THE INTRODUCTION OF WAQF INTO FRACTIONAL AND FULL RESERVE BANKING SYSTEMS TO ACHIEVE ECONOMIC STABILITY

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ABSTRACT

Fractional reserve banking is a system in which banks extend loans by creating credit/deposit money, and which can be considered the basis of modern financial architecture. Nevertheless, it has been criticised because of its inherently weak and fragile structure in terms of financial and economic stability. As a theoretical solution, full reserve banking has been supported in academic circles, with many technical variations. However, Islamic economics can help to maintain financial and economic stability with its original institution of waqf. Besides performing social functions, waqf also undertakes financial intermediary functions and preserved financial stability in the period of the Ottoman Empire. The purpose of this study is to examine the effects of fractional reserve banking on economic stability and to make a comparison with full reserve banking to observe its potential as an alternative solution . The study also examines the efficiency of the Islamic social and economic institution of waqf in maintaining economic stability in both fractional and full reserve systems. The results demonstrate that full reserve banking is a promising approach to maintaining economic stability and that waqf enhances economic stability in both banking systems.

I. INTRODUCTION

1.1. Background

In today's economic systems, money is created mostly in the form of demand deposits. However, there are two common misconceptions about the creation of money. One is that banks are financial intermediaries which lend out depositors' money, while the other is that the central bank controls the money supply through the reserve ratio and central bank money, which is known as the money multiplier approach (McLeay, Radia, & Thomas, 2014, p. 2). The reality is that commercial banks create money through lending and that it is destroyed by repayments. A bank lending transaction is recorded by entering a loan to assets, with an equal demand deposit to liabilities (Dixhoorn, 2013, p. 5). Tobin (1967) called this money newly-created by the stroke of the bank president's pen when approving a loan "fountain pen money" (Tobin, 1967, p. 1). This system, in which banks can first make a loan and later maintain the required reserves or seek funding, is called fractional reserve banking.

The adoption of fractional reserve banking was a radical change in the money creation mechanism. Fractional reserves emerged with goldsmiths' illegitimate action of lending out deposits without the consent of the depositors, facilitated by the common use of goldsmith receipts as a means of payment. The simple explanation of this phenomenon was human greed, through which the very objective of homo economicus could be served, with capital accumulation facilitated to a minority at the expense of others by exploiting them through unsustainable debt and unjust distribution of wealth (Tekdogan & Sarac, 2019). Eventually, banks replaced goldsmiths and accordingly bank checks replaced goldsmith receipts. The gold backing for banknotes and paper currency has weakened continuously and different monetary standards have been applied in economies (Qaradāghī, 1995, p. 8).

Full reserve banking implies the separation of the payments system from credit creation, through which centralised money creation does not allow banks to alter the money supply. As demand deposits are fully backed by reserves and are always accessible, banks cannot lend out and benefit from them. Banks would become pure financial intermediaries by first borrowing money and then lending it out (Dixhoorn, 2013, p. 2). Over the last two centuries, many prominent economists and Nobel Prize winners have proposed or advocated various full reserve banking models, which can be classified under several categories, such as the Chicago Plan, Sovereign Money, Pure Commodity Standard, Narrow Banking, and Limited Purpose Banking. A comprehensive historical survey of these approaches can be found in Lainà (2015), from which it is evident that full reserve banking has been implemented several times as a solution to financial instability. One example was the UK's Bank Charter Act of 1844, which prohibited private money creation by requiring banks to fully back deposits with government money. The exemption of demand deposits from this regulation eventually made them the most common circulating medium (Lainà, 2015, p. 1).

Waqf is a voluntary act of charity, which is also termed sadaqah jariyah, or ongoing charity, since it generates benefits continuously (Ahmed, 2004, p. 28). Cash waqf differs from real estate waqf in that its original capital consists purely or partially of cash. The origins of cash waqf can be traced back to the eighth century,

when Imam Zufar issued a fatwa concerning it (Cizakca, 1998, p. 53). Pamuk (2004) included cash awqaf as one of the financial institutions in the Ottoman Empire, established to lend their cash assets for a return and to use the income to fulfil their goals. After these endowments began to be approved by the Ottoman courts, cash waqf became popular by the end of the sixteenth century (Pamuk, 2004, p. 11). Cash waqf appeared as a unique Ottoman institution of capital accumulation, but functioned as an institution of capital distribution. Their funds were mostly utilised for financing the personal needs of small consumers, rather than financing important business ventures (Cizakca, 1998, p. 60).

