

Arbitrage Detector Alert System

By

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CERTIFICATION OF APPROVAL

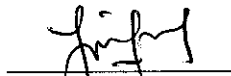
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A project dissertation submitted to the
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Universiti Teknologi PETRONAS
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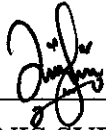


(Mr. Saipunidzam Mahamad)

UNIVERSITI TEKNOLOGI PETRONAS
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CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgements, and that the original work contained herein have not been undertaken or done by unspecified sources or persons.



(ANIS SURIA BINTI MOHD ZAINUDIN)

ABSTRACT

Arbitrage is a trading strategy based on the purchase of a commodity, including foreign exchange, in one market at one price while simultaneously selling it in another market at a more advantageous price, in order to obtain a risk-free profit on the price differential. The project main objective is to create a system to ease the arbitrageurs in order to detect arbitrage. Currently, the arbitrageurs have to detect a possible arbitrage manually by looking at the foreign exchange rates everyday. The system will read the latest foreign exchange rate everyday and inform or alert the arbitrageurs if it detects any possible arbitrage. The system also will be able to recognize the specific countries that have the possible arbitrage. A study was conducted for finding solution for the system, understanding foreign exchange rates and the regulations in buying and selling currencies, designing interface, and developing coding. The system was relied on exchange rates from several countries, a study to gather data from Internet and extract data from HTML source code also was done. In order to develop the system, the prototyping approach is used to ensure the system could be completed in limited time. The system was built from new solutions based from case study and literature search and integrated with solutions that built based on current system so it can be a complete arbitrage detector alert system. The project finally will help to link the arbitrageurs to the appropriate link to do the selling and buying of the currency. As for a conclusion, the system is being developed to help the arbitrageurs to detect any possible arbitrage in the markets.

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ABBREVIATIONS

1	U.S	United States
2	FOREX	Foreign Exchange
3	IT	Information Technology
4	UML	Unified Modeling Language
5	KLSE	Kuala Lumpur Stock Exchange
6	BMA	Bond Market Association
7	BIS	Bank for International Settlements
8	BNM	Bank Negara Malaysia

CHAPTER 1

INTRODUCTION

1.1 Background of Study

Arbitrage is a trading strategy and it happens when a same product has different price within different places or markets. As an example, a Big Mac in Japan cost ¥262, while the same Big Mac in the United States cost \$2.90. The actual exchange rate was ¥112.50/\$ at this time. The price of a Big Mac in Japan in terms of the U.S dollar was therefore $¥262 / (¥112.50/\$) = \$2.33/¥$ [1]. In this case, the Big Mac sold in Japan was cheaper compared to U.S even after converting the ¥ (Yen) to \$ (dollar). So, without taking consideration of transportation cost and taxes, if we buy Big Mac at Japan and sell them at U.S, we will gain profit of \$0.57 per Big Mac. The same concept implies in the FOREX arbitraging.

The main concern of the study is to develop a system for the arbitrageurs to detect the arbitrage without using the manual ways like what they were using right now. As an arbitrage detector alert system, it helps the arbitrageur to alert on any possible arbitrage by monitoring the current exchange rates on different markets. As for that, the system will be able to display the exchange rates from several countries such as Malaysia, Australia, Europe and etc. The exchange rates are taken from the Central Bank's websites for each country. The feature of the system also includes the link to buy and sell the foreign exchange (FOREX) currency on different countries.

The buying and selling process must be done through banks so the user for this system must have an account at those banks.

The study focused on designing a solution to suit with arbitrageurs' needs and to ease their current way of detecting an arbitrage. It also focused on programming and coding structure of the system. It focused on designing program flow of the system. A solution was designed based on case study or theory in order to find accurate requirements, which means only use and needed functions are included in. Besides the designing solution, part of the system was also build up based on integrating existing solutions or to be accurate existing calculation in the programming. System implementation relies so badly on the current currency exchange rate for several markets in the world. Therefore, the system can run smoothly with the latest market condition.

1.2 Problem Statement

By using traditional method, which is the non-computerized system, in arbitrage it is very tiring and taking quite a long time to spot any possible arbitrage. Without computerized system, human could do errors while analyzing all exchange rates markets. Thus, it will lead error in making a decision. Human may also make mistakes while in operations when they do not have systematic way in doing it.

Another problem to overcome is time consuming in business operation. Arbitrage happens in a very short period. So, once the arbitrageurs detected any possible arbitrage, they need to buy and sell them very quickly. That's when this system will become very handy to the arbitrageurs. Because by using a proper system, they can save a lot of time and gain profit with a low risk method.

1.3 Objectives and Scope of Study

1.3.1 Objectives

The objectives of this project are as follow:-

- To develop an arbitrage detector alert system
- To enable to calculate the inter market arbitrage
- To embed the current exchange rate currencies from several countries

1.3.2 Scope of Study

Focus on studying the use of mathematics formulas for arbitrage and HTML in developing the arbitrage detector system.

This includes:

- The design of the interface that is accessible for everyone
- The database to save the foreign exchange markets results
- The network to access the foreign exchange markets in the world
- The strong mathematics formula to detect arbitrage

The system is not a very complex system because it uses the basic calculation of cross rate in arbitraging. However, because there is no existing system to compare and enhanced, the system development became quite challenging.

1.4 Relevancy of Study

The study is match to Information Technology (IT) field because it concentrates with system development. The study will start with understanding the arbitrage processes and methods and find applicable requirements. Then, the study continues with analyzing requirements and designing the solution. Finally, the study is about doing the programming and coding. Therefore, the study is relevant to IT field particularly.

The study allows IT student to improve their programming skills in many different languages and also allows students to apply the real situation in developing software.

1.5 Feasibility Study

The project is scheduled to finish within one year. By using prototyping approach the goal may be accomplish since the system development could be incremental. The project cost is only cover the tool used during development and also supported software and database during run time. However, the cost could be reduced by using freeware for the tool used during development. The knowledge required to finish the project is programming knowledge in centralized application and also more knowledge in financial analysis and operations.

CHAPTER 2

LITERATURE REVIEW

2.0 Background

In economics and finance, arbitrage is the practice of taking advantage of a price differential between two or more markets: a combination of matching deals is struck that capitalize upon the imbalance, the profit being the difference between the market prices. When used by academics, an arbitrage is a transaction that involves no negative cash flow at any probabilistic or temporal state and a positive cash flow in at least one state; in simple terms, a risk-free profit [2].

