NUS
National University of Singapore

SCAPE

Singapore Centre for Applied and Policy Economics

Does Stock Market Liberalisation Benefit The Economy? Evidence From Industry-Level Data

by

Lee Chee Tong

Department of Economics
SCAPE Working Paper Series
Paper No. 2005/16 – Dec 2005
http://nt2.fas.nus.edu.sg/ecs/pub/wp-scape/0516.pdf

DOES STOCK MARKET LIBERALISATION BENEFIT THE ECONOMY? EVIDENCE FROM INDUSTRY-LEVEL DATA

Lee Chee Tong*

Singapore Centre for Applied and Policy Economics
Department of Economics
National University of Singapore

Abstract

The paper examines the impact of stock market liberalisation on four industry-level economic variables, i) growth in real value added, ii) growth in real wages per worker, iii) growth in the number of employees and iv) growth in the number of firms using data on 18 developing countries for the period between 1981 - 2000. Genetic programming methodology is used to determine the liberalisation dates. Results from difference-in-differences regression indicate that stock market liberalisation has minimal impact on the growth of real value added. On the other hand, growth rates of real wages per worker, number of employees and number of firms are significantly higher for most countries after stock market liberalisation.

Keywords: stock market liberalisation, genetic programming, difference-in-differences regression

JEL classification: G18, J30, O12

* 1 Arts Link, Block AS2 #06-20, Singapore 117570. Tel (65) 6516-3944. Email:ecslct@nus.edu.sg

1. Introduction[1]

The late 1980s and early 1990s witnessed many developing countries, among other economic reforms, liberalizing their stock markets. The large number of liberalisations has motivated economists and policymakers to examine the consequences of these liberalisations. Interest was further fuelled after countries such as Mexico and those in East Asia were hit by financial crises. Literature on the impact of stock market liberalization can be divided into two broad groups, those that focus on macroeconomic variables and those on financial variables. Table 1 provides a list of previous studies.

The objective of the paper is to determine whether stock market liberalisation has any effect on various economic variables. It differs from previous studies in three important respects. First, the paper looks at the effects of stock market liberalisation on four industry-level economic variables, specifically (a) real growth in value added, (b) real growth in wages per worker, (c) growth in number of employees, and (d) growth in number of firms. Second, the paper uses Genetic Programming (GP) methodology to determine the market liberalization dates. Third, the paper uses difference-in-differences regression to examine the impact of liberalisation on the various economic variables.

The impacts of stock market liberalisation are examined using data on 18 developing countries from 1981 to 2000. The external financing needs of the industrial sectors are first determined. The five sectors that have the highest external equity financing needs are (i) professional and scientific equipment, (ii) other chemicals, (iii) electrical machinery, (iv) non-electrical machinery and (v) industrial chemicals. On the other hand, the five sectors that have the lowest external equity

[1] I would like to thank Dr Zhang Xibin of Monash University for allowing me to use his codes for genetic programming.

financing needs are (i) wood products, (ii) pottery, (iii) textile, (iv) rubber products and (v) fabricated metal products. Of the 18 countries examined, 10 countries exhibit multiple breaks. These breaks could signify further liberalisations or reversals of capital flows. Further analyses show that of these 10 countries, five countries experience a net outflow of capital. Results from difference-in-differences regression seem to suggest that stock market liberalisation does not have any impact on the growth rates of value added. On the other hand, growth rates for wages per worker, growth rates for number of employees and growth rates for number of firms are significantly higher following stock market liberalisation.

The remainder of the paper is structured as follows. Section 2 computes the external equity financing needs of the various industrial sectors. Section 3 outlines the GP approach and reports the stock market liberalisation dates. Section 4 presents the difference-in-differences methodology and results. Section 5 concludes and summarizes.

2. External Equity Financing Needs of Industries

The external equity financing needs of the industrial sectors are approximated by two indicators. Fisman and Love (2003) compute the indicator by dividing the difference between total assets and retaining earnings by total assets. As this indicator measures dependence on general external financing, the formula has to be modified before it can be used here. This is accomplished by further subtracting long-term liabilities from the numerator. The resultant formula (EQFIN) is as follows.

$$\text{EQFIN} = \frac{\text{Total Assets} - \text{Retained Earnings} - \text{Long Term Liabilities}}{\text{Total Assets}}$$

Annual data on total assets, retained earnings and long-term liabilities of US firms for the period between 1980 and 1999 are collected from the entire COMPUTSTAT database. EQFIN is calculated for all individual firms in each and every industrial sector and for each and every year. Medians of EQFIN are then computed for all the industrial sectors. Average industry medians for the periods 1980-89 (EQFIN80) and 1990-99 (EQFIN90) are then calculated. The higher the EQFIN, the greater is the demand for external equity finance for that industrial sector.

As the COMPUTSTAT database contains only accounting information on public listed companies, EQFIN may be inadequate in identifying the industries' need for external equity financing. Thus, the ratio of number of public listed companies to total number of companies (PTR) for each industrial sector is also used. Similar to EQFIN, the higher the PTR, the greater is the demand for external equity finance for that sector. The number of US public and private companies in each industrial sector for the years 1990 and 1998 are obtained from Ward's Business Directory. Data on these two years are chosen purely for data availability reason. As the data from these two sources are classified using the US Standard Industrial Classification (SIC) codes, to make the data suitable for subsequent analysis, the codes are converted to the United Nation's International Standard Industrial Classification (ISIC) codes, using the appropriate concordance table[2].

EQFIN80 ranges from 26% to 66% with a mean of 49% while EQFIN90 ranges from 34% to 98% with a mean of 61%. PTR90 varies from 1% to 18% with a mean

[2] The data used are on US companies. The assumption that external equity financing needs of US industries are representative of the needs of companies in developing countries is made out of necessity, as data on developing countries are generally not available. Moreover, in developing countries, with a repressed financial system, misallocation of funds is rampant, funds often flow to inefficient public enterprises and to privileged sectors and not to the sectors that need it the most. To capture the actual industries' needs for external equity financing, it is more appropriate to consider a country with well-developed capital market, where the allocation of equity funds is optimal.

of 5% whereas PTR98 varies from 2% to 20% with a mean of 8%[3]. To establish the overall external equity financing needs, the 28 industrial sectors are ranked separately according to their EQFIN80, EQFIN90, PTR90 and PTR98. A 1 is assigned to the sector with the lowest EQFIN80, a 2 is assigned to the sector with the next lowest EQFIN80, and so on. The exercise is repeated for the other three indicators. The ranks are then averaged across the four indicators[4]. Table 2 shows, with their respective average rank, the five industrial sectors with the lowest external equity financing needs and the five industrial sectors with the highest external equity financing needs. The five industrial sectors with the lowest external equity financing needs are (i) wood products, (ii) pottery, (iii) textile, (iv) rubber products and (v) fabricated metal products while five industrial sectors with the highest external equity financing needs are (i) professional and scientific equipment, (ii) other chemicals, (iii) electric machinery, (iv) machinery and (v) industrial chemicals. It can be seen that the sectors that have the low external equity financing needs are mostly labour-intensive industries while those with high external financing needs are capital-intensive industries.

3. Identifying Stock Market Liberalisation Dates Using GP

Stock market liberalisation dates are determined for 18 developing countries using GP[5] [6]. Given the dependent variables, independent variables (known as terminals)

---

[3] The need for a complement indicator is justified by the low correlations between the two indicators. The lowest correlation is 0.26 (between EQFIN80 and PTR98) and the highest correlation documented is 0.6 (between EQFIN90 and PTR90). In contrast, the correlations between EQFIN80 and EQFIN90 and between PTR90 and PTR98 are 0.8 and 0.94 respectively. This signifies that relative financing needs of the industrial sectors remain stable over the years.

[4] The rationale for converting to ordinal data to determine the external equity financing needs is to mitigate any distortion caused by drastic changes in the percentages. For example, for the period 1980-89, EQFIN for the Tobacco industry is a mere 36%; it jumps to 72% for the period 1990-99.

[5] The 18 countries are Argentina, Brazil, Chile, Colombia, Greece, India, Indonesia, Jordan, Korea, Malaysia, Mexico, the Philippines, South Africa, Taiwan, Thailand, Turkey, Venezuela and Zimbabwe.

[6] The methodology differs from that used by Bekaert, Harvey and Lumsdaine (2002a) in a couple of ways. It is nonparametric and model-free, and thus has the advantage of being less sensitive to minor perturbations, which may give rise to spurious structural changes. More importantly, GP can be used to identify multiple structural breaks in a multivariate framework. This

and a set of operators (known as activity functions), basic genetic programming (BGP) selects a model that best fits the time series. It does so by generating many equations by randomly selecting and combining independent variables and operators. Each set of equations is known as an individual (or a GP-tree) and the collection of individuals is called a population. The program solves each individual equation and then assigns it a fitness value according to how well it solves the problem. BGP then creates a new generation of individuals by applying the evolutionary process of reproduction and crossover[7]. The probability of being selected for the reproduction and crossover operations depends on the fitness value. The fitter the individual, the higher is the chance of being chosen. The evolutionary process of creating fitter individuals continues until the maximum number of generations specified by the user is attained. Recursive genetic programming (RGP) differs from BGP in that the former breaks the whole sample into sub-samples and performs BGP on the various sub-samples. The details of the RGP process are outlined below.

Step 1

Specification of 5 basic elements required in RGP.

(i) Set of activity functions

The activity function used in this study is defined as follows,

$$F = \{+, -, \times, \div, \sin, \cos, \log, \exp\}$$

---

comes in useful when countries liberalize their stock markets in stages or when countries experience subsequent net capital outflows for a significant period of time.

[7] Reproduction is an asexual operation and requires only one individual (parent). The result of the reproduction operation is one child equation. In contrast, crossover is a sexual operation that involves two individuals from the previous generation. The result of this operation is two offspring equations. The difference between reproduction and crossover is that the former operation does not create new individuals; the child equation is just a direct replica of its parent whereas the latter creates new individuals containing parts of equation from both parents.

(ii) Set of terminals

Let the largest lagged order be denoted as MLAG. The terminal set in the genetic process for m-dimensional multivariate system is represented as follows,

$$\kappa = \{x_{t-h,1}, x_{t-h,2,} \cdots, x_{t-h,m} : h = 1,2,\cdots, MLAG\}$$

(iii) Fitness value

The fitness of each individual is computed through a fitness function, *fit(.)*, and is defined as the sum of squared residuals.

$$fit_i = \sum_{t=1}^{n} \left(x_{ts} - \text{predicted values}_{\text{i}}\right)^2$$

(iv) Parameters for controlling the run

The population size is set at 100. The maximum lag (MLAG) used is 6. Crossover is performed on 90% of the population and the probability of being selected for crossover is equal to the inverse of their fitness values. The crossover point is determined arbitrarily by the computer. Reproduction is performed on 10% of the population. Thus, 10 individuals from each generation are selected from the population with a probability equal to the inverse of their fitness values. The maximum number of variables allowed in the equations, known as tree depth is set at 20. To perform RGP, the sample has to be broken down into sub-samples. In this study, the number of observations in each sub-sample (N_1) is 12. The second sub-sample is the modification of the first sub-sample by moving forward by N_2 steps. N_2 is fixed at 3 in this paper. Thus, there will be a total of $T=[(N - N_1)/N_2 + 1]$ sub-samples. The final step of RGP will require the computation of the average fitness value for the sub-sample. The first q smallest fitness values will be used to calculate the average fitness and q is set at 10.

(v) Criterion for designating a result and terminating a run

The single individual with the highest fitness value over all the generations is chosen as the result of the run. Each run is terminated at end of the tenth generation.

Step 2

Generate an initial generation for the first sub-sample by randomly selecting a function from *F*. Denote the number of input variables for the selected function as *N*(*f*). The selected terminal will be connected with the *N*(*f*) terminal in the next layer. An element is then chosen from set *B* = $F \cup \kappa$ as the final terminal. If the selected element is a function of *F*, then a second element will be selected so that the GP-tree keeps growing. If the selected element is a terminal from κ, then the GP-tree will terminate. This selection process continues until 100 GP-trees are generated. Fitness values for the individuals are calculated as described above. Individuals with the smallest fitness values are selected for the reproduction and crossover operations to create the next generation. At the tenth generation, the fitness value of each GP-tree is arranged in ascending order, $fit_1(\cdot) \leq fit_2(\cdot) \leq \cdots \leq fit_{100}(\cdot)$. The first 10 smallest fitness values are used to calculate the average fitness for the first sub-sample.

$$\overline{fit}_1 = \frac{1}{10}\sum_{i=1}^{10} fit_i(\cdot)$$

The same process is applied to the second sub-sample with the initial generation being the last generation of the first sub-sample. The average fitness of last generation of the second sub-sample is similarly obtained and is denoted as $\overline{fit}_2$. The process is repeated with the remaining sub-samples.

Step 3

When BGP has been performed on all the sub-samples, there will be T average fitness values. The diagnostic statistic (D_k) is used to identify structural breaks in the time serie.

$$D_k = \frac{\overline{fit_k}}{\overline{fit}_{k-1}} \qquad k = 2,...T$$

D_k reflects the relative change in average fitness between two adjacent sub-samples. D_1 is fixed at 1. If a structural change occurs in the k*-th sub-sample, then the average fitness for the k*-th sub-sample will be larger than the average fitness for the (k*-1)-th sub-sample, i.e. $\overline{fit}_{k^*} > \overline{fit}_{k^*-1}$, and the statistics D_k is will be greater than one. After the k*-th sub-sample, the individuals in the system will accustom to the new operating pattern, and if there is no further structural change, the average fitness of the (k*+1)-th sub-sample will be similar to that for the k*-th sub-sample, and D_k will be one[8].

Four monthly financial time series, namely monthly stock returns, volatility, correlation and the ratio of monthly US net equity flows to market capitalization are used individually and quadravariately as inputs to GP to identify structural breaks. Volatilities are estimated using a GARCH (1,1) model. Correlations between country and world returns are computed using a 36-month moving window. The monthly data on individual country stock indexes are collected from Standard and Poor's/International Finance Corporation Emerging Markets Database, while the monthly net equity capital flows from US are obtained from the US Treasury Bulletin.

[8] This brings in the question of how much greater than one must D_k be for it to be qualified as a structural break. This is a difficult question. Setting the threshold too high may yield the conclusion that there is no structural break, while having too low a threshold will result in too many structural breaks. So far, there are no studies addressing this issue. Following Lien, Tse and Zhang (2003), the threshold for this study is fixed at 1.2.

A stock index computed by Datastream is used as a proxy for the world market portfolio. The structural break dates are reported in Appendix A1[9].

As factors other than stock market liberalisation are also likely to induce a structural break, only break dates that appear in both the quadravariate framework and in at least two univariate settings, are being considered as break dates due to stock market liberalisation. Due to the possibility that one time series could lead or lag the other time series in its breaks, dates that fall within one quarter before or after each other are viewed as the same break.

To further ensure that the break dates identified are due to stock market liberalisation, dates that satisfied the above requirement are subject to further testing. This is done by examining whether the values of nine financial and macroeconomic variables before and after the break dates are significantly different and whether the changes in the variables are consistent with what have been argued theoretically and observed empirically in previous studies[10]. The final month of the break quarter identified by the quadravariate framework is used as the break month. To perform the test, the following regression equation is run,

$$y_t = \beta_o + \beta_1 D + \varepsilon_t$$

where y_t is one of the nine variables above, *D* is a dummy variable and equals 0 for periods before the break dates and equals 1 for periods after the break dates. To mitigate any possible contamination due to the transition period, data three months prior and three months subsequent to the break months are excluded. If there are

[9] Since the next sub-sample is obtained by moving the period forward by one quarter, structural breaks can only be identified for a specific quarter. This explains why the dates reported are for a period of three months.

[10] The nine monthly financial and macroeconomic variables are (i) stock returns, (ii) dividend yield, (iii) market capitalization/GDP, (iv) net equity flows from US/market capitalization, (v) correlation, (vi) turnover ratio, (vii) value traded/GDP, (viii) inflation and (ix) total trade/GDP. Data on dividend yields market capitalization, value trade, turnover ratio are collected from Standard and Poor's/International Finance Corporation Emerging Markets Database, while data on inflation, imports, exports and gross domestic product (GDP) are obtained from International Financial Statistics published by the IMF. As annual GDP numbers are collected, it is divided by 12 before it is used as denominators. Total trade is the sum of imports and exports for the month. As the impact of stock market liberalisation on volatility is inconclusive, the variable is excluded.

multiple breaks for the country, the regression period ends three months before the next break date. Newey-West corrected t-statistics are used to determine the level of significance. If stock market liberalisation occurs, β_1 for US returns, dividend yield and inflation are hypothesized to be negative, whereas β_1 for market capitalization/GDP, net equity flows from US/market capitalization, correlation, turnover ratio, value traded/GDP, and total trade/GDP are hypothesized to be positive. Conversely, if considerable amount of foreign capital leaves and stays away from the countries for a significant period, the opposite is expected to hold[11]. The results are reported in Appendix A2.

Most countries have multiple breaks. Of the 18 countries examined, 10 countries have at least two breaks. They are Argentina, Brazil, Colombia, Greece, Indonesia, Malaysia, the Philippines, Thailand, Turkey and Venezuela. The other eight countries, Chile, India, Jordan, Korea, Mexico, South Africa, Taiwan and Zimbabwe, have only one significant break. For all the countries, regression results for the first break (and for some countries the only break) are in line with what have been hypothesized for market liberalisation. Of the 10 countries that have two or more breaks, five of them, namely Argentina, Brazil, Colombia, Greece and Turkey, show further stock market liberalisation. Turkey has the biggest number of breaks and all indicate stock market liberalisation. Regression results for the remaining five countries, namely Indonesia, Malaysia, the Philippines, Thailand and Venezuela, show a reversal of the liberalisation process.

[11] There is concern that prejudice could be introduced when the variables used to identify break dates are also used to test whether these variables are significantly different before and after the break. Such concern should not arise, as the regression results may not be consistent with what is being hypothesized.

4. Impacts of Stock Market Liberalisation on Industry-level Economic Variables

The impact of stock market liberalisation on four industry-level economic variables, namely, (a) growth in real value added, (b) growth in real wages per worker (c) growth in number of employees and (d) growth in number of firms are examined for 17 countries[12]. Annual data on value added, wages, number of employees and number of firms required for difference-in-differences regressions are collected from United Nations Industrial Development Organization's (UNIDO) Industrial Statistics Database (3-digit)[13].

Since only annual data are available, the break months have to be converted to break years. If the break falls on or before June, that year will be the break year; if the break occurs after June, the following year will be the break year. For example, the break year for Chile is 1990 since the break month is before June. On the other hand, the break year for Taiwan is 1989 since the break appears after June. Another point to note is that, for some countries, data for periods showing signs of reversal to the market liberalisation process are excluded. For example, data on Malaysia after 1997 are excluded as there are signs indicating a reversal of the market liberalisation process on June 1998.

The difference-in-difference regression is as follows,

$$y_{it} = \gamma_i + \lambda_1 t + \lambda_2 td_i + \lambda_3 td_t + \lambda_4 td_i d_t + \mu_{it}$$

where y_{it} is the variable of interest, γ_i is the intercept term that is allowed to vary from one industry to another, t is a time trend. The dummy variable, d_i equals to zero if

[12] Argentina, Chile, Colombia, Greece, India, Indonesia, Jordan, Korea, Malaysia, Mexico, the Philippines, South Africa, Taiwan, Thailand, Turkey, Venezuela and Zimbabwe for the period 1981 – 2000. Brazil is not examined because the available data are too sparse for any meaningful study.

[13] The analyses in this paper are restricted to industrial sectors for two reasons, (i) to mitigate distortions due to the dependence on country-specific factors such as natural resources, and (ii) only data on industrial sectors are available from UNIDO database.

the industry belongs to the control group and equals to one if the industry belongs to the treatment group, while d_t, equals to zero before stock market liberalisation and equals to one after stock market liberalisation and ε_{it} is the error term and satisfies the assumption, $E[\mu_{it}|d_{i,}d_t] = 0$. The coefficient of interest is λ_4, which shows the growth rates of the economic variables of the treatment group, after taking into consideration the growth rates of economic variables of the control group, pre- and post stock market liberalisation. If stock market liberalisation increases the real growth rates of value added, real growth rates of wages per worker, growth rates of number of employees and growth rates of number of firms, then λ_4 should be positive.

In this paper, the control group is selected in two different ways. Since the industries have been segregated according to their external equity financing needs, this is a good starting point. When markets liberalize and foreign funds flow into the countries, industries with the greatest needs of external equity financing will benefit the most. In contrast, industries that have low external equity financing needs will not be significantly affected. Earlier results show that the five industries that have the lowest external equity financing needs are (i) wood products, (ii) pottery, (iii) textile, (iv) rubber products and (v) fabricated metal products. These five industries could thus serve as a control group (Control Group 1). Since both the control group and the treatment group are from the same country, it is very likely that stock market liberalisation is the only factor that affects the treatment group and not the control group. But there are also shortcomings. On one hand, the two groups of industries are not similar. On the other, there could be spillover effect from one group of industries to the other. In order to overcome these limitations, a second control group is also used (Control Group 2). The economic variables of the five industries that have the highest external equity financing needs are compared to those of identical industries in countries that have not liberalized their stock markets. The countries are selected using information from IFC emerging stock markets factbook. At the end of year 2001, the control countries were still considered non-investible by the IFC[14]. To mitigate the problem of country-specific factors distorting the regression results, data on the six countries are averaged. Regressions using official liberalisation dates reported in Bekaert and Harvey (2000b) as break dates are also performed.