Discussion of the full reserve banking system's relationship with the fractional reserve system in terms of economic instability is conducted on theoretical grounds, because data unavailability for the full reserve system is a major constraint to undertaking empirical studies on this subject .

1.2. Objective

This study attempts to contribute to this theoretical discussion by filling the empirical gap with a simulation model. Furthermore, introducing waqf to the model to assess its potential as a stabilising institution in both banking systems will bring a new dimension to the discussion and will constitute the originality of the study.

This paper is structured as follows: Section 2 comprises the literature review, bringing together various opinions about the implications of fractional reserve and full reserve banking in terms of economic stability and income and wealth equality, as well as other opinions on the matter from the Islamic economics and finance perspective. Some agent-based models focusing on fractional reserve banking and its economic implications are presented in this section. Section 3 gives a brief explanation of agent-based modeling and describes the model developed for the study and its originality . Section 4 analyses and evaluates the results of the simulations, while Section 5 concludes.

II. LITERATURE REVIEW
2.1. Background Theory
2.1.1. Fractional Reserve and Economic Stability

Since the 19th century, there has been an ongoing controversy between the Currency School and Banking School about who could create money and how the money supply should be controlled. The Currency School advocates that banks' functions of money creation under fractional reserve and financial intermediation should be separated. The state should create money and be the sole keepers of seignorage (Goodhart & Jensen, 2015, p. 2). Concerning the level and growth of money supply, Currency School supporters propose a variety of rules, including a gold standard rule (Ricardo, 1824); a k-percent rule (Friedman, 1960); a price level rule (Fisher, 100% Money, 1935); or an inflation target. Banking School proponents do not agree with this, since the financial system is evolutionary, and a rule adopted for today's circumstances could become outdated and inappropriate in the future. Instead, they prefer discretion and flexibility over money supply in order to

respond to the needs of trade (Goodhart & Jensen, 2015, p. 4). The best solution is to let the Central Bank set its interest rate to achieve certain macroeconomic or inflation targets and to fund commercial banks at this rate. Commercial banks could then set their terms and conditions for lending and endogenously create money (Goodhart & Jensen, 2015, pp. 9-10).

Economic stability is defined as stable economic growth, inflation and unemployment, without wide fluctuations. However, besides these three measures, the literature includes other macroeconomic indicators to describe economic stability. For instance, the results of Hauner's (2017) empirical study show that wealth inequality and aggregate wealth are mutually important in determining economic stability, as the accumulation and distribution of wealth play a significant role in such stability (Hauner, 2017). Therefore, economic stability can be measured by different indicators, primarily by production, inflation and employment rates at acceptable levels which do not exhibit any periodical large fluctuation. Other indicators, such as income and wealth equality, balance of payments, the savings gap and public and private debt levels, can be added to the list. The fractional reserve banking system has its instability resourced from unlimited issuance of fiat and credit money, which brings about constant inflationary pressure and currency depreciation (Shapiee & Zahid, 2010, p. 769).

Central banks use the policy (base) rate as a tool to keep inflation under control by limiting aggregate demand and hindering price level. An increase in the policy rate produces additional costs for banks that want to make loans but do not have sufficient reserves to do so. As a consequence, banks must raise the interest rate on their new loans to keep their profit margins steady. Therefore, the demand for loans will fall and banks will create less deposit money, which will eventually reduce the amount of money supply. This implies less spending on goods and services and lower price levels (Jackson & Dyson, 2012, p. 124).

In Iceland between 1986 and 2006, commercial banks increased money supply via credit creation at a rate (18.6% p.a) that was more than enough to support economic growth (the average growth rate p.a was 3.2%). During this period, which ended with devaluation of the Icelandic krona (ISK), the Central Bank of Iceland tried to narrow the loan supply by increasing policy interest rates from 5.6% to 18%, but it was largely ineffective in restricting money creation by the banks (Sigurjonsson, 2015, p. 11).

Zaman (2015) points out that the fractional reserve system undermines social justice by worsening wealth equality. Banks prefer to lend to the wealthier classes, who can offer assets as collateral and use this power to manipulate the government, financial institutions, corporations, and individuals to make even more money. The way in which the wealthy extract more money from the productive sector of the economy can lead to its collapse and eventually destabilise it (Zaman, 2015, p. 12).

