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ISLAMIC RESEARCH AND TRAINING INSTITUTE  
A MEMBER OF THE ISLAMIC DEVELOPMENT BANK GROUP

## SEARCH MODELS, SAMUELSON-FRIEDMAN'S & HOSIOS' INEFFICIENCIES AND ISLAMIC FINANCE

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## ABSTRACT

The introduction of search costs into the macroeconomic model exposes two inefficiencies that have not generally been made apparent to mainstream economists, because the construction of search models has been a nascent phenomenon. In the first type of inefficiency, search activities would not be uniform among traders. Those who do more searching would be unable to internalize their extra information by selling it to others. Such gains from search would become a deadweight loss. Lack of internalization leads traders to limit their search activities which would lead to keeping the volume of transactions below optimum. This is termed the Hosios inefficiency.

The existence of a positive rate of interest in a search economy would entice economic agents to economize on cash balances and carry out a volume of transactions that is less than optimal. In addition, they would attempt to substitute real resources for money in transactions, thereby reducing total output and lowering efficiency. This is termed the Samuelson-Friedman inefficiency.

Switching from an interest-based finance to Islamic finance would serve two purposes at the same time. First, money would have no positive guaranteed rate of return, and consequently, traders have no incentive to economize on money in transactions. The volume of real balances used in transactions would reach its optimum. Second, all search externalities related to significant trading deals would be internalized to trading partners through banks providing Islamic finance, through both sale and partnership finance. On both counts, Islamic finance is a winner.

The limitation of this theory is obvious. The ability of Islamic finance to correct for both types of inefficiencies will be extremely weakened with Islamic banks mimicking conventional banks. In such case, the Islamic finance contracts would be shunned and replaced by

camouflage contracts, which does not involve real trading or real investment. A great deal of added value would therefore be lost by Islamic finance.

Our analysis has exposed serious weaknesses in the neoclassical analysis of intertemporal choice. Such weaknesses would be dealt with in our future research.

## THE EXISTENCE OF MONEY

### I. UNDER PERFECT COMPETITION

The theory of value has been developed in a world without money. In order to construct an economic model where money can justifiably serve as a means of exchange, i.e., a *monetary model*, economists must add a friction that becomes the *raison d'être* of money. Several models with friction sprang out for this purpose<sup>1</sup>.

In economies without friction, similar to the neoclassical perfectly competitive world, money as a means of exchange does not exist. Instead, we can imagine the existence of a numéraire. Each commodity would be associated with a degree of time preference uniquely defined for each individual by his/her tastes. Only in the case of similar tastes among individuals and homothetic intertemporal utility functions, displaying preferences that do not change with income, an aggregate demand for consumption, as an alternative to saving, can be defined in terms of the numéraire.

Assuming that the public somehow agrees to a choice of a unit of account, perhaps because of its physical properties, e.g., divisibility. Such unit of account could become a store of value. Its physical properties alone would not encourage the formation of private clubs, to trade it as a gambling asset, similar to the encrypted money. As the neoclassical model presumes perfect information, the Keynes' theory of beauty contest would not apply, as everyone in the market can point out to a unique girl as the most beautiful, who is certain to be the choice of all traders. Therefore, there would be no chance in this model for the rise of encrypted currencies.

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<sup>1</sup> Kiyotaki and Wright (1991, 1993) and Kocherlakota (1998)

## II. TIME PREFERENCE IN VISCOUS MODELS

Once a viscosity or a friction that justifies the use of a means of exchange is introduced in the macroeconomic model, a serious difficulty arises confronting the aggregation of individual demands for and supplies of present versus future goods. The obvious reasons are two. First, each individual would have a unique intertemporal preference for each commodity. Second, each commodity would have unique physical units that cannot be aggregated with others. This is reminiscent of the *Cambridge capital controversy*. Using values of commodities to aggregate their intertemporal demands and supplies would hardly be satisfactory. The obvious reason is that the weight of each commodity would not be necessarily proportional to its value. For example, the relative importance of bread would exceed one hour of driving a luxury car. The urgency of present to future consumption of the former would certainly exceed that of the latter.

