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ScienceDirect
Journal of Banking & Finance 31 (2007) 297–316
Journal of BANKING & FINANCE
www.elsevier.com/locate/jbf

Privatization and stock market liquidity ☆

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Received 7 March 2006; accepted 3 April 2006
Available online 14 August 2006

Abstract

This paper shows that share issue privatization (SIP) is a major source of domestic stock market liquidity in 19 developed economies. Particularly, privatization IPOs have a negative effect on the price impact – measured by the ratio of the absolute return on the market index to turnover. This result is robust to the inclusion of controls for other observable and unobservable factors, having also considered the endogenous nature of the decision to privatize.

We also provide evidence of a positive spillover of SIP on the liquidity of private companies. This cross-asset externality is one implication of liquidity theories emphasizing the improved risk diversification opportunities and risk sharing brought about by privatization. This externality stems from both domestic privatization IPOs and cross-listings.

☆ We thank Yakov Amihud, Viral Acharya, Gabriella Chiesa, Mara Faccio, Dirk Jenter, Arie Melnik, Bill Megginson, David Parker, Enrico Perotti and Alessandro Sembenelli for comments, and Utpal Bhattacharya for comments and for generously providing his data. We wish to thank participants in the meetings of AFFI, the Econometric Society and the Western Finance Association, in PFM workshops at the University of Amsterdam, City University Business School, FEEM and Paris Evry, and in seminars at Bocconi University, ICER and the University of Ljubljana. Laura Poddi provided excellent research assistance. This research has been funded by the European Commission (contract no. HPSE-CT-1990-00007).

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doi:10.1016/j.jbankfin.2006.04.008

JEL classification: L33; G14; F30; O16

Keywords: Privatization; Liquidity externality; Financial market development; International finance

1. Introduction

Financial market development is mentioned as one of the primary objectives of share issue privatization (SIP) programs in developed economies. One of the first experiments to foster the domestic stock market through privatization was carried out in Germany during the 1960s by the Adenauer government (Esser, 1994). More recently, the promotion of investors' participation and the revitalization of national exchanges have been top priorities of privatization programs not only in the United Kingdom, but also in France, Spain, and Italy (Vickers and Jarrow, 1988; Dumez and Jeunemaître, 1994; Chiri and Panetta, 1994).

A remarkable wealth of evidence shows the correlation between financial market development and privatization. For instance, stock trading volume in developed countries outside the US grew from a little over $400 billion in 1983 to more than $12 trillion in 2002, while massive privatization plans were in progress (Megginson, 2005). Yet, stock markets develop also in the absence of privatization. Indeed, the US experienced an exponential growth in capitalization and turnover during the same years with only limited privatization. So does privatization contribute to the development of stock markets?

Some theories suggest that it should. Due to the positive externalities generated by listing decisions, privatization initial public offerings (IPOs) may jumpstart an economy's stock market by improving investors' diversification opportunities (Pagano, 1993; Subrahmaniam and Titman, 1999). Moreover, SIPs involving the floating of shares in both domestic and international exchanges (SIPs with cross-listings) reduce informational barriers to foreign investment and enlarge firms' shareholder base (Mendelson, 1985; Chiesa and Nicodano, 2003) thereby boosting liquidity in the domestic market. Despite the relevance of these issues, a comprehensive empirical analysis concerning the impact of privatization on equity markets in developed countries is still missing in the literature. This paper aims at filling this gap.

We relate measures of privatization to a fundamental aspect of stock market development: market liquidity. A deeper secondary market allows companies to raise capital at a lower price (Ellul and Pagano, forthcoming) by reducing investors' required return (Amihud and Mendelson, 1986). Furthermore, liquidity – rather than capitalization – provides incentives for information acquisition to financial analysts. This in turn stimulates the use of stock-based managerial incentive schemes, which may enhance corporate performance and growth (Hölmstrom and Tirole, 1993). Empirically, the initial level of stock market liquidity is a robust predictor of economic growth and capital accumulation, while initial capitalization is not (Levine and Zervos, 1998; Levine, 1997).

In order to capture the variation in market liquidity we first construct an aggregate measure of the price impact, inspired by the Amihud illiquidity index (Amihud, 2002). Price-impact measures for the US stock market have usually been computed as averages of the price impact of individual companies (see for example Acharya and Pedersen, 2005). In contrast to this approach, we compute the price impact of the stock index, i.e. the ratio of the absolute return on the index to total trading volume, and show that our proxy moves closely together with the average of the individual price-impact measures.

Our analysis, covering 19 developed economies in the 1985–2002 period, shows that SIP positively affects stock market liquidity. The effect of privatization is robust to the inclusion of several other possible determinants of liquidity identified by the theoretical literature, as well as for country-specific and time-varying factors. Albeit new relative to previous research, these results could be ascribed to the higher liquidity of privatized stocks themselves, which are usually the bellwether and most actively traded stocks in the market (Keloharju et al., 2004). Contrasting this view, we point out an externality effect associated with privatization: SIPs, both domestic issues and cross-listings, enhance the liquidity of *private* companies as well. This positive cross-asset externality is a primary implication of liquidity theories that imply that privatization may bring along both risk reduction and improved risk sharing (Mendelson, 1985; Chiesa and Nicodano, 2003; Pagano, 1993; Subrahmaniam and Titman, 1999). Indeed new domestic privatization IPOs allow for better diversification opportunities for local investors, while cross-listed ones may enlarge the shareholders' base to foreigners and reduce informational barriers. To the best of our knowledge, Amihud et al. (1997) is the only paper that provided evidence on cross-asset externalities, finding that the introduction of an improved trading method for a subset of stocks generated price increases for stocks that traded under the old method. In that paper, the spillover arises from improvements in the trading method rather than new privatization listings.

Our research is related to the vast literature on the effects of privatization on financial market development (see Megginson, 2005 for an excellent survey). To our knowledge, the only paper addressing explicitly the relation under study is Boutchkova and Megginson (2000). The authors of that paper regress the turnover ratios for individual markets on the number of privatization deals (SIPs and asset sales) and find a significant positive relation. Our paper complements this evidence by both using a more precise measure of liquidity, the Amihud index, and accounting for endogeneity issues. Moreover, we identify the channels through which SIP affects market liquidity and isolate spillovers in liquidity and turnover to non-privatized firms.

