

**DETERMINATION OF ARBITRAGE PRICING FACTORS
IN THE MALAYSIAN STOCK MARKET**

By

AZHAR BIN ZAKARIA

**Thesis Submitted to the Graduate School of Management,
Universiti Putra Malaysia, in Partial Fulfillment of the Requirement for the
Degree of Master of Science**

August 2006

This thesis is specially dedicated to my wife, Zawahia binti Abdul Wahab and son, Muhammad Amirul Haziq, for their tolerance and support.

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in partial fulfillment of the requirement for the degree of Master of Science

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Chair : Professor Mohamad Ali bin Abdul Hamid, PhD

Faculty : Graduate School of Management

The equilibrium-pricing model using Arbitrage Pricing Theory (APT) has become one of the central models of modern financial theory. However, the APT is too general in determining the factors which influences expected returns. In this regard, the identification of factors is an issue with the most potential to be discussed and thus it is necessary in the test of the APT. An empirical study on the APT has already been conducted in developed countries but the identification of factors is still inconsistent. To add to this problem, little attention has been given in emerging markets especially in the Malaysian market. This study undertakes to identify the number of common factors in the asset returns, the number of priced factors in the expected returns, and the macroeconomic variables that significantly affect the stock market returns. To identify both factors and the macroeconomic variables, monthly data was used for a period from January 1991 through December 2001. The analysis was divided into two sub-periods based on the 1997 Asian financial crisis; namely sub-period 1 (before financial crisis) and sub-period 2 (after financial crisis). This will give the research the opportunity to identify the number of common factors and the number of priced factors in a pre and post economic situation.

The objective of this research is to identify the number of common factors, the number of priced factors and macroeconomic variables that influence the stock market returns. In this research, Principal Component Analysis (PCA) is used to identify the groups of macroeconomic variables and to identify the number of common factors from forty groups of portfolios in the asset returns. The cross-sectional Generalized Least Squares (GLS) regression analysis test is then used to identify the number of priced factors from the number of common factors identified earlier using the PCA. The Canonical Correlation Analysis (CCA) is then used to find the correlation between the Principal Component (PC) scores of the number of priced factors and the PC scores of the macroeconomic variables. This procedure will identify which macroeconomic variables significantly affect the stock market returns before and after the Asian financial crisis.

According to the PCA results, the sub-period 1 suggests that there were six groups of macroeconomic factors. While after the financial crisis, there were five groups of macroeconomic factors. The groups of macroeconomic variables in both sub-periods were factorized from the fourteen Malaysian macroeconomic variables. On the other hand, the monthly returns of the forty groups were subjected to PCA to identify the number of common factors. The PCA on stock market returns showed that, the forty groups consist of ten, eleven, and twelve common factors influencing the asset returns in sub-period 1. However, in sub-period 2, the PCA on stock market returns showed that, the forty groups consists of seven, eight, nine, and ten common factors influencing the asset returns. The cross-sectional GLS regression analysis showed that there was at least one to three numbers of priced factors in both sub-periods.

The CCA suggested that macroeconomic variables and stock market returns in sub-period 1 were significantly correlated at PC scores of the macroeconomic variables; namely FECON1 (0.4470), FECON2 (0.3214), and FECON3 (0.7791). The results suggest that FECON1 represents the macroeconomic variables such as the United States exchange rate, the Singapore exchange rate, and money supply (M2). While, the FECON2 represents macroeconomic variables such as export, import, industrial production index, and gross domestic product. FECON3 represents macroeconomic variables such as oil prices (petroleum) and Japanese exchange rate.

In sub-period 2, the CCA suggested that macroeconomic variables and stock market returns were significantly correlated at PC scores of the macroeconomic variables; namely FECON2 (0.6945), and FECON5 (0.4433). The results suggest that FECON2 represents the macroeconomics variables such as the Japanese exchange rate, the Singapore exchange rate, money supply, trade balance, and oil prices (petroleum). While the FECON5 represents macroeconomic variables is composed of composite index. The bottom line conclusion of these empirical findings show that the numbers of macroeconomic variables are highly significantly influenced by stock market, namely two PC scores of macroeconomic variables such as FECON3 (0.7791) and FECON2 (0.6945). They are oil prices (petroleum), and consumer price index before the Asian financial crisis. While, the Japanese exchange rate, the Singapore exchange rate, money supply, trade balance and oil prices (petroleum) after the Asian financial crisis.

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**PENENTUAN FAKTOR HARGA ARBITRAJ DI DALAM
PASARAN SAHAM MALAYSIA**

Oleh

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Penggunaan model keseimbangan harga ke atas teori penentuan harga arbitraj (APT) sudah menjadi sebahagian daripada model utama dalam teori kewangan moden. Walau bagaimanapun, APT adalah terlalu umum dalam menentukan faktor yang mempengaruhi pulangan terjangka. Oleh itu, identifikasi ke atas faktor merupakan isu yang berpotensi untuk diperbincangkan dan oleh itu, ia diuji ke atas APT. Kajian empirik ke atas APT telahpun dikendalikan di negara maju tetapi identifikasi faktor masih tidak konsisten dan sukar dikenalpasti. Menambah ke atas masalah ini, sedikit perhatian telah diberikan pada pasaran baru terutamanya pasaran Malaysia. Kajian ini juga adalah bagi mengenalpasti bilangan faktor sepunya ke atas pulangan aset, bilangan faktor yang signifikan ke atas pulangan terjangka dan pembolehubah- pembolehubah makroekonomi yang signifikan mempengaruhi pasaran saham. Bagi mengenalpasti kedua-dua faktor dan pembolehubah makroekonomi, data bulanan telah digunakan