A person who engages in arbitrage is called an arbitrageur. The term is mainly applied to trading in financial instruments, such as bonds, stocks, derivatives, commodities and currencies. If the market prices do not allow for profitable arbitrage, the prices are said to constitute an arbitrage equilibrium or arbitrage free market. Arbitrage equilibrium is a precondition for a general economic equilibrium. Statistical arbitrage is an imbalance in expected values.

2.1 Arbitrage

In order to develop a system on arbitrage, it is important to understand the fundamental of arbitraging. The fundamentals of arbitraging can be divided into conditions of arbitrage, example of arbitrage, and types of arbitrage.

2.1.1 Conditions of Arbitrage

Arbitrage is possible when one of three conditions is met:

- The same asset does not trade at the same price on all markets
- Two assets with identical cash flows do not trade at the same price
- An asset with a known price in the future does not today trade at its future price discounted at the risk-free interest rate (or the asset does not have negligible costs of storage; for example, this condition holds for grain but not for securities).

Arbitrage is not simply the act of buying a product in one market and selling it in another for a higher price at some later time. The transactions must occur simultaneously to avoid exposure to market risk, or the risk that prices may change on one market before both transactions are complete. In practical terms, this is generally only possible with securities and financial products which can be traded electronically.

In the simplest example, any good sold in one market should sell for the same price in another. Traders may for example, find that the price of wheat is lower in agricultural regions than in cities, purchase the good, and transport it to another region to sell at a higher price. This type of price arbitrage is the most common, but this simple example ignores the cost of transport, storage, risk, and other factors. “True” arbitrage requires that there be no market risk involved. Where securities are traded on more than one exchange, arbitrage occurs by simultaneously buying in one and selling on the other.

2.1.2 Example of Arbitrage

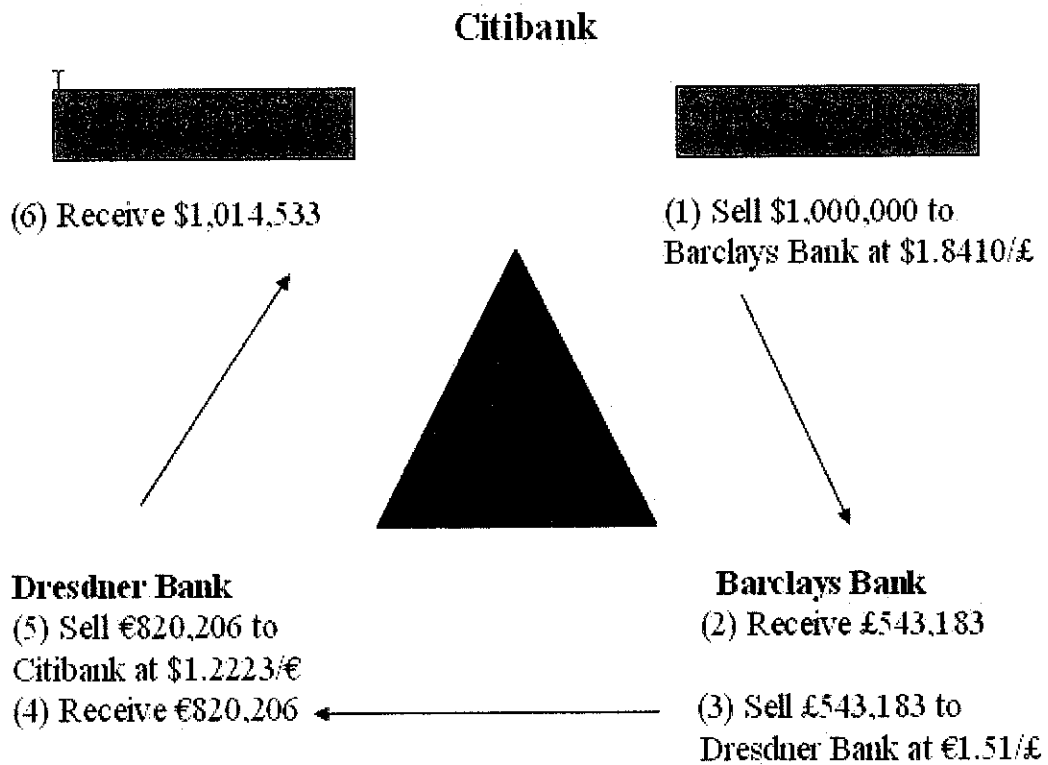


Figure 2.1: Triangular Arbitrage

Cross rates can be used to check on opportunities for inter market arbitrage. Suppose the following exchange rates are quoted:

Citibank quotes U.S dollars per euro:	\$1.2223/€
Barclays Bank quotes U.S dollars per pound sterling:	\$1.8410/£
Dresdner Bank quotes euros per pound sterling:	€1.5100/£

The cross rate between Citibank and Barclays is

$$\frac{\$1.8410/\text{£}}{\$1.2223/\text{€}} = \text{€}1.5062/\text{£}$$

This cross rate is not the same as Dresdner's quotation of €1.5100/£, so an opportunity exists to profit from arbitrage between the three markets [1]. Figure 2.1.2 shows the steps in what is called *triangular arbitrage*.

2.1.3 Types of Arbitrage

- Merger arbitrage

Also called risk arbitrage, merger arbitrage generally consists of buying the stock of a company that is the target of a takeover while shorting the stock of the acquiring company. Usually the market price of the target company is less than the price offered by the acquiring company. The spread between these two prices depends mainly on the probability and the timing of the takeover being completed as well as the prevailing level of interest rates. The bet in a merger arbitrage is that such a spread will eventually be zero, if and when the takeover is completed. The risk is that the deal “breaks” and the spread massively widens [2].