Our study complements existing evidence on stock market liberalization, which mainly refers to developing and emerging economies. In that context, privatization is usually linked to a country's decision to allow for foreigners' stock purchases. A burgeoning empirical literature has shown the effects of such liberalization on equity prices, the cost of capital, investment, and systemic liquidity (Henry, 2000; Stulz, 1999; Bekaert and Harvey, 2000; De Jong and De Roon, 2005; Jain-Chandra, 2002; Patro and Wald, 2005). The OECD countries considered in this study did not have formal barriers to foreign investment during the sample period. This allows us to isolate more accurately the effect of privatization on liquidity, while controlling for the degree of economic openness and for the intense financial integration which took place, especially among the European countries, during the 1990s.

In the next section, we provide a conceptual framework to analyze how privatization may affect stock market liquidity. The review of theoretical models allows us to both set forth some empirical implications and identify the potentially relevant privatization measures to be used in the econometric analysis. Sections 3 and 4 present the data set and our empirical model. The results are discussed in Section 5. Section 6 concludes.

2. Theoretical framework

A stock is illiquid when "sell" orders are filled at a lower price than "buy" orders. Such spread can be interpreted as the compensation required by traders and intermediaries who

satisfy other investors' liquidity needs. The spread has three main components (see O'Hara, 1995). The first is the inventory control cost. It arises due to the fact that liquidity provision implies a temporary deviation from optimal asset holdings, involving excess risk taking and a risk premium.[4] The second component is linked to adverse selection: the order being filled may be placed by a counterpart with private information on the future price. A third component gathers costs which are unrelated to volatility or information, such as order-processing costs and mark-ups charged by non-competitive dealers. In what follows, we identify the channels through which SIP affects the first component of the spread.[5]

First, SIP may reduce illiquidity by improving investors' diversification opportunities when, due to a coordination failure among firms and investors, stock markets are trapped in a low liquidity-high risk premium equilibrium (Pagano, 1993). Investors have opportunities to diversify their portfolios only if many firms go public. However, the equilibrium number of private IPOs may be lower than optimal. This is because each entrepreneur bears the full listing cost, but does not internalize the diversification benefits arising from an additional listing. If investors anticipate too few IPOs, they do not enter the equity market, which remains small and illiquid. A privatization policy, aiming at increasing the number of IPOs of state-owned enterprises (SOEs), can move away the equilibrium from this under-development trap benefiting the liquidity of private companies. Indeed, the government – being the single owner of several listed firms – can better "internalize" the benefits from additional listings.

A similar effect on stock market liquidity arises when agents receive on-the-job costless information concerning their own companies' payoffs, as in Subrahmaniam and Titman (1999). Since it may not be possible for investors to trade shares of private firms, opportunities to profit from such "serendipitous" information exist only if many firms go public. In turn, going public firms may benefit from a large number of informed investors who require a lower risk premium because their information enables them to forecast firms' payoffs more accurately. This increases liquidity. Again, a coordination failure may lead to a low-welfare-low-liquidity equilibrium in which agents correctly anticipate too few IPOs and firms do not consequently list their shares. An established SIP program may induce both informed investors and firms to enter the stock market.[6]

These theories suggest that stock market liquidity is positively related to privatization IPOs.

H 1. Privatization IPOs increase both the overall liquidity of the stock market and the liquidity of the shares of non-privatized companies by improving on investors' diversification opportunities.

Second, SIPs may reduce the spread by stimulating the participation of foreign investors. Privatization has typically been associated with cross-listings, involving the issue of the shares of a state-owned enterprise in both the local and at least one foreign exchange.

[4] This component is therefore absent when pricing is risk neutral, such as in Kyle (1985).

[5] We deal with the other two components in Section 4.

[6] Most of the effects described in this section obtain only when transaction costs prevent domestic investors from internationally diversifying their portfolios. The existence of a home bias in domestic portfolios, which has widely been documented, indicates that this may indeed be the case (Lewis, 1999).

Road-shows performed in connection with the listing in the international exchange may be effective in increasing foreign participation in the domestic market.[7] They usually bring along enhanced investor recognition, which leads to greater investments and reduced risk premium (Merton, 1987; Foerster and Karolyi, 1999). This effect can be magnified if the cross-listing enhances the legal protection of the firm's investors and reduces the agency costs of controlling shareholders (Fuerst, 1998; Lombardo and Pagano, 2000). This happens when shares are cross-listed in a reputable exchange which is known for its strict transparency requirements and standards for corporate governance (Doidge et al., 2004).

Even though it concerns primarily the cross-listed firms, foreign participation may also benefit the liquidity of shares traded only in the local market due to a positive externality. Foreigners purchasing cross-listed stocks start sharing some of the risk borne only by domestic investors prior to privatization. This reduces the required risk premium and positively affects the liquidity of both privatized and non-privatized companies (Mendelson, 1985; Chiesa and Nicodano, 2003). Furthermore, road-shows are aimed at providing investors with information about not only the firm on sale but also the country of its incorporation. Improved investor recognition for the cross-listed shares should ease value discovery for local stocks, if their returns are correlated, resulting into more liquidity (Amihud et al., 1997).

H 2. A SIP program implemented through cross-listings increases the liquidity of both the overall stock market and the shares of non-privatized companies by enhancing the participation of foreign investors.

The possibility of order flow migration to foreign markets yields a competing empirical implication with respect to H2. By definition, order flow migration decreases the domestic turnover of cross-listed stocks. At the same time, enhanced competition among market makers located in different exchanges may reduce bid-ask spreads especially when there are intense information linkages across markets (Domowitz et al., 1998). Thus domestic liquidity of cross-listed stocks can be higher when the beneficial effect of increased competition dominates.[8] However, cross-listings have a *negative* effect on the liquidity of purely domestic stocks (Hargis and Ramanlal, 1998) because institutional investors reallocate their portfolios selling stocks traded only domestically and buying cross-listed stocks with lower bid-ask spreads. This theory bears the following implication concerning the spillover effect of SIPs.

H 3. A SIP program implemented through cross-listings reduces the liquidity of non-privatized companies as investors shift their portfolio compositions towards cross-listed shares.

[7] "Governments have discovered that privatization through a global equity market placement created an unmatched opportunity to get the attention of investors around the world and to tell the country's story. No investment mission has the impact of a global equity road-show". Jeffrey R. Shafer, Salomon Smith Barney, in *Privatization International Yearbook, 2000.*

[8] Several papers analyze the incentive for a company to list abroad (see Pagano et al., 2002) and the effect of cross-listing IPOs on value (Doidge et al., 2004). Our focus is on the effects of cross-listings on the liquidity of the domestic market.