Money creation based on fractional reserve requires credit creation and implies continuously rising debt levels. Increasing interest payments reduce the disposable income of debtors, thus reducing spending in the real economy, but raise the amount of money in the financial sector if the interest payments are retained within it . If most of the money from interest remaining in the financial sector is distributed to its employees, income inequality would worsen (Dyson,

Greenham, & Ryan-Collins, 2010, pp. 21-22). Credit money creation increases inequality through inflation; while the assets possessed by the wealthy mostly increase in value in inflationary periods, the poor and middle classes lose wealth, as their saving value falls (Syammon, Abdullah, & Meera, 2017, pp. 280-281). Eventually, there arise both a politically and economically empowered class, and a poor and middle-income class that is obliged to work for the benefit of capital owners and depend on the wages paid by them to live. Considering the low level of influence of the wage sector on decision-making processes, the risk of social conflict increases in society.

Economic stability cannot be sustained in the absence of financial stability, which refers to the resilience of the financial system to shocks. The financial system performs many functions in the economy, such as operating payments systems, channeling savings to investments through financial intermediation, and creating liquidity through maturity transformation. If credit money creation is not backed by real savings, financial stability could be undermined. When financial capital frequently increases, independently of real capital, inflation rises and speculative bubbles form in stocks, housing and commodities. When these bubbles burst, financial stability deteriorates, and consequently the economy is destabilised and wealth is redistributed unjustly (Askari & Krichene, 2014, p. 21).

Minsky's financial instability hypothesis asserts that with the expansion of the economy, asset prices, stock values and returns on investments increase. When the difference between the rate of return and interest rates increases, debt leveraging becomes attractive for investors, and banks support this by creating more credit money. However, this economic expansion further increases asset and stock prices. Eventually, these price increases become unsustainable, and price bubbles burst, leading to financial crisis. When crises occur, increasing unemployment and bankruptcies, and falling prices, reduce the rate of return and investments will be less attractive. In this case, banks avoid lending and reduce money creation considerably, causing liquidity shortages in the market and exacerbating the crisis (Minsky, 1992).

2.1.2. Full Reserve Banking

The fractional reserve system has been a subject of discussion both today and in the past, and alternative approaches have been sought. The full reserve banking system, which stands out as a structural solution alternative, has been proposed in the form of various types of models for nearly two hundred years. These proposals can be mainly grouped under the Chicago Plan, Pure Commodity Standard, Sovereign Money, Narrow Banking, Limited Purpose Banking, Deposited Currency, and Collateralised Money. The main purpose of full reserve banking proposals is to eliminate the ability of commercial banks to generate money and to establish economic stability. The featured idea is that commercial banks are divided into deposit keeping institutions and credit institutions, so that banks first assume the role of a financial intermediary that collects money and then makes funds available for lending.

Benes and Kumhof (2012) revisited the Chicago Plan and tested and fully validated Fisher's (1936) claims, so that the plan could significantly reduce

business cycle volatility, eliminate bank runs, and result in an instantaneous and large reduction in the debt levels of both the government and private sector. Benes and Kumhof (2012) concluded that with the plan, monetarism would become feasible because the government could control the money supply and steady-state inflation would fall to zero in an environment without liquidity traps. This finding was important for those who argue that a money supply monopoly will lead to high inflation. This ability to generate and live with zero steady-state inflation responds to the claim that a monetary system in which the government has an exclusive monopoly on money issuance would be highly inflationary.

Dixhoorn (2013) investigated full reserve banking proposals and the arguments for and against them. Under the fractional reserve system, the safety of the money and payments system is dependent on the soundness of the commercial banks and their willingness to trust each other, whereas under the full reserve system this will depend on the central monetary authority and the government. Since money will be always obtainable, there will be no bank runs. This promises stronger financial stability, as people will not be worried about being unable to access deposits or making payments in a banking crisis, and also the failure of investments will not pose a risk to the payments system. Moreover, the payments system will be more stable and secure, as the government and monetary authority will follow the right fiscal and monetary policies, given that the payments system will no longer depend on obtaining reserves or on interbank borrowing.

