



**IMPACT OF FINANCIAL LIBERALISATION ON STOCK MARKET LIQUIDITY:
EXPERIENCE OF CHINA**

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Abstract

This paper assesses the impact of the recent financial reforms in China. Following the country's accession to World Trade Organisation, financial liberalisation has picked up considerable momentum. Measures introduced encompass deregulations in the banking sector and refinements in various financial markets, as well as allowing more freedom for Chinese and foreign investors to participate and interact domestically and overseas. Compared to other studies on financial liberalisation, this study focuses on a relatively narrower aspect of financial reforms, namely, the impact on stock market liquidity. Using a panel data set drawn from the Shanghai stock market, we find a positive and significant liquidity impact associated with the recent round of measures, which reflects not only improvement in capital allocation efficiency in China's equity market but, from a financial stability point of view, also reduction in its vulnerability. The finding also provides evidence on one of the important channels in which financial liberalisation can translate into economic growth over time.

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EXECUTIVE SUMMARY

- *In a drive to meet the needs of a rapidly growing economy, the Chinese government has in recent years introduced ambitious and wide-ranging reforms to liberalise its financial system. In this paper, we study the impact of these reforms on financial market liquidity, focusing on stock trading.*
- *Using a panel data set of 50 selected stocks drawn from the Shanghai stock market, we find a positive and significant liquidity impact associated with the recent round of measures, which reflects not only improvement in capital allocation efficiency in China's equity market but, from a financial stability point of view, also reduction in its vulnerability. The finding also provides evidence on one of the important channels in which financial liberalisation can translate into economic growth over time.*
- *Of the results an interesting point to note is the impact of the dual-listing of shares in the Shanghai and Hong Kong markets. The finding that the dual-listing contributes to the liquidity of those stocks is consistent with those of the studies that assess the costs and benefits of the creation of the Euronext in Europe. The combination of this finding and the lesson that can be drawn from Europe appears to imply that it is beneficial for stock exchanges on the Mainland to pursue closer cooperation or integration with stock exchange outside the Mainland such as Hong Kong's due to the possibility of exploiting economies of scale and tapping the benefits from strategic interaction.*

I. INTRODUCTION

In a drive to meet the needs of a rapidly growing economy, the Chinese government has in recent years introduced ambitious and wide-ranging reforms to liberalise its financial system. These reforms include, among many, deregulating the banking sector, refining the interbank funding markets, opening up its domestic financial markets to foreign investors, allowing domestic investors to participate in financial markets overseas, and introducing a new mechanism to allow greater flexibility of the exchange rate. In this paper, we study an important aspect of the reforms, namely, their impact on financial market liquidity, focusing on stock trading.

In the literature, the relationship between financial liberalisation and economic growth has been extensively studied and so there is no shortage of empirical studies supporting that the former positively impacts the latter.² However, evidence is less precise as to how a more liberalised financial system delivers growth. That financial liberalisation creates more liquid financial markets is a possible channel. Theory suggests that more liquid stocks markets can induce more research on firms, given the incentives to profit from new information (Boot and Thakor, 1997); more liquid stock markets can stimulate greater corporate control, leading to more efficient resource management of firms (Stein, 1988); and more liquid markets are more able to channel savings into long-term investment, increasing capital allocation efficiency (Levine, 1991).

This paper looks at China's experience, evaluating the effects of its recent reforms on stock market liquidity. It is hoped that this study can also generate useful insights about the impact of financial liberalisation on market efficiency and economic growth. The rest of the paper is organised as follows. Section II gives a brief historical account of financial reforms in China since the opening up of the economy in 1978 and discusses the nature of the reforms implemented more recently. Section III discusses the rationale underlying the relationship between financial liberalisation and market liquidity, and provides the details of the variables employed. Section IV presents the data and the results of the estimation. Section V discusses the results along with overseas experiences, especially with reference to Europe. Section VI concludes.

² For instance, in a recent comprehensive study by Hermes and Lensink (2005) covering 25 developing countries, financial liberalisation is found to be positively related to private investment and per capital GDP growth. Ranciere, et al (2006) evaluate, for 60 countries, the costs and benefits of financial liberalisation to the economy and concludes that the positive impact of financial liberalisation on economic growth far outweighs its negative impact associated with the triggering of financial crises potentially.

II. FINANCIAL REFORMS IN CHINA

Prior to the adoption of the so-called open-door policy in 1978, the financial system in China was a closed and centralised one (Chan, 1993). In the absence of financial markets, the financial system was equivalent to the banking system, one that consisted of only one bank, the People's Bank of China. In structure, below its national headquarters in Beijing was a network of regional headquarters, branches and rural credit cooperatives spreading over the country. The responsibility of the Bank was to perform banking functions in a centrally-planned economy, such as allocating credit, and granting subsidies and aids to nationalised industries and other production units.

Four commercial banks were subsequently established after 1978 and the People's Bank of China was formally given the central bank status in 1984. The banking system then began to be reminiscent of that of a modern economy. Following this major evolution, trading or exchange of funds among the commercial banks became necessary, giving rise to an informal interbank money market in 1986. This was followed by establishment of other financial markets and infrastructure in the next ten years, a period that can be referred to as phase one financial liberalisation. In this phase, stock exchanges were established in 1990, the foreign exchange market in 1994, the primary government bond market in 1996, the interbank bond market in 1997, and so forth.

The following decade, between 1997 and 2007, saw financial reforms continue in its second phase. This round of financial reforms differs from those in phase one in that it focused more on (i) deregulation of the banking sector; (ii) refinement and enhancement to the markets and infrastructure established earlier; and (iii) integration of the domestic financial markets with the rest of the world. Measures in this phase ranged from recapitalising the state-owned commercial banks, restructuring their operations, introducing strategic investors to these banks, listing their shares in the stock exchange, allowing Chinese firms to open foreign exchange accounts, permitting domestic residents to buy B shares, introducing the QFII and, more recently, the QDII, refining the interbank money market, introducing flexibility to the exchange rate system, and encouraging domestic entities to issue bonds. Table 1 presents a chronology of the most significant financial reforms over the past two decades.

As a whole, the reforms in phase two were targeted more at increasing efficiency through reducing regulations as well as increasing interactions between local and overseas market participants. Our study here is concerned with this round of reforms, ones that have made financial markets in China more liberalised.

