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THE ECONOMIC CONSEQUENCES OF THE INTEREST-FREE ISLAMIC BANKING SYSTEMS

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ABSTRACT

The Economic Consequences of the
Interest-Free Banking Systems

by

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To ensure full compliance with the teachings of Islam, which forbid interest charges on loans, several Islamic nations have modified their financial systems by eliminating all interest paying assets and establishing new banking institutions called interest-free banking systems. This study addresses questions concerning the economic consequences of interest free banking systems. The objectives are threefold: 1) To analyze the impact of interest-free banking on risk-taking and the savings behavior of households at the micro level, 2) to analyze the impact of interest-free banking on the rate of aggregate investment and the level of output at the macro level, and 3) to study the conduct of monetary and fiscal policies in an Islamic economy and compare their effectiveness in Islamic and regular economies.

The analysis begins at the micro level. To understand the reaction of households to the elimination of interest charges a two-period, two-person, two-commodity general equilibrium model is developed. Utility maximizing

households must allocate their resources between consumption and an investment portfolio which consists of a risky and a riskless asset. The risky asset is a loan issued by the less risk-averse household to the other one. Starting from an economy with no interest charges (zero nominal interest rates,) and allowing the interest rate to increase slightly, we observe that moving away from the zero interest rate will increase net savings and improve the allocation of risk. The net welfare effects, however, are not determined.

The macro-economic analysis is based on a static macro model with one commodity market and three asset markets for savings deposits, money and equities. Using the method of comparative statics, we observe that elimination of interest charges on savings deposits will reduce the demand for equities and lead to a reduction in the rate of private investment. We expect this effect to be reinforced when interest payment on private loans are reduced to zero. The suppression of interest on government bonds, however, could have an opposite effect. At zero interest, many people might abandon the government bonds and switch to equity stocks. The increased demand for equity will increase equity prices and encourage more investment.

A similar macro-economic model is used to study the monetary and fiscal policy options available to the government in an Islamic economic system. Since bonds are eliminated, the open-market operations in the bond market (which are used in the Western economies) are replaced with

open-market operations in equity markets. The other policy options considered are variations in government deficit and money supply. Using comparative static methods, we observe that the policy multipliers for these three options have the expected signs. An open-market purchase and an increase in money supply are both expansionary; while an increase in government deficit has an indeterminate effect.

To compare the effects of these policies in Islamic and regular economies, we develop a macro model for the regular economy by adding a market for government bonds to the original model of Islamic economy. Then we derive the policy multipliers of the three policy tools that were mentioned above. Comparing the corresponding multipliers for Islamic and regular economies, we observe that these policies are more effective and less indeterminate under Islamic regime. The higher level of uncertainty under regular regime is attributed to a possible negative feedback from the bond market to the equity and money markets. Such a feedback will no longer exist in an Islamic economy.

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Chapter 1

INTRODUCTION TO THE FINANCIAL INSTITUTIONS OF ISLAM

In 1981, the government of Pakistan modified the entire banking system of that nation to make it compatible with the laws of Islam which forbid any loan transactions on the basis of interest charge. In 1983, the new revolutionary government of Iran undertook similar measures to establish an "interest-free banking system." At the same time in every other Islamic nation (which still tolerates a regular banking system that allows loan transactions on the basis of interest charge), independent interest-free banks are in operation. These banks have had to compete against regular commercial banks; and surprisingly, they have been able to attract a significant number of depositors. A large number of these depositors are devout Muslims who, for religious reasons, prefer to conduct financial transactions with the Islamic banks because these banks do not pay or receive any interest. There are also other depositors who are attracted by the high profit rate that Islamic banks have been able to offer.[1]

The introduction of Islamic banking at the national level could have some serious consequences for the economic performance of these nations . Empirical research has shown that the level of private savings in developing nations is sensitive to the degree of financial development. As will

be demonstrated later, Islamic opposition to interest charges will lead to the elimination of every kind of debt instrument. To the extent that a large number of people put their savings in various forms of interest-paying assets, their intertemporal and portfolio allocations will be affected. In the aggregate, the level of domestic savings and investment might change.

In the last three decades, the issue of Islamic banking has received a great deal of attention in the cleric and academic circles. This attention has resulted in many books and articles. The specific issues that have received most attention are the justifications for the abolition of interest charges and the operational aspects of Islamic banking. However, the review of the literature on Islamic banking reveals that there is hardly any analytical research on the consequences of Islamic banking. I believe that in this area there are many unanswered questions which must be addressed. In this project I will try to study some of these questions. In specific, I will focus on the impact of Islamic banking on household savings and risk taking, as well as the implications of Islamic banking for fiscal and monetary policy.

The opposition to interest charges is only one aspect of Islamic views on the economic system . There are also specific rules on taxation, property ownership, market operation and many other issues. Before concentrating on

the main topic of this research, it would be helpful to present a general background on the Socio- Economic views of Islam and then gradually focus on Islamic banking.

1. The Socio-Economic Institutions Of Islam.

One of the most surprising developments in the second half of the 20th century which was hardly expected by anyone is the re-emergence of religion as an important social force in almost every corner of the world. The social thinkers of the 19th century in Europe and the United States were predicting that with the advancement of science and technology the significance of religion in the mind of mankind would diminish. Yet, to everyones surprise, religion is still a source of hope and motivation to millions of people all over the world. In the United States and Europe, various religious groups are involved in organizing campaigns on such important issues as disarmament and abortion. In Latin America and Poland, the Catholic church has become an outspoken advocate of political reform and social justice.

In other parts of the world also, religion is attracting more and more people, especially the youth. This renewed attention to religion has been most noticeable in the Islamic nations of Africa and Asia. To the traditional people of these nations who have felt insecure and threatend by the intrusion of Western ideas in their lives, Islam has

become a source of identity and security. It has also become an instrument of social and political unity. The Iranian revolution, which led to the downfall of the Shah, is one example of how Islam has grown into a strong political and social force. Another example is the nationalist struggle in Afghanistan. The single most important element that has united the resistance movement (against Soviet occupation) is Islam. The struggle against the communist regime is viewed as a holy war or "Jihad".

Islam in many ways is similar to Orthodox Christianity. For example, the ethical teachings on the role of family and the individual responsibility towards God and society are very similar. A visible difference, however, is that the laws and teachings of Islam are much more detailed and specific. They affect every aspect of an individual's social and private life. Unlike the early Christian fathers who did not pay much attention to worldly affairs[2], Islamic clergy were strongly concerned with the affairs of both worlds. The modern Islamic thinkers put a great emphasis on the attention of Islam to material prosperity and economic progress.

Comparing the modern political and social thought of Islam and Christianity, the most important difference is on the issue of secularism. While the separation of church and state is almost fully accepted by the Christians, only a small minority of Islamic scholars advocate secularism. The

mainstream political thought among Muslims is that government must function according to the rules of Islam. Any law which is in conflict with the views of Islam must be rejected. Further, it is argued that Islam gives exact instructions on the political and economic structure of the so called "Islamic society". There are two sources for these instructions. The most important source is the holy book of Islam Quran , and the second source is the comments and teachings of the Prophet Mohammed during his lifetime. The collection of these teachings is called "Sunnat" (also called "Hadith").

The emphasis on the link between state and religion has led to two important trends in Islamic societies. The first trend is political. The clergy and their followers are putting pressure on the governments to modify the civil codes and make them consistent with Islamic rule. In recent years, the evidence of this pressure has been observed in many countries such as Pakistan, Egypt and Sudan. And, of course, in those nations that are ruled by the clergy or a leadership that is highly committed to Islam (such as Iran, Pakistan and Lybia), the entire legal system has already been modified. The second trend is a literary movement among Muslim scholars. The objective is to describe the structure of an ideal modern Islamic society based on the early teachings of Islam and study its dynamics.

To confront the growing popularity of the liberal and communist ideologies in Islamic nations, these scholars began to develop an independent Islamic socio-economic school of thought. This concern started in the 1930's in Pakistan (then part of India). After the Second World War, many of the Islamic lands gained independence and, even though the leadership in many of these nations was secular, the clergy and the Islamic scholars paid very strong attention to the issue of the Islamic socio-economic system. In the 1960's and 1970's, research intensified and specialization emerged. Scholars began to address specific questions such as the sociology of Islam, the Islamic educational system, and the economic system of Islam.

Among these different fields of specialization, the economic system of Islam has received the most attention. There are currently two research centers, one in Pakistan and one in Saudi Arabia, for the study of the Islamic economic system. In recent years many books and articles on this topic have been published; and starting in 1983, the "Center for Research in Islamic Economics" in Saudi Arabia began publishing the Journal of Research in Islamic Economics. There have also been several conferences on different aspects of the economics of Islam over the last 10 years.

The earlier works were mostly nontechnical and descriptive. They were written by authors who had a strong

background in religion but very limited knowledge of economic science. However, gradually several researchers with formal economic training showed interest and in recent years many technical papers have been published.[3] These authors reside in different parts of the world. In 1976, M. Siddiqui published an extensive review of the literature on the Islamic economic thought. His work is by far the most detailed review published on the topic so far.

Before studying the Islamic banking system in detail, we will briefly review the economic philosophy and the economic system of Islam. The topic is further divided into several subtopics, each covering the views of Islam on a specific economic problem. These subtopics are:

1) The goals of Islamic Economic system.

2) The economic enterprise and ownership in Islam.

3) Economic competition and cooperation.

4) Views of Islam on economic growth and development.

5) The role of state in economic enterprise.

6) Taxation

7) Money, banking and the financial system.

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1) <u>The Goals of the Economic System</u>. The goals of the Islamic economic system are interlinked with the objectives and the responsibilities of man himself as defined by Islam. According to Islam, man has spiritual and material needs that must be satisfied. Therefore the goals of the economic

system are divided into economic and noneconomic. The material prosperity is condoned and even encouraged as a precondition for spiritual growth. According to Paidar, "For most people, attention to spiritual needs and development of moral personality before satisfaction of material needs is very difficult if not impossible."[4]

Some of the economic goals are: satisfaction of material needs of people, the equitable distribution of wealth and income and the optimum utilization of natural resources. The noneconomic goals as listed by Maududi include: fulfillment of "spiritual needs", moral growth, social justice, "safeguarding the freedom of man", equality of opportunity and cooperation. Taleghani presents another view of the noneconomic goals of the system: "The basis of legal ordinance and economic relations are the verses of Quran and Hadith of Islam, all of which call upon one to uphold justice, truth and equality."[5]

2) <u>The Economic Enterprise and Ownership</u>. Since Islam is concerned with the material welfare of the public, it encourages any kind of economic activity in the fields of agriculture, commerce and industry. The creation of economic enterprise (whether private or public) is welcomed. The goal of an economic enterprise must not be profit maximization alone. It must also show concern for the problems that confront the society. Some authors have expressed negative views on excessive reliance on profit

motives. For example, Taleghani says "...The root of all the problems and disorders, all these pressures upon workers and their ensuing dissatisfaction is that the drive for profit and accumulation of capital has been made the goal of the society."[6] The attitude of Islam towards ownership is that the absolute ownership of every thing in this world belongs to God. Man can only exercise limited ownership rights over his private property. He is responsible before God for the way that he utilizes his property. He must not waste or misuse even his own property.

In Islam, three types of property ownership are recognized. These are private, state, and communal ownership. The last two items combined are equivalent to public ownership. Even though almost all scholars agree that Islam tolerates some degree of private ownership, they disagree with each other on the extent of private ownership. Some authors with strong socialist orientation like Pervez and N. A. Sheik advocate a very limited private ownership and see a very small role for the private sector in Islamic economy. A more moderate view is given by Baghir Al Sadr who argues that Islam gives equal importance to individual, state and communal ownership.[7] Overall, Islam views ownership as conditional and limited. For example, the ownership of agricultural land is conditional on farming activity. If an individual farms land that has not been farmed and which was not owned by anyone before, he will be

recognized as the owner of that piece of land. On the other hand, if the owner leaves his land idle for a long period of time without any justification, he will lose his title to that piece of land.

3) Economic Competition and Cooperation. Islam strongly condemns any form of monopoly power in the private sector. To this extent, competition is prefered to monopoly. However, excessive competition, which reduces the bond of brotherhood among men, is also rejected as equally harmful. With some regulations, the operations of a free market is acceptable. The common view is that there must be a middle ground between competition and cooperation such that the economy can operate with efficiency and at the same time a feeling of solidarity and brotherhood can exist among the people. Not much research has yet been done on how actually to achieve this balance.

4) On Economic Growth and Development. Islam encourages the individual as well as the entire society to work towards economic growth and development. This growth however, must be associated with economic justice which is basically reflected in a fair distribution of income. To achieve this balance, Islam calls for full exploitation of natural resources to ensure economic growth, and it also calls for an active role by the state in the economic affairs of the society.[8]

5) The Role of State in the Economic System of Islam. The views of Muslim scholars on the role of state is very similar to the Keynesian/liberal view in Western economic thought.[9] The commonly accepted view is that an Islamic society is organized as a welfare state. Therefore, the government must be actively involved in the economic affairs of the society. Siddiqi proposes the following duties for the government in an Islamic society:

(a) Ensuring compliance with the Islamic code of conduct by individuals through education and, whenever necessary, through coercion.

(b) Maintaining healthy conditions in the market to insure its proper functioning.

(c) Modifying the market allocation of resources and distribution of income by guiding and regulating it as well as by direct intervention and participation in the process,

(d) Taking positive steps in the field of production and capital formation to accelerate growth and ensure social justice.

Other authors add the provision of a social security program to the above list. Baghir Al-Sadr (pp. 615-636) argues that every individual in the society, regardless of his ability to work, is entitled to government assistance if needed because in Islam the natural resources belong to the entire society and the state is the guardian of these resources. Similarly, Awsaf Ali argues that the call for

active participation of the state in the economic affairs of the society is the direct result of "the social philosophy of Islam."

6) On Taxation. Islamic law has specifically defined a wealth tax called Zakat. Paying Zakat is considered a religious duty for every Muslim.Zakat is a 2.5% annual wealth tax on accumulated net worth of the individual. There are some disagreements among Muslim scholars on the coverage of Zakat and its flexibility. Some authors, including Maududi, believe that Zakat does not apply to machinery and capital goods. Others believe that it should apply to all forms of wealth. On the flexibility of the tax rate for Zakat, the disagreement is mostly between the clergy and the Muslim scholars. The clergy unanimously agree that the 2.5% Zakat rate is fixed by Islamic law and it cannot be altered by the state. The non-clerical scholars are more concerned with the economic consequences and recommend that the state must have the power to adjust the Zakat rate whenever appropriate.

Islam's holy book, Quran, gives clear direction on how the Zakat funds are to be used. Surah 9, Verse 61 of the Quran mentions the following uses for Zakat funds: " The poor, needy, employees of the Zakat office, those whose hearts have been recently reconciled, those in bondage and in debt, in the cause of Allah (God), and wayfarer." It is

also commonly accepted that the state has the right to impose other taxes besides Zakat to raise revenue.

7) The Banking and the Financial System. (The institutions of Islamic banking will be covered in detail in the next section.)

2) The Financial System in Islam.

Since Islam condemns any form of usury and interest charge, the conventional banking institutions practiced in the rest of the world cannot be applied in Islamic nations. At the same time, everyone agrees that, to promote economic growth, a nation needs a sound and efficient financial system. Every developing country has to finance all or a portion of her gross investment from domestic savings. The efficiency of the banking system will help raise the level of domestic savings and channel it to the most productive projects.

Aware of this issue, the Muslim scholars have tried to design an efficient financial system without a bond market and interest charge. The research in the area of Islamic banking has covered three major areas:

1) The attitude of Islam towards the interest charge.
2) The operation of a banking system without an interest charge.
3) The conduct of monetary policy in the absence of interest-paying assets.

We will study each of these areas separately and review the related literature. The emphasis will be on the second area which introduces the institutions of interest-free banking as perceived by the majority of Muslim scholars. The assumptions needed for the analytical chapters that follow are derived from these institutions.

2-A) The Attitute of Islam Towards Interest. The opposition to interest charges in Islam is deeply rooted in the Muslim holy book, Quran. On several occasions in this book, "Riba", which is the Arabic word for usury, is condemned and anyone involved in lending or borrowing based on Riba is considered an enemy of God. Since Quran is the undisputed source of guidelines for all Muslims, there is unanimous agreement on the fact that Islam has forbiden the practice of usury. There is, however, some disagreement on exactly what it is that Islam has forbidden. A minority of writers have claimed that what was prohibited by Islam was the interest charge on consumer loans. Since business loans were not common in the early years of Islam, we cannot say that they are also forbidden. The advocates of this view include Syed Yaqub Shah(60), Fazalur Rahman(55), Jafar Shah Phalwarwi(52), and Tamanna Imadi(28). Shah presents two historical records to support his view:

1. In the early years of Islam commercial borrowing was not practiced. Profit sharing and partnership

were the only ways to increase the stock of capital.

2. In that period only consumption loans were prevalent and the rate of interest charged was very high.

Therefore, he argues that an interest charge on business loans is not forbidden in Islam.

On the opposite side of this issue, Mufti Shafi(59) and Maulavi Fazalur Rahman(55) have argued that even if some kind of interest-based transaction was not practiced in the same time that this rule was made, it is still subject to that same rule. To support their view, they reason that when Islam prohibited alcoholic beverages, many of the drinks which are common today did not exist. Yet every one agrees that they are still prohibited. Maududi questions the historical evidence presented by Shah. He presents some other historical evidence to show that commercial loans were indeed common in the early Islamic society. Maududi's position on this issue seems to be correct. The majority of authors as well as the religious clergy agree that prohibition of interest in Islam applies to all forms of interest. The Quran and other sources of Islamic teachings do not give exact explanations as to why the interest charge is forbidden. Consequently, a number of Muslim scholars have tried to provide some justification for this rule. The explanations fall under two categories. Some authors present

historical and pragmatic reasons for the prohibition of interest. For example Rudinson argues that: "It is possible, some have thought, that it may have been designed at a time when the little Muslim community, poor and surrounded by enemies in Medina, was trying hard to collect funds from the sympathizers and stigmatize those among the latter who refused to lend money to the Muslims at reasonable conditions. But it is also from the plain meaning of the passages concerned, a question of getting the Muslims to prefer paying Zakat (wealth tax for the needy), to making more profane but more profitable use of their resources by lending at interest."

Another historical reason is presented by Hamidollah(23). In his view, the interest charges were prohibited to nationalize the credit, then the state provided interest-free loans to the public. Another group of scholars takes a different approach and tries to present rational arguments on why the Islamic prohibition of interest charges is justified. They generally give two types of arguments. First, they try to argue that there is hardly any economic justification for interest and, secondly, they try to show that the prohibition of interest charges will benefit society.

In Western economic thought, attempts to rationalize the institution of interest have led to the development of several distinct theories such as: A) The Abstinance theory,

B) The Time preference theory, C)The liquidity-preference theory, and D)The productivity theory of capital. Several Muslim scholars such as Uzair(71), Mettwally(47), and others have criticized these theories as being either wrong or at best weak. Both authors mentioned above have commented on all or some of these theories.

On the abstinance theory, Uzair argues that today most of the saving is done by the rich individuals and corporations. These agents do not really sacrifice any of their well-being by saving. From this argument, it seems as if Uzair believes in the satiation of human wants. He seems to be saying that, since the standard of living is not damaged by saving, the saver does not deserve any interest. Mettwally also mentions that banks do not sacrifice when creating money(47,p20). He and Uzair both note that, even in the absence of interest, people will still save a portion of their income and corporations can use retained earnings.

Mettwally notes that the productivity theory of interest is circular. To calculate the rate of interest, we must know the value of the capital assets, and to arrive at the value of capital there must already be a rate of interest at hand. (This point has been observed by Western economists as well.) Besides, the productivity theory does not explain why interest must be paid when the borrower suffers a loss.

Unfortunately, these authors ignore the concept of opportunity cost. The lender in any loan transaction could have invested the funds directly instead of lending them. Thus, if he does agree to lend, he deserves some compensation. Some authors such as Mettwally have mistakenly argued that, since Islam prohibits speculation, there is no opportunity cost to lending. First of all, there is no unanimous agreement on the attitute of Islam towards speculation. Secondly, Islam tolerates the earning of profits and rents. Therefore, a lender can always find an alternative use for his financial capital. Overall, the criticisms of Western theories of interest by Muslim economists are not very convincing. They often lack strong logic and evidence.

The second line of argument against interest charges is based on pointing out their undesirable consequences for the economy. Several authors including Khan(32), Ahmed(3), Mannan(41), and Sheikh(63) argue that interest charges cause unemployment. (Note that this is not the same as saying high interest rates lead to unemployment.) According to them, this is because interest becomes a component of the capital cost and causes the prices to be higher. The higher prices in turn will lead to less consumption and less production, thus leading to less employment.

This chain of reasoning might appear correct in surface, but one must ask what will be the level of

employment without interest? If the same amount of lending credit is being generated without interest charges then the argument seems valid. However, if the elimination of interest reduces the supply of credit, the level of investment and production will decline and, as a result, unemployment will be even higher.

Some authors have refered to the well known inverse relation between the rate of interest and the rate of investment which is known as the marginal efficiency of investment function. Since in this relation higher levels of investment are associated with lower rates of interest, these authors claim that by eliminating interest charges altogether, the level of investment will increase. This, however, is not true because the validity of the above argument depends on the availability of credit for the given rate of interest. If, when the interest rate is suppressed to zero, no one will agree to lend, the firms will face a shortage of credit and the rate of investment might even decline.

One issue that has been raised by almost every author is that the existance of interest charges leads to inequality because it transfers resources from the poor and the middle class to the wealthy lenders. If this claim is correct, it only applies to the consumer loans. In the case of business loans, the borrowers are corporations and the owners of businesses while the lenders (who save in the

banks and buy bonds) include many of the middle class and the blue-collar workers.

In other areas, Khan(35) has tried to show that the interest charge is one of the causes of the international monetary crisis. Several authors including Siddiqui(65) Ahmed(3), Abu Su'ud(1), Maududi(44), and Sheikh(62) have argued that the institution of interest is one of the main causes of trade cycles in the economy. Unfortunately, none of them has tried to elaborate and prove this point. Western economists such as Fisher and many others have also raised the same possiblity that monetary fluctuations such as expansion and contraction of credit cause trade cycles.

Aside from the arguments that were reviewed above, there is yet another explanation for the prohibition of interest which appears to be built on more solid grounds. The return to capital could fall under three categories: interest, profit and rent. Islam allows the earning of profit and rent but prohibits an interest charge. The Muslim economists and jurists argue that, according to Islam, only those who participate in a productive venture or provide a valuable service deserve to be rewarded. Islam also insists that any reward to capital owners must be linked to the outcome of the project for which the capital is utilized. The interest charge is prohibited because, assuming that the borrowed credit was used for a profitable investment, the lender is promised a fixed rate of return on his capital

while the borrower must face all the risk and uncertainty of the project. Since the lender does not share in the risk of the project, from the Islamic point of view, his return(the interest) is undeserved.

Profit, on the other hand, is acceptable because it's directly related to the outcome of the project. In general then, Islam requires that the return to capital must not be pre-specified as is the case when lending at interest. Instead, it must be linked to the productivity of capital in the project that it is used for. In the next section, we will see that this last argument is the main rationale for the model of Islamic banking that is the most commonly accepted.

2-B. The Institutions of an Interest-Free Banking System. The concept of the Islamic banking system is very new. It has emerged as a natural consequence of the Islamic opposition to interest charges on loans. Since the lending and borrowing operations of the modern banks are primarily based on an interest charge, Muslim scholars were faced with the challenge of developing an alternative model of a banking system which could allocate credit by some other means. The early research in this area began with the works of Qureshi(54), Siddiqui(64) and Ahmed(3) in the 40's and 50's. They essentially proposed that profit- and loss-sharing arrangements should replace the interest charge as the basis for operations of Islamic banks. The profit- and loss-

sharing (PLS) arrangement was a common commercial practice in Arabia before and during the early years of Islam. In Islamic culture it is known as Mudarabah. Mudarabah is an agreement between an owner of capital and an agent. The owner provides the capital which is invested by the agent in a profitable project. If the project is profitable, they share the profits on a predetermined ratio. In case of loss, however, the full burden falls on the capitalist. The agent loses only the value of time and effort that he has put into the project. The authors that were cited above argued that similar arrangements could be applied to the relations between the bank and the public.

In the 1960's, research on the details of interest-free banking intensified . A very detailed and organized account of the topic was given in Banking Without Interest by Siddiqui. His work was followed by several articles in the same direction by Al-Jarhi(6), Uzair(71), Al-Araby(5), Najjar(49) and many others in the 1970's. In addition to improving the earlier model of Siddiqui, these authors proposed some mechanisms for central banking and monetary intervention under an interest-free banking system.

In recent years, scepticism towards this version of interest-free banking has diminished. Today, the existing banking systems of Pakistan and Iran operate on the basis of the PLS mechanism and it is gaining more acceptance in other areas as well. In the remaining pages of this section, I

will describe the basic institutions of interest-free banking which are commonly accepted. This will be followed by a brief review of the possible deficiencies and weaknesses of this particular model.

Aside from their interactions with the central bank, the commercial banks basically transact with two types of agents: the depositors and the borrowers. In the regular banking systems the primary assets and liabilities of these banks are interest-paying debt instruments such as savings deposits and business loans. Under an interest-free banking system, these debt instruments will be unacceptable. They will be replaced with PLS and equity instruments. We will describe the Islamic banking system by defining the relations and arrangements that would exist between the bank and its depositors as well as the bank and its credit customers.

A. The Bank-Depositor Relations.

To attract the savings of households, Islamic banks will offer two types of accounts. These are the profit- and loss-sharing accounts and the demand deposits.

A.1. The Profit and Loss Sharing (PLS) Accounts. The PLS accounts are substitutes for savings and time deposits. They are "Modarabah-type" arrangements. The depositor provides financial capital and the bank acts as his agent. The bank invests these PLS funds along with its own capital and additional funds that are raised through other types of

accounts in profitable projects. The performance of the bank's operations are assessed periodically. At the end of each investment period, the generated profits (or losses) will be shared among the bank and the PLS account holders. The division of the profits takes place in two steps. Since the profits were generated by the entire financial capital of the bank, the first step is to divide the profits in proportion to the PLS funds and the rest of the capital. The second step is to divide the portion of the profits that are accrued to the PLS funds between the depositors and the bank. This division will be based on a predetermined ratio called the profit-sharing ratio which was agreed upon at the time the PLS account was opened. In case of a loss, the bank and the PLS depositors will share in proportion to their capital contribution. To clarify the procedure further, we will give a numerical example. We assume that the period of investment is one year.

The total financial capital of the bank	= 1000,000 $
Funds raised through PLS accounts.	= 400,000 $
Bank's own financial capital and other funds	= 600,000 $
The profit sharing ratio	= (30% bank, 70% PLS depositor)
The total profits of the bank in one year	= 100,000 $

The share of PLS accounts from total profits = 100,000 * 0.4
= 40,000

This 40,000 $ profits will be divided between the bank and the PLS depositors:

The share of the PLS depositors = 40,000 * 0.7
= 28,000

The rate of return to PLS deposits = 28,000/400,000
= .07 (7%)

Bank's share in PLS account profits = 40,000 * 0.3
= 12,000 $

The rate of return on bank's investment = (12,000 + 60,000)/
600,000
= .12 (or 12%)

On the other hand, if the bank reports a loss at the end of the period, this loss is shared in proportion to its capital contribution. Consider a 100,000$ loss in the same example.

Loss to the PLS depositors =loss on PLS accounts = 100,000 * .4
= 40,000 $

Since this procedure does not guarantee a fixed predetermined return to the PLS depositors, it is acceptable to Islam. This advantage, however, comes with a price which is the added risk. As the annual profits of the bank fluctuate, so does the rate of return on PLS deposits. Indeed, their variances are highly correlated. Some risk-averse households might stay away from these accounts in order to avoid assuming any risk. If a minimum return on these accounts is guaranteed by the bank, public trust will be higher and more funds could be raised. But, unfortunately, such an insurance will make the return on the PLS the same as interest and thus it would not be acceptable.

At the operational level, the calculation of profits on PLS accounts poses a major problem . If the dividend payment interval is too long, the PLS accounts will become highly illiquid. Therefore, the profits on these accounts must be assessed in 3- or 6-month intervals. On the other hand, banks generally have long-term investments and it would be dificult for them to evaluate profits in short periods. Unfortunately, no satisfactory solution to this problem has been found yet.

A.2- The Demand Deposits. The Islamic banks, like regular commercial banks, will offer demand deposits to the public. These demand deposits are fully insured and do not earn any return. Whether or not a service fee must be

charged on demand deposits is not an issue on which Islamic law implies any position. The services that Islamic banks provide for demand depositors are no different from those provided by regular banks.

In Western banking systems, the commercial banks are required to keep reserves on demand and savings deposits. The primary reason for these reserves is that, by altering them, the government would be able to change the supply of credit whenever necessary. In an interest-free financial system, it would still be desirable if a central bank could change the money supply through the banking system. Such an option is even more important in an Islamic regime because some of the other instruments of monetary control will no longer exist. (These are the instruments that deal with bonds and interest rates.)

The imposition of the reserve requirement on demand deposits of Islamic banks is fully acceptable. However, there is controversy over application of such a requirement to the PLS accounts. These accounts are not debt instruments. They are indeed very similar to equity. If banks have to keep a portion of these funds idle, their rate of return will be further reduced, causing a reduction in public demand for these accounts. Furthermore, it should be noticed that, in managing the PLS accounts, Islamic banks operate very similar to the Mutual Funds in the West and the latter do not have to keep any reserves.[11] More on the

similarity of Islamic banks to the Mutual Funds will be said later.

B. The Bank Borrower Relations.

Since the interest charge cannot be used in any banking transactions, the lending and investing operations of commercial banks must also be modified. The banks advance credit to the rest of the economy for three purposes: investment, consumption and government expenditures. In a regular banking system, all three types of borrowing are conducted on the basis of interest charge. In an Islamic banking system, alternative mechanisms must be used. The investment loans are used for profitable projects. The lender of an investment loan could receive dividends instead of interest on the basis of PLS arrangements. Islamic scholars have suggested that banks should lend credit on a PLS basis or provide credit by direct equity investment.

