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Securities market infrastructure for small countries

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Abstract

The development of liquid, efficient securities markets has been a major goal for policy makers in the third world. Casual empiricism suggests that small countries are unlikely to obtain liquid securities markets. There are only 16 countries in the world where the annual turnover on the stock market exceeds 75% of the market capitalisation of the stock market. All but one of these countries has a GDP of above $20 billion.

In this paper, we offer some conceptual insights into the problems of obtaining liquid securities markets in small countries. We use cross-country datasets and case studies to obtain some empirical insights into the questions. Finally, we offer some policy proposals for strategies that could be adopted in small countries.

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Contents

1 Introduction

From the 1960s onwards, advanced countries have experienced an enormous increase in the importance of anonymous securities markets, as a vehicle of financial intermediation, as opposed to banks. In the decade of the 1980s, policy debates in the third world started displaying an awareness of the importance of developing modern securities markets, as a vehicle for obtaining efficient utilisation of capital. In the decade of the 1990s, dozens of countries embarked on building stock markets, which were seen as a key ingredient of market–oriented economic policies.

These efforts have not been entirely successful. Today, it appears that the vast fraction of stock markets in the world are highly illiquid: there are only 16 countries in the world where annual equity trading volume is above 75% of equity market capitalisation. The promise of liquid, anonymous markets that would play a pivotal role in shaping resource allocation appears to be unattainable in all but a handful of developing countries.

As a first approximation, *market size* appears to be an important factor at work. The smallest countries with active securities markets seem to have a GDP of $20 billion. This raises a host of questions for economic policy analysis:

- What are the channels through which increasing returns to scale might appear in securities markets?
- What is the empirical evidence about the role of size in shaping successful securities markets?
- What can policy-makers do, today, in trying to obtain liquid markets in small countries?

In this paper, we seek to shed some light on these questions. We start in Section 2.1 by highlighting an identification problem that we face in many small countries. Small countries often have small firms, and small firms tend to be illiquid everywhere in the world. Hence, the observed outcome (an illiquid market) could be because of *firm characteristics* or because of *market characteristics*. To the extent that firm characteristics are atleast partly responsible for illiquidity, it suggests that the gains from even the best market reforms could be limited.

In Section 2.2, we highlight the difficulties in measurement of liquidity. To an economist, liquidity is about transactions costs; a liquid market is one in which transacting is frictionless. However, the measurement of liquidity and cross-country comparisons of liquidity are difficult. Hence, turnover ratio (turnover over the last one year, as percent of yesterday's market capitalisation) is often used as a poor proxy for liquidity.

In Section 2.3 we try to identify possible sources of increasing returns to scale. We argue that there are significant fixed costs in securities regulation, the operation of core securities infrastructure (exchange, clearing corporation, depository), and information infrastructure. These would generate scale economies in financial systems.

In Section 3, we turn to an examination of empirical evidence. In Section 3.1, we study the cross–sectional variation of liquidity and size on NASDAQ. We find strong evidence of a sharp dropoff of liquidity for smaller firms. We argue that these results purely reflect firm characteristics, without constraints imposed by market characteristics. Hence, the size/liquidity profile that we see here could be interpreted as an upper bound for what we might see in other countries.

In Section 3.2, we analyse a unique dataset of transactions costs measured off real–world trades by 1600 brokerage firms, on 208 exchanges, in 42 countries. This dataset was created by the firm Elkins/McSherry. We find a strong cross-sectional relationship between the market capitalisation of a country and the total transactions costs in the country, with an elasticity of -0.156. That is, a 1% increase in the market capitalisation of the country is accompanied (on average) by a 0.156% reduction in total transaction costs.

This dataset has a sampling bias in favour of large countries of interest to Western financial institutions (who are clients to Elkins/McSherry). Hence, we also examine the inferior liquidity proxy (turnover ratio) for a larger dataset. We find that until a country reaches a GDP of $20 billion, there is little improvement of equity turnover with GDP growth. Beyond this threshold, we find an elasticity of 0.43.

As a case study, we utilise the cross–sectional variation of the turnover ratio on NASDAQ, as a benchmark, to interpret the cross-sectional variation of the turnover ratio on India's NSE. We find that for small firms, with a market capitalisation between $6 million and $24 million, NASDAQ liquidity is significantly superior to that of NSE. However, above a market capitalisation of $24 million, NSE turnover ratios appear to be comparable or superior to those of NASDAQ. This suggests that while the broad market infrastructure at NSE might be sound, features such as disclosure and enforcement, which might affect small companies the most, might have lacunae when compared with the US.

Our next case study is Mauritius, a genuinely small country. We are able to succintly capture the distinction between firm characteristics and country characteristics in our examination of turnover ratios in Mauritius. The state of disclosure and enforcement in Mauritius is probably comparable to that found in India, hence it is most useful to compare turnover ratios seen in Mauritius against those found in India (rather than those seen on NASDAQ). We find that in all size quartiles, firms in Mauritius could obtain sharply better turnover if market infrastructure was improved to Indian levels.

Finally, in Section 4, we turn to normative economics. Our first argument, in 4.1, is in favour of benchmarking exercises where poor liquidity in a country is decomposed into firm characteristics and market characteristics. Policy makers in the financial sector can influence the latter, but not the former. This can give a realistic assesment of the outer bounds to gains from policy initiatives.

In Section 4.2, we argue that E-finance is a powerful tool through which the minimum threshold of size required for obtaining liquidity can be brought down. Specifically, modern computers and communications technology can reduce fixed costs of the securities industry, and make small-value transactions feasible. We show cost estimates where the exchange, clearing corporation and depository in a typical small country can now be built using capital expenses of just around $1 million. Thus many small countries, which may have opted for less sophisticated market designs earlier, can now build a full set of securities institutions at low cost.

Many developing countries have fragmented securities markets, with walls that separate the equity market, the debt market, commodities trading, etc. In Section 4.3, we argue that bringing these together into a shared securities industry infrastructure is a simple tool through which scale economies can be obtained.

In recent years, the spread of capital account convertibility has made new concepts of finan-

cial market design possible, including the use of offshore financial centres. We highlight two, different, models through which scale economies can be exploited. At the simplest, a purely *domestic* securities industry can outsource *functions* (such as the depository) to an offshore entity. This would merely outsource certain IT services, and throws up no complex contractual difficulties.

Alternatively, firms and investors of one country can use the intermediation services of another country. This approach has strengths and weaknesses. On one hand, for a country like Malaysia or Mexico, it offers easy access to a sophisticated financial sector. On the other hand, this path is clearly harmful to the domestic financial sector, since it would then be much less likely to develop economies of scale.

In Section 4.5, we describe one case study, the Middle East Financial Network, which was an attempt at a shared order routing facility between over a dozen stock markets in the Middle East. Section 5 concludes.

2 Issues

Casual empiricism suggests that small capitalisation securities, and small countries, are unlikely to obtain liquid and efficient markets. For example, feasibility studies about the establishment of spot or derivative markets in a country typically start by reviewing the probability of success of markets in countries with similar total market capitalisation.

In this section, we try to understand some aspects of this problem. At the outset, in Section 2.1, we highlight an identification problem that we suffer, between illiquidity owing to small *securities* versus illiquidity owing to small *markets*. In Section 2.2, we deal with some measurement problems in liquidity and turnover ratios. We go on to sources of increasing returns to scale in in Section 2.3.

2.1 Market characteristics versus firm characteristics

When we try to understand the problems of stock market liquidity in small countries, we have to deal with an identification problem between two causal explanations: the role of *small size of firms* and the role of *small size of country*.

Small firms We expect small firms to be less liquid. Small firms are generally less diversified, which enhances their volatility. Small firms tend to expend smaller resources on information disclosure. Small firms are likely to have fewer investors and analysts following the firm. Thus small firms are likely to have high volatility, and high asymmetric information. An extensive literature, starting from Benston & Hagerman (1974) and Stoll (1978), has found that these characteristics are associated with poor liquidity. These arguments hold, regardless of the characteristics of the country where the firm is traded.

Small countries We expect a small country to have a smaller financial sector, with inferior resources devoted to operating exchanges, legal and information infrastructure, human capital devoted to analysing firms and portfolios, trading, etc. Small countries often have poor

laws about disclosure and insider trading, which yields conditions of high asymmetric information. Small countries often have weak enforcement against market manipulation, which raises adverse selection costs. Both these are likely to yield inferior liquidity in small countries.

These two characteristics are correlated. Small countries generally have small firms, and the securities issued by small firms have smaller capitalisations.

This suggests that when we consider policy proposals which could enhance the quality of *financial infrastructure* (i.e., market characteristics) in small countries, the gains that could be obtained from the best executed policy initiatives which improve the market design can be sharply bounded for countries where many traded products are afflicted with features that are associated with poor liquidity.

Hence, the most useful policy question that can be asked in a small country is:

> "Would product X become much more liquid if it were traded on much superior market infrastructure?"

In this question, we hold the characteristics of product X constant, and ask whether liquidity can be sharply altered using a substantially altered market infrastructure.[1] If the environment in terms of product characteristics is hostile, we may find there are sharp limitations to the gains that can be obtained by improving market infrastructure.

2.2 Measurement

In order to analyse cross–country evidence about stock market liquidity, we need to obtain metrics which are logically sound and consistently measured across countries.

Liquidity is defined as the transactions costs suffered in undertaking trades. This reflects a combination of brokerage and other charges, and the "market impact cost" suffered on the market when the trade is executed.

Unfortunately, there are numerous difficulties in measuring the bid–offer spread and in making comparisons of the bid–offer spread across different trading rules. Consider, for example, a comparison of transactions costs between NASDAQ and India's NSE. NASDAQ uses a market lot of 100 and NSE uses a market lot of 1. Hence, the bid–offer spread at NSE typically pertains to small transaction sizes (as small as one share). Further, the typical share price at NSE is Rs.90 or $2, while the typical share price at NASDAQ is $50. Hence, a casual comparison of the bid-offer spread at NASDAQ versus NSE is incorrect since the NASDAQ spread pertains to a

[1] The phenomenon of Mexican stocks trading in the US is a natural experiment of such a phenomenon. The US has superior securities markets infrastructure as compared with Mexico, so the gains in liquidity obtained by Mexican stocks when trading in the US began is a response to improved market infrastructure. At the same time, the Mexican stocks are small in absolute terms, and their liquidity in the US is poor in absolute terms.

transaction size of roughly $5000 while the NSE spread pertains to a transaction size of roughly $2.[2]

The second problem pertains to missing data. At many timepoints, both buy and sell orders might not exist (at either of NASDAQ or NSE). When this happens, the bid/offer spread is not observed. This raises questions about how a measure of location will be estimated.

These difficulties inhibit a direct comparison of liquidity across exchanges.

Hence, we often use the "turnover ratio", defined as annualised trading volume per unit market capitalisation, as a metric of liquidity. For example, if a stock has a market capitalisation of $100 on 31 December 2001, and if the trading volume over calendar 2001 was $125, then the turnover ratio works out to 125%.

Using cross–sectional data for the firms listed on NASDAQ, the rank correlation between log spread and log turnover ratio works out to 0.087, with a t-statistic of 4.25. Thus the turnover ratio is only a poor proxy for transactions costs. However it presents no difficulties in measurement and cross-country comparison.

2.3 Increasing returns to scale in the securities markets

Consider a traditional purely-domestic securities industry, as summarised in Figure 1. The costs incurred by the securities markets, which are all ultimately borne by local firms and investors, are:

1. The costs of securities regulation,
2. The costs of operating exchange, clearing corporation and depository,
3. The costs incurred by a "sufficient" mass of financial intermediaries.
4. Costs of information dissemination and information processing.

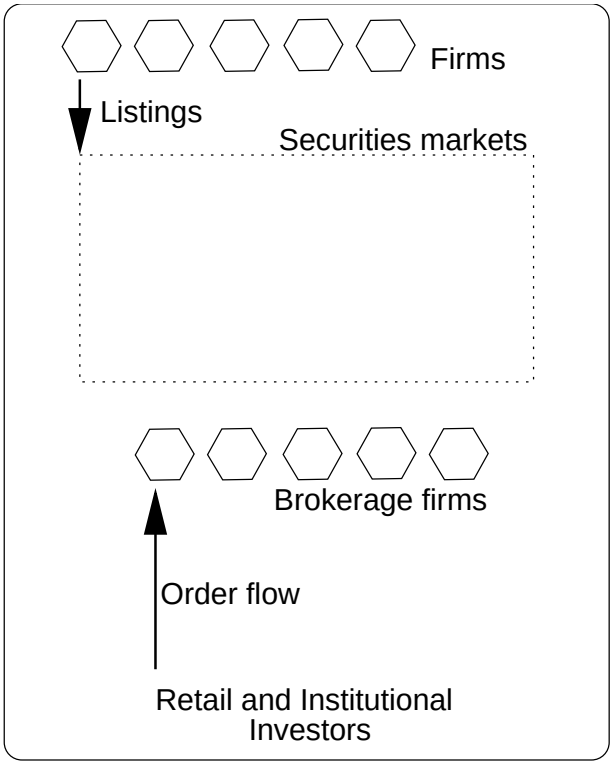
All these costs are ultimately paid by households and firms in the form of listing fees and transactions costs.

It appears that there are significant increasing returns to scale for many of these elements. If we focus on the *marginal* cost in the financial system when one new firm goes IPO, then increasing returns to scale are sharply visible. This marginal cost for one additional firm is near–zero when it comes to regulation, stock exchange, clearing corporation, depository, the information business and the fixed costs of financial intermediaries.

There is only one area – analyst coverage – where it appears that economies of scale are not readily observed. If n analysts are required to track m firms, then roughly $2n$ analysts would be required to track $2m$ firms.

[2] At NSE, "snapshots" of the complete limit order book are observed. Thus any market order can be simulated, and the impact cost accurately measured. If a transaction of (say) $5000 is of interest, it can be simulated and the market impact cost measured. However, there are very few electronic markets in the world which put out datasets of the complete limit order book. Hence this approach would work at India's NSE, but it does not scale to other countries.

Figure 1 A purely domestic securities industry



For a small country, the aggregate revenues from financial intermediation might not be large enough to support a sophisticated securities industry in all these respects. A small country could be trapped in an equilibrium where the securities markets are illiquid, which deters listings, so that the minimum economies of scale continue to elude the domestic securities markets.

3 Empirical evidence

In this section, we seek to obtain empirical evidence on some of these questions. We try to do this via large-scale datasets about firms and countries. We deal with the relationship between size and liquidity at the firm level in Section 3.1, and the relationship between the size of a country and stock market liquidity in Section 3.3. In addition, we also go closer to the evidence about two countries, as case studies.

3.1 Liquidity of small capitalisation stocks

As a broad regularity, small capitalisation stocks have poor liquidity all over the world. As an empirical example, we focus on the cross-sectional evidence at NASDAQ, which is arguably the most successful exchange internationally in terms of obtaining liquidity for small stocks. The United States enjoys substantial resources devoted to disclosure, information processing, regulation, valuation of securities, trading, etc. This produces a conducive environment for obtaining market liquidity.

We may hence consider the NASDAQ experience with the liquidity of small firms as being the outcome constrained purely by firm characteristics, and not market characteristics. In other words, this evidence can tell us something about the impact of size on liquidity, when the fixed costs of securities market infrastructure is not a strong constraint.

Figure 2 shows this relationship as of one timepoint. It suggests that size is a powerful explanatory variable, and larger stocks tend to have finer spreads.[3]

It is useful to observe that of 4596 firms traded on NASDAQ, only 2403 had observations of both bid and offer prices. Of these, only 1194 had bid/offer spreads of better than 10%. Thus most firms seem to have bid/offer spreads above 10%, which is 100 times worse than spreads of the order of 0.1% which are found for the most liquid financial products. In absolute terms, this figure suggests that even at NASDAQ, the liquidity of small stocks is quite dismal.

Figure 3 shows the relationship between size and the turnover ratio. This figure involves a larger number of firms, since the difficulty of unobserved bid or ask is absent. It suggests that size is a powerful explanatory variable, and larger stocks tend to have higher turnover ratios.[4]

Table 1 re-expresses this as turnover ratio for size deciles. We utilise this in our comparisons with smaller countries later in this paper.

In the typical small country which is the focus of this study, stocks would seldom have a size in excess of $100 million. As a rough guiding principle, we may infer that small stocks can

[3]The slope of the robust regression of log spread on log market capitalisation is -0.18, with a t-statistic of -12.6.