III. MODELLING THE RELATIONSHIP BETWEEN FINANCIAL REFORMS AND MARKET LIQUIDITY

The concept of financial liberalisation is very broad. It covers a wide range of issues from how freely capital can move in and out of a country to who can buy and sell a certain financial asset. Financial market liquidity is much more specific; it refers to the sensitivity of prices changes to the level of trading activity. In a liquid market, financial assets can be bought and sold without a significant change in price. Juxtaposing these definitions of financial liberalisation and market liquidity does not immediately suggest a direct causal link from the former to the latter. However, we would argue that there is an indirect link between the two concepts.

Once people have more freedom to make their own financial choices and decisions, the cost – monetary and non-monetary – of funding economic and financial activities should also be lower than otherwise. We hypothesise that the lower cost would stimulate financial market activities and thereby lead to an increase in market liquidity. We choose one of the most important financial markets to test this hypothesis, namely, the stock market in Shanghai. We implement the test by regressing measures of market liquidity on a number of variables we believe are indicators of financial liberalisation.

Because of the broad concept of financial liberalisation, we try to cover most aspects of liberalisation of the financial system including the capital account, the banking system and the stock market itself. The model is estimated by means of fixed-effect panel regression:³

$$LQ_{it} = \alpha + \rho KFLOW_t + \mu M2_t + \psi DUAL_t + \lambda MARKET_t + \delta RISK_{it} + \eta_i + \varepsilon_{it} \text{ ----- (A)}$$

or

$$LQ_{it} = \alpha + \beta QFII_t + \mu M2_t + \psi DUAL_t + \lambda MARKET_t + \delta RISK_{it} + \eta_i + \varepsilon_{it} \text{ ----- (B)}$$

where LQ denotes liquidity, KFLOW short-term capital flow, QFII the investment quota approved under the qualified foreign institutional investor scheme, M2 money supply M2 as a ratio of GDP, DUAL the market capitalisation of the dual-listed A -shares as a share of the total A-share market capitalisation, MARKET overall market condition, RISK risk profile, and subscripts i and t stock i and time t respectively.

³ We performed the Hausman test and for six out of our eight models, the results rejected the null hypothesis that there is no misspecification when the random-effect model is used. Although this is only marginally significant for the remaining two models, for consistency, the fixed-effect model is chosen in the estimation for all our models. The fixed and random-effect panel regression models are discussed in more detail in the Appendix.

LQ is measured in three ways as commonly defined in literature (Kyle, A., 1985). The first is the *tightness* of the market or the cost of transaction, which can be represented by the size of the bid-ask spread.⁴ The second is the *depth* of the market or the degree of participation, which can be measured by the transaction volume. The third is the *resilience* of the market, which can be viewed as the power of the market to pull the price back to its, previous or new, equilibrium after a shock; or, alternatively, the speed at which price fluctuations dissipate after a shock. In addition, the fourth measure of liquidity is the composite indicator, which is computed by taking simple average of the inverse of the normalised components of the three liquidity measures discussed above.^{5, 6}

KFLOW measures the short-term capital flowing in and out of the economy. This is proxied by the sum of the inflow and outflow of portfolio investment as a share of GDP.⁷ Short-term capital flow is an important *de facto* measure of financial openness of an economy, which should reflect the degree of financial liberalisation in terms of how integrated it is with the outside world (Prasad, *et al*, 2003). This is irrespective of how restrictive the economy may be on a *de jure* basis. We expect the effect of this variable on market liquidity to be positive.

QFII is the accumulated level of approved QFII investment quota. The quota indicates the degree of freedom as in the maximum amount of investment that foreign investors can make in purchasing and holding domestic financial assets if they consider fit.⁸ It is therefore important to note that it does not necessarily reflect how much foreign investors invest in China's financial markets, let alone in the stock market. QFII is used as an alternative variable to KFLOW because of their collinearity and the fact that it should capture an aspect of the *de jure* capital mobility. Like KFLOW it should have a positive impact on market liquidity.

M2 is the ratio of money supply M2 to GDP. Reform and deregulation have gained tremendous momentum in the banking sector over the past decade. Both at the wholesale level (e.g., money and bond markets) and retail level (deposit and lending

⁴ It should be noted that this variable, which has to be expressed a percentage of the stock price during estimation, may not be a satisfactory measure in the case of China. Due to the presence of institutional control, the bid-ask spread is almost fixed. As a result, this variable often reflects stock price movements, rather than changes in the bid-ask spread itself.

⁵ The Bank of England (2007) has also calculated a similar summary indicator of market liquidity by taking the average of nine component indicators across five markets (stock, corporate bonds, Gilt, foreign exchange and money markets).

⁶ The components are the average bid-ask spread over stock price, total outstanding shares over trading volume and absolute value of price change over trading volume.

⁷ Portfolio investment and GDP data are available on a semi-annually and quarterly basis respectively. Monthly observations for these variables are obtained by linear interpolation. For consistency with other variables, portfolio investment, which is originally denominated in US dollars, is converted to renminbi in our estimation.

⁸ For consistency with other variables, the QFII quota, which was originally denominated in US dollars, is converted to renminbi in our estimation.

business), the financial system has deepened considerably as a result of greater efficiency of financial intermediation. Due to the lack of a consistent set of data for both money and bond markets and the potential problem of multicollinearity, money supply M2 is our preferred variable of choice. It should have a positive impact on market liquidity.

DUAL is the market capitalisation of the dual-listed A-shares as a share of the total A-share market capitalisation.⁹ The dual-listed A- H shares, representing those companies that have an additional channel to raise capital outside the Shanghai market, are more able to gain investor recognition and access a broader investor base. We take this variable to be an indicator of the degree of integration between the Shanghai and Hong Kong markets and it should therefore impact market liquidity positively.

MARKET is proxied by the level of the Shanghai 180 index and RISK is measured by the 30-day price volatility of the stock concerned. Market liquidity may change as a result of other factors such as market conditions or volatility. Bullish market sentiment itself may lead to more trading activity, while higher volatility may keep investors on the sideline, assuming that they are risk-averse. Hence, the purpose of introducing these two variables to the model is to control for the potential effects of cyclical factors on liquidity.

IV. EMPIRICAL RESULTS

Models A and B are estimated with monthly data of the 50 constituent stocks of the SSE50 index (Table 2), covering the period from October 2002 to December 2007.¹⁰ Stock price, volume, number of outstanding shares and volatility data are extracted from Bloomberg; all other data are extracted from CEIC and EMED.¹¹ Around 4% of observations of selected stocks are missing in the beginning of the period (because some companies were not yet listed) or towards the end (because some stocks were suspended for trading for various reasons). However, this is not a problem from the estimation point of view, as the fixed-effect panel regression model can accommodate unbalanced panel data in the computation of standard errors by incorporating unequal group sizes in the disturbance variance estimator and within-group estimators such that t statistics are correctly weighted in the estimation.¹²

⁹ The total A-share market capitalisation is the sum of the market capitalisation of the Shanghai A-share market and Shenzhen A-share market.