3. Data

We focus on OECD countries because we are interested in isolating the effect of SIP in developed economies with established stock markets. We exclude from the sample Luxembourg, Iceland and Ireland since their stock markets were not systematically covered by conventional data sources over the entire sample period. We also eliminate Turkey and Greece because in those countries foreign ownership restrictions were lifted simultaneously with the launch of SIP programs. With this restriction, we are able to disentangle the effects of SIP from those of financial liberalization. The analysis thus covers 19 economies in a panel with monthly observations over the period 1985–2002.

3.1. Privatization and financial market development: Descriptive analysis

Our main sources for privatization information are *Privatization International*, *Securities Data Corporation* (SDC) Global New Issues Database, and *Privatization Barometer*. Their broad coverage across countries and over time allows us to identify the entire population of major SIPs implemented over the sample period.[9]

We define a SIP as an issue of common stock of a state-owned enterprise on a public equity market. This definition comprises both IPOs and secondary offerings. We collect information concerning the date of issue, company industry, the target market (domestic and international), and the percentage of capital sold at the privatization sale. We then follow the history of the company during the sample period in order to track the changes of names, de-listings, and M&A activity, using *SDC Platinum*, *World Wide Mergers & Acquisitions Database* and company websites. If the privatized company merged with or was acquired by a private company, and was consequently de-listed or listed with shares registered under a new name, we consider as a ''privatized company'' either the newly created company or the acquirer of the privatized company itself, provided their shares trade on the stock market where the privatized company was initially floated.

The sample includes 387 SIPs by 245 previously state-owned enterprises (SOEs). Total privatization revenues raised by these deals are worth $623bn. Fig. 1 shows the acceleration of the privatization process in the 90s and the abrupt interruption following the sharp decline in stock prices starting from March 2000. Fig. 2 displays the contribution of SIPs to the growth of market capitalization. Over the last two decades, privatized companies progressively gained market share and ended up accounting for one fifth of aggregate market capitalization of OECD countries (excluding the US).

Table 1 provides detailed information about the economic relevance of privatized companies in domestic stock markets. Privatization variables display a strong variability across countries. The number of privatized firms ranges from 2 (in Denmark and Belgium) to 37 in the United Kingdom, and represents a tiny 0.1% of all listed firms in the US but more than 18% in a country like Portugal. Privatized companies are often the largest firms in the market, as they represent on average 3.9% of all listed firms while their capitalization accounts for 20.3% of total market value. Not surprisingly, we find a large cross coun-

[9] These data sources are widely used in the empirical literature on privatization (see Jones et al., 1999; Megginson and Netter, 2001).

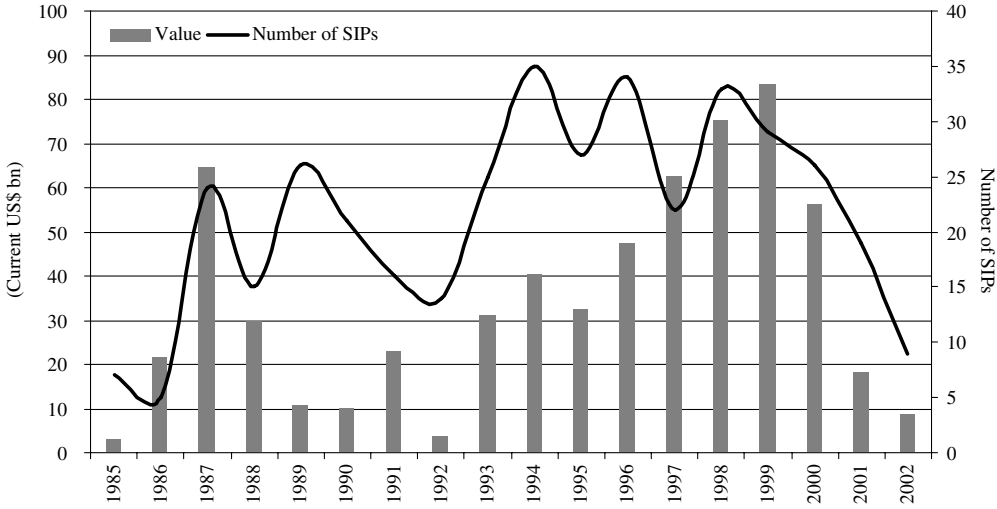

Fig. 1. Share issue privatizations (SIP) in OECD countries, 1985–2002.

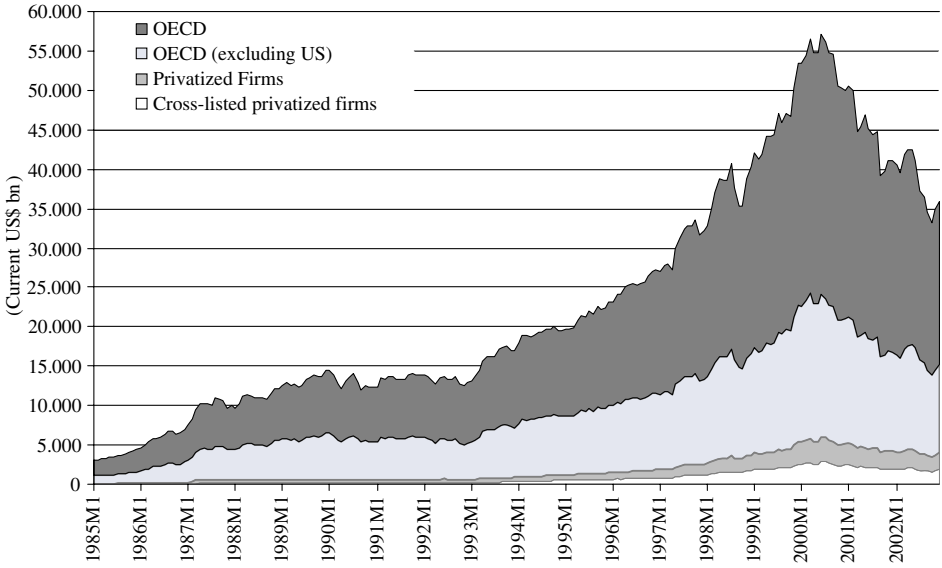

Fig. 2. Stock market capitalization in OECD countries, 1985–2002.

try variability also in their market share – with Italy boasting 45.6% while the US a bare 0.08%.

Being the largest companies of the economy, SOEs are typically sold by tranches. This sequencing of sales has been ascribed to several reasons, ranging from the absorption capacity of domestic stock markets to the building of reputational capital by privatizing governments (Megginson and Netter, 2001). Out of 387 share issues in the sample, only about half are IPOs (50.3%) and the average number of issues per company is 1.58.

Table 1
Privatization and domestic stock markets (as of 12/31/2002)

Country	Privatized firms	Privatized firms in % of total listed firms	Capitalization of privatized firms in % of total	Cross-listed privatized firms in % of total privatized firms	Capitalization of cross-listed privatized firms in % of total
Australia	14	0.99	19.13	28.57	15.04
Austria	14	10.85	40.74	71.43	39.29
Belgium	2	0.75	1.71	–	–
Canada	15	1.17	8.41	53.33	7.94
Denmark	2	1.00	7.65	100.00	7.65
Finland	8	5.37	12.23	88.89	11.99
France	30	3.10	41.76	59.38	32.00
Germany	15	1.61	16.95	33.33	15.68
Italy	29	9.83	45.60	68.97	44.89
Japan	6	0.28	5.54	33.33	2.97
Netherlands	5	1.29	17.81	100.00	17.81
New Zealand	7	3.52	32.15	42.86	24.84
Norway	6	2.96	37.78	33.33	37.12
Portugal	20	18.02	33.86	35.00	24.54
Spain	13	7.93	27.22	84.62	26.72
Sweden	9	3.03	16.76	55.56	16.76
Switzerland	3	0.75	3.63	100.00	3.63
United Kingdom	37	1.63	15.47	54.05	15.22
United States	6	0.10	0.08	83.33	0.08

Sources: Elaborations on *Privatization International*, *Securities Data Corporation*, *Privatization Barometer*, and *Datastream*.

The international profile of these issues is also worth noticing. It has been argued that privatization became a driving force of international financial markets integration, as major sales were often implemented through international offers. Indeed, the majority (58%) of the 245 privatized companies in the sample are cross-listed in foreign exchanges, including OTC markets. Particularly, 96 companies are dual-listed (i.e. listed in the domestic and in one foreign exchange), and 46 companies are cross-listed (i.e. listed in two or more foreign exchanges).[10] As Table 1 shows, in several countries cross-listed firms account for an overwhelming share of the market value of privatized firms.

3.2. Measuring privatization on public equity markets

In order to assess the role of the transmission channels identified in H1, H2, and H3, we construct three privatization measures. Information on daily stock prices, market capitalization, and the value of trades for each privatized company and for the market as a whole are obtained from Datastream.

The first indicator, PRIVATOTAL, is the cumulative capitalization of privatized firms scaled by total market capitalization.[11] This ratio increases in the number of privatization

[10] The appendix (available from the authors) provides detailed information about the geography of privatized stocks.

[11] Each variable is constructed as a monthly series, for each of the 19 countries in the sample.

IPOs. It must therefore be suitable for an empirical test of our first hypothesis suggesting that by improving investors' diversification opportunities, privatization IPOs spur liquidity when markets are caught in a low-liquidity trap.

Information about the international profile of SIPs allows us to distinguish between companies floated only domestically (PRIVADOM), and companies listed also in one or more foreign exchanges (PRIVABROAD). This distinction is crucial for a proper test of H2 and H3. PRIVADOM represents the capitalization of privatized companies listed *only* in the domestic market, while PRIVABROAD refers to the capitalization of privatized companies listed both in the domestic *and* in one or more foreign exchanges. Both variables are scaled by total market capitalization. PRIVABROAD reflects the changes in the international dimension of equity trading in privatized stocks by accounting for the allocation of shares in foreign exchanges at secondary offerings. Using this variable, we are able to test the specific effect of increased foreign market participation on domestic liquidity.

3.3. Measuring market liquidity

We compute market illiquidity in each country as the ratio of the *absolute return on the index*[12] to turnover. A high value of this measure, ILLIQ, indicates that the market is illiquid because the stock index changes considerably in response to little turnover. A value of 3 of ILLIQ indicates that the absolute return is 3% on a day when 1% of the market value is traded. The standard practice in the literature for computing illiquidity in month t is to take the average of this ratio:

$$\mathrm{ILLIQ}_t = D^{-1} \sum_d \{|R_{dt}|/\mathrm{TURNOVER}_{dt}\},$$

where $|R_{dt}|$ is the absolute return in day d, D is the number of trading days in month t, and daily turnover is equal to the total value of shares traded (TVOLUME) scaled by total daily market capitalization (MVALUE).[13] In order to mitigate the impact of outliers, we use the monthly *median* of the absolute return-to-turnover ratio instead of the monthly average.

Stock market models highlighted in the theoretical section bear implications for a more conventional notion of stock illiquidity, the *price impact*.[14] Its computation however requires transaction data, which are hard to find for long time spans. Moreover, market microstructure varies across countries, making transaction data hardly comparable. The literature circumvents these difficulties by using the ratio of absolute return to dollar volume, a proxy for the price impact which captures the illiquidity of stock portfolios (Amihud, 2002).

Our illiquidity measure is based on daily aggregate market return and turnover, and therefore differs from the average of the Amihud index on individual stocks, which has been computed for the US market by Amihud (2002), Acharya and Pedersen (2005) and Hasbrouck (2003). To compare this market-based measure with individual firm based

[12] The market index may not include all the companies in a market. Usually, the most important companies are selected on the basis of their market value.

[13] For notational convenience the country subscript has been suppressed.

[14] The price impact coincides with the price response associated with a unit trade in auction markets (Grossman and Stiglitz, 1980; Kyle, 1985) and with the effective bid-ask spread in dealer markets (Glosten and Milgrom, 1985; Biais, 1993).

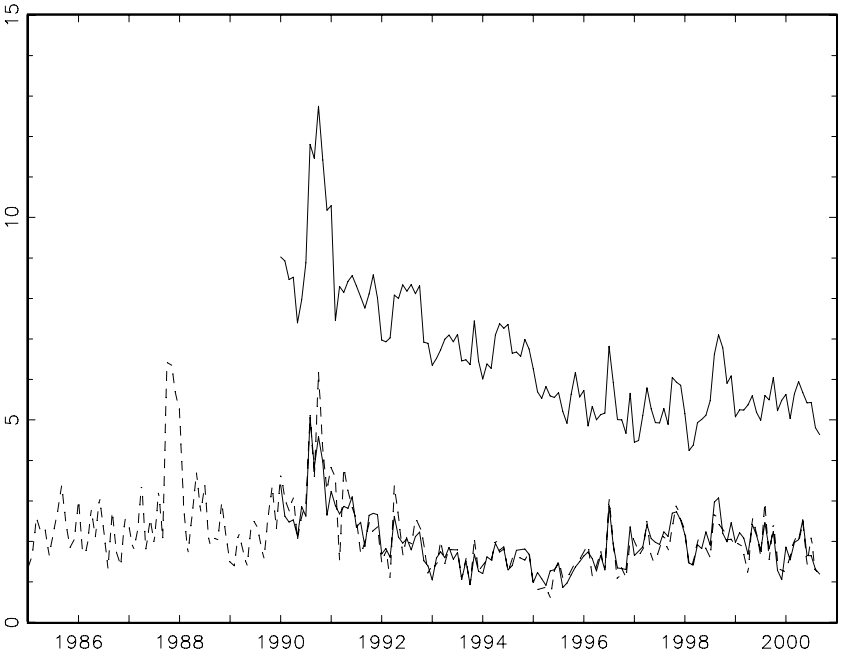

Fig. 3. Illiquidity measures for the US. This figure shows alternative ILLIQ measures for the US. The upper line shows the estimates based on the average of individual firms' price-impact measure. The lower lines track estimates based on index returns and aggregate turnover; the solid line refers to SP500 index data, while the dashed line to Datastream index data.

estimates, we calculate ILLIQ for all the SP500 firms, and take an average of these measures. We refer to the resulting series as the 'individual ILLIQ measure'. We also calculate an 'aggregate ILLIQ measure' based on the SP500 return and the aggregate turnover on the SP500 stocks from January 1990 through November 2000. Fig. 3 plots the individual and aggregate ILLIQ measures for the SP500 stocks, together with the ILLIQ measure for the US based on the Datastream index data from January 1985 through November 2000. The aggregate SP500 and the Datastream index price-impact measures are strongly correlated; the correlation coefficient between these two series is 0.956.[15] The individual price-impact measure is much higher than the aggregate measures, but its correlation with the aggregate measure based on the S&P index is 0.703. Since we are not interested in explaining the level of liquidity across countries, but its time variation within each country, the difference in levels is irrelevant. The coefficient of the regression of the aggregate ILLIQ on the individual ILLIQ (rescaled to have the same mean as the aggregate ILLIQ) is equal to 1.005 (with and R-square of 0.493). This suggests that the aggregate and individual ILLIQ measures indeed move one-for-one over time.

Fig. 4 graphs the time series of ILLIQ for the countries in our sample and Table 2 provides summary statistics, based on stock market data from Datastream.[16] In early years, until 1994

[15] The difference between the series is caused by the different composition of the SP500 and Datastream indices.

[16] For a few countries stock market data turned out to be available only from a date later than January 1985. Table 2 shows the first day considered for each country.

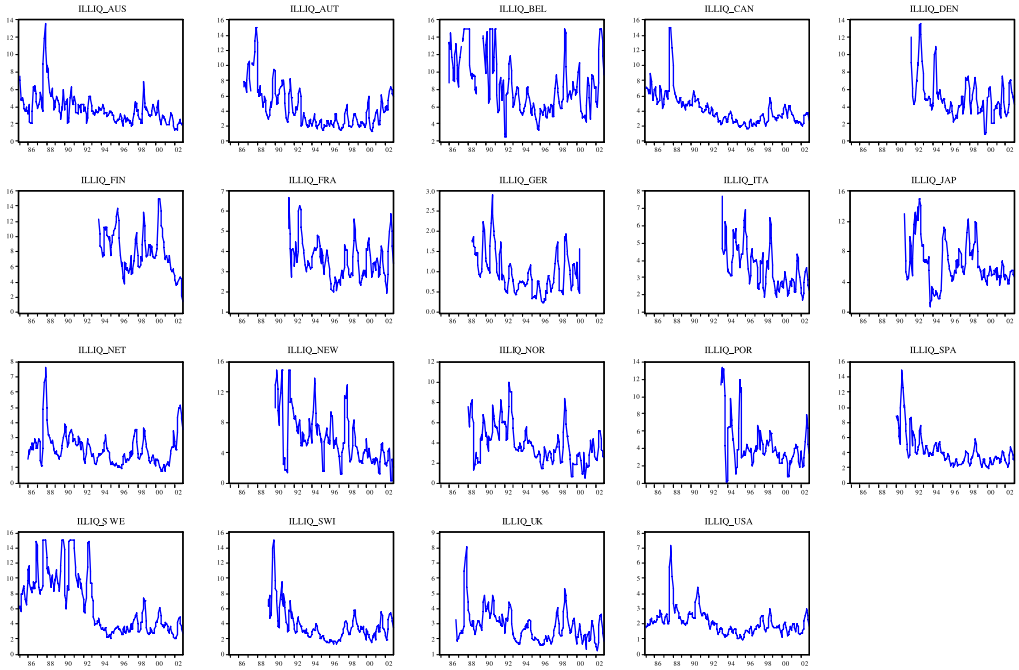

Fig. 4. Time series graphs of ILLIQ.

Table 2
Descriptive statistics of liquidity measures

Countries	TURNOVER 1985–1993	TURNOVER 1994–2002	ILLIQ 1985–1993	ILLIQ 1994–2002	First date used in estimation
Australia	9.05	13.28	4.58	2.86	01-01-85
Austria	8.47	12.97	5.94	2.97	01-08-86
Belgium	2.40	5.52	10.06	7.21	01-01-86
Canada	5.69	13.93	5.42	2.97	01-01-85
Denmark	5.13	9.47	7.04	4.58	01-10-91
Finland	4.45	12.97	10.44	7.01	01-10-93
France	10.19	16.68	4.15	3.41	01-07-91
Germany	36.64	51.60	1.18	0.81	01-06-88
Italy	10.65	19.93	5.50	3.45	01-07-93
Japan	7.48	9.99	8.12	5.91	01-12-90
Netherlands	13.94	27.99	2.58	2.00	01-02-86
New Zealand	5.64	8.20	8.14	4.79	01-01-90
Norway	12.03	16.32	5.06	3.06	01-04-88
Portugal	3.53	10.73	8.05	4.02	01-11-93
Spain	8.06	18.25	6.29	3.31	01-02-90
Sweden	5.91	19.61	9.63	3.55	01-01-85
Switzerland	7.76	16.66	5.28	2.96	01-01-89
United Kingdom	12.88	18.51	3.25	2.47	01-10-86
United States	16.55	29.48	2.45	1.71	01-01-85

This table reports the average values of the monthly turnover ratio (in percentages), given by the ratio of the value of trades to total market value, and of the variable ILLIQ, given by the monthly average of the absolute price change to the trading value.
Source: *Datastream*.

approximately, the ILLIQ measures in certain countries are unusually high. In later years the measure is more stable in time and more similar across countries, although countries with higher capitalization to GDP ratio (Germany, Netherlands, UK and USA) seem to have higher liquidity. In all markets, the ILLIQ measure is declining over time, indicating an improvement in liquidity, accompanied by a remarkable increase in turnover.