[4]The slope of the robust regression of log turnover ratio on log market capitalisation is 0.42, with a t-statistic of 33.3.

Figure 2 Size and liquidity – cross–sectional evidence from NASDAQ

This figure depicts the cross–sectional relationship between size (i.e. market capitalisation) and the bid/offer spread on NASDAQ at one point in time (on 2 October 2001). Firms where either bid or offer was not observed were removed from the dataset, hence this evidence is biased towards the characteristics of more liquid firms. The scatter points are individual firms. The line that has been superposed is a robust regression.

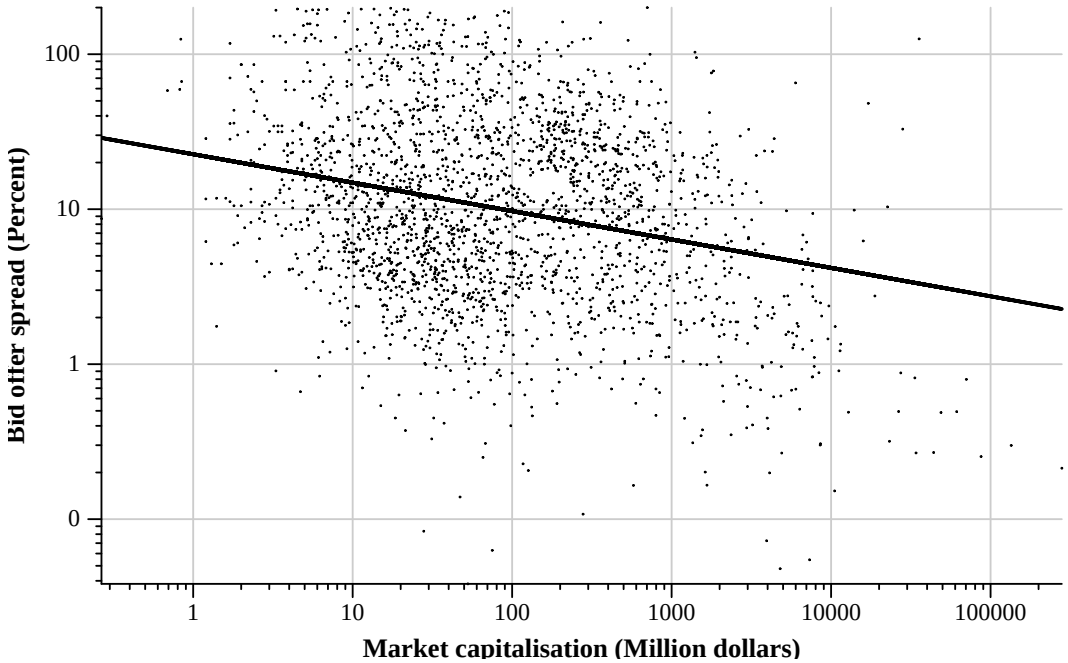


Table 1 Turnover ratio by size deciles on NASDAQ (March 2001)

Decile	Mean market capitalisation (Million $)	Mean liquidity ratio (percent)
1	5.44	97.51
2	13.61	82.92
3	24.31	82.14
4	39.66	85.71
5	63.34	96.80
6	102.82	118.24
7	167.48	160.89
8	302.16	195.33
9	645.95	253.05
10	6062.69	314.58

Figure 3 Size and turnover ratio– cross–sectional evidence from NASDAQ

This figure depicts the cross–sectional relationship between size (i.e. market capitalisation) and the turnover ratio on NASDAQ at one point in time (on 2 October 2001). The scatter points are individual firms. The line that has been superposed is a robust regression.

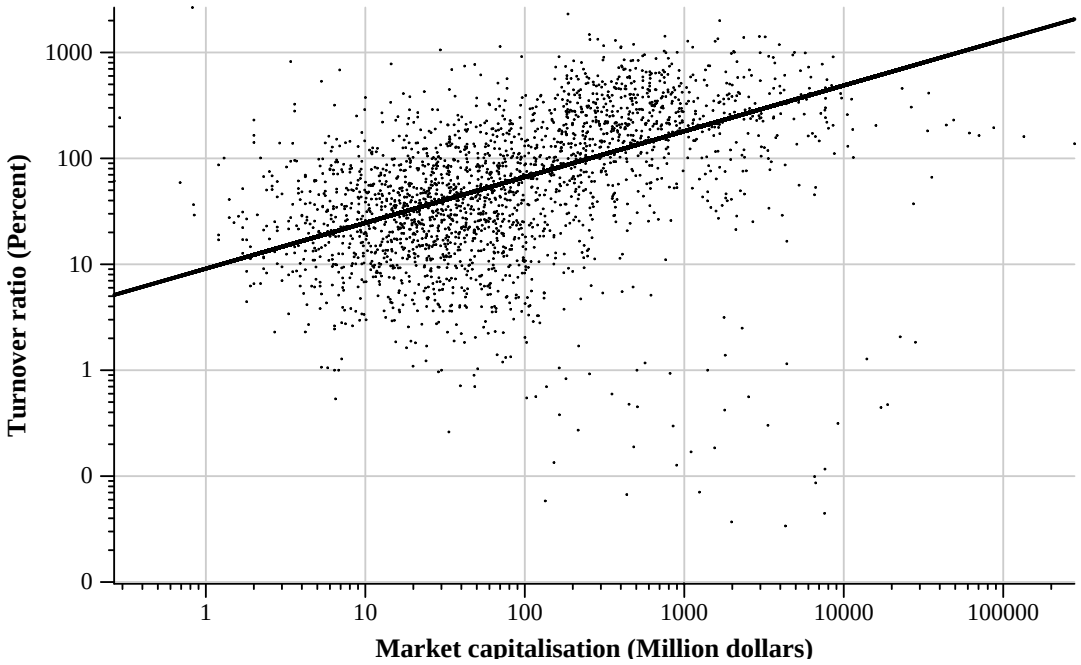
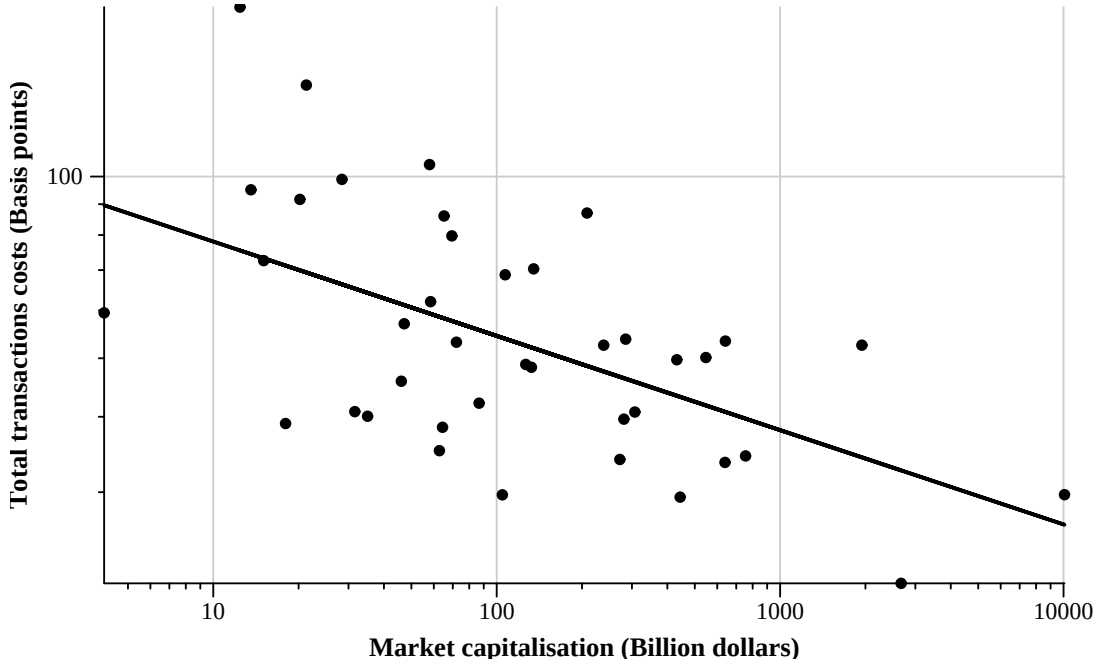


Figure 4 Market size and market liquidity (2001)



obtain liquidity ratios in the region of 100% given US–style disclosure, US–style regulation and enforcement, given US–quality securities markets infrastructure. Conversely, we may conclude that even under these benign conditions, small stocks are unlikely to obtain liquidity ratios above 100%, which larger stocks do appear to obtain.

Going beyond NASDAQ, the global experience with trading small stocks is quite dismal (Angel 1997). In the US, in 1992, AMEX tried to create an "Emerging Companies Marketplace". This was closed down in 1995. In the UK, the "Unlisted Securities Market" was closed down in 1996. "Incubator" segments for small stocks in Europe have uniformly failed. Later in this paper, we compare NASDAQ's turnover ratios with those on two countries in the third world. We find that small firms on NASDAQ generally obtain higher turnover ratios as compared with those seen elsewhere. This is consistent with our attempt at interpreting the NASDAQ evidence as outer bounds for the turnover which firms of a given size can obtain.

3.2 Empirical evidence on country size and market liquidity

In this section, we analyse a unique dataset, created by the firm Elkins/McSherry, which monitors transactions costs incurred on real–world trades by 1600 brokerage firms on 208 exchanges in 42 countries.[5] We focus on the "total transactions cost" reported by Elkins/McSherry, which includes brokerage fees, charges, and market impact cost. This would measure market liquidity as seen by the institutional investor.

[5]Elkins/McSherry can be accessed at <http://www.elkinsmcsherry.com>.

Table 2 The smallest countries with turnover ratio $> 75\%$

Country	Aggregate GDP (billion $)
Swaziland	1.3
Oman	15.6
Slovak Republic	20.4
Kuwait	30.0
Hungary	45.7

Table 3 Summary statistics

	Median	Mean	Std.Dev.	N
Banking spread	6.35	8.92	7.71	64
Log GDP	9.91	10.34	2.02	87
Turnover ratio	0.12	0.38	0.62	87
Log Turnover Ratio	-2.06	-1.99	1.57	87

Figure 4 shows a scatter–plot of market capitalisation of the equity market, and total transactions costs, in 42 countries. A robust regression is superposed on this scatter plot. The coefficient (elasticity) is -0.156, with a t-statistic of -3.867.

This suggests that larger countries have a substantial advantage in terms of obtaining greater stock market liquidity.

3.3 Empirical evidence on country size and turnover

Table 1 suggests that the smallest firms on NASDAQ obtain a turnover ratio of roughly 100%. There are only 16 countries in the world where the overall stock market obtains a modest turnover ratio of above 75%. This suggests that an active stock market is a rarity, by world standards. It also serves to highlight the difficulties that small countries face in obtaining liquid securities markets.

Table 2 shows the smallest five countries (by GDP) which obtain turnover ratios above 75%. This suggests a thumb–rule of around $20 billion of GDP as a threshold faced by the smallest active equity markets.

In order to obtain empirical evidence about the determinants of market liquidity, we created a dataset of all countries where information about stock market turnover and stock market capitalisation was observed, in addition to other macro-economic information. This information was captured for 1999, and consists of 87 countries. Summary statistics about this dataset are shown in Table 3.

As mentioned in Section 2.2, market liquidity is normally defined in terms of transactions

Table 4 Models for log(turnover ratio)

	Model 1		Model 2	
	OLS	Robust Reg	OLS	Robust Reg
Banking spread	-0.05818	-0.00619	-0.05649	-0.00558
	(-2.852)	(-2.692)	(-2.784)	(-2.551)
Log GDP	0.29897	0.05543		
	(3.548)	(5.835)		
Linear Spline in Log GDP				
Below median			0.00451	0.03223
			(0.019)	(1.286)
Above median			0.43273	0.06406
			(3.348)	(4.597)
Intercept	-4.54265	-0.34878	-1.92565	-0.14979
	(-4.694)	(-3.197)	(-0.894)	(-0.645)
N	62	62	62	62
R^2	0.3269		0.3477	
Adjusted R^2	0.3041		0.3139	

cost. Consistent measures of transactions costs across countries are not available. Hence we fall back upon the 'turnover ratio', trading volume divided by market capitalisation, as a proxy of market liquidity.

At the level of casual examination, countries with large GDPs dominate the ranks of countries with high turnover. The median GDP in the dataset in 1999 was $20 billion and the median turnover ratio was 0.12. If we restrict ourselves to countries with LR> 0.5, then the median GDP of this set works out $919 billion.

Table 4 shows simple OLS regressions explaining the log of the turnover ratio. The banking spread proves to be a useful proxy of financial sector development, and high values of the banking spread are associated with low stock market liquidity. For the present purpose, we focus on market size. Log GDP is a strong explanatory variable. The log-log specification allows us to interpret the coefficient as an elasticity. If we use a linear specification in log GDP, the elasticity works out to roughly 0.3. If we use a linear spline, with a break at the median value of log GDP (i.e. $20 billion), we see that the relationship is essentially flat below the median, and the positive impact of GDP comes strongly into play – with an elasticity of 0.43 – above the median. The small countries of interest to us are often below median GDP.

These regressions are vulnerable to outliers, hence we also show show the same models estimated using Huber's robust regression.[6] The elasticities seen here are much smaller, however

[6]We use the implementation of robust regression in Stata: this consists of first rejecting observations where Cook's $D > 1$, and then using an iterative procedure where regressions are recalculated using weights based on absolute residuals (Huber 1964).

Table 5 Turnover ratio by size deciles on India's NSE (January 2001)

Decile	Mean market capitalisation (Million $)	Mean liquidity ratio (percent)
1	1.18	10.38
2	2.54	14.01
3	3.96	5.25
4	6.27	9.96
5	9.85	17.00
6	15.37	25.84
7	23.44	45.26
8	42.28	127.54
9	105.12	88.69
10	847.64	351.43

the relationships are qualitatively similar.

3.4 Case study: India

In this section, we examine cross-sectional evidence on the turnover ratio in India, a medium–sized economy with aggregate GDP of $460 billion. We focus on the 924 most liquid stocks, traded on the National Stock Exchange, India's largest stock exchange. This is analogous to the set of 4595 stocks on NASDAQ used for Table 1. The variation of the turnover ratio by size deciles is shown in Table 5. This table supports four inferences:

- In decile 1, 2 and 3, the stocks traded on NSE are smaller than those seen in the smallest decile on NASDAQ. Hence, while the turnover ratios seen appear to be low in absolute terms, it is not clear whether these low turnover ratios are innately associated with size, or a reflection of inferior market characteristics in India.
- In decile 4 through 7, the stocks traded on NSE are comparable in size to the stocks traded on NASDAQ. However their liquidity ratios are significantly inferior to their peers who trade on NASDAQ.
- In decile 8, 9 and 10, the turnover ratios seen on NSE are comparable to those seen on NASDAQ.
- The top decile on NSE and on NASDAQ are both at a liquidity ratio of 350% or so. However the mean market capitalisation seen in the top decile at NSE is just $847 million, which is much smaller than that seen on NASDAQ ($6 billion). In other words, stocks on NSE obtain turnover ratios of the order of 350% at a much lower size threshold when compared with NASDAQ.

In summary, this evidence suggests that India's NSE fares significantly worse than NASDAQ in terms of turnover for firms with size from $6 million to $24 million. Firms with market capitalisation above $24 million seem to fare well on NSE. In particular, NSE seems to obtain

Table 6 Basic facts about the Mauritius equity market

Year	Listed Firms	Mkt. Cap ($ mln)	Turnover ($ mln)	Turnover ratio (%)	GDP ($ bln)	Mktcap/GDP (%)
1989	6	93	0.92	0.99	2.16	4.30
1990	13	255	5.93	2.32	2.63	9.66
1991	19	310	5.17	1.66	2.82	10.98
1992	21	424	10.16	2.39	3.17	13.33
1993	29	842	39.07	4.64	3.19	26.37
1994	34	1578	85.93	5.44	3.47	45.40
1995	39	1563	69.24	4.43	3.88	40.26
1996	42	1693	81.30	4.80	3.92	43.14
1997	42	1755	142.03	8.09	4.09	42.85
1998	42	1850	104.32	5.63	3.99	46.34
1999	43	1643	77.88	4.74	4.19	39.18
2000	43	1336	73.83	5.52	4.26	31.30

turnover ratios above 350% at a much lower size threshold as compared with NASDAQ. We may conjecture that this reflects (a) sound market infrastructure in terms of trading, clearing and settlement, so that large firms trade very efficiently in India, and (b) poor disclosure and enforcement in India, which would affect liquidity of small firms the most.

3.5 Case study: Mauritius

Mauritius is a typical "small country", so we will examine it at some length.[7]

The broad facts about the recent experience with the Mauritius equity market are summarised in Table 6. The number of listed firms rose sharply till 1995, but has not grown since. The turnover ratio of the market rose to roughly 5.5% in 1994, went on to 8.1% in 1997 but was back to roughly 5.5% in 2000. The total market capitalisation, expressed as percent of GDP, rose sharply from 4.3% in 1989 to 45% in 1994, but has slipped to 31% in 2000.

The low base of transaction volume in Mauritius has generated extremely high charges for exchange infrastructure. The exchange imposes a tariff of 0.25%, the depository has a tariff of 0.2% and the regulator has a tariff of 0.05%. Thus the basic charges of a transaction in Muritius are 0.5%, which is one of the highest in the world.

Are these poor turnover ratio values in Mauritius inescapable? Specifically:

- Does the small GDP of Mauritius imply that the turnover ratio cannot be much higher?
- Does the small size of listed firms imply that the turnover ratio cannot be much higher?

[7]This treatment is based on a consulting assignment on the Mauritius Capital Markets done by the first author, for the Ministry of Economic Development, Financial Services and Corporate Affairs in Mauritius, and funded by the World Bank.

Table 7 Turnover ratio in countries with GDP's similar to Mauritius (1997)

Country	GDP ($ bln)	Turnover ratio (%)
Armenia	1.6395	8.69
Fiji	2.1009	2.28
Barbados	2.1924	2.40
Namibia	3.2338	4.12
Zambia	3.9110	2.00
Mauritius	4.0790	8.09
Honduras	4.7244	67.30
Nepal	4.9219	2.45
Botswana	5.0545	12.12
Latvia	5.6376	34.41
Trinidad and Tobago	5.8635	6.00

Table 8 Variation of turnover ratio by size quartiles in Mauritius

Quartile	Total market cap (million rupees)	Turnover ratio (percent)
1	29,624	6.26
2	4,995	3.94
3	2,397	4.00
4	834	3.26

Table 7 shows the turnover ratio observed in ten countries which have an aggregate GDP which is close to that of Mauritius. While none of these countries exhibits turnover ratios near 100%, which are seen in large countries, we do see many countries which have obtained turnover ratios significantly above that seen in Mauritius.

Table 8 divides the universe of traded products in Mauritius into four quartiles by size. We see that the market capitalisation is strongly concentrated in the ten companies which make up the top quartile. These companies have an average liquidity ratio of 6.26%. The turnover ratio drops off to 4% at the second and third quartiles, and to 3.25% at the bottom quartile.

Table 9 engages in an interesting counter-factual calculation. The mean market capitalisation of firms in the quartiles of the Mauritius market works out to $105 million, $18 million, $9 million and $3 million. We then go on to compute the *average* turnover ratio that accrues to firms of this size on NSE and NASDAQ. In this average, we are ignoring all other stock characteristics (such as volatility, shareholding patterns, etc); we are only focusing on the most important explanatory factor, i.e. size.

- At the top quartile, the mean firm with a market capitalisation of $105 million would obtain a

Table 9 Mean turnover ratio at NSE and NASDAQ for Mauritius size–deciles

Quartile	Mean market cap	Predicted TR	
	(million dollars)	NSE (India)	NASDAQ (US)
1	105	89	118
2	18	35	83
3	9	17	90
4	3	15	

turnover ratio of 89% at NSE and 118% at NASDAQ.

- At the second quartile, the mean firm ($18 million) would obtain a turnover ratio of 35% at NSE and 83% at NASDAQ.
- At the third quartile, the mean firm ($9 million) would obtain a turnover ratio of 17% at NSE and 90% at NASDAQ.
- In the second and third quartile, we see that small firms have much inferior TRs on NSE as compared with NASDAQ.
- Finally, in the bottom quartile ($3 million), we do not observe NASDAQ listed firms, however the NSE turnover ratio would be 15%.
- In all cases, the TRs projected on NSE and NASDAQ are higher than those found on the Mauritius market.

There are numerous caveats in the interpretation of this evidence.[8] Specifically, this evidence does *not* imply that if top quartile firms from Mauritius listed at NSE, they would obtain a turnover ratio of 89%.[9] What this evidence *does* suggest is that much higher turnover ratios *are* obtained, for well developed financial markets, for firms of a comparable size to those found in Mauritius. This suggests that the poor turnover ratio observed in Mauritius is significantly caused by difficulties of the *market*, and not inexorably a consequence of the small size of firms found in Mauritius.

Conversely, these estimates give us upper bounds for the gains in TR that can be obtained through improvements in the securities markets infrastructure. For example, this evidence suggests that for the bottom quartile by size, if market infrastructure to compare with India's NSE

[8]Liquidity at the firm level is influenced by firm size, however it also varies by stock volatility, ownership patterns, disclosure quality, enforcement against insider trading, the design of the equity market, etc. The tables here only deal with the variation by one explanatory variable (size). In reality, all these other explanatory variables do vary significantly across Mauritius, India and the US.

[9]The difficulty here is the extent to which local news drives local speculation. Offshore listings generally suffer from a lack of local knowledge and interest on the part of local speculators. Air Mauritius is an important and interesting stock in Mauritius, but there will be relatively few people in India or in the US who have exposures to Air Mauritius and take interest in trading in the stock. The mean TRs seen on NSE and NASDAQ primarily reflect local speculation for local stocks. Offshore listings are likely to face inferior liquidity.

can be constructed, it might only yield an turnover ratio of 15% as compared with the value of 3.3% presently found in Mauritius. This would be a significant gain, yet it is useful to think that for the bottom quartile firms, turnover ratio outcomes much beyond 15% require an effort in building securities market infrastructure which is better than that found in India.

4 Policy issues

Given this conceptual and empirical backdrop, we now turn to normative economics. What can policy makers in small countries do, in trying to obtain stock market liquidity?

4.1 Diagnosis

The first question that policy-makers in small countries need to address is that of assessing the extent to which their securities markets have inferior liquidity in a way that is inconsistent with their product characteristics.

The broad strategy here is based on cross-sectional models which predict bid-offer spreads and turnover ratios in well developed markets as a function of explanatory variables like size, volatility and shareholding structure. The predicted outcomes from these models would be compared against the observed values for the bid-offer spread and the turnover ratio. If there is a gap in liquidity, these predicted outcomes show the maximal gains that could possibly be obtained from policy initiatives designed to obtain superior market infrastructure.

4.2 The role for E-finance

In the last 40 years, we have seen revolutionary gains in information technology. Computer hardware has grown enormously in power and dropped in price. In addition, the computer industry has seen important structural in terms of a move away from proprietary technology, where firms like Stratus, Tandem, IBM or Microsoft earned rents, to "open standards" based on Unix and Internet protocols, where these rents have been eliminated. Thus end–users of technology have obtained benefits from these two changes: improvements in price/performance of hardware, and elimination of monopoly rents.

In the US, the bond market, the equity market and the derivatives exchanges continue to use inefficient, labour–intensive methods. However, financial trading elsewhere in the world has undergone radical changes in terms of redesigning market mechanisms to move away from labour–intensive methods towards more technology–intensive modes of functioning.

The Internet is the last, and most visible part of this transformation. However, the impact of technology on all aspects of securities trading is profound and pervasive. It is now important for us to rethink many questions of financial sector policy with these new technological opportunities, which are collectively referred to as "E–Finance", in mind (Claessens et al. 2001).

From the perspective of obtaining securities market liquidity in small countries, there are two aspects of E-finance that are important: reduction in the fixed costs of securities infrastructure, and enabling the processing of small value transactions.

4.2.1 Reducing fixed costs

The fixed costs of core securities industry infrastructure have all dropped sharply owing to the gains in information technology. It is now possible to use a computer–intensive market design, and obtain substantially lower costs, as compared with traditional labour–intensive methods of functioning.

The impact of modern IT on fixed costs is seen in all elements of the securities industry:

- The cost of establishing a securities exchange with the ability to process (say) 10,000 trades per day in 2000 is roughly one–hundredth of what it was in 1980.
- The risk management functions of the clearing corporation can be completely automated, and implemented using low–cost software and hardware.
- The first implementation of a securities depository (in 1974 in the US) was based on storing a warehouse of physical securities. In the 1980s, the idea of "dematerialisation" came about, where physical securities were destroyed and only a computer database existed. In the 1990s, the fixed cost of establishing a depository came down from the cost of mainframe computers to small Unix servers.
- A variety of costs are suffered in the process of capturing information disclosure and news about one company, and communicating this to investors and speculators all across the economy. The fixed cost of establishing information networks are sharply lower when they are designed using modern IT.[10]

Credit rating firms incur a fixed costs in producing one credit rating, and securities firms incur a fixed cost in producing one analyst report. Both these fixed costs are substantially lowered in a world where information capture and information processing exploit modern IT.

In the field of credit risk in the western world, databases and models were a means for obtaining low–cost credit analysis about individuals, where human costs of credit analysis were larger than the costs of relatively inaccurate computer models. This argument applies in the third world for small *firms*.

There is now a small literature which analyses the impact of information technology on access to finance for small firms in OECD countries. For OECD countries, in the pre–technological world, the overheads of intermediation were large for small and medium enterprises, which consequently faced financing constraints. The IT revolution sharply cuts the fixed costs of information capture, distribution and processing. In the OECD, this is merely useful since it yields greater access to capital for small and medium enterprises. In the third world, this is enormously more important since most firms are "small and medium enterprises" by OECD standards.

[10]The Centre for Monitoring Indian Economy (in India, <http://www.cmie.com>) has applied technology into information processing over the last decade, giving a 1000–fold increase in the number of firms in their database while having a 10–fold increase in the labour force utilised. This has made possible a CD-ROM with basic financial information on 200,000 firms in India, at a price of roughly $500.

4.2.2 Cost estimates of core securities infrastructure for a small country

The exchange, clearing corporation and depository are purely computer–driven operations today.

Two software firms were asked to offer price quotations for a complete exchange system (order matching, brokerage front office, brokerage back office, clearing corporation, and depository).[11]

The price quotations were inclusive of hardware and software, the cost of installation, local training, and minimal required local customisations. Both firms were asked to cater to the needs of a small country, with a modest peak capacity of 100 trades a minute. For a frame of reference, the peak load observed at India's NSE in February 2001 was 2500 trades per minute today, and development efforts are underway to take the capacity of the trading system to 10,000 trades per minute.

These price quotations imply that the fixed cost of establishing such a facility works out to roughly $1 million. This number is vastly smaller as compared with what it was a decade ago. It is not a large capital cost by the standards of even the smallest of countries. This suggests that the capital cost of the core exchange infrastructure are no longer an important bottleneck for small countries. Thus many small countries, which may have opted for less sophisticated market designs earlier can now build a full set of securities institutions at low cost. This could yield some gains in liquidity as compared with the existing state.

4.2.3 Low–cost processing of small value transactions

A central feature of small countries, and poor countries, are *small transactions* and *small portfolios*. These are found in all aspects of the financial sector:

- Mutual funds in India accept contributions by individuals of $10, which would not be acceptable transactions elsewhere in the world. In India's pension system, a central goal for policy makers is to cater to the needs of individuals who have monthly contributions of $6.
- The mean transaction size on the NYSE is $6000, the mean transaction size on India's NSE is $500.
- The minimum balance at a typical retail bank in the US is $500 to $1000. Banks in the third world use minimum balances as low as $5.
- The share depository in India is unique by world standards: it features individual accounts, has 4.2 million accounts, and a mean account balance of $25,000.

Obtaining low overheads while having small value accounts and small value transactions is a major challenge in doing process engineering in the financial sector in poor countries. The fixed costs of the transaction loom large for such small transactions.

This aspect is particularly important when we think of the international competition that is increasingly prevalent in the securities industry. When an exchange in a country with mean

[11]The two firms were Millennium Information Technology (Sri Lanka) <http://www.millenniumit.com> and NSE.IT, the IT firm created by India's National Stock Exchange <http://www.nse-india.com>. Both firms are leading providers of software solutions to the global securities industry.

transaction size of $500 competes with an exchange in a country with mean transaction size of $5000, there is a greater pressure on the former exchange to have a low tariff per transaction.

Many elements of the design of the financial sector that are conventionally utilised in the Western world require large transaction sizes in order to pay for transaction overheads. These elements do not scale to the third world.[12]

E-finance offers opportunities for sharply reducing the cost per transaction. Using modern IT, the marginal cost of processing a transaction can drop to near-zero levels. The average trade value at India's NSE is one–tenth of that seen on the NYSE. This is made possible by NSE's use of computers for matching orders, while the NYSE uses human beings in this function.

In advanced countries, E-finance is merely beneficial, insofar as it gives cost reductions. In the third world, E-finance is vitally important, since it makes transactions possible when they were previously infeasible.

4.3 Avoiding fragmentation

A central feature of the securities industry is the economies of scale. Once a securities markets infrastructure (such as that seen in Figure 1) is working, the marginal cost of trading one more security or conducting one more trade is close to 0, until the point is reached where infrastructure of much larger capacity is required. In addition, expansions of infrastructure capacity require less than linear cost escalations.

In this situation, it is useful for a small country to take stock of all traded financial products and integrate their trading under a unified single securities market. These securities would range over shares, corporate bonds, government bonds, some commodities and some derivatives.

As of today, it is typical for trading in these products to be scattered across disparate, small markets with conflicting regulation. For example, it is typical for government bonds to be traded using a non-transparent OTC market, with poor post-trade arrangements. In a large country, the market size supports such inefficiencies, and unification is merely desirable. However, in a small country, every attempt should be made to bring the local securities markets up to a critical mass, and unification is essential. For example, there is no case for having a stock depository and a bond depository as distinct institutional mechanisms requiring different procedures. The ownership records for all securities can easily be maintained using one depository.

In many countries, the stock market alone is small compared with the size thresholds described in this paper ($3-$6 billion of market capitalisation or 8,000 to 12,000 trades per day). However, it may be possible to reach these size thresholds by bringing bonds and some other

[12] In a pre–technological financial sector, the *marginal* cost of processing a transaction in the 3rd world is lower (owing to cheap labour). It may appear that this offsets the small transaction values. However,

- Many financial firms are characterised by large fixed costs and relatively low per-transaction marginal costs. These fixed costs would be distributed over a smaller base of transaction value in the third world.
- When we focus on marginal cost, there is a subtle contest, between the ratio of transaction sizes versus the ratio of wages. It is not clear that these ratios work out in favour of intermediation efficiency in the third world.

traded products into a unified securities infrastructure.

4.4 International linkages

In recent years, securities exchanges across the world have attempted a plethora of different mechanisms for cooperation (Lee 1998). For our purposes, it is useful to use a three–fold classification of the policy positions that a country can choose between:

1. A country can seek to have a complete set of markets domestically.
2. A country can aim to have domestic securities market *institutions* while avoiding the fixed costs of the core market infrastructure by outsourcing these functions. This outsourcing can be done to market infrastructure in another country, or to a neutral facility shared by a group of countries.
3. A country could have domestic investors interacting with domestic firms on securities markets offshore.

By default, countries in the world fall into purely domestic strategies. We will focus on the strengths and weaknesses of the other two strategies.[13]

4.4.1 Outsourcing of core market infrastructure

In Strategy 2, the small country embarks upon the full complexity of regulation and institutional design of the securities markets. However, it obtains cost reductions by outsourcing the IT infrastructure.

This can be done in two ways. One way, shown in Figure 5, consists of outsourcing to securities infrastructure in another country. In Figure 5, the exchange in country L matches orders for stocks in country L and for stocks in country S. Alternatively, a group of countries $S_1, S_2, \ldots S_n$ can work together to build a central IT facility which is shared by all of them.

The cost savings obtained through this strategy are valuable. However they are relatively limited. The costs of the IT infrastructure comprising exchange, clearing corporation and depository are no longer the dominant part of the overall costs of the securities industry. However, the case for this outsourcing is stronger than a simple cost–saving argument. If a small country S is able to outsource these IT problems to a large country L, then it is likely to be able to harness the research and development which is taking place in L. The securities industry is characterised by a high pace of innovation in traded products, trading mechanisms, methods of harnessing information technology, etc. Securities exchanges in small countries typically under-invest in R&D owing to their resource constraints. Hence, the dynamic argument in favour of such outsourcing is stronger than a simple static cost–saving argument.

One example of an opportunity for outsourcing is found between Sri Lanka, Mauritius and India. The depository in India is designed for 10 million accounts and 5 million transactions

[13]There are other, more radical alternatives, which can also be visualised. There has been one proposal for the the establishment of a stock market in the Seychelles (which has a population of less than 100,000 inhabitants), where trading, listing and brokerage services would all be performed by a single Western financial firm.

Figure 5 Renting IT facilities

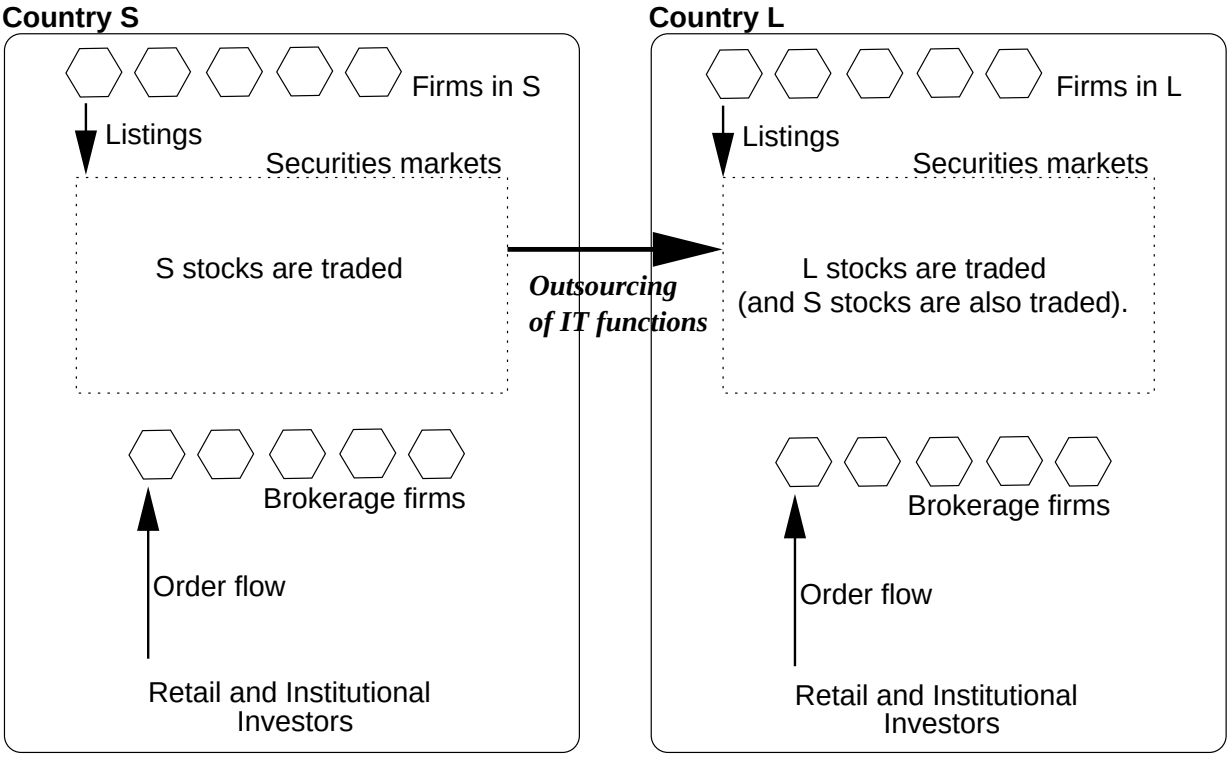
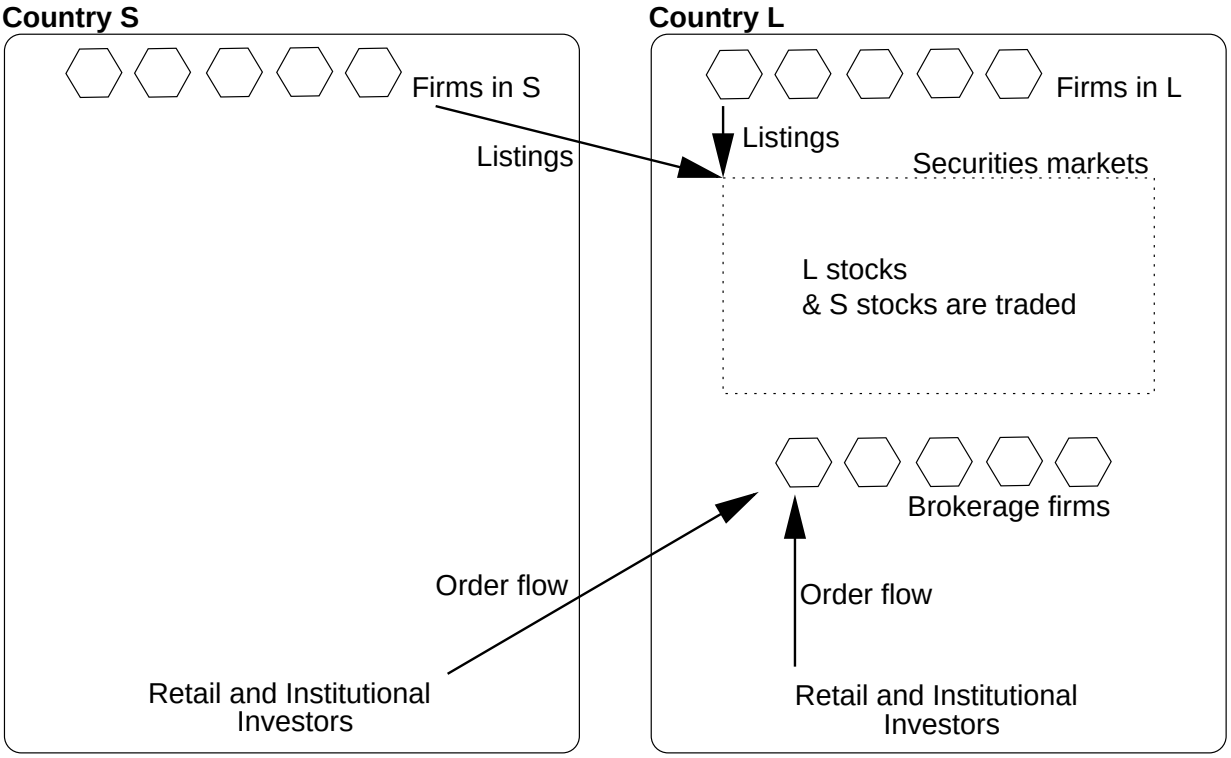


Figure 6 Harnessing the securities markets of another country



per day. It imposes a tariff of roughly 0.005% on transactions. The depositories of Sri Lanka and Mauritius have a tiny base of users and transactions in comparison, and impose extremely large charges (e.g. the depository at Mauritius imposes a tariff of 0.2%). It is possible for both Sri Lanka and Mauritius to obtain major cost savings by outsourcing their depository function to India's NSDL.

Outsourcing of core securities industry infrastructure is easy insofar as it does not involve complex legal and institutional difficulties. Mauritius would continue to have a depository governed by Mauritius law. It is only the internal IT implementation of the depository which would be performed by a foreign contractor.

4.4.2 Using markets in another country

Some small countries are endowed with neighbours which have well developed securities markets. In this situation, harnessing these markets is often the simplest path to obtaining liquidity and market efficiency for local products.

The mechanism that would be employed would be as follows (see Figure 6):

- Firms in country S would be listed on exchanges in country L.
- They would utilise infrastructure in terms of exchange, clearing corporation, depository and regulation in country L.

- These securities would trade alongside local securities in L.
- Retail or institutional investors who can access intermediaries in L would be able to trade these stocks (exactly like they can access other stocks in L).
- Citizens of S would purchase intermediation services of brokerage firms or mutual funds in L when they wanted to undertake transactions or investments in these stocks.