¹⁰ These 50 stocks under study were the constituent stocks of the SSE50 index in January 2004 when the index was launched. But since the pace of the financial reforms began to accelerate much earlier, we try to maximise the length of the period under study subject to the data availability constraint.

¹¹ See www.bloomberg.com, www.ceicdata.com and www.emed.com.hk.

¹² See Appendix for more discussions on adjustment for unbalanced panel data.

Table 3 reports the summary statistics of the data. Charts 1-4 plot the four measures of liquidity of the 50 stocks (grey lines) together with their respective median (the thick black line). As can be seen, before mid-2005, there was no obvious change in the median measure for the stocks except for the bid-ask spread, which showed an upward trend from around the beginning of 2004. Between mid-2005 and mid-2007, the average liquidity increased significantly on all measures before tapering off towards the end of the period under study (or even fell in terms of transaction volume). Overall, it is quite clear that the liquidity of the stocks, on average, increased in the period as a whole.

In the estimation, cross-section weight is applied to correct for the presence of cross-section heteroskedasticity. Robust standard errors are computed by the White diagonal method so that the estimator is robust to different error variances in each stock or time period. Table 4 reports the estimation results.

As can be seen, both models yield similar results. The adjusted R^2 's indicate a reasonably good fit of the model. The three different liquidity measures, highlighting different aspects of market liquidity, respond similarly to the financial reforms under study. All explanatory variables are significant and have the hypothesised signs for most definitions. Only when liquidity is defined as the average bid-ask spread as a percentage of the stock price, the coefficient of KFLOW displays a wrong sign but is insignificant.¹³ As a whole, the results support the notion that financial liberalisation, as indicated by variables KFLOW, QFII, M2 and DUAL, positively impact the liquidity of the stock market in China. In other words, a closer financial linkage with the rest of the world and rapid financial deepening enhance the liquidity and efficient functioning of its stock market.

The two control variables, MARKET and RISK, also capture a positive impact on the liquidity. Our results are consistent with the argument that better market performance promotes market participation, which in turn increases the trading activity and market liquidity. The direction of the trading order flow can also be explained by the relative riskiness of the stocks. Based on our results, higher market activity and liquidity are associated with stocks that experience a higher volatility. This suggests that Mainland investors tend to trade more heavily on riskier stocks, which is consistent with the finding of Fong, *et al* (2007).

¹³ However, this should be viewed with caution. See footnote 4.

V. STOCK DUAL-LISTING AND STOCK MARKET INTEGRATION

As most overseas markets are more liberalised and cross-border capital flows are generally unrestricted, other empirical studies do not share exactly the same focus as ours. However, a growing volume of empirical studies on the effect of stock exchange mergers and acquisitions on market efficiency and liquidity has produced results of similar flavour.

In Europe, research has found that the creation of the pan-European exchange, Euronext, for instance, has been followed by significant improvements in the market liquidity and efficiency.¹⁴ Using bid-ask spread, trading volume and volatilities as liquidity measurements, Pagano and Padilla (2005) show that the resulting integration of cash trading and clearing platform has contributed to an improvement in liquidity. Nielsson (2007) also finds that the integration had a significant and positive liquidity effects on (i) big firms and firms with foreign sales and (ii) the overall market share and competitiveness of Euronext.

In the case of China, there are no mergers and acquisitions between stock exchanges. However, the A-H dual-listing mechanism can be seen as the first step that the two markets work together. A wider range of securities, namely the A-shares, available for Hong Kong's investors and an additional source of capital for Chinese enterprises are the practical outcome under this arrangement. Compared with the forming of Euronext in the European case, the dual listing of A and H-shares can be considered as a weak-form integration to that effect. Our finding that the A-H dual listing mechanism, as proxied by variable DUAL, positively influences all four measures of stock market liquidity is in agreement with what is found in Europe, i.e., integration can lead to improvement in liquidity.

VI. CONCLUSION

Empirical literature on financial liberalisation tends to study its impact from the macroeconomic perspective, assessing, for instance, its contribution to economic growth. This paper has a narrower but no less important focus, putting its impact on the liquidity of financial markets under the spotlight. It is important, because increase in

¹⁴ The monetary union in 1999 has since intensified cross-border financial cooperation and integration. Based on the information published in Euronext and NYSE's websites, Euronext was formed when the stock exchanges in Paris, Brussels and Amsterdam merged. The merged exchange subsequently also integrated with the Portuguese exchange and expanded its operations through acquiring London International Financial Futures and Options Exchange (LIFFE) in 2002. Euronext integrated with New York Stock Exchange (NYSE) in 2007. This cross-continent integration created a combined group, called NYSE Euronext.

market liquidity not only signifies improvement in economic efficiency as it reduces transaction cost (measure of tightness), but also indicates reduction in vulnerability as it has a price stabilising effect (measure of resilience). Evidence of positive impact on market liquidity also contributes to the understanding about the linkage between financial liberalisation and economic growth.

Our study employs a panel dataset of 50 selected stocks listed in the Shanghai Stock Exchange. Three popular measures of liquidity, as well as a composite measure, are adopted and the estimation has yielded consistent findings, supporting the notion that the recent measures of financial liberalisation have had a significant and positive impact on stock market trading of those stocks. The results are encouraging to the policymakers on the Mainland, as they suggest that the reforms they have accomplished are bearing fruits.

Of the results an interesting point to note is the impact of the dual-listing of shares in the Shanghai and Hong Kong markets. The finding that the dual-listing contributes to the liquidity of those stocks is consistent with those of the studies that assess the costs and benefits of the creation of the Euronext in Europe. The combination of this finding and the lesson that can be drawn from Europe appears to imply that it is beneficial for stock exchanges on the Mainland to pursue closer cooperation or integration with stock exchange outside the Mainland such as Hong Kong's due to the possibility of exploiting economies of scale (Malkamaki, 1999) and tapping the benefits from strategic interaction (Noia, 2001).

REFERENCES

- Arnold, T., Hersch, P., Harold Mulherin, J. and Netter, J., 1999, Merging Markets, *The Journal of Finance*, Vol. 54, No.3, 1083-1107
- Amihud, Y., 2002, Illiquidity and Stock Returns: Cross-section and Time Series Effects, *Journal of Financial Markets* 5, 31-56
- Bank of England, Financial Stability Report, Issue 21 (26 April 2007) and Issue 22 (25 October 2007)
- Boot, A. and Thakor, A., 1997, Financial System Architecture, *Review of Financial Studies*, Vol 10, No. 3, 693-733
- Bekaert, G., Harvey, C. and Lundblad, C., 2005, Does Financial Liberalization Spur Growth? *Journal of Financial Economics*, Volume 77, Issue (1), 3 -55
- Chan, K., 1993, Monetary Reform and Control in China, *Asia Pacific Review*, Second Quarter 1993, 5-8.
- China Money Magazine, Issue 65 (March, 2007), Issue 68 (June, 2007), Issue 69 (July, 2007), Issue 70 (August, 2007), Issue 71 (September, 2007), Issue 74 (December, 2007), Issue 75 (January, 2008) and Issue 76 (February, 2008)
- European Central Bank, 2007, The Stock Market's Changing Structure and Its Consolidation: Implications for the Efficiency of the Financial System and Monetary Policy, *ECB Monthly Bulletin*, November 2007, 61-74
- Fong, T., Wong, A. and Yong, I., 2007, Share Price Disparity in Chinese Stock Markets, *Hong Kong Monetary Authority Working Paper 11/2007*
- Galindo, A., Schiantarelli, F. and Weiss, A., 2005, Does Financial Liberalization Improve the Allocation of Investment? Micro Evidence from Developing Countries, *Boston College, Working Papers in Economics*
- Galati, G. and Tsatsaronis, K., 2001, The Impact of the Euro on Europe's Financial Markets, *Bank for International Settlements Working Papers No.100*
- Greene, W., 1997, *Econometric Analysis*, Prentice-Hall, New Jersey
- Guo, S., 2002, Management of Capital Flows in Corporate Sector: Current Situation and Outlook in China, *Speech, People's Bank of China*
- Hermes, N. and Lensink, R., 2005, Does Financial Liberalization Influence Saving, Investment and Economic Growth? Evidence from 25 Emerging Market Economies, 1973-96, *United Nations University, World Institute for Development Economics Research, Research Paper No. 2005/69*
- Hsiao, C., 1986, *Analysis of Panel Data*, Cambridge University Press, Cambridge

- International Monetary Fund, 2004, People's Republic of China, Article IV Consultation – Staff report; Staff Statement; and Public Information Notice on the Executive Board Discussion, *Country Report No. 04/351*
- International Monetary Fund, 2006, People's Republic of China, Article IV Consultation – Staff report; Staff Statement; and Public Information Notice on the Executive Board Discussion, *Country Report No. 06/394*
- Kyle, A., 1985, Continuous auctions and insider trading, *Econometrica*, Vol.53, No.6
- Levine, R., 1991, Stock Markets, Growth, and Tax Policy, *The Journal of Finance*, Vol. 46, No. 4, 1445-1465
- Levine, R. and Zervos, S., 1996, Capital Control Liberalization and Stock Market Development, *Policy Research Working Paper 1622, The World Bank*
- Levine, R. and Zervos, S., 1998, Stock Markets, Banks, and Economic Growth, *The American Economic Review*, Vol. 88, No. 3, 537-558
- Levine, R., 2001, International Financial Liberalization and Economic Growth, *Review of International Economics*, 9(4), 688-702
- Malkamaki, M., 1999, Are there Economics of Scale in Stock Exchange Activities? *Bank of Finland Discussion Papers 4/99*
- Nielsson, U., 2007, Stock Exchange Merger and Liquidity
- Noia, C., 2001, Competition and Integration among Stock Exchanges in Europe: Network effects, Implicit Mergers and Remote Access, *European Financial Management*, Vol. 7, No.1, 39-72
- Pagano, M. and Padilla, A., 2005, Efficiency Gains from the Integration of Exchanges: Lessons from the Euronext “Natural Experiment”, *A report for Euronext*
- People's Bank of China, 2005, Report on Steady Progress in Market-based Interest Rate Reform, Supplement to the China Monetary Policy Report, January 2005
- People's Bank of China, 2006, A Year of Smooth Implementation of the Reform of the RMB Exchange Rate Regime, *Appendix of Monetary Policy Report, Quarter Two, 2006*
- People's Bank of China, 2007, Unservingly Deepening the Reform of State-Owned Commercial Banks
- Prasad, E. and Wei, S., 2005, Understanding the Structure of Cross-border Capital Flows: The Case of China
- Prasad, E., Rogoff, K., Wei, S. and Kose, M., 2003, Effects of Financial Globalization on Developing Countries: Some Empirical Evidence, *IMF Occasional paper No.220*

- Podpiera, R., 2006, Progress in China's Banking Sector Reform: Has Bank Behavior Changed? *International Monetary Fund Working Paper/06/71*
- Ranciere, R., Tornell, A. and Westermann, F., 2006, Decomposing the Effects of Financial Liberalization: Crises vs. Growth
- Sarr, A. and Lybek, T., 2002, Measuring Liquidity in Financial Markets, *International Monetary Fund Working Paper/02/232*
- SESRTCIC, 2006, Cooperation among the Stock Exchanges of the OTC Member Countries, *Journal of Economic Cooperation*, 27-3,121-162
- Stein, J., 1988, Takeover Threats and Managerial Myopia, *Journal of Political Economy*, Vol. 96, No.1, 61-80
- Wong, J. and Fung, L., 2002, Liquidity of the Hong Kong Stock Market since the Asian Financial Crisis, *CGFS Conference volume No.2, Part 12, Bank for International Settlements*
- Wooldridge, J., 2002, *Econometric Analysis of Cross Section and Panel Data*, The MIT Press, Cambridge
- Zhang, J., 2004, Net Positive Non-FDI Capital Inflows in China

Appendix

Fixed *versus* random effect panel regression model¹⁵

Panel data, which combines time series and cross-sectional data in one data set, allows the construction and testing of more complicated dynamic behavioural models than pure time series or cross-sectional data. Due to repeated observations for the same cross-section units measured over time, the efficiency of the estimation can be enhanced with more degrees of freedom and reduced collinearity among the variables.

