



CHAPTER III

LIQUIDITY AND MARKET DEVELOPMENT

3.1 Methodology and Data

To empirically test the assumptions that merging stock exchanges will improve both liquidity and the development of the exchange itself, two models are created. The first model is to test if liquidity relative to market capitalization is higher in countries that have merged their exchanges than those who have not. The second model is similar to the first, however it examines the overall market capitalization relative to gross domestic product to test the assumption that merged exchanges will grow their market capitalization better than exchanges that have remained independent.

3.2 Sample and Data Sources

A list of nations/dependencies with a population under 10.5 million citizens anytime during the years 1986 and 2006 was examined and nations with an operational exchange were selected. The list of selected nations was vetted for data irregularities, resulting in 68 nations/dependencies for analysis. Thirteen nations were associated with a merger of stock exchanges while 55 nations were independent during the period of study. Data was collected from stock exchanges, the IMF, the World Bank, and the World Federation of Stock Exchanges. For further information about the countries, years used, and sources of data please refer to Appendix A Table 1 and Table 4. To obtain more accurate results, certain unusual outliers were removed from the econometric analysis with their reasons listed in Appendix A Table 2 and Table 3.

The greatest challenge of working with both small exchanges as well as newly established exchanges is the reliability of the data. Data was collected from multiple resources and compared in an effort to ensure accuracy. The main sources of data were from International Financial Corporation's, Emerging Stock Markets Factbooks 1992-1999, the World Federation of Exchanges' Annual Statistics Report 2000-2006, The World Bank, and the IMF databases, as well as the stock exchanges' own published records. For further information concerning data sources and the author's calculations used please refer to Appendix A Table 3.

3.3 Models and Testing

The models used for evaluation were combinations of ideas gleaned from similar research topics by Claessens, Klingebiel, and Schmukler (2006), Kasauskas and Visockas (2003), along with Torre and Schmukler (2004). An unbalanced panel regression model was chosen as the most appropriate method to analyze the data due to the various dates of origin for the exchanges studied. The dependent variable in the first model is the ratio of annual value traded (VT) to year end value of market capitalization (MC). The dependent variable in the second model is the ratio of year end value of market capitalization (MC) to annual gross domestic product (GDP). Both models used the same independent variables initially and later corrected for variables that had no explanatory effects. A one period lagged autoregressor of the dependent variable was added to both models to correct for serial correlation of residuals. The models were first tested with an ordinary least squares (OLS) regression and then compared against a fixed effects period weighted general least squared (EGLS) regression. This second format, EGLS, was selected to correct for assumed heteroskedasticity of residuals between the years while assuming the cross-sectional residuals are not correlated. The EGLS regression was further tested using both fixed effects and random effects then evaluated to determine which procedure offered the best results. For both models, the EGLS regression was more appropriate, based on residuals tests, than OLS however the fixed effects period weighted EGLS with a one period lagged autoregressor of the dependent variable proved to be the most usable model.

The two models are as follows¹:

Model 1: Liquidity

$$\begin{aligned} (VT/MC)_{it} = & \alpha + \mu_i + \beta(GDP/POP)_{it} + \beta(FDI/GDP)_{it} + \beta(FD/GDP)_{it} + \beta(FB/GDP)_{it} + \\ & \beta(MQM/GDP)_{it} + \beta(LOGMC_L)_{it} + \beta(LOGASF_L)_{it} + \beta(LOGYOO)_{it} + \beta(LOGNOC)_{it} \\ & + \beta(VT/MC(-1))_{it} + \beta(AFR)_{it} + \beta(AME)_{it} + \beta(ASI)_{it} + \beta(RESTRICTED)_{it} + \beta(UNSOE)_{it} \\ & + \beta(MNEX)_{it} + \square_{it} \end{aligned}$$

Model 2: Development

¹ The outline of the models shown here is referenced from Kasauskas and Visockas (2003) model.

$$\begin{aligned}
(MC/GDP)_{it} = & \alpha + \mu_i + \beta(GDP/POP)_{it} + \beta(FDI/GDP)_{it} + \beta(FD/GDP)_{it} + \beta(FB/GDP)_{it} + \\
& \beta(MQM/GDP)_{it} + \beta(LOGMC_L)_{it} + \beta(LOGASF_L)_{it} + \beta(LOGYOO)_{it} + \beta(LOGNOC)_{it} \\
& + \beta(MC/GDP(-1))_{it} + \beta(AFR)_{it} + \beta(AME)_{it} + \beta(ASI)_{it} + \beta(RESTRICTED)_{it} + \\
& \beta(UNSOE)_{it} + \beta(MNEX)_{it} + \square_{it}
\end{aligned}$$

i = is country number [1;n]

t = is time period [1;n]

α = is common slope intercept

μ = is subject specific factor

Variables were placed either into a ratio or log format. Since the nations being studied were of a similar size a ratio format would acceptably bind their progress in one category within the measurement of the most important determining factor of that progress. Most notably the nation's GDP was used to compare with another category as the overall size of the nations' economic activity was the most easily comparable determining factor between nations. Log format was used to compare the relative growth, in a manner that recognizes the movements in terms of a percentage change, of that variable annually.