Dow, Johnsen, & Montagnoli (2015) argue that full reserve banking proposals are designed to promote financial and economic stability by allowing countercyclical money creation, but that success is dependent on the condition that only government money exists and credit growth must follow the same path as money supply growth. If the restrictions on near monies and credit expansion were to be successful, the undesirable outcome of this would be an inelastic economy that would be slow to react to economic shocks, hence amplifying rather than dampening the negative consequences of economic shocks (Dow, Johnsen, & Montagnoli, 2015, p. 13).

However, full reserve banking proposals have never been implemented, for various reasons. García, Cibils, and Maino (2004) give some possible explanations for the lack of explicit implementation. First, there is no public demand for safe deposits, but even so, the state has provided explicit or implicit subsidies to some through deposit insurance and satisfied this demand . Second, despite its drawbacks, the fractional reserve system is seen to be superior to the full system because of the benefits of providing deposit and lending services under the same roof, and welfare is enhanced by the money multiplier, allowing for more loans with the same monetary base. Thirdly, full reserve banking calls for developed capital markets, as it leaves financing to these. Finally, there are usually special pressure groups which oppose most banking reforms in order to protect their own interests (García, Cibils, & Maino, 2004, p. 14).

2.1.3. Islamic Perspective

One of the major defects of the fractional reserve system is that it promotes riba and leads to a reduction in zakat collections. Riba is the main motivator for banks

in a fractional reserve system, and is completely dependent on lending to survive. The existence of the system depends on the continuous creation of new loans, thus increasing the amount of money spent on riba. In retrospect, it has been the case that debt levels have continued to rise and debtors have had to roll over debt. On the other hand, the capitalist consumerist lifestyle dragged potential zakah obligates to borrow more in order to follow the culture of consumption, thus falling into the bank lending traps. Consequently, a lifelong community structure has been developed, with people constantly believing they need to replace their house, car or furniture, thereby mortgaging their assets to the bank. A social mass that possesses virtual wealth, but owes too much to pay zakat, has led to a gradual decrease in the amount of zakat given to those who need it (Tekdogan, 2019, p. 97).

Borrowing should not be the preferred option unless someone is in dire need of money. Islamic law does not permit borrowing or lending for the satisfaction of wants and luxuries, as this could lead to the massive use of debt and make people ever-indebted (Hatta & Dien, 2014, p. 59). Debt-based financial activities provide huge benefits to a small group of people; however, high levels of debt make debt rollover inevitable in order to service the debts, and this process can eventually lead to financial instability and crisis (Hatta, Dien, & Mohamad, 2014, p. 16). It is an injustice when a small group gains at the expense of the rest of society.

One of the pillars of the maqasid al-shariah is the preservation of wealth. Shariah forbids circulation and concentration of wealth among a small group of individuals (Al-Hashr 59:7) and it also requires justice and fairness among people. Banks' money creation based on fractional reserve causes inflation, which is a hidden tax for society and creates hardship, especially among the poor. Shariah encourages wealth transfer from the rich to the poor through zakah and sadaqah; however, in the fractional reserve system this takes place in the opposite way, and consequently deterioration of society occurs, with increasing numbers of crimes such as robbery, corruption, theft and adultery (Sani, Arfah, Meera, & Aziuddin, 2012, p. 13). Wealth accumulation in the hands of a few money-creating banks violates the Shariah objective of the sovereignty of individuals, by worsening people's faith, life, intellect and progeny. Prophet Muhammad (pbuh) said that poverty, in all probability, leads to unbelief (kufr), (Baihaqi and Tabrani) (Sani, Arfah, Meera, & Aziuddin, 2012, p. 12).

When someone applies for a loan to acquire an asset, a bank extends credit through private money creation under the fractional reserve system. For the same number of assets in the economy, there is now a higher level of money supply. The result is inflation, in which decreased purchasing power is a reward for those who created the money. This zero-sum game redistributes wealth and the ownership of assets in the economy. Private money creation is a way of taking others' possessions forcedly, without their knowledge or consent, and lending out those possessions for a return (Meera & Larbani, p. 14). Meera and Larbani argue that this is equivalent to theft and a clear violation of Islamic principles on ownership. Since the fractional reserve system is legitimised by legal provisions, Meera and Larbani term it 'legalized theft' (Meera & Larbani, p. 16).

Askari and Krichene (2014) argue that full reserve depository banking and safekeeping system and equity-based investment banking is one of the two pillars of Islamic finance. The main difference between the full reserve system approach

and Islamic finance is the prohibition of interest-bearing debt in Islam. In the Islamic system, there is no money multiplