sends a positive signal to the market regarding the ability of the firm to meet international listing requirements, which can cause investors to invest in the overseas market rather than the domestic market due to better investor protection (Domowitz et al., 1998). We calculate trading volume using the variable Number of shares traded (VO). We estimate trading volume for each stock and then calculate the average for a period for 150 days before and 150 days after cross-listing each firm. We expect that cross-listed companies will decrease in trading volume after cross-listing. Further, when companies cross-list in one of the three stock exchanges, we expect decline in liquidity for all the three exchanges and across different time periods.

B.) Turnover ratio

The second measure of stock liquidity that we use is turnover ratio in the home market. We estimate daily turnover ratio as follows:

Equation (1)

$$\text{Turnover Ratio} = \frac{\text{VO}}{\text{NOSH}}$$

where VO is the daily number of shares traded and NOSH is the number of shares outstanding.

We use daily turnover ratios to estimate the average turnover ratio for each stock 150 days before and 150 days after the cross-listing. Also, we compare the impact with matched samples, to observe the benefits of cross-listing. We expect that turnover ratio will decrease for firms after cross-listing and for domestic companies we expect no impact on turnover ratio. We also expect turnover ratio to decline on all the three stock exchanges and across the different time periods. We take a log of turnover ratios for our calculations.

C.) Bid-ask spread

We use bid-ask spread to proxy the level of liquidity before and after cross-listing. We calculate bid-ask spread as follows:

Equation (2)

$$\text{Spread \%} = \frac{\text{Ask Price} - \text{Bid Price}}{(\text{Ask Price} + \text{Bid Price})/2} \times 100$$

Ask price is the asking price quoted at the end of each day and bid price is the bid price quoted at the end of each day. We estimate the daily spread for 150 days before and 150 days after cross-listing and then calculate the average of before and after cross-listing for each firm. We expect that cross-listed companies will observe an increase in bid-ask spread after cross-listing and domestic firms will experience no impact. We also expect that companies cross-listed on the NYSE will not observe a further decrease in spread compared to GDR listings on the LSE and LuSE. Also, the spread will increase over the different time periods.

D.) Amihud illiquidity measure

Amihud (2002) proposed a model for stock illiquidity by taking into consideration daily returns and the number of shares traded. Amihud (2002, p. 35) defined stock illiquidity as the “average ratio of the daily absolute return to the (dollar) trading volume on that day”. We estimate the Amihud illiquidity measure as follows:

Equation (3)

$$ILLIQ_i = R_i / VO_i$$

R_{it} is the daily return of stock i and VO_{it} is the daily trading volume of (in dollars) stock i

We calculate the daily Amihud illiquidity ratio for cross-listed and matched stocks for 150 days before and after cross-listing and then take the average of before and after cross-listing to interpret the impact of cross-listing. We expect Amihud illiquidity will be higher after cross-listing and matched firms will experience no impact. Further, we expect that Amihud illiquidity will decline and will be indifferent for companies listed in the NYSE as compared to companies that are listed in LSE or LuSE and over different time periods.

To examine our first approach for our first hypothesis regarding the relationship between liquidity and Indian cross-listed companies, we use a panel data regression for a period of 6 months before cross listing and 6 months after cross listing. We use daily frequency data. The regression model is as below:

Equation (4)

$$Liquidity_i = \alpha + \beta_1 D_CL_i \times D_Post_i + \sum \gamma_k Control_{ki} + \varepsilon_i$$

where $D_CL_i \times D_Post_i$ is the product of the cross-listing dummy variable and post cross listing dummy variable. It equals 0 for matched sample and for the cross-listed sample before cross-listing and equals 1 for the cross-listed sample after cross-listing. We expect $D_CL_i \times D_Post_i$ variable to decline for our sample.

In our regression model, we use two control variables to control for firm characteristics, namely, a firm's size and growth opportunities. We measure firm size using the market value variable. We measure growth opportunities using the market to book ratio. For conducting univariate analysis, we use two additional control variables: the number of foreign institutional investors and foreign sales. However, we dropped these variables from the regression analysis due to the very small number of observations. To calculate control variables, we take daily data for 150 days before and 150 days after cross-listing and then calculate the average for before and after cross-listing for all cross-listed and matched stocks. To reduce the impact of outliers on our results, we winsorize the variables at 1 percent on both sides of the distribution. We expect these 2 control variables to be positively related to liquidity

To investigate the relationship between liquidity and cross-listing, we use the regression model earlier used by Dodd and Gilbert (2016) to examine the impact of cross-listing in the US on the information environment and stock price efficiency in the home market. We use this model for our second approach to test the first hypothesis and for the second hypothesis. We use daily data for the below equation

Our regression model is as follows:

Equation (5)

$$Liquidity_i = \alpha + \beta_1 D_CL_i \times D_Post_i + \beta_2 D_Post_i + \beta_3 D_CL_i + \sum \gamma_k Control_{ki} + \varepsilon_i$$

$D_CL_i \times D_Post_i$ is the main explanatory variable. $D_CL_i \times D_Post_i$ is the product of

the cross-listed dummy variable and post cross-listing dummy variables. The interaction of this variable allows us to estimate the impact of cross-listed stocks post cross-listing event. We expect $D_CL_i \times D_Post_i$ and D_Post_i to be negative and D_CL_i to be positive. D_CL_i is the cross-listed dummy variable that equals 1 if the stocks are from the cross-listed sample and 0 if the stocks are from the matching sample. D_CL_i allows us to estimate the differences in liquidity of cross-listed stocks relative to matched domestic stocks. D_Post_i is the post-cross-listing dummy variable that equals 1 for the period before cross-listing for the cross-listed and matched sample and equals 0 for the period before cross-listing for the cross-listed and matched sample. D_Post_i estimates if there are differences in liquidity before and after the cross-listing for both cross-listed and match stocks..

In our regression model, we use two control variables to control for firm characteristics, namely, a firm's size and growth opportunities. We measure firm size using the market value variable. We measure growth opportunities using the market to book ratio. For conducting univariate analysis, we use two additional control variables: the number of foreign institutional investors and foreign sales. However, we dropped these variables from the regression analysis due to the very small number of observations. To calculate control variables, we take daily data for 150 days before and 150 days after cross-listing and then calculate the average for before and after cross-listing for all cross-listed and matched stocks. To reduce the impact of outliers on our results, we winsorize the variables at 1 percent on both sides of the distribution.

4. Data

To understand the benefits of cross-listing on stock liquidity, we hand collect data for Indian companies that are cross-listed on the NYSE using ADR, and the LSE and LuSE using GDR for the period 1992 to 2017. We obtain information on the companies that are cross-listed from Datastream and we obtain dates of cross-listing for Indian companies from the stock exchanges' websites. As the purpose of the paper is to understand the impact of cross-listing on stock trading in the home (Indian) market, we have excluded those companies that are not listed in the home market at the time of foreign listing. As Datastream is our main data source, we have excluded all those stocks that are not covered in Datastream. In our sample, we include some companies twice as they are listed on multiple stock exchanges during our sample period, making it two separate cross-listing events. For example, HDFC bank cross-listed on the NYSE on 20 July 2001 and the LuSE on 17 February 2009, hence HDFC bank data is used twice but in different years and we expect the impacts to be different. We have also included companies that are now delisted to avoid survivorship bias. After applying the above selection criteria, we have a total of 161 companies that are cross-listed, out of which seven companies are cross-listed in more than one stock exchanges, making a total of 168 cross-listing events. In our sample, we have 29 companies cross-listed in LSE, 128 companies in LuSE and 11 companies on the NYSE. To obtain information for our matched samples, we download all the Indian stocks that are listed in either BSE (Bombay Stock Exchange) or NSE (National Stock Exchange) available in Datastream and then divide them on the basis of industry. As Datastream is our main source, we have excluded those companies that are not in Datastream. For our matched sample, we have chosen companies that are in the same industry as the cross listed sample and have similar market value and price to book ratio.

Figure 1 represents the distribution of cross-listed companies by host exchange and year of cross-listing. The largest number of companies are cross-listed on the LuSE, as it has the lowest cost and lowest number of disclosure requirements. Only 11 companies are listed on the NYSE due to high cost and high disclosure requirements. We can observe an increase in cross-listing in 1994, with 19 companies cross-listed in one of the three exchanges. The reason for this is the economic liberation in 1992; the government for the first time allowed Indian companies to trade outside the domestic market and hence large

companies took advantage of this situation (Panagariya, 2008). Later, in 2004, the government further simplified the process of issuing DRs. Before 2004, approval from the Ministry of Finance was required to issue DRs. However, in 2004 this was abolished and an automatic route was created without the interference of the Ministry of Finance, thus simplifying the process (Kaur et al, 2013). Hence, we can observe an increase in cross-listings in 2005, especially for the LuSE. After the global financial crisis (GFC), India and China were the leading emerging markets to come out of crisis. Also, when the Congress party won the election in 2009, further support was provided to companies willing to export or go beyond the home market to improve their market presence and expand globally (Sally and Sen, 2011). Low impact from the GFC and support from government led to an increase in cross-listing due to improved market presence and liquidity in 2010. However, from 2012, we observe a decrease in companies that have cross-listed on the LSE, LuSE and NYSE. We can observe a common pattern in listing for all the three exchanges. The listing in these three exchanges are positively correlated.

Table 1 in Section 11 provides the distribution of cross-listed companies by industry. As India is known as a hub for the software industry, it can be observed that software and computer services lead the table with 19 companies, followed by the personal goods industry and construction and materials.

To continue with our analysis, we obtain daily data for stocks including price, returns, number of shares outstanding (NOSH), number of shares traded (VO) and bid and ask price from Datastream. Control variables like market value, foreign sales, number of foreign institutional investors and market to book are also obtained from Datastream.

4.1. Spearman Correlation Matrix

Table 2 reports the Spearman correlation matrix between dependent variables and control variables for the cross-listed sample before the cross-listing event. Market value is positively correlated to all variables except price to book and trading volume. Foreign sales is negatively correlated to all variables except noshfr. Trading volume is positively correlated to market value and turnover ratio. Turnover ratio is positively correlated to spread and the Amihud illiquidity measure is negatively correlated to trading volume. Spread is negatively correlated to price to book ratio. Amihud illiquidity is negatively correlated to turnover but positively correlated to spread as expected.

5. Univariate Analysis

We begin our examination of the impact of cross-listing events on 168 Indian companies that have cross-listed on at least one of the three stock exchanges, namely, LSE, LuSE, and NYSE. To initiate our study, we use univariate analysis between before and after cross-listing for both cross-listed and matched samples for dependent variables. We use four dependent variables as a proxy for liquidity, namely – trading volume, turnover ratio, bid-ask spread, and Amihud illiquidity ratio. We test univariate differences between cross-listed and matched samples for the 150 days before cross-listing period and the 150 days after the cross-listing period. To test these differences, we estimate differences in mean using t-stat and differences in median using the Wilcoxon rank sum test. We report the results in Table 3.

Observing the difference in pre and post for a cross-listed sample from table 3, as expected we report a decrease in trading volume and turnover ratio; however, bid-ask spread and Amihud illiquidity ratio have also declined as well. We observe that only the turnover ratio is statistically significant. Increased Intermarket competition due to cross-listing has led to a decline in bid-ask spread and amihud illiquidity. However, the decline in trading volume and turnover ratio is due to a drop-in liquidity owing to order flow migration. The overall results support the partial fragmentation argument. We also report differences in before and after the cross-listing event for the matched sample. As expected, we do not find any significant evidence of liquidity increasing after the cross-listing event. However, we do observe a decrease in all variables post-cross-listing event for the matched sample, which is similar to the cross-listed sample. Overall, the results of the univariate analysis provide weaker evidence for our hypothesis that liquidity will decline post-cross-listing.

Next, we estimate univariate results for control variables in Table 4. For summary statistics, the control variables used are market value, market to book, foreign sales and number of foreign institutional investors (NOSHFR). To estimate these variables, we take the average of daily observations for each variable for a period of 150 days before and 150 days after cross-listing for each firm. The first and second column represent pre- and

post-cross-listing values for the cross-listed companies. The third column represents the difference in mean and median for pre and post-cross-listing. The fourth and fifth columns represent the pre- and post-cross-listing values for the matched sample companies. The last column represents the difference in mean and median for the matched samples. We calculate differences in mean using t stats and differences in median using the Wilcoxon rank sum test. From the summary statistics in Table 4, the results suggest that there has been an increase in the firm's size (measured by market value), market to book ratio, foreign sales, and foreign institutional ownership after cross-listing for cross-listed sample; however, only the increase in market value is statistically significant for the cross-listed sample. For the matched sample firms, the changes post cross-listing event compared to the pre-cross-listing event are insignificant for all control variables, which is expected as the matched sample firms should not be impacted by the cross-listing event.

6. Multivariate Analysis – OLS Regression

To control the potential explanation for changes in liquidity measures after cross-listing, we conduct a multivariate regression analysis. We construct panel data and estimate the regression using the OLS estimation procedure. We winsorize the data by 1 percent on both sides of the distribution. To control for time variations such as industry and year, we use industry and year fixed effects. For control variables, we only use market value and market to book, as the foreign sales and NOSHFR have very limited data.

6.1. Cross-listed Sample

In this section, we estimate the regression for only the cross-listed sample. We use equation (4) to estimate our results for the cross-listed stocks that are cross-listed on the LSE, LuSE, and NYSE between the period 1992–2017. We also include industry and year fixed effects. Table 5 reports the results of our estimation. In Table 5, we do not observe any significant results for our main explanatory variable Cross-listed X Post indicating no impact on liquidity after cross-listing for cross listed stocks. Cross-listed X Post variable is negative and has a t-stat close to being significant (t-stat = -1.61) in the regression of Turnover Ratio. For control variables, we observe that market value is a significant explanatory variable for positive trading volume and negative spread. For the market to book variable, we observe insignificant result for all the measures of liquidity with low t-stats in regression to liquidity measures. Overall, we did not find any significant increase or decrease in liquidity for cross-listed stocks after cross-listing.

6.2. Full Sample: Cross-listed and Matched Sample

In this part of the analysis, we estimate regression for the full sample that includes cross-listed and matched Indian stocks that were listed on the LSE, LuSE, and NYSE between the period 1992–2017. We estimate the output using equation (5). Table 6 reports the results of our estimation. In general, from the results of Table 6, we do not report many statistically significant results. For Cross-listed X Post variable, which is our main explanatory variable, we observe that this variable is insignificant for all measures of liquidity indicating no impact on liquidity for cross-listed stocks post cross listing compared to matched samples. Also, a decrease in turnover ratio is consistent with the

study by Mitto (1997), who had observed a decrease in trading volume if there is insider trading in the domestic market. The decline in the spread and Amihud illiquidity are explained in the earlier table, i.e, due to inter-market competition. The cross-listed variable is statistically significant and positive in the regression of trading volume and turnover ratio. This indicates that cross-listed stocks are more liquid for these two measures of liquidity as compared to matched sample stocks. The post cross-listing variable is insignificant for all measures of liquidity indicating no significant changes after cross-listing that are common for cross-listed and the matched samples.

With regards to control variables, we report that market value variable is significant for three out of four measures of liquidity which are trading volume (positive), spread (negative) and amihud illiquidity (negative). We report that for the market to book ratio is statistically significant for trading volume (positive), spread and Amihud illiquidity (negative) . From the control variables results, we again observe that stocks that actively traded and that are large benefit more by cross-listing.

6.3. *Full Sample – Using Location Dummy*

It is important to understand the benefits of cross-listing that are specific to certain locations. To evaluate this, we estimate regression using a location dummy. We divide the entire sample based on location and then re-run equation (5) with additional variables for dummy LSE, LuSE and NYSE. We report our estimation results in Table 7. In Table 7, we again report that we do not find any statistically significant results for our three main explanatory variables, despite using the location dummy variables. Also, the t-stats in regression for all the liquidity measures are low indicating that cross-listing did not lead to any significant change in liquidity for cross-listed stocks post cross-listing irrespective of the location of cross-listing. For cross-listed variable, we report statistically significant explanatory variable for positive trading volume and turnover ratio. This indicates that cross-listed stocks are more liquid for these two measures of liquidity as compared to matched sample stocks. For the post-cross-listing sample, again no significance can be reported, indicating the matched and cross-listed samples have nothing in the common post-cross-listing event. Overall, we did not find any significant changes in liquidity for cross-listed stocks which are consistent with previous studies from Domowitz et al. (1998) and Levine and Schmukler (2006).

7. Location Based Regression

In the earlier tables, we were unable to find significant results suggesting improvement in liquidity, and hence now we further investigate using individual locations to evaluate if the benefits are different for different locations. We begin with Indian companies that are listed via GDR on the LSE and LuSE together and then separately regress for LSE and LuSE and finally ADR for NYSE listed companies.

7.1. GDR Listed companies:

In this section, we evaluate Indian companies that are cross-listed via GDR to see if the benefits of cross-listing exist for GDR-listed companies. Here, we only consider those Indian companies that are listed on the LSE and LuSE. We re-run the regression (5) and report the results in Table 8. In the table 8, we do not report many significant results in Indian companies that are cross-listed via GDR on the LSE and LuSE. For our main explanatory variable Cross-listed X Post, we report an insignificant results for all measures of liquidity indicating no impact on liquidity post cross listing for cross listing stocks. The t-stats for all the measures of liquidity are low as well. For cross-listed variable, as reported in earlier tables, we report significant and post for regressors trading volume and turnover ratio, indicating that cross listed companies are more liquid than matched sample companies for these two regressors. The cross-listed variable is insignificant explanatory variables for all the four measures of liquidity indicating that after cross-listing, the cross-listed sample and matched samples do not have anything in common. The significance improves for control variables, as market value is statistically significant for three out of four measures of liquidity which are trading volume (positive), spread (negative) and Amihud illiquidity (negative) and market to book variable is significant for two out of four variables which are trading volume (negative) and spread (positive), indicating that for GDR stocks, active and large stocks have better liquidity. Overall, we find weak evidence of decline or improvement in liquidity post cross listing for cross listed stocks but find strong evidence of large and active stocks having better liquidity.

7.2. LSE listed companies:

In the earlier section, we examined companies cross-listed via GDR together. In this section, we regress companies that are cross-listed on the LSE only. From the full sample, we select those companies that are cross-listed on the LSE and their matched sample stocks. We re-run equation (5) for LSE companies only and the results are reported in Table 9. From the results in Table 9, we report that, as expected, we do not observe any significant results for Cross-listed X Post, indicating no impact in liquidity post cross listing for cross listed sample. However, we observe that Cross-listed X Post variable is negative and has a t-stat close to being significant ($t\text{-stat} = -1.58$) in the regression of spread. For cross-listed variable, we report that the variable is statistically significant for negative spread as a dependent variable. The post-cross-listing variable is insignificant for all measures of liquidity. This indicates that the purpose of Indian companies to cross list in LSE is not to increase liquidity but it could be other numbers of factors like increase market recognition and raising capital. For the control variables, the market value variable is significant explanatory variable for trading volume (positive), spread (negative) and illiquidity ratio (negative). For market to book ratio, the variable is insignificant for all the measures of liquidity. Overall, from the results of this table, we report weaker evidence of changes in liquidity on cross listed stocks This is consistent with our earlier results. One of the reasons for low t-stats could be that the number of companies cross-listed on the LSE is very limited (29 companies).

7.3. LuSE listed companies

Next, we examine Indian companies that are cross-listed on the LuSE only, hence the number of observations from the full sample is reduced. We re-run equation (5) with only the LuSE listed companies and report the estimation results in Table 10.

From the results in Table 10, for cross-listed X post variable, we do not observe any significant results for all measures of liquidity and the t-stats for all the regression for dependent variables are low, indicating no impact on liquidity post cross listing for cross listed companies. Our results are consistent with the order flow migration theory suggested by Domowitz et al. (1998). The cross-listed sample variable is significant in the regression with trading volume as a dependent variable only, with a high t-stat of 4.34. This indicates that when Indian companies are cross listed in LuSE trading volume in domestic market for those companies is higher. For post-cross-listing sample variable, all the measures of liquidity are insignificant as we would expect no similarity between cross

listed and matched sample in terms of liquidity. For control variables, market value variable is significant explanatory variable for trading volume (positive), spread (negative) and amihud illiquidity (negative). For market to book variable, we report the variable is statistically significant in the regression with trading volume (negative) and spread (positive). Overall, we did not report any strong evidence of change in liquidity for cross listed companies.

7.4. NYSE listed companies:

In the previous sections, we reported the results for companies cross-listed via GDR on the LSE and LuSE. In this section, we report the results for companies that are cross-listed via ADR on the NYSE. Eleven companies were cross-listed via ADR on the NYSE in the period 1992–2017. We select only NYSE listed companies from our sample and re-run the equation (5) and report the estimation results in Table 11. The Cross-listed X Post sample variable is insignificant for all the measures of liquidity indicating no changes in liquidity for cross listed companies post cross listing. For the cross-listed sample, we report that the variable is statistically significant with regressor trading volume while the other three regressors are insignificant. For post cross-listing variable, we do not report any significant results for all the measures of liquidity. This indicates that there are no similar patterns that can be observed post cross-listing that are common to both the cross-listed and matched samples. The t-stats for all the variables are better than earlier tables, indicating that liquidity has slightly improved as compared to earlier tables. The number of variables that are cross-listed is relatively low and could be one of the reasons for insignificance. We find no evidence of improvement or decline in liquidity post cross-listing for cross listed stocks when compared to matched samples.

7.5. Comparing the LSE, LuSE and NYSE companies:

Initially, we begin with comparing results for GDR and ADR results. From the estimation outputs from Table 8 and Table 11, we do not find any significant evidence of decline in liquidity post cross-listing. However, when comparing the two outputs for our main explanatory variable cross-listed X post sample, we report that none of the outputs show any sign of significance for any of the measures of liquidity which indicates that there is no change in liquidity post-cross-listing for cross-listed companies. Also, comparing the t-stats, we can observe that cross-listing has improved more for the ADR listed companies. For cross-listed sample variable, we observe that this variable is significant

explanatory variable for trading volume for both GDR and ADR listed companies and is only significant for regressor turnover ratio for GDR listed companies. The post-cross-listing variable is insignificant across all measures of liquidity for both GDR and ADR listed companies, indicating there is nothing similar between cross listed and matched sample companies post cross listing event. Next, we compare each stock exchange individually. For our main explanatory variable, cross-listed X post sample, we report that none of the outputs in the three locations show any sign of significance for any of the measures of liquidity which indicates that there is no change in liquidity post-cross-listing for cross-listed companies. Comparing the three stock exchanges, though all the results are insignificant, we can observe that NYSE listed companies have increased their liquidity the most. This indicates that the location of the listing does play a role in liquidity improvement, however, we have a weak evidence to prove this. A possible explanation for these differences is that NYSE is one of the most reputed stock exchanges in the world with stringent rules and disclosure requirements, leading to an increase in confidence among investors and thereby increasing liquidity in the domestic market consistent with liquidity theory. For the LuSE, most of the companies are medium sized firms and cross-listing on the LuSE gives investors better protection compared to the home market, hence a company's shares move out to LuSE, thereby reducing liquidity in the home market.

For cross-listed sample variable, we report that it is statistically significant with regressor trading volume when cross-listed in LuSE and NYSE and with spread when cross-listed in LSE. The post-cross-listing variable is insignificant across all measures of liquidity for all the three locations.

8. Year based regression:

In our earlier results, although we did not find significant results, we did observe a decrease in liquidity for cross-listed firms. In this section, we further investigate by grouping years into three division and then re-run equation (5) to observe if cross-listed benefits prevailed in any particular point of time. We have grouped the years from 1992 to 2017 in three categories: 1.) 1992–1999; 2.) 2000–2007; 3.) 2007–2017.