3.4 Independent Variables

The independent variables were selected to address issues highlighted in the research of the authors above. Broadly speaking, they represent the main influences recognized on stock exchanges which are money supply, size, support, and fiscal stability. Each variable is explained in detail below while supporting tables, charts, and results can be found in the Appendix.

3.4.1 GDP per Capita (GDP/POP) (in units of 100,000 US dollars)

This term is used by all the authors above as an indicator of the country's overall economic development however they put it into log form. It has been placed into a ratio format to better reflect the difference in development between nations. Countries that are

better developed are more capable of supporting the activities of the stock exchange. It is expected to have a significant positive impact and to work well in both models.

3.4.2 FDI/GDP

This variable was used by Claessen, Klingebiel and Schmukler (2006) as a de facto market liberalization indicator. Markets that are open to foreign investment tend to be more liquid and better developed. They also have to worry about those investments as part of the money supply within the country as it is often called “hot money” due to the rapid nature of its arrival and exit. It is expected to have a significant positive impact upon the first model yet it is uncertain if it will have any impact upon the second model.

3.4.3 Government Deficit/GDP (FD/GDP)

This ratio was used by Torre and Schmukler (2004) and Claessen, Klingebiel and Schmukler (2006) as a measure for national macro economic soundness. Excessive government spending can be inflationary as well as over-supportive for some business groups which may not be the most efficient use of capital. The variable is expected to have a significant positive impact upon both models as the less negative this number is represents that the economy is more sound.

3.4.4 Government Budget/GDP (FB/GDP)

This variable is used as a proxy to measure the strength of taxation and the legal system. Taxation can also retard investment as capital is sent to government instead of re-invested. Claessens (2000), Beck (2000), and Torre and Schmukler (2004) notice how legal systems are important for firms to list on stock exchanges. Claessens sites the willingness to cheat on taxes as a major reason to avoid public scrutiny while Beck examines the securities and exchange regulation’s impact upon stock exchange development. This variable was added to determine if the legal system is strong enough to carry out routine duties, such as collect the national taxes. The impact is expected to be negative, as higher taxation should slowdown re-investment. A low taxation rate, below 20%, could be a sign of poor legal enforcement and possibly hurt the development of a stock exchange. This dichotomy of ideals could influence the significance of this variable.

3.4.5 Money + Quasi Money/GDP (MQM/GDP)

Concern over inflation was cited by Torre and Schmukler (2004) and Claessen, Klingebiel and Schmukler (2006) for their inclusion of an inflation variable into their models. The change in money supply relative to GDP should prove to be a good indicator for inflation in both models. Mild inflation has traditionally raised the value of markets and is expected to have a significant and positive impact upon both models.

3.4.6 Log Market Capitalization (LOGMC_L) (in millions of local currency)

Unlike the authors above, this variable is included to examine the network effects and critical mass theory that Economides (1994) refers to. This is believed to help attract both liquidity and development as an exchange grows in size. In both models this variable is expected to have a slightly positive influence.

3.4.7 Log Average Size of Firm (LOGASF_L) (in millions of local currency)

Similar to the previous variable, this variable was included to examine the network effects and critical mass theory of Economides. It was also used by Kasauskas and Visockas (2003). Again, a critical mass is vital to attract large institutional investors which improve liquidity and market development. On an individual firm level, the goodwill of news coverage and other 'free advertising' effects occur as companies grow in size. It is also expected to have a small, positive impact upon both models.

3.4.8 Log Year of Operation (LOGYOO)

The number of years an exchange has been in operation is placed in log form to have the greatest influence in the early years before reducing in importance over time. It is used to recognize the goodwill effect that is accrued from the successful operation of an exchange through its history. There has been no studies reviewed that uses this variable yet. It is included to reflect goodwill that grows overtime in a similar pattern. It is expected to have a small, positive impact upon both models.

3.4.9 Log Number of Companies Listed (LOGNOC)

This variable was included in the studies of Levine and Demirguc-Kunt (1996) and Kasauskas and Visockas (2003) to help determine critical mass of an exchange. The ability of an exchange to improve turnover and increase market capitalization is reliant upon the number of companies willing to list upon it. This variable has been paired with the dummy variable Government Unloading State Owned Enterprises (UNSOE) below due to the research of Claessen, Djankov, and Klingebiel (2000) citing a disturbance in modeling the development of some nations' exchanges. It is expected that this variable will have a significant positive impact upon the second model, however it is uncertain if it will have any impact upon the first model.

3.4.10 Region (AFR AME ASI)

The research by Torre and Schmukler (2004) highlighted the difference in development upon different continents. Their findings that Latin America has significantly lower development created concern that a global model that did not account for regional differences would be flawed. Stock exchanges were divided up into four regional groups, Americas, Africa, Europe, and Asia. Since Europe had the majority of exchanges, they were used for the base while the impact of the other three regions was evaluated in the model. It is expected that Africa and America will have significant negative impacts while Asia is uncertain if it will be significantly different than Europe.

3.4.11 Restricted Investments (RESTRICTED)

The works of Chin and Ito (2005); Bekaert, Harvey, and Lundbald (2005); Kaminsky and Schmukler (2003), and Vinhas de Souza (2004) highlight the various impacts that these distortions can play on the development of markets/exchanges. Reports published by The Heritage Foundation and the observed stock exchanges were used to determine which countries limited or restricted investments. Countries that restricted the exchange of money, investments into the market as a whole or a significant proportion of industries listed were classified as restricted investments. While it is common for all countries to review investments in 'sensitive' industries, a systematic restriction in several industries or the capital markets altogether was required for a nation to be

classified as a restricted market. It is expected that this will have a small negative impact upon both models.

3.4.12 Government Unloading State Owned Enterprises (UNSOE)

Highlighted by Claessen, Djankov, and Klingebiel (2000), this dummy variable was included for all countries whose government established or used the local stock exchange as a vehicle to sell off a majority of their state owned enterprises. This is used along with the number of listed companies as a way to remove the disturbance created from this activity yet allows the inclusion of the number of listed companies (LOGNOC) variable to help determine critical mass. It is expected to be significantly negative in both models as these countries underperform their peers.

3.4.13 Multinational Exchange (MNEX)

This dummy variable is used to isolate the countries and years involved with merging of stock exchanges. It tests the assumptions that merging stock exchanges together will provide better results than independent exchanges based upon the two models used. Three methods of using this dummy variable were tested to compare the impact its inclusion had upon the overall models. The countries that participated in a merger of exchanges carried the dummy variable in the **first** round of testing observing their relative performance **prior** to merging. They were then tested in a **second** round observing only the years after the merger. Finally, they were tested in a **third** round observing only the years after the merger but including the near merger of 3 Caribbean nations that agreed to link their trading platform but not ownership. The number of observations with merger dummy value equal to one in each case was 129, 62, and 110 out of 957 total observations in regular OLS testing. After adjustments for EGLS testing, the observations become 119, 59, and 107 out of 889 observations. The merger dummy variable affects between 6.5% and 13.5%² of all observations with the critical second round of testing having the least observations.

² Testing only 36 European and Middle Eastern countries produced similar results while the merger dummy variable equals 1 between 6% and 22% of total observations during testing. OLS pre-merger testing has 118/523 (22.56%) observation while post-merger has 38/523 (7.26%) observations. EGLS pre-merger

3.5 Testing and Results

A step by step review of the testing can be found in Appendix B. The two models are examined carefully to make certain that their performance is consistent and reliable. Unit root testing is conducted on the variables to ensure the accuracy of ordinary least squares regression. The result from ordinary least squares testing shows signs of heteroskedacity and positive serial correlation in the residuals leading to the use of a generalized least squares regression with a weighted period fixed effects to correct for heteroskedacity and the dependent variable was lagged one time period and added to the regressors to resolve the serial autocorrelation.

After an examination of the residuals and gradients was conducted to find and remove outliers from the data several observations were noted for being unusual and further information about these can be found in Appendix A Table 3. At this point, the general models are ready to be tested and a test of how robust the models performed was done using all of the original 'dirty data'³ as well as a smaller test using only the European region.

The independent variables mostly performed as expected above however the differences are discussed below.