Modelling a panel data set calls for some advanced stochastic specifications since it involves techniques for time-series cross-section data analysis. Specifically, the panel data regression model can be written as

$$y_{it} = \mu_i + \beta'x_{it} + \varepsilon_{it} \quad (1)$$

where subscripts i and t denote individual i ($i = 1, \dots, N$) and time t ($t = 1, \dots, T$) respectively; y_{it} is the dependent variable; x_{it} is the observed explanatory variable, which contains k regressors; μ_i is the unobserved and time-invariant individual effect; and ε_{it} are the idiosyncratic errors, which change over time t and across individual i .¹⁶

The introduction of fixed and random effect offers two alternative extensions to this classical model. The fixed effect model, an obvious generalisation of the constant-intercept-and-slope model for panel data, is to introduce dummy variables to account for the effects of those omitted variables that are specific to individual cross-sectional units but stay constant over time.¹⁷ In the specification, the individual effects $\mu_1, \mu_2, \dots, \mu_N$ are therefore allowed to be distinct. It is a reasonable approach when the differences between units can be viewed as parametric shifts of the regression function.¹⁸

Note that the panel data becomes unbalanced when the group sizes are unequal, therefore, adjustments to the total counts are required. By using $\sum_{i=1}^n T_i$ instead of nT (where T_i is the number of observation in the unit i) to account for the total

¹⁵ Greene (1997) and Hsiao (1986) are the main reference for the discussion in this appendix.

¹⁶ It is also common to assume that the slope coefficients of the observed explanatory variables are constant across individuals and over time.

¹⁷ Note that it could also introduce a dummy variable for the effects that are specific to each time period but are the same for all cross-sectional units. The resulting model becomes fixed at both individual and time specific dimensions.

¹⁸ Fixed effect model also allows for the unobserved individual effect to be arbitrarily correlated with the observed explanatory variables (Wooldridge, 2002).

number of observations, proper variances and F tests can be computed. Fixed panel data model can accommodate such unequal group sizes in the computations of the disturbance variance estimator and the within-groups estimators, such that the t statistics will be correctly weighted. Most modern econometrics computer packages (including EViews) fully automate the computation.¹⁹

However, when sampled cross-sectional units are believed to have intercepts randomly distributed, the random effect approach may be more appropriate as it treats the individual effect as random variables. The rationale is that it considers the sample of panel data as drawn from a large population, so the introduction of an individual specific random disturbance in the model can appropriately summarise factors that affect the value of dependent variable but that have not been explicitly included as independent variables. The specification in equation (1) is reformulated into:

$$y_{it} = \mu + \beta'x_{it} + u_i + \varepsilon_{it} \quad (2)$$

where the newly introduced component u_i is the random disturbance characterizing the i -th observation and is constant through time. In addition, it is assumed to be uncorrelated with the random error term. More details of the random effect model can be found in Hsiao (1986).

There are many considerations in choosing fixed or random effects in the model specification. One dimension is to consider the number of observations for estimation. In the cases in which T is small and N is large, it can make a substantial amount of difference in the estimates of the parameters. When only a few observations are available, for different individuals over time, it is exceptionally important to make the most efficient use of the data across individuals to estimate that part of behavioural relationship containing variables that differ substantially from one individual to another, in order that the lesser amount of information over time can be used to best advantage for estimation of the common part of the relationship studied. In the literature, one commonly used test for checking whether fixed or random effects statistically is the Hausman test. It checks the assumption that the random effects are uncorrelated with the explanatory variables.

¹⁹ See Greene (1997) and Wooldridge (2002) for more details of adjustment for unbalanced panel data.

Charts & Tables

Table 1. Chronology of key financial market reforms

| Year | Financial Reforms |
|-------------|--|
| 1986 | Specialised bank was allowed to lend to each other and the lending rate and maturity would be negotiated and determined by the parties involved. |
| 1990 | Upper limits were introduced for the interbank lending rate. Shanghai Stock Exchange and ShenZhen Stock Exchange were established. |
| 1991 | Market underwriting was introduced as a mechanism in the government bond issuance. |
| 1992 | B share market was established; foreign investors were allowed to buy B shares. |
| 1994 | Interbank foreign exchange market was established in Shanghai. |
| 1996 | China Interbank Offered Rate (CHIBOR) was introduced. The upper limits on the interbank lending rate were removed and this rate was then determined by the market forces. |
| 1997 | Interbank bond market was launched. The mechanism of setting the outright cash transaction price and bond repo interest rate was reformed. From that time onwards, these rates were determined by the banks involved. Qualified Chinese Enterprises were allowed to open foreign exchange account. |
| 1998 | China Development Bank and China Import and Export Bank issued policy financial bond by means of public bidding. |
| 1999 | Interest rate bidding was introduced and adopted for the first time to issue the government bonds in the interbank bond market. |
| 2001 | Domestic residents were allowed to buy B share using foreign exchange. Qualified joint ventures, wholly foreign-funded enterprises and cooperative enterprises were allowed to issue A shares and list on the market. |
| 2002 | Qualified Foreign Institutional Investors (QFII) scheme was launched. |
| 2003 | Investment quota for QFII scheme was started to allocate to qualified financial institutions. A capital injection of 45 billion USD into Bank of China and China Construction Bank was announced in an effort to recapitalise the banks. |

| Year | Financial Reforms |
|-------------|---|
| 2004 | <p>Banks in Hong Kong were allowed to offer a limited variety of renminbi banking services to the public. They were only allowed to conduct business for personal deposits, foreign exchange transactions between the two currencies, arranging remittances and offering credit and debit cards.</p> <p>Strategic investor (HSBC) was brought into Bank of Communications.</p> |
| 2005 | <p>The renminbi's peg to the US dollar was abolished. The currency was then revalued to 8.11 renminbi per US dollar. The daily RMB exchange rate against US dollar was allowed to move within a 0.3% band around the central parity. The new renminbi exchange rate mechanism was now based on market forces with reference to a basket of foreign currencies.</p> <p>The interbank RMB forward market was established.</p> <p>Renminbi banking services were further expanded to cover the current account services in Hong Kong.</p> <p>Investment quota for QFII scheme was increased to 10 billion USD.</p> <p>A reform program was launched in the stock market to convert the state-owned shares to tradable shares in the listed firms.</p> <p>Strategic investors were brought into Bank of China (Temasek, UBS and a consortium led by Royal Bank of Scotland) and China Construction Bank (Bank of America and Temasek).</p> <p>China Construction Bank and Bank of Communications were listed in Hong Kong Stock Exchange.</p> <p>People's Bank of China launched the short-term corporate bills market, which offers an alternative market for raising funding.</p> |
| 2006 | <p>Qualified Domestic Institutional Investors (QDII) scheme was introduced.</p> <p>National social security fund was permitted to invest in offshore securities market.</p> <p>OTC transactions were introduced in the interbank RMB spot market.</p> <p>The foreign exchange purchase quotas for overseas investment were removed.</p> <p>Bank of China and Industrial and Commercial Bank of China were listed in Hong Kong stock exchange.</p> <p>Bank of China and Industrial and Commercial Bank of China were listed in Shanghai stock exchange.</p> <p>Strategic investors, including Allianz, American Express and Goldman Sachs, were brought into Industrial and Commercial Bank of China.</p> |

| Year | Financial Reforms |
|-------------|---|
| 2007 | <p>The scope of commercial bank's QDII products initially covered only fixed income products; it was further expanded to cover equities products.</p> <p>RMB/Foreign currency swap was introduced in the interbank foreign exchange market.</p> <p>Qualified securities houses were allowed to operate QDII business.</p> <p>Insurance companies were allowed to invest in offshore securities market using foreign exchange.</p> <p>State Administration of Foreign Exchange (SAFE) announced that the investment quota for QFII scheme would be increased to 30 billion USD.</p> <p>Mainland Chinese financial institutions were allowed to issue renminbi-denominated bonds.</p> <p>Shanghai Interbank Offered Rate (SHIBOR) was introduced. It is based on the daily average interbank funding rate of 16 quotation banks after excluding the two highest and two lowest rates for each maturity.</p> <p>China Construction Bank and Bank of Communications were listed in Shanghai stock exchange.</p> |

Source: China Money magazine, HKMA, International Monetary Fund, People's Bank of China and SHIBOR

Table 2. The 50 selected firms in the Shanghai stock market

| Stock code | Company |
|-------------------|---|
| 600000 | Shanghai Pudong Development Bank |
| 600004 | Guangzhou Baiyun International Airport Co., Ltd |
| 600006 | Dongfeng Automobile Co Ltd |
| 600008 | Beijing Capital Co Ltd |
| 600009 | Shanghai International Airport Co., Ltd |
| 600011 | Huaneng Power Intl Inc |
| 600015 | Huaxia Bank Co Ltd |
| 600016 | China Minsheng Banking Corp., Ltd |
| 600018 | Shanghai International Port (Group) Co.,Ltd |
| 600019 | Baoshan Iron & Steel Co |
| 600026 | China Shipping Development Company Ltd |
| 600028 | China Petroleum & Chemical |
| 600029 | China Southern Airlines Co |
| 600030 | Citic Securities Co |
| 600033 | Fujian Expressway Developmnt Company Ltd |
| 600036 | China Merchants Bank |
| 600038 | Hafei Aviation Industry Co |
| 600050 | China United Telecommunication Corporation Ltd |
| 600098 | Guangzhou Development Industry (Holdings) Co., Ltd |
| 600100 | Tsinghua Tongfang Co Ltd |
| 600104 | Saic Motor Corporation Ltd |
| 600171 | Shanghai Belling Co Ltd |
| 600221 | Hainan Airlines Co |
| 600350 | Shandong Expressway Co Ltd |
| 600569 | Anyang Iron & Steel Co Ltd |
| 600591 | Shanghai Airlines Co |
| 600597 | Bright Dairy & Food Co Ltd |
| 600601 | Founder Technology Group |
| 600602 | Sva Electron Co Ltd |
| 600609 | Shenyang Jinbei Automotive Company Limited |
| 600637 | Sva Information Industry Co., Ltd |
| 600642 | Shenergy Company Limited |
| 600643 | Shanghai Aj Corporation |
| 600649 | Shanghai Municipal Raw Water Co.,Ltd |
| 600652 | Shanghai Ace Co Ltd |
| 600664 | Harbin Pharmaceutical Grp |
| 600688 | Sinopec Shanghai Petrochemical Co.,Ltd |
| 600705 | Beiya Industrial Grp Co |
| 600717 | Tianjin Port Co Ltd |
| 600795 | Gd Power Development Co |
| 600805 | Jiangsu Yueda Investment Co |
| 600808 | Maanshan Iron & Steel Company Limited (Mas C.L.) |
| 600811 | Orient Group Inc. |
| 600812 | North China Pharm Co |
| 600832 | Shanghai Oriental Pearl(Group) Co.,Ltd |
| 600839 | Sichuan Changhong Electric Co.,Ltd. |
| 600863 | Inner Mongolia Mengdian Huaneng Thermal Power Corporation Ltd |
| 600887 | Nner Mongolia Yili Industrial Group Co.,Ltd |
| 600895 | Shanghai Zhangjiang Hi-Tech Park Development Co., Ltd. |
| 600900 | China Yangtze Power Co Ltd |

Source: Shanghai Stock Exchange

Table 3. Summary statistics of the Data

| | Mean | Median | Maximum | Minimum | Std. Dev. |
|---|-------------|---------------|----------------|----------------|------------------|
| Average bid ask spread over stock price (x 10 ⁻³) | 2.1 | 1.8 | 10.9 | 0.3 | 1.1 |
| Trading volume over total outstanding shares (x 10 ⁻³) | 7.6 | 4.4 | 114.3 | 0.1 | 9.7 |
| Absolute value of price change over trading volume (x 10 ⁻⁶) | 0.004 | 0.002 | 0.293 | 0 | 0.012 |
| Liquidity Index | -0.002 | 0.122 | 1.568 | -3.928 | 0.788 |
| Portfolio investment as a share of GDP (x10 ⁻³) | 20 | 20 | 60 | 0 | 20 |
| Accumulated level of approved QFII investment quota (RMB billion) | 40 | 30 | 80 | 0 | 30 |
| Money supply M2 as a share of GDP | 1.61 | 1.62 | 1.67 | 1.5 | 0.04 |
| Market capitalisation of the dual listed A share over total market capitalisation of A share market | 0.22 | 0.17 | 0.6 | 0.12 | 0.11 |
| SSE 180 Index | 3897.1 | 2795.6 | 12614.8 | 2019.8 | 2768.7 |
| 30-day annualized standard deviation of stock price change (%) | 39.21 | 36.27 | 115.89 | 11.34 | 15.69 |