4. Empirical model

We estimate the following specification:

$$y_{it} = \alpha_i + \alpha_t + \beta' x_{it} + \gamma' \mathrm{PRIVA}_{it} + \upsilon_{it}, \tag{1}$$

where y_{it} is the price impact (ILLIQ) for country i in month t, PRIVA_{it} is a privatization measure (PRIVATOTAL, PRIVADOM, or PRIVABROAD), x_{it} is a vector of control variables, α_i is a country fixed effect, and α_t is a year fixed effect. We consider the following control variables suggested by the literature on privatization and stock market development.

Market size. We use the (log of the) number of listed firms to control for market size, which is a proxy for existing diversification opportunities affecting liquidity in Pagano (1989) and Subrahmaniam and Titman (1999). Including the number of firms as an explanatory variable may cause simultaneity problems in the regressions because market size may be endogenous to liquidity. To avoid this problem, for an observation at month t we take into account the number of listed firms at month $(t - 12)$. This provides only a partial solution to the problem making the lagged variable predetermined but not strictly exogenous. However, since the longitudinal size of our panel is relatively large (16 years of monthly data), we believe the resulting bias is of second-order relevance (see Baltagi, 2001).

Cumulative returns over the previous six months. Stock liquidity is higher in booms than in bear markets (Pastor and Stambaugh, 2003) because of larger investments which induce a higher volume of rebalancing trades (Eisfeld, 2004). This variable allows to control for the willingness to trade generated by better market performance.

Country risk. In emerging economies country risk is often of a primary concern. It is an a priori less serious concern in advanced economies with established democracies and a sound rule of law. In spite of this expectation, we employ control variables capturing changes in the institutional environment and the countries' policy risk assessments, which are motivated by the analyses in Perotti (1995), Perotti and Laeven (2002), Perotti and van Oijen (2001) and Lombardo and Pagano (2000). Our proxies for the institutional environment are a set of time varying indicators collected by the International Country Risk Guide (ICRG), namely political risk, risk of expropriation and contract repudiation, the quality of bureaucracy, the rule of law, corruption, and ethnic tensions. These indicators are contained in the IRIS Dataset and are available for the 1985–1997 period only.

Capital market integration. We include a dummy EU92 that is equal to one for 1992 and later years for the European Union countries only. This dummy is expected to capture the effect of European capital market integration that picked up substantially after the Maastricht treaty. Due to increased competition in the financial services industry, in the last decade EU countries began to modernize their financial institutions and regulatory practices. In several countries the trading system in the stock exchange has been drastically reformed (Demarchi and Foucault (2000)), a development that is likely to affect both the material trading costs and the mark-up components of the spread. For instance, competition

among stock exchange intermediaries improves liquidity in Biais (1993): as the number of dealers increases, the spread charged to liquidity traders falls because dealers attempt to undercut each other's prices.

We also construct a dummy variable for 1996 and subsequent years, to capture the possible acceleration in European stock market integration triggered by the implementation of the first Investment Services Directive. Under the new rules, EU financial intermediaries can directly conclude deals in other member countries, without opening a local brokerage branch.

We also control for financial liberalization through a measure of openness to trade, given by the sum of export and imports relative to GDP of the particular country. The correlation between trade and capital flows induced by liberalization has been widely documented in the literature (see Bekaert et al., 2005).

Last but not least, the launch of the Euro may have reduced the currency premium, thus increasing the liquidity of EMU stock markets. Even if the currency risk of the original constituent currencies were priced properly, as argued by Dumas and Solnik (1995) and Allayannis and Ihrig (2001), the elimination of such risks in 1999 through a single currency may have reduced the risk premium component of the price impact. We thus include a dummy variable (EURO) which equals 1 from 1999 on, in order to test whether there is an independent effect associated with the introduction of a single European currency.

Insider trading. The adverse selection component of illiquidity increases with the likelihood of information trading (Glosten and Milgrom, 1985; Kyle, 1985) initiated both by analysts and insiders. Enforcement of insider trading regulation may reduce the adverse selection premium and thus increase liquidity provided that the information produced by analysts is not a substitute of the insiders' foreknowledge. This hypothesis is supported by Bhattacharya and Daouk (2002), showing that turnover significantly increases after the first prosecution for insider trading. We use their panel indicator for the enforcement of insider trading regulations as control variable (INSIDER). The dummy takes the value one starting from the year of the first prosecution for insider trading.

4.1. Endogeneity

Consistent estimates for Eq. (1) can be obtained under the assumption that the explanatory variables PRIVA_{it} and x_{it} are uncorrelated with the error terms, υ_{it}. The condition implies that $E[\text{PRIVA}_{it}\upsilon_{it}] = 0$. In our basic model this condition may not hold: the privatization variables are likely to be endogenous, since governments may attempt to privatize at times when stock returns are high. To the extent that "hot markets" are accompanied with high trading intensity, privatization is simultaneously determined with liquidity. In this case, consistent estimates are obtained through two stage least squares estimation (2SLS). To perform this analysis, we use a vector of exogenous instruments z_{it} for which the condition $E[z_{it}\upsilon_{it}] = 0$ holds.

The empirical literature has identified a set of instruments that are strongly correlated with SIP but uncorrelated with market liquidity (Bortolotti et al., 2003; Bortolotti and Pinotti, 2003). They include the partisan orientation of governments, political–institutional indexes, and public finance variables. The proxy for political orientation ranges from 0 (extreme left) to 10 (extreme right of the political spectrum): it is given by a weighted average of scores attributed in expert surveys to the parties supporting the

government, as in Huber and Inglehart (1995).[17] The political–institutional index has been developed in comparative political science and it positions countries in the majoritarian/consensual dimensions of the political spectrum (see Lijphart, 1999).[18] These political indexes are based on electoral data and display variability both in time and longitudinal dimension. The public finance variables include the fiscal deficit and the debt-to-GDP ratio.