The consumer and government loans, however, do not generate any profits so they cannot be lent on the same basis. Unfortunately, Islamic institutions do not provide any alternatives other than profit and loss sharing. Whenever the project financed by a loan is such that profits cannot be assessed, no single scheme for lending is available. The field remains wide open to speculation. Some authors have proposed that banks must be required by law to provide consumer loans at no interest by setting aside a portion of demand deposits especially for these loans.

Another proposal is to let Islamic banks concentrate on investment loans and have the government provide consumer loans with no interest charge.

These and other proposals for consumer loans lack any theoretical basis. Furthermore, they are not in any way connected to the PLS mechanism which is the basis of Islamic banking. The result is that proposed mechanisms for consumer and government loans ignore market forces and the opportunity cost of credit. With these schemes, it is not clear how credit will be allocated between consumer and business loans. Since my main objective is to study the consequences of Islamic banking as it is proposed by Islamic scholars, I have decided not to include the government and consumer loans in any of the analytical chapters of my model. This exclusion will make the model incomplete; but including arbitrary institutions for consumption loans will also equally reduce the value of the model. The model without consumption loans is preferred because it could be extended in the future to include such loans once a proper mechanism has gained common acceptance. At the same time, however, since the topic is still being debated, I will present a brief review of the literature along with a new proposal in an attached appendix to this chapter.

In the case of profitable loans, the primary mechanisms are PLS arrangement and direct equity investment. The operation of PLS loans is exactly the same as the PLS

deposits that were described earlier. The only difference is that here the bank provides the capital and the borrower acts as the agent.

Aside from these two mechanisms, another scheme has also been proposed . This third scheme is called price mark-up and can be used when a firm needs credit to purchase certain commodities or machinery. First, the bank purchases the goods that a firm needs, then it sells the same goods to the firm at a higher price. The firm will agree to pay the cost on an installment basis. It does not take too much thought to realize that this scheme is indeed the same as lending at interest. The only difference is that, instead of credit being given, the commodity is sold by the bank at a higher price. In a way, it's like the bank lending the money to the firm and taking care of the purchase on the firm's behalf. The interest is disguised in the difference between the purchase and the resale price. To be consistent with the Islamic requirement, this scheme and those similar to it must be rejected. Overall, Islamic banks provide credit for investment purposes by PLS loans and direct equity lending.

The fact that Islamic banks are able to hold equity will set them apart from Western commercial banks which are not allowed to hold any equity. On the other hand, it makes Islamic banks very similar to the mutual funds. In the Western Financial systems, a mutual fund is an investment

company that purchases a wide variety of primary securities and issues a secondary security on itself called a mutual fund share. The shares are claims on the mutual funds entire assets. The value of these shares depends on the value of the primary securities held by the mutual fund. Because of diversification, the risk on these shares will be less than any of the primary securities that are included in the mutual funds portfolio. If we consider the PLS deposits as equivalent to the mutual fund shares, the similarity between these two types of institutions becomes obvious.

Of the many services that commercial banks provide to the public, perhaps the most important ones are risk arbitrage and denomination arbitrage. While Islamic banks can offer many of these services, they are not able to arbitrage risk because to do so would require transactions based on interest charges. Furthermore, by eliminating the private loan markets, Islamic code destroys all the possibilities of risk arbitrage. One expects that this phenomena will be harmful to the welfare of borrowers and lenders alike. This and other questions about the welfare results of Islamic economic system are addressed in the next chapter. To analyze these questions, a two-agent, micro-economic model is developed. The model reveals that elimination of risk arbitrage will lead to suboptimal allocation of risk and a reduction in savings.

3. The Conduct of Monetary and Fiscal Policy in the Absence of Interest-Paying Assets.

One of the most interesting problems in the area of Islamic banking is the question of monetary policy under such a regime. In a regular economy, the government bond market and depository institutions are the major channels of monetary control. The Islamic prohibition of interest will eliminate the debt instruments and cause serious changes in depository institutions. Consequently, the conduct of monetary policy in an Islamic economy will differ from the regular economy in several respects.

Siddiqui(65), Al-Jarhi(6) and Chapra(18), among others, comment on this issue. They note that while a central bank can no longer intervene in the government bond market (since it no longer exists), it can alter the money supply by intervening in the equity and PLS loan markets. It will still have control over the reserve requirement on demand deposits as well. To expand the money supply, a central bank can open PLS deposits in Islamic banks and deposit any desired quantity of newly created high-powered money in these accounts. Then the process of money creation within the banking system will expand the money supply.

The creation of money in Islamic banking will be similar to money creation in Western commercial banks. If the supply of high-powered money goes up, a portion of it will end up in an Islamic bank as a PLS deposit or demand

deposit. That bank will reinvest these additional funds by providing credit to a firm or a household. A portion of this credit will eventually end up in the same or another Islamic bank and the process continues. Since it is very similar to the process of money creation by commercial banks and this latter process is described in any intermediate book on macro-economics, I will not describe it here any further.

A central bank could use the equity market for day-to-day monetary intervention. By the purchase and sale of equity, the central bank can expand and contract the money supply respectively. This process, however, requires direct government ownership in some industries and that might cause concern about the excessive powers of government. Also, it is possible that different industrial groups might pressure the central bank to buy the stocks of one particular industry at the expense of others. These are clearly serious concerns. One possible remedy for this is to create well-diversified mutual funds and limit the central bank to trading on the shares of these funds only. In this way, no particular industry will lose or gain as a result of monetary intervention. In Chapter 3, we develop a macro model of Islamic economy and analyze the conduct of monetary and fiscal policy. We will also compare the performance of these policies under regular and Islamic regimes.

Summary and Conclusion.

Since the idea of Islamic banking is totally unfamiliar to the majority of Western readers, this first chapter was devoted to presenting an introduction to the topic. There is no question that Islamic opposition to an interest charge is taken seriously by the scholars and politicians in the Muslim world. This attention is observed in moderate nations like Saudi Arabia and Egypt as well as radical ones such as Syria and Iran. Some countries such as Iran have gone as far as modifying their entire banking system.

Gradually, a consensus has emerged among Muslim scholars on two issues. First of all, there is a general agreement that Islamic opposition to an interest charge applies to all forms of interest charges and not just to the consumer loans. Secondly, most scholars agree that profit and loss sharing is the appropriate replacement for interest charges. We described the operations of a banking system based on PLS arrangement. The PLS arrangement and equity ownership will allow the banks to function as intermediaries but they will be very limited in their capacity to arbitrage risk. While the regular commercial banks can offer fully insured savings and time deposits, the Islamic banks can only offer a diversified low-risk portfolio in their PLS accounts. Unfortunately these accounts cannot be insured. The consequences of this type of banking is the main topic of study in the next chapter. As expected, the model

indicates that elimination of risk arbitrage leads to welfare loss.

The elimination of government bonds along with the reforms in the banking system will eliminate many of the channels of monetary control that are available to Western central banks. Thus, it has been proposed that the central bank in an Islamic economy should be allowed to invest in the equity market and PLS accounts. The consequences of this and other options for monetary policy will be studied in the third chapter. The analysis in that chapter reveals that, while monetary and fiscal policies have similar effects in a regular and an Islamic economy, some differences persist. These differences could be explained by the fact that a regular economy has a bond market and an Islamic economy does not.

Finally, it must be noted that the survival of Islamic banking systems is more of a political decision than an economic one. Nevertheless, since this policy could have serious affects on savings and investments, this and other studies on the topic are well justified. Unfortunately, so far the literature has been filled with unproven conjectures and speculations which are often erroneous. There are many questions at the theoretical level that have not been resolved yet. In this project I hope to address some of these issues analytically and reject some of the false views that have been expressed by others on this subject.

NOTES
(CHAPTER ONE)

1. Independent Islamic banks are currently in operation in several countries such as Egypt, Sudan, Jurdan, and Saudi Arabia. Their progress will be reviewed in the last chapter.

2. Winer and Jackob give some examples from early Christian writings to support this point, see pages 20 and 21.

3. In 1981, at conference held in Pakistan on Islamic Economics, several Muslim scholars, who teach in various European and American universities, presented research papers.

4. See Paidar, page 10.

5. See Taseghani, page 50.

6. Ibid., page 54.

7. See Bagir Al-Sadr, page 257.

8. See Tahawi, pages 229-232.

9. This similarity could be partly explained by the fact that most of these authors received their formal economic training in Western universities during the 1960's and 1970's.

10. In practice so far, the Islamic banks have ignored this religious objection. In Iran, for example, the nominal value of PLS deposits is fixed and they are fully insured along with the demand deposits.

11. Rafi Khan (page 10) gives a comparison of the Islamic banks and Western Mutual Funds. For more detail on Mutual Funds, see George Kaufman, "The U.S. Financial Systems, Money Markets and Institutions".

Chapter 2

THE CONSEQUENCES OF ISLAMIC BANKING IN A MICRO-ECONOMIC FRAMEWORK

The analysis of the consequences of Islamic banking must start at the micro level. Islamic regulations will modify the financial markets. The firms and households who interact with these markets will face a different set of financial opportunities. Some types of assets are eliminated while some other types are added. At the same time, these changes might alter the rates of return on different assets. In reaction to these changes, the economic agents will adjust their resource allocation. This means the households will change their intertemporal and portfolio allocations while the firms will modify their choices of production level, investment level and financial mix.

The cumulative effect of these micro changes will affect the aggregate demand for the real and financial assets. Through this channel, the Islamic restriction might have some effects on the real economy. For example, if the Islamic regulations lead to a reduction in demand for

capital and as a result the rate of return on capital rises, the real investment will decline.

In this chapter, we will study the impact of Islamic regulations on the behavior of households and firms . Then we will use the findings to develop a macro-economic model in the next chapter. The economic institutions of Islam in general and the institutions of Islamic banking in particular were described in Chapter 1. To conduct our analysis, we must first define the economic institutions that must be incorporated in our model. While the market mechanism is not directly advocated in Islam, it is not rejected either. The same is true for the institution of private ownership with certain limitations. Therefore, the first assumption of our model is that, in an Islamic economy, a market mechanism exists and the private ownership of real and financial assets is tolerated. We also assume that, aside from the interest rate restrictions, the other requirements of perfect capital markets are satisfied. (This is necessary to single out the effects of Islamic banking from the other imperfections.)

The other two characteristics of Islamic banking are: a zero nominal interest rate on bonds and the application of a profit- and loss-sharing arrangement in banking operations. According to Islam, the suppliers of capital to a profitable project are entitled to a portion of the profits only if they share in the risk of the project. The interest charge

is forbidden because the lender is entitled to a fixed return from the uncertain profits of the borrower. The PLS contract is recommended as a substitute for interest-paying loans and deposits in the banking operations. In a more general view, the banks are supposed to transact with the depositors and the borrowers on the basis of equity arrangements. (The PLS is a specific type of equity contract.)

Our method of analysis is to develop a model of household resource allocation and then see how this allocation changes after the Islamic restrictions are imposed. The emphasis is on the interactions of the households with the capital markets. Each household must make two major decisions with regard to the accumulation and the composition of his wealth. First, he must decide how much to save and then he must choose a suitable portfolio from the existing assets. The analytical tools needed for this analysis have already been developed in the field of finance. They are provided by the modern portfolio theory which is specifically concerned with the financial decisions of the households. The portfolio theory has two major sources of strength. First of all, it explicitly takes account of the sensitivity of investors to risktaking. Secondly, the resource allocations of the households are derived from utility maximizing behavior. Our model relies heavilly on tools borrowed from the portfolio theory. To

familiarize the reader with the portions of the theory which are used in the model, a brief review is provided in appendix B to this chapter.

One of the surprising characteristics of the model that follows is that, despite the fact that the P.L.S. arrangement is claimed to be the basis of Islamic banking transactions, we have not explicitly included it in the model. There are several reasons for this decision. One reason is that P.L.S. assets are very similar to equity assets. Indeed, every P.L.S. loan is linked to an equity or a risky project. To the household investor, a P.L.S. loan will not be much different from other risky assets. Our model includes one risky and one riskless asset. The risky asset is a representative equity asset. It could be an equity stock, a P.L.S. deposit or a portfolio which consists of many risky assets. Since we are interested in how the overall risktaking changes, having one representative risky asset seems to be sufficient.

The second and perhaps more important reason for ignoring the P.L.S. assets is that unless the transaction and information costs in the equity markets are significant, the market for P.L.S. loans will fail. As was explained earlier, the P.L.S. lender and the P.L.S. borrower will share the profits when the profits are positive; but any possible loss is entirely born by the lender. Since the borrower does not have to share in the losses, he will not

face increased risk by P.L.S. borrowing. At the same time, the more he borrows, the higher his expected profits will be so he would have an indefinite demand for P.L.S. loans. The P.L.S. lender, on the other hand, could directly invest his funds in the same project that the P.L.S. borrower would have invested in originally. The lender's risk of loss would be the same under both cases (equity holding and P.L.S. lending for the same project). His expected gain, however, will be smaller under P.L.S. because the borrower will take away a portion of the profits whenever they are positive. Therefore, the savers will be reluctant to lend on the P.L.S. basis whenever there are opportunuties for equity investment at low transaction and information costs. The P.L.S.. lending is preferred when the portfolio selection and trade in the equity markets is costly.

Since small investors are more likely to face high information and transaction costs in the equity markets, they would be the primary demanders of P.L.S. deposits which are offered by the Islamic banks. These banks, on the other hand, enjoy significant economies of scale in the financial markets which helps them reduce the information and transaction costs of direct investment. Consequently, they would prefer providing credit to the firms by direct investment instead of P.L.S. lending. The evidence from the portfolio selection of Islamic banks in Pakistan confirms this tendency. These banks actively offer P.L.S. accounts

to the depositors but so far they have been reluctant to provide credit to their customers on the P.L.S. basis. Instead, they prefer other mechanisms such as direct equity holding and short-term leasing contracts.

Overall, it seems that the introduction of the P.L.S. institution does not alter the financial system significantly. Therefore, in our analytical model, we will ignore the P.L.S. arrangement and instead concentrate on the elimination of the interest charge. The relative advantages and disadvantages of the P.L.S. contracts versus direct equity holding are discussed in more detail in Appendix B to this chapter.

Before starting the analysis, one more institutionnal detail must be explained. At zero interest rate, the private loan market will clearly fail because the savers have no incentive to lend their savings. Instead, they can keep them in cash or demand deposits. At zero interest rate, the banks will continue to offer demand deposits and they will be allowed to utilize a large portion of these funds after setting aside the appropriate reserve requirements. This implies that the demand depositors are indirectly lending a portion of their money to the banks. Under this institutional arrangement, the supply of loans at zero interest rate will be positive. The model presented in this chapter is based on this assumption because most of the operating Islamic banks offer demand deposits and invest the

funds that are gathered in this way. However, the alternative outcome of complete loan market failure could also happen if, for some reason, the the public preferred to keep their savings in safe boxes instead of putting them in demand deposits. The consequenses of the model under this assumption will be studied in Appendix A to this chapter.

In a decentralized economy, each household makes several important decisions such as: 1) the quantity of labor services to be supplied. 2) the allocation of income in each period between savings and consumption, and 3) the allocation of wealth among different assets. To make the analysis managable, we ignore the employment decisions and instead concentrate on intertemporal and portfolio decisions. These later decisions are influenced by the characteristics of the financial and real assets that are available to the investors. The most important characteristics which receive formal treatment in the theory of finance are the expected return and risk of each asset. The other important elements that also affect the decisions of households are their degrees of risk aversion and time preference. These characteristics are reflected in each persons' utility function.

We study the impact of interest-free banking under two environments. In the first section, investors have perfect information about prices and income in the future. In this certainty model, the portfolio choice is irrelevant because

all the assets are riskless and, therefore, rates of return are equal. To the investor, they are all perfect substitutes and their rate of return is the pure rate of interest. In the second section, we consider the more realistic case of incomplete information about the future. In this case, there will be many assets with different risk/return characteristics. To make the model manageable, however, we include only two assets. One asset represents bonds and is assumed to be risk free and the other asset represents physical capital or equity and is assumed to be risky.

SECTION 1

The Impact of Islamic Regulation Under Certainty.

In this section, we use a number of two-period models to demonstrate how the intertemporal allocations of households change when there is no uncertainty about prices in the second period. Each person has a fixed endowment at the beginning of the first period. He must allocate his endowment between consumption and savings in period one. The total return on savings is then consumed in the second (last) period. He chooses that allocation which will maximize his utility of consumption over two periods:

$$\text{Max } U(C_1, C_2) \ , \ U_1 \ , \ U_2 > 0 \ , \ U_{11} < 0 \ , \ U_{22} < 0.$$

C_1 , C_2 = Consumption in the first and second periods.

The models developed in this section consist of two, utility-maximizing individuals with different degrees of intertemporal preference. Having two agents allows us to simulate a condition of general equilibrium. In the more limited first model, each agent will only choose the optimal level of savings and consumption. In the second model, we have added the option of direct investment in a productive process. Now each household must allocate his endowment among consumption, savings and direct investment. In both models, we try to find out how these allocations change as the rate of interest is reduced to zero.

1-A. The Two-Person Equilibrium With Intertemporal Allocation Only.

In this model, we consider two persons who can trade present and future goods with each other. First, in a regular capital market, the interest rate will be endogenously determined to clear the loan market. Each person maximizes his lifetime utility of consumption subject to his endowment constraint:

Person A $\quad \text{Max } U(C_1^A, C_2^A)$

$$\text{S.T. } C_1^A + C_2^A/(1+r) = C_1^{0A} + C_2^{0A}/(1+r)$$

Person B Max $U(C_1^B, C_2^B)$

S.T. $C_1^B + C_2^B/(1+r) = C_1^{0B} + C_2^{0B}/(1+r)$

C_1^{0A}, C_2^{0A} = Person A's endowment in each period.

C_1^{0B}, C_2^{0B} = Person B's endowment in each period.

r = Rate of interest.

The first order conditions are:

$$U_2^A/U_1^A = 1/(1+r) \qquad U_2^B/U_1^B = 1/(1+r)$$

The loan market equilibrium is shown by:

$$(C_1^A - C_1^{0A}) = -(C_1^B - C_1^{0B}).$$

These three equations along with the budget constraint will solve for r, C_1^A, C_2^A, C_1^B and C_2^B. The solution is pareto optimal because the tangency conditions are satisfied.

Under the Islamic restriction, individuals cannot earn any interest when lending money to each other. We assume that at zero interest rate the supply of loans will be restricted to whatever the lenders are willing to save at that rate. To find the solution, we will first find the optimal allocation for each person at zero rate of interest. If both were found to be net savers, no loans are traded and

their optimal allocations will be the market allocation under zero interest. If one is a saver and the other one is a net borrower, the market solution will be the same for the saver. For the borrower, the maximization is repeated subject to the quantity constraint on the amount that he can borrow. He can at most borrow what the other person is saving

In the first stage we will have:

$$\text{Max } U^A(C_1^A, C_2^A) \qquad \text{Max}(U^B(C_1^B, C_2^B)$$

$$\text{S.T. } C_1^A+C_2^A = C_1^{0A}+C_2^{0A} \qquad \text{S.T. } C_1^B+C_2^B = C_1^{0B}+C_2^{0B}$$

If, for example, it was found that person A is a net lender:

$$C_1^{0A}-C_1^A = Z^A>0,$$

then we must repeat the maximization for person B subject to a quantity constraint.

$$\text{Max } U^B(C_1^{*B}, C_2^{*B})$$

$$\text{S.T. } C_1^{*B} + C_2^{*B} = C_1^{0B} + C_2^{0B}$$

$$C_1^{0B}+Z^A-C_1^{*B} \geq 0$$

(C_1^{*B}, C_2^{*B}) will be different from (C_1^B, C_2^B) if the inequality constraint is binding. The final allocations are

$C_1^A, C_2^A, C_1^{*B}, C_2^{*B}$. The equilibrium under perfect markets is demonstrated in Fig. 6. The equilibrium interest line is R_1R_2. The optimal allocation point is E. H represents the initial positions of persons A and B. The solution under no interest charge is shown in Fig. 7 by point F. s_1s_2 is the zero interest line. Comparing the welfare of person A at E and F, we see that as a net lender he is clearly worse off under the Islamic regime. Person B could be worse off or better off depending on the amount that he can borrow. In Fig. 7, he is shown to be worse off: $U_2^B < U_1^B$. Again, we cannot make a general statement on how the net savings changes.

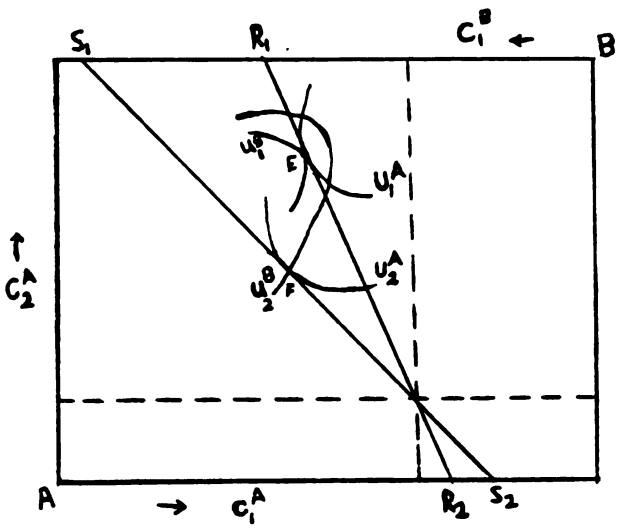

Figure 7

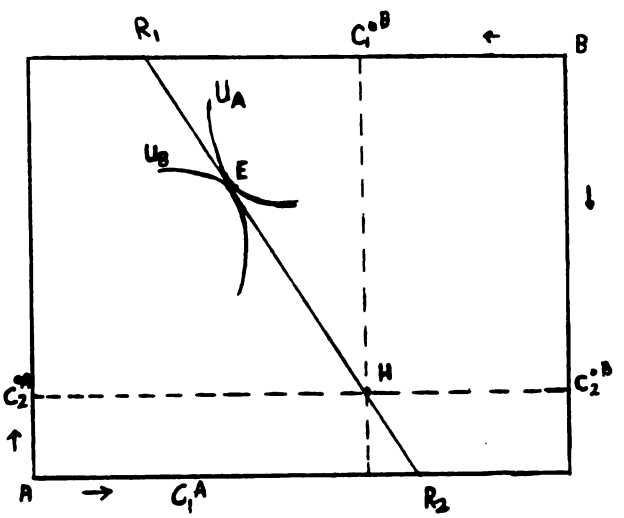

Figure 6

1-B. A Two-Person Model With Saving And Investment.

In this part, we add production opportunities to the two-person model presented in 1-A. Each person now has two options: to lend or to invest according to a concave nondecreasing production function. The production functions are:

$$T^A(K_1^A, K_2^A)=0 \qquad T^B(K_1^B, K_2^B)=0$$

$K_1<0$ is the input and $K_2>0$ is the output.

Fig. 8-A demonstrates how an agent allocates his resources between savings and investment. The production possiblities are shown by the concave curve C_1^0. C_1^0 is his initial endowment. To maximize his utility, he will invest $K_1=-C_1^0.X^1$ and save X'Y'. Then he will be able to consume C_2 in the second period.

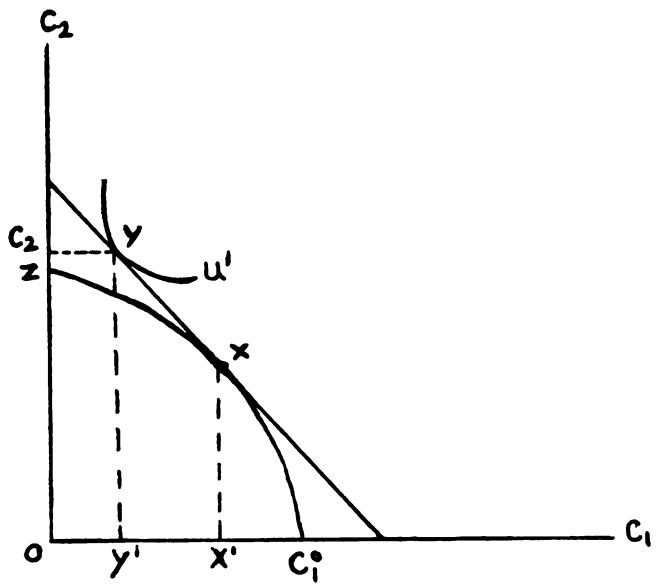

Figure 8-A

In our two-person model the equilibrium conditions are derived from each person's maximization subject to the production and budget constraints. In a regular capital market with free movement of the interest rate, we will have:

$$\text{Max } U^A(C_1{}^A, C_2{}^A)$$

$$\text{S.T. } C_1{}^A + C_2{}^A/(1+r) = C_1{}^{0A} + K_2{}^A/(1+r) + K_1{}^A \;,\quad T^A(K_1{}^A, K_2{}^A) = 0$$

$$\text{Max } U^B(C_1{}^B, C_2{}^B)$$

$$\text{S.T. } C_1{}^B + C_2{}^B/(1+r) = C_1{}^{0A} + K_2{}^A/(1+r) + K_1{}^A \;,\quad T^B(K_1{}^B, K_2{}^B)$$

Using the Kuhn-Tucker method, the Lagrangians are

$$L_A = U^A(C_1{}^A, C_2{}^A) - q_1{}^A . T^A(K_1{}^A, K_2{}^A) + q_2{}^A . (K_1{}^A + K_2{}^A/(1+r) - C_1{}^A - C_2{}^A/(1+r) + C_1{}^{0A})$$

$$L_B = U^B(C_1{}^B, C_2{}^B) - q_1{}^B . T^B(K_1{}^B, K_2{}^B) + q_2{}^B . (K_1{}^B + K_2{}^B/(1+r) - C_1{}^B - C_2{}^B/(1+r) + C_1{}^{0B})$$

The first order conditions are:

$$U_1{}^A - q_1{}^A = 0 \;,\quad U_2{}^A - q_1{}^A/(1+r) = 0$$

$$q_2{}^A . T_1{}^A + q_1{}^A = 0 \;,\quad q_2{}^A T_2{}^A + q_1{}^A/(1+r) = 0$$

$$U_1{}^B - q_1{}^B = 0 \;,\quad U_2{}^B - q_1{}^B/(1+r) = 0$$

$$q_2{}^B . T_1{}^B + q_1{}^B = 0 \;,\quad q_2{}^B T_2{}^B + q_1{}^B/(1+r) = 0$$

Simplication gives:

$$U_2^A/U_1^A = 1/(1+r) \quad , \quad U_2^B/U_1^B = 1/(1+r)$$

$$T_2^B/T_1^B = -1/(1+r) \quad , \quad T_2^A/T_1^A = -1/(1+r)$$

For equilibrium in the loan market, we have:

$$C_1^A + K_1^A - C_1^{0A} = -(C_1^B + K_1^B - C_1^{0B})$$

The above 5 equations plus the two budget constraints will solve for these seven parameters: $r, C_1^A, C_2^A, K_1^A, C_1^B, C_2^B, K_1^B$. This is the market equilibrium under perfect capital markets. We demonstrate the solution in Fig. 8.B. A is the lender and B is the borrower. The equilibrium in the loan market means $Y_B X_B = Y_A X_A$.

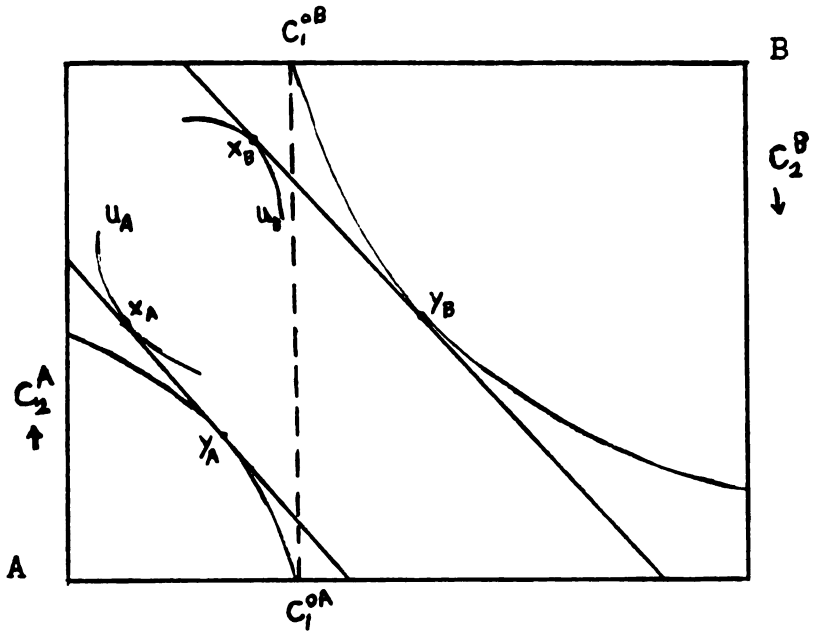

Fig. 8.B

Figure 8-B

Under the Islamic restriction, the interest rate is fixed at zero and the borrower faces a restriction on how much he can borrow. To find the new equilibrium, first we find the optimal solution for each person under zero rate of interest and no limitations on lending or borrowing. If it is seen that they are both lenders, the feasible solution will be same as what was found for each one of them. If they are both net borrowers, then to find the feasible solution we repeat the optimization for each person under the condition that no borrowing is allowed.

Finally, if one person was a lender and the other one was a borrower, the allocation of the lender will be already feasible. To find the feasible solution for the borrower, his maximization problem will be repeated subject to the restriction that he can't borrow more than what the other person is willing to lend.

Formally in the first stage we will have:

$$\text{Max } U^A(C_1{}^A, C_2{}^A)$$

$$\text{S.T. } T^A(K_1{}^A, K_2{}^A)=0$$

$$C_1{}^A+C_2{}^A=C_1{}^{0A}+K_1{}^A+K_2{}^A$$

$$\text{Max } U^B(C_1{}^B, C_2{}^B)$$

$$\text{S.T. } T^B(K_1{}^B, K_2{}^B)=0$$

$$C_1{}^B+C_2{}^B=C_1{}^{0B}+K_1{}^B+K_2{}^B$$

If they are both net borrowers, the feasible solution is obtained by the following optimizations:

$$\text{Max } U^A(C_{1A}, C_{2A})$$

$$\text{S.T. } T^A(K_{1A}, K_{2A}) = 0$$

$$C_{1A} + C_{2A} = C_{10A} + K_{1A} + K_{2A}$$

$$C_{1A} \leq C_{10A} + K_{1A}$$

$$\text{Max } U^B(C_{1B}, C_{2B})$$

$$\text{S.T. } T^B(K_{1B}, K_{2B}) = 0$$

$$C_{1B} + C_{2B} = C_{10B} + K_{1B} + K_{2B}$$

$$C_{1B} \leq C_{10B} + K_{1B}$$

Figures 9-A and 9-B demonstrate this situation.