- Municipal bond arbitrage

Also called municipal bond relative value arbitrage, municipal arbitrage, or just muniarb, this hedge fund strategy involves one of two approaches. Generally, managers seek relative value opportunities by being both long and short municipal bonds with a duration-neutral book. The relative value trades may be between different issuers, different bonds issued by the same entity or capital structure trades referencing the same asset (in the case of revenue bonds). Managers aim to capture the inefficiencies arising from the heavy participation of non-economic investors (i.e. high income “buy and hold” investors seeking tax-exempt income) as well as the “crossover buying” arising from corporations’ or individuals’ changing income tax situations (i.e., insurers switching their munis for corporates after a large loss as they can capture a higher after-tax yield by offsetting the taxable corporate income with underwriting losses). There are additional inefficiencies arising from the highly fragmented nature of the municipal bond market which has two million outstanding issues and 50,000 issuers in contrast to the Treasury market which has 400 issues and a single issuer. Second, managers construct leveraged portfolios of AAA- or AA-rated tax-exempt municipal bonds with the duration risk hedged by shorting the appropriate ratio of taxable corporate bonds. These corporate equivalents are typically interest rate swaps referencing Libor or BMA

(short for Bond Market Association). The arbitrage manifests itself in the form of a relatively cheap longer maturity municipal bond, which is a municipal bond that yields significantly more than 65% of a corresponding taxable corporate bond. The steeper slope of the municipal yield curve allows participants to collect more after-tax income from the municipal bond portfolio than is spent on the interest rate swap; the carry is greater than the hedge expense. Positive, tax-free carry from muni arb can reach into the double digits. The bet in this municipal bond arbitrage is that, over a longer period of time, two similar instruments--municipal bonds and interest rate swaps--will correlate with each other; they are both very high quality credits, have the same maturity and are denominated in U.S. dollars. Credit risk and duration risk are largely eliminated in this strategy. However, basis risk arises from use of an imperfect hedge, which results in significant, but range-bound principal volatility. The end goal is to limit this principal volatility, eliminating its relevance over time as the high, consistent, tax-free cash flow accumulates. Since the inefficiency is related to government tax policy, and hence is structural in nature, it has not been arbitrated away [2].

- Convertible bond arbitrage

A convertible bond is a bond that an investor can return to the issuing company in exchange for a predetermined number of shares in the company. A convertible bond can be thought of as a corporate bond with a stock call option attached to it. The price of a convertible bond is sensitive to three major factors:

- Interest rate - When rates move higher, the bond part of a convertible bond tends to move lower, but the call option part of a convertible bond moves higher (and the aggregate tends to move lower).
- Stock price - When the price of the stock the bond is convertible into moves higher, the price of the bond tends to rise.
- Credit spread - If the creditworthiness of the issuer deteriorates (e.g. rating downgrade) and its credit spread widens, the bond price tends to move lower, but, in many cases, the call option part of the convertible bond moves higher (since credit spread correlates with volatility).

Given the complexity of the calculations involved and the convoluted structure that a convertible bond can have, an arbitrageur often relies on sophisticated quantitative models in order to identify bonds that are trading cheap versus their theoretical value. Convertible arbitrage consists of buying a convertible bond and hedging two of the three factors in order to gain exposure to the third factor at a very attractive price [2].

For instance an arbitrageur would first buy a convertible bond, then sell fixed income securities or interest rate futures (to hedge the interest rate exposure) and buy some credit protection (to hedge the risk of credit deterioration). Eventually what he'd be left with is something similar to a call option on the underlying stock, acquired at a very low price. He could then make money either selling some of the more expensive options that are openly traded in the market or delta hedging his exposure to the underlying shares.

CHAPTER 3

METHODOLOGY

3.1 Project Phase

In order to develop the system within the set time, the fast approach needs to be carried out. There are many examples of current software development models, but approaches that suitable for finishing a system within a limited time would be spiral model, prototyping model, reuse model, exploratory model and others. Actually, this is a number of process models that have evolved from the iterative approach [3].

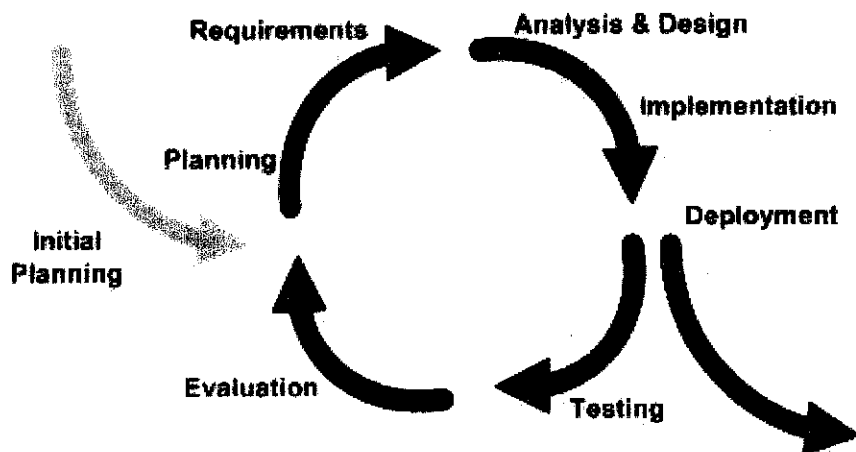


Figure 3.1: Iterative and incremental development

Iterative and Incremental development is the best method to be used in the development of this system. It is a cyclical software development process developed in response to the weaknesses of the waterfall model. It is an essential part of the Rational Unified Process, the Dynamic Systems Development Method, Extreme Programming and generally the agile software development frameworks. [4]

The phases that were going through along this system development:-

- Initial Planning/Planning

In this phase, a lot of observation was been done to figure the possible system that can be developing to help to ease the expected user. For example, this system was inspired from the arbitrageurs and how to help to ease them to gain as much profit as possible.

- Requirements

In this phase, the system functional and non-functional requirements were collected from many different sources. The collection of requirements could be done by interviewing and research from written references. It also done by studying on existing non-computerized system and understand some usual operations in arbitrage.

In order to gather the requirements of the system, there are interviews with two parties which is representative from a financial organization and also a lecturer in finance field. The interview with the financial organization is mainly to understand the process of buying and selling the foreign currency. The interview with the lecturer is mainly to understand the arbitrage itself.

- Analysis and Design

After the initial layer of requirements information is collected, or new information is gathered, it is rapidly integrated into a new or existing design so that it may be folded into the prototype. In this phase, the system data flow will be recognized by identifying its input, process and output. Interface and database design will also be involved.

The design then is discussed with the supervisor in order to gain approval and to enhance the design specifications. The system is design by using Unified Modeling Language (UML). See Appendix B to see the system use case diagram.

- Implementation

This can be consider as testing phase also because in this phase, the prototype will be tested to the expected user and if the important requirements is not achieved, redesign must be done. But if the system manages to fulfill the requirements, the testing phase will be done after that.

- Testing

The difference between testing in the implementation phase and testing phase is the user acceptance test is being used in the testing phase. The user will have to fill the user acceptance test form, and acknowledge the system is ready to be used.

- Evaluation

In this final phase, the prototype will be presented and being evaluated by internal and external evaluator. The final delivery will be on the Part B FYP presentation.

The system is not exactly following the structure and rules in iterative and incremental development. Some features need to be adjusted to suit in the environment. The system was assigned to be completely finished within one year or two semesters time period. For the first semester, the requirements need to be defined, system needs to be designed and first prototype would be developed. In second semester, it is all about prototype refinement until the prototype become as a complete system for final presentation. See Appendix A for complete Gantt chart.

3.2 Tools and Equipments

3.2.1 System Requirements

Table 3.1: List of System Requirements

Device/Software/Tools	Requirements
Operating System	Windows XP Pro Service Pack 2
Processor	Intel Pentium D, 2.80 GHz
Disk Space	20 GB
Memory	512 MB of RAM
Peripherals	Mouse, Keyboard, Printer
Network	Fast Ethernet Adapter
Database	Microsoft Access

3.2.2 Software and Tools for Development

Table 3.2: List of Software and Tools for Development

Software/Tools	Description
Adobe Photoshop	Tools to be used for developing system interface
Dreamweaver MX	Tools to be used for interface design and programming codes
Microsoft Access	Software that creates and provides database for the system

CHAPTER 4

RESULT AND DISCUSSION

4.1 System Development

4.1.1 Online data source

Arbitrage Detector Alert System depends crucially on the latest exchange rate currency from several countries around the world. For that, the system must have connection with the internet and be able to retrieve information from them. There is one website that listed the entire link to the Central Banks' website around the world; <http://www.bis.org/cbanks.htm>. The website was called the Bank for International Settlements (BIS). The BIS is an international organization which fosters international monetary and financial cooperation and serves as a bank for central banks.

The BIS fulfils this mandate by acting as a forum to promote discussion and policy analysis among central banks and within the international financial community. Also it is a centre for economic and monetary research and a prime counterparty for central banks in their financial transactions. BIS also is an agent or trustee in connection with international financial operations.

The head office is in Basel, Switzerland and there are two representative offices: in the Hong Kong Special Administrative Region of the People's Republic of China and in Mexico City. Established on 17 May 1930, the BIS is the world's oldest international financial organization. [6]

4.1.2 Functionality

The other crucial parts or function in the system is to ease the buy and sell currency process. The process must be done simultaneously and in very short period. This is when the service from Citibank became handy to compliment Arbitrage Detector Alert System. This is because Citibank allows their customer to buy or sell foreign currency 24 hours despite the time zone the user's in. So as soon as the system finds a possible arbitrage, the user can do the transaction using Citibank account.

However, there is another issue that must be taken into consideration. Since the recession on 1998, Malaysian government had changed their regulation on foreign exchange currency. All the foreign exchange currency transaction must be under the control of Bank Negara Malaysia. This means that even though we are using the commercial bank service to do the transaction, the commercial banks must inform the transaction to BNM. Also, there are limited amount of currencies to be change at one time.

4.2 System Modeling

4.2.1 Use-Case Diagram

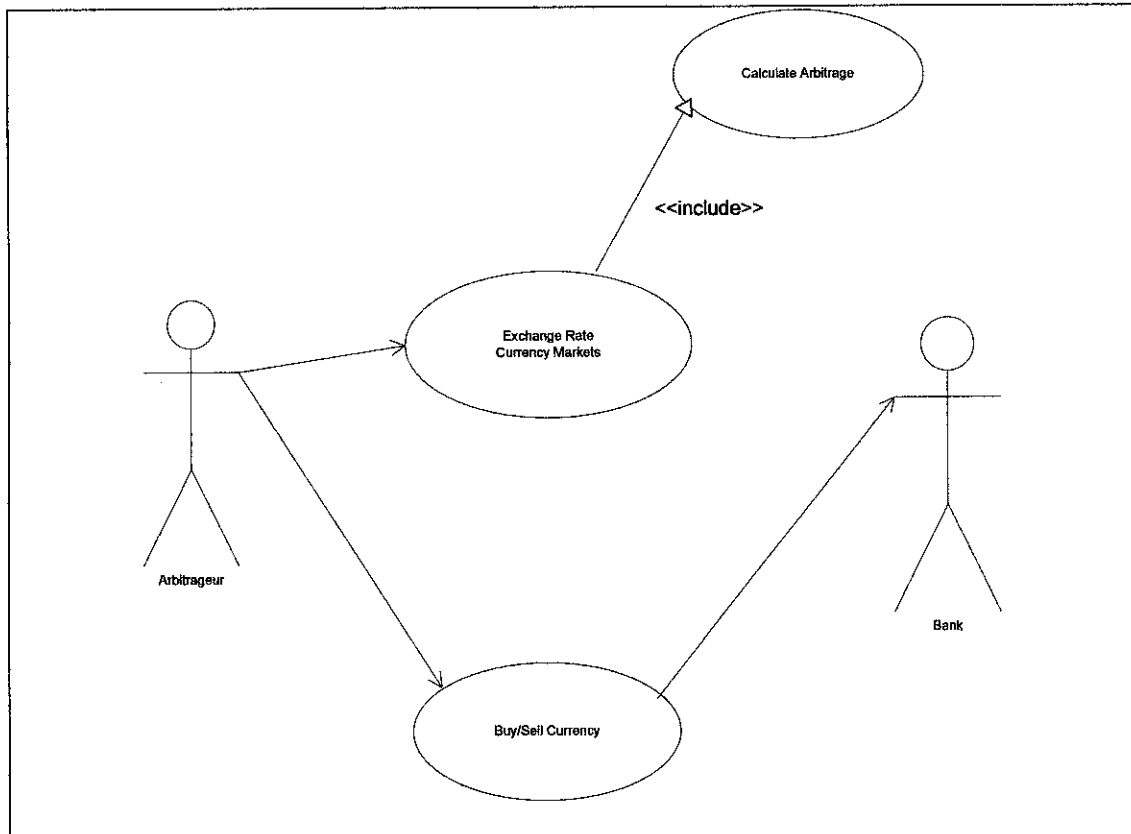


Figure 4.1: Use Case Diagram of Arbitrage Detector Alert System

Use-cases are a scenario-based technique for requirements elicitation which were first introduced in the Objectory method [7]. The system has 3 use cases; exchange rate currency markets case, buy/sell currency case, and calculate arbitrage case. It also has two actors; arbitrageur and bank.