## III. TIME PREFERENCE & THE MONEY MARKET

We can therefore admit that intertemporal preferences are dissimilar for different commodities. In addition, such preferences associated with any commodity are dissimilar for different individuals. In addition, intertemporal utility functions are not homothetic, meaning the degree of urgency of present relative to future consumption of any commodity changes with income. In parallel to the Sonnenschein-mantle-Debreu conditions for the aggregation of individual demand curves, we can conclude that there can be no aggregate demand and supply functions of present versus future money, as an aggregate of present versus future commodities. Therefore, the Irving Fisher's theory of the rate of interest cannot hold.

Nonetheless, we will assume the existence of a rate of interest as a prime rate administered by the monetary authority. Lenders in turn would add margins to this rate to reflect their perception of each borrower's credit worthiness. This is perhaps the current case.

## **PRICE SEARCH AND TRADING EFFICIENCY**

The inefficiencies resulting from the presence of the rate of interest (whether as an equilibrium or administered price) becomes exposed. The friction would make money usable as a means of exchange. Paying interest as a premium for obtaining present against future money would make it costly to use as such and produce inefficiency consequences.

When the friction of information cost is introduced to convert the model into a price-search model, the numéraire would become a medium of exchange. In such models, where money has *raison d'être*, the use of money in trade when accompanied with (interest-based) conventional finance, is associated with two important inefficiencies. The first is the Friedman-Samuelson inefficiency. The payment of a positive interest rate of return on money, associated with loans whose principle and return are guaranteed, motivates agents to economize on the use of cash in transactions. In order to keep the volume of transactions the same, traders would use real resources (capital and labor) as money substitutes. The substitution of real resources for cash in transactions would be used to develop schemes that would allow an increase in the velocity of money, maintaining the volume of transactions on the one hand and allowing more money to be kept in interest-bearing accounts<sup>2</sup>. This would be

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<sup>2</sup> Such schemes would include using capital and labor to deposit cash more often and at shorter intervals to the bank, and the use of sophisticated software and more

the Samuelson-Friedman inefficiency (Samuelson, 1958; Friedman, 1969).

The other type of inefficiency directly relates to the price-searching activities in the model. As there is no way to indicate where and when to stop searching, price searchers tend to over-search. Information collected about trading opportunities would exceed the level required by the needs to search. Such extra information would remain a deadweight loss to each price-searchers until internalized by selling it to other traders. This is the Hosios (1990) inefficiency which results from the existence of externalities in search activities by agents. Failure to internalize such externalities would also reduce the volume of transactions below optimum.

The amazing thing is that the neoclassical model, being devoid of frictions that justify the use of a medium of exchange, has hidden the inefficiencies related to the role of interest in the economy. Once a justifiable friction, like search cost is introduced, the nakedness of the emperor becomes apparent.

## I. THE NEOCLASSICAL GENERAL EQUILIBRIUM MODEL CANNOT AVOID BARTER

Barter exchange is associated with inefficiencies. The lack of double coincidence of wants, even with perfect divisibility of commodities would leave many exchanges inexecutable. The resulting number of exchanges under barter would be suboptimal. In order to solve this problem, the Walrasian general equilibrium model introduces an auctioneer within the arrangement of centralized exchange in order to reach equilibrium. All traders (buyers and sellers) in the economy meet in one place. The auctioneer cries a list of prices of all commodities and takes offers of sale and purchase. He allows

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talented developers for fund managers in order to allocate less money for transactions and more of it for interest-earning.



trading only when quantity demanded is equal to quantity supplied at the cried price. Traders would try to profit from price difference by *arbitrage*. They adjust their sale and purchase offers. Gradually equilibrium is reached through *tatonnement*. Such arrangement to reach general equilibrium, while conceptually wonderful, is absolutely impractical. The introduction of money would be a good substitute. This would require a different setup where money use can be justified. Unfortunately, the classical perfect model has no place for money as a medium of exchange.