8.1. Years 1992–1999

In this section, we estimate the results for Indian companies that were cross-listed on the LSE, LuSE or NYSE between 1992 and 1999. A total of 38 companies were cross-listed during this period. From our entire sample, we select data for these 38 companies along with matched samples and re-run equation (5) and estimate the results in Table 12. From the results, for our main explanatory variable, Cross-listed X Post variable is insignificant for all measures of liquidity. Liquidity has decreased for three out of four dependent variables, however, all the variables are insignificant with low t-stat, indicating that there is order flow migration, leading investors to invest in overseas markets due to better protection and stringent disclosure requirements. We do not observe any significant results from cross listed sample variable or post cross listing sample variable, indicating no change in liquidity for cross listed sample when compared to matched sample. Market value is significant for regressors trading volume and spread. Market to book variable is insignificant for all the measures of liquidity.

8.2. Years 2000–2007

In this section, we estimate the results up until Global Financial Crisis. The estimation results are reported in Table 13. From the results in Table 13, for the cross-listed X post variable, we report insignificant results across all measures of liquidity. All the regressors have very low t-stat indicating no impact on liquidity. For cross-listed sample variable, we report that the variable is significant explanatory variable for trading volume. For post-cross-listing variable, we report insignificant results across all measures of liquidity. However, we report an increase in liquidity for the control variables. Market value variable is significant for three out of four dependent variables and supports the liquidity theory, as trading volume is positive and spread and Amihud are negative, indicating that

large firms have a better information environment. For market to book ratio, we report statistical significance for regressor spread as a dependent variable.

8.3. Years 2008–2017

In this section, we report the results after the Global Financial Crisis until 2017. We select companies from 2008–2017 that are cross-listed on the LSE, LuSE or NYSE. A total of 65 companies were cross-listed during this period. From the full sample, we select data for these 65 companies along with their matched samples and re-run the equation (5) and estimate the results in Table 14. The cross-listed X post sample variable is insignificant for all liquidity measures with low t-stats. For cross listed sample variable, we report statistically positive significance for regressors trading volume and turnover ratio. For post cross-listing sample variable, we do not observe any significant results. For control variables, the market value sample variable is significant for 3 out of 4 measures of liquidity which are trading volume (positive), spread (negative) and amihud illiquidity (negative) and market to book ratio is positively significant for 2 out of 4 measures of liquidity which are spread and amihud illiquidity as dependent variables. This indicates that large and active firms gain more from cross listing.

8.4. Comparing the 3 time periods:

Comparing the three time periods, we do not observe any significant results of increase or decrease in liquidity post cross listing. This indicates that increasing liquidity might not be a factor for Indian companies to cross list overseas. From period., 1999 to 1999, we observed a decline in liquidity, for 2000 to 2007, we observed a non significant but an increase in liquidity compared to earlier period and in 2008-2017, we observe some improvements in liquidity but the t-stat are low indicating that cross listing made no impact in liquidity for Indian companies. Overall, comparing the three time periods, we do not observe any strong significant results to support our hypothesis, which indicates that liquidity might not be the factor for cross listing for Indian companies

9. Conclusion and future research

Liquidity benefits of cross-listing has been a popular topic of debate in recent times. While some previous literature has found an improvement in liquidity (Brockman & Chung, 1999), others have found no impact or a decline in liquidity (Domowitz et al., 1998). Emerging market studies in this field are limited, hence in this paper, we explored Indian companies that are cross-listed on the LSE, LuSE, and NYSE between 1992 and 2017. Using four liquidity measures, namely, trading volume, turnover ratio, bid-ask spread, and Amihud illiquidity ratio. Supporting the views of earlier literatures that liquidity will decline post cross-listing for cross-listed companies due to order flow migration (Domowitz et al, 1998), insider trading (Smith and Safianos, 1997; Halling et al., 2008) and weak investor protection (Biddle and Saudagaran, 1991), we evaluated whether liquidity declines for Indian cross-listed companies are not.

Our sample consists of 168 Indian companies cross-listed in LSE, LuSE and/or NYSE as well as the same number of matched samples. Our findings suggest liquidity does not decline or increase post-cross-listing for Indian cross-listed stocks. Controlling for firm characteristics, industry and year fixed effects for cross-listed stocks, we found insignificant results with low t-stats indicating that stock liquidity in the home market had no impact after cross-listing. On further, investigating the impact of the location on cross-listing, we again found insignificant results, comparing the three exchanges, cross-listings on the NYSE are associated with a greater increase in liquidity post-cross-listing. This could be due to strict rules and disclosure requirements that cross-listed companies must adhere to and hence boosting confidence among investors. Further, we considered different time periods, namely, 1992 – 1999; 2000-2007; 2008-2017, we again did not find any significant results. This indicates that liquidity might not have been a factor for Indian companies to cross-list in the overseas market.

One direction for future research would be to explore the motivations for Indian companies to cross-list. Another direction for future research could be to compare the liquidity benefits of BRIC countries cross-listing and to obtain more comprehensive data. Another direction could be to study equity stocks other than ADR and GDR listed companies, which could produce different results.

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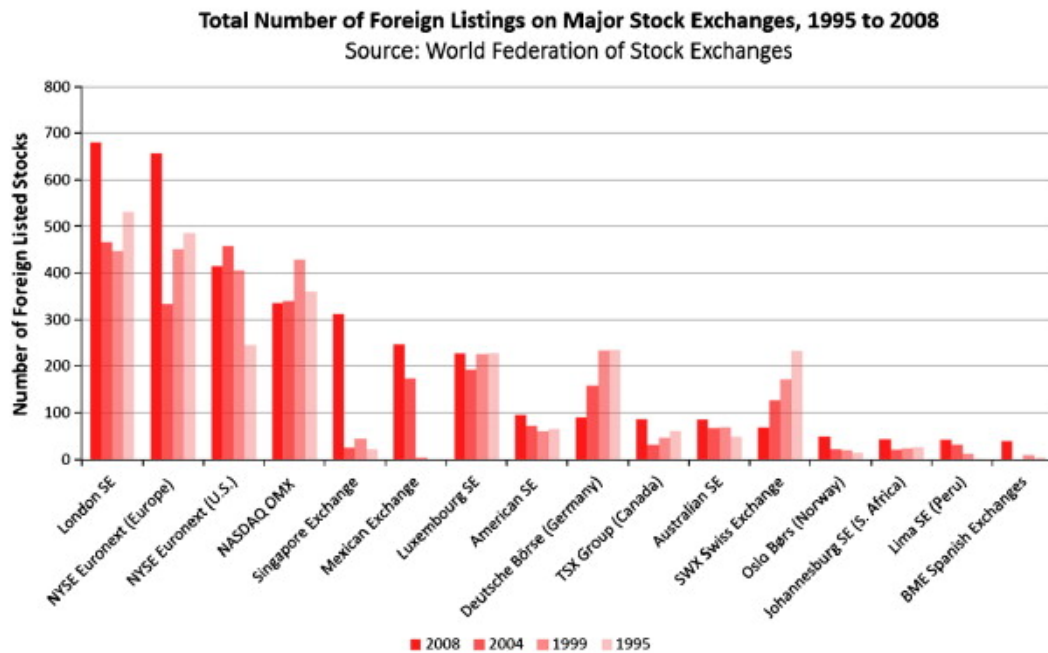
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11. Figures and Tables

Fig 1: Foreign listings on major stock exchanges



Source: World Federation of Stock Exchanges.

Figure 1 shows changes in the total number of foreign listings from 1995–2008 in 16 major stock exchanges.