The system will work exactly like the use-cases. The arbitrageur or the expected user for the system will run the system by getting exchange rates from 5 different markets. Then, the rates will be saved in the database and the system will calculate the rates by getting data from the database. If the arbitrageur finds a possible arbitrage in the calculation, they will continue to the next use case.

The buy/sell currency use case will allow the system to the related banks' online website. As for this system, it takes Citibank online website as the medium transaction.

4.2.2 Class Diagram

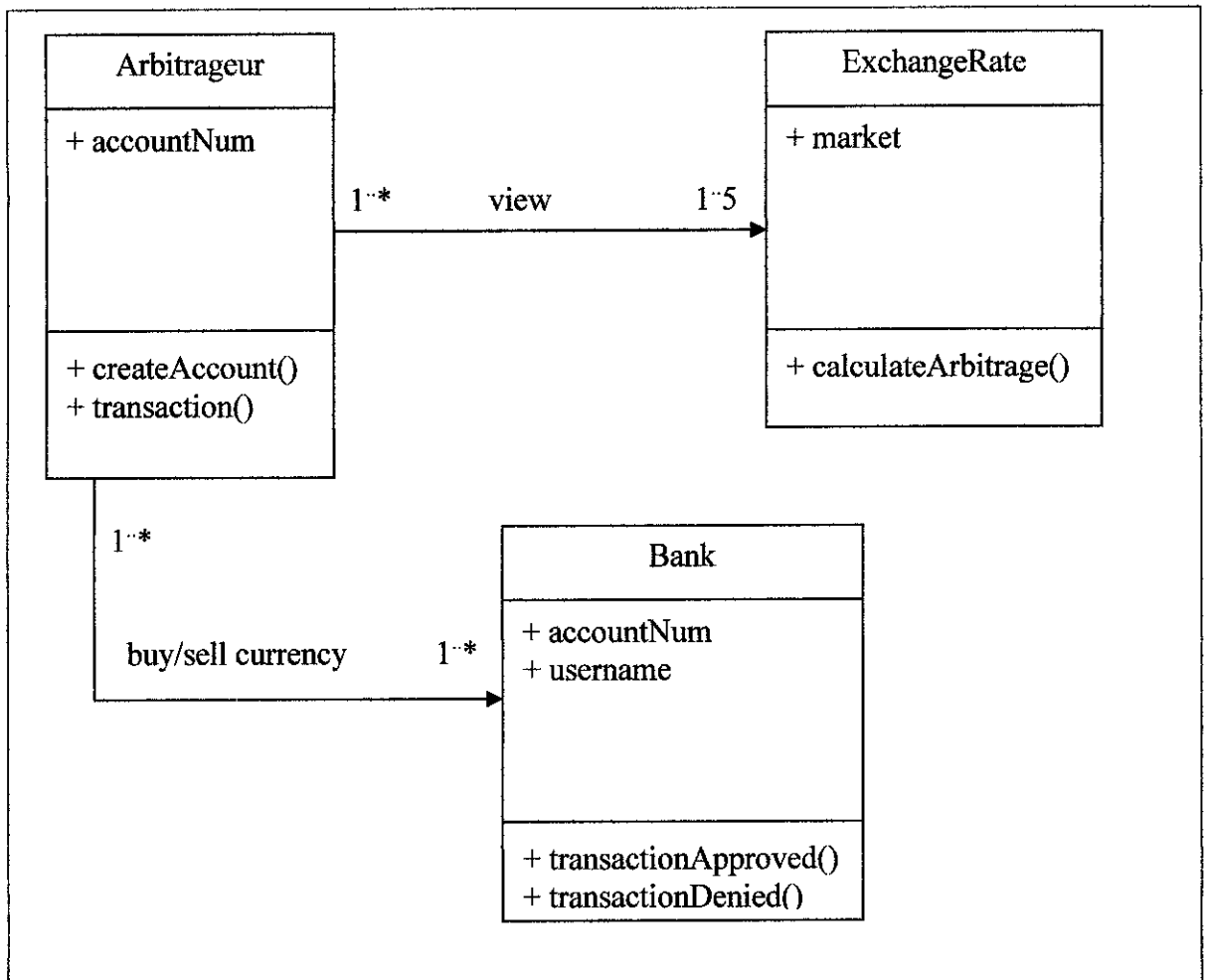


Figure 4.2: Class Diagram of Arbitrage Detector Alert System

Arbitrage Detector Alert System only has 3 classes; Arbitrageur class, ExchangeRate class, and Bank class. The arbitrageur will view the exchange rate board through the ExchangeRate class. The class also will calculate the arbitrage using the data captured and saved in the class. If the arbitrageur wishes to buy or sell the currency, the Bank class will do the transaction.

In the Arbitrageur class, there will be only one attribute which is the account number in the Citibank but it has 2 functions, createAccount() and transaction(). In ExchangeRate class there is also one attribute, market and one function calculateArbitrage(). The last class is the Bank class. It has 2 attributes which are the accountNum and username and 2 functions; transactionApproved() and transactionDenied().