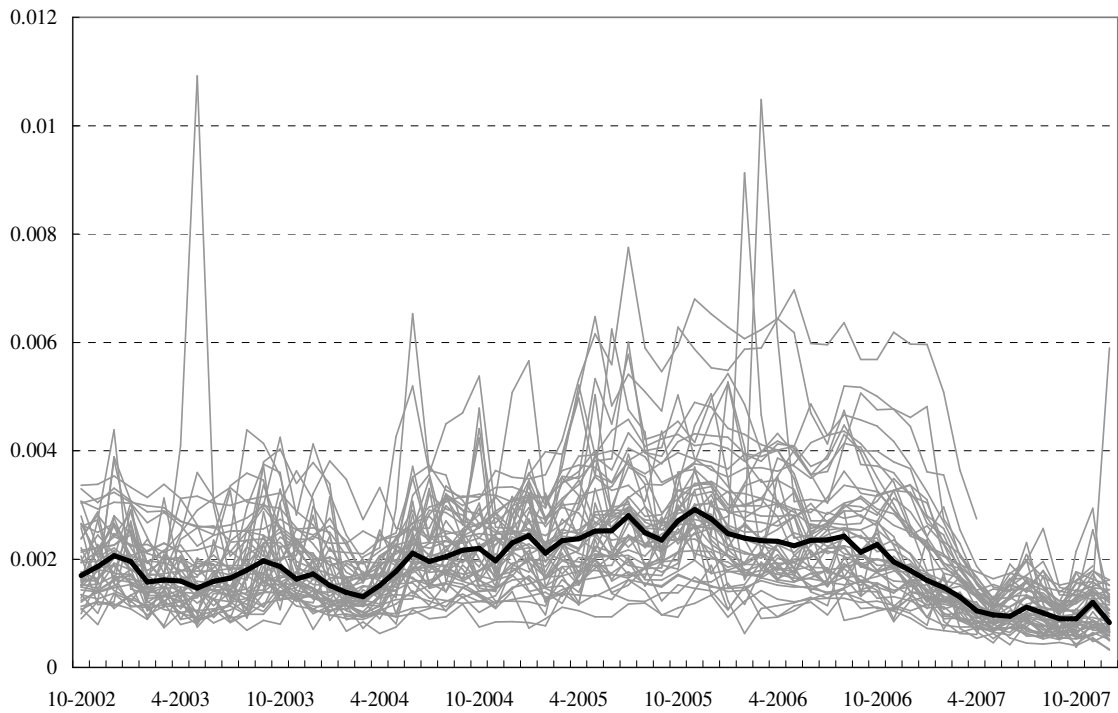
Table 4. Estimation Results

| Variable | Average bid ask spread over stock price | | Trading volume over total outstanding shares | | Absolute value of price change over trading volume | | Liquidity Index | |
|--|---|----------|--|---------|--|----------|-----------------|-----------|
| | Model A | Model B | Model A | Model B | Model A | Model B | Model A | Model B |
| | Coeff. | | Coeff. | | Coeff. | | Coeff. | |
| KFLOW ($\times 10^{-2}$) | 0.07 | - | ***9.31 | - | ***-1.84 | - | ***677.82 | - |
| QFII ($\times 10^{-1}$) | - | *-0.02 | - | ***0.51 | - | ***-0.08 | - | ***33.75 |
| M2 ($\times 10^{-1}$) | ***-0.05 | ***-0.04 | **0.07 | ***0.17 | ***-0.05 | ***-0.08 | ***32.27 | ***37.66 |
| DUAL ¹ ($\times 10^{-2}$) | ** -0.02 | ** -0.02 | **0.19 | ***0.25 | ***-0.06 | ***-0.07 | ***15.32 | ***17.00 |
| MARKET ² ($\times 10^{-5}$) | ***-0.01 | ***-0.01 | ***0.33 | ***0.33 | ***-0.05 | ***-0.05 | ***37.40 | ***38.00 |
| RISK ($\times 10^{-4}$) | ***-0.10 | ***-0.09 | ***1.20 | ***1.11 | ***-0.12 | ***-0.11 | ***154.48 | ***153.22 |
| No. of stocks | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 |
| No. of periods | 63 | 63 | 63 | 63 | 63 | 63 | 63 | 63 |
| Adjusted R-squared | 0.68 | 0.68 | 0.65 | 0.64 | 0.57 | 0.56 | 0.61 | 0.61 |

Notes:

1. Taking the change of natural logarithm of the variable in the estimation.
2. Taking the first difference of the variable in the estimation.
3. The residuals are specified as an autoregressive process to remove serial autocorrelation.
4. ***, ** and * denote significance at the 1 percent, 5 percent and 10 percent levels respectively.
5. Note that around 4% observations of selected stocks are either missing in beginning of the period (because some companies, such as stocks with tickers 600004, 600015, 600029, 600030 and 600900, were not yet listed) or towards the end (because some companies, such as stock, with ticker 600705, were suspended for trading for various reasons).

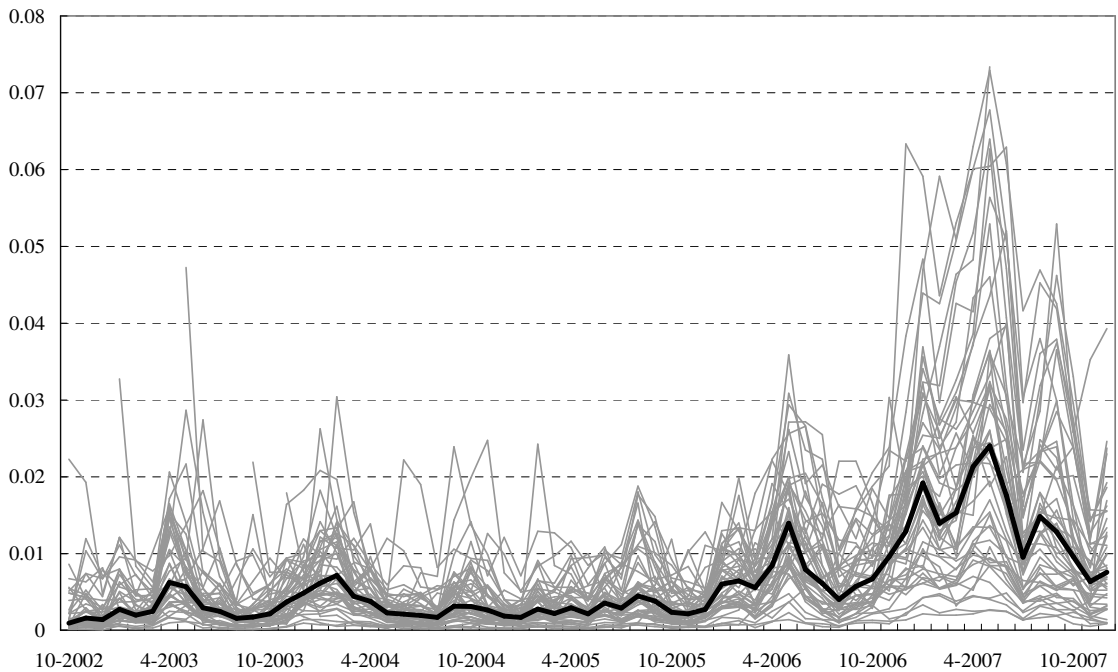
Chart 1. Average bid ask spread over trading volume



Source: Bloomberg and staff estimates

Note: The black line in the above chart represents the median of the average bid ask spread over trading volume of the 50 stocks under our study.