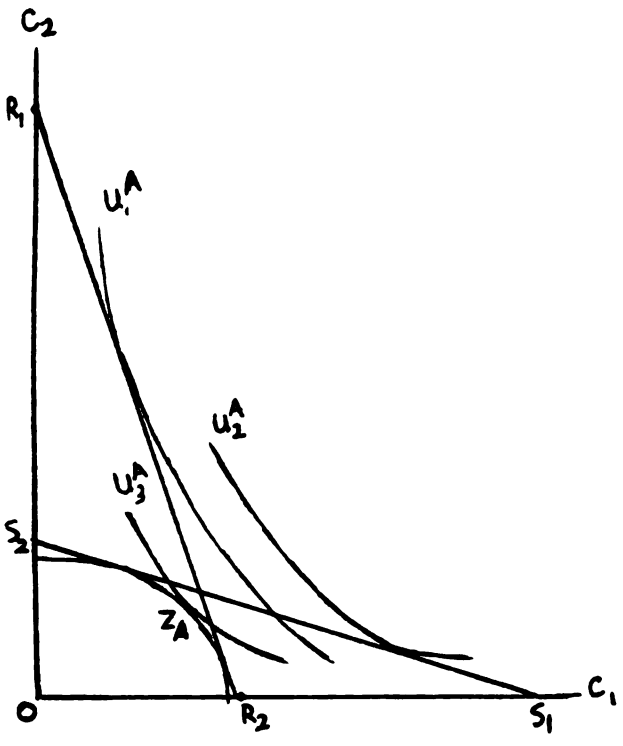

Figure 9-A

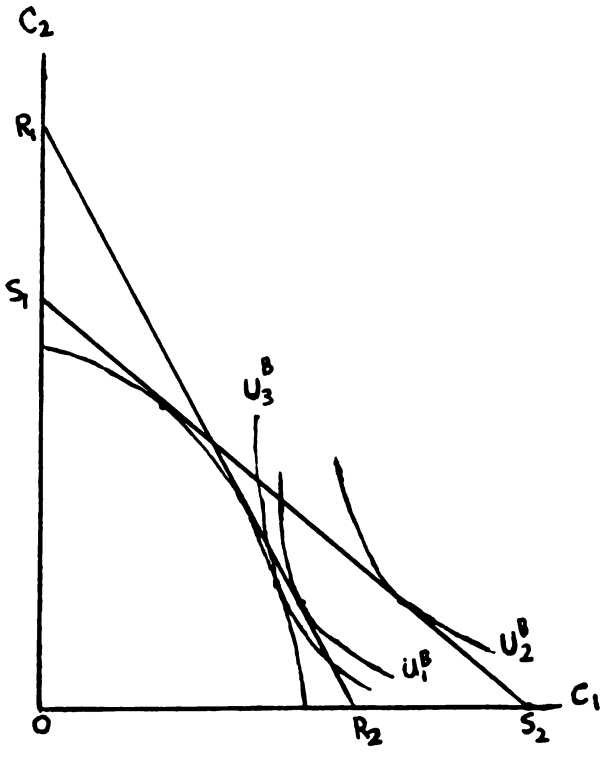

Figure 9-B

Under the positive market rate of interest, A is a lender and B is a borrower. Setting the interest rate at zero will rotate the interest rate line R_1R_2 to S_1S_2 for both of them. Now if unrestricted borrowing was allowed, they would both be better off, achieving utility levels U_2^A and U_2^B. But since they can't borrow, the feasible optimal allocations are Z_A and Z_B . Both persons are worse off.

If in the first stage one of them was a net lender and the other one was a net borrower, the lender's allocation is feasible but we must repeat the borrower's optimization problem. Assuming B is the borrower:

$$\text{Max } U^{*B}(C_1^{*B}, C_2^{*B})$$

$$\text{S.T. } T^{*B}(K_1^{*B}, K_2^{*B}) = 0$$

$$C_1^{*B} + C_2^{*B} = C_1^{0B} + K_1^{*B} + K_2^{*B}$$

$$Z_A - C_1^{*B} + C_1^{0B} + K_1^{*B} \geq 0$$

where $Z_A = C_1^{0A} - C_1^A + K_1^A$. Z_A is the amount that person A lends at zero interest. Then, the optimal allocations under Islamic restriction are $C_1^A, C_2^A, C_1^{*B}, C_2^{*B}, K_1^A, K_2^A, K_1^{*A}, K_1^{*B}$. Figs. 10-A and 10-B show the feasible solutions and the welfare results in this case:

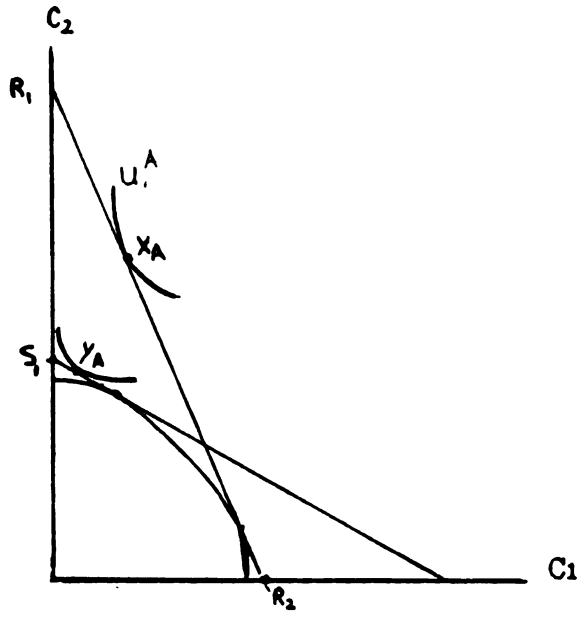

Fig. 10-A

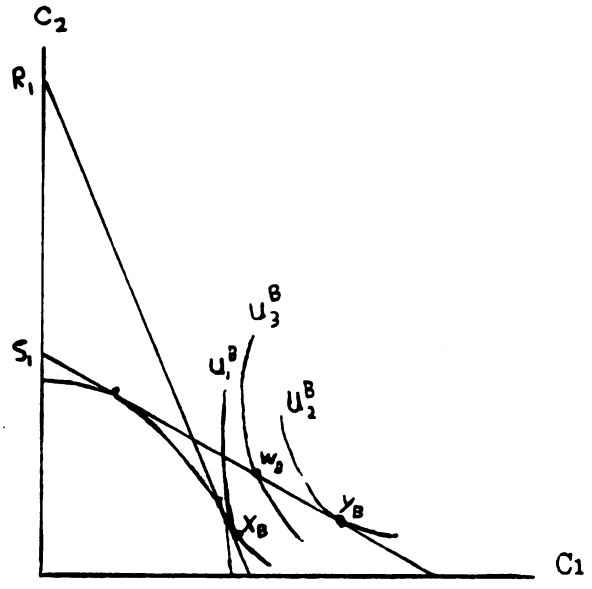

Fig. 10-B

Under Islamic restriction, person A chooses Y_A and person B wants to choose Y_B but, since he can't borrow enough to reach Y_B, he borrows all that A is willing to lend. Person B achieves the highest level of utility at W_B: Max $U^B|_{r=0} = U_3^B$. In Fig. 10-B, $U_3^B > U_1^B$ implies that the borrower will be better off. But this is not a general conclusion. We could easily give other examples where $U_3^B < U_1^B$. We could say with certainty that A will be worse off because he is a lender and the rate of interest has been reduced to zero.

Section 2

THE IMPACT OF ISLAMIC REGULATION UNDER UNCERTAINTY

The model of section one is insightful on the welfare results of the Islamic Economic regime, but it is not capable of determining the direction of change in total savings. It also reveals nothing about portfolio decisions and above all it is unrealistic because it does not take into account the existing risk in the asset markets. Clearly, any risk-averse investor will be sensitive to the risk of every asset in his portfolio, and he would choose a portfolio with minimum risk for any given expected return. In this section, we study the reaction of risk-averse investors to the elimination of interest in a model that formally incorporates uncertainty. The objective is to see how the portfolio and intertemporal allocations change as the interest-paying assets are eliminated. Another goal is to see how their welfare changes.

The model introduced here is a two-period, two-person, two-asset model. Individuals will invest their savings in a portfolio of risky and safe assets. Under regular capital markets, the rate of interest adjusts until the loan market clears. Under Islamic regime, the interest rate is set at zero and the loan market will be at disequilibrium. Clearly the private investors will not agree to lend funds to each

other at a zero rate of interest. Instead, they will keep their money in cash and demand deposits which together represent the safe asset of our model. Therefore, one might be tempted to say that at zero interest no credit is lended, but this observation is not correct because when a person opens a demand deposit account, he is indeed lending money to the bank. The bank keeps only a small portion of this money as reserve and invests the rest (in loans or direct-equity holdings). We divide the investors into two groups. Let one group be the stockholders of banks and another group be everyone else. (These will be the two persons in our model.) Then under the Islamic regime, the second group will be lending money to the first group through the demand deposits.

We start the analysis by first solving the optimization problems of both individuals for a general value of the rate of interest r_0. Then we differentiate the first order conditions with respect to r_0 to see how the savings and risk-taking behavior of each individual changes as we change the interest rate slightly. Our model is basically a disequilibrium model where the rate of interest is a policy tool. It could be set at any level between 0 and its equilibrium value. The direction of local change in saving and risk taking that is obtained by differentials remains valid for any original value of interest rate in this range. Our goal is to approximate the direction of change in risk

taking and savings when the interest rate is suppressed from its original positive value to zero. The differentiation approach, however, is only valid for small changes in the interest rate. When the interest rate is reduced from its positive value to zero, the change might be too large to justify this method. To go around this difficulty, we will change our point of origin. We assume that the rate of interest is originally zero, then we use the differentials to approximate the change in the savings and risk taking as the rate of interest is allowed to take a small positive value. In other words, we observe how the behavior of people changes as we go from an Islamic economy to a regular economy with financial suppression, then based on this finding, we will approximate the changes in household behavior when switching from a regular to an interest-free economy. The argument of Islam is that the interest rate must be zero as opposed to any positive rate. Comparing the welfare and allocative results of the Islamic economy against a regular economy with any level of interest rate suppression will still give some insights about the relative performance of an Islamic economy. The analysis reveals that, for even a slight increase in the rate of interest (from its original position at zero), the total saving increases and risk allocation improves.

There is already vast literature on financial suppression which indicates that the interest-rate ceiling

is nonpareto optimal compared to the competitive loan markets. Using this result, we can argue that, since Islamic economy is inferior to a similar economy with financial suppression and the latter is itself inferior to a similar economy with no interest ceiling, the Islamic economy will be inferior to a competitive economy. We start the analysis with a general equilibrium model of a one-period portfolio choice and extend it to a two-period model with portfolio and intertemporal choice.

2-A. A Two-Person Uncertainty Model with Portfolio Choice Only.

Consider two individuals with fixed initial endowments W_1 and W_2. Each person should allocate his endowment between holdings in a risky asset and a safe bond. If the individual is a net borrower, his bond holdings will be negative. The objective is to choose an allocation which will maximize the expected utility of final wealth. Before developing the model, note that in this case the expected return to the risky asset is fixed because the total savings of each person is given: $r=r(W_1, W_2)$. The bonds issued by one person to another do not affect the aggregate investment since all the existing funds are invested. The maximization problem for each person is:

$$\text{Max } EU^A(W_1 . (1+r_0 + X_A(r^* - r_0)))$$

$$\text{W.R.T. } X_A$$

$$\text{Max } EU^B(W_2 . (1+r_0 + X_B(r^* - r_0)))$$

$$\text{W.R.T. } X_B$$

X_A, X_B = Portions of wealth invested in risky asset by A and B.

r^* = The random rate of return on the risky asset.

For equilibrium in the bond market we must have:

$$(1-X_A).W_1 = -(1-X_B).W_2 \qquad (1)$$

The first order conditions are:

$$dEU^A/dX_A = 0, \quad dEU^B/dX_B = 0 \qquad (2)$$

We have three equations which could be solved for the equilibrium values of X_A, X_B and r_0. The equilibrium is demonstrated in Fig. 11. The optimal allocations are shown by points F and G. r_0 is the interest rate for which EF=EG, total lended equals total borrowed. The outcomes are pareto optimal because the slopes of the indifference curves are the same for both persons.

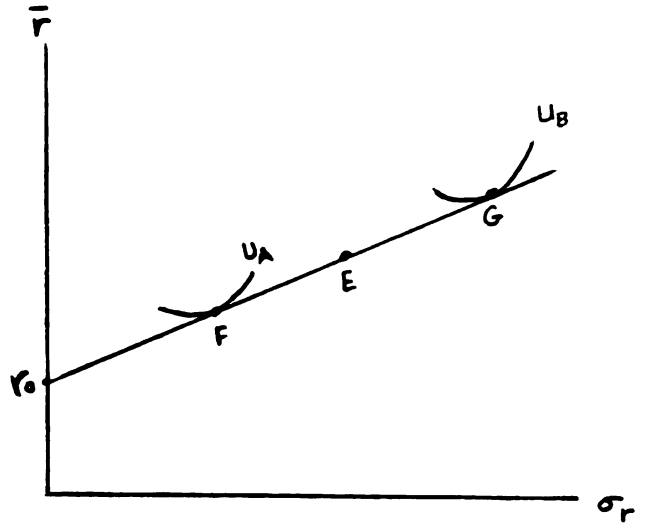

Figure 11

When we suppress the interest rate, it is the borrower who faces quantity constraint in the bond market. The lender will simply save as much as he desires under zero interest rate. The optimal allocations at zero interest rate are shown by points H and J.

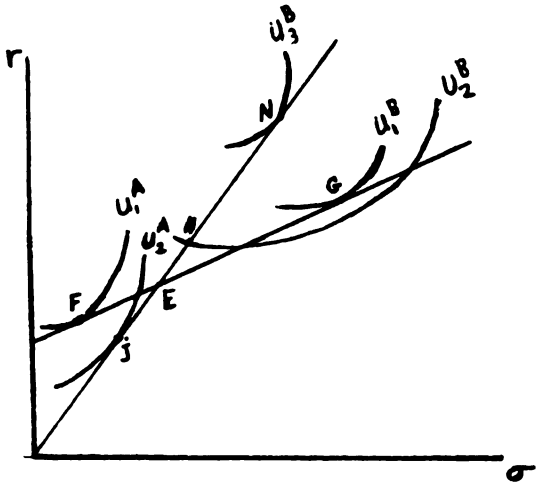

Figure 12-A

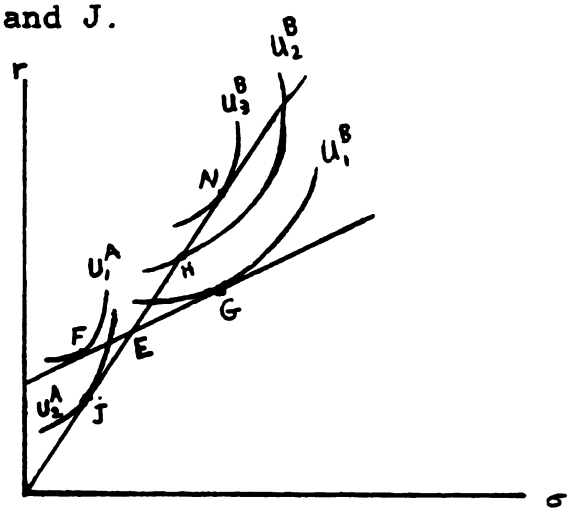

Figure 12-B

If person B could borrow all that he wishes, he would choose point N, but he is forced to choose a position on EH. In Figs. 12-A and 12-B, we see that the lender is clearly worse off while the impact on the borrower is not determined. On one hand, the cost of borrowing is lower and, on the other hand, he can't borrow as much as he desires; he could be worse off or better off. Nevertheless, we see that the outcome under zero interest rate is not pareto optimal because the rate of substitution between risk and return is not the same for both persons.

To gain further insight and also to find out how the risk allocation changes, we have to develop an algebraic treatment. To do so, we must choose specific utility functions for the two persons in our model. We assume that the investors in our model are only concerned with the mean and the variance of the return. Then their expected utility of wealth function will be equivalent to a quadratic utility function. Even though quadratic utility functions have a number of weaknesses that have been pointed out in the literature, we have chosen to work with them because they make the algebraic derivation possible.

Let: $U_A(C^*_A) = C^*_A - d.C^{*2}_A$, $U_B(C^*_B) = C^*_B - d'.C^{*2}_B$

C^*_A, C^*_B = The random final wealth.

The expexted utilities are:

$$EU^A(C^{*A}) = \bar{C}^A - d.\bar{C}^{A2} - d.sc^{*A2}$$

$$EU^B(C^{*B}) = \bar{C}^B - d'.\bar{C}^{B2} - d'.sc^{*B2}$$

s = The standard deviation

As we can see, the expected utility can be written as a function of mean and variance. In our model we have:

$C^{*A} = W_1.(1+r_0+X_A.(r^*-r_0))$ $\qquad$ $C^{*B} = W_1.(1+r_0+X_B.(r^*-r_0))$

$\bar{C}^A = W_1.(1+r_0+X_A.(\bar{r}-r_0))$ $\qquad$ $\bar{C}^B = W_1.(1+r_0+X_B.(\bar{r}-r_0))$

$sc^{*A2} = W_1^2.X_A^2.s_r^2$ $\qquad$ $sc^{*B2} = W_1^2.X_B^2.s_r^2$

The first order condition for the lender is:

$$dEU^A/dX_A = [1-2.d.\bar{C}^A].(\bar{r}-r_0).W_1 - 4.d.s_r^3.W_1^3.X_A^2$$

$$= [1-2dW_1.(1+r_0+X_A(\bar{r}-r_0))](\bar{r}-r_0) - 4dW_1^2.X_A^2.s_r^3 = 0$$

Next, we differentiate this F.O.C. with respect to r_0, the rate of interest.

$$dX_A/dr_0 = [8X_A.W_1^2.s_r^3 + 2d.W_1.(\bar{r}-r_0)^2]$$

$$= -1-2dW_1.(1-X_A)(\bar{r}-r_0)$$

We can see that $dX_A/dr_0 < 0$. The change in the interest rate when going from regular to Islamic regime is $dr = 0 - r_0 = -r_0$.

As explained earlier, for any interest rate less than the equilibrium rate r_0, the borrower will face quantity constraint in the bond market. His optimization problem is:

$$\text{Max } EU^B(W_2(1+r_0+X_B(\bar{r}-r_0)))$$

$$\text{S.T. } (1-X_A)W_1+(1-X_B)W_2 \geq 0$$

The Lagrangian is: $L=EU^B-q_1((1-X_A)W_1+(1-X_B)W_2)$

$$dL/dX_B = (1-2d'.W_2.(1+r_0+X_B(\bar{r}-r_0))).(\bar{r}-r_0)$$
$$-4d'W_2^2.X_B^2.s_r^3+q_1X_B.W_2=0$$

$$dL/dq_1 = (1-X_A)W_1+(1-X_B)W_2 \geq 0 \quad \text{and} \quad dL/dq_1 . q_1 = 0.$$

If the degree of risk aversion is small enough, the constraint will become binding. In this case, we can derive the dX_B/dr by differentiating the bond market constraint W.R.T. r_0.

$$(dX_A/dr).W_1-(dX_B/dr).W_2=0$$

or

$$dX_B/dr=-dX_A/dr . W_1/W_2 = (-)(-)(+) > 0.$$

Now that the signs of dX_A/dr and dX_B/dr have been determined, we can find the direction of change in X_B and X_A when the interest rate is allowed to increase (starting from zero interest rate). As the interest rate increases, the highly risk-averse person is able to reduce his risk taking and the less risk-averse person can do the opposite.

$$dX_A = dX_A/dr \;.\; dr = (-)(+)<0$$

$$dX_B = dX_B/dr \;.\; dr = (+)(+)>0$$

To find the impact on the utility of each person, we will first determine the signs of dEU^A/dr and dEU^B/dr.

$$dEU^A/dr_0 = dEU^A/d\bar{C}^A \,.\, W_1\,(1-X_A) + dEU^A/dX_A \,.\, dX_A/dr_0 \,.\, (\bar{r}-r_0)$$

$$+ (dEU^A/dsc^{A2}) \,.\, 2X_A \,.\, dX_A/dr \,.\, W_1 \,.\, s_r^2$$

$$= dEU^A/d\bar{C}^A \,.\, W_1 \,.\, (1-X_A) + dX_A/dr \,.\, [dEU^A/dX_A]$$

$$= dEU^A/d\bar{C}^A \,.\, W_1 \,.\, (1-X^A) \,.$$

The second term is zero since we have dEU^A/dX_A .

Therefore we get: $dEU^A/dr = dEU^A/d\bar{C}^A \,.\, W_1 \,.\, (1-X_A) = (+)(+)>0$. The impact of moving away from zero interest on the welfare ofthe more risk-averse person is: $dEU^A \sim dEU^A/dr_0 \,.\, dr_0 = (+)(+)>0$. An increase in the rate of interest improves his welfare. For the borrower we again have:

$$dEU^B/dr = dEU^B/d\bar{C}^B \,.\, (1-X_B) + dX_B/dr \,.\, [dEU^B/dX_B];$$

but since the borrower faces quantity constraint, we have $dEU^B/dX_B \neq 0$. since for the borrower X_B is smaller than the desired $dEU^B/dX_B > 0$. We also know that $X_B > 1$. Therefore,

$$dEU^B/dr = dEU^B/d\bar{C}^B (1-X_B) + dX_B/dr \,.\, [dEU^B/dX_B] \;<>0.$$

The direction of change in the utility of the less risk-averse person is not clear. On one hand, the quantity of loans increases and, on the other hand, he must now pay a

positive interest. Whatever the impact on the welfare of the borrower may be, under the Islamic regime, the conditions of pareto optimality are violated. We explained this in Figs. 12-A and 12-B.

2-B. The Impact of Islamic Restriction in a Two-Period Intertemporal and Portfolio Choice Model.

In this model, we extend the model presented in 2-A to include savings/consumption decisions as well as portfolio choice. Each person has an initial endowment which must be allocated between consumption in two periods.The first period savings must be allocated between safe and risky assets as described in 2-A. In this model, the rate of return on the the risky asset is endogenously determined and it is a decreasing function of net savings by both persons. This rate of return is derived from a general stochastic investment function:

$$Y^* = Y(W_1 - C_1^A + W_2 - C_1^B, \epsilon)$$

The only argument of this function besides the error term is the total investment of both individuals which is in turn equal to the total savings of both of them. The stochastic element reflects the uncertainty about the outcome of the investment project. We assume that $\epsilon \sim N(0,1)$. For this general investment function, the stochastic, one-period rate of return is:

$r^*=(Y^*-I)/I = r^*(W_1-C_1{}^A+W_2-C_1{}^B,\in)$ where $I=(W_1-C_1{}^A)+(W_2-C_1{}^B)$.

We assume that the production function is concave such that $dEY^*/dI<0$, then the expected rate of return is also a declining function of total savings.

$$d\bar{r}/dI=\frac{(dY^*/dI-1).I-(\bar{Y}-I)}{I^2}<0.$$

Furthermore, $dr/dI<0 \Rightarrow dr/d(W_1-C_1{}^A)<0$ and $dr/d(W_2-C_1{}^B)<0$. Since the source of savings is not relevant to the process of investment, we also have:

$$d\bar{r}/d(W_1-C_1{}^A)=d\bar{r}/d(W_2-C_1{}^B)$$

In the analysis we assume a linear-expected rate of return function which is derived from a quadratic investment function.

$$Y^*=2I-eI^2+\in_I \Rightarrow \bar{Y}=2I-eI^2.$$

$$\bar{r}=(\bar{Y}-I)/I=1-e.(W_1-C_1{}^A+W_2-C_1{}^B)$$

For this expected return function, we have:

$$d\bar{r}/d(W_1-C_1{}^A)=d\bar{r}/d(W_2-C_1{}^B)=-e$$

e is a positive number which is small enough to give a positive expected rate of return for the acceptable range of total savings. In other words, we require that $\bar{r}\geq 0$. This implies:

$$e< 1/[W_1-C_1{}^A+W_2-C_1{}^B].$$

The choice of this specific investment function is only for algebraic ease. The same results will still hold if we consider a general form for the expected return function and write:

$$d\bar{r}/d(W_1 - C_{1A}) = d\bar{r}/d(W_2 - C_{1B}) = -e.$$

However, the same restrictions that are imposed on e must still be imposed in the general case.

Each person is assumed to have a quadratic utility function over the two periods.

$$U_A(C_{1A}, C_{2*A}) = C_{1A} - d.C_{1A}^2 + C_{1*A} - d.C_{2*A}^2$$

$$C_{2*A} = (W_1 - C_{1A})(1 + r_0 + X_A(r^* - r_0))$$

$$U_B(C_{1B}, C_{2*B}) = C_{1B} - d.C_{1B}^2 + C_{1*B} - d.C_{2*B}^2$$

$$C_{2*B} = (W_1 - C_{1B})(1 + r_0 + X_B(r^* - r_0))$$

Then, the expected utilities are:

$$EU_A(C_{1A}, C_{2*A}) = C_{1A} - dC_{1A}^2 + \bar{C}_{2A} - d.\bar{C}_{2A}^2 - d.sc_A^2$$

$$EU_B(C_{1B}, C_{2*B}) = C_{1B} - dC_{1B}^2 + \bar{C}_{2B} - d.\bar{C}_{2B}^2 - d.sc_B^2$$

We will first study the behavior of the lender who does not face any quantity consrtaints. Allow A to be the more risk-avers person (the lender). His optimization problem is:

$$\underset{X_A, C_{1A}}{\text{Max}}\ EU_A(C_{1A}, C_{2*A}) = \bar{U}_A(C_{1A}, \bar{C}_{2A}, sc_A^2)$$

$$\text{S.T. } C_{2*A} = (W_1 - C_{1A})(1 + r_0 + X_A(\bar{r} - r_0))$$

The first order conditions are:

$$dEU^A/d\bar{C}_{1A} = \bar{U}_{1A} - \bar{U}_{2A}.(1+r_0+X_A(\bar{r}-r_0))$$
$$-2.\bar{U}_{3A}.X_A^2(W_1-C_{1A}).s_r^2=0 \qquad (4)$$
$$dEU^A/dX^A = \bar{U}_{2A}(\bar{r}-r_0)+2.\bar{U}_{3A}.X_A(W_1-C_{1A}).s_r^2=0 \qquad (5)$$

Even though the rate of return to the risky asset is endogenous, each consumer treats r a given parameter when maximizing his expected utility. The reason for so doing is that we want the model to reflect the conditions of competitive general equilibrium. We can further write equation 4 as:

$$dEU^A/dC_{1a} = \bar{U}_1^A - \bar{U}_{2A}(1+r_0) - X_A.dEU^A/dX_A$$
$$= \bar{U}_{1A} - \bar{U}_{2A}(1+r_0) \qquad (6)$$

Expanding equations 5 and 6 for the quadratic utility function we get:

$$d\bar{U}^A/dC_{1A} = \bar{U}_{1A} - \bar{U}_{2A}(1+r_0)$$
$$=1-2d.C_{1A}-(1+r_0)+2d.(W_1-C_{1A})(1+r_0+X_A(\bar{r}-r_0)).(1+r_0)=0. \qquad (7)$$
$$d\bar{U}^A/dX_A = 2d.(W_1-C_{1A})^2.X_A^2.s_r^3-(\bar{r}-r_0)$$
$$+2d.(W_1-C_{1A})(1+r_0+X_A(\bar{r}-r_0)).(1+r_0)=0 \qquad (8)$$

Solving 7 and 8 for C_{1A} and X_A will tell us the optimal choice of the lender. However, what we are interested in is how his choice changes as the interest rate varies. To achieve this, we totally differentiate the F.O.C.'s with respect to r_0. The total differentiation of equation 7 gives:

$$d(W_1-C_1^A)/dr_0\,.\,[2d+2d.(1+r_0)^2+2d.(\bar{r}-r_0)(1+r_0).X_A+2d.(W_1-C_1^A).X_A.(1+r_0)(-e)]+dX_A/dr_0\,.\,[2d.(W_1-C_1^A).(\bar{r}-r_0)(1+r_0)]=$$

$$1-2d.(W_1-C_1^A).(1+r_0).2-2d.(W_1-C_1^A).X_A.(1+r_0).(-1-e.\frac{d(W_2-C_1^B)}{dr_0})$$

$$-2d.(W_1-C_1^A).X_A.(\bar{r}-r_0).$$

and the total differentiation of equation 8 gives:

$$d(W_1-C_1^A)/dr_0\,.\,[2d.s_r^3.X_A^2.(W_1-C_1^A).2+e+2d.(1+r_0+X_A(\bar{r}-r_0)).(\bar{r}-r_0)+2d.(W_1-C_1^A).X_A.(\bar{r}-r_0).(-e)+2d.(W_1-C_1^A).[1+r_0+X_A(\bar{r}-r_0).(-e)]]+dX_A/dr_0\,.\,[4d.s_r^3.X_A.(W_1-C_1^A)^2+2d.(W_1-C_1^A).(\bar{r}-r_0)^2]=(-1-e.\frac{d(W_2-C_1^B)}{dr_0})-2d.(W_1-C_1^A).[1+r_0+X_A(\bar{r}-r_0)].(-1-e.\frac{d(W_1-C_1^A)}{dr_0})$$

Using A,B,C,D,H and G for the coefficients in these equations, we can rewrite them as:

$$d(W_1-C_1^A)/dr_0\,.\,A+dX_A/dr_0\,.\,B=H \quad \text{for } dU^A/dC_1^A=0$$
$$d(W_1-C_1^A)/dr_0\,.\,C+dX_A/dr_0\,.\,D=G \quad \text{for } dU^A/dX_A=0$$

In the matrix form we have:

$$S=\begin{bmatrix}A & B\\ C & D\end{bmatrix} \qquad \begin{bmatrix}A & B\\ C & D\end{bmatrix}.\begin{bmatrix}d(W_1-C_1^A)/dr_0\\ dX_A/dr_0\end{bmatrix}=\begin{bmatrix}H\\ G\end{bmatrix} \tag{9}$$

System 9 could be solved for $\begin{bmatrix}d(W_1-C_1^A)/dr_0\\ dX_A/dr_0\end{bmatrix}$. Since we are not using any numerical values, we can only solve for the signs of these items. To do so, we must first find the signs of A,B,C,D,H and G and det(S). We will investigate the signs below: Since d, s_r, X_A and $(W_1-C_1^A)>0$; B and D are clearly positive.

Sign of A

$$A=2d+2d.(1+r_0)^2+2d.X_A.(\bar{r}-r_0).(1+r_0)+$$
$$2d.(W_1-C_{1A}).X_A.(1+r_0)(-e)$$

We know that $\bar{r}>0$, $\bar{r}=1-e.(W_1-C_{1A}+W_2-C_{1B})$ =>

$$\Rightarrow e<1/(W_1-C_{1A}+W_2-C_{1B})<1/(W_1-C_{1A}).$$

In the last term of A, we replace e by $1/(W_1-C_{1A})$. This makes the term a larger negative number, then by rearranging the terms, we will have:

$$A>2d+2d.(1+r_0)^2+2d.X_A.(\bar{r}-r_0).(1+r_0)-2d.X_A.(1+r_0).$$

The sum of the last two terms is positive so the whole phrase is positive <u>A>0</u>.

Sign of C

$$C=[2d.s_r^3.X_A^2.(W_1-C_{1A}).2+e+2d.(1+r_0+X_A(\bar{r}-r_0)).(\bar{r}-r_0)+$$
$$2d.(W_1-C_{1A}).X_A.(\bar{r}-r_0).(-e)+2d.(W_1-C_{1A}).[1+r_0+X_A(\bar{r}-r_0).(-e)]$$

Again we have: $e<1/(W_1-C_{1A})$ which allows us to claim:

$$C>[4d.s_r^3.X_A^2.(W_1-C_{1A})+e+2d.(1+r_0+X_A(r-r_0)).(r-r_0)+$$
$$2d.X_A.(r-r_0).(-1)+2d.(W_1-C_{1A}).(1+r_0)+2d.X_A(r-r_0).(-1)>0$$

<u>C>0</u>

Sign of H

$$H=1-4d.(W_1-C_1^A).(1+r_0)-2d.(W_1-C_1^A).X_A.(1+r_0).(-1-e.\frac{d(W_2-C_1^B)}{dr_0})$$
$$-2d.(W_1-C_1^A).X_A.(\bar{r}-r_0).$$

If d and e are small enough, this statement is positive. This will happen if W_1 and W_2 are large numerical values.

Sign of G

$$G=(-1-e.\frac{d(W_2-C_1^B)}{dr_0})-2d.(W_1-C_1^A).[1+r_0+X_A(r-r_0)].(-1-e.\frac{d(W_1-C_1^A)}{dr_0})$$

Assuming that $e<1/(W_2-C_1^B)$ and $\frac{d(W_2-C_1^B)}{dr_0}$ $\Longrightarrow$

$$(-1-e.\frac{d(W_2-C_1^B)}{dr_0}) < (-1-e.[d(W_2-C_1^B)/dr_0]/(W_2-C_1^B))$$

As a result $\underline{G<0}$.

Then we can write the system in the following form.

$$\begin{bmatrix}+ & +\\ + & +\end{bmatrix}\cdot\begin{bmatrix}d(W_1-C_1^A)/dr_0\\ dX_A/dr_0\end{bmatrix}=\begin{bmatrix}+\\ -\end{bmatrix}$$

The only remaining step is to find the size of the determinant [S]=AD-BC. Applying the formulas for B and D we get:

$$|S]=A.2X_A.2d.(W_1-C_1^A)^2.s_r^3+$$
$$2d.(W_1-C_1^A).(\bar{r}-r_0)[(\bar{r}-r_0).A-(1+r_0).C] \qquad (10)$$

After expanding the bracket in the second and collecting terms we get:

$$[(\bar{r}-r_0).A-(1+r_0).C]=$$
$$(\bar{r}-r_0).2d-4d.s_r^3.X_A^2.(W_1-C_1A).(1+r_0)-$$
$$e.(1+r_0).[1-2d.(1+r_0+X_A(\bar{r}-r_0)).(W_1-C_1A)].$$

Then, by carrying out all of the mathematics in equation 10, we have:

$$|S|=4d^2.(\bar{r}-r_0)^2(W_1-C_1A)-8d^2.s_r^3.X_A^2.(W_1-C_1A)^2.(1+r_0).(\bar{r}-r_0)-$$
$$2d.e.(1+r_0).(\bar{r}-r_0)).(W_1-C_1A)+$$
$$4d^2.e.(1+r_0)^2.(\bar{r}-r_0)).(W_1-C_1A)^2+$$
$$4d^2.e.(1+r_0).(\bar{r}-r_0)).(W_1-C_1A)^2.X_A+$$
$$8d^2.s_r^3.X_A^2.(W_1-C_1A)^2+8d^2.s_r^3.X_A.(W_1-C_1A)^2.(1+r_0)^2+$$
$$8d^2.s_r^3.X_A^2.(W_1-C_1A)^2.(1+r_0).(\bar{r}-r_0)-$$
$$8d^2.s_r^3.X_A^2.(W_1-C_1A)^3.(1+r_0).e$$

After rearranging terms, we get:

$$|S|=8d^2.s_r^3.X_A^2.(W_1-C_1A)^2.[-(1+r_0).(\bar{r}-r_0).X_A^2+$$
$$(1+r_0).(\bar{r}-r_0).X_A^2+(1+r_0)^2.X_A-(1+r_0)^2.X_A.e]+$$
$$2d.(W_1-C_1A).(\bar{r}-r_0)[(\bar{r}-r_0).2d+4d.s_r^3.X_A^2.(W_1-C_1A)/(\bar{r}-r_0)-$$
$$e.(1+r_0)]+4d^2.(W_1-C_1A).(\bar{r}-r_0).(1+r_0).e.[1+r_0+X_A.(\bar{r}-r_0)].$$

The first and the third terms are clearly positive. The second term will be positive if e is small enough. Recall that $e<1/(W_1-C_1A)$. Therefore, if (W_1-C_1A) is large enough,

e will become small and this term will also become positive. Thus $|S|>0$.

With a positive determinant, we can now determine the signs of the elements in the inverse matrix S^{-1}. If $S=\begin{vmatrix}+ & +\\ + & +\end{vmatrix}$ and $\det(S)>0$, then:

$$S^{-1}=\begin{bmatrix}+ & -\\ - & +\end{bmatrix}$$

And, finally, we will get: $\begin{bmatrix}d(W_1-C_1{}^A)/dr_0\\ dX_A/dr_0\end{bmatrix}=\begin{bmatrix}+ & -\\ - & +\end{bmatrix}\begin{bmatrix}+\\ -\end{bmatrix}=\begin{bmatrix}+\\ -\end{bmatrix}$

<u>The lender will take less risk and save more if we move away from zero interest rate.</u>

<u>The Reaction of the Borrower</u>

From the lender's behavior we know that when the interest rate increases, the quantity of bonds increases. Next we find out how the borrower reacts to this increase in quantity of bonds and the rate of interest. The bond market equilibrium is given by:

$$(1-X_A)(W_1-C_1{}^A)=-(1-X_B)(W_2-C_1{}^B) \qquad (12)$$

Totally differentiating the bond market equation (12) with respect to r_0, we get:

$$(1-X_A).d(W_1-C_1{}^A)/dr_0-(W_2-C_1{}^B).dX_A/dr_0=$$
$$(1-X_B).d(W_1-C_1{}^B)/dr_0-(W_2-C_1{}^B).dX_B/dr_0$$

We can rewrite this equation as:

$$(1-X_B).d(W_1-C_{1B})/dr_0-(W_2-C_{1B}).dX_B/dr_0=K<0$$

$$d(W_1-C_{1A})/dr_0>0 \quad \text{and} \quad dX_A/dr_0<0 \Longrightarrow K<0 \qquad (13)$$

Besides equation 13, we need one more equation to determine the signs of $d(W_1-C_{1B})/dr_0$ and dX_B/dr_0. To find the second equation, we look at borrowers' optimization subject to the bond market constraint:

$$\underset{X_B,\,C_{1B}}{\text{Max}}\ EU^B(C_{1B},C_2{}^{*B})=\bar{U}^B(C_{1B},\bar{C}_{2B},sc^{B2})$$

$$\text{S.T.}\ \bar{C}_2{}^{*B}=(W_1-C_{1B})(1+r_0+X_B(\bar{r}-r_0))$$

$$sc^{B2}=sr^2.X_B{}^2.(W_2-C_{1B})^2$$

$$(1-X_A)(W_1-C_{1A})+(1-X_B)(W_2-C_{1B})\geq 0$$

$$[\bar{U}^B=C_{1B}-d'C_{1B}{}^2+C_{2B}-d'.C_{2B}{}^2-d'.sc^{B2}]$$

The Lagrangian is: $L=\bar{U}^B+q_2((1-X_A).(W_1-C_{1A})+(1-X_B).(W_2-C_{1B}))$

The first order conditions are:

$$dL/dC_{1B}=\bar{U}_{1B}-\bar{U}_{2B}.(1+r_0+X_B(\bar{r}-r_0))$$
$$-2.\bar{U}_{3B}.X_B{}^2(W_2-C_{1B}).sr^2+q_2.(X_B-1)=0$$

$$dL/dX^B = \bar{U}_{2B} \cdot (W_2 - C_{1B})(\bar{r} - r_0) + 2 \cdot \bar{U}_{3B} \cdot X_B [(W_{21} - C_{1B}) \cdot s_r]^2 - q_2 (W_1 - C_{1B}) = 0$$

$$dL/dq_2 = (1 - X_A) \cdot (W_1 - C_{1A}) + (1 - X_B) \cdot (W_2 - C_{1B}) \geq 0, \quad q_2 \cdot dL/dq_2 = 0$$

Assuming that $q_2 \neq 0$, we need one equation from above to solve for dX_B/dr_0 and $d(W_2 - C_{1B})/dr_0$.

The best strategy is to combine $d\bar{U}^B/dC_{1A}$ and $d\bar{U}^B/dX_B$ into one equation by eliminating q_2.

$$dL/dX^B = \bar{U}_{2B} \cdot (\bar{r} - r_0) + 2 \cdot \bar{U}_{3B} \cdot X_B (W_{21} - C_{1B}) \cdot s_r^2 - q_2 = 0 \qquad (14)$$

$$dL/dC_{1B} = \bar{U}_{1B} - \bar{U}_{2B}(1 + r_0) - X_B \cdot (d\bar{U}^B/X_B) + q_2 \cdot (X_B - 1) = 0$$

$$dL/dC_{1B} = \bar{U}_{1B} - \bar{U}_{2B}(1 + r_0) - X_B \cdot q_2 + q_2 \cdot (X_B - 1) = 0$$

$$= \bar{U}_{1B} - \bar{U}_{2B}(1 + r_0) - q_2 = 0 \qquad (15)$$

By combining 14 and 15, we get:

$$\bar{U}_{2B} \cdot (\bar{r} - r_0) + 2 \cdot \bar{U}_{3B} \cdot X_B (W_{21} - C_{1B}) \cdot s_r^2 - \bar{U}_{1B} + \bar{U}_{2B}(1 + r_0) = 0$$

$$2 \cdot \bar{U}_{3B} \cdot X_B (W_{21} - C_{1B}) \cdot s_r^2 - \bar{U}_{1B} + \bar{U}_{2B}(1 + r) = 0$$

Expanding this equation for a quadratic utility function, we get:

$$-4d' \cdot (W_2 - C_{1B})^2 \cdot X_B^2 \cdot s_r^3 - 1 + 2d' \cdot C_{1B} +$$
$$[1 - 2d' \cdot (W_2 - C_{1B})(1 + r_0 + X_B \cdot (\bar{r} - r_0))] \cdot (1 + \bar{r}) = 0$$

Totally differentiating this equation with respect to r_0 gives:

$$d(W_2-C_1^B)/dr_0\,.\,[-8d'.(W_2-C_1^B)^2.X_B^2.s_r^3-2d'-e+$$
$$e.2d'.(W_2-C_1^B)(1+r_0+X_B.(\bar{r}-r_0))+2d'.e.(W_2-C_1^B).(1+\bar{r})-$$
$$2d'.(1+r_0+X_B.(\bar{r}-r_0)).(1+\bar{r})]\ +$$

$$dX_B/dr_0\,.\,[-2d'.(W_2-C_1^B).(\bar{r}-r_0).(1+\bar{r})-8d'.(W_2-C_1^B)^2.X_B.s_r^3]=$$
$$2d'.(W_2-C_1^B)(1+r_0+X_B.(\bar{r}-r_0)).(-e.d(W_1-C_1^A)/dr_0)+$$
$$e.d(W_1-C_1^A)/dr_0)+$$
$$2d'.(W_2-C_1^B).(1+\bar{r}).(1+X_B.(-e.d(W_1-C_1^A)/dr_0-1)). \qquad (16)$$

Equations 13 and 16 give a system that could be solved for

$$d(W_2-C_1^B)/dr_0 \text{ and } dX_B/dr_0$$

Writing 13 and 16 in matrix form, we have

$$S'=\begin{bmatrix}A' & B'\\ C' & D'\end{bmatrix} \qquad \begin{bmatrix}A' & B'\\ C' & D'\end{bmatrix}.\begin{bmatrix}d(W_2-C_1^B)/dr_0\\ dX_B/dr_0\end{bmatrix}=\begin{bmatrix}H'\\ G'\end{bmatrix} \qquad \begin{matrix}13^*\\ 16^*\end{matrix}$$

We must determine the signs of A', B', C', D', H' ,G' and $|S'|$. From equation 13, we know that $C'<0$, $D'<0$ and $G'<0$. Also $X_B>1$, $d(W_1-C_1^A)/dr_0>0$ allow us to claim that $\underline{B'<0}$.

Sign of A'

$$A'=[-8d'.(W_2-C_1^B)^2.X_B^2.s_r^3-2d'-e+$$
$$e.2d'.(W_2-C_1^B)(1+r_0+X_B.(\bar{r}-r_0))+2d'.e.(W_2-C_1^B).(1+\bar{r})-$$
$$2d'.(1+r_0+X_B.(\bar{r}-r_0)).(1+\bar{r})]$$

If e is small enough, we can safely argue that A' is negative. $A' < 0$

Sign of H'

$$H' = (-e.d(W_1 - C_1{}^A)/dr_0).[-2d'.(W_2 - C_1{}^B)(1+r_0+X_B.(\bar{r}-r_0))+1] + 2d'.(W_2 - C_1{}^B).(1+\bar{r}).(1+X_B.(-e.d(W_1 - C_1{}^A)/dr_0 - 1)).$$

Since person B is less risk-averse, d' will be very small. H' will be positive if d' and e are small enough. Assuming e to be sufficiently small, we claim that $\underline{H'>0}$.

The final step is to find the determinant of S'.

$$|S'| = A'D' = -(W_2 - C_1{}^B).A' - (1-X_B).B'$$

After expanding A' and B', we get:

$$|S'| = 2d'.(W_2 - C_1{}^B) + e.[-2d'.(W_2 - C_1{}^B)(1+r_0+X_B.(r-r_0)) + 1].(W_2 - C_1{}^B) + 2d'.(W_2 - C_1{}^B).(1+\bar{r}).(1+r_0) + 2d'.(W_2 - C_1{}^B)^2.X_B.(4s_r{}^3 - e.(1+\bar{r}))$$

$$\underline{|S'|>0}$$

The determinant will be positive for sufficiently small values of e. Now the system of equations 13 and 16 could be written as:

$$\begin{bmatrix} - & - \\ - & - \end{bmatrix} . \begin{bmatrix} d(W_2 - C_1{}^B)/dr_0 \\ dX_B/dr_0 \end{bmatrix} = \begin{bmatrix} + \\ - \end{bmatrix} \qquad \text{and} \quad |S'|>0.$$

The inverse of S' is:

$$S'^{-1} = \begin{bmatrix} + & - \\ + & - \end{bmatrix} . 1/|S'| = \begin{bmatrix} - & + \\ + & - \end{bmatrix}$$

Then:

$$\begin{bmatrix} d(W_2 - C_1^B)/dr_0 \\ dX_B/dr_0 \end{bmatrix} . \begin{bmatrix} - & + \\ + & - \end{bmatrix} = \begin{bmatrix} - \\ + \end{bmatrix}$$

$$d(W_2 - C_1^B)/dr_0 < 0 \quad \text{and} \quad dX_B/dr_0 > 0$$

As the interest rate increases (being zero originally), the borrower's saving and risk-taking behavior changes in the following directions:

$$d(W_2 - C_1^B) = d(W_2 - C_1^B)/dr_0 . dr_0 = (-)(+) < 0$$

$$dX_B = dX_B/dr_0 . dr_0 = (+)(+) > 0 .$$

<u>The less risk-averse person takes more risk and saves less</u>.

Next, we will look at the welfare results of Islamic restriction. For the lender we have:

$$\begin{aligned} d\bar{U}^A/dr_0 &= \bar{U}_1^A . dC_1^A/dr_0 + \bar{U}_2^A . dC_2^A/dr_0 + \bar{U}_3^A . dsc^{A2}/dr_0 \\ &= \bar{U}_1^A . (-1) . d(W_1 - C_1^A)/dr_0 + dX_A/dr_0 . [\bar{U}_2^A . (W_1 - C_1^A) . (\bar{r} - r_0) + \\ &\quad 2\bar{U}_3^A . sr^3 . X_A . (W_1 - C_1^A)^2] + \\ &\quad \bar{U}_2^A . d(W_1 - C_1^A)/dr_0 . (1 + r_0 + X_A + . (\bar{r} - r_0)) + \bar{U}_2^A . (W_1 - C_1^A) . (1 + \\ &\quad X_A . (d\bar{r}/dr_0 - 1)) + 2U_3^A . sr^3 . X_A^2 . (W_1 - C_1^A) . d(W_1 - C_1^A)/dr_0 \end{aligned}$$

After collecting terms, we get:

$$d\bar{U}^A/dr_0 = -d(W_1 - C_1{}^A)/dr_0 \,.\, [d\bar{U}^A/dC_1] + dX_A/dr_0 \,.\, [d\bar{U}^A/dX_A] + \bar{U}_2{}^A (W_1 - C_1{}^A) \,.\, (1 + X_A \,.\, (d\bar{r}/dr_0 - 1))$$

However, we know that $d\bar{U}^A/dC_1{}^A = 0$ and $d\bar{U}^A/dX_A = 0$, therefore,

$$d\bar{U}^A/dr_0 = \bar{U}_2{}^A (W_1 - C_1{}^A) \,.\, (1 + X_A \,.\, (d\bar{r}/dr_0 - 1)) \qquad (17.A)$$

similarly for the borrower we have:

$$d\bar{U}^B/dr_0 = -d(W_2 - C_1{}^B)/dr_0 \,.\, [d\bar{U}^B/dC_1] + dX_B/dr_0 \,.\, [d\bar{U}^B/dX_B] + \bar{U}_2{}^B (W_2 - C_1{}^B) \,.\, (1 + X_B \,.\, (d\bar{r}/dr_0 - 1)) \qquad (17.B)$$

For the borrower, however, $d\bar{U}^B/dC_1{}^B < 0$ and $dU^B/dX_B > 0$.

The direction and size of change in the utilities depends on $d\bar{r}/dr_0$. We will first expand $d\bar{r}/dr_0$ and determine its sign. From the optimization problem of the borrower we obtained the system of equations 13 and 16. Solving this system we get:

$$d(W_2 - C_1{}^B)/dr_0 = [D'H' + B'G']/|S'| \qquad (17.C)$$

From the bond market constraint equation 13, we get:

$$G' = (X_A - 1) \,.\, d(W_1 - C_1{}^A)/dr_0 + (W_1 - C_1{}^A) \,.\, dX_A/dr_0$$

Putting this in equation 17.C, we will get:

$$d(W_2-C_1^B)/dr_0=\{D'H'+B'(X_A-1).d(W_1-C_1^A)/dr_0+$$
$$B'.dX_A/dr_0(W_1-C_1^A)\}/|S'|$$

$$d(W_2-C_1^B)/dr_0+d(W_1-C_1^A)/dr_0=\{D'H'+[B'(X_A-1)+$$
$$|S'|].d(W_1-C_1^A)/dr_0+B'.dX_A/dr_0(W_1-C_1^A)\}/|S'| \qquad (18)$$

In equation 18, we have added $d(W_1-C_1^A)/dr_0$ to both sides of equation 17.C. Further, we have $|S'|=A'D'-B'C'$ which gives:

$$R.H.S. = \{D'H'+B'[(X_A-1).d(W_1-C_1^A)/dr_0+dX_A/dr_0.(W_1-C_1^A)-$$
$$(1-X_B).d(W_1-C_1^A)/dr_0]+A'D'.d(W_1-C_1^A)/dr_0\}/|S'|$$

We will use the following breakdown to find the sign.

$$R.H.S. = \{D'H'+A'D'.d(W_1-C_1^A)/dr_0+B'(X_A-1).d(W_1-C_1^A)/dr_0+$$
$$B'.[dX_A/dr_0.(W_1-C_1^A)-(1-X_B).d(W_1-C_1^A)/dr_0]/|S'|$$

The denominator was already shown to be positive. We should only be concerned with the numerator.

In the numerator, the last term is clearly positive because $B'<0$ and $dX_A/dr_0.(W_1-C_1^A)-(1-X_B).d(W_1-C_1^A)/dr_0$. The second inequality is the result of the following inequalities: $d(W_1-C_1^A)/dr_0>0$, $dX_A/dr_0<0$ and $X_A<1$. Our next step is to determine the sign of:

$$D'H'+A'D'.d(W_1-C_{1A})/dr_0+B'(X_A-1).d(W_1-C_{1A})/dr_0$$

We have:

$$H'+A'.d(W_1-C_{1A})/dr_0 =$$

$$-8d'(W_2-C_{1B}).X_B^2.s_r^3.d(W_1-C_{1A})/dr_0-2d.d(W_1-C_{1A})/dr_0-$$

$$e.d(W_1-C_{1A})/dr_0.[1-2d'.(W_2-C_{2B})(1+r_0+X_B(r-r_0))]+$$

$$e.d(W_1-C_{1A})/dr_0.2d'.(W_2-C_{2B}).(1+\bar{r}).X_B-2d'.(1+r_0+$$

$$X_B(\bar{r}-r_0)).(1+\bar{r}).d(W_1-C_{1A})/dr_0+e.d(W_1-C_{1A})/dr_0.[1-$$

$$2d'.(W_2-C_{1B})(1+r_0+X_B(\bar{r}-r_0))]-e.2d'.(W_2-C_{1B})(1+$$

$$\bar{r}).X_B.d(W_1-C_{1A})/dr_0+2d'.(W_2-C_{1B})(1+\bar{r})(1-X_B).$$

Some of the terms cancel each other out and afterwards we get:

$$H'+A'.d(W_1-C_{1A})/dr_0 =$$

$$-8d'(W_2-C_{1B}).X_B^2.s_r^3.d(W_1-C_{1A})/dr_0-2d.d(W_1-C_{1A})/dr_0$$

$$-2d'.(1+r_0+X_B(r-r_0)).(1+r).d(W_1-C_{1A})/dr_0+$$

$$2d'.(W_2-C_{1B})(1+r)(1-X_B)$$

Also, remember that $D'=(W_2-C_{1B}).(-1)$ and

$$B'= 2d'.(W_2-C_{1B})(1+\bar{r})(\bar{r}-r_0)-8d'.(W_2-C_{1B})^2.X_B.s_r^3$$

Then, $D'H'+A'D'.d(W_1-C_{1A})/dr_0+B'(X_A-1).d(W_1-C_{1A})/dr_0 =$

$$2d'.(W_2-C_{1B})(1+\bar{r})(\bar{r}-r_0).d(W_1-C_{1A})/dr_0+$$

$$2d'.(W_2-C_{1B})(1+\bar{r})(1+r_0).d(W_1-C_{1A})/dr_0+$$

$$8d'.(W_2-C_{1B})^2.x_B.s_r^3.d(W_1-C_{1A})/dr_0+$$

$$2d'.(W_2-C_{1B}).d(W_1-C_{1A})/dr_0+2d'.(W_2-C_{1B})^2.(1+\bar{r}).(1-X_B).$$

Every term in the above phrase is positive. Therefore,

$$D'H'+A'D'.d(W_1-C_1{}^A)/dr_0+B'(X_A-1).d(W_1-C_1{}^A)/dr_0>0$$

Overall, we have shown that the numerator of the fraction in equation 18 is positive, so the whole fraction is positive and we have:

$$d(W_1-C_1{}^A)/dr_0+d(W_2-C_1{}^B)/dr_0\geq 0$$
$$d\bar{r}/dr_0=-e.(d(W_1-C_1{}^A)/dr_0+d(W_2-C_1{}^B)/dr_0)<0$$

We can now estimate the direction of change in net savings and return to capital when moving away from the zero interest rate.

$$d(\text{Net Savings})=d(W_1-C_1{}^A+W_2-C_1{}^B)$$
$$=dr_0.(d(W_1-C_1{}^A)/dr_0+d(W_2-C_1{}^B)/dr_0)=(+).(+)>0$$

The net savings increases.

$$d(\text{Return to Capital})=d\bar{r}=[d\bar{r}/dr_0].dr_0=(+)(-)<0$$

The return to capital declines.

We can now elaborate on the welfare effects of Islamic restriction based on the results of our model. Equations

17.A and 17.B give formulas for $d\bar{U}^A/dr_0$ and $d\bar{U}^B/dr_0$. For the more risk-averse person, A, the change in utility depends on the sensitivity of the expected return on risky assets to changes in the interest rate. If $d\bar{r}/dr_0$ is a large negative number, the return to capital (the risky asset in our model) falls rapidly as the interest rate rises. This reduction in r will offset part of the welfare gain from the increased interest payment on the bonds that person A holds. Compared to the one-period model of 2.A, the welfare gain of person A will be smaller.

The welfare results for the borrower is undetermined because, as the interest rises, the cost of borrowing increases but, at the same time, the quantity of bonds increases also. If he did not face any quantity constraints, we would have had:

$$d\bar{U}^B/dr_0 = \bar{U}_2{}^B . (W_2 - C_1{}^B) . (1 + (d\bar{r}/dr_0 - 1) . X_B)$$

$$X_B > 1 \text{ and } d\bar{r}/dr_0 < 0 \Rightarrow d\bar{U}^B/dr_0 < 0$$

Therefore $d\bar{U}^B = [d\bar{U}^B/dr_0] . dr_0$ indicating that the borrower would have been better off under Islamic regime. It is the shortage of credit that could change the results. The net impact on the welfare of the borrower is not clear.

In addition to the above results, we must also point out that, similar to the one-period model, we observe that the interest-free system is non-pareto optimal. Under a

competitive regime with no restrictions on the interest charge, we have:

$$d\bar{U}^A/dC_{1A} = \bar{U}_{1A} - \bar{U}_{2A}.(1+r_0) = 0 \quad \Rightarrow \quad \bar{U}_{1A}/\bar{U}_{2A} = 1+r_0$$
$$d\bar{U}^B/dC_{1B} = \bar{U}_{1B} - \bar{U}_{2B}.(1+r_0) = 0 \quad \Rightarrow \quad \bar{U}_{1B}/\bar{U}_{2B} = 1+r_0$$
$$\bar{U}_{1A}/\bar{U}_{2A} = \bar{U}_{1B}/\bar{U}_{2B} \qquad (19)$$

Equation 19 is the condition of pareto optimality and it no longer holds under Islamic regime.

Interpretation

The models that were analyzed in 2-A and 2-B gave us approximate indications on how the savings and risk-taking behaviors of the investors changed as a small positive rate of interest was introduced into an Islamic economy. All that was needed was to reverse the results that were found above.

1. For the highly risk-averse individual who was a net lender, a switch from regular to Islamic regime was welfare reducing. He saved less and had to take more risk than before.

2. For the less risk-averse person who was a net borrower, the welfare impact was not clear. He saved more and had to take less risk because he couldn't borrow as much as he wanted to.

3. The net saving of the economy declined. As a result, the rate of return on capital was higher under the Islamic regime compared to the regular regime (which lead to less investment).

Notes

1) In a recent article, M. Hassan Imam studied the welfare cost of interest rate ceilings in developing nations. His study has shown that interest-rate suppression causes significant distortions in the capital markets of lesser developed nations.

CHAPTER 3

THE CONSEQUENCES OF ISLAMIC BANKING IN A MACRO-ECONOMIC FRAMEWORK

In this chapter, we focus on the macro-economic consequences of the Islamic economic system. We are primarily interested in three questions:

1) What are the effects of interest-charge elimination on the volume of real investment and output?
2) How can we conduct monetary and fiscal policy in the absence of a government bond market?
3) How do policy multipliers compare between regular and Islamic economies?

The only Islamic regulation which is studied here is the elimination of an interest charge on financial transactions. In Chapter 1, we showed that the other views of Islam on the economic structure did not substantially vary from those of a regulated market economy.

The abolition of an interest payment will primarily affect the financial sector of the economy. Financial assets in a modern economy can be divided into debt and equity instruments. Equity instruments, such as stock shares, do not have a fixed return. They are simply claims on a certain productive asset and receive a portion of the

profits as a dividend. Debt instruments such as private and government bonds have a pre-assigned rate of interest which is realized if the debtor does not default on his debt. By forbidding an interest charge, Islam effectively eliminates the debt instruments. Consequently, the only financial instruments available in an Islamic economy are in the form of equity. The only other remaining asset will be money.

The elimination of an interest charge does not necessarily lead to the elimination of the depository institutions such as banks. Instead, it will cause certain reforms. Banks will provide credit to the public on the basis of equity arrangements such as the profit- and loss-sharing contracts. They will raise credit by offering PLS accounts and demand deposits. (Savings and time deposits will not be permitted.) Demand deposits will be the only debt instruments in an Islamic economy. They are tolerated because no interest charge is involved.

The existence of banks allows the public to divide their money holdings into currency and demand deposits. They can also divide the risky portion of their portfolios between equity stocks and PLS accounts. (For reasons that were explained in Chapter 2, it is not necessary to differentiate between direct equity and PLS accounts in our model.) The Islamic economy, therefore, retains many features of a regular market economy with the modification that government and private bonds as well as the interest-paying bank deposits are eliminated. In the following

sections, we introduce a Keynesian macro-economic model which has been modified to reflect these differences.

Section 1

The Consequences of Interest Rate Elimination.

The elimination of an interest charge leads to the elimination of three types of debt assets: private loans, government bonds and bank savings deposits. It will be too difficult to study the effect of eliminating all three assets simultaniously. If the interest rate on bank deposits are eliminated, they will be transformed into demand deposits. Similarly, government bonds are transformed into money. The public will continue to hold money and demand deposits because, to a large extent, they trust the government and the banking system. Besides, these assets provide some utility to the households as stores of value and means of exchange. Private loans, on the other hand, will no longer exist if the lender is not allowed to charge interest. The reason is that these loans carry a high risk of default and no one will assume this risk when there is no reward. So the elimination of the interest charge will eliminate the private loan market altogether.

Since our main analytical method is comparative statics, we will ignore private loans and government bonds at first and concentrate on bank deposits. At the end, we will demonstrate how the results will change if the elimination of government bonds and private loans are also

taken into account.

Our model will consist of the equilibrium conditions for the real and financial sectors of the economy. The real sector will be in equilibrium if the aggregate supply of real output is equal to the aggregate demand. In the absence of the government sector, which is the case in this model, we can show the equilibrium by equating savings and investment.[1] The savings and investment functions of our model are described as follows. We assume that there is a single homogeneous capital good that is being utilized by all firms. Firms can increase their capital by investment in new capital at low cost. But it is more costly to buy or sell a used capital good. As a result, there are two separate markets for capital. There is one market for the newly produced capital good and another market for claims on the existing stock of capital. The rate of investment will depend on the price differentials between these markets. When the value of equity claims is more than the cost of new capital, firms are encouraged to invest. On the other hand, if the price of new capital (also called the replacement cost of capital) increases relative to the equity price of capital, new investments will decline. This approach to the investment behavior follows Tobin(69), Tobin-Brainard(17) and Benavie(15) among others.

The appropriate investment function is:

$$I=(V,P) \qquad I_1>0 \quad \text{and} \quad I_2<0 \ .$$

I = The rate of real investment.

P = The price of output. (In our one sector model, the consumer and capital goods are the same commodity.)

V = The value of the equity supply. $V=P_e xE$ where P_e=the price of equity and E = the equity claims on the stock of capital. Since we assume that E is constant, the choice of V instead of P_e will not affect the results.

The rate of savings by households is assumed to be positively related to real income and to the rates of return on financial assets. It is negatively related to the level of wealth.

$$S= \overset{+}{S}(\overset{+}{q},\overset{+}{r},\overset{-}{W})xY$$

q = The rate of return on equity.

r = The rate of return on saving deposits.

W = Real wealth.

Y = Real income.

Then for the equilibrium condition in the real sector, we have:

$$\overset{+}{S}(\overset{+}{q},\overset{+}{r},\overset{-}{W})x\ Y = I(V,P) \qquad 1.1$$

There are three assets in the financial sector of our model. These are equity ,saving deposits and money. Each household must allocate its wealth among these three assets. Savings deposits are offered by the banks. Banks will keep a portion of these deposits as reserve and invest the rest in the equity markets. The equilibrium conditions for these

markets are given by the following equations:

$$(1-K).B/P + h_1(\overset{+}{q},\overset{-}{r},\overset{-}{Y},\overset{+}{W}) = V/P \qquad \text{Equity} \qquad (1.2)$$

$$K.B/P + h_2(\overset{-}{q},\overset{-}{r},\overset{+}{Y},\overset{+}{W}) = M/P \qquad \text{High-powered money} \qquad (1.3)$$

$$h_3(\overset{-}{q},\overset{+}{r},\overset{-}{Y},\overset{+}{W}) = B/P \qquad \text{Savings deposits} \qquad (1.4)$$

B = Saving Deposits; M = Money; K = The reserve requirement ratio on demand deposits

h_1, h_2, h_3 = The household demands for equity, currency and savings deposits, respectively.

This model has a Keynesian structure where, due to insufficient demand, the economy is operating at less than full employment level. As a result, the price level is assumed to be fixed. Any increase in demand will stimulate output without putting an upward pressure on prices. We rely on these assumptions as well as the static nature of our model to ignore the question of inflation altogether.

We assume that the interest rate on savings deposits is fixed below its equilibrium value by the monetary authorities. As a result, the banks accept all the deposits that they can get at any level of the interest rate ceiling. Equation 1.4 indicates that the equilibrium value of the savings deposits is always the quantity demanded by the households. The derivative signs of the asset-demand equations indicate that the demand for each asset is positively related to its own rate of return and negatively

related to the rate of return on other assets.

An increase in income will increase the public demand for money because of the transaction needs. Since income is not a component of real wealth, we have $h_{13} + h_{23} + h_{33} = 0$. We also know that h_{23} implies that the increase in income must reduce the total demand for other assets:

$$h_{13} + h_{33} = -h_{23} < 0$$

Finally, the asset demand functions are positively related to changes in real wealth. The wealth constraint is $W = V/P + M/P$. Since savings deposits are a liability of the private sector to itself, they do not appear in the wealth constraint.

We will modify the model further to reflect the dependence of dividends on the value of equity and income. While the model itself does not include the supply side of the economy, we will make a brief reference to the commodity and labor supplies in order to explain this dependency.

On the supply side of the economy, the production function is:

$$Y = F(L, K^0) \qquad F_1 > 0 \quad \& \quad F_2 < 0$$

L = Quantity of labor demanded.

K^0 = The supply of capital which is assumed to be fixed in the short run.

Since equity represents claims on the stock of capital, the return on equity will depend on the share of capital in national income.

$$q=[P.\ F_2(L,K^0).\ K^0]/V \qquad (+,-)$$

$F_2(L,K^0)$=Marginal product of capital. (An increasing function of labor demanded.)

The demand for labor is a positive function of demand for Output.

$$L=L(Y) \qquad (+)$$

Replacing for L in $F_2(L,K^0)$, we get $q=[P.H(Y,K^0).K^0]/V$. $(+,-)$ Since K^0 is fixed, any increase in output will increase the marginal product of capital. Therefore, we can write the rate of return to capital as[2]: $q = q(P,Y,V)$. $(+,+,-)$ The real wealth could also be written as $W = W(V,M,P)$. $(+,+,-)$ Replacing for q and W in equations 1.1-1.4, we get:

$$S(Y,P,V,M).Y = I(V,P) \qquad (+,+,-,-)\ (+,-) \qquad \text{Commodities (2.1)}$$

$$(1-K).B/P + f_1(Y,P,r,V,M) = V/P \qquad (?,?,-,?,+) \qquad \text{Equity (2.2)}$$

$$K.B/P + f_2(Y,P,r,V,M) = M/P \qquad (?,-,-,+,+) \qquad \text{High-powered money (2.3)}$$

$$f_3(Y,P,r,V,M) = B/P \qquad (-,-,+,+,+) \qquad \text{Savings deposits (2.4)}$$

As we can see, the dependency of the equity rate of return on income and the value of equity leads to indeterminacy in some of the derivative signs.

To study the impact of interest rate control, we will first combine the asset market equations into a single equilibrium condition for the financial sector. From 2.4, we replace for B/P in 2.2 and 2.3. The wealth constraint allows us to ignore one of the two resulting equations. We

will keep the money market equation and drop the other one. Then the IS and LM equations of our model are:

$$\overset{+\ +\ +\ -\ -}{S(Y,P,r,V,M)}.Y = \overset{+\ -}{I(V,P)} \qquad 3.1 \quad IS$$

$$\overset{-\ -\ +\ +\ +}{K.f_3(Y,P,r,V,M)} + \overset{?\ -\ -\ +\ +}{f_2(Y,P,r,V,M)} = M/P \qquad 3.2 \quad LM$$

The endogenous variables are Y and V. M and r are exogenously determined.

Our objective is to see how the endogenous variables change as the rate of interest is reduced to zero from its original positive value. Since the method of comparative statics is only applicable for the study of relatively small changes in the exogenous variables, we analyze the problem from a different point of reference. We assume that the rate of interest is originally fixed at zero, then we observe the direction of change in the endogenous variables as the rate of interest is slightly increased. These changes will approximately reflect the opposite of what will happen if the interest rate is reduced from an original small positive value to zero.

The equilibrium conditions 3.1 and 3.2 hold for any nonnegative rate of interest including zero. Totally differentiating these equations with respect to V, Y, and r we have:

$$\begin{bmatrix} S_4.Y-I_1 & S_1.Y+S \\ K.f_{34}+f_{24} & K.f_{31}+f_{21} \end{bmatrix} \cdot \begin{bmatrix} dV \\ dY \end{bmatrix} = \begin{bmatrix} -S_3.Y \\ -K.f_{33}-f_{32} \end{bmatrix} \cdot dr \qquad 4.1$$

System 4.1 could be written as:

$$A.\begin{bmatrix} dV \\ dY \end{bmatrix} = B.dr \qquad 4.2$$

By defining the signs of the elements of A and B, we would like to determine the signs of dV/dr and dY/dr . From the derivative signs of 3.1 and 3.2 it is clear that:

$$A_{11}<0, \quad A_{12}>0, \quad A_{21}>0, \quad B_{11}<0$$

A_{22} and B_{21} are apriori indeterminate. To determine their signs, we must make certain assumptions about the elasticities of asset demands.

If we assume that the demand for money is more sensitive to variations in income than to variations in return to equity, then f_{12} will become positive, and since K is very small, we would have $A_{22}=k.f_{31}+f_{21}>0$. Also, we assume that the savings deposits are the primary substitutes for money. This assumption implies that f_{23} is significantly different from zero and as a result:

$$B_{21}=-K.f_{33}-f_{32}>0$$

These two assumptions could be combined into a single assumption which says that in a regular economy bonds are strong substitutes and equity is a weak substitute for money. This requirement does not weaken the results because both intuitively and empirically appear to be true. Using these signs, we write 4.2 as:

$$A^{-1} = \begin{bmatrix} - & + \\ + & + \end{bmatrix} \qquad \begin{bmatrix} - & + \\ + & + \end{bmatrix} \cdot \begin{bmatrix} dV \\ dY \end{bmatrix} = \begin{bmatrix} - \\ + \end{bmatrix} \cdot dr \qquad 4.3$$

$$\det(A) < 0$$

$$\begin{bmatrix} dv/dr \\ dy/dr \end{bmatrix} = \begin{bmatrix} - & + \\ + & + \end{bmatrix} \begin{bmatrix} - \\ + \end{bmatrix} = \begin{bmatrix} + \\ ? \end{bmatrix} : dv/dr > 0 \ , \ dy/dr > 0.$$

We can now interpret these results to say approximately the following:

Result 1: The suppression of interest payments on savings deposits will reduce the value of equity assets and cause a drop in the rate of investment. The net change in real output, however, is indeterminate.

The reason for the second result is that the reduction in the interest rate reduces the size of investment but at the same time increases the level of consumption. Thus, the aggregate demand could increase or decrease.

So far, we have seen the impact of Islamic regulation if the only existing debt instruments were savings deposits. In most nations, however, we find several other debt instruments such as private bonds and government bonds. The regulation will eliminate these instruments as well. We will now briefly describe what happens when these instruments are eliminated. First, consider the case of private bonds that are used for investment.

We assume that firms are originally issuing bonds and equity. Under Islamic regulation, these bonds must be liquidated. Whether the liquidation takes place gradually or suddenly, the net result is that the firms must pay back the value of bonds or replace them with equity. At the

aggregate level, we assume that the entire stock of capital is owned and employed by the firms. Then it must be the case that the market value of the stock of capital equals the value of the equity and bonds that firms have issued.

$$P_k^0 . K = P_e . E_0 + B_p \qquad 1^*$$

P_k^0 = The price of physical capital before change.

K = The stock of physical capital (assumed fixed.)

P_e = The price of equity.

E_0 = The stock of equity shares before change.

B_p = The nominal value of private debt issued by the firms to the public.

Due to the possibility of default, the private loans are risky; but since in every firm bonds have the first claim on earnings, they are less risky than the stocks. When the interest payment on bonds is eliminated, households will eventually transfer the funds that were invested in bonds into money and equity. This transfer will generate a new demand for equity. At the same time, the firms must raise funds to pay back the loans and they do so by selling stocks or by PLS borrowing. Therefore, we would have a rise in the supply and demand for equity at the same time. If private bonds and equity were perfect substitutes, households would have replaced equity for their entire bond holdings and no funds would have been pulled out of the private securities markets; but since equities are generally riskier than bonds, risk-averse investors will not replace each bond with

an equal value of equity. Instead, they will replace it with a combination of equity and money. The allocation will depend on each person's degree of risk aversion. In this case some funds will be pulled out of the private claims market and held as money. Because the total demand for securities of private firms has declined, both sides of equation 1* will decline. We will have:

$$P_k^1 \cdot K = P_e^1 \cdot E_1 \qquad 2^*$$

$$P_e^1 \cdot E_1 < P_e \cdot E_0 \qquad 3.A^*$$

$$P_k^1 \cdot K < P_k^0 \cdot K \Rightarrow P_k^1 < P_k^0 \qquad 3.B^*$$

P_k^1 =Price of capital after the elimination of bonds.

P_e^1 =Price of equity after the elimination of bonds.

Inequalities 3.A* and 3.B* indicate that:

Result 2: The elimination of private investment bonds, as a result of the Islamic regulation, will lead to a decline in the value of physical capital as well as the value of claims on capital (equities). The drop in value of capital will reduce people's incentive to invest.

Next, we consider the removal of the government bonds market. The Islamic restriction will forbid any interest payment on these bonds. Under zero interest, the public will prefer money and demand deposits to the government bonds because the latter are less liquid while they all pay the same nominal zero interest and carry the same level of risk. The government will have to retire all of its debt. The

needed funds could be raised either by increased taxation or by increasing the money supply. Since the effects of tax increases have already been extensively studied in the literature, we ignore this option and concentrate on the case where the government pays back the debt by increasing the money supply. If the debt is large, this proportional increase in the money supply could be significant, leading to an increased demand for commodities and equity. As a result, the price of equities rises leading to a rise in the value of equity and encouraging more investment. At the same time, the price level will also rise; both investment and consumer goods will be more expensive. These higher prices, on the other hand, will discourage investment. The net effect on investment depends on whether the economy is at full employment or not. If the economy is at full employment, the price level will rise and the net effect of this policy will not be clear. On the other hand, if there is unemployment, prices will remain stable and both investment and output will increase. In brief, we will have:

Result 3: To eliminate the interest payment by the government, all the existing government bonds must be liquidated. In order to retire its debt, the government must raise funds by means other than public borrowing. The remaining options are taxation and increasing the money supply.

Result 4: If the government prints additional money to

buy back its bonds, the money supply will rise leading to an increase in demand for equities which will in turn stimulate investment.

We see that elimination of the interest charge will result in several institutional changes. Each of these changes has a clear impact on the level of output and the rate of investment. The direction of change however is not the same for all of them. Unlike savings deposits and private investment bonds, the elimination of government bonds will not necessarily lead to a drop in investment. Thus, we will arrive at the final result of this section:

Result 5: In the short run, the impact of interest-charge elimination depends on the existance and relative magnitude of private loans and government bonds:

a) In the absence of government bonds, the elimination of interest charges will reduce the aggregate demand for equities and adversely affect the rate of investment.

b) If government bonds already exist in the economy, their liquidation (which is assumed to be financed by an increase in the money supply) will have an opposite effect on investment. In this case, if the volume of government bonds is significantly larger than private loans, interest-rate elimination will lead to an increase in demand for equity and investment. Otherwise, the net demand for equity declines and leads to a drop in the rate of investment.

Section 2

Fiscal and Monetary Policy in an Islamic Economy.

In this section, we concentrate on developing a macro model for an interest-free economy in order to study the conduct of fiscal and monetary policy in such an economy. With the elimination of the bond market, the remaining financial assets in the Islamic economy are money and equity. Thus, any monetary policy must be conducted within these asset markets. The tools of monetary policy which depend exclusively on debt instruments such as open-market operations on government bonds and various interest-rate controls (such as regulation Q and the discount rate) will no longer be available. Instead, there will be two major tools of monetary control. These are open-market operations on equity markets and control over the reserve requirement ratio of the demand deposits. The monetary authorities could intervene in the stock market in the same manner that the central banks intervene in the bond market in a regular economy. In priori we expect the open-market sale and purchase of stocks to be contractionary and expansionary, respectively. These will be further investigated in the analytical model that will follow.

The elimination of government bonds implies that the government can only borrow from the central bank. In response, the central bank has two options, it can monetize the deficit by increasing the money supply or it can keep

the money supply unchanged and finance the deficit by sale of equity. The second option is limited to the maximum-equity ownership of the central bank. If the government debt continues to grow, eventually the central bank will have to monetize it. (We have analyzed the debt financed fiscal policy in appendix A to this chapter.) To study the impact of these fiscal and monetary policies, we will use the same model that was developed in section one after making the necessary modifications.

The Macro Model of Islamic Economy.

We consider a one-sector economy were the same output is used for consumption and investment. There are three sources of demand for the real output of the economy: private consumption, private investment and government expenditure. The equilibrium in the real sector is demonstrated by:

$$\overset{+}{C}(\overset{+}{Y},\overset{-}{q},\overset{-}{P},\overset{+}{W})+\overset{+}{I}(\overset{-}{V},\overset{-}{P})+G = Y \qquad 5.1$$

G = The government expenditure[3].

There are three assets in the financial sector: High-powered money, demand deposits, and equity. The banks use demand deposits to purchase equity after satisfying the reserve requirements. The equilibrium conditions for the asset markets are:

$$(1-K).D/P + h_1(\overset{+}{q},\overset{-}{Y},\overset{+}{W}) + V_g/P = V/P \qquad 5.2$$

$$K.D/P + \overset{- + +}{h_2(q,Y,W)} = M/P \qquad 5.3$$

$$\overset{- + +}{h_3(q,Y,W)} = D/P \qquad 5.4$$

D = The supply of demand deposits.

h_3 = The demand for demand deposits.

K = The reserve requirement ratio on demand deposits.

V_g = The value of equity held by the central bank.

Since the demand deposits do not receive any interest, banks accept all the demand deposits that they can get and, thus, equilibrium is given by equation 5.4. Without loss of any generality we can combine the demands for high-powered money and demand deposits into a general demand function for money when analyzing monetary and fiscal policy.[4] The financial sector then will consist of two assets: money and equity. The complete model of the economy becomes:

$$\overset{+ - - +}{C(Y,q,P,W)} + \overset{+ -}{I(V,P)} + G = Y \qquad 6.1$$

$$\overset{+ - +}{h_1(q,Y,W)} + V_g/P = V/P \qquad 6.2$$

$$\overset{- + +}{h_2(q,Y,W)} = M/P \qquad 6.3$$

Before starting the comparative static analysis, we will incorporate the following additions and modifications. In section one, we already showed that:

$$q = \overset{+ - +}{q(Y,V,P)} \qquad \text{and} \qquad W = V/P + M/P$$

Furthermore, we also know that a change in government equity holding through an open-market operation will change the money supply. A change in government debt will also

change the money supply if the central bank chooses to monetize it. Therefore, we have:

$$M/P = \underset{+\ +}{M(V_g, G)}/P$$

Real wealth then will also be a function of V_g and G. The change in V_g, however, does not change the real wealth of the private sector because we will always have: $dW = -dV_g/P + dM/P$. Consequently, we have:

$$W = \underset{+\ +\ -}{W(V, G, P)}$$

After adding these changes to the equilibrium conditions 6.1-6.3, we will get:

$$\underset{-\ ?\ +\ +}{C(P,Y,G,V)} + \underset{+\ -}{I(V,P)} + G = Y \qquad \text{Commodities} \qquad 7.1$$

$$V_g/P + f_1\underset{+\ ?\ +\ ?}{(P,Y,G,V)} = V/P \qquad \text{Equities} \qquad 7.2$$

$$f_2\underset{-\ ?\ +\ +}{(P,Y,G,V)} = \underset{+\ +}{M(G,V_g)}/P \qquad \text{Money} \qquad 7.3$$

The asset market equilibrium conditions are connected together by the wealth constraint and we can ignore one of the markets in our analysis. To derive the fiscal and monetary multipliers for the Islamic economy, we totally differentiate 7.1 and 7.2 with respect to V, Y, G and V_g. Writing the results in the matrix form we have.

$$\begin{bmatrix} c_4 + I_1 & C_2 - 1 \\ f_{14} - 1/P & f_{12} \end{bmatrix} \cdot \begin{bmatrix} dV \\ dY \end{bmatrix} = - \begin{bmatrix} 0 & C_3 + 1 \\ 1/P & f_{13} \end{bmatrix} \begin{bmatrix} dV_g \\ dG \end{bmatrix} \qquad 8.1$$

8.1 could be written as:

$$A^* \begin{bmatrix} dV \\ dY \end{bmatrix} = -B^* \cdot \begin{bmatrix} dV_g \\ dG \end{bmatrix} \qquad 8.2$$

From 7.1 and 7.2, we can easily see that $A_{11}^*=C_4+I_1>0$ and $A_{12} = C_2-1<0$. $A_{21} = f_{14} - 1/P$ From the wealth constraint, we know that $f_{14}+f_{24}=1/P$. We also know that $f_{24}>0$. Combining these two facts, we have $f_{14}-1/P=- f_{24} <0$. So $A_{21}<0$. A_{22} is indeterminate.

B* has the following signs:

$$B^* = \begin{vmatrix} 0 & + \\ + & + \end{vmatrix}$$

The determinant of A* is dependent on the sign of $A_{22}=f_{12}$.

$$A^* = \begin{vmatrix} + & - \\ - & ? \end{vmatrix} \qquad \det(A^*)=D^* = \begin{vmatrix} ? & \text{if } f_{12}>0 \\ - & \text{if } f_{12}<0 \end{vmatrix} \qquad 9$$

$$A^{*-1} = 1/D^* . \begin{vmatrix} f_{12} & -A_{12} \\ -A_{21} & A_{11} \end{vmatrix} = 1/D^* . \begin{vmatrix} ? & + \\ + & + \end{vmatrix}$$

Solving for dV and dY, we have:

$$\begin{vmatrix} dV \\ dY \end{vmatrix} = - A^{*-1} \cdot B^{*-1} \cdot \begin{vmatrix} dV_g \\ dG \end{vmatrix} = -1/D^* . \begin{vmatrix} ? & + \\ + & + \end{vmatrix} . \begin{vmatrix} 0 & + \\ + & + \end{vmatrix} . \begin{vmatrix} dV_g \\ dG \end{vmatrix} =$$

$$= \begin{vmatrix} +/-D^* & (?+(+))/-D^* \\ +/-D^* & +/-D^* \end{vmatrix} \begin{vmatrix} dV_g \\ dG \end{vmatrix}$$

The multipliers have the following signs:[5]

$$dV/dG=?/D^* \qquad dV/dV_g=-/D^*$$
$$dY/dG=-/D^* \qquad dY/dV_g=-/D^*$$

The results depend on the sign of the determinant. We apply the correspondence theorem to find the sign of D* which is required for stability. We assume that the time rates of change in V and Y are increasing functions of excess demands for equity and commodity.

$$dV/dt=n(V_d-V) \qquad n'>0 \ \& \ n(0)=0$$
$$dY/dt=m(C+I+G-Y) \qquad m'>0 \ \& \ m(0)=0$$

Applying a Taylor expansion to these differential equations around the equilibrium values we get:

$$\begin{bmatrix} dV/dt \\ dY/dt \end{bmatrix} = \begin{bmatrix} m'.(C_4+I_1) & m'.(C_2-1) \\ n'.(f_{14}-1/P) & n'.f_{12} \end{bmatrix} . \begin{bmatrix} V-V_0 \\ Y-Y_0 \end{bmatrix} = Q. \begin{bmatrix} V-V_0 \\ Y-Y_0 \end{bmatrix}$$

The characteristic equation is $|Q-z.I|=0$. For stability, the Eigenvalues (the z^0s) must have negative real parts: The determinant equation is:

$$z^2-(m'.(C_4+I_1)+n'.f_{12}).z + m'.(C_4+I_1).n'.(f_{12}) - n'.(f_{14}-1/P).m'(C_2-1)=0$$

We must have: $m'.(C_4+I_1)+n'.f_{12} < 0$.

$$m'.(C_4+I_1).n'.(f_{14}-1/P) - m'.(C_2-1).n'(f_{14}-1/P) > 0$$

The first inequality implies that $f_{12} < 0$. Furthermore, $f_{12}<0$ is a sufficient condition for $|D^*| < 0$. Therefore, we see that, for the system to be stable, an increase in income must lead to a net reduction in demand for equity. Originally, an increase in income had two offseting effects on demand for equity. On the one hand, it raised the return on equity leading to an increase in demand for equity, and on the other hand, it increased the transaction demand for money and, since equity is the only substitute asset for money, the public increased their money holdings at the

expense of equity. We require the second effect to be stronger in magnitude, even if the dividend effect of a change in income is stronger than the substitution effect[6], such that f_{12} is positive, we will still get the above results as long as f_{12} is sufficiently small.[7]

For the condition that was stated, the open-market operation multipliers have the expected signs. $dV/dV_g > 0$ and $dV/dG < 0$. The government purchase of equity is expansionary. It increases the demand for equity leading to a rise in investment and output.

The fiscal policy multipliers are $dY/dG > 0$ and $dV/dG <> 0$. A money-financed government deficit increases the real output but the net impact on investment is not clear. In algebraic terms, we have: $dV/dG = -1/D^* .[f_{12}.(C_3+1) + (1-C_2).f_{13}]$.

By further manipulation of this formula, we will be able to identify the direct and indirect effects of G on V. The bracket could be written as:

$$(1-C2).[f_{13} + f_{12}.(C_3+1)/(1-C_2)]$$

f_{13} is the direct impact of increased G on equity demand via the wealth effect. The indirect effect is given by the second term inside the bracket. The increased government spending increases the aggregate demand and Y will increase to restore equilibrium. The net effect of these actions is shown by fraction $(C_3+1)/(1-C_2)$. The increased income affects the demand for equity f_{12} but, unfortunately, the direction of change is not clear.

Therefore, the direct and indirect effects could reinforce or offset each other.

The impact of a monetized deficit on output is expansionary because the feedback from the equity market into the real sector reinforces the direct effect.

$$dY/dG=-1/D^*.[(1/P-f_{14}).(C_3+1) + (C_4+I_1).f_{13}]$$

Factoring out $(1/P-f_{14})$, we get:

$$dY/dG=-1/D^*.(1/P-f_{14}).[C_3+1+ f_{13}.(C_4+I_1)/(1/P-f_{14})]$$

C3+1 is the direct impact of G on Y and is clearly positive. The feedback from the equity market is shown by the second term in the bracket. A rise in G has a wealth effect on the equity demand, causing an excess demand for equity. To restore equilibrium, V must rise as shown by $(1/P-f_{14})$. The increase in V will further increase the aggregate demand. Both direct and indirect effects are positive.

Section Three

Monetary and Fiscal Policy in a Regular Economy.

Now that we have developed the tools of monetary and fiscal policy for an equity-based economy, the next question is how do these differ from similar policies in a regular economy in the size and direction of their effects. To demonstrate a regular economy, we must add two additional markets to our model of an interest-free economy. These are the markets for private and government bonds. The policies that we are concerned with are open-market operations on government bonds and fiscal policy.

Since none of these require any direct interaction with the private bond market, we choose to ignore this market as we did in the model of section 2. Therefore, in the macro model of the regular economy, there are three assets markets for government bonds, equity and money. In this model, government does not hold any equity because the equity market is not used for monetary intervention. Instead, we have introduced the conventional method of monetary intervention that is practiced in the Western economies. The equilibrium conditions for the regular economy are:

$$C(Y,q,b,P,W)+I(V,P)+G = Y \qquad 10.1 \quad \text{Commodity}$$

$$f_1(q,b,Y,W) = V/P \qquad 10.2 \quad \text{Equity}$$

$$f_2(q,b,Y,W) = M/P \qquad 10.3 \quad \text{Money}$$

$$f_4(q,b,Y,W) = S/(b.P) \qquad 10.4 \quad \text{Bonds}$$

b = The rate of return on government bonds. (Endogenously determined)

S = The nominal supply of government bonds.

f_4 = Real demand for government bonds.

The wealth constraint for this model is W=V/P+M/P+S/(b.P). Changes in government deficit and open-market operations by the central bank will change the money supply and we have:

$$M/P=M(\underset{-}{S},\underset{+}{G})/P$$

We also have the following function that was explained in section 2.

$$q=q(\underset{+}{Y},\underset{-}{V},P)$$

An exchange of bonds for money does not change real wealth. An open-market operation changes the supplies of bonds and money by the same magnitude in opposite directions. When replacing the wealth parameter in model 10.1-10.4, we demonstrated this neutrality by writing:

$$W=W(\underset{+}{G},\underset{+}{V},\underset{-}{b})$$

G appears in the wealth function because we have assumed that the government deficit is monetized.[8] Thus, as G changes, the money supply changes and causes the real wealth to change.