4.3 User Interface Design

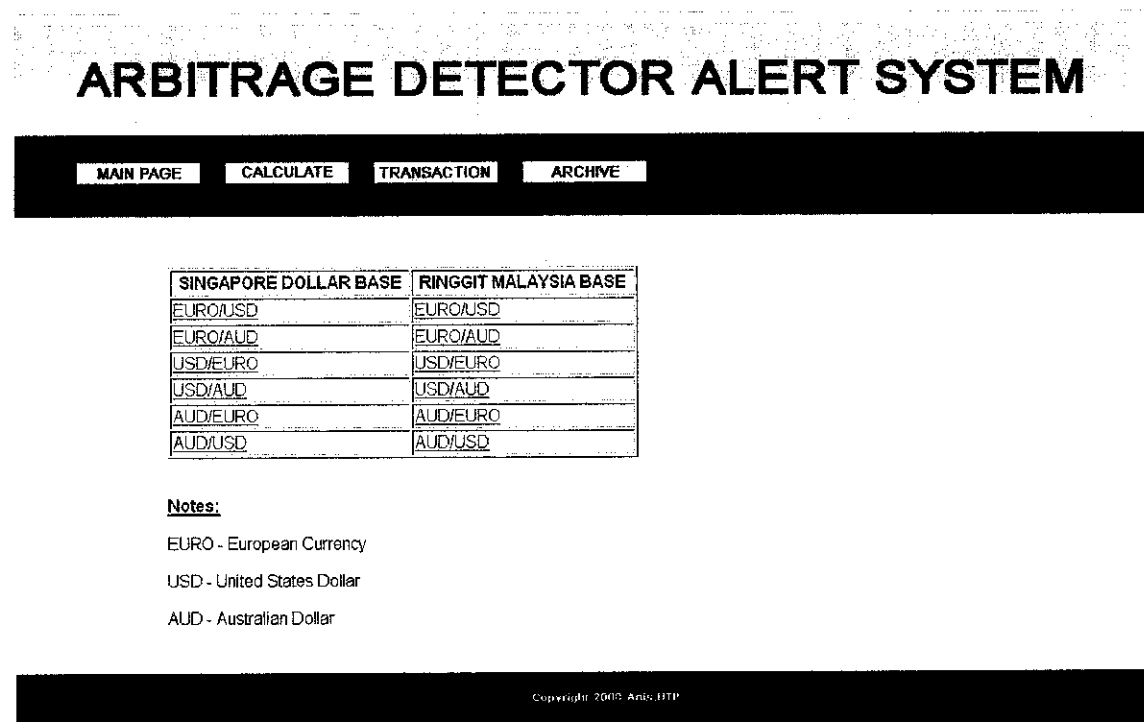


Figure 4.3: Screen shot of the Calculate Page

The Calculate Page consists of a list of tables for all the calculated currencies that taken from the 5 markets. The system divided the table into two columns; Singapore Dollar base and Ringgit Malaysia base because those two markets were not taking their own currency as a base at their own exchange rate markets.

Once the user clicks the link, the system will be directed into Microsoft Excel worksheet. In the Excel worksheet, one of the columns will write 'TRUE' or 'FALSE'. If the system finds that there is a possible arbitrage, the column will write 'TRUE' and vice versa.

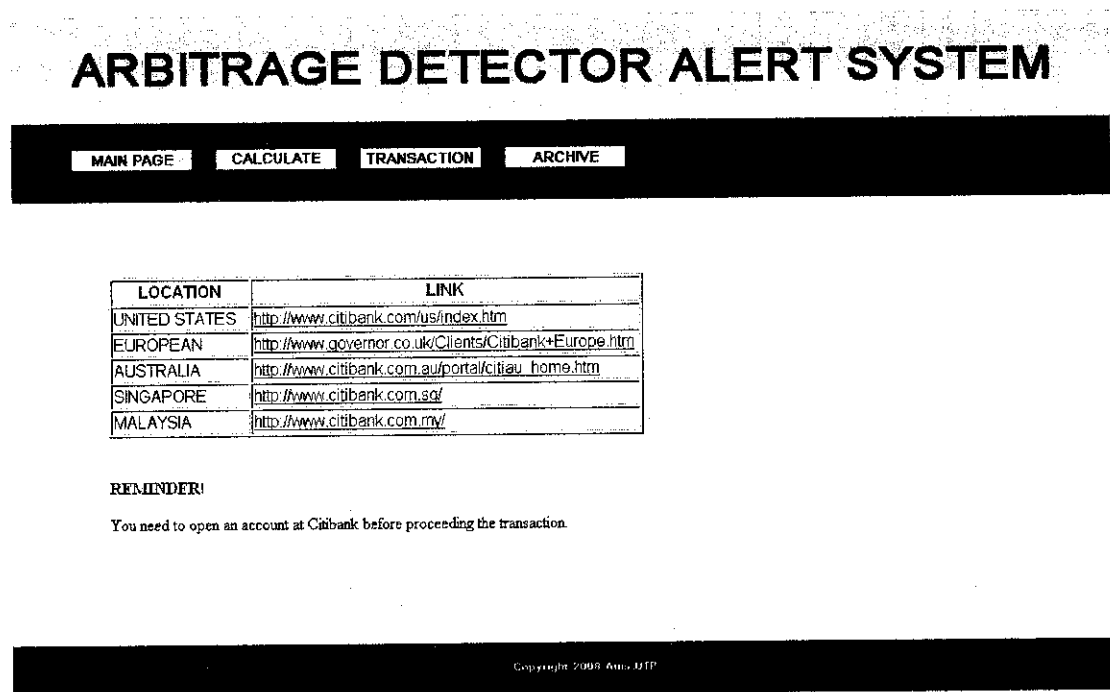


Figure 4.4: Screen shot of the Transaction page

The Transaction page displays the link to be directed to the related bank, which in this case the Citibank online website for each country. In the Citibank websites, the transaction can be made but first of all the user must have an account in the Citibank. The transaction can be made 24 hour per day regardless of time zone.

ARBITRAGE DETECTOR ALERT SYSTEM

MAIN PAGE

CALCULATE

TRANSACTION

ARCHIVE

BANKS	YEAR
MALAYSIA	2008
SINGAPORE	2008
AUSTRALIA	2008
UNITED STATES	2008
EUROPEAN	2008

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Figure 4.5: Screen shot of the Archive page

The Archive page will display a table that listed the banks exchange rates history and the year the data were taken. For the moment, there is only one year inserted, which is year 2008. As the user clicks on the banks' name, the system will direct the user to the database in Excel worksheet format. The user may choose to save or open to view only the databases.

The sequences for the system are as bellow:

- The arbitrageur opens the system and the system will view the main page.
- The arbitrageur clicks "Calculate" and the system will view a table with 2 columns. One column is for the rate by taking Singapore dollar as base and the other column is Ringgit Malaysia as the base.
- The arbitrageur clicks "Transaction" button and the system will directed the arbitrageur to the bank's website to do the transaction.
- The arbitrageur clicks the "Archive" and the system will connect to database and display the database in Microsoft Excel worksheet.

4.4 Discussion

Arbitrage Detector Alert System may look very simple and easy system. However, there was no serious effort from any developers to develop this kind of system. It's all because not many people are aware of what arbitrage is and how to gain benefit from it. Lack of awareness on arbitrage may cause by lack of source of information in finance. Even if some people may have heard and know what is arbitrage, not all will take the advantages because they thought arbitrage is too good to be truth.

Plus, because people thought that the difference time zone will be a disadvantage for arbitrage because once the East market opens their exchange rate market, the West market had already closed theirs. But the solution solves by the service offered by Citibank that operates 24 hours per day and using the rates from their own branch.