To carry the intellectual exercise further, let us assume that we no longer have an auctioneer, and no longer have a place in which all traders gather (which in reality would be impossible). Additionally, if no authority can control *centralized* exchange, the Walrasian arrangement would not be possible. The process of arbitrage would be interrupted, and degenerate the exchange economy back into barter. The Walrasian numéraire will be exposed as incapable of being used as a medium of exchange.

## II. ACCOUNTING FOR MONEY

We must therefore do away with the central exchange model and move forward to a model with some friction that justifies the use of a medium of exchange. The best alternative to introduce transactions costs that results from structural reasons directly attributable to the fact that traders do not know the equilibrium prices and have to search for them. This would give a strong justification for the use of money, and allow for a step forward towards consistent monetary economics.

Search models use frictions in the commodity markets to justify the use of a medium of exchange. Intuitively, the mere introduction of transactions costs, by assuming costly information and

consequently, costly search for prices would be sufficient. However, economists as usual would want to imbed into the model something that results in costly information. That gave rise to search models.

The nascent search literature contains many different variants of a basic search model, each designed to deal with some application<sup>3</sup>. On the one hand, Reinganum (1979) introduces identical buyers while firms have different constant marginal costs. The equilibrium distribution of prices is attached to firms' costs. On the other hand, Rob (1985) introduces identical firms while buyers facing different search costs. Carlson and McAfee (1983) admits buyers' heterogeneous search costs and firms' constant marginal costs, only under assumptions to enable the solution of his model. B´enabou (1993) extends Carlson and McAfee (1983) model by combining the Reinganum and Rob models. Rauh (2007) extends B´enabou (1993) model and prove existence of equilibrium in pure strategies under two distinct sets of assumptions. The first standard set directly generalize B´enabou model. The second general set allows for heterogeneity in buyers' search costs, demand functions and firms' cost functions. It is notable that neoclassical doctrine is always concerned with equilibrium and proving its existence. Obviously, this is mostly done through heroic assumptions. We will ignore this methodological defect to be handled in a later research.

Another type of search models pioneered by Kiyotaki and Wright (1991, 1993) introduced frictions through random bilateral matching and private trading histories, in the context of decentralized exchanges (Kocherlakota, 1998). Without money, it is difficult for agents to conduct socially desirable trades. Money becomes necessary to facilitate trade and increase social welfare. Agents use

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<sup>3</sup> The paper focuses on price search models. There is another class of labor search and survival models reviewed by Canals et al. (2002).

money instead of barter to trade efficiently as any two traders require only single coincidence of wants.

The construction of search models is a step towards establishing general equilibrium in a macroeconomic model that is not marred with perfect competition. Curiously enough, such models expose serious inefficiencies of the conventional economy. Despite the use of money, general equilibrium remains inefficient, albeit not as inefficient as the barter exchange model.

### III. OPTIMALITY IN SEARCH MODELS

We can therefore use the search model for two purposes. The first is to see if the introduction of money in the economy in the face of costly information, while keeping the classical loan contract, based on an administered rate of interest, overcomes the hurdles of barter while ushering the economy to efficient frontiers. The second, is to check whether the removal of the classical loan contract and its substitution by the Islamic investment and finance contracts, or Islamic finance properly implemented would remove any remaining inefficiencies from the search model.

### IV. INEFFICIENCIES SURFACING IN THE SEARCH MODEL

Any two trading agents have either asymmetric bargaining powers or asymmetric demands for the goods each wishes to exchange with the other.

The lack of double coincidence of wants can be manifested in the form of asymmetric demands, but not necessary to justify the use of money in a search model (Engineer & Shi, 1998, 2001; Berentsen & Rocheteau, 2001). In other words, barter exchange would still work

without money in the case of asymmetric demand, if asymmetric matches can be reached.

Money facilitates exchanges in asymmetric matches. The use of money can be justified, based on facilitating exchange and improving social welfare where the two agents have *only single coincidence of wants*. The introduction of money goes a long way in rehabilitating barter exchange and increasing the scope of exchange and division of labor.

However, monetary equilibrium in such models suffers from two types of inefficiency. First, because agents ignore the externalities, as their search improves their partners' matching probabilities, the number of trades is inefficient. This is called the Hosios type inefficiency that results in a search economy (Hosios, 1990). Second, because buyers in each match are constrained by the available real money balance, due to imposing a positive rate of interest on their use, the quantity of goods in each trade is inefficient. This is called the Samuelson-Friedman inefficiency (Samuelson, 1958; Friedman, 1969) that results from a positive monetary rate of interest.

## V. THE HOSIOS TYPE INEFFICIENCY

In a monetary economy, where money is actually and justifiably used, information would be costly and searching by economic agents would be a necessary outcome. Buyers and sellers would search for the best match. Understandably, search efforts would be significant for large-value items, bought individually or in a bunch, e.g., weekly, monthly, or seasonal shopping as well as when durables are purchased by households and factors of production are purchased by firms. In such cases, the resources spent on search would be significant and may affect the search outcome.

Apparently, research models implicitly assume divisibility across the board, which makes this factor insignificant. Naturally, this occurs in exchanges involving large quantities of commodities to be traded in bulk, durables, or factors of production. In such cases, agents would spend proportionately higher amounts on price searching. Spending on search for any item would not be uniform for all traders. Those who spend relatively more, gain more information.

Gains from search would be unevenly distributed between trading partners. Those who spend more resources in search and gain more information about the available prices and counterparties, have no way of internalizing such externality through selling some of the information they collected to some trading agents.

Knowing that the surplus information, once obtained by a trader is not sellable, i.e., it cannot be internalized, traders will curtail the number of transactions in high-value items. In other words, the volume of transactions would be below optimal. In addition, price-search activities will often exceed what is required by the trader to be sufficiently informed in order to strike a deal. The extra information, once inadvertently collected will not translate into more trade. In other words, such extra information would be paralleled by unconsumated trading opportunities. The final results would be less trading than optimal.

## VI. THE FRIEDMAN-SAMUELSON INEFFICIENCY

The Samuelson-Friedman inefficiency related to the existence of a positive interest rate. This has been discovered earlier before the introduction of search models, while neoclassical economists had been considering the implications of monetary exchanges without explicitly introducing money. They found that a zero-nominal interest rate is a necessary condition for the optimal allocation of resources

(Samuelson, 1958; Friedman, 1969). The reason is simple. In a world with fiat money, adding one marginal unit of real balances costs no real resources to the community. Therefore, imposing a positive price on the use of money would lead traders to economize on the use of money in transactions, in their pursuit to minimize their transactions costs. They would therefore use some real resources instead of money in transactions. However, when the rate of interest is zero, traders will have no incentive to substitute real resources for money. Additional real resources can therefore be released for consumption and investment.

When this matter was investigated within general equilibrium models, it was found that a zero-interest rate is both a necessary and sufficient condition for allocative efficiency (Cole & Kocherlakota, 1998; Chari & Kehoe 1996; Wilson, 1979). Though these theoretical results are dependent on some simplifying assumptions, they have been found to be robust in a variety of models (Correia and Teles, 1997).

Milton Friedman suggested steadily contracting the money supply at a rate equal to the representative household time preference (Friedman, 1969, p. 34 quoted by Ireland, 2000). This has come to be known as the Friedman's rule. Notably, Friedman's use of the time preference of the *representative household* presumes some similarity of intertemporal preferences among households. In contrast, we have explained above that the time preference of each individual would be different for different goods as well as different for that of other individuals for the same good.

Accordingly, economists continued to search for the set of monetary policies that would bring the rate of interest to zero, in order to reach an optimal allocation of resources. They depended on the relationship known as the *Fisher hypothesis*, which decomposes (in the terms used by St. Amant, 1996) the nominal interest rate as the sum of the expected inflation rate and ex ante real interest rate.

Therefore, it appears that deflating the economy at a rate equal to the real rate of interest would automatically set the (nominal) rate of interest to zero. This would be the optimal monetary policy rule that ensures that financial resources are allocated efficiently. Such policy rule clearly implies that the optimal rate of inflation is negative. However, Central bankers would never seriously advocate a long-run policy of deflation (Wolman, 1997)<sup>4</sup>.