Fig. 2: Funds raised via Depository Receipts

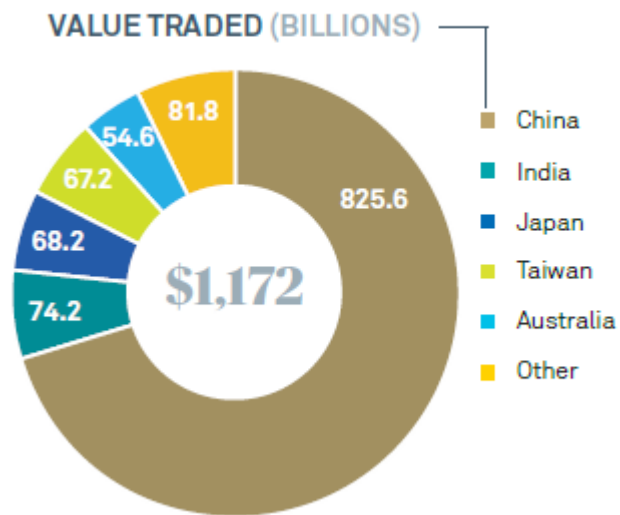
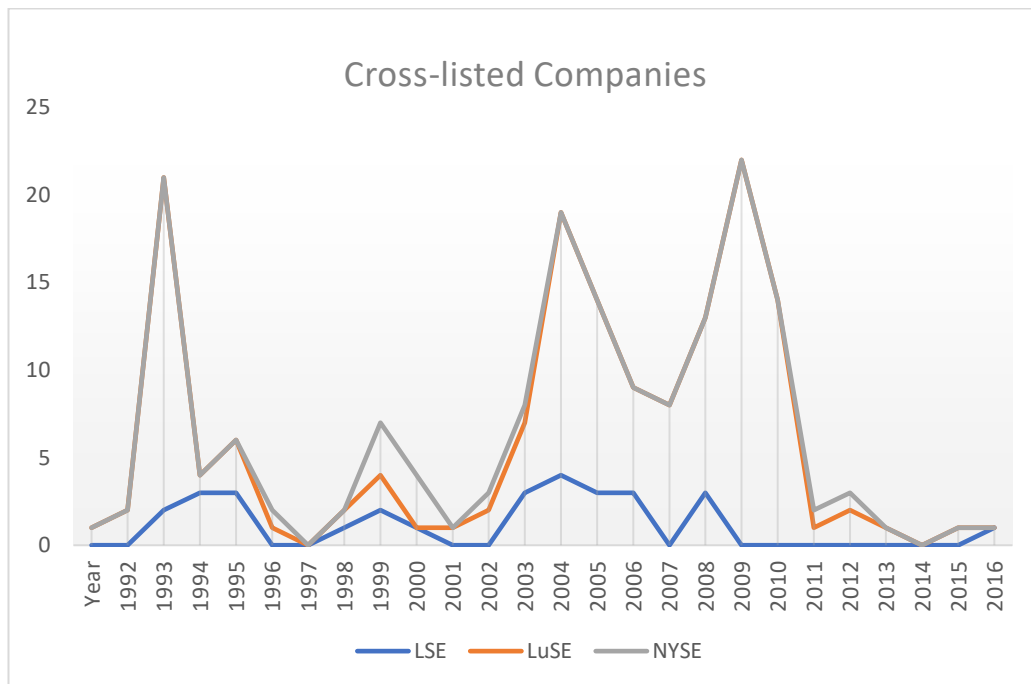


Figure 2 shows the funds that were raised via DRs in 2012. We can observe that China has the largest stake followed by other countries and then Indian and Japan.

Figure 3: Cross-listed Indian companies – Distributed by year



Note: The figure reports the companies that are cross-listing on the NYSE, LSE and LuSE stock exchanges during the period 1992–2017 by year and stock exchange.

Table 1: Cross-listed firms: Industry-wise distributions

This table reports Indian companies that are cross-listed on the LSE, LuSE and NYSE from 1992–2017 by stock exchange and industry.

Industries	Total	LSE	LuSE	NYSE
Aerospace and Defence	1		1	
Alternative Energy	2		2	
Automobiles and parts	1	1		
Banks	9	3	4	2
Beverages	1		1	
Chemicals	11		11	
Construction and Materials	15	1	14	
Electricity	6	2	4	
Electronic and Electrical Equipment	5	1	4	
Financial Services (Sector)	3	1	2	
Fixed Line Telecommunications	3	1		2
Food Producers	9	2	7	
Forestry and Paper	2		2	
General Industrials	2		2	
General Retailers	1		1	
Health Care Equipment and Services	1		1	
Household Goods and Home Construction	1	1		
Industrial Engineering	7	3	3	1
Industrial Metals and Mining	12	2	10	
Industrial Transportation	2	2		
Leisure Goods	1		1	
Media	6		5	1
Nonlife Insurance	1		1	
Oil & Gas Producers	3	1	2	
Personal Goods	18	2	16	
Pharmaceuticals and Biotechnology	13	1	10	2
Real Estate Investment and Services	1		1	
Software and Computer Services	19	3	13	3
Support Services	3		3	
Technology Hardware and Equipment	4	1	3	
Tobacco	1		1	
Travel and Leisure	4	1	3	
Total	168	29	128	11

Table 2: Correlation matrix

This table represents the Spearman correlation matrix for dependent variables and control variables for a sample of 168 cross-listed stocks. All the variables are measured for 150 days before cross-listing.

	mv	foreign_sales	ptbv	noshfr	vo	spread	turnover	Amihud
mv	1							
foreign_sales	-0.1165	1						
ptbv	0.4623	-0.411	1					
noshfr	-0.2715	0.8559	-0.6271	1				
vo	0.1858	-0.3314	-0.1958	-0.5198	1			
spread	-0.515	-0.4683	0.4727	-0.5469	-0.0804	1		
turnover	-0.1007	-0.4157	0.6208	-0.7543	0.314	0.8149	1	
Amihud	-0.3032	-0.2741	-0.2798	0.2549	-0.4804	-0.0482	-0.5695	1

Table 3: Univariate test: Dependent variables

The table reports the mean, median, minimum, maximum, standard deviation and total number of observations for cross-listed and matched sample. We have used trading volume, turnover ratio, bid-ask spread and Amihud illiquidity as proxy measures for liquidity. The first two column of cross listed sample

and matched sample represent the pre- and post-cross-listing variables. The difference in mean is estimated using t-stat and difference in median is estimated using the Wilcoxon rank sum test. The total sample consists of 168 stocks for the cross-listing and matched sample.

	Cross-listed Sample			Matched Sample		
	<i>Pre</i>	<i>Post</i>	<i>Diff</i>	<i>Pre</i>	<i>Post</i>	<i>Diff</i>
<u>TRADING VOLUME</u>						
Mean	2.2067	2.1672	-0.039	1.1642	1.1151	-0.0491
Median	2.2429	2.2986	0.056	1.1168	1.0461	-0.0707
Minimum	-0.9398	-0.5341		-0.9318	-1.0000	
Maximum	5.1784	5.1245		4.2952	4.0441	
Std. Dev.	1.1627	1.1704		1.1160	1.0578	
Obs.	146	154		144	147	
<u>TURNOVER RATIO</u>						
Mean	0.0258	0.0155	-0.0103*	0.0081	0.0038	-0.0043
Median	0.0072	0.0043	-0.0029*	0.0013	0.0011	-0.0002
Minimum	0.0000	0.0000		0.0000	0.0000	
Maximum	0.5091	0.2661		0.4988	0.0701	
Std. Dev.	0.0664	0.0306		0.0428	0.0089	
Obs.	146	154		144	147	
<u>SPREAD</u>						
Mean	1.0019	0.9228	-0.079	2.5624	2.5450	-0.0174
Median	0.6093	0.6214	0.012	1.6330	1.5991	-0.0339
Minimum	0.0219	0.0428		0.0752	0.0512	
Maximum	4.4060	4.2631		19.7829	14.8326	
Std. Dev.	1.0317	0.8553		3.1859	2.7856	
Obs.	110	111		107	108	
<u>AMIHUDDILLIQ</u>						
Mean	0.2867	0.2533	-0.033	0.9256	0.8754	-0.0502
Median	0.0082	0.0089	0.001	0.1170	0.1450	0.0280
Minimum	0.0000	0.0000		0.0001	0.0001	
Maximum	8.7500	5.6669		9.0476	10.0000	
Std. Dev.	1.0496	0.7177		1.7690	1.6370	
Obs.	146	154		144	147	

*indicates statistically significant at 0.10 level

Table 4: Univariate test: Control variables

The table reports mean, median, minimum, maximum, standard deviation and total number of observations for the cross-listed and matched sample. We have used market value, market to book, foreign sales and number of foreign institutional investors for our control variables. The first two column of cross listed

sample and matched sample represent the pre- and post-cross-listing variables. The difference in mean is estimated using t-stat and difference in median is estimated using the Wilcoxon rank sum test. The total sample consists of 168 stocks for the cross-listing and matched sample.

	Cross-listed Sample			Matched Sample		
	<i>Pre</i>	<i>Post</i>	<i>Diff</i>	<i>Pre</i>	<i>Post</i>	<i>Diff</i>
<i>Market Value</i>						
Mean	3.8026	3.9896	0.1871*	3.1172	3.1515	0.0343
Median	3.7765	3.9879	0.2114*	3.1014	3.1121	0.0107
Minimum	1.4386	2.2688		0.7190	0.8214	
Maximum	6.1336	6.1764		5.9984	6.0614	
Std. Dev.	0.8887	0.8021		0.9245	0.9337	
Obs.	168	168		168	167	
<i>Market to Book</i>						
Mean	2.3627	2.4112	0.0485	2.7280	2.7097	-0.0183
Median	1.7300	1.8717	0.1417	1.6492	1.5187	-0.1304
Minimum	0.0933	0.1555		0.1236	0.1484	
Maximum	27.2505	30.7968		25.5750	13.7363	
Std. Dev.	2.7898	3.2908		3.5607	2.9385	
Obs.	152	158		108	110	
<i>Foreign Sales</i>						
Mean	11.9370	12.1234	0.1865	7.0878	6.7952	-0.2927
Median	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Minimum	0.0000	0.0000		0.0000	0.0000	
Maximum	100.0000	100.0000		100.0000	100.0000	
Std. Dev.	26.0788	26.3042		19.1430	18.9020	
Obs.	130	136		92	92	
<i>No. of Foreign Inst. Of Investors</i>						
Mean	17.6347	17.8360	0.2013	35.1799	33.2002	-1.9797
Median	12.0000	14.0000	2.0000	23.3210	14.4000	-8.9210
Minimum	8.0000	6.0000		5.0000	5.0000	
Maximum	51.0000	51.0000		86.0000	83.6214	
Std. Dev.	13.7294	14.4108		28.8797	32.6175	
Obs.	10	9		10	11	

*indicates statistically significant at 0.10 level

Table 5: OLS regression for Cross-listed sample:

The table reports the OLS regression estimation results of equation (4). We have considered four dependent variables as a proxy for liquidity measures: a.) Trading volume, b.) Turnover ratio

computed in equation (1), c.) Spread computed in equation (2) and d.) the Amihud illiquidity ratio, computed in equation (3) respectively. The sample includes cross-listed Indian stocks that cross-listed on the LSE, LuSE and NYSE during the period 1992–2017. Standard errors are clustered at firm level and t-stats are reported in parentheses.

	Trading Volume	Turnover Ratio	Spread	Amihud Illiquidity
Cross-listed X Post	-0.0402 (-0.48)	-0.0103 (-1.61)	-0.0368 (-0.38)	-0.1246 (-1.36)
Market Value	0.6170*** (8.49)	0.0006 (0.11)	-0.4555*** (-5.01)	-0.1339 (-1.69)
Market to Book	-0.0095 (-0.55)	-0.0008 (-0.60)	-0.0018 (-0.11)	0.0112 (0.59)
Constant	-2.3095*** (-3.85)	0.0032 (0.07)	3.6697*** (3.56)	2.5802*** (3.93)
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
No. of observations	280	280	204	280
R2	0.7191	0.1857	0.5956	0.4563

*** indicates statistically significant at 0.01 level

Table 6: Regression using full sample (cross-listed and matched sample)

The table reports the OLS regression estimation results of equation (5). We have considered four dependent variables as a proxy for liquidity measures: a.) Trading volume, b.) Turnover ratio

computed in equation (1), c.) Spread computed in equation (2) and d.) Amihud illiquidity ratio computed in equation (3) respectively. The sample includes Indian stocks that cross-listed on the LSE, LuSE and NYSE during the period 1992–2017. It also consists of matched samples for those cross-listed stocks. Standard errors are clustered at firm level and t-stats are reported in parentheses.

	Trading Volume	Turnover Ratio	Spread	Amihud Illiquidity
Cross-listed Sample	0.4877*** (5.23)	0.0157*** (2.44)	-0.1565 (-0.82)	-0.0409 (-0.39)
Post Cross-listing	-0.0842 (-0.9)	-0.0055 (-0.85)	0.2965 (1.53)	-0.0113 (-0.11)
Cross-listed X Post	0.0072 (0.06)	-0.0049 (-0.58)	-0.2385 (-0.93)	-0.0687 (-0.49)
Market Value	0.7119*** (14.25)	0.0009 (0.27)	-1.1555*** (-10.73)	-0.2596*** (-4.64)
Market to Book	-0.0217* (-1.71)	-0.0005 (-0.53)	0.0677** (2.57)	0.0225 (1.58)
Constant	-2.1783*** (-4.88)	0.0139 (0.45)	7.3018*** (5.98)	2.7465*** (5.5)
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
No. of observation	487	487	358	487
R2	0.7025	0.12222	0.5072	0.334

*, **, *** indicate statistically significant at 0.10, 0.05 and 0.01 levels respectively

Table 7: Regression using location dummy

The table reports OLS regression estimation results of equation (5). We have considered 4 dependent variables as a proxy for liquidity measures: a.) Trading volume, b.) Turnover ratio

computed in equation (1), c.) Spread computed in equation (2) and d.) Amihud illiquidity ratio computed in equation (3) respectively. The sample includes Indian stocks that cross-listed in LSE, LuSE and NYSE during the period 1992–2017. It also consists of matched samples for those cross-listed stocks. Standard errors are clustered at firm level and t-stats are reported in parentheses.

	Trading Volume	Turnover Ratio	Spread	Amihud Illiquidity
Cross-listed Sample	0.4996*** (5.36)	0.0161** (2.48)	-0.1384 (-0.72)	-0.0408 (-0.39)
Post Cross-listing	-0.0846 (-0.9)	-0.0055 (-0.85)	0.2952 (1.52)	-0.0118 (-0.11)
d_LSE_Cross-listed X Post	0.1089 (0.62)	-0.0009 (-0.07)	-0.1999 (-0.53)	-0.1537 (-0.78)
d_LuSE_Cross-listed X Post	-0.0569 (-0.44)	-0.0068 (-0.76)	-0.3128 (-1.16)	-0.0644 (-0.44)
d_NYSE_Cross-listed X Post	0.3510 (1.42)	0.0030 (0.17)	0.2148 (0.46)	0.0830 (0.3)
Market Value	0.6995*** (13.9)	0.0006 (0.17)	-1.1709*** (-10.78)	-0.2596*** (-4.59)
Market to Book	-0.0206 (-1.61)	-0.0004 (-0.47)	0.0676** (2.54)	0.0215 (1.5)
Constant	-2.0986*** (-4.69)	0.0162 (0.52)	7.4264*** (6.04)	2.7496*** (5.47)
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
No. of observation	487	487	358	487
R2	0.705	0.1234	0.5095	0.335

*, **, *** indicate statistically significant at 0.10, 0.05 and 0.01 levels respectively

Table 8: Regression using GDR listed companies on the LuSE and LSE:

The table reports the OLS regression estimation results of equation (4). We have considered 4 dependent variables as a proxy for liquidity measures: a.) Trading volume, b.) Turnover ratio

computed in equation (1), c.) Spread computed in equation (2) and d.) Amihud illiquidity ratio computed in equation (3) respectively. The sample includes Indian stocks that cross-listed in LSE and LuSE together during the period 1992–2017. It also consists of matched samples for those cross-listed stocks. Standard errors are clustered at firm level and t-stats are reported on parenthesis.