Table 3 shows the difference-in-differences regression results for real value added growth. Panel A shows the results when Control Group 1 is used. Of the 17 countries examined, only one country (Indonesia) shows significantly higher real value added growth. After stock market liberalisation, real value added growth in Indonesia is, on average, 4% higher. Therefore, the results seem to suggest that stock market liberalisation has no effect on economic growth. Results using official liberalisation dates as break dates are not significantly different. Panel B shows the corresponding regression results when Control Group 2 is used. The results reinforce the view that stock market liberalisation plays an insignificant role in promoting economic growth. Of the 17 countries examined, only three countries show significantly higher value added growth following stock market liberalisation. Stock market liberalisation increases real value added growth rate by 5.8%, 4.6% and 1.2% for Chile, the Philippines and Thailand respectively. Real value added growth rates for Indonesia, however, are no longer significantly higher when Control Group 2 is used. When official liberalisation dates are used as break dates, real

[14] The six control countries are Bangladesh, Bolivia, Bulgaria, Ecuador, Kenya and Mauritius. As Bulgaria does not have sufficient data on value added and number of firms, the country is excluded as a component of the control group when examining the impact of stock market liberalisation on real value added growth and growth in number of firms.

value added growth rate for Thailand is no longer significantly higher. In contrast, real value added growth rates for Argentina, Greece, Indonesia and Korea are shown to be significantly higher following stock market liberalisation. Thus, the results seem to suggest that the relationship between financial liberalisation and economic growth is weak.

Panel A of Table 4 presents the difference-in-differences regression results for growth in real wages per worker when Control Group 1 is used. Only two countries show a significantly higher wages per worker growth rate after stock market liberalisation. Real growth in wages per worker is 1.8% higher in Greece and 1.7% higher in Venezuela. Results from regressions using official liberalisation dates as break dates are similar. Panel B reports the regression results when Control Group 2 is used. Real wages per worker growth rates are, on average, 5% higher following stock market liberalisation. The nine countries that show significantly higher real wages per worker growth rates are Argentina (by 4.8%), Chile (by 9%), Colombia (by 4.3%), Greece (by 3.6%), Indonesia (by 2.7%), Mexico (by 7.4%), Thailand (by 3.9%), Turkey (by 9%) and Venezuela (by 2.4%). On the other hand, India, Korea, South Africa and Taiwan have lower real wages per worker growth after stock market liberalisation. The growth rates fall by 1.8%, 5.5%, 1.5% and 2.4% respectively for the four countries. When the official liberalisation dates are used, growth rate for Indonesia is no longer significantly higher. On the other hand, growth rate for Zimbabwe is now significantly lower.

Regression results for growth in number of employees are shown in Table 5. Panel A shows that when Control Group 1 is used, four countries have significantly different growth rates in number of employees after stock market liberalisation. While results for Argentina, Indonesia and Zimbabwe show higher growth rates, results from Venezuela shows lower growth rate. When Control Group 2 is used, results are more consistent and they indicate that stock market liberalisation raises the growth rates of number of employees by 3.4%. The 13 countries that saw higher growth in number of employees after stock market liberalisation are Argentina, Chile, Colombia, Greece, India, Indonesia, Jordan, Malaysia, the Philippines, South Africa, Thailand, Venezuela and Zimbabwe. The highest growth rate is seen in the Philippines (5.9%) whereas the lowest growth rate is seen in Thailand (1.2%).

The difference-in-differences regression results from Tables 4 and 5 indicate that stock market liberalisations benefit workers by increasing their employment opportunities and at the same time enjoy higher real wages. The fall in the cost of equity capital reduces the cost of production. This encourages firms to produce more, which then translates into higher demand for labour and higher wages per worker. The higher wages paid to worker could also be justified by their higher productivity. Marginal product of labour increases as each worker is now equipped with a greater amount of capital.

Table 6 presents the regression results for growth in number of firms. Results are inconclusive when Control Group 1 is used. Of the 11 countries examined, only four countries have significantly different growth rates. Of these four countries, three countries, namely Jordan, the Philippines and Thailand, have higher growth rates and the remaining one (Venezuela) shows lower growth. When Control Group 2 is used, regression results indicate that stock market liberalisation increases the growth in number of firms. Seven of the 11 countries examined have higher growth rates. The seven countries are India (2.7%), Indonesia (1.8%), Jordan (5.9%), the Philippines (3.3%), Thailand (3.6%), Venezuela (2.7%) and Zimbabwe (2.9%). Thus, results suggest that stock market liberalisation promotes entrepreneurship.

5. Conclusions

The impacts of stock market liberalisation on (i) growth in real value added, (ii) growth in real wages per worker, (iii) growth in number of employees and (iv) growth in number of firms using data on 18 developing countries for the period 1981 – 2000 are examined.

Examining specifically industries that benefit the most from stock market liberalisation allows us to better evaluate the impact of stock market liberalisation on the four economic variables. To find out what these industries are, the paper uses two indicators to measure their needs for external equity financing. The first measure is computed by subtracting retained earnings and long term liabilities from total assets and then divides the results by total assets. The second measure is the ratio of number of public companies to total number of companies. Results show that the five industrial sectors with the lowest external equity financing needs are (i) wood products, (ii) pottery, (iii) textile, (iv) rubber products and (v) fabricated metal products whereas the five industrial sectors with the highest external equity financing needs are (i) professional and scientific equipment, (ii) other chemicals, (iii) electric machinery, (iv) machinery and (v) industrial chemicals.

The use of official liberalisation dates is not suitable, as liberalisation does not signify the actual movement of capital. Using genetic programming, it is found that most of the countries have liberalisation dates later than the official liberalisation dates. Furthermore, most of these countries have multiple liberalisation dates. For all the countries, the first break dates indicate stock market liberalisation, but subsequent break dates signify further liberalisation for some countries and reversal for others. The countries that exhibit reversals to the market liberalisation process are mostly from East Asia.

Results from difference-in-differences regression show that stock market liberalisations have little impact on the real growth rates of value added. On the other hand, growth rates of real wages per worker, growth rates of number of employees and growth rates of number of firms are significantly higher for most countries after stock market liberalisation.

Table 1 List of Previous Studies

Types of variables	Variables	Authors
Macroeconomic	Economic growth	Henry (2003), Edison, Klein, Ricci and Sloek (2002), Edison, Levine, Ricci and Sloek (2002), Bekaert, Harvey and Lundblad (2001b), Levine and Zervos (1998), Kraay (1998), Rodrik (1998)
	Private investment	Henry (2003), Henry (2000b)
	Inflation	Kim and Singal (2000), Bekaert and Harvey (2000a)
	Exchange rates	Kim and Singal (2000), Bekaert and Harvey (2000a)
	Trade	Bekaert and Harvey (2000a)
	Government spending	Bekaert and Harvey (2000a)
	Income equality	Das and Mohapatra (2003)
	Capital flow	Bekaert, Harvey and Lumsdaine (2002b)
Financial	Cost of equity	Henry (2003), Bekaert, Harvey and Lumsdaine (2002b), Bekaert and Harvey (2000b), Errunza and Miller (2000)
	Risk	Chari and Henry (2004), Kim and Singal (2000), Bekaert and Harvey (1997), de Santis and Imrohoroglu (1997)
	Stock prices	Henry (2000a), Kim and Singal (2000)
	Stock market fluctuations	Kaminsky and Schmukler (2003), Edwards, Biscarri and de Gracia (2003)
	Stock market efficiency	Jain-Chandra (2002), Kim and Singal (2000)
	Liquidity	Jain-Chandra (2002)

Table 2 Industries with the Lowest and Highest External Equity Financing Needs

Industrial sectors are ranked separately according to their EQFIN80, EQFIN90, PTR90 and PTR98. A 1 is assigned to the sector with the lowest EQFIN80, a 2 is assigned to the sector with the next lowest EQFIN80, and so on. The exercise is repeated for the other three indicators. The ranks are then averaged across the four indicators.

	Average Rank
Industries with the lowest external equity financing needs	
Wood products, except furniture (331)	2.00
Pottery, china and earthenware (361)	6.25
Textile (321)	7.50
Rubber products (355)	7.50
Fabricated metal products (381)	7.75
Industries with the highest external equity financing needs	
Professional and scientific equipment (385)	27.50
Other Chemicals (352)	24.75
Machinery, electric (383)	24.25
Machinery, except electric (382)	21.50
Industrial chemicals (351)	21.25

Table 3 Difference-in-differences Regression Results for Growth in Real Value Added

The difference-in-differences regression equation is $y_{it} = \gamma_i + \lambda_1 t + \lambda_2 t d_i + \lambda_3 t d_t + \lambda_4 t d_i d_t + \mu_{it}$, where y_{it} is real value added, γ_i is the intercept term that is allowed to vary from one industry to another, t is a time trend. The dummy variable, d_i equals to zero if the industry belongs to the control group and equals to one if the industry belongs to the treatment group, while d_t, equals to zero before stock market liberalisation and equals to one after stock market liberalisation. λ_4 shows whether the value added growth rates are significantly different after stock market liberalisation, after taking into consideration the growth rates of economic variables of the control group. The t-statistics are corrected for heteroskedasticity. Panel A shows results when industrial sectors with the lowest external equity financing needs are used as control group. Panel B shows results when identical industrial sectors in countries that have not undergone stock market liberalisation are used as control group. The second column presents results using break dates determined by GP. The third column presents results using official liberalisation dates. The comment 'Break date coincides' means that the official liberalisation date coincides with that determined by GP.

Panel A: Control Group 1

	GP-determined break dates		Official liberalisation dates	
	λ_4	t-stat.	λ_4	t-stat.
Argentina	0.0233	1.3812	0.0260	0.8315
Chile	0.0273	1.4001	Break date coincides	
Colombia	-0.0079	-1.1113	Break date coincides	
Greece	0.0063	0.6011	0.0207	1.0244
India	0.0005	0.0736	Break date coincides	
Indonesia	0.0392	2.6193**	0.0678	3.6879**
Jordan	-0.0328	-1.3457	0.0031	0.1092
Korea	-0.0050	-0.2234	-0.0017	-0.1512
Malaysia	-0.0114	-1.0013	-0.0157	-0.7349
Mexico	-0.0257	-1.6047	-0.0287	-1.4639
Philippines	-0.0009	-0.0444	Break date coincides	
S. Africa	-0.0069	-0.8497	n.a.	n.a.
Taiwan	-0.0038	-0.2477	-0.0014	-0.1555
Thailand	0.0906	1.5711	0.0966	1.1899
Turkey	0.0140	0.7771	Break date coincides	
Venezuela	-0.0060	-0.4995	-0.0085	-0.8675
Zimbabwe	0.0185	0.9809	0.0283	1.6461

** 1% level of significance
* 5% level of significance

Panel B: Control Group 2

	GP-determined break dates		Official liberalisation dates	
	λ_4	t-stat.	λ_4	t-stat.
Argentina	0.0355	1.8475	0.0917	2.5006*
Chile	0.0577	2.7115**	Break date coincides	
Colombia	0.0110	0.7946	Break date coincides	
Greece	0.0112	0.6423	0.0478	2.1281*
India	-0.0045	-0.4531	Break date coincides	
Indonesia	0.0180	1.1599	0.0792	3.9788**
Jordan	-0.0238	-1.6857	-0.0172	-1.2623
Korea	0.0054	0.2544	0.0372	3.0494**
Malaysia	0.0139	1.0191	0.0317	1.3748
Mexico	-0.0097	-0.4952	-0.0130	-0.5894
Philippines	0.0459	2.5327*	Break date coincides	
S. Africa	-0.0214	-1.9185	n.a.	n.a.
Taiwan	-0.0268	-1.5784	-0.0345	-1.7676
Thailand	0.0120	2.2149*	0.0146	1.9387
Turkey	0.0302	1.4022	Break date coincides	
Venezuela	0.0197	1.5715	0.0213	1.1564
Zimbabwe	0.0128	0.7236	-0.0017	-0.1018

** 1% level of significance
* 5% level of significance

Table 4 Difference-in-differences Regression Results for Growth in Real Wages Per Worker

The difference-in-differences regression equation is $y_{it} = \gamma_i + \lambda_1 t + \lambda_2 td_i + \lambda_3 td_t + \lambda_4 td_i d_t + \mu_{it}$, where y_{it} is real wages per worker, γ_i is the intercept term that is allowed to vary from one industry to another, t is a time trend. The dummy variable, d_i equals to zero if the industry belongs to the control group and equals to one if the industry belongs to the treatment group, while d_t, equals to zero before stock market liberalisation and equals to one after stock market liberalisation. λ_4 shows whether the growth rates in real wages per worker are significantly different after stock market liberalisation, after taking into consideration the growth rates of economic variables of the control group. The t-statistics are corrected for heteroskedasticity. Panel A shows results when industrial sectors with the lowest external equity financing needs are used as control group. Panel B shows results when identical industrial sectors in countries that have not undergone stock market liberalisation are used as control group. The second column presents results using break dates determined by GP. The third column presents results using official liberalisation dates. The comment 'Break date coincides' means that the official liberalisation date coincides with that determined by GP.

Panel A: Control Group 1

	GP-determined break dates		Official liberalisation dates	
	λ_4	t-stat.	λ_4	t-stat.
Argentina	-0.0084	-0.3579	-0.0048	-0.1415
Chile	-0.0085	-0.6232	Break date coincides	
Colombia	0.0006	0.1083	Break date coincides	
Greece	0.0181	2.0066*	0.0102	0.7142
India	-0.0003	-0.0688	Break date coincides	
Indonesia	-0.0024	-0.3316	-0.0115	-1.1789
Jordan	-0.0008	-0.0808	-0.0006	-0.0012
Korea	-0.0061	-0.4345	-0.0020	-0.2582
Malaysia	-0.0060	-1.3506	-0.0152	-1.6082
Mexico	0.0037	0.2490	0.0048	0.3075
Philippines	-0.0065	-0.9486	Break date coincides	
S. Africa	-0.0072	-1.4245	n.a.	n.a
Taiwan	-0.0006	-0.0633	-0.0028	-0.4963
Thailand	0.0083	0.4836	0.0015	0.0854
Turkey	-0.0005	-0.0278	Break date coincides	
Venezuela	0.0171	1.9851*	0.0194	2.1952*
Zimbabwe	0.0012	0.1239	0.0039	0.3987

** 1% level of significance
* 5% level of significance

Panel B: Control Group 2

	GP-determined break dates		Official liberalisation dates	
	λ_4	t-stat.	λ_4	t-stat.
Argentina	0.0482	2.5927*	0.1633	6.3736**
Chile	0.0903	5.9712**	Break date coincides	
Colombia	0.0434	6.8337**	Break date coincides	
Greece	0.0359	3.9747**	0.0622	4.5593**
India	-0.0176	-3.5672**	Break date coincides	
Indonesia	0.0267	4.2654**	0.0156	1.9318
Jordan	-0.0069	-0.8434	-0.0047	-0.7547
Korea	-0.0554	-5.1244**	-0.0221	-3.3358**
Malaysia	0.0089	1.5541	0.0032	0.3486
Mexico	0.0737	6.1255**	0.0946	7.1219**
Philippines	0.0075	1.0966	Break date coincides	
S. Africa	-0.0154	-2.8800**	n.a.	n.a.
Taiwan	-0.0241	-2.7926**	-0.0122	-2.0236*
Thailand	0.0392	3.9958**	0.0348	2.2216*
Turkey	0.0901	6.8732**	Break date coincides	
Venezuela	0.0242	3.1498**	0.0342	3.4241**
Zimbabwe	-0.0039	-0.4484	-0.0178	-2.0377*