The service is called World Wallet Services and it's a service that delivers foreign currency to the customer's home, office, or nearest Citibank Financial Center. The customers order or exchange rate money will be debited from the customer's Citibank checking, savings or money market account. The customers also may exchange unused foreign banknotes at Citibank Financial Center. All the delivery is free to the Citibank Financial Center. However delivery to the customer's home or office will be charged \$5(waived for CitiGold clients).[8]

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

To meet all the objectives of this system enhancement, a lot of effort must be put on. During the beginning phase, most of the activities are focus on understanding what arbitrage is, how arbitrage occurs and most important thing the calculation to detect arbitrage from the real life foreign exchange market board. The purpose of this system is to help the arbitrageurs to gain profit from the possible arbitrage because arbitrage occurs not very often and it happens in a very short period.

There are many types of arbitrage profit, but the study only focus on the arbitrage that gains by reading the differences from 2 or more foreign exchange currency markets. However, to be able to read the difference on the market, a very strong mathematical calculation is needed and also a fast internet connection. That is the reason the Iterative and Incremental method was chosen in developing this system because there will be some adjustment to be done along the development of the system.

5.2 Recommendation

The system still can be improved to be a better system. The system can be enhance by extracting the data or exchange rates from the website of Central Banks and automatically the rates been saved in the database. It can ease more the user of the system because they don't need to key in the rate in the database manually everyday. However, as for a start this system should be able to ease a little bit the process in calculating arbitrage.

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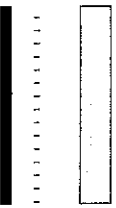
APPENDIX A:

Gantt Chart

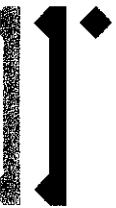
ID	Task Name	Duration	Start	Finish	July	Augu	Sept	Octo	Nov	Dece	Janu	Febr	Marc	April	May	June
1	Proposal submission and approval	6 days?	Fri 8/3/07	Fri 8/10/07												
2	Planning/Requirement Definition Phase	11 days?	Sat 8/11/07	Fri 8/24/07												
3	Redefine topic	6 days?	Sat 8/11/07	Fri 8/17/07												
4	Data Gathering Process	10 days?	Sat 8/11/07	Thu 8/23/07												
5	Preliminary Report Submission	1 day?	Fri 8/24/07	Fri 8/24/07												
6	Analysis and Design Phase	56 days?	Sat 8/25/07	Tue 11/6/07												
7	Define system requirements	2 days?	Sat 8/25/07	Sun 8/26/07												
8	Define user requirements	2 days?	Mon 8/27/07	Tue 8/28/07												
9	Project architecture design	2 days?	Wed 8/29/07	Thu 8/30/07												
10	Selecting on Tools and Equipment	1 day?	Fri 8/31/07	Fri 8/31/07												
11	System flow design	2 days?	Sun 9/2/07	Mon 9/3/07												
12	Interface design	2 days?	Mon 9/3/07	Tue 9/4/07												
13	Database structure design	2 days?	Mon 9/3/07	Tue 9/4/07												
14	Seminar 1: Preliminary Reporting	1 day?	Wed 9/5/07	Wed 9/5/07												
15	Progress Report Submission	1 day?	Thu 9/27/07	Thu 9/27/07												
16	Seminar 2: Progress Reporting	1 day?	Thu 10/4/07	Thu 10/4/07												
17	Interim Report Submission	1 day?	Fri 10/19/07	Fri 10/19/07												
18	Oral Presentation 1	2 days?	Mon 11/5/07	Tue 11/6/07												
19	Implementation	11 days?	Wed 3/19/08	Wed 4/2/08												
20	Progress Report submission	1 day?	Wed 3/19/08	Wed 3/19/08												
21	Pre EDX	1 day?	Wed 4/2/08	Wed 4/2/08												
22	Testing and Evaluation	31 days?	Fri 4/4/08	Fri 5/16/08												
23	FYP website submission	1 day?	Fri 4/4/08	Fri 4/4/08												
24	Oral Presentation 2	5 days?	Mon 4/21/08	Fri 4/25/08												
25	Dissertation submission	1 day?	Fri 5/16/08	Fri 5/16/08												

Project: gant chart
Date: Thu 5/8/08

Task
Split
Dwimace



Milestone
Summary
Product Summary



External Tasks
External Milestone
Deadline

APPENDIX B:

User Manual

Arbitrage Detector Alert System User Manual

Open the System

- (1) Open any internet browser (Mozilla Firefox, Internet Explorer)
- (2) Open file “index.html”

ARBITRAGE DETECTOR ALERT SYSTEM

MAIN PAGE

CALCULATE

TRANSACTION

ARCHIVE

Welcome to Arbitrage Detector Alert System!

This system is created to help arbitrageurs calculate and find the possible arbitrage in exchange rate market.

However, this system only calculate from 5 different markets; Malaysia, Singapore, Australia, United States and European.

Hope this system will satisfy some of your needs.

Copyright 2008 Agus HTP

- (3) This page displays the introduction of the system.

Operation Module

To calculate arbitrage

(1) Click 'CALCULATE' button

ARBITRAGE DETECTOR ALERT SYSTEM

MAIN PAGE

CALCULATE

TRANSACTION

ARCHIVE

SINGAPORE DOLLAR BASE	RINGGIT MALAYSIA BASE
EURO/USD	EURO/USD
EURO/AUD	EURO/AUD
USD/EURO	USD/EURO
USD/AUD	USD/AUD
AUD/EURO	AUD/EURO
AUD/USD	AUD/USD

Notes:

EURO - European Currency

USD - United States Dollar

AUD - Australian Dollar

Copyright 2008 Anas JTF

(2) Click any of the links in the table.