	Trading Volume	Turnover Ratio	Spread	Amihud Illiquidity
Cross-listed Sample	0.4464*** (4.58)	0.0157** (2.27)	-0.17557 (-0.84)	-0.0531 (-0.47)
Post Cross-listing	-0.0966 (-0.99)	-0.0062 (-0.89)	0.3345 (1.58)	-0.0307 (-0.27)
Cross-listed X Post	0.0043 (0.03)	-0.0054 (-0.59)	-0.2612 (-0.94)	-0.0658 (-0.44)
Market Value	0.7169*** (13.39)	0.0007 (0.18)	-1.2621*** (-10.11)	-0.2571*** (-4.15)
Market to Book	-0.0465*** (-3.08)	-0.0011 (-1.04)	0.0749** (2.12)	0.0170 (0.98)
Constant	-2.0694*** (-4.55)	0.0182 (0.56)	7.7514*** (6.04)	2.7707*** (5.26)
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
No. of observation	451	451	325	451
R2	0.6982	0.1278	0.5092	0.3349

*, **, *** indicate statistically significant at 0.10, 0.05 and 0.01 levels respectively

Table 9: Regression using companies cross-listed on the LSE:

The table reports the OLS regression estimation results of equation (5). We have considered four dependent variables as a proxy for liquidity measures: a.) Trading volume, b.) Turnover ratio

computed in equation (1), c.) Spread computed in equation (2) and d.) Amihud illiquidity ratio computed in equation (3) respectively. The sample includes Indian stocks cross-listed on the LSE only during the period 1992–2017. It also consists of matched samples for those cross-listed stocks. Standard errors are clustered at firm level and t-stats are reported on parenthesis.

	Trading Volume	Turnover Ratio	Spread	Amihud Illiquidity
Cross-listed Sample	0.1451 (0.5)	0.0263 (1.45)	-2.0249* (-1.92)	-0.3039 (-0.79)
Post Cross-listing	-0.1674 (-0.67)	-0.0008 (-0.05)	1.5869 (1.87)	-0.0332 (-0.10)
Cross-listed X Post	0.1130 (0.37)	-0.0176 (-0.93)	-1.5559 (-1.58)	-0.1229 (-0.31)
Market Value	1.087*** (3.94)	0.00181 (0.11)	-3.7754*** (-4.34)	-0.8547*** (-2.37)
Market to Book	-0.0557 (-1.00)	0.0016 (0.45)	0.1918 (0.83)	0.0193 (0.27)
Constant	-5.2995*** (-4.47)	-0.2383*** (-3.23)	13.1931*** (4.63)	4.4069*** (2.84)
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
No. of observation	85	85	50	85
R2	0.7035	0.1738	0.5795	0.6923

*, **, *** indicate statistically significant at 0.10, 0.05 and 0.01 level respectively

Table 10: Regression using companies cross-listed on the LuSE:

The table reports OLS regression estimation results of equation (5). We have considered 4 dependent variables as a proxy for liquidity measures: a.) Trading volume, b.) Turnover ratio

computed in equation (1), c.) Spread computed in equation (2) and d.) Amihud illiquidity ratio computed in equation (3) respectively. The sample includes Indian stocks that cross-listed on the LuSE only, during the period 1992–2017. It also consists of matched samples for those cross-listed stocks. Standard errors are clustered at firm level and t-stats are reported in parentheses.

	Trading Volume	Turnover Ratio	Spread	Amihud Illiquidity
Cross-listed Sample	0.4629*** (4.34)	0.0119 (1.69)	-0.2893 (-1.46)	-0.1738 (-1.59)
Post Cross-listing	-0.0564 (-0.53)	-0.0065 (-0.92)	0.1718 (0.85)	-0.02251 (-0.21)
Cross-listed X Post	-0.0324 (-0.23)	-0.0014 (-0.15)	-0.1055 (-0.39)	0.0686 (0.47)
Market Value	0.6776*** (11.69)	0.0004 (0.12)	-1.0952*** (-9.16)	-0.2656*** (-4.46)
Market to Book	-0.0395** (-2.39)	-0.0011 (-1.04)	0.0726** (2.18)	0.0191 (1.12)
Constant	-2.150*** (-4.53)	0.0164 (0.52)	7.8594*** (5.67)	2.7997*** (5.74)
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
No. of observation	362	362	271	362
R2	0.6694	0.1026	0.5541	0.3473

*, **, *** indicate statistically significant at 0.10, 0.05 and 0.01 levels respectively

Table 11: Regression using companies cross-listed on the NYSE:

The table reports OLS regression estimation results of equation (5). We have considered 4 dependent variables as a proxy for liquidity measures: a.) Trading volume, b.) Turnover ratio

computed in equation (1), c.) Spread computed in equation (2) and d.) Amihud illiquidity ratio computed in equation (3) respectively. The sample includes Indian stocks that cross-listed on the NYSE only during the period 1992–2017. It also consists of matched samples for those cross-listed stocks. Standard errors are clustered at firm level and t-stats are reported in parentheses.

	Trading Volume	Turnover Ratio	Spread	Amihud Illiquidity
Cross-listed Sample	0.6562*** (3.19)	0.0015 (0.14)	-0.0196 (-0.18)	-0.0015 (-0.01)
Post Cross-listing	-0.1506 (-0.72)	-0.0061 (-0.58)	0.0667 (0.61)	0.2825 (1.97)
Cross-listed X Post	0.2080 (0.85)	0.0031 (0.25)	-0.1108 (-0.85)	-0.2509 (-1.49)
Market Value	0.5458*** (4.76)	0.0054* (1.99)	-0.3915*** (-6.83)	-0.05015 (-0.64)
Market to Book	-0.0276 (-1.29)	-0.0011 (-1.04)	0.0094 (0.88)	-0.0007 (-0.05)
Constant	0.1729 (0.29)	-0.0138 (-0.46)	2.0927*** (6.96)	0.2157 (0.53)
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
No. of observation	36	36	33	36
R2	0.5937	0.1537	0.5036	0.128

*, **, *** indicate statistically significant at 0.10, 0.05 and 0.01 level respectively

Table 12: Companies cross-listed: 1992–1999

The table reports the OLS regression estimation results of equation (5). We have considered four dependent variables as proxy for liquidity measures: a.) Trading volume, b.) Turnover ratio

computed in equation (1), c.) Spread computed in equation (2) and d.) Amihud illiquidity ratio computed in equation (3) respectively. The sample includes Indian stocks that cross-listed during the period of 1992–1999 only. It also consists of matched samples for those cross-listed stocks. Standard errors are clustered at firm level and t-stats are reported in parentheses.

	Trading Volume	Turnover Ratio	Spread	Amihud Illiquidity
Cross-listed Sample	0.3201 (0.99)	0.0115 (0.54)	-0.5308 (-0.72)	-1.6099 (-1.75)
Post Cross-listing	0.3541 (1.13)	0.0007 -0.03	-0.4118 (-1.1)	-0.3787 (-0.43)
Cross-listed X Post	-0.0653 (-0.18)	-0.0177 (-0.72)	0.2054 (0.47)	-0.8724 (-0.83)
Market Value	0.5779* (1.99)	0.0059 -0.31	-3.1627* (-2.13)	-0.3792 (-0.46)
Market to Book	0.1012 (1.22)	0.0001 (0.31)	0.3274 (1.03)	-0.2018 (-0.86)
Constant	1.0248 (0.71)	0.4182*** (4.45)	15.0789** (2.37)	4.1820 (1.03)
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
No. of observation	47	47	25	47
R2	0.1433	0.3589	0.5938	0.1033

*, **, *** indicate statistically significant at 0.10, 0.05 and 0.01 level respectively

Table 13: Companies cross-listed: 2000–2007

The table reports OLS regression estimation results of equation (5). We have considered four dependent variables as a proxy for liquidity measures: a.) Trading volume, b.) Turnover ratio

computed in equation (1), c.) Spread computed in equation (2) and d.) Amihud illiquidity ratio computed in equation (3) respectively. The sample includes Indian stocks that cross-listed during the period 2000–2007 only. It also consists of matched samples for those cross-listed stocks. Standard errors are clustered at firm level and t-stats are reported in parentheses.