** 1% level of significance
* 5% level of significance

Table 5 Difference-in-differences Regression Results for Growth in Number of Employees

The difference-in-differences regression equation is $y_{it} = \gamma_i + \lambda_1 t + \lambda_2 td_i + \lambda_3 td_t + \lambda_4 td_i d_t + \mu_{it}$, where y_{it} is the number of employees, γ_i is the intercept term that is allowed to vary from one industry to another, *t* is a time trend. The dummy variable, d_i equals to zero if the industry belongs to the control group and equals to one if the industry belongs to the treatment group, while d_t, equals to zero before stock market liberalisation and equals to one after stock market liberalisation. λ_4 shows whether the growth rates in number of employees are significantly different after stock market liberalisation, after taking into consideration the growth rates of economic variables of the control group. The t-statistics are corrected for heteroskedasticity. Panel A shows results when industrial sectors with the lowest external equity financing needs are used as control group. Panel B shows results when identical industrial sectors in countries that have not undergone stock market liberalisation are used as control group. The second column presents results using break dates determined by GP. The third column presents results using official liberalisation dates. The comment 'Break date coincides' means that the official liberalisation date coincides with that determined by GP.

Panel A: Control Group 1

	GP-determined break dates		Official liberalisation dates	
	λ_4	t-stat.	λ_4	t-stat.
Argentina	0.0384	5.8785**	0.0337	4.0209**
Chile	0.0285	1.9488	Break date coincides	
Colombia	-0.0105	-1.7963	Break date coincides	
Greece	-0.0037	-0.6754	-0.0042	-0.4783
India	0.0001	0.0034	Break date coincides	
Indonesia	0.0301	3.6176**	0.0266	2.2262*
Jordan	-0.0048	-0.2371	0.0099	0.5587
Korea	0.0114	0.5580	0.0071	0.5375
Malaysia	0.0077	0.7010	0.0031	0.1953
Mexico	-0.0191	-1.1569	-0.0231	-1.1921
Philippines	0.0076	0.5515	Break date coincides	
S. Africa	0.0005	0.1094	n.a.	n.a.
Taiwan	0.0120	1.2571	0.0063	0.9202
Thailand	0.0566	1.7635	0.0704	1.6056
Turkey	-0.0026	-0.3064	Break date coincides	
Venezuela	-0.0193	-2.7981**	-0.0060	-0.6412
Zimbabwe	0.0359	4.0057**	0.0297	3.4067**

** 1% level of significance
* 5% level of significance

Panel B: Control Group 2

	GP-determined break dates		Official liberalisation dates	
	λ_4	t-stat.	λ_4	t-stat.
Argentina	0.0427	6.8770**	0.0283	3.0278**
Chile	0.0299	2.4350*	Break date coincides	
Colombia	0.0386	5.1852**	Break date coincides	
Greece	0.0221	2.3748*	0.0230	1.9780
India	0.0317	6.0385**	Break date coincides	
Indonesia	0.0366	4.3228**	0.0463	3.9994**
Jordan	0.0383	5.1493**	0.0126	1.6656
Korea	0.0161	1.2531	0.0106	1.4001
Malaysia	0.0531	5.6883**	0.0643	4.9039**
Mexico	-0.0112	-0.6606	-0.0137	-1.2315
Philippines	0.0591	5.5969**	Break date coincides	
S. Africa	0.0231	4.0897**	n.a.	n.a.
Taiwan	-0.0092	-1.0232	-0.0177	-1.3993
Thailand	0.0122	4.0808**	0.0196	3.0372**
Turkey	0.0209	1.8719	Break date coincides	
Venezuela	0.0128	1.9743*	0.0228	2.3090*
Zimbabwe	0.0372	4.7832**	0.0405	5.1756**

** 1% level of significance
* 5% level of significance

Table 6 Difference-in-differences Regression Results for Growth in Number of Firms

The difference-in-differences regression equation is $y_{it} = \gamma_i + \lambda_1 t + \lambda_2 td_i + \lambda_3 td_t + \lambda_4 td_i d_t + \mu_{it}$, where y_{it} is the number of firms, γ_i is the intercept term that is allowed to vary from one industry to another, t is a time trend. The dummy variable, d_i equals to zero if the industry belongs to the control group and equals to one if the industry belongs to the treatment group, while d_t, equals to zero before stock market liberalisation and equals to one after stock market liberalisation. λ_4 shows whether the growth rates in number of firms are significantly different after stock market liberalisation, after taking into consideration the growth rates of economic variables of the control group. The t-statistics are corrected for heteroskedasticity. Panel A shows results when industrial sectors with the lowest external equity financing needs are used as control group. Panel B shows results when identical industrial sectors in countries that have not undergone stock market liberalisation are used as control group. The second column presents results using break dates determined by GP. The third column presents results using official liberalisation dates. The comment 'Break date coincides' means that the official liberalisation date coincides with that determined by GP.

Panel A: Control Group 1

	GP-determined break dates		Official liberalisation dates	
	λ_4	t-stat.	λ_4	t-stat.
Chile	0.0092	0.9747	Break date coincides	
Colombia	-0.0057	-0.7920	Break date coincides	
India	0.0010	0.3135	Break date coincides	
Indonesia	0.0093	1.4314	0.0217	2.3345*
Jordan	0.0527	3.1660**	0.0432	2.3987*
Korea	0.0094	0.6318	0.0091	0.9373
Malaysia	-0.0080	-0.4846	-0.0085	-0.3386
Philippines	0.0392	2.3401*	Break date coincides	
Thailand	0.0525	3.2282**	0.0141	0.4474
Venezuela	-0.0200	-2.8318**	-0.0151	-2.2649*
Zimbabwe	0.0040	0.4492	-0.0002	-0.0237

Panel B: Control Group 2

	GP-determined break dates		Official liberalisation dates	
	λ_4	t-stat.	λ_4	t-stat.
Chile	0.0017	0.0951	Break date coincides	
Colombia	0.0044	0.3556**	Break date coincides	
India	0.0274	3.6466**	Break date coincides	
Indonesia	0.0184	2.0138*	0.0020	0.1107
Jordan	0.0593	3.8325**	0.0483	2.8529**
Korea	-0.0377	-1.8505	-0.0469	-1.9583
Malaysia	-0.0082	-0.3627	-0.0071	-0.6171
Philippines	0.0333	1.9916*	Break date coincides	
Thailand	0.0362	3.7347**	0.0324	2.9767**
Venezuela	0.0268	2.1959*	0.0067	0.3904
Zimbabwe	0.0285	2.8726**	0.0330	2.8915**

** 1% level of significance
* 5% level of significance

Reference

Bai, J. and P. Perron, 1998, Estimating and Testing Linear Models with Multiple Structural Changes. *Econometrica* 66, 47 – 78

Bai, J., R. L. Lumsdaine and J. H. Stock, 1998, Testing for and Dating Breaks in Stationary and Non-stationary Multivariate Time Series. *Review of Economic Studies* 65, 395 – 432.

Bekaert, G. and C. R. Harvey, 1997, Emerging Equity Market Volatility. *Journal of Financial Economics* 43, 29 – 77.

Bekaert, G. and C. R. Harvey, 2000a, Capital Flows and the Behavior of Emerging Equity Market Returns, in S. Edwards (ed.), *Capital Flows and the Emerging Economies: Theory, Evidence and Controversies*, Chicago: University of Chicago Press.

Bekaert, G. and C. R. Harvey, 2000b, Foreign Speculators and Emerging Equity Markets. *Journal of Finance* 55, 565 – 613.

Bekaert, G., C. R. Harvey and C. Lundblad, 2001b, Does Financial Liberalization Spur Growth? NBER Working Paper No. 8245. Cambridge, MA: National Bureau of Economic Research

Bekaert, G., C. R. Harvey and R. L. Lumsdaine, 2002a, Dating the Integration of World Equity Markets. *Journal of Financial Economics* 65, 203 – 247.

Bekaert, G., C. R. Harvey and R. L. Lumsdaine, 2002b, The Dynamics of Emerging Market Equity Flows. *Journal of International Money and Finance* 21, 295 – 350.

Chari, A. and P. B. Henry, 2004, Risk Sharing and Asset Prices: Evidence from a Natural Experiment. *Journal of Finance* 59, 1295 – 1324.

Chen, S. H. and C. H. Yeh, 1997, Using genetic programming to model volatility in financial time series, in Koza, J., Deb, K., Dorigo, M. Fogel, D., Garzon, M., Iba H. and Riolo, R. (eds.), *Genetic programming: Proceedings of the second annual conference 1997*, San Francisco: Morgan Kaufmann, 58 – 63.

Das, M. and S. Mohapatra, 2003, Income Inequality: The Aftermath of Stock Market Liberalization in Emerging Markets. *Journal of Empirical Finance* 10, 217 – 248.

De Santis, G. and S., Imrohoroglu, 1997, Stock Returns and Volatility in Emerging Financial Markets. *Journal of International Money and Finance* 16, 561 – 579.

Edison, H. J., M. W. Klein, L. Ricci and T. Sloek, 2002, Capital Account Liberalization and Economic Performance: Survey and Synthesis, NBER Working Paper No. 9100. Cambridge, MA: National Bureau of Economic Research.

Edison, H., J., R. Levine, L. Ricci and T. Sløk, 2002, International Financial Integration and Economic Growth. *Journal of International Money and Finance* 21, 749 – 776.

Edwards, S., J. G. Biscarri and F. Perez de Gracia, 2003, Stock Market Cycles, Financial Liberalization and Volatility, NBER Working Paper No. 9817, Cambridge, MA: National Bureau of Economic Research.

Errunza, V. R. and D. P. Miller, 2000, Market Segmentation and the Cost of Capital in International Equity Markets. *Journal of Financial and Quantitative Analysis* 35, 577 – 600.

Fisman, R. and I. Love, 2003, Trade Credit, Financial Intermediary Development, and Industry Growth. *Journal of Finance* 58, 353 – 374.

Henry, P. B., 2000a, Stock Market Liberalization, Economic Reform, and Emerging Market Equity Prices. *Journal of Finance* 55, 529 – 564.

Henry, P. B., 2000b, Do Stock Market Liberalizations Cause Investment Booms. *Journal of Financial Economics* 58, 301 – 334.

Henry, P. B., 2003, Capital Account Liberalization, the Cost of Capital and Economic Growth, NBER Working Paper No. 9488. Cambridge, MA: National Bureau of Economic Research.

Jain-Chandra, S., 2002, The Impact of Stock Market Liberalization on Liquidity and Efficiency in Emerging Markets. Working paper, Columbia University.

Kaminsky, G. L. and S. L. Schmukler, 2003, Short-Run Pain, Long-Run Gain: The Effects of Financial Liberalization, NBER Working Paper No. 9787. Cambridge, MA: National Bureau of Economic Research

Kim, E. H. and V. Singal, 2000, Stock Market Openings: Experience of Emerging Economies. *Journal of Business* 73, 23 – 66.

Koza J. R., 1994, Genetic Programming II: Automatic Discovery of Reusable Programs, Massachusetts, Cambridge: The MIT Press.

Kraay, A., 1998, In Search of the Macroeconomic Effects of Capital Account Liberalization. Working paper, Washington DC: The World Bank.

Levine, R. and S. Zervos, 1998, Stock Markets, Banks and Economic Growth. *American Economic Review* 88, 537 – 558.

Lien, D., Y. K. Tse and X. B. Zhang, 2003, Structural Change and Lead-Lag Relationship between the Nikkei Spot Index and Futures Prices: A Genetic Programming Approach. *Quantitative Finance* 3, 136 - 144.

Rodrik, D., 1998, Who Needs Capital Account Convertibility? Princeton Essays in International Finance 207, 55 – 65.

Appendix A1: Structural Break Dates

Four monthly financial time series, namely (i) stock return, (ii) volatility, (iii) correlation and (iv) US net equity flows/market capitalization, are used separately and concurrently as inputs to GP to determine the break dates. Stock returns is the monthly returns of respective countries' stock indexes obtained from S&P/IFC. Volatility is estimated using a GARCH (1,1) model. Correlations between country and world returns are computed using a 36-month moving window. Break dates under Quadravariate are obtained by using all the four time series as inputs to GP. Sample period shows the starting and ending months of the time series.

Country	Sample Period	Quadravariate	Return	Volatility	Correlation	Net Flows/Market Cap
Argentina	Jan 88 – Dec 02	Apr – Jun 92 Jan – Mar 97	Apr – Jun 92 Apr – Jun 97	Apr – Jun 92	Jul – Sep 92 Apr – Jun 97	Jan – Mar 92 Apr – Jun 96 Jan – Mar 00
Brazil	Jan 86 – Dec 02	Oct – Dec 90 Oct – Dec 96	Oct – Dec 96	Oct – Dec 90	Jan – Mar 91 Jan – Mar 97	Jul – Sep 90 Oct – Dec 96
Chile	Jan 88 – Dec 02	Jan – Mar 90	Jan – Mar 90	Jan – Mar 90 Apr – Jun 97	Apr – Jun 90	Apr – Jun 90
Colombia	Jan 89 – Dec 02	Jan – Mar 91 Oct – Dec 96	Jan – Mar 91	Oct – Dec 96	Apr – Jun 91	Jul – Sep 96
Greece	Jan 86 – Dec 02	Jan – Mar 90 Jul – Sep 98	Jan – Mar 90	Jan – Mar 90 Jul – Sep 98	Apr – Jun 90 Oct – Dec 98	Jan – Mar 90
India	Jul 84 – Dec 02	Jul – Sep 92	Jul – Sep 92	Apr – Jun 92	Apr – Jun 00	Jul – Sep 92
Indonesia	Jan 87 – Dec 02	Jan – Mar 93 Jul – Sep 98	Jan - Mar 93 Jul – Sep 96 Oct – Dec 98	Jul – Sep 98	Apr – Jun 93 Jan – Mar 96 Oct – Dec 98	Jan – Mar 93 Jul – Sep 98
Jordan	Jan 86 – Dec 02	Jul – Sep 92 Apr – Jun 99	Jul – Sep 88 Jul – Sep 92	Jul – Sep 92	Oct – Dec 92 Apr – Jun 99	NA