Replacing for q and W in equations 10.1-10.4, we have:

$$\underset{-\ ?\ +\ +\ -}{C(P,Y,G,V,b)}+\underset{+\ -}{I(V,P)}+G = Y \qquad 11.1$$

$$\underset{?\ ?\ +\ ?\ -}{f_1(P,Y,G,V,b)} = V/P \qquad 11.2$$

$$f_2(\overset{-}{P},\overset{?}{Y},\overset{+}{G},\overset{+}{V},\overset{-}{b}) = M(G,S)/P \qquad 11.3$$

$$f_4(\overset{-}{P},\overset{-}{Y},\overset{+}{G},\overset{+}{V},\overset{?}{b}) = S/(b.P) \qquad 11.4$$

Since by the virtue of the wealth constraint one of the equilibrium conditions for the asset markets is redundant, we choose to ignore the bond market. To analyze the impact of fiscal policy and open-market operations, we totally differentiate equations 11.1-11.3 with respect to b,Y,V,S,G.

$$\begin{bmatrix} C_4+I_1 & C_2-1 & C_5 \\ f_{24} & f_{22} & f_{25} \\ f_{14}-1/P & f_{12} & f_{15} \end{bmatrix} . \begin{bmatrix} dV \\ dY \\ db \end{bmatrix} = - \begin{bmatrix} 0 & C_3+1 \\ -M_2/P & f_{23}-M_1/P \\ 0 & f_{13} \end{bmatrix} . \begin{bmatrix} dS \\ \\ dG \end{bmatrix} \qquad 12.1$$

In matrix form, 12.1 could be written as: $\bar{A}.\begin{bmatrix} dV \\ dY \\ db \end{bmatrix} = -\bar{B}.\begin{bmatrix} dS \\ \\ dG \end{bmatrix}$ 12.2

We must determine the signs of the elements of $\bar{A}$ and $\bar{B}$ in order to derive the signs of the multipliers. Based on the derivative signs in system 11.1-11.4, the signs of the following elements are obvious:

$$\bar{A}_{11}=C_4+I_1 >0 \ , \ \bar{A}_{12} = C_2-1 <0 \ , \ \bar{A}_{13} = C_5<0$$

$$\bar{A}_{21} = f_{24} >0 \ , \ \bar{A}_{22} = ? \ , \ \bar{A}_{23} = f_{25}<0$$

$$\bar{A}_{31} = f_{14} - 1/P<0, \ \bar{A}_{32} = ? \ , \ \bar{A}_{33} = f_{15}<0$$

Only two elements of $\bar{A}$ are a priori undetermined: $\bar{A}_{22}=f_{22}$, $\bar{A}_{23}=f_{12}$. f_{22} is the derivative of demand for money with respect to income. The only reason that f_{22} might be negative is that an increase in Y will increase the dividend rate and encourage people to increase the ratio of equity in their portfolio. We call this the dividend effect. This

tendency is in conflict with the transaction demand for money which rises with income. However, in the presence of bonds, equity will be a weak substitute for money. Thus, we assume that the transaction demand for money dominates the dividend effect and an increase in income raises the demand for money. $\bar{A}_{22} = f_{22} > 0$.

f_{12} is the derivative of equity demand with respect to income. An increase in income will have two opposite impacts on equity demand, the dividend effect increases the equity demand while the substitution effect reduces it. In the equity-based model, we argued that, since equity was the only substitute for money, the substitution effect was fairly strong. This leads to the assumption that $f_{12} < 0$. In this model of the regular economy, we assume that bonds are the primary substitutes for money. Therefore, it is reasonable to assume that the net effect of a change in income on equity demand is more likely to be positive than negative. We carry out the analysis conditional on the sign of f_{12} .

In matrix $\bar{B}$, the signs of the elements are easily determined.

$$B = \begin{bmatrix} 0 & + \\ + & - \\ 0 & + \end{bmatrix}$$

We have already shown that $\bar{A}$ has the following signs.

$$\bar{A} = \begin{bmatrix} + & - & - \\ + & + & - \\ - & f_{12} & - \end{bmatrix} \qquad \bar{A}^{-1} = 1/\bar{D} \cdot \begin{bmatrix} O_{11} & O_{21} & O_{31} \\ O_{12} & O_{22} & O_{32} \\ O_{13} & O_{23} & O_{33} \end{bmatrix} = 1/\bar{D} \ .O'$$

$$\begin{bmatrix} dV \\ dY \\ db \end{bmatrix} = -\tilde{A}^{-1} . B . \begin{bmatrix} dS \\ \\ dG \end{bmatrix}$$

$\bar{D}$ = det($\bar{A}$). O = The matrix of cofactors for matrix A. The signs of A_{ij} allow us to determine the signs of most of the elements in O under the assumption of $f_{12} > 0$.

$$O' = \begin{bmatrix} O_{11} & - & + \\ + & - & O_{23} \\ + & O_{23} & + \end{bmatrix}$$

The indeterminate elements are:

$$O_{11} = f_{12} . f_{15} - f_{12} . f_{25} \qquad 13.A$$

$$O_{23} = -[(C_4 + I_1) . f_{12} - (C_2 - 1)(f_{14} - 1/P) \qquad 13.B$$

$$O_{32} = -[(C_4 + I_1) . f_{25} - C_5 . f_{24}] \qquad 13.C$$

The solution to the system is:

$$\begin{bmatrix} dV \\ dY \\ db \end{bmatrix} = 1/\bar{D} . \begin{bmatrix} O_{11} & - & + \\ + & - & O_{32} \\ + & O_{23} & + \end{bmatrix} . \begin{bmatrix} 0 & - \\ - & + \\ 0 & - \end{bmatrix} . \begin{bmatrix} dS \\ dG \end{bmatrix} = \begin{bmatrix} +/\bar{D} & [(-)-O_{11}]/\bar{D} \\ +/\bar{D} & [(-)-O_{32}]/\bar{D} \\ -O_{23}/\bar{D} & [(-)+O_{23}]/\bar{D} \end{bmatrix} . \begin{bmatrix} dS \\ dG \end{bmatrix}$$

The multipliers are:

$$dV/dS = +/\bar{D} \qquad dV/dG = [(-)-O_{11}]/\bar{D}$$

$$dY/dS = +/\bar{D} \qquad dY/dG = [(-)-O_{32}]/\bar{D} \qquad 14$$

The signs of these multipliers depend on the sign of the determinant which in turn depends on f_{12}. It could be shown that $f_{12} > 0$ is a sufficient condition for $\bar{D} < 0$. It is also clear from basic monetary theory that dV/dS and dY/dS must be negative. This requirement is satisfied when $\bar{D} < 0$. Unfortunately, even when $f_{12} > 0$ is given the proper sign, the

government deficit multipliers are still indeterminate.

This indeterminacy is caused by two factors: first, the reaction of equity demand to changes in income is not clear and second, the presence of a bond market causes a negative feedback from the financial sector to the real sector. Consider an initial increase in G which leads to an increase in income. The rise in Y will cause a drop in demand for equity which could be partially offset by the wealth effect f_{34}. Nevertheless, the net effect could very well be negative causing an excess supply in the bond market. To restore equilibrium in the bond market, the bond rate must rise. The rise in bond rate will have a negative impact on consumption demand.

The initial increase in G will also increase the demand for equity (increase in money supply will have a wealth effect on equity demand); but at the same time, the higher bond rate will have an opposite effect on the equity demand. As a result, the net change in equity values is not clear. This indeterminacy causes an indeterminate change in the investment demand. Consequently, the net change in the aggregate demand is not clear because the increase in government spending could be offset by reductions in private consumption and investment.

Based on the multiplier formulas in 14, we can present sufficient conditions which, if met, will make the fiscal policy expansionary. dY/dG would be positive if $O_{32} > 0$, and from 13.c, O_{32} will be positive if $(C_4+I_1).f_{24}-C_5.f_{24}<0$.

Finally, this last condition will be satisfied if the aggregate demand for output is more sensitive to changes in equity return compared to the bond rate[9] and, at the same time, the demand for money is more sensitive to the bond rate compared to the equity return:

$$(C_4+I_1)>C_5 \quad \& \quad |f_{25}|>|f_{24}|$$

Both parts of this condition are expected to be true. The second part, however, depends on the degree of substitution between money and other assets.

dV/dG will be positive if $O_{11}=f_{22}.f_{15} - f_{12}.f_{25}>0$. A sufficient condition for this inequality to be satisfied is for the money demand to be less sensitive to income than to bond rate and the equity demand to be less sensitive to the bond rate than to income.

$$f_{25}>f_{22} \quad \text{and} \quad |f_{12}|>|f_{15}|$$

It is not clear if these conditions are satisfied in the real world.

Section Four

A Comparison of Policy Effects for the Regular and Equity-Based Regimes.

To compare the impact of fiscal and monetary policies in the regular- and equity-based economies, we have developed separate models for each economy. The basic difference between these models is that the equity-based economy does not have any bond market. Before going into the comparison of these two regimes, we must point out that the macro model of regular economy that is developed here differs from the standard textbook macro models. In these textbook models, money and bonds are the only assets considered. The implicit assumption is that bonds and equity are perfect substitutes. They are combined into a single bond market. The bond rate is the same as the rate of return on equity.

In this type of two-asset models, there is more confidence about the impact of fiscal policy. For example, consider a pure increase in government expenditure which initially will increase the output. At the same time, it could cause an excess supply in the bond market leading to an increase in the bond rate. the rise in bond rate will feed back into the consumption and investment demand and put a downward pressure on output. This decline can, at most, offset the initial increase in output but it cannot cause a net decline. (If the feedback effect is large enough to

cause a net decline in output, the model will be unstable.) Therefore, a fiscal policy in this case will be expansionary or at worst neutral.

In a three-asset model like the one that was developed in this chapter, however, the presence of a third market for equity could cause a net decline in output in response to a fiscal policy. The main feature of the three-asset models, which is partially responsible for this added uncertainty about the impact of fiscal policy, is the fact that the net effect of a change in income on demand for equity is not clear.

We will now turn our attention to comparing the regular and the equity-based economic systems. The comparative static analysis of several policy instruments shows that, while the policies in general have similar effects, there are some differences in the performance of these two regimes. As one would expect, these differences are explained by the fact that one model includes a bond market and the other one does not. The policies that we studied are:

1) Open-market operations.

2) Monetized fiscal deficit.

3) Bond (Equity) financed fiscal policy.

In an appendix to this chapter, we have also analyzed the impact of two other policies: 1) pure fiscal policy and 2) a pure increase in the money supply. Because of the

governments' budget constraint, these policies can never be implemented alone. They are only analyzed to aid us in understanding the original three policies. The qualitative effect of these policies is presented in Table 1.

A. Pure Fiscal Policy.

This policy consists of an autonomous increase in government expenditures without any equivalent change in the supply of bonds or money. Such an increase will increase the commodity demand but it will not have a wealth effect on the asset demands:

RESULT 1: A pure fiscal policy will be expansionary under Islamic and regular regimes.

RESULT 2: A pure fiscal policy will increase (decrease) investment if the demand for equity is positively (negatively) related to variations in real income, $dV/dY>0$ and $(dV/dY<0)$, under both regimes.

The first result comes as no surprise. When the economy operates at less than full employment, an autonomous increase in expenditures will stimulate more production. The explanation for the second result is that an increase in income has two offsetting effects on the demand for equity. On one hand, it leads to higher dividends which will increase demand for equity and on the other hand, it causes a shift from equity to money because of the increased transaction demand for money. This second effect might seem

		Pure Fiscal Policy	Pure Increase In Money Supply	Bond Financed Deficit	Money Financed Deficit	Open Market Operation
Equity Based Economy	Y	+	+	<>0	+	+
	V	<>0	<>0 Apriori ---------- + if f_{12}<0	-	<>0	
Regular Economy	Y	+	<>0 Apriori --------- + conditional	<>0	<>0 Apriori -------- + conditional	+
	V	<>0	<>0 Apriori ---------- + Conditional	<>0	<>0 Apriori ---------- + Conditional	+

TABLE 1

strange but it is a direct consequence of the fact that income is not a component of wealth. Therefore, if a change in income leads to a change in the asset demands, these changes must offset each other. Since an increase in income increases the demand for money, it must cause a decline in all or some of the other asset demands. In the Islamic economy, equity is the only substitute for money and any increase in demand for money as a result of rising income is offset by a decline in equity demand.

Therefore, at the same time that Y increases, investments could increase or decrease; but investments will never decline sufficiently enough to cause a net reduction in aggregate demand. To see this, consider the following possibilities:

a) If $dV/dY<0$, the increase in G will increase Y and cause a drop in V which will reduce I and C, so we have had a decline in C and I. The net effect on Y could be positive or negative. A reduction in Y, however, will be inconsistent. This is because, if Y declines, V will increase . That will increase C and I, then we will have an increase in Y which is contradictory;

b) If $dV/dY>0$, the increase in G will increase Y and that in turn will increase C and I. Consequently, Y can only increase.

B) A Pure Increase in the Money Supply.

RESULT 3: A pure increase in the money supply under the Islamic regime will increase output. Investment will also increase if equity demand is positively related to income, $dV/dY>0$.

RESULT 4: A priori, in a regular economy, the impact of a pure increase in the money supply on output and investment is indeterminate. (The sufficiency conditions for an increase in output and investment are given in results 6 and 7.)

RESULT 5: The existance of the bond market in a regular economy will reduce our confidence about the impact of an increase in the supply of money on the aggregate demand.

The explanation for result 3 is same as the one given for results 1 and 2 with the single difference that this time the process starts with an increase in the money supply rather than G. The increase in the money supply will have a wealth effect on consumption which will increase output. At the same time, it will have a positive wealth effect on equity demand, but this might be offset by the income effect which could be negative.

The lower degree of confidence under the regular regime compared to the Islamic regime (Results 3 & 4) is due to the

feedback from the bond market into the equity and commodity markets. Consider an initial increase in the money supply which will have a positive wealth effect on the demand for all three assets. It will cause an excess supply in the money market and an increase in the consumption demand. The increased consumption will increase the transaction demand for money at the expense of a demand for bonds. Therefore, there are two conflicting forces on the bond market. On one hand, the increase in money supply will have a positive wealth effect and, on the other hand, the increased transaction demand for money will reduce the demand for bonds. If the net effect of these two forces is a reduction in bond demand, the bond rate must increase to restore equilibrium. The rise in the bond rate will then feed back into the consumption demand and equity demand, offsetting the initial increase that was brought about by the original increase in the money supply.

This is only a possibility and the outcome also depends on how sensitive the consumption and equity demands are to changes in the bond rate. We can give sufficiency conditions that will make the increase in the money supply expansionary:

RESULT 6-A: Under a regular regime, a pure monetary policy will be expansionary if the aggregate demand is more sensitive to changes in return to equity compared to the interest rate and, at the same time,

the demand for money is more sensitive to changes in the interest rate compared to the equity return.

RESULT 6-B: A second sufficient condition for an increase in output is the zero-interest elasticity of consumption.

RESULT 7-A: Under a regular regime, a pure increase in the money supply will increase investment if the money demand is less sensitive to changes in income than changes in the bond rate and, at the same time, equity demand is less sensitive to changes in the bond rate compared to changes in income.

RESULT 7-B: A second sufficient condition for an increase in investment is for the elasticity of the equity demand, with respect to the bond rate, to be zero.

To explain these results, we refer to the money-supply multipliers that were developed in Appendix B.

$$dV/dM=(-O_{11}-(-))/\bar{D} \qquad O_{11}=f_{22}.f_{15}-f_{12}.f_{25}$$

$$dY/dM=((-)-O_{32})/\bar{D} \qquad O_{32}=-[(C_4+I_1).f_{25}-C_5.f_{24}]$$

We have already shown that $\bar{D}<0$.

These multipliers will be positive if O_{11} and $O_{32}>0$. Results 6 and 7 simply present sufficiency conditions for $O_{11}>0$ and $O_{32}>0$, respectively. Note that these sufficiency conditions are independent of the units of measurement. For

example, in O_{11} a change in the unit of measurement for income will change f_{12} and f_{22} by the same proportion without changing the sign of O_{11}.

C) A Pure Money Financed Fiscal Policy.

RESULT 8: In an equity-based economy, a money-financed fiscal policy will clearly increase output. The investment level will increase if equity demand is positively related to income, $dV/dY>0$.

RESULT 9: The a priori impact of a money-financed fiscal policy on output and investment in a regular economy is not clear. The policy will be expansionary if the conditions that were listed in results 6 and 7 are met.

This policy is a combination of a pure fiscal policy and a pure increase in the money supply. Accordingly, the net impact is a mixture of these two policy effects. Even though we are less confident about the effects of this policy in a regular economy, a careful look at the conditions that were stated in Result 6 reveals that they are very likely to be met. Recent studies have shown that consumption in the United States is not significantly sensitive to the interest rate. Overall, under both regimes, the response to this policy depends on how changes in income affect the demand for equity. In case of the regular regime, another factor is the sensitivity of

consumption and equity demands to changes in the interest rate. If they are insensitive, the policy will be expansionary.

D) A Bond-Financed Fiscal Policy.

RESULT 10: A bond (equity) financed fiscal policy will have an indeterminate effect on output in a regular (an equity-based) economy.

RESULT 11: An equity-financed fiscal policy will reduce investment in an Islamic regime while a bond-financed fiscal policy will have an indeterminate effect on investments in a regular economy.

The justification for these results is that the original increase in G could be offset by a possible reduction in investment and consumption demands. These reductions are caused by an increase in the interest rate in the regular economy and a reduction in equity values in the equity-based economy. Under the equity-based regime, the added deficit is financed by the sale of government-owned equity. This sale will reduce the value of equities and cause a drop in investment. The impact on investment under a regular regime is not clear because the debt is financed by the sale of bonds rather than equity. There will be two opposing pressures on equity demand. The increased bond rate will have a negative effect while the increase in government expenditures could have a positive effect. Thus,

the net result is not clear.

E) Open-Market Operations.

In an equity-based economy, the open-market operations are conducted in the equity market instead of the bond market (which no longer exists).

RESULT 12: The open-market operations are effective under both regimes, and the policy multipliers have the expected signs. In both economies an open-market purchase will increase both output and investment.

Overall, we see that the elimination of government bonds does not dramatically alter the ability of the central bank to conduct monetary and fiscal policy. Both monetary and fiscal policy are effective. The surprising result is that in no case did we observe the impact of a policy on the equity-based economy to be more uncertain than the impact of the same policy on the regular economy. To the contrary, for some policies we have more confidence about the response in the equity-based economy compared to the regular economy.

NOTES

1. In this section, we are not concerned with policy analysis and as a result, the government sector is not included.

2. The reason we ignore the capital gains is that, in this short term model, expectations are exogenous. Sargent-Henderson also use this assumption in their model.

3. Other variables have the same definitions that were given in Section 1.

4. With this action, we exclude the banking sector altogether. Consequently, we can no longer study the impact of changes in the reserve-requirement ratio, K. The policy impact of changes in K, however, are straight forward. An increase in K is contractionary.

5. The exact formulas for these multipliers are:

$$dV/dV_g = (-1/D^*).(1-C_2)/P$$

$$dV/dG = (-1/D^*).[f_{12}.(C_3+1)+(1-C_2).f_{13}]$$

$$dY/dG = (-1/D^*).[(1/P-f_{14}).(C_3+1)+(C_4+I_1).f_{13}]$$

$$dY/dV_g = (-1/D^*).[(C_4+I_1).1/P]$$

6. By dividend and substitution effects, we are referring to the components of the following derivative:

$$df_1/dY = (df_1/dq).(dq/dY) + df_1/dY$$

7. We can derive an upper bound for f_{12} which results in $D^*<0$.

8. Another type of fiscal policy involves a debt-financed government deficit. In an equity-based economy, this will be equivalent to financing the government deficit by the sale of equity (that the central bank owns). We will compare the effects of debt-financed and equity-financed fiscal policies in a separate appendix.

9. There is a significant body of evidence that consumpton in the United States is not sensitive to the rate of return on financial assets, especially bonds. For a survey of this evidence, see Chapters 3 and 6 of Evans, M.K., Macro Economic Activity New York, Harper & Row, 1969.

CHAPTER 4

ISLAMIC BANKING IN PRACTICE

Currently in the Muslim world, there are two distinct and parallel approaches to Islamic Banking. Two Muslim countries, Iran and Pakistan, have eliminated their conventional banking systems in favor of complete Islamic banking. In contrast, many other Muslim nations have introduced individual Islamic banks while allowing the conventional banking system to continue. We will review the progress of these competing approaches separately.

4-A. INDEPENDENT ISLAMIC BANKS

The first experiments on Islamic banking began in the mid-1950's. Before that time, the post-colonial leaderships in the Middle East were so preoccupied with secular modernization that Islamic concerns about the interest charge were brushed aside. Most of these nations had already established Western-style banking institutions. In addition, foreign banks were also active in more developed countries of the region. In Egypt, for example, the British-owned banks began operation as early as 1856. The

first Egyptian-owned bank (Bank Misr) was established in 1919 by a Cairo financier named Mohammed Talat Harb.[1] Similarly, at the same time, financial development was underway in other nations as well.

The first attempt to create an Islamic bank was made in Pakistan. Since Pakistan was originally established as an Islamic nation, the religious leaders called for abolition of interest in the early years of independence.[2] In that time, the idea was rejected by the leadership because of economic considerations. After a few years, however, a small experimental Islamic bank was established in rural Pakistan. The initial capital was provided by a group of small local land owners who deposited funds in the institution primarily for religious reasons. No interest or profit was paid to these depositors. The bank provided interest-free loans to the poorer land owners for a small administrative charge. Unfortunately, this venture did not survive for long. After a few years, the original enthusiasm diminished and the bank was closed down. A major difficulty facing the bank from the start was the shortage of funds. Without paying any interest or profit, it was difficult for the bank to attract depositors. At the same time, the low administrative earnings prevented the bank from paying competitive wages and keeping the staff motivated.

The second initiative towards Islamic banking was taken in Egypt in 1963. In this case, a small savings bank was founded by a man named Ahmed Al Nagar in a rural town near Cairo. Originally, the bank had about 1,000 depositors but very soon it gained the trust of the conservative local community and the number of depositors grew to more than 60,000 in three years. While conventional banks were successful in larger towns, they were received with suspicion in rural communities. The success of Mitr Ghams Savings Bank was based on its appeal to the devout Muslim population of these communities. Persons who were hoarding funds or accumulating real assets (because they found the conventional banks un-Islamic) willingly deposited funds in the Mitr Ghams Savings Bank. The operations of this bank were similar to the Islamic Savings Bank of Pakistan. The bank did not charge any interest on loans and did not pay any interest on deposits either. While a portion of loans were borrowed for investment purposes, the bank did not share in the borrowers' profits. Instead, they only charged a small administrative fee. The bank operated for almost three years.[3]

These two early attempts in Islamic banking were not investment or profit oriented. Their main objective was to provide interest-free loans to the low income and poor individuals. The lack of a clear alternative to the interest charge was the primary reason for their inability

to survive beyond a few years. Their shortcomings were one of the reasons that Islamic scholars proposed profit and loss sharing as the basis of Islamic banking.

During the 1970's, development of Islamic banking took a different direction. Unlike the two savings banks that were described above, the new Islamic banks were oriented toward profitable investments. In 1972, Ahmed Al Nagar, the founder of Mitr Ghams Savings Bank, established a new Islamic bank called Nasser Social Bank. This bank continued to offer many of the services that were offered by the Mitr Ghams Savings Bank. In addition, the Nasser Social Bank allocated a portion of its resources to direct equity investment. While no profit was shared with the depositors, they enjoyed an implicit benefit by having the privilege to borrow funds at no interest charge. The initial capital of nearly $2m was provided by the Egyptian government which has remained the sole owner of the bank. The state support has continued and the paid-up capital of the bank is much larger today.[4]

The progress of the Nasser Social Bank was a major source of encouragement for Islamic banking in other countries. Through frequent contacts with other Arab leaders and financiers, Ahmad Al Nagar[5] encouraged them to establish commercial Islamic banks. He motivated a group of Dubai merchants to establish the Dubai Islamic Bank in 1975.[6] He also convinced Prince Mohamad Bin Faisal (son of

the late King Faisal of Saudi Arabia) to help establish other Islamic banks in Sudan and Egypt.

In 1977, the Faisal Islamic Bank of Egypt and the Faisal Islamic Bank of Sudan were established. The Saudi Arabian private citizens provided 40% of the initial capital for the Faisal Islamic Bank of Sudan and 49% of the initial capital for the Faisal Islamic Bank of Egypt.[7] The operations of these banks were much closer to the model of Islamic banking that was described in Chapter 1. Unlike the Mitr Ghams and Nasser Social Banks, they distributed a portion of their profits among depositors and shifted their lending and investment activities from interest-free assistance loans to profitable equity investment and PLS loans. They offered two basic types of accounts: savings accounts that are fully insured but earn no profits and investment accounts that share in the profits and losses of the bank. The investment operations of these banks are very similar to items that were described in Chapter 1. These three banks have been able to survive and compete with regular banks for depositors. The Dubai Islamic Bank has become the largest national Islamic bank with $13 million in paid up capital and nearly $100 million in deposits in 1980.[8]

Ever since 1975, new Islamic banks similar to the Dubai Islamic Bank have been established in almost every Islamic country and their presence has been accepted by the

financial communities of these nations. As expected, Islamic banks have appealed to the devout Muslims more than other groups and their operations have reduced hoarding in money and jewelry. The operation of independent Islamic banks along with regular commercial banks has increased the efficiency of financial systems by adding new and diverse assets without eliminating any of the already existing assets. The negative effects of Islamic banking that were demonstrated in our analysis will only arise when the entire financial system is modified and all interest-paying assets are eliminated.

Development of International Islamic Banks.

During the 1970's and 80's, Saudi Arabia provided moral and financial support to Islamic banks more than any other nation. This support went beyond establishing and assisting the independent Islamic banks. The more important contribution of Saudi Arabia was the establishment of two international Islamic banks: The Islamic Development Bank and Dar al-Mall Al-Islami. The Islamic Development Bank (IDB) was established in 1975 by the approval of the 38 participating nations of the Islamic conference. The main objective of this bank was to provide financial capital for industrial and agricultural projects in Islamic nations. A second goal was to promote international trade among Muslim states. The activities of the bank were limited to

mechanisms that are allowed in Islam, primarily equity participation and interest-free loans.

The original capital for IDB was provided by several oil-exporting Islamic nations; Saudi Arabia contributed 25%. Other major contributers were Libya, United Arab Emirates and Kuwait. In 1981, IDB had more than $1.5 billion in paid-in capital. During its first five years of operation, IDB financed many development and trade projects throughout the Muslim world. Several nations, including Turkey, Pakistan and Sudan, received interest-free loans to finance the import of petroleum products and other commodities (from other Muslim nations).[9]

Other activities of the IDB included equity participation and leasing. To encourage Islamic banking, IDB invested in national Islamic banks. It also invested in equity projects in many Islamic nations. Leasing out industrial machinery was another scheme used by IDB. The bank leased out refining equipment to Pakistan and machinery to the Turkish Electrical Company. Overall, the Islamic Development Bank played a significant role in popularizing Islamic Banking and providing assistance to low income Islamic nations.[10]

Dar Al-Mall Al-Islami (Islamic House of Funds) is the second international Islamic bank that was established by Saudi Initiative in 1981 with a paid-in capital of $300 million. The stated objective of the bank was to support

development projects in Non-Arab Islamic states such as Malaysia, Sri Lanka, Turkey, Pakistan and others. Most of the depositors and shareholders were attracted from the oil-rich gulf nations. (Nearly 80% of the liabilities of DMI, Dar al-Mall al-Islami are owned by the Arab nations of the Persian Gulf area.) DMI has tried to reduce its dependency on Persian Gulf capital by opening branches in other Muslim states.

So far, the operations of DMI have been profitable. The performance of the bank during the 1984-85 financial year, in particular, was impressive. To achieve further diversification, DMI targeted the Muslim nations of Africa and Southeast Asia for future investment. Besides the Islamic Development Bank and Dar al-Mall al-Islami, there were several smaller international banks as well. Some of these banks were headquartered in European capitals, particularly London and Geneva. They were primarily involved in equity investment and foreign trade financing among Arab and European nations.

Overall, there are more than 30 Islamic banks currently operating throughout the Muslim world. Many of them have been able to offer attractive profits to their depositors and compete against conventional banks for people's savings. Their operations have pleased a large number of devout Muslims who were reluctant to use the conventional banks. However, at the same time, some conservative Muslims have

raised concern about the long-term effect of these banks. According to these critics, the operation of individual Islamic banks inside the conventional financial system could delay the total transformation of the financial system from regular to Islamic. It was for similar fears that plans for the creation of a pilot Islamic bank in Pakistan (in the late 1970's) were rejected in favor of a complete Islamization of the entire banking system.[11] In the following section, we will review the progress of the Islamic banking systems (as opposed to independent Islamic banks).

4-B. ISLAMIC BANKING SYSTEMS

So far only two states, Iran and Pakistan, have established complete Islamic banking systems. The idea, however, is popular in the religious circles of many Islamic states. In Pakistan, the process began in 1981. In the first phase, special corners for Islamic financial transactions were established in every bank. This was followed by the removal of interest-paying assets. The reforms were completed in 1985. The modification of Iran's banking system began in 1984 and it is expected to be finished within 5 years. Since the Islamic banking systems of Iran and Pakistan are very similar, it would be redundant to review both of them here. Several reviews of the Pakistani Experience have already been published. In

contrast, the Islamic banking system of Iran is mostly unknown; therefore, it would be appropriate to briefly review the progress and structure of Iran's Islamic banking system.

The Islamic Banking System Of Iran.

In the few years before the 1979 revolution, the Iranian economy was experiencing very rapid growth. The main reason for this expansion was the sudden increase in the oil revenues. The financial system was also growing very rapidly in the same period. The banking institutions of this era, however, were entirely secular. Despite religious opposition, banks were issuing loans and accepting deposits on the basis of interest.

After the 1979 Islamic revolution, the new government decided to abolish any economic and social institutions that were unacceptable to Islam. In the economic sector, the banking system became the first target of this reform. At the same time, under popular pressure, the government nationalized the entire banking industry. Having direct control made it easier for the government to implement any future reforms. (In Pakistan also the banks are nationalized.)

With regard to the banking system, the goal was to abolish any institutions that involved interest charge and introduce new arrangements that were acceptable to

Islam. Since there was no prior experience in Islamic banking, it was clear that the design and implementation of the new system would take some time. To avoid any kind of financial collapse or loss of public confidence in the banking system, it was decided to continue with the old banking institutions until the new program was ready for implementation.