While the rule is logically consistent with the neoclassical structure, its implementation would require a piece of information that is difficult to find by policymakers. The neoclassical structure allows for aggregating individual intertemporal demand schedules into an economy-wide schedule. As pointed out above, such aggregation requires similar intertemporal preferences among all individuals as well as homothetic preferences, by which such preferences would not change with the level of income. With aggregation, we can set the rate of interest at the intersection of aggregate demand and supply for loanable funds. Such assumptions obviously make the aggregation meaningless. In addition, as also pointed out, the use of monetary values as proxies of present as well as future commodities ignores the fact that monetary values do not reflect the true nature of time preference for each commodity.

Even if we were to accept the neoclassical meaningless aggregation, while taking the Friedman rule for granted, we would find that deflating the economy would bring with it several problems both conceptually and practically. Conceptually, economists would naturally worry about the existence of a liquidity trap when the rate of interest is zero (Uhlig, Harald, 2000). Another conceptual problem is what happens with the volume of money supply that is shrinking over time. Practicalities mandate that such volume would be

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<sup>4</sup> Economists also recommended the application of 100 percent required reserve ratio. However, policy-makers have not been impressed, despite the obvious benefits.

(numerically) sufficient to carry out transactions at the current price level. Economists, as they often do, assume divisibility. Therefore, money can be used in infinitesimally small denominations, so that a dollar can be broken into cents and cents can be broken into smaller parts and so on. This may go on and on until money vanishes.

Several economists point out that deflationary policies have to be exercised only asymptotically in order to apply the Friedman's Rule (Cole & Kocherlakota, 1998). Asymptotic behavior of deflation is a claim that can conflict with the rule that it should be equal to the real rate of interest. It is not perceivable in a growing economy to have a real rate of return that behaves asymptotically.

Some claim that even if the asymptotic conditions are not fulfilled, short term constraints on monetary policy can do the job (Ireland, 2000). Others may worry that when the rate of interest becomes very low, monetary authorities have less leeway with adjusting it downwards in the face of recession. Meanwhile, some economists respond by proposing alternative ways to overcome the zero-bound on interest rate policy (Goodfriend, 2000). Another conceptual problem is that deflation has efficiency problems parallel to those of inflation, even at very low interest rates (Lucas, 1994). However, the welfare cost of implementing a zero rate of interest has been claimed to be negligible (Wolman, 1997).

Many economists appear to dismiss the practical and conceptual problems involved with zero interest rates. Besides, monetary authorities are not yet impressed. No monetary authority has so far come forward to adopt the optimal monetary policy rule. However, all economists, when analyzing the zero-bound interest rates, they neglect the undeniable fact that both inflation and deflation have similar inefficiency effects. This means that any policy that sets inflation or deflation targets, no matter how small, is still inefficient. The Friedman's optimal rule is therefore hardly optimal.



## ISLAMIC FINANCE AND TRADING INEFFICIENCIES

The availability of money through the classical loan contract, i.e., the purchase of spot money for future money at a premium, causes both types of inefficiency. Friedman-Samuelson inefficiency is assured because of the positive interest rate. Hosios inefficiency exists too because the process of finance does not interfere with asymmetric matches. The shift to Islamic finance would have to involve few institutional changes (Al-Jarhi, 1981).

First, banks would give up the use of the classical loan contract in favor of 20 investment and finance contracts that can be grouped into five categories of equity, profit and product sharing, agency investment, and sale and lease finance. Second, all money issued by the central bank would be placed in investment accounts with banks, called central deposits or CDs while total reserves are observed<sup>5</sup>. Third, the central bank issues central deposit certificates, CDCs, whose proceeds would be placed in CDs. The central bank would conduct monetary policy through changing the money supply by adding or withdrawing from CDs. Fine tuning would be done through open market operations in CDCs. The rate of return on CDCs, or RCDC, would become a good indicator of the real rate of growth.

The optimal monetary policy rule would become to equate the rate of monetary expansion with the rate of growth, which is calculated from RCDC<sup>6</sup>. Absolute price stability, instead of target inflation or deflation,

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<sup>5</sup> This represents the most radical part of our proposal, as it replaces *debt money* with *investment money*.

<sup>6</sup> The rate of return on aggregate investment would be equal to a weighted average of the rates of return on all investments in the economy, where weights are the value of resources invested in each. The RCDC would be equal to the average profitability of aggregate investment or the real rate of growth minus the *Muḍārib* fee charged by banks investing CDC proceeds and the central bank fee in lieu of its intermediation between CDC holders and banks.

would be the natural result of such policy.

Instead of an administratively determined rate of interest on loans whose principal and interest are guaranteed by the virtue of the classical loan contract, the RCDC is paid on *Muḍārabah* deposits whose principle and return are not guaranteed. People would allocate their savings between different investment outlets, based on comparing RCDC with the rates of return on other investments. The incentive to economize on real balances in transactions would be eliminated, as there would be no incentive in a growing economy to add monetary balances to investment deposits for the sake of earning an uncertain rate of profit, coupled with the possibility of loss. The Friedman-Samuelson inefficiency would consequently disappear.

The availability of finance through the 20 Islamic financial contracts, i.e., through profit and product partnership, investment agency, lease and sale finance can have positive effects on the process of trading.

Traders, knowing that banks are good sources of information regarding prices and trading partners, they would not take time out of their productive activities to search. Even if they have sufficient liquidity, when saving in the search cost is considered, prices for deferred payment net of search cost would favor obtaining finance from banks than liquidating their own “invested resources” to finance their purchases. This leads to division of labor in the search activities, where banks specialize and become more efficient in information collection and dissemination. While individual traders find themselves at a comparative disadvantage in information search, they cannot sell any surplus information they might collect to other traders. Their information-collection activities become rather unproductive.

Banks meanwhile, expecting that traders, both buyers and sellers, will refer to them as sources of trading information, they accumulate a

portfolio of trading information through systematic and professional search they would bargain with suppliers on attractive prices that would provide buyers what they consider good deals and afford them comfortable profit margins. The information collected by banks in their search activities would be directly translated into improvement in matching possibilities of each trader and internalized through better prices for both buyers and sellers and better profit margins for banks.

In brief, by providing sale finance, banks play a catalytic role in matching buyers and sellers and distributing the externalities of improving match opportunities to trade partners as well as banks themselves, so that such externalities can be completely internalized. The improvement in the efficiency in the search activities due the division of labor, and the resulting incentives provided to traders, would expand rather than restrict the volume of transactions in commodities.

On the investment side, banks in an Islamic economic system specialize in investment activities. Their specialization enables them to better handle the lemon problem through feasibility studies, financial analyses, and governance. Their expertise in investment evaluation makes them more capable to conduct due diligence. Their participation in business management boards, on their own behalf or as agents to their customers, would protect their investments from risks associated with information asymmetry. This would further enable them to provide their investment partners with larger volumes of finance through *Muḍārabah*, *Salam* and *Wakālah*, which can be subject to information asymmetry.

In other words, banks undertaking of equity finance, would enable them to provide more finance as partnership in product and profit, in addition to *Muḍārabah*, *Wakālah* and *Salam*. The participation of banks in capital subscription provides a signal to other investors that a sufficient amount of due diligence has been done to avoid the

lemon problem. This would be instrumental in attracting other equity investors to the same venture. The same applies to *Muḍārabah*, *Salam* and *Wakālah* finance.

## CONCLUSIONS

The introduction of search costs into the macroeconomic model exposes two inefficiencies that have not generally been made apparent to mainstream economists, because the construction of search models has been a nascent phenomenon. In the first type of inefficiency, search activities would not be uniform among traders. Those who do more searching would be unable to internalize their extra information by selling it to others. Such gains from search would become a deadweight loss. Lack of internalization leads traders to limit their search activities which would lead to keeping the volume of transactions below optimum. This is termed the Hosios inefficiency.

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## Dr. Mabid Ali Mohamed Mahmoud Al-Jarhi



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