Examples of such relationships could include Mexico (which could utilise the US), Malaysia (which could harness Singapore), Ireland (which could harness the UK), and Sri Lanka (which could harness India). Geographical proximity is convenient in aligning time zones, and reducing the transactions costs of travel when required. However, the core activity on financial markets – that of traders watching screens and placing orders – is now quite implementable using the Internet between any desktop in the world and any exchange in the world, regardless of geographical distance.

In the case of Mexico, securities markets in the US are the dominant venue where Mexican products are traded. This has given liquidity and market efficiency to Mexico without requiring the development of local securities markets. This phenomenon fuels factor payments to labour and capital employed in the US financial sector as opposed to the Mexican financial sector. While this should be a minor issue when compared with the importance of liquid securities markets in obtaining allocative efficiency, it can become a political stumbling block when it triggers off protectionist responses on the part of the domestic financial industry. In a typical small country, the domestic financial industry is politically more effective at obtaining protectionist government policies when compared with many other industries, hence policy-makers who seek to adopt such a course should anticipate and plan for such pressures.

If domestic capital markets development is a goal, then the decision by a firm to list abroad has negative externalities, insofar as it reduces the mass of financial transactions that are taking place through the domestic capital markets. If a domestic securities industry is in an intermediate stage of liquidity, defections by a few key firms to offshore listings can have a sharp impact on the viability of domestic securities markets.

An open capital account on the part of both countries is a pre-requisite for such working arrangements. For example, Sri Lanka once requested India to have the trading of Sri Lankan government bonds in India. While this would fuel factor payments into India's financial industry while simultaneously offering improved liquidity to Sri Lankan bonds, it proved to be inconsistent with India's repressed capital account. Similarly, Malaysian capital controls may impede the trading of Malaysian products in Singapore.

Finally, such relationships can only come about in an environment of political stability. A small country S has to feel comfortable in abandoning financial sector development, and trust in reliable access to the securities markets in a large neighbouring country L. In numerous cases, political frictions between L and S prevent the exploitation of such opportunities.

There is one variation upon this theme: the idea of a 'financial free trade zone', where a group of countries seek to obtain the scale efficiencies by pooling their financial sectors into one. Thus the group of countries would have a single regulator, a single exchange, and one set of brokerage firms without regard for nationality. This is also a viable approach. However, it

does demand the full complexity of financial sector institutional development, complexities of obtaining cooperation across countries, etc.

4.5 Case study: Middle East Financial Network (MEFN)

From the late 1950s onwards, the Federation of Arab Stock Exchanges has debated mechanisms for greater cooperation between the stock exchanges in the Middle East. The notion of a single, unified Arab Stock Exchange has been discussed periodically, without any progress in implementation. Such unification is considered desirable from the perspective of economic policy, and to further the larger political goal of unification in the Arab world.

In the meantime, individual countries set about separately building stock exchanges. These stock exchanges typically started out as trading floors in the 1980s and migrated into electronic trading in the 1990s. Countries which embarked on launching stock markets in the 1990s adopted electronic trading at the outset. The Middle East has also been successful in obtaining a high degree of capital mobility. The existing regime can be summarised as follows: (a) Citizens of the Gulf Cooperation Council (GCC) countries can own shares in any country, but (b) Only citizens of GCC countries are allowed to own shares of GCC companies.

In 1999, a mechanism for cooperation was conceived, called *Middle East Financial Network* (MEFN), <http://www.alshabaca.com>. The design of MEFN was as follows.

MEFN would be a central order–routing facility. MEFN would obtain an information feed from each participating exchange, which would continue to perform existing order matching functions. MEFN would produce an integrated screen which would show bids and offers for every stock on MEFN. This screen would be available, over the Internet, to every brokerage firm which had a membership on any exchange which participated in MEFN. This screen would also be available to any institutional or retail investor in the Middle East or elsewhere over the Internet.

Each brokerage firm would establish links with respondent brokerage firms in exchanges on MEFN where it did not have memberships. The central MEFN systems would be told of these relationships. When an investor in country m wanted to place an order for any stock visible in MEFN, he would approach his local broker in exactly the same fashion as he would for trading a local stock. The broker would place this order on the MEFN screen, which would route this to a respondent broker in the appropriate country.

The information flows on MEFN may be summarised as:

- Information feeds originate from each participating exchange and come to the central MEFN facility (over the Internet).
- This information is broadcast to all MEFN terminals, which go to brokerage firms and investors all over the world (over the Internet).
- When an investor wants to place an order with a brokerage firm which is a member of an exchange participating in MEFN, this order is placed on the MEFN screen, and routed by the central MEFN facility to this brokerage firm.

- If the brokerage firm does not have a membership on the exchange where the order is destined, it is routed on to a respondent firm through the central MEFN facility.
- Order confirmations are sent back through MEFN.

The key insight of this design was to harness the latent order flow which could emanate from countries in the region, where regional capital account convertibility was already in place. The MEFN design only increased the order flow that any one exchange could obtain, and the transactions that any one brokerage firm could process. Hence, it was in the self-interest of brokerage firms and exchanges to support MEFN. This was a key feature in overcoming the political mistrust which a cross-country financial network would normally attract from entrenched players in each country.

The major vulnerability of such an architecture lies in dispute resolution and incompatible regulations. If a transaction fails or encounters malpractice in one country, what are the rules of the game through which the dispute will be resolved? Differences in enforcement principles and practice between different countries could also throw up hurdles for MEFN. MEFN is a mere order–routing system, and has no legal powers over participating exchanges and brokerage firms.

The question of disclosure and accounting is another important bottleneck. MEFN will appear like a single market offering a large number of homogeneous traded securities if and only if all participating firms and countries have a high commonality of accounting and dislosure norms.

MEFN is being implemented by a private firm, QTes, which has been contracted by the Federation of Arab Stock Exchanges for this purpose. QTes will build, own and operate the central facility where feeds from exchanges and orders will flow, to be routed on to MEFN terminals or respondent brokers over the Internet.

The implementors of MEFN were highly conscious of the hurdle faced in terms of a low transaction intensity, atleast at the outset. It was hence essential for MEFN to be a low–cost system, so that the transaction charges it would impose per trade would not be onerous.[14]

5 Conclusion

Small countries do appear to have limitations in their ability to support a modern securities industry; an aggregate GDP of $20 billion seems to be the existing threshold below which active

[14]MEFN adopted a three-fold strategy in order to obtain low costs:

- In the late 1980s and early 1990s, such a project would have required a large cost in custom telecommunications lines. Instead, MEFN harnessed the Internet as a public wide-area network.
- The designers took care to ensure that every hardware or software component in MEFN has multiple competing vendors, so as to avoid the markups associated with single-vendor solutions. Hence, MEFN relied exclusively upon commodity Unix hardware and commodity software based on open Internet protocols. Several key software components in MEFN are drawn from the open-source community.
- The software development for the back–end of MEFN, i.e. the information dissemination and order routing system, was done by an Indian software company which specialises in securities industry problems, Infotech Financials <http://www.infofin.com>, at a low cost of roughly $100,000.

stock markets do not seem to occur.

However, when evaluating this question, it is important to distinguish between product characteristics and market characteristics. Small countries typically trade small securities, and these securities would have inferior liquidity even if they were traded on the best possible securities markets. It is possible to undertake benchmarking exercises through which the maximal gains from policy reforms could be measured for a given country.

The constraints faced by small countries are less binding today than ever before, owing to sharp cost reductions in information technology on both hardware and software costs. The remarkable feature of the specific IT cost estimates found in this paper is their low magnitudes. A pervasive adoption of E-finance brings modern financial systems within reach of smaller countries than ever before.

One element of a policy platform that small countries should evaluate is a unification of all organised financial trading into a single securities market. This would avoid fragmentation across stock markets, bond markets, commodity markets, etc., and harness economies of scale.

The other path that small countries can evaluate is that of exploiting international linkages. This can be done at two levels: outsourcing of IT functions of core exchange institutions, or listing on markets outside the country. Both these approaches have strengths and weaknesses, and could be relevant in certain circumstances.

These arguments, and case studies, suggest that there *are* innovative policy options which small countries can evaluate, which can yield significant enhancements in the functioning of their securities markets. The key engine of change here is E-finance: the falling prices of computer hardware, telecommunications links (particularly the Internet, which is now the global public data network) and custom software development.

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