dalam tempoh Januari 1991 hingga Disember 2001. Analisis ini telah dibahagikan kepada dua subtempoh berdasarkan kepada krisis kewangan Asia pada tahun 1997; iaitu subtempoh 1 (sebelum krisis kewangan) dan subtempoh 2 (selepas krisis kewangan). Kajian ini akan memberi peluang bagi bilangan faktor sepunya dan bilangan faktor yang signifikan sebelum dan selepas situasi ekonomi. Objektif penyelidikan ini adalah mengenalpasti bilangan faktor sepunya, bilangan faktor signifikan dan pembolehubah makroekonomi yang mempengaruhi ke atas pasaran saham. Dalam kajian ini, analisis komponen prinsipal (PCA) telah digunakan untuk mengenalpasti set pembolehubah makroekonomi dan mengenalpasti bilangan faktor sepunya daripada empat puluh kumpulan portfolio. Ujian regresi keratan rentas kuasa dua terkecil umum (GLS) telah digunakan untuk mengenalpasti bilangan faktor yang signifikan daripada faktor sepunya yang telah dikenalpasti menerusi kaedah PCA. Seterusnya, analisis korelasi berkanun (CCA) telah digunakan bagi memperolehi korelasi di antara komponen prinsipal (PC) skor pada bilangan faktor signifikan terhadap PC skor pembolehubah makroekonomi. Kaedah ini dapat mengenalpasti pembolehubah makroekonomi yang signifikan mempengaruhi pasaran saham sebelum dan selepas krisis kewangan Asia.

Berdasarkan kepada keputusan PCA, subtempoh 1 telah mencadangkan bahawa terdapat enam set faktor makroekonomi. Manakala, selepas krisis kewangan, terdapat lima set faktor makroekonomi. Bagi kedua-dua subtempoh, set faktor makroekonomi

telah difaktorkan daripada empat belas pembolehubah makroekonomi Malaysia. Manakala, PCA ke atas pasaran saham menunjukkan bahawa terdapat sepuluh, sebelas, dan dua belas bilangan faktor sepunya yang telah mempengaruhi ke atas aset pada subtempoh 1. Walau bagaimanapun pada subtempoh 2, PCA ke atas pulangan saham menunjukkan bahawa terdapat tujuh, lapan, sembilan dan sepuluh bilangan faktor sepunya yang mempengaruhi ke atas pulangan aset. Ujian regresi GLS telah menunjukkan sekurang-kurangnya satu hingga tiga bilangan faktor yang signifikan pada kedua-dua subtempoh. Manakala CCA pula telah mencadangkan bahawa pembolehubah makroekonomi dan pasaran saham di dalam subtempoh 1 adalah sangat signifikan berkorelasi pada PC skor pembolehubah makroekonomi; iaitu FECON1 (0.4470), FECON2 (0.3214) dan FECON3 (0.7791). Seterusnya, keputusan ini mencadangkan bahawa FECON1 mewakili kepada pembolehubah makroekonomi seperti kadar pertukaran matawang Amerika Syarikat, kadar pertukaran matawang Singapura serta bekalan wang (M2). Manakala, FECON2 mewakili pembolehubah makroekonomi seperti eksport, import, indeks pengeluaran perindustrian, dan keluaran dalam negara kasar. FECON3 mewakili pembolehubah makroekonomi seperti harga minyak (petroleum) dan kadar pertukaran matawang Jepun.

Pada subtempoh 2, CCA mencadangkan bahawa pembolehubah makroekonomi dan pasaran saham adalah sangat signifikan berkorelasi pada PC skor pembolehubah makroekonomi; iaitu FECON2 (0.6945) dan FECON5 (0.4433). Keputusan ini telah mencadangkan bahawa FECON2 mewakili kepada pembolehubah makroekonomi seperti kadar pertukaran matawang Jepun, kadar pertukaran matawang Singapura, pasaran wang, imbalan

perdagangan, dan harga minyak (petroleum). Manakala, FECON5 mewakili kepada pembolehubah makroekonomi iaitu indeks komposit Bursa Malaysia. Kesimpulan utama di dalam kajian empirik ini memberi gambaran bahawa pembolehubah makroekonomi Malaysia sangat signifikan mempengaruhi pulangan pasaran saham; dua PC skor pembolehubah makroekonomi iaitu FECON3 (0.7791) dan FECON2 (0.6945). Ia mewakili kepada harga minyak (petroleum) dan indeks harga pengguna sebelum krisis kewangan Asia. Manakala kadar pertukaran matawang Jepun, kadar matawang Singapura, imbangan perdagangan, dan harga minyak selepas krisis kewangan Asia.

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~ AL-FATIHAH ~

“He Who created Death and Life, that He may try which of you is best in deed; and He is the Exalted in Might, Oft-Forgiving”

Al-Mulk_s (67:2)

I certify that an Examination Committee met on **5 April 2006** to conduct the final examination of **Azhar bin Zakaria** on his **Master of Science** thesis entitled "**Determination of Arbitrage Pricing Factors in the Malaysian Stock Market**" in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The Committee recommends that the candidate be awarded the relevant degree. Members of the Examination Committee are as follows:

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DECLARATION

I hereby declare that the thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UPM or any other institutions.

AZHAR BIN ZAKARIA

Date:

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