F1	A	B	C	D	E	F
	DATE	European Rate from Bank Negera Malaysia	Ringgit Malaysia from Reserve Bank of Australia	Australian Dollar from European Central Bank	AD/EURO	IF(D>E)=F
1	2/19/2008	4.7449	2.9612	1.5984	1.602357153	FALSE
2	2/20/2008	4.7464	2.9490	1.6031	1.609494744	FALSE
3	2/23/2008	4.8579	3.0147	1.6226	1.61140412	TRUE
4	3/4/2008	4.6372	2.9584	1.6304	1.635073012	FALSE
5	3/10/2008	4.9936	2.9296	1.6974	1.704533042	FALSE
6	3/19/2008	5.0145	2.9542	1.6841	1.697413851	FALSE
7	3/25/2008	4.9677	2.9180	1.7036	1.702433173	TRUE
8	3/28/2008	5.0358	2.9580	1.7171	1.702434077	TRUE
9	3/31/2008	5.0532	2.9266	1.7334	1.726645254	TRUE
10	4/1/2008	5.0008	2.8938	1.7215	1.72810837	FALSE
11	4/3/2008	4.9740	2.9146	1.7065	1.706580663	FALSE
12	4/4/2008	5.0178	2.9106	1.7110	1.723974438	FALSE
13	4/8/2008	5.0243	2.9564	1.6968	1.699465566	FALSE

(3) Look at the table F in the Excel worksheet. If TRUE means there is a possible arbitrage detected. If FALSE means no arbitrage possibility for the rate.

(4) You can go back to 'CALCULATE' page by clicking the close button.

To do a transaction

(1) Click 'TRANSACTION' button

ARBITRAGE DETECTOR ALERT SYSTEM

MAIN PAGE

CALCULATE

TRANSACTION

ARCHIVE

LOCATION	LINK
UNITED STATES	http://www.citibank.com/us/index.htm
EUROPEAN	http://www.governor.co.uk/Clients/Citibank+Europe.htm
AUSTRALIA	http://www.citibank.com.au/portal/citibank_home.htm
SINGAPORE	http://www.citibank.com.sg/
MALAYSIA	http://www.citibank.com.my/

REMINDER!

You need to open an account at Citibank before proceeding the transaction.

Copyright 2003 Citicorp

(2) Choose the banks that included in the possible arbitrage. For example, from the above Excel worksheet, the banks related are Bank Negara Malaysia, Bank of Australia and European Central Bank. So, click the 3 links from Malaysia, Australia and European.

The screenshot shows the Citibank website interface. At the top, there is a navigation bar with links for 'Open an Account', 'Find Citi Locations', 'Search', 'Help', 'Contact Us', 'Security', 'Privacy', and 'Citi.com'. Below this, there are links for 'Banking', 'Credit Cards', 'Lines & Loans', 'Investing', 'Planning', 'Sign on', and 'My Citi'. A 'Citi en español' link is also visible. On the left side, there are two dropdown menus for signing on to an account and applying for a new account. The main content area features a large banner with the text 'Put your money to work. Prepare for takeoff.' and an image of an airplane. Below the banner, there are several promotional offers: '20,000 Bonus Points, enough for a round trip ticket up to \$400.', 'Save over \$1,000 with no lender fees. Apply at CitiMortgage now.', and 'More from Citi' with a link to corporate and small business services. At the bottom, there is a 'New & Noteworthy' section with an information icon and a 'Welcome to Citibank' message. On the right, there is an 'IN FOCUS: Citibank en Español' section with a photo of a woman.

(3) You will be connected to the Citibank online website.

Archive

(1) Click 'ARCHIVE' button

ARBITRAGE DETECTOR ALERT SYSTEM



BANKS	YEAR
MALAYSIA	2008
SINGAPORE	2008
AUSTRALIA	2008
UNITED STATES	2008
EUROPEAN	2008



(2) Click any banks from the table to view the archive of exchange rates.

1	A	B	C	D	E	F	G	H	I	J	K	L
DATE	Australian	Brunei dollar	Canadian dollar	Cambodian riel	Chinese renminbi (yuan)	European	Hong Kong dollar	Indonesian rupiah	Japanese yen	Korean won	Philippine	
2/14/2008	2.9236	2.2837	3.2465	0.0825	0.4501	4.7325	41.4709	0.0351	2.9878	0.3422	7.6874	
2/19/2008	2.9634	2.2827	3.2043	0.0811	0.4505	4.7449	41.3165	0.0352	2.9885	0.3414	7.9326	
2/20/2008	2.9578	2.2804	3.1795	0.0819	0.4513	4.7464	41.3340	0.0351	2.9987	0.3408	7.9102	
2/23/2008	3.0146	2.2923	3.2680	0.0813	0.4495	4.8579	41.0413	0.0352	3.0579	0.3401	7.9860	
3/4/2008	2.9714	2.2894	3.2087	0.0802	0.4482	4.8372	40.9157	0.0351	3.0813	0.3382	7.8410	
3/17/2008	2.9721	2.3058	3.1995	0.0811	0.4479	5.0121	40.8616	0.0344	3.2648	0.3122	7.6772	
3/18/2008	2.9323	2.2970	3.1746	0.0797	0.4472	4.9936	40.7626	0.0345	3.2436	0.3119	7.6372	
3/19/2008	2.9669	2.3067	3.2120	0.0801	0.4504	5.0145	40.9207	0.0346	3.2446	0.3152	7.6423	
3/21/2008	2.8725	2.2942	3.1030	0.0812	0.4508	4.9204	40.8948	0.0346	3.1927	0.3171	7.6411	
3/24/2008	2.9019	2.3021	3.1159	0.0807	0.4547	4.9349	41.2107	0.0349	3.2067	0.3216	7.7017	
3/25/2008	2.9187	2.3130	3.1459	0.0813	0.4534	4.9677	41.0867	0.0348	3.1778	0.3269	7.6981	
3/27/2008	2.9358	2.3086	3.1409	0.0804	0.4546	5.0550	41.0500	0.0347	3.2318	0.3207	7.6779	
3/28/2008	2.9426	2.3152	3.1388	0.0820	0.4557	5.0358	41.0640	0.0347	3.1949	0.3220	7.6484	
3/31/2008	2.9229	2.3150	3.1299	0.0809	0.4556	5.0532	41.0426	0.0347	3.2153	0.3223	7.6619	
4/1/2008	2.9026	2.3118	3.1067	0.0827	0.4549	5.0008	40.9568	0.0346	3.1849	0.3240	7.6600	
4/3/2008	2.9216	2.3055	3.1469	0.0803	0.4548	4.9740	40.9415	0.0347	3.1037	0.3267	7.6664	
4/4/2008	2.9264	2.3068	3.1729	0.0817	0.4550	5.0178	40.9884	0.0347	3.1183	0.3277	7.6534	
4/8/2008	2.9567	2.3095	3.1454	0.0810	0.4555	5.0243	40.9334	0.0347	3.1242	0.3266	7.6328	

(3) The Excel worksheet will display all the rates from the respective banks.