Within the central bank, a special task force was established to design the new code of banking laws. Because of the social and political instability that existed in those early years of the revolution. the work of the task force was delayed. The first set of Islamic banking laws were submitted to the Parliament by this task force in 1982. Gradually, the complete codes of Islamic banking were passed within two years. The Islamization process began in the summer of 1984. The interest-paying time and savings deposits were replaced with investment accounts. On the investment and lending side, all the new transactions were based on nonusurious arrangements. Banks continued to receive interest on long-term loans that were issued earlier. It is expected that all of these contracts will end within five years. We will describe the structure of the Iranian banking system below.

Depository Accounts.

Banks offer two types of depository accounts:

1) The interest-free current accounts and interest-free savings accounts.

2) Short-term and long-term investment accounts.

The interest-free deposit accounts are technically the same as demand deposit accounts. They are fully insured and are redeemable upon request. Even though these deposits are not entitled to any regular interest or profitsharing, the banks can occasionally offer prizes to the account holders. The prizes could be cash or durable goods such as radios or irons. The account holders will also be given priority in using other banking services such as receiving loans.

The investment accounts are similar to the PLS accounts that were described in Chapter 1. However, no profitsharing is specified. Instead, the bank announces a dividend rate on these accounts. The rate is variable and is supposed to fluctuate with the overall profits of the banking system in each period. The same rate of dividends is paid by all banks. This rate is determined by a special commission within the central bank. The minimum time for short-term accounts is three months and for long-term accounts is one year. In 1984, which was the first year of operation for Islamic Banks, the short- and long-term accounts paid 7.5% and 9% dividend rates, respectively.[12]

Even though the investment accounts are fully insured, the central bank authorities have argued that the return on these accounts is not interest because no fixed rate of dividend is declared in advance. The dividend for each six-month period is declared at the end of that period. The exact method of dividend measurement is not clear. It is unlikely that dividends are linked to the banking profits in the same manner that was described in Chapter 1. It is interesting to note that the dividend rates offered on these accounts are very close to the interest rates that were paid on short- and long-term time deposits by the commercial banks of Iran in years prior to the revolution. (In 1975, the interest rates on savings and time deposits were 7% and 9%, respectively.)

On religious grounds, these accounts might be questionable because the principal is fully insured. It was explained earlier that these risks face the possibility of losses. Since the holders of investment accounts do not face any risk of loss, their dividend is equivalent to a variable interest. Indeed, if the dividend rate stays above a certain level for a long period, the public would perceive it as a safe interest with a minimal rate.

Such accounts may not be Islamic by this standard, but they would be more efficient than a purely Islamic account which is not fully insured. Since the principal is insured, these accounts will be considered riskless. By offering

these accounts, banks can attract the savings of risk-averse individuals. One could expect the public to treat these accounts in the same way as the savings and time deposits that existed before.

The Lending and Investment Activities.

To make the lending operations of Islamic banks nonusurious, it was necessary to replace the interest-paying loans with other arrangements. Some of these new mechanisms are derived from the business customs that were common in the early years of Islam. Others were developed over the centuries to circumvent the prohibition of interest. The lending and investment mechanisms of the Iranian Islamic banking system are:

1) Interest-Free Loans. These loans are provided to the needy and poor at no interest for necessary expenses such as the treatment of illness or repair of damaged property. These loans are also granted to small businessmen in small towns and villages. The primary criteria for interest-free loans is proof of need. There is, however, an upper limit on the size of these loans. The maximum amount of interest-free loans for business and industry is 5,000,000 Iranian Rials. The upper limit for personal need is 500,000 Rials. Another limitation is that, collectively, the interest-free loans should not constitute more than 10% of the assets of the banking industry. This sum should also

be less than or equal to the interest-free deposit funds that banks receive from the public. This implies that all the funds collected by banks from investment accounts will be invested in profitable projects. No part of these funds is used for interest-free loans.

2) The Equity Partnership. Banks are allowed to provide short- and long-term credit to businesses on an equity basis. There are three different types of equity arrangements available to the banks:

a) Direct partnership between bank and businesses.

b) Equity stock ownership in corporations.

c) Direct investment by banks without any partners.

The partnership between the bank and businesses is specially designed for short-term projects. It could only be used in cases where the project is expected to be completed within one year. Only in special cases could the time limit be extended to three years. Under a partnership, the bank can at most provide 80% of the capital that is needed for a project. The equity stock partnership is designed for longer term projects of existing corporations. Banks can provide capital to these corporations by purchasing up to 49% of their total outstanding stocks. The 49% upper limit is designed to curtail any bank control of corporations. The banks can sell the stocks to the public at a future date. In this function, Islamic banks are operating similarly to the investment banks in the West.

They purchase the newly issued stocks of corporations and then gradually sell them to the public.

3) Advance Purchase. In this arrangement, the bank purchases the product of a productive unit before it is ready. The unit then can use the funds to pay for the required working capital. The bank can resell the product after receiving it.

4) Price Mark-up Resale. If an industrial unit needs funds for the purchase of machinery and equipment, the price mark-up mechanism is used. In this scheme, the bank purchases a particular tool that was requested by the unit and resells it to that unit at a higher price. In exchange for the profit, the bank allows the unit to pay the cost on an installment basis. A similar mechanism could be applied to the sale of existing houses where the bank buys a house on behalf of a costumer and resells it to him for a higher price on an installment basis.

5) Rent To Own. Banks can buy productive equipment and structures and rent them to the public on the condition that the renter will assume ownership of the item after paying rent for a certain period.

6) Crop Sharing. In the area of agriculture, besides the above-mentioned financing schemes, banks can own land and enter into crop-sharing agreements with peasants. In addition to land, banks can provide other items (such as

fertilizers and transportation) which are needed for farming.

Overall, the profit-oriented lending operations of Islamic banks fall under two categories.

a) The equity arrangements (Items 2 and 6 in above list)

b) Price mark-up schemes (Items 3,4 and 5)

The equity-based arrangements are truly nonusurious. In these schemes, the bank does assume some degree of risk as required by religion. In practice, both profits and losses are possible. However, to avoid bad investments, banks can only invest in projects that are expected to generate profits above a minimum rate that is determined by the central bank. While encouraging the banks to be efficient, this law ignores the possibility that more profitable projects might also carry higher risks. If the minimum profitability rate is too high, the bank might be forced to acquire a highly risky portfolio. A better approach would be to put limits on an expected risk as well as the expected profit rate of acceptable projects.

While no explicit interest charge is involved in the price mark-up schemes, they are implicitly usurious. The mark-up on the resale price of a tool, when it is resold by the bank to a buyer, can only be explained as the financing cost which is equivalent to the interest charge. The difference between the purchase and resale price will

determine the implicit rate of interest. Therefore, from a religious point of view, these schemes will be questionable. On one hand, trade is permited in Islam and the exchange price is a matter of agreement among parties involved. This view makes the price mark-up mechanism acceptable. But, on the other hand, if the interest charge is forbidden, one might expect the price of a commodity to be the same regardless of the method of payment. The price mark-up mechanism contradicts this principle by charging a higher price for deferred payment. Thus, it could be seen as a usurious act. This conflict, however, is purely religious. From an economic efficiency point of view, the mark-up price is justified because the financial capital is productive and there is an opportunity cost to receiving the payment in the future. The availability of price mark-up options will make the Iranian Islamic banks more productive by offering risk-free and low-risk investment channels. Banks can use these options to offset their high-risk equity investments and create diversified portfolios. Indeed, some banks might even prefer these low-risk options to equity investments.[15] The experience of Islamic banks in Pakistan reveals that most banks prefer price mark-up schemes to equity-based investments. This has led some officials to question the Islamic nature of that country's banking system.[16]

NOTES
(Chapter 4)

1) This bank was owned by a small group of wealthy merchants and land owners in Cairo. It attracted a large group of depositors from middle and low income classes as well. (See Rodney Wilson page 29.)

2) There was a debate in Pakistan in that time on whether the banning of interest charge should be included in state constitution or not. The proposal was not included. (Maxime Rudinson page 154.)

3) One major reason for its failure was the low salaries that bank employees recieved. The rural location of the bank was also a disincentive to the staff members who prefered to live in larger cities.

4) By 1980 the paid-in capital was $14.3 million. The total assets for the same year were $330.0 million. Source: Wohlers-Scharf, table 12, page 164.

5) The founder and first general manager of Nasser Social Bank.

6) Dubai is a small Arab nation in the Persian Gulf area.

7) See Rodney Wilson page 85.

8) The multinational Islamic banks such as Islamic Development Bank and Dar Al-Mall Al-Islami have much larger financial resources. Islamic Development Bank, for example, has more than $1.5 billion in Paid-in capital. (Wohlers-Scharf, Table 12, page 164.)

9) Islamic Development Bank, Fourth Anual Report, Jaddah 1979, Page 34.

10) In recent years IDB has paid special attention to the African developing nations. Actvities include a leasing conract with a Tunisian-Saudi company for Small projects in Tunisia. The country of Benin has also recieved $5 million in loan and technical assistance from IDB (Source: Arabia, June 1985 page 76.)

11) See "Report of the Council of Islamic Ideology (Pakistan) in Money and Banking in Islam by Ziauddin Ahmed, Munawar Iqbal, and F. Fahim Khan.

12) Reported in Keyhan Havai, "Negahi-Be Vaz-iatt-e Faaliatha-E Banki" Page 14, July 12, 1985.

13) Ibid.

14) Source: Banking Structure and Sources of Finance in the Middle East, page 15.

15) During the first year of Islamic Banking in Iran (1984) almost 44% of the resources of Islamic Banks were invested in Hire Purchase and Price Mrak-Up contracts while 37% were allocated to various equity arrangements. (Keyhan Havai July 12, 1985, page 14.)

16) Arabia, September 1984 pages 48-49.

CONCLUSION

In this concluding section, the analytical findings of the previous chapters will be put into perspective, then the implications of these findings for the field of Islamic Economics in practice will be analyzed. Finally, several suggestions for further research on Islamic banking will be offered.

The objectives of this research project were two fold. The first goal was to analytically study the consequences of switching from a conventional to an Islamic banking system. This investigation was conducted within two distinct models: one macro-economic model and one micro-economic model. The basic results of these analyses were that at the micro-level elimination of the interest charge will adversely affect the welfare and resource allocation of households. In particular, the more risk-averse persons are forced to assume more risk while the less risk-averse persons are not able to take as much risk as before.

The reason behind these adverse developments is that clearly money and risky assets are weak substitutes for the interest-paying riskless asset. So when the interest rate

is reduced to zero, the risk-averse investor will transfer a fraction of his funds from the riskless to the risky asset. Thus, his total investment in risky assets will increase. At the same time, since the more risk-averse investor will lend a smaller amount at zero interest, the borrower cannot borrow (and consequently take risk) as much as before.

The analysis shows that the relatively more risk-averse persons will save less while the less risk-averse individuals will do the opposite. Since each expected rate of return is associated with a higher level of risk under the zero interest rule, for the more risk-averse individual, the opportunity cost of consumption is smaller. Therefore, he is expected to increase his consumption at the expense of savings. The less risk-averse person is not as concerned about risk and under zero interest rate, his borrowing cost will be smaller so, to him, savings and investments will be more attractive under the zero rate of interest.

While the savings of the lender and the borrower change in different directions, the net effect on aggregate savings is negative. When switching from positive to the zero interest rate, the net savings is expected to decline. This decline will increase the marginal productivity of capital which leads to a higher rate of return on capital.

Similarly, in the macro economic analysis, we were able to demonstrate that aggregate real investment will decline as the interest rate is reduced to zero. In the absence of

government bonds, it was assumed that banks invested the funds available to them in the equity market. At the zero interest rate, the savings deposits will become demand deposits. When the interest payments on savings deposits are stopped, people will transfer a portion of their funds from the original savings deposits to equity and money. The total demand for equity declines by the amount of funds that have been transferred from savings deposits into money. The bank demand for equity declines while the direct demand for equity increases. The net effect, however, is a decline in the total demand for equity. Consequently, the level of aggregate investment will decline.

The second objective was to gain some insights on the structure and the performance of the Islamic economy itself. The institutions of Islamic banking were described in Chapter 1. We demonstrated that in the absence of the interest charge, Islamic banks will operate similar to mutual funds. The new banking institution to replace interest-based lending is profit and loss sharing. Using Mean/Variance analysis and portfolio theory, we have shown that PLS lending was inferior to lending at zero interest and PLS borrowing was preferred to borrowing at zero interest. These findings indicate that, even though there will be many investors who like to borrow PLS loans, they would face a severe shortage of credit because savers are reluctant to lend on the PLS basis. Therefore, with the

regular bonds prohibited and the PLS loans rejected by the lenders, the only mode of transaction remaining is equity. Even if banks choose to operate based on the PLS mechanism, the competitive pressure will make these arrangements very similar to equity contracts.

Therefore, based on the above reasoning, we did not find it necessary to include the PLS account as an independent asset in the macromodel of the Islamic economy. Also, since all types of bonds are eliminated, the model does not include any bond markets either. The three financial assets included in our model are equity, high-powered money and demand deposits. A unique feature of this model is that the central bank is allowed to hold equity and use equity transactions to alter the supply of credit in the same manner that Western central banks use open-market operations in the bond market.

We introduced several tools of monetary and fiscal policy for an Islamic economy. The three basic tools are:

1) Open-market intervention in the equity markets by the central bank.
2) The control of the required reserve ratio on demand deposits.
3) A monetized and equity-financed fiscal policy.

We have assumed that government debt in an Islamic economy is either monetized or financed by the sale of government-held equity. The reason is that government

cannot pay any interest on its debt and the public will be reluctant to purchase the bond at no interest. The only remaining option is for the government to borrow interest-free loans from the central bank.

To analyze the effect of these policy instruments, we have applied the method of comparative statics. First, the equations of the model are reduced into two equations representing equilibrium in real and financial sectors, then we totally differentiate these equations with respect to the policy instruments and the endogenous variables. The endogenous variables of our model are real output and the value of equity stocks. The results of the analysis were as expected, the purchase of equity and the reduction in reserve requirements are both expansionary and they increase the level of output and investment. An increase in monetized debt is also expansionary but the effect on equity values is unclear.

To further understand the nature of the economic policy in an Islamic economy, we developed a similar model for a regular economy by adding an additional equation for government bonds to our original model of the Islamic economy. After applying a similar comparative static analysis to this model, we were able to compare the effects of these policy instruments on regular and Islamic economies. The results were summarized at the end of Chapter 3. We observed that open-market operations had the

expected effects under both regimes (an open-market purchase will increase investment and aggregate demand). A money-financed deficit will be expansionary under Islamic regime. The impact of the same policy under a regular regime will depend on the interaction between the bond market and other markets. If the sensitivity of commodity and equiy markets to the interest rate is relatively small, the policy will be expansionary. A bond-financed deficit will have an indeterminate effect on output under both regimes. Overall, it appears that open-market operations in the equity market are the most effective tools of monetary policy in an Islamic economy.

Under an Islamic banking system, the equity market is used for open-market intervention. In practice, however, the central bank could use the PLS accounts of Islamic banks for intervention. As was described earlier, these accounts are similar to mutual fund shares in the Western world. One advantage of using PLS accounts instead of direct involvement in the stock market is that bank portfolios are highly diversified and any change in demand for the PLS accounts (which are related to these portfolios) will have minimal effect on the relative prices of different equity assets. Therefore, using PLS accounts allows the government to control the money supply without any distributional effect in favor of any particular industries or stocks.

The welfare effects of interest-charge elimination could be deduced from a basic knowledge of optimization. At the micro level, we know that in a utility maximization problem, imposition of a new restriction will either reduce the maximum utility available or give the same result as before. Since Islamic restriction primarily affects the lenders by eliminating the interest they can receive on loans, they will be clearly worse off. The welfare effect on the borrowers is not clear because, on one hand, they face a quantity restriction on loans and, on the other hand, the rate of return on their investments will be higher.

When talking about the welfare effects of Islamic banking however, we must not ignore the impact of religious faith on the preferences of individuals. It could very well be the case that, to the believers the existance of interest-paying assets is disturbing because it indicates disobedience from the commands of Islam. In that case, the elimination of these assets could even increase the utility of this group of Muslims.

Some authors such as Rafi Khan have indicated that, under a regular banking regime, some devout Muslims might shy away from the banks which are considered usurious institutions. He estimates that devout Muslims are hoarding as much as $80 billion in Saudi Arabia. Once an Islamic system is established, these funds will be deposited in banks and channeled into productive investment projects.

Therefore, he argues that the level of savings and investment might actually be higher under an Islamic banking regime.

This argument could be criticized on several grounds. First of all, there has never been a formal scientific investigation on this issue. Secondly, there is evidence that the majority of people in Muslim nations use the services of the conventional banks without any hesitation. As demonstrated in Rudney Wilson's book on Middle Eastern Banking, conventional banking in the Arab middle east has been expanding more rapidly than any other region in the world during the past two decades. This growth indicates that a substantial number of people find it acceptable to interact with commercial banks. Most likely, therefore, the number of investors who shy away from regular banks and the size of funds that are hoarded this way is minimal. Besides, the act of hoarding currency and precious metals is a portfolio allocation decision, not an intertemporal one. The monetary authorities could easily offset the effects of hoarding by increasing the supply of credit to the commercial banks. It is the intertemporal decisions of households that affect the rate of investment most significantly. Nevertheless, the issue of religiously motivated hoarding could be an interesting topic for further research in the field of Islamic banking.

Our theoretical analysis has led to a number of predictions about the consequences of Islamic banking which were reviewed earlier. How closely these predictions apply to the operation of Islamic banks throughout the Muslim world depends on how similar they are to our theoretical model. The basic assumption of our model is that, under an Islamic banking system, all of the interest-paying assets are eliminated and the remaining financial assets are risky. The negative impact of Islamic banking in our model was a direct result of this assumption. Obviously, in those nations that have established independent Islamic banks without eliminating their regular financial systems, the predictions of our model will not be applicable. This rules out all nations accept for Iran and Pakistan.

Iran and Pakistan are the only nations that have modified their entire banking system. The banking systems of these countries, however, do not operate according to the basic assumptions of our model. In these countries, banks can insure the principles of investment accounts (PLS accounts). They also have the right to request insurance and guarantees from their loan customers. In addition, the price mark-up schemes are, to a large extent, risk free. The result is that the Islamic banks of these nations are similar to the conventional banks in many aspects.

In contrast to the assumptions of my model, the Islamic banks of Iran and Pakistan are able to arbitrage risk.

Consequently, these banking systems are not as inefficient as predicted in our model. The closer they comply with the Islamic requirement, the greater would be the level of inefficiency. This inefficiency, however, might appear tolerable to an extremely religious people. To them it would be a small price to be paid for obedience to Islam. Alternatively, a Muslim people (or their leadership) might be concerned about efficiency in the financial markets and choose a semi-Islamic banking system.

Finally, the single most important policy recommendation of this dissertation is that establishing independent Islamic banks without the elimination of conventional banks is more efficient than switching to a complete Islamic banking system. The direction of Islamic banking in the future depends on the performance of these experiments with Islamic banking which are currently underway in Iran and Pakistan. It is also dependent on the political will of the Muslim population in each nation. While certain reforms in the furture are likely, there is no doubt that the notion of Islamic banking itself enjoys considerable support. There are still many unresolved issues and additional research will surely be welcomed.

Suggestions For Future Research.

Clearly, the volume of research on Islamic economic systems has significantly increased over the past six years.

However, there are still many important questions to be analytically investigated. With regard to the impact of Islamic banking on savings and investment, which was the main topic of my research, there is more work to be done. First of all, my research was limited to theoretical analysis. It must be followed by empirical tests. Within a few years, sufficient volume of data on the banking systems of Iran and Pakistan will be available, making such tests feasible.

My micro-economic analysis could be improved by replacing the quadratic utility functions with more general, functional forms which do not suffer from the weaknesses attributed to quadratic functions. The results of my model might be sensitive to the choice of the utility function because the quadratic utility function leads to increasing degrees of absolute risk aversion. It must be noted, however, that if a general utility function is used, the comparative static method will be fruitless. The reason is that we will not be able to determine the signs of the parameters which are needed to indicate the direction of change in savings and risk taking. Therefore, with general utility functions, a different method of analysis is required.

One possible direction for improving the macro model is to specify the equity and bond markets in more detail in order to capture their differences better. We have already

shown some of these differences by specifying the dividend as a function of income while the interest rate is independent of income. Another major difference that could be included is the risk structure. Bondholders have the first claim on a firm's earnings, thus they are less risky compared to equity. To capture this difference, we must formally incorporate uncertainty in our model. Doing so, however, will make the model more complex.

Aside from the topic of this dissertation, there are other issues which are worthy of consideration. The large scale use of PLS arrangements will lead to a number of difficulties. If the lender and the borrower have assymetric information about the concerned project, the borrower might under-report his profits to minimize the lender's profitshare. Also, one could perceive a situation where a borrower conceals the actual risks of a project in order to make it look more attractive. These questions of moral hazard and adverse selection should be studied empirically to see how Islamic banks deal with these issues.

A second interesting topic is the difference between economic stability of a regular and an Islamic economy. Some authors (M. Khan for example) have argued that an Islamic economy would be more stable than a regular economy because savings and investment would be better synchronized. This important issue could be a rich area for further research.

APPENDIX A

(CHAPTER 2)

The Impact of Zero Interest When the Loan Market Fails

In this appendix, we study the impact of interest-charge elimination under the assumption of complete loan market failure. The microeconomic analysis of Chapter 4 is based on the assumption that even at zero interest the savings of risk-averse investors are transferred to the less risk-averse individuals by the intermediaries. Therefore, the bond market still exists even though it is in disequilibrium.

While I believe that this assumption of partial lending is a realistic description of how the financial system of the Islamic nations will operate, the total failure of the loan market is also worth considering as a possible alternative outcome. We will briefly review the outcomes of the certainty and uncertainty models of Chapter 4 under the assumption that at zero interest no one will agree to lend. The public will keep their savings in the form of idle cash in the safe boxes and there would be a strong demand for loans but no supply.

A) The Loan Market Failure in the Certainty Framework.

The failure of the loan market imposes no new constraints on the risk-averse savers. They will simply keep their savings in a safety box instead of placing it in a bank deposit (which will no longer pay any interest). The failure of the loan market will change the constraint that the borrowers face. The two-person models of sections 1-c and 1-d will be modified to reflect the no-lending constraint.

In model 1-C (where no investment option is included), each person must maximize his utility subject to no interest-charge and no borrowing.

For person A: $\text{Max } U^A(C_1^A, C_2^A)$

$$\text{S.T. } C_1^A + C_2^A = C_1^{OA} + C_2^{OA}$$

$$C_1^A \leq C_1^{OA}$$

For person B: $\text{Max } U^B(C_1^B, C_2^B)$

$$\text{S.T. } C_1^B + C_2^B = C_1^{OB} + C_2^{OB}$$

$$C_1^B \leq C_1^{OB}$$

Figure A-1 shows the allocation under regular regime and the Islamic regime (with no lending). Persons A and B are lender and borrower, respectively. Point E is the equilibrium under regular regime. When the interest rate is suppressed to zero, the optimal allocations must lie on

S_1S_2. The lender chooses point F. Person B (the borrower) is deprived of any loans so he remains at his original position at point H. He is obviously worse off as is the lender. (Under the partial lending assumption of 1-C, the welfare impact on the borrower is indeterminate.)

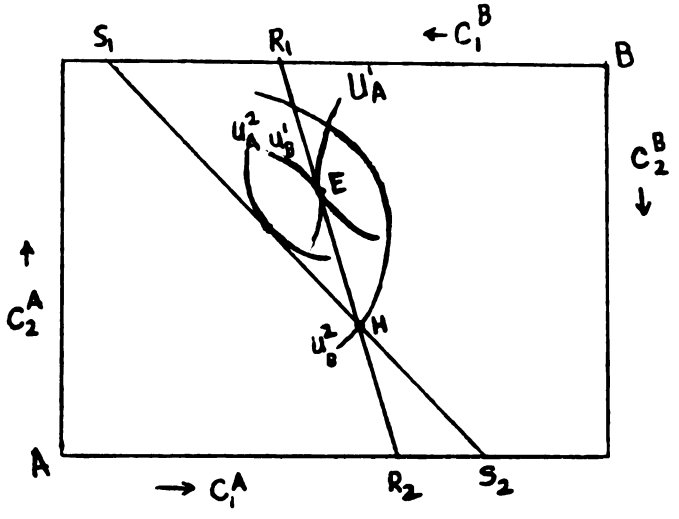

Figure A-1

When the investment opportunities exist but the loan market fails at zero interest, the optimization problem of the saver is the same as the one given in section 1-D, but for the borrower, we would have:

$$\text{Max } U^B(C_1{}^B, C_2{}^B)$$

$$\text{S.T. } C_1{}^B + C_2{}^B = C_1{}^{OB} + K_1{}^B + K_2{}^B$$

$$C_1{}^B \leq C_1{}^{OB} + K_1{}^B$$

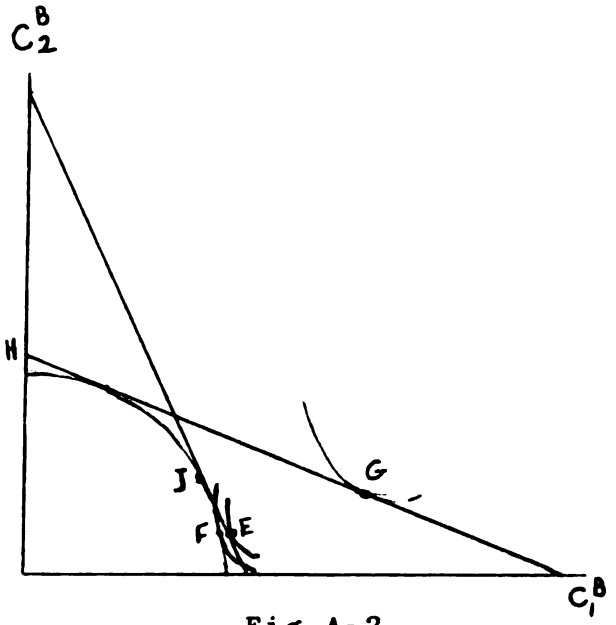

Fig A-2

In figure A-2, the borrower chooses the consumption and investment pattern shown by points E and J. Under zero interest, he wishes to borrow up to point G and invest at point K; but since no borrowing is allowed, he is forced to produce and consume at point F. In this case, the borrower is clearly worse off (compared to a regular capital market).

B) <u>The Loan Market Failure under Uncertainty Framework</u>.

To analyze the general uncertainty model which allows for investment as well as consumption, we will look at the behavior of the risk-averse saver in more detail. In the partial lending model of Chapter 4 (section 2-B), we assume that the risk-averse investors will deposit their savings in the bank even when the interest rate is zero. The banks, in turn, invest these funds or lend them to other investors. In

other words, the total savings of both persons is eventually invested. There are no idle savings in this model as demonstrated by the loan market clearing condition (equation 12).

Here, we assume an alternative behavior by the savers. They can now put their riskless savings in money or bank deposits which are both risk free (inflation is ignored). As the interest rate on bank deposits declines, the demand for these deposits diminishes until it reaches zero at a zero rate of interest. (This implies that the loan market fails completely at a zero rate of interest.) These investors will substitute money and risky assets for the bank deposits. Figure A-3 compares the supply of loanable funds under partial lending and complete loan market failure.

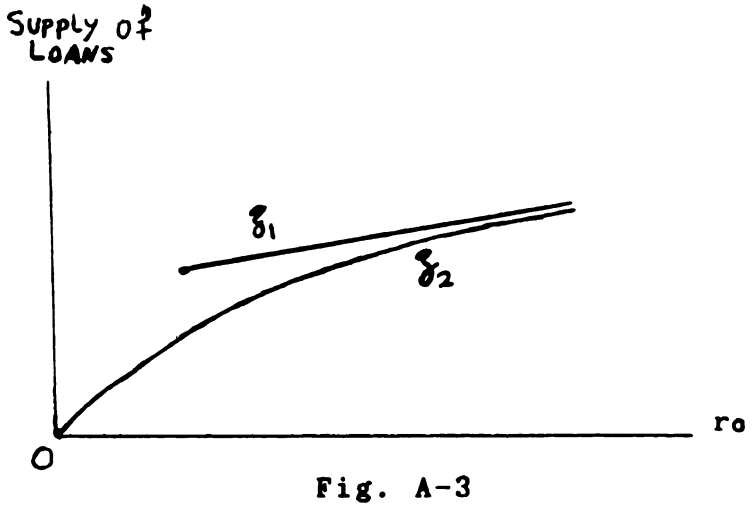

Fig. A-3

g_1 is the supply of loanable funds when all savings is kept in banks. There is a positive supply of loans at zero interest. g_2 is the supply of loanable funds under the alternative assumption. In this case, the loanable funds are not the same as savings. At zero interest rate, the riskless savings of original lenders is positive but the supply of loanable funds is zero.

We define two types of savings: idle and active. The portion of savings that is placed in banks is active and the rest which is kept in currency is idle. The active savings are:

$$Z_A(W_1 - C_1^A)$$

Z_A = The fraction of total savings kept in the bank deposits. $Z_A = Z_A(r_0)$. This fraction falls to zero as the rate of interest goes to zero. Now the bond market constraint facing the borrowers is:

$$Z_A(W_1 - C_1^A) = -(1 - X_B)(W_2 - C_1^B) \qquad 12^*$$

The maximization problem of the lender that was given in section 2-B still holds. For the borrower, we have:

$$\text{Max } EU^B(C_1^B, \tilde{C}_2^B) = \text{Max } \bar{U}^B(C_1^B, \bar{C}_2^B, s_c^2)$$

$$\text{S.T. } \bar{C}_2^B = (W_2 - C_1^B)(1 + r_o + X_B(\bar{r} - r_o))$$

$$s_c^2 = (W_2 - C_1^B)^2 . X_B^2 . s_r^2$$

$$Z_A(W_1 - C_1^A) + (1 - X_B)(W_2 - C_1^B) \geq 0$$

When the constraint is binding, $Z_A = 0$ and $X_B = 1$.

To study the impact of interest-free banking on the behavior of the borrower, we must go through the same procedure that led to the derivation of equations 13 and 14 in section 2-B. Equation 14 will essentially be the same, but since the bond market constraint has been changed, we must derive a replacement for equation 13. Then we will have a two-equation, two-variable system to solve for $d(W_2 - C_1^B)/dr_o$ and dX_B/dr_o .