	Trading Volume	Turnover Ratio	Spread	Amihud Illiquidity
Cross-listed Sample	0.5681*** (3.88)	0.0123 (1.21)	-0.2083 (-0.58)	-0.1999 (-1.44)
Post Cross-listing	-0.1678 (-1.16)	-0.0109 (-1.09)	0.4881 (1.35)	0.0228 (0.17)
Cross-listed X Post	-0.0023 (-0.01)	0.0039 (0.3)	-0.2279 (-0.48)	0.0263 (0.15)
Market Value	0.7158*** (8.16)	-0.0038 (-0.63)	-1.8281*** (-7.50)	-0.2639*** (-3.18)
Market to Book	-0.0233 (-1.26)	-0.0003 (-0.23)	0.1005** (2.09)	0.0113 (0.65)
Constant	-0.2817 (-0.54)	0.0613 (1.7)	7.1029*** (5.74)	1.1201** (2.28)
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
No. of observation	204	204	143	204
R2	0.6719	0.1746	0.5901	0.2175

*, **, *** indicate statistical significant at 0.10, 0.05 and 0.01 levels respectively

Table 14: Companies cross-listed: 2008–2017

The table reports the OLS regression estimation results of equation (5). We have considered four dependent variables as a proxy for liquidity measures: a.) Trading volume, b.) Turnover ratio

computed in equation (1), c.) Spread computed in equation (2) and d.) Amihud illiquidity ratio computed in equation (3) respectively. The sample includes Indian stocks that cross-listed during the period 2008–2017 only. It also consists of matched samples for those cross-listed stocks. Standard error are clustered at firm level and t-stats are reported on parenthesis.

	Trading Volume	Turnover Ratio	Spread	Amihud Illiquidity
Cross-listed Sample	0.4536*** (3.88)	0.0169** (2.43)	-0.1852 (-0.81)	-0.1094 (-1.18)
Post Cross-listing	-0.0869 (-0.74)	-0.0016 (-0.24)	0.2202 (0.97)	0.0338 (0.36)
Cross-listed X Post	0.1049 (0.65)	-0.0078 (-0.8)	-0.2134 (-0.68)	-0.0588 (-0.46)
Market Value	0.7412*** (12.48)	0.0018 -0.51	-0.9039*** (-7.62)	-0.2782*** (-5.9)
Market to Book	-0.02318 (-1.34)	(-0.0009) -0.88	0.0865** (2.64)	0.0379** (2.76)
Constant	-0.2047 (-0.27)	0.0036 (0.08)	3.7518** (3.10)	0.6802 (1.12)
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
No. of observation	232	232	186	232
R2	0.7401	0.1306	0.5220	0.4265

*, **, *** indicate statistically significant at 0.10, 0.05 and 0.01 level respectively

Appendix A:

Differences between the three markets: London Stock Exchange, Luxembourg Stock Exchange, and New York Stock Exchange

Owing to globalization, the world is coming closer together. This has provided opportunities for companies to expand beyond their home market to establish a global market presence, raise capital and increase the liquidity of their company. One of the ways in which emerging market companies expand is through DRs. DRs have low costs, low disclosure requirements and a shorter time for cross-listing compared to raising equity. A study by Wojcik and Burger (2010) reported that BRICs companies contributed 73 percent of new depository receipts on international stock exchanges in 2007. The LuSE and LSE are dominant exchanges for cross-listing via GDR; on the other hand, NYSE is a leading exchange for cross-listing via ADR.

All the three exchanges work differently and have different regulations, disclosure requirements, and costs associated with listing.

Understanding the NYSE, LSE and LuSE markets

New York Stock Exchange (NYSE)

The NYSE has more than 2,400 companies listed, out of which approximately 500 are international companies. The market is highly regulated. Its primary aim is to ensure protection of investors. The NYSE is a 225-year-old market and tops the list of global listing exchanges due to its unique market model, unmatched network and brand visibility. This allows companies to reduce execution risk and price volatility by more than 30 percent, thus enabling an increase in liquidity (<https://www.nyse.com/market-model>). Listing on the NYSE is subject to a high level of regulation and hence costs a lot in terms of resources and funds.

London Stock Exchange (LSE)

The LSE is one of the world's largest international capital markets with approximately 2,200 companies from 70 countries, out of which more than 500 companies are international. The LSE offers three different markets based on a company's size and objectives: Main Market, AIM and Professional Securities Market (PSM). The Main Market is for the large and established companies, while AIM market is for smaller and growing companies. PSM is a specialized market designed to meet the specific needs of all issuers, such as raising capital through specialist debt securities or through DRs to professional investors. All the three markets accept GDR listings. For the period 1994–2017, more than 40 Indian companies cross-listed through DRs on the LSE.

Luxembourg Stock Exchange (LuSE)

The LuSe ranks first in terms of listed international bonds in Europe (PWC Luxembourg, 2013). The LuSE has more than 35,000 listed securities and can list in as little as 24 hours according to the information available on the LuSE website. Companies can list GDRs in two markets: Bourse de Luxembourg (BDL) market or the exchange-regulated Euro MTF market. The BDL market is more regulated and only companies that are from Europe are eligible. As we are looking at the Indian market, Indian companies can only cross-list on the Euro MTF market. The LuSE oversees prospectus approval, unlike the BDL market, in which prospectuses must be approved by the Commission de Surveillance du Secteur Financier (CSSF), Luxembourg's supervisory authority. More than 150 Indian companies have cross-listed via GDR on the LuSE. However, when combining the market capitalisation of the top 15 companies, Indian companies together formed a market capitalization of EUR 1,100 million in 2010 (Indian Depository Receipts, 2010).

Listing requirements and cost associated with cross-listing

The listing requirements and the costs associated with listing on the NYSE, LSE and LuSE differ notably. All three exchanges have different acceptable accounting standards and approval levels. The requirements for international companies differ from domestic companies in all three exchanges.

For listing and being able to trade on the NYSE, international companies are required to apply to the Securities and Exchange Commission (SEC) for a Level II or Level III registration. They also need to comply with General Accepted Accounting Principles (GAAP) and further they need to apply to and be accepted by the NYSE board to be able to trade. Additionally, for listing, companies are required to have a minimum of 2.5 million shares publicly held worldwide and have a market value of US\$100 million. The approval fee for listing is USD 100,000 with an annual fee of USD 16,000– 30,000 to continue listing. The NYSE usually takes an average of 24–48 weeks to list a non-US company. For companies listed on the NYSE, the SEC requires companies to provide a financial audit report once a year and quarterly financial statements. In addition to this, NYSE also needs companies to disclose any major event that would affect the interests of the investors. Further to these requirements, in 2002 the US introduced the Sarbanes–Oxley Act (SOX), which increased regulation and abiding the new act was made mandatory. This Act has increased regulations such as the requirement for registered

accounting firms and company to attest to the truthfulness of annual reports and disclose material changes in financial conditions; and the introduction of fines and imprisonment for destroying or falsifying documents, and so on. With such a high amount of regulation, listing requirements and costs involved, it becomes extremely difficult for companies, especially, from emerging markets, to cross-list on the NYSE. Also, the SOX Act, 2002, has discouraged companies inform listing on the NYSE, especially those from emerging markets, due to the limited availability of funds and lack of disclosure knowledge, hence they turn towards European stock exchanges.

For listing in the LSE, international companies are required to obtain SEAQ – I registration, which is comparable to SEC level I registration on the NYSE. For accounting purposes, companies can use International Financial Reporting Standards (IRFS), GAAP or home country accounting standards. They do not need any approval from government or the LSE board. Further, for listing on the LSE, companies are required to have a minimum market capitalization of EUR 700,000 worldwide out of which 25 percent of the shares must be publicly traded. The approval and listing fee is EUR 6,000 while the annual fee is EUR 3,000. Listing on the LSE usually takes around 20 to 24 weeks. Companies listed via GDR are required to provide information on the number of securities issued and outstanding on a quarterly basis. They need to disclose financial reports monthly. When dividends are announced, companies are expected to notify the Exchange at least three days prior to providing the dividend.

There is no specific listing requirement that is unique to the LuSE. Companies can use IRFS or GAAP or the home country-specific accounting standards. Listing on the LuSE is not subject to the approval of the government. The LuSE requires a minimum capitalization of EUR 1,000,000 and the company needs to maintain a minimum float of 25 percent that is publicly traded. The listing fee is EUR 1,250, with an annual fee ranging from EUR 500 to EUR 2,500 depending on the issue amount. In terms of disclosure, companies need to disclose information related to corporate events, concerns and company operations as soon as possible. Companies are required to provide an annual financial report annually, but exemptions are available. It is possible to list within one week if proper documentation is provided.