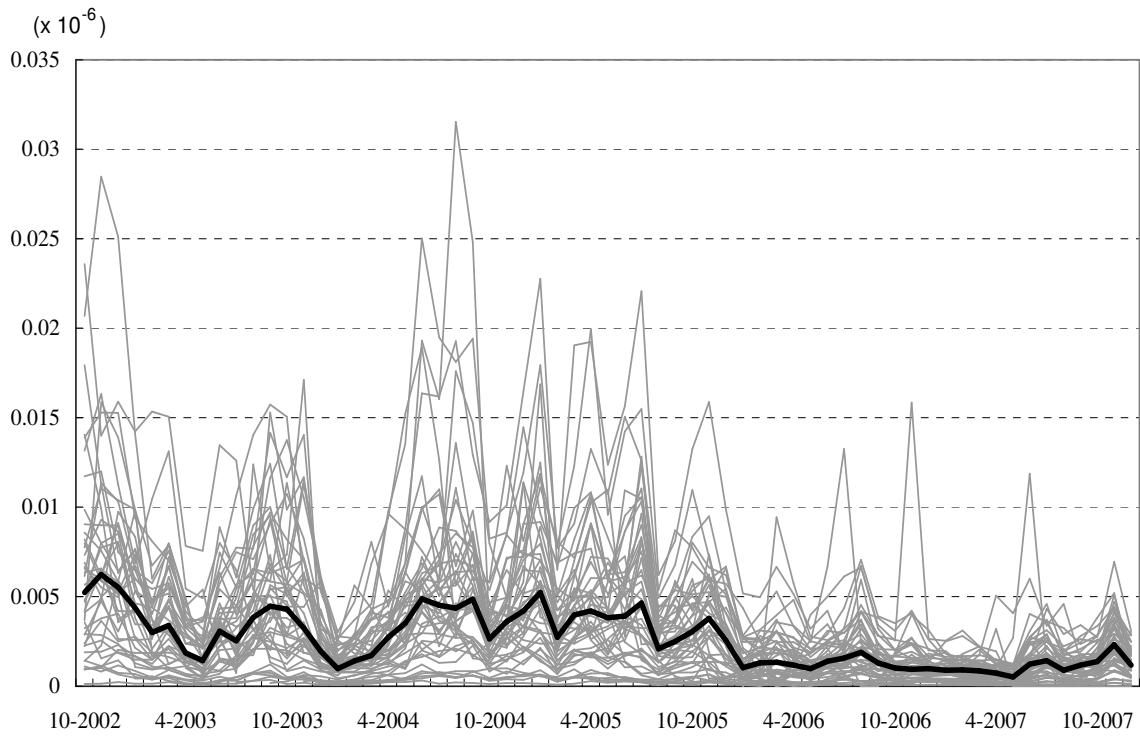
Chart 2. Trading volume over total outstanding shares



Source: Bloomberg and staff estimates

Note: The black line in the above chart represents the median of the trading volume over total outstanding shares of the 50 stocks under our study.

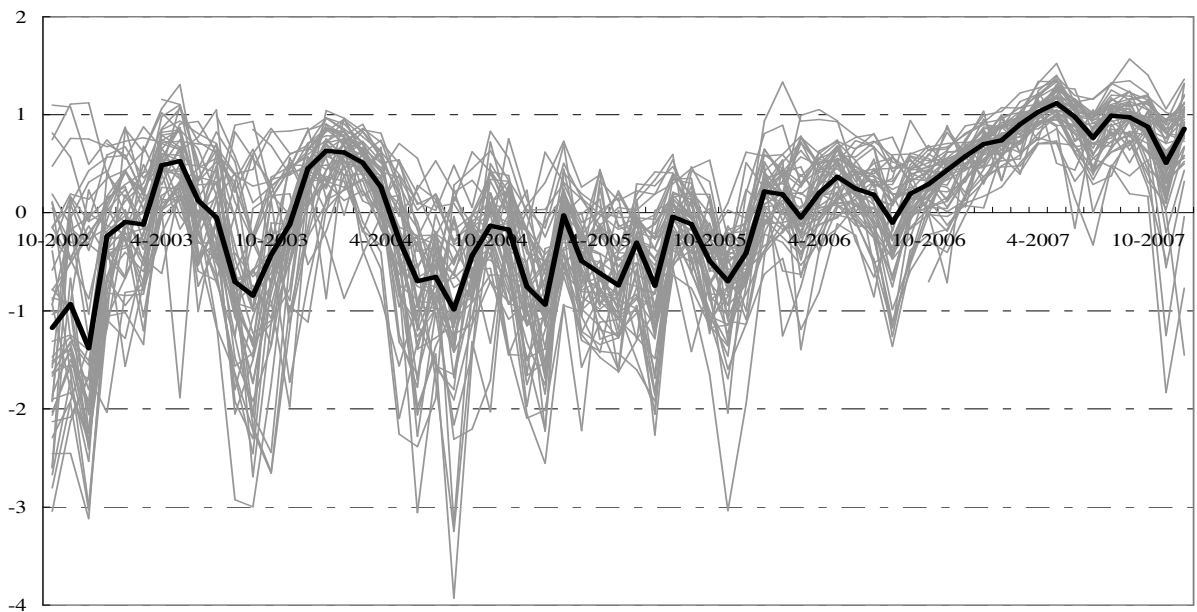
Chart 3. Absolute value of price change over trading volume



Source: Bloomberg and staff estimates

Note: The black line in the above chart represents the median of the absolute value of price change over trading volume of the 50 stocks under our study.

Chart 4. Liquidity Index



Source: Bloomberg and staff estimates

Note: The black line in the above chart represents the median of the liquidity indices of the 50 stocks under our study.