To follow the conventional 2SLS routine, we run 19 regressions (one for each country) of the endogenous privatization variables on all the instruments z_{it} and exogenous variables x_{it}, including an intercept and year dummies. The latter control for variations that are common across countries, such as business cycles, stock market bubbles, and the reduction in trading costs due to technological developments:

$$\text{PRIVA}_{it} = \delta_i'(z_{it}, x_{it}) + u_{it},$$

We then run regression (1), with the fitted value of PRIVA_{it} as explanatory variable, as a panel regression with country fixed-effects and year dummies. Finally, we adjust the standard errors of regression (2) to the two-step nature of the estimation procedure (Baltagi, 2001). Standard errors are computed by the Newey–West procedure for panel data that takes into account heteroskedasticity and serial correlation.[19]

5. Empirical results

5.1. Privatization and aggregate market liquidity

Table 3 reports our results of the second stage of the 2SLS procedure. The regressions include privatization indicators together with control variables. These PRIVA variables estimate the direct effect of privatization on market liquidity above the indirect effect of the increase in the number of listed firms, which is captured by the variable NUMFIRMS. Our most important finding is that SIPs have a statistically significant direct impact on market liquidity.

The negative sign of the coefficient of PRIVATOTAL in the first column indicates that SIPs spur market liquidity. This result is in line with our first hypothesis (H1), since PRIVATOTAL increases in the number of privatization initial public offerings which allow for better diversification opportunities. However, the statistical significance of total SIPs could derive essentially from the capitalization of privatized companies that are cross-listed, PRIVABROAD. In the second column market illiquidity is regressed on both components of PRIVATOTAL–PRIVABROAD as well as the capitalization of privatized companies listed only in domestic markets, PRIVADOM. Since both their coefficients are statistically different from zero, we conclude that domestic privatization stimulate domestic liquidity as much as initial cross-listings. Indeed, the hypothesis of equal coefficients of PRIVADOM and PRIVABROAD is not rejected by a standard statistical test.

[17] The weights are the number of seats obtained by each party as a percentage of the total number of seats of the ruling coalition.

[18] It is an average of three (standardized) variables measuring the dis-proportionality of the electoral rule, the effective number of parties, and government stability, as explained in Bortolotti and Pinotti (2003).

[19] Heteroskedasticity and autocorrelation consistent standard errors are calculated using the Newey–West procedure – adapted to fixed effects models (Greene, 2000, p. 580) – with a window of 13 months.

Table 3
Privatization and market liquidity: regression analysis (2SLS estimates)

Dependent variable	ILLIQ		NONPRIVILLIQ	
	(1)	(2)	(3)	(4)
PRIVATOTAL	**−55.06**		**−50.02**	
	(−3.26)		**(−3.04)**	
PRIVADOM		**−53.82**		−51.11
		(−3.76)		(−1.87)
PRIVABROAD		**−59.27**		**−57.06**
		(−4.48)		**(−4.44)**
NUMFIRMS	−0.26	−0.50	−0.27	−0.50
	(−0.41)	(−0.72)	(−0.48)	(−0.74)
RETURN6M	**−4.25**	**−4.40**	**−4.28**	**−4.44**
	(−5.81)	**(−5.86)**	**(−6.09)**	**(−6.03)**
TRADE	**0.04**	**0.04**	0.04	0.04
	(2.13)	**(2.03)**	(1.35)	(1.89)
EU92	**4.51**	**5.09**	**4.54**	**5.20**
	(3.82)	**(6.19)**	**(4.01)**	**(6.61)**
POLRISK	−0.03	−0.02	−0.03	−0.01
	(−1.05)	(−0.53)	(−0.92)	(−0.36)
INSIDER	1.22	1.19	1.09	1.15
	(1.71)	(1.72)	(1.60)	(1.71)
Year dummies	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes
N_{obs}	2945	2945	2941	2941
Adj R^2 (weighted)	0.37	0.35	0.40	0.35

This table shows results of IV fixed effect panel data regressions. The dependent variable is ILLIQ in columns (1–2) and NONPRIVILLIQ in columns (3–4). PRIVATOTAL is the sum of the capitalization of privatized firms scaled by total market capitalization. PRIVADOM is the sum of the capitalization of privatized companies listed only in the home market, scaled by total market capitalization. PRIVABROAD is the sum of the capitalization of privatized companies listed at home and in one or more than one foreign exchange, scaled by total market capitalization. NUMFIRMS is the (log) of the total number of listed companies, lagged one year. RETURN6M is the market return over the previous six months. TRADE is the sum of export and imports, scaled by GDP. EU92 is a dummy variable taking the value 1 from 1-1-1992 onwards, and zero otherwise, for EU countries. POLRISK is the International Country Risk Guide political risk measure. INSIDER is a dummy taking the value one starting from the date of one country's first prosecution of insider trading. Instrumental variables are the debt ratio, the deficit to GDP, the political orientation of privatizing government (PARTISAN), and a political–institutional index locating countries in the majoritarian-consensual dimension, POLINST. Year dummies are always included in the regressions without reporting estimated coefficients. Significant estimates (1% level or higher) are typed **bold**, *t*-statistics are in brackets.

Thus, initial cross-listings appear to have the same effects as purely domestic IPOs on domestic liquidity, without dominating the latter, as far as explanatory power is concerned.

In order to assess the economic relevance of this effect, we analyze the impact of a one standard deviation change in the indicators PRIVATOTAL and PRIVABROAD on illiquidity. In this exercise we use the time series standard deviation of each variable, averaged across the 19 countries. When multiplied by the estimated coefficients, a one standard deviation increase in PRIVATOTAL and PRIVABROAD implies a decrease in the ILLIQ measure of 4.15 and 5.28, respectively. Since the value of ILLIQ ranges from a high (averaged over all countries) of around 5.96 in the early years to a low of around

3.68 in the last years, one can draw the conclusion that the *average* effect of SIP is large, and larger for cross-listings.[20] These averages hide considerable cross-country variations, which are due to different time series standard deviations of the privatization indicators. For instance, the estimated decrease of stock market illiquidity associated with a one standard deviation rise in PRIVATOTAL is only equal to 0.03 in the US but reaches 6.25 in Italy.

The only control variable affecting liquidity with the expected sign is past stock market performance, RETURN6M: past booms reduce the price impact of trades, while past bear markets increase it. When this variable is included, the explanatory power of other controls – such as the size of the equity market NUMFIRMS – is reduced below conventional levels. The dummy variable for capital market integration in EU countries (EU92) and the measure of country openness (TRADE) remain significantly correlated with ILLIQ. However, the sign of the coefficient becomes opposite to the one might expect, once past performance is controlled for. Our results seem to suggest that, once the effects on returns are controlled for, market integration reduces liquidity. Other measures of liberalization, such as dummy variables associated with the introduction of either the EURO (in 1999) or the First Investment Services Directive (in 1996), have no explanatory power and are not reported. The effect of privatization on liquidity is robust to including the ICRG political risk measure[21] and the enforcement of insider trading rules (INSIDER) in the estimation, both of which have no impact on ILLIQ.[22]

5.2. The spillover effect of SIP programs

So far, we focused on aggregate liquidity, i.e. the liquidity of the market as a whole. One may argue, however, that the increase in liquidity due to privatization is a consequence of the higher liquidity of the privatized firms' shares. This may indeed be the case since large privatized firms represent attractive investment opportunities for financial institutions. But does privatization contribute to the liquidity of non-privatized firms? In other words, does SIP generate a spillover effect on the liquidity of private companies – as implied by several theories summarized in the first section?