- The FDI/GDP variable does not have a significant impact upon either model. Removing it from the models had negligible effects.
- FB/GDP is found to have a negative impact on both models although it was not always significant in the liquidity model thus its influence is questionable. Its significance and impact is more consistent in the development model.
- The money supply variable was tested for unit root and determined it needed to be converted to the first differential. Using this form of money + quasi money and replacing the above term. Its performance is inconsistant in the liquidity model although it has a strong positive impact and modest significance when examining only the European region. The increase or decrease of the money supply variable

testing has 109/487 (22.38%) observations while post-merger has 29/487 (5.95%) observations. Results are in Appendix B.

³ The results of the dirty data were similar to others only with severe shocks related to the outliers. The most significant variables still retain their signs and significance however some of the less significant variables changed and were insignificant when compared to the clean data. See Appendix B for details.

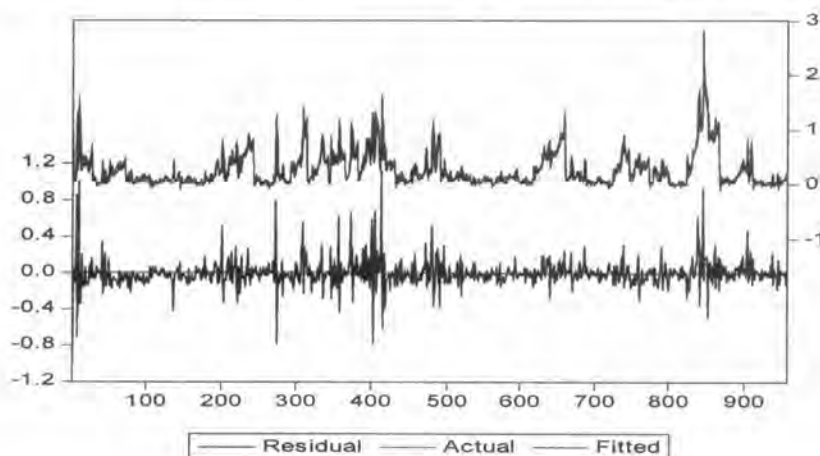
relative to gross domestic product consistently has a significant positive impact upon the development model.

- In both models the LOGASF_L variable had significant correlation of error terms with LOGMC_L and LOGNOC and was therefore removed.
- It is found that LOGYOO is significant in the liquidity model and carries a small positive effect in this model. The slightly negative effect in the development model is questionable due to the lack of significance this variable carries and produces negligible effects when removed.
- The LOGNOC does not have a significant impact upon either model and does not work well with UNSOE as it was expected to. This variable could be dropped with minimal impact in both models.
- The GDP_POP variable, after being converted to its first differential to meet unit root requirements, actually carried a significantly negative impact in the development model which was not expected. However it carried a high level of significance and a positive impact for the liquidity of markets, which was expected. It is possible that the rate of growth in wealth per person is faster than the rate of growth of the market itself.
- In the liquidity model the region dummy variable set was significant and indicated that the performance from this study was similar to the results of Torre and Schmukler (2004) above. They did not perform well in the development model with the exception of the African region that was modestly significant with a negative impact. Removing them, however, had a noticeable impact upon the model performance.
- The restricted dummy variable was insignificant in both models and removing it had minimal impact. It did, however, have a significantly positive impact upon the development model when examining the European region only indicating that the restriction of investments might artificially inflate market capitalization value.
- The UNSOE dummy variable had mixed success and did not work well with LOGNOC as it was expected to. The impact in both models was negative as anticipated however its significance is not consistently conclusive in the development model.

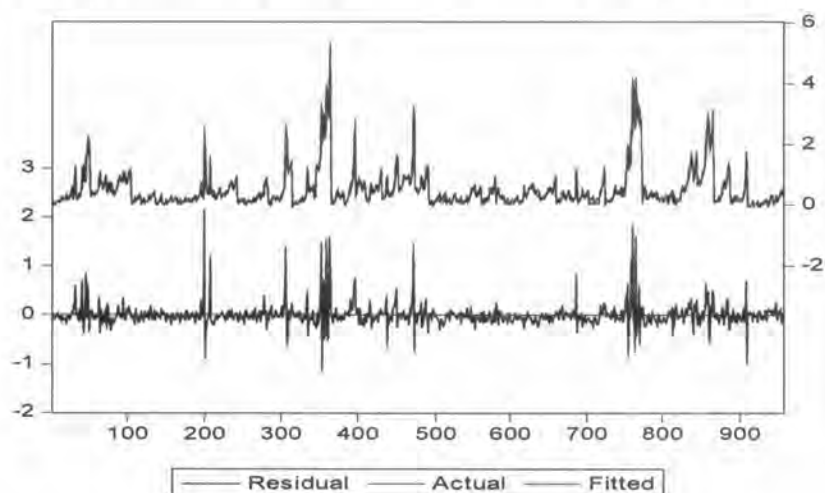
- Overall the main dummy variable, MNEX, had poor results in all three versions tested raising questions of its feasible use. Admittedly it has very modest representation out of the total observations yet further testing using only one region returned similar results. See more details about this below in the discussion about hypothesis testing.