Korea	Sep 82 – Dec 02	Jan – Mar 89	Jan – Mar 89 Oct – Dec 92	Jul – Sep 95	Apr – Jun 89 Oct – Dec 96	Jan – Mar 89
Malaysia	Jan 86 – Dec 02	Apr – Jun 92 Apr – Jun 98	Jan – Mar 87 Apr – Jun 92	Jan – Mar 92	Jul – Sep 98	Apr – Jun 92 Apr – Jun 98
Mexico	Jan 80 – Dec 02	Jan – Mar 90	Jan – Mar 86 Jan – Mar 90	Jan – Mar 87 Oct – Dec 89	Apr – Jun 90	Oct – Dec 89
Philippines	Jan 87 – Dec 02	Jan – Mar 91 Jan – Mar 98	Jul – Sep 94	Apr – Jun 91 Jan – Mar 98	Jan – Mar 91 Apr – Jun 98	Apr – Jun 91 Oct – Dec 97
South Africa	Jan 79 – Dec 02	Jan – Mar 93	Jan – Mar 93	Jan – Mar 93	Jul – Sep 98	Jan – Mar 93
Taiwan	Jan 85 – Dec 02	Oct – Dec 88 Jan – Mar 98	Oct – Dec 88	Oct – Dec 88	Jan – Mar 89 Jan – Mar 98	Jan – Mar 00
Thailand	Jan 84 – Dec 02	Apr – Jun 90 Oct – Dec 97	Jul – Sep 90 Oct – Dec 97	Apr – Jun 86 Oct – Dec 97	Apr – Jun 90 Jan – Mar 98	Apr – Jun 90 Jan – Mar 98
Turkey	Jan 88 – Dec 02	Oct – Dec 89 Jan – Mar 94 Oct – Dec 97	Oct – Dec 89	Apr – Jun 94 Oct – Dec 97	Jan – Mar 90 Oct – Dec 97	Oct – Dec 89 Jan – Mar 94 Jul – Sep 97
Venezuela	Jan 89 – Dec 02	Apr – Jun 92 Apr – Jun 98	Apr – Jun 92 Apr – Jun 98	Jul – Sep 98	Jul – Sep 92	Apr – Jun 92
Zimbabwe	Jan 90 – Dec 02	Oct – Dec 93 Jan – Mar 97	Oct – Dec 93	Oct – Dec 93	Jan – Mar 94 Jan – Mar 97	NA

Appendix A2: Post Break Dates Response of Financial and Economic Variables

Nine monthly financial and macroeconomic variables are used. They are (i) stock returns, (ii) dividend yield, (iii) market capitalization/GDP, (iv) net equity flows from US/market capitalization, (v) correlation, (vi) turnover ratio, (vii) value traded/GDP, (viii) inflation and (ix) total trade/GDP. The GDP numbers are divided by 12 before they are used as denominators. Total trade is the sum of imports and exports for the month. The final month of the break quarter identified by the quadravariate framework is used as the break month. The regression equation is $y_t = \beta_o + \beta_1 D + \varepsilon_t$, where y_t is one of the nine variables above, *D* is a dummy variable and equals 0 for periods before the break dates and equals 1 for periods after the break dates. To mitigate any possible contamination due to the transition period, data three months prior and three months subsequent to the break months are excluded. If there are multiple breaks for the country, the regression period ends three months before the next break date. Newey-West corrected t-statistics are used to determine the level of significance.

		β_1								
	Break Dates	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)
Argentina	Jun 92	-0.0843*	0.0070	0.1207**	0.6336**	0.2102**	-0.2512	0.0228**	-1.6618*	0.0226*
	Mar 97	-0.0410*	0.0061	0.2415**	-0.1971	0.2236**	-0.9111	0.0035	-0.0054**	0.0356**
Brazil	Dec 90	0.0282	-0.0353**	0.1246**	0.0256**	0.1561**	0.9051*	0.0463*	-0.2062	0.0066
	Dec 96	-0.0493*	0.0286**	0.1738**	0.0420**	0.3416**	0.2601**	0.0789**	-0.8612**	0.0337**
Chile	Mar 90	-0.0300**	-0.0260**	0.4500**	0.0366**	0.2022**	0.1770**	0.0536**	-0.0103**	-0.0388**
Colombia	Mar 91	-0.0575*	-0.0221**	0.1315**	0.1029	0.1347*	0.0549	0.0106**	-0.0046**	0.0091
	Dec 96	-0.0017	-0.0275**	0.2993**	0.0992*	0.0257	0.3033**	0.0072**	-0.0064**	0.0176*
Greece	Mar 90	-0.0400*	-0.0214*	0.1507**	0.0068**	0.0821*	0.2431**	0.8446**	-0.0041**	-0.3769**
	Sep 98	-0.0132	-0.0282**	0.3707**	0.0008	0.1517**	0.3403**	0.7133**	-0.0076**	-0.0768**
India	Sept 92	-0.0355*	-0.0045*	0.2339**	0.0064**	0.0112	0.3309**	0.0311**	-0.0020*	0.0485**
Indonesia	Mar 93	-0.0470*	0.0967**	0.1220**	0.0338**	0.1758**	0.1605	0.0464**	0.0044*	0.0521**
	Sept 98	0.0650*	0.0267	-0.1653**	-0.0101*	-0.1940**	-0.1628	-0.0024	0.0055	0.1402**
Jordan	Sep 92	-0.0140*	-0.0118*	0.2259**	NA	0.1245*	0.0058	0.0400*	-0.0577*	0.0984*

Korea	Mar 89	-0.0415**	-0.0208**	0.2099**	0.0052*	0.1803**	0.6898	0.0139**	0.0021*	-0.1233*
Malaysia	Jun 92	-0.0382*	-0.0044*	0.1724**	0.0890**	0.0149	0.3130**	0.1272**	0.0002	0.3326**
	Jun 98	0.0213	0.0090*	-0.1238**	-0.0701**	-0.1466**	-0.2556**	-0.1084**	-0.0008	0.2921**
Mexico	Mar 90	-0.0417**	-0.0175**	0.1782**	0.0581**	0.3115**	-0.2164**	0.0063**	-0.0403**	0.1933**
Philippines	Mar 91	-0.0419	-0.0102**	0.5477**	0.0091**	0.0148*	0.7153**	0.0162**	-0.0029*	0.1518**
	Mar 98	0.0090	0.0039**	-0.1191*	-0.0042*	0.0363**	-0.4702	-0.0072*	-0.0008	0.3068**
South Africa	Mar 93	-0.0243*	-0.0092**	0.0979**	0.0266**	0.0974	0.5840*	0.1430**	-0.0056**	0.0350*
Taiwan	Dec 88	-0.0541*	-0.0096**	0.4797**	0.0110	0.0877*	-0.0150	0.1033**	0.0017**	-0.0810**
Thailand	Jun 90	-0.0435*	-0.0059*	0.5287**	0.0039**	0.1251*	-0.3156**	0.0186*	0.0002	0.0905**
	Dec 97	0.0616*	-0.0053	-0.5172**	-0.0027*	-0.1192*	0.1628	-0.0181*	-0.0016	0.2340*
Turkey	Dec 89	-0.1110*	-0.0201*	0.0969**	0.0064**	0.1207*	0.4903**	0.0711**	0.0063	-0.0314*
	Mar 94	-0.0070	-0.0077*	0.0801**	0.0081**	0.0272	0.6005**	0.1631**	0.0208*	0.1136**
	Dec 97	-0.0454	-0.0151**	0.1899**	0.0241*	0.1630*	0.2394*	0.3137**	-0.0206**	0.0558**
Venezuela	Jun 92	-0.0621*	0.0140**	0.1065*	0.0604**	0.1262**	0.6256**	0.1980*	-0.0023	-0.0566*
	Jun 98	0.0433*	0.0249**	-0.0409**	0.0168	-0.0444	-0.1051**	-0.1660**	-0.0332*	-0.0282*
Zimbabwe	Dec 93	-0.0040*	-0.0371**	0.0444**	NA	0.3207**	0.6623**	0.0008**	0.0014**	0.2836**

** 1% level of significance
* 5% level of significance