We measure the liquidity of non-privatized companies using the following method. We first sum the daily market value of privatized firms. Then we compute daily market value of non-privatized firms by subtracting the market value of privatized firms from the total market value. We repeat the same calculations for trading volume. This procedure is slightly inaccurate, because in our data set total market value and turnover refer to the

[20] The average decrease of ILLIQ in the sample is equal to only 2.28, which is smaller than the estimated effect of privatization, but privatizations have the biggest effect in countries with low initial liquidity. Yet specifications allowing for a different coefficient of the PRIVA regressors across the sample do not appear to outperform the proposed ones.

[21] There may be an indirect effect of privatization on liquidity via an associated reduction in political risk, as in Perotti and Laeven (2002). Thus, we compute a measure of political risk orthogonal to privatization, which is given by the residuals of a regression of POLRISK on two privatization indicators. When we include this measure as an explanatory variable, we obtain very similar results.

[22] Other institutional variables mentioned in Section 4 – such as indicators of expropriation and repudiation risk, the quality of the bureaucracy, the rule of law, corruption, and ethnic tensions – neither affect liquidity, nor change the explanatory power of privatization irrespective of the presence of past stock market performance among the control variables.

constituents of the Datastream index, which does not always include all companies listed in the domestic market. On the other hand, privatized firms – often the largest ones with the most actively traded shares – are typically included in the index.[23] Our approach will thus 'correct too much' the total market value and may result in an underestimated value of non-privatized firms. This bias will however distort our empirical results against the hypothesis of a positive spillover effect.

Using the newly created data, we calculate the average ILLIQ measure according to the definitions described in Section 3.[24] The resulting dependent variable NONPRIV_ILLIQ is used in the estimations presented in the last two columns of Table 3. The results show that privatization does generate a positive cross-asset externality. The positive impact on the liquidity of non-privatized shares is not consistent with the claim (H3) that the liquidity of domestic stocks decreases as a result of a portfolio reallocation by institutional investors towards more liquid cross-listed securities. This effect can be attributed to either diversification opportunities (H1) or improved risk sharing and investor recognition, as envisaged in (H2), or both. Indeed the results in the third regression support (H1), while the statistical significance of the coefficient of PRIVABROAD in the second regression supports (H2). We emphasize that a statistical test of the equality of the coefficients of PRIVADOM and PRIVABROAD cannot be rejected at conventional significance levels.

The size of the spillover effects of privatization on liquidity is similar to those obtained for the market as a whole, indicating that the change in private firms' liquidity due to SIP is of the same order of magnitude as the change in liquidity of the privatized firms.

Earlier studies have shown the presence of liquidity spillovers across different securities[25] (Amihud et al., 1997). To our knowledge, our study provides the first evidence that private companies obtain large liquidity gains thanks to public offerings of state-owned companies.

5.3. Turnover

The turnover ratio is a more traditional proxy for liquidity. It has widely been used in microstructure (Datar et al., 1998) and cross-country studies of financial development (Levine, 1997). Turnover may, however, not account for all aspects of market liquidity: there has been episodes – such as October 1987 – when turnover was high yet market liquidity was low (Pastor and Stambaugh, 2003). Indeed, the Amihud index is claimed to better capture market liquidity (Hasbrouck, 2003). To check the robustness of our results, in this section, we reconsider all previous estimations using the turnover ratio as a dependent variable. This exercise reveals whether privatization generates liquidity gains along with increased trading activity.

[23] We have checked the coverage of privatized companies in the Datastream index for a random sample of countries using the Data Appendix. On average, 98% of privatized companies are included in the market index.

[24] Daily return is set equal to the relative change in market value of the non-privatized firms. This excludes dividends, and includes increases in market capitalization due to primary issues of non-privatized firms. While a price index based on a portfolio of private firms would yield a more precise measure, the use of median monthly data reduces significantly the impact of outliers in returns due to non-price variations in market capitalization.

[25] Barclay and Hendershott (2004) document another kind of liquidity externality, arising from the temporal consolidation of trades on a given security: the arrival of another trader in the marketplace reduces trading costs for all market participants.

The turnover measure is constructed by dividing total trading volume over a month by the average market value during that month. Overall, the results on turnover closely resemble to those obtained in estimations of the illiquidity measures: the same specifications that we proposed in Table 3 explain over 80% of the variability in trading activity.[26]

The coefficient of PRIVATOTAL on (the log of) the aggregate turnover is equal to 7.72. This implies that one standard deviation change in PRIVATOTAL raises (log) turnover by almost 60% due to privatization.

We also find a large spillover effect of privatization on the turnover of private companies: the average turnover of private companies increases by almost 70% in response to privatization IPOs.[27]

6. Conclusion

This paper contributes to understanding the sources of variation in market liquidity by studying price impact and turnover of 19 stock market indexes. We document that liquidity is enhanced by share issue privatization, as often claimed by policymakers. The results survive the inclusion of several controls for other observable and unobservable factors and are robust to endogeneity concerns. Privatization-related reductions in the aggregate price impact are not simply driven by the liquidity of privatized stocks themselves, but also by a cross-asset externality generated by SIP. In other words privatization has a spillover effect on the price impact of non-privatized stocks, besides the perhaps trivial impact on the liquidity of privatized companies' shares.

This externality is related to both domestic privatization IPOs and cross-listings. We suggest to interpret this finding in the light of liquidity theories that emphasize the role of risk diversification and risk sharing as well as positive listings externalities. Through privatization, governments allow for the trading of company related risk which was not tradable before, thereby allowing for increased diversification. Through cross-listings, governments enhance foreign investors' recognition and participation in privatized stocks, lowering the overall risk borne by domestic investors. Both effects reduce the required risk premium thereby increasing the liquidity of private securities listed in the domestic stock market.

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[26] The regressions on turnover are available upon request from the authors.

[27] A similar effect obtains with cross-listings. This increased turnover of domestic companies may be peculiar to our sample of OECD economies, or to our privatization experiment. Indeed, Karolyi (forthcoming) shows that – consistent with H3 – home market turnover falls in developing countries as a consequence of cross-listing at American exchanges.

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