It needs to be noted that the first hypothesis test examined if there was any difference between the stock exchanges that eventually merged together **prior to** their merger against those that would remain independent. There were ten exchanges isolated here with a total of 129 observations out of 957 prior to modeling adjustments. The second test examined the performance of stock exchanges that merged **after** their announcement against those that remained independent. There were thirteen exchanges isolated in this sample with a total of 62 observations out of 957 prior to modeling adjustments. The third test examined the performance of stock exchanges **after** their announced merger but this time also **includes** three Caribbean island countries Barbados, Jamaica, and Trinidad and Tobago. These countries have all agreed to a uniform trading platform allowing trade of each other's securities on their exchanges while maintaining their independent ownership. These 'merged' exchanges are compared against those exchanges that remained independent. There were sixteen exchanges isolated in this sample with 110 observations out of 957 prior to modeling adjustments.

3.5.2 Graph 1: Model 1 AR Residuals to Actual Comparison



3.5.3 Graph 2: Model 2 AR Residuals to Actual Comparison



3.5.1 Test One: Pre-Merger Test

The results from the pre-merger tests are mixed. The regressors carried the same signs and a coefficient with a similar magnitude as before the addition of the MNEX dummy variable. Model 1 showed no significance for the variable. The main difference is that in model 2 the impact of the multinational exchange variable is positive prior to the merger indicating that these exchanges were already outperforming their peers. This pattern raises serious doubts about the performance improvements of exchanges post merger.

3.5.2 Test Two: Post-Merger Test

The results from the post-merger tests are similar to the results from the pre-merger tests. The regressors carried the same signs and a coefficient with a similar magnitude. The main difference is that in model 2 the multinational exchange variable's impact is negative after the merger indicating that these exchanges potentially now underperformed others. With neither model showing significant signs of improvement relative to their peers, it looks dubious that mergers do provide benefits over the first few years.

3.5.3 Test Three: Unified Trading Platforms Test

The results from the final test were very similar to the previous two. Model 1 showed no significance while model 2 showed weak levels of significance. Considering that the direction of impact returns positive like it did in the test prior to merging the inclusion of the Caribbean nations does not reinforce the post merger theory of improvement.

3.6 Analysis of Results

Liquidity Model: The wealth of citizens, as denoted with GDP per Capita, is the most influential variable in this model. Wealthy countries tend to have more liquid stock exchanges. Money supply and its growth, whether from fiscal deficits or other sources, is the next most important factor in encouraging liquidity, or turnover on the exchange. The size, in terms of market capitalization, and the age of the exchange do play a supportive role in encouraging liquidity upon an exchange albeit a minor one. Taxation and government intervention, specifically noting governments selling off state owned enterprises, has shown to impede liquidity although the selling off of state owned enterprises is likely a temporary shock to the liquidity ratio. The region that an exchange is located in also has a significant impact upon liquidity during the years studied, although it is uncertain how long this difference will remain. Other variables, such as FDI, the number of companies listed, restrictions on foreign investments, as well as merging stock exchanges together do not show a significant influence upon the liquidity of an exchange.

Development Model: Money supply growth, in the form of government spending and other sources, has the largest impact upon growing the market capitalization of an exchange relative to GDP. This is likely a result of inflation as much as any real wealth creation. The overall size of the exchange, as well as restricting foreign investment, shows a minor supporting role in positively supporting a larger market capitalization. Taxation as well as the wealth of citizens shows significant impediment to increasing the market capitalization of an exchange. During times of significant wealth creation it is expected that either taxes or interest rates will be raised, negatively influencing equity investments. Regional differences were not as noticeable however Africa lags behind the other regions a little. Other variables such as FDI, the age of an exchange, number of

companies listed, selling off state owned enterprises, and merging stock exchanges together do not have a significant impact upon developing a larger stock market in a country.

Overall the impact of merging exchanges does not show any improvement for liquidity or growth of an exchange in the general models used above. Similar testing that removed less significant variables continued to indicate that merging an exchange does not produce significant improvements to the two variables examined.