Totally differentiating equation 12* with respect to r_o, we get:

$$(1 - X_B).d(W_2 - C_1^B)/dr_o - (W_2 - C_1^B).dX_B/dr_o =$$

$$-dZ_A/dr_o.(W_1 - C_1^A) - Z_A.d(W_1 - C_1^A)/dr_o \qquad 13^*$$

From the lender's behavior, we know that:

$$dZ_A/dr_o > 0 \qquad \text{and} \qquad d(W_1 - C_1^A)/dr_o > 0$$

Therefore, the right hand side of this equation is negative. Then we get: $(1-X_B).d(W_2-C_1^B)/dr_O-(W_2-C_1^B).dX_B/dr_O = K'$. Since $K'<1$, this equation has the same signs as equation 13. Therefore, the results obtained from the system of equations 13 and 16 in section 2-B remains valid in this case as well. Even under complete market failure at zero interest, we still have:

$$d(W_2-C_1^B)/dr_O<0 \text{ and } dX_B/dr_O>0$$

$$d(W_2-C_1^B) = d(W_2-C_1^B)/dr_O.\ dr_O=(-)(+)<0$$

$$dX_B=dX_B/dr_O.\ r_O=(+)(+)>0$$

Moving away from zero interest (in a positive direction) will encourage the (less risk-averse) borrowers to take more risk and reduce total savings.

In section 2-B, it was shown that the lender will have lower utility under a zero interest rate. The same result is valid when the loan market fails at zero interest because for him the financial opportunities have not changed. We also saw that the direction of change in the utility of the borrower was unclear. One expects that, under loan market failure at zero interest, the borrower will be worse off compared to the regular loan market. This, however, is not true because there are still two conflicting forces in action. The change in the utility of the borrower is:

$$d\bar{U}^B/dr_O = dX_B/dr_O \cdot [d\bar{U}^B/dX_B] - d(W_2 - C_1^B)/dr_O \cdot [dU^B/dC_1^B] + \bar{U}_2^B \cdot (W_2 - C_1^B) \cdot d\bar{r}/dr_O$$

We know that $d\bar{U}^B/dC_1^B = 0$ but $d\bar{U}^B/dX_B > 0$ because X_B is constrained below its optimum value.

$$d\bar{U}^B/dr_O = dX_B/dr_O \cdot [d\bar{U}^B/dX_B] + \bar{U}_2^B \cdot (W_2 - C_1^B) \cdot [d\bar{r}/dr_O]$$

$d\bar{U}^B/dX_B > 0$, $dX_B/dr_O > 0$ and $d\bar{r}/dr_O < 0 \Rightarrow d\bar{U}^B/dr_O = (+)+(-)=?$

The direction of change in the utility is unknown because, on one hand, the investor can no longer borrow any funds and, on the other hand, the rate of return on the risky assets is higher. We can only argue that because the borrowing restriction is stronger under the assumption of total market failure, the borrower is more likely to be worse off in this case.

APPENDIX B

(CHAPTER 2)

The P.L.S. Arrangement

According to Muslim economists, the Islamic banks will use profit- and loss-sharing arrangements as their main mode of financial transactions. In this appendix, the reaction of lenders and borrowers to the P.L.S. arrangement will be briefly analyzed.

As an investment asset, a PLS loan is very similar to equity and the two could be close substitutes for each other. Indeed, every PLS loan is borrowed for investment in a risky project (or a portfolio that consists of several risky projects). As a result, the expected return and variance of a PLS loan is linked to the risk/return characteristics of the project for which it is borrowed.

Let's assume a PLS borrower has $W of his own and wishes to borrow $B on a PLS basis to invest in project A that is risky. The expected return and risk of A are $\bar{X}$ and σx, respectively. Let $0<q<1$ be the profit-sharing ratio (the lender receives $(1-q)$% of the joint profits), then the share of the lender and the borrower from total profits will

be (W+qB)/(W+B) and (1-q)B/(W+B), respectively. However, if a loss occurs, the lender assumes the entire loss on the funds that he has lended.

Given that X is the random rate of return on asset A, the borrower faces the random return X' on his investment. X' will be related to X by the following equation:

$$X' = \begin{cases} [(W+qB)/W].X & \text{if } X \geq 0 \\ X & \text{if } X < 0 \end{cases} \qquad \text{B.1}$$

Equation B.1 indicates that, with PLS borrowing, the investor can expect a higher return when a profit is realized. However, the probability and the size of his losses remain unchanged. In order to understand the advantages of PLS borrowing, we must derive the expected return and risk of X'. From equation B.1, we can see that X' has the same distribution as X. Assuming the distribution function of X, f(X), to be discrete we have:

$$\bar{X}' = \sum_{X_i \geq} X_i' . f(X_i) + \sum_{X_i < 0} X_i' . f(X_i)$$

$$\bar{X}' = \sum_{X_i \geq 0} X_i . f(X_i) + \sum_{X_i < 0} X_i . f(X_i) + \sum_{X_i \geq 0} [qB/W] . X_i . f(X_i)$$

And finally we have:

$$\bar{X}' = \bar{X} + [qB/W] . e \quad \text{where:} \quad e = \sum_{X_i \geq 0} X_i . f(X_i) > 0 \qquad \text{B.2}$$

(The results will not change if a continuous function is used.) Equation B.2 shows that the expected return with PLS borrowing will be larger than without it. The degree of increase in an expected return depends on the profit share of the borrower, q .

We must also derive the variance of X. $Var(X') = \Sigma(X_i' - \bar{X}')^2 . f(X_i')$. After expanding this equation and collecting terms, we get:

$$Var(X') = Var(X) + (qB/W)^2 . (\Sigma X^2_i . f(X_i) - e^2) + [2qB/W] . [\Sigma X^2_i . f(X_i) - e\bar{X}] \qquad B.3$$
$$X_i > 0$$

Now we can compare the expected return and risk of PLS borrowing to regular borrowing at zero interest. When borrowing at PLS, the investor is entitled to q% of the profits on the borrowed funds. Therefore, an equivalent portion of profits is obtained by borrowing qB$ from a regular bond market at zero interest. Then the expected return and risk on his profit will be:

$$\bar{X}_0 = (1+qB/W) . \bar{X} \quad \text{and} \quad \sigma_0 = (1+qB/W) . \sigma_X \qquad B.4$$

Comparing expected returns, we can see that: $e = \Sigma X_i . f(X_i) \Rightarrow e \geq \bar{X}$.

Therefore, since $\bar{X}' = \bar{X} + [qB/W] . e$ and $\bar{X}_0 = \bar{X} + [qB/W] . \bar{X}$

$$\underline{\bar{X}' \geq \bar{X}} \qquad B.5$$

To compare the standard deviations, we note the following inequalities:

$$\sum_{X_i \geq 0} X^2_i \cdot f(X_i) \leq \sum_{i=1}^{N} X^2_i \cdot f(X_i) \qquad \text{B.6}$$

$$e > \bar{X} \Rightarrow e^2 > \bar{X}^2 \qquad \text{B.7}$$

Therefore: $$\sum_{X_i > 0} X_i \cdot f(X_i) - e^2 < \left[\sum_{i=1}^{N} X^2_i f(X_i) - \bar{X}^2\right] = Var(X) \qquad \text{B.8}$$

Similarly:

$$e\bar{X} \geq \bar{X}^2 \Rightarrow \Sigma X^2_i - e\bar{X} \leq \left[\Sigma X^2_i f(X_i) - \bar{X}^2\right] = Var(X) \qquad \text{B.9}$$

From B.4, we have:

$$\sigma^2_0 = \sigma^2_x + [q^2 W^2/W^2].\sigma^2_x + [2qB/W].\sigma^2_x \qquad \text{B.10}$$

Using inequalities B.6 and B.7, we can compare the variances of X and X as given by equations B.3 and B.10 . Clearly, we can see that:

$$Var(X') \leq Var(X_0) \qquad \text{B.11}$$

Inequalities B.5 and B.11 demonstrate that PLS borrowing is more advantageous to regular borrowing at any rate of interest even Zero.

Using similar procedures, we can compare the characteristics of PLS lending and regular lending. As explained before, the way PLS loan transactions work is that, if there is a loss, it will be born by the lender; but if there is a profit, it is shared between the lender and the borrower. If Y is the random rate of return on the

lended funds and those funds are invested by the borrower in portfolio A which was described earlier, then Y and X will be related by the following equation.

$$Y = \begin{cases} (1-q).X & \text{if } X>0 \\ X & \text{if } X\leq 0 \end{cases}$$

Let $\bar{Y}$ and σ_y denote the expected return and risk of random variable Y, respectively. Then we have:

$$\bar{Y} = \sum_{i=1}^{N} Y_i . f(X_i) = \bar{X} - qe \qquad \text{B.12}$$

After rearranging terms and simplification, the variance of Y could be written as:

$$\sigma^2_y = Var(x) + q^2 . [\sum_{X_i \geq 0} X^2_i f(X_i) - e^2] - 2q . [\sum_{X_i \geq 0} X^2_i f(X_i) - e.\bar{X}] \qquad \text{B.13}$$

For sake of comparison, assume that the investor wants to use an alternative portfolio which would have the same expected rate of return as PLS lending. If this portfolio consists of dividing the original funds between direct investment in portfolio A and safe cash which does not pay any interest, then his expected return will be $\bar{Y}^* = (1-p).\bar{X}$ where p is the portion kept in cash. With the expected return being the same under both cases, we have:

$$\bar{Y}^* = \bar{Y} \Rightarrow (1-p).\bar{X} = \bar{X} - qe$$

$$\text{and we get } p\bar{X} = qe \Rightarrow p>q \text{ and } p = qe/\bar{X} \qquad \text{B.14}$$

The variance of Y* is $(1-p)^2\sigma^2x$. We like to compare the variances of Y and Y*.

$$\sigma^2y^*=\sigma^2x+p^2.\sigma^2x-2p\sigma^2x \qquad B.15$$

To compare σ^2y^* and σ^2y as given in equations B.13 and B.15, we use inequalities B.8, B.9 and B.13.

Let: $H=[\Sigma X^2_i f(X_i)-e^2]$, $G=[\Sigma X^2_i f(X_i)-e.\bar{X}]$ $\bar{X}<e \Rightarrow G>H$

$$\sigma^2y^* - \sigma^2y = q^2H-2qG-p^2.\sigma^2x+2p\sigma^2x$$

$$\sigma^2y^* - \sigma^2y = q^2H-2qG+2q(e/\bar{X}).\sigma^2x-q^2(e/\bar{X}).\sigma^2x$$

$$\sigma^2y^* - \sigma^2y = q^2[H-(e/\bar{X}).\sigma^2x]+2q[(e/\bar{X}).\sigma^2x-G)]$$

We know that $H\leq G\leq\sigma^2x$, leading to: $|(e/X).\sigma^2x-G)| \geq |H-(e/X).\sigma^2x|$ and $q^2<2q$. We conclude:

$$\sigma^2y^* - \sigma^2y \leq 0$$

Therefore, PLS lending is an inferior strategy.

The above analysis indicates that, under conditions of perfect capital markets, the market for PLS loan transactions will fail. The PLS lender can always do better by investing a portion of PLS loans in the same project for which the funds were borrowed and keeping the rest in cash. Only when small investors face prohibitive transaction and information costs will the PLS loans appear attractive.

APPENDIX A

(CHAPTER THREE)

Debt (Equity) Financed Fiscal Policy in a Regular (Islamic) Economy

In this chapter, we studied the fully monetized fiscal deficit. Another option available to the policy makers is to finance the increased government expenditure without increasing the money supply. In a regular economy, the government can finance its deficit by the sale of bonds. In an Islamic economy, the government can borrow from the central bank. The central bank, in turn, could raise the needed funds by the sale of equity. In this appendix, we will derive the multipliers of a debt-financed fiscal policy in a regular economy and an equity-financed fiscal policy in an Islamic economy, respectively.

In an equity-based economy, an increase in the deficit without any change in the money supply will require an equivalent sale of government-held equity. Therefore, we will have $dG=(-dV_g/P)$. V_g will change every time that G changes: $V_g=V_g(G)$. Since G is measured in real output and V_g is measured in nominal money value, we have $dV_g/dG = P$,

or for every 1 unit increase in equity, $P worth of equity must be sold.

An equity-financed deficit will have a wealth effect because at the same time that public equity holdings rise, the central bank gives the money that is raised by the sale of equity to the government for spending, and the money supply stays the same. We will have: $W = W(\overset{+}{V},\overset{+}{G},P)$. Incorporating these changes in the original model of an equity-based economy that was given by equations 6.1-6.3, we get:

$$\begin{aligned} \overset{- \; ? \; + \; +}{C(P,Y,G,V)} + \overset{+ \; -}{I(V,P)} &= Y \\ V_g(G)/P + \overset{+ \; ? \; + \; ?}{f_1(P,Y,G,V)} &= V/P \\ \overset{- \; ? \; +}{f_2(P,Y,G,V)} &= M/P \end{aligned}$$

Totally differentiating the first two equations of this model with respect to Y, V and G gives:

$$A^*.\begin{vmatrix} dV \\ dY \end{vmatrix} = -\begin{vmatrix} C_3 & + & 1 \\ -1+f_{13} & & \end{vmatrix} . \; dG$$

A^* was given in equation 8.2. We showed that A^{*-1} had the following signs:

$$A^{*-1} = (1/D^*).\begin{vmatrix} ? & + \\ + & + \end{vmatrix}$$

We claim that $f_{13}-1<0$ because: $f_{13}+f_{23} = 1$, $f_{23}>0$. Then we will have:

$$\begin{vmatrix} dV \\ dY \end{vmatrix} = A^{*-1}\begin{vmatrix} - \\ + \end{vmatrix}.dG = 1/D^*.\begin{vmatrix} ? & + \\ + & + \end{vmatrix}$$

$$\begin{vmatrix} dV \\ dY \end{vmatrix} = 1/D^*.\begin{vmatrix} (-)(?)+(\;+\;) \\ (+)(-)+(+)(+) \end{vmatrix}.dG$$

$D^*<0$ if $f_{12}<0$. At the same time, $dV/dG<0$ if $f_{12}<0$. In Section 2, we showed that $f_{12}<0$ was a required condition for the stability of this model. Unfortunately, even when f_{12} is assumed to be negative, we still don't know the sign of dY/dG.

The initial increase in G will increase the private demand for equity, but the sale of equity by the central bank will more than offset the initial increase leading to excess supply of equity. To restore equilibrium, the value of equity must fall, thus, we have $dV/dG<0$. The indeterminacy of dY/dG is due to the fact that the decline in V leads to a reduction in investment and consumption demand which could offset the increased government expenditure.

For a regular economy, a debt-financed fiscal policy implies that an increase in government expenditure is associated with an increase in the supply of bonds. We will always have $dG=dS/(b.P)$. The money supply will remain constant $M/P=M_0/P$. This policy will have a wealth effect because the supply of bonds changes while the supply of other assets remains unchanged, therefore, we have:

$$\underset{+\ +\ -}{W=W(G,V,P)}$$

Taking these modifications into account, model 11.1-11.4 could be written as:

$$\underset{-\ ?\ +\ +\ -\quad +\ -}{C(P,Y,G,V,b)+I(V,P)+G} = Y \qquad 11.1A$$

$$f_1(P,Y,G,V,b) \quad \begin{matrix} ? & ? & + & ? & - \end{matrix} \qquad = V/P \qquad 11.2A$$

$$f_2(P,Y,G,V,b) \quad \begin{matrix} - & ? & + & + & - \end{matrix} \qquad = M_0/P \qquad 11.3A$$

$$f_4(P,Y,G,V,b) \quad \begin{matrix} - & - & + & + & ? \end{matrix} \qquad = S/(b.P) \qquad 11.4A$$

To derive the multiplier, we totally differentiate equations 11.1-11.3 with respect to V,Y,b,G.

$$\bar{A}.\begin{vmatrix} dV \\ dY \\ db \end{vmatrix} = -\begin{vmatrix} C_3+1 \\ f_{13} \\ f_{23} \end{vmatrix}.dG \qquad \begin{matrix} C_3+1>0 \\ f_{13}>0 \\ f_{23}>0 \end{matrix}$$

$\bar{A}$ is given in the left hand side of equation 12.1. In section 3, we showed that:

$$\bar{A} = \begin{vmatrix} + & - & - \\ + & + & - \\ - & f_{12} & - \end{vmatrix}$$

$\bar{A}$ was found to be dependent on f_{12}. We have already developed $\bar{A}^{-1}$ in Section 3. Solving for the endogenous values, we have:

$$\begin{vmatrix} dV \\ dY \\ db \end{vmatrix} = -\bar{A}^{-1}.\begin{vmatrix} C_3+1 \\ f_{13} \\ f_{23} \end{vmatrix}.dG = -1/\bar{D}.\begin{vmatrix} O_{11} & - & + \\ + & - & O_{32} \\ + & O_{23} & + \end{vmatrix}\begin{vmatrix} + \\ + \\ + \end{vmatrix}.dG$$

$$\begin{vmatrix} dV \\ dY \\ db \end{vmatrix} = -1/\bar{D}.\begin{vmatrix} O_{11} & + & (-) & + & (+) \\ (+) & + & (-) & + & O_{32} \\ (+) & + & O_{23} & + & (+) \end{vmatrix}.dG$$

As we can see, both dY/dG and dV/dG are indeterminate and, even when O_{11} and O_{32} are determined, the multipliers will still remain undetermined. In the case of a pure bond-financed deficit, the impact on investment is not clear because the policy does not directly affect the equity

market. An increase in the supply of bonds increases the real wealth and the rate of interest on bonds at the same time. These two will have offsetting effects on the demand for equity and the net change in the equity values is not clear.

The net change in the aggregate demand for output is also unclear because, at the same time that G rises, the bond rate also rises. The higher bond rate will reduce the demand for investment and private consumption. Comparing the results of a debt-financed and equity-financed deficit, we see that there is more certainty about the impact in the case of the equity-financed deficit. We at least know that the investment will decline.

APPENDIX B

(CHAPTER THREE)

A Study of Pure Fiscal Policy and a Pure Increase in the Supply of Money

The government's budget constraint requires that any increase in a government deficit be accompanied by an equivalent increase in the supply of bonds or money. Similarly, an increase in the money supply is always accompanied by an equivalent increase in bonds or government deficit. While a pure increase in money supply or a pure increase in government deficit can never happen without something else also increasing, their study will help us improve our understanding of the feasible policies that were described in this chapter.

B-1. A Pure Fiscal Policy in an Equity-Based Economy

Working with the model of an equity-based economy that was developed in section 2, we modify the model to show that an increase in G, in this case, does not change the supplies of money or bonds and, therefore, has no wealth effect. The model becomes:

$$\underset{? \; - \; + \; +}{C(Y,P,M,V)} + \underset{- \; ? \; + \; ?}{I(V,P)} + G = Y \qquad 15.A$$

$$V_g/P + \underset{- \; ? \; + \; +}{f_1(P,Y,M,V)} = V/P \qquad 15.B$$

$$f_2(P,Y,M,V) = M/P \qquad 15.C$$

Totally differentiating the first two equations of the model W.R.T. Y,V,G, we get:

$$\begin{bmatrix} C_4+I_1 & C_2-1 \\ f_{14}-1/P & f_{12} \end{bmatrix} \cdot \begin{bmatrix} dV \\ dY \end{bmatrix} = \begin{bmatrix} -1 \\ 0 \end{bmatrix} .dG$$

$$\begin{bmatrix} dV \\ dY \end{bmatrix} = 1/D^* . \begin{bmatrix} f_{12} & 1-C_2 \\ 1/P-f_{14} & C_4+I_1 \end{bmatrix} \begin{bmatrix} -1 \\ 0 \end{bmatrix} = 1/D^* . \begin{bmatrix} -f_{12} \\ f_{14}-1/P \end{bmatrix} .dG$$

We have already shown that for this model to be stable, f_{12} must be negative. f_{12} is a sufficient condition for $D^*<0$. Therefore, we have:

$$dY/dG = (-)/(-) > 0$$

$$dV/dG = -f_{12}/(-) \; <> \; 0$$

If the system is stable, then $f_{12}<0$ and $dV/dG<0$.

B-2. <u>A Pure Fiscal Policy in a Regular Economy</u>

We repeat the same exercise with the model in section 3 for a regular economy. Since there is no wealth effect, G will no longer appear in the asset-demand functions. The modified model is:

$$\underset{\;-\;?\;+\;+\;-}{C(P,Y,M,V,b)}+\underset{\;+\;-}{I(V,P)}+G=Y \qquad 16.A$$

$$\underset{\;-\;?\;+\;?\;-}{f_1(P,Y,M,V,b)}=V/P \qquad 16.B$$

$$\underset{\;-\;?\;+\;+\;-}{f_2(P,Y,M,V,b)}=M/P \qquad 16.C$$

$$\underset{\;-\;-\;+\;+\;?}{f_4(P,Y,M,V,b)}=S/(bP) \qquad 16.D$$

Totally differentiating the first three equations W.R.T. V,Y,b,G, we get:

$$\begin{vmatrix} C_4+I_1 & C_2-1 & C_5 \\ f_{24} & f_{22} & f_{25} \\ f_{14}-1/P & f_{12} & f_{15} \end{vmatrix} \cdot \begin{vmatrix} dV \\ dY \\ db \end{vmatrix} = - \begin{vmatrix} +1 \\ 0 \\ 0 \end{vmatrix} .dG$$

The multipliers will be:

$$\begin{vmatrix} dV \\ dY \\ db \end{vmatrix} = 1/\tilde{D} \begin{vmatrix} O_{11} & - & + \\ + & - & O_{23} \\ + & O_{23} & + \end{vmatrix} \begin{vmatrix} -1 \\ 0 \\ 0 \end{vmatrix} = -1/\tilde{D} \begin{vmatrix} O_{11} \\ + \\ + \end{vmatrix} \qquad D<0$$

dV/dG <>0 , dY/dG>0 and db/dG>0 .

Appendix C

(CHAPTER THREE)

The Stability of the Macro Models

In this appendix, we will use Samuelson's Correspondence theorem to investigate the stability of the macro models that were developed in this chapter. This investigation shows that, within acceptable range of the parameters, all three models are stable.

C-1. Stability of the Model in Section One.

We define the time rate of changes in V and Y as increasing functions of excess money supply and excess demand for output, respectively.

$$dV/dt = \sigma(M - M_d) \qquad dY/dt = \Gamma(I - s.Y)$$

$$\sigma' > 0 \qquad \Gamma' > 0$$

After replacing M_d, s and I from 3.1 and 3.2, we apply a Taylor expansion to these equations and write them in the matrix form:

$$\begin{bmatrix} dV/dt \\ dY/dt \end{bmatrix} = \begin{bmatrix} \sigma'(K.f_{34} + f_{24})(-1) & \sigma'(K.f_{31} + f_{12})(-1) \\ \Gamma'(I_1 - s_4.Y) & \Gamma'(-s_1.Y - s) \end{bmatrix} \cdot \begin{bmatrix} V-V_0 \\ Y-Y_0 \end{bmatrix} \qquad C.1$$

The characteristic equation of this system is:

$$\begin{vmatrix} -\sigma'A_{12} - \mu & -\sigma'A_{22} \\ -\Gamma'A_{11} & -\Gamma'.A_{12} - \mu \end{vmatrix} = 0 \qquad C.2$$

We have:

$$A_{11} = s_4.Y - I_1 \qquad A_{21} = K.f_{34} + f_{24}$$
$$A_{12} = s_1.Y + S \qquad A_{22} = K.f_{31} + f_{21}$$

$\begin{vmatrix} - & + \\ A11 & A12 \\ + & + \\ A21 & A22 \end{vmatrix}$ is the Jacobian of system 4.1 and μ's are the eigenvalues of equation C.2.

Expanding equation C.2, we get:

$$\mu^2 - \mu(-\sigma'A_{11} - \Gamma'A_{12}) + \Gamma'\sigma'(A_{21}.A_{12} - A_{11}.A_{22}) = 0 \qquad C.3$$

For the system to be stable, the roots of this equation must have negative real parts. The necessary and sufficient conditions for having negative real parts are:

$$(-\sigma'A_{21} - \Gamma'A_{12}) < 0 \qquad C.4$$

$$(A_{21}.A_{12} - A_{11}.A_{22}) > 0 \qquad C.5$$

Since A_{21} and A_{12} are both positive, the first inequality is satisfied. The second inequality implies that the determinant of A must be negative.

Furthermore, we can give a different interpretation for inequality, C.5. The slopes of IS and LM equations (3.1 and 3.2) are:

$$\left.\frac{dV}{dY}\right|_{IS} = -\frac{dIS/dY}{dIS/dV} = -\frac{(s_1.Y + s)}{s_4.Y - I_1} = -\frac{A_{12}}{A_{11}}$$

$$\left.\frac{dV}{dY}\right|_{LM} = -\frac{dLM/dY}{dLM/dV} = -\frac{(K.f_{31} + f_{21})}{K.f_{34} + f_{24}} = -\frac{A_{22}}{A_{21}}$$

Manipulating inequality C.5, we have:

$$A_{21}.A_{12} > A_{11}.A_{22} \Rightarrow -A_{12}/A_{11} > -A_{22}/A_{21}$$

In other words, for stability, the IS curve must be steeper than the LM curve.

C-2. Stability of the Model of an Equity-Based Economy.

For the model that was developed in section two, we define the time rates of change of the endogenous variables, V and Y, as increasing functions of excess demands for equities and commodities, respectively.

$$dV/dt = \sigma(V_d - V) \qquad \sigma' > 0 \qquad \sigma(0) = 0$$

$$dY/dt = \Gamma(C+I+G-Y) \qquad \Gamma' > 0 \qquad \Gamma(0) = 0$$

Applying Taylor expansion to these differential equations around the equilibrium values, we get:

$$\begin{bmatrix} dV/dt \\ dY/dt \end{bmatrix} = \begin{bmatrix} \sigma'(f_{14} - 1/P) & \sigma' f_{12} \\ \Gamma'(C_4+I_1) & \Gamma'(C_2-1) \end{bmatrix} \begin{bmatrix} V-V_0 \\ Y-Y_0 \end{bmatrix}$$

The characteristic equation is

$$\begin{bmatrix} dV/dt \\ dY/dt \end{bmatrix} = \begin{bmatrix} \sigma'(f_{14} - 1/P)-\mu & \sigma' f_{12} \\ \Gamma'(C_4+I_1) & \Gamma'(C_2-1)-\mu \end{bmatrix} \begin{bmatrix} V-V_0 \\ Y-Y_0 \end{bmatrix} = 0$$

or

$$\mu^2 - (\sigma'(f_{14}-1/P)+\Gamma'(C_2-1)).\mu + \sigma'(f_{14}-1/P).\Gamma'(C_2-1) - \sigma'\Gamma'(C_4+I_1).f_{12} = 0$$

The roots of this equation must have negative real parts in order for the system to be stable. The necessary and sufficient conditions for having negative real roots are:

1) $\sigma'(f_{14}-1/P)+\Gamma'(C_2-1)<0$

2) $(f_{14}-1/P).(C_2-1) - (C_4+I_1).f_{12}>0$

We have already shown in section 2 that $(f_{14}-1/P)<0$ and $(C_2-1)<0$, so the first equation is satisfied. $f_{12}<0$ is a sufficient condition for the second inequality to hold. In general, we can write the second condition as:

$$-(C_2-1)/(C_4+I_1) > -f_{12}/(f_{14}-1/P)$$

From equations 7.1 and 7.2, we can drive the slopes of the IS and LM equations:

$$\left.\frac{dV}{dY}\right|_{IS} = -\frac{dIS/dY}{dIS/dV} = -\frac{(C_2-1)}{C_4+I_1} >0$$

$$\left.\frac{dV}{dY}\right|_{LM} = -\frac{dLM/dY}{dLM/dV} = -\frac{f_{12}}{f_{14}-1/P} <> 0$$

Therefore, a necessary condition for stability is for the IS curve to be steeper than the LM curve in a (Y,V) graph. Finally, it must be noted that an equivalent condition for stability is that the determinant must be negative.

C-3. Stability of the Model of Regular Economy.

For the regular model in section 3, we investigate stability by defining the following three differential equations.

$$dV/dt = \sigma(V_d-V) \qquad \sigma'>0 \quad \sigma(0) = 0$$

$$dY/dt = \Gamma(C+I+G-Y) \qquad \Gamma'>0 \quad \Gamma(0) = 0$$

$$db/dt = \tau(-M/P + f_2) \qquad \tau'>0 \quad \tau(0) = 0$$

Applying Taylor expansion, we get:

$$\begin{bmatrix} dV/dt \\ dY/dt \\ db/dt \end{bmatrix} = \begin{bmatrix} f_{14}-1/P & f_{12} & f_{15} \\ C_4+I_1 & C_2-1 & C_5 \\ f_{24} & f_{22} & f_{25} \end{bmatrix} \begin{bmatrix} V-V_0 \\ Y-Y_0 \\ M-M_0 \end{bmatrix} = A^* \begin{bmatrix} V-V_0 \\ Y-Y_0 \\ M-M_0 \end{bmatrix} \qquad C.4$$

The characteristic equation of C.4 is:

$$|A^*-\mu I| = \begin{vmatrix} \sigma'(f_{14}-1/P)-\mu & \sigma' f_{22} & \sigma'.f_{25} \\ \Gamma'(C^4+I_1) & \Gamma'(C_2-1)-\mu & \Gamma'.C_5 \\ \tau'.f_{24} & \tau'.f_{22} & \tau'.f_{25}-\mu \end{vmatrix} = 0$$

According to Samuelson's correspondence theorem, the model will be stable if the principle minors of matrix A* alternate in sign as follows.

$$|f_{14}-1/P|<0 \quad , \quad \begin{vmatrix} f_{14}-1/P & f_{12} \\ C_4+I_1 & C_2-1 \end{vmatrix} >0$$

$$\begin{vmatrix} f_{14}-1/P & f_{12} & f_{15} \\ C_4+I_1 & C_2-1 & C_5 \\ f_{24} & f_{22} & f_{25} \end{vmatrix} <0$$

The last determinant is the same as D*; therefore, D*<0 is a necessary condition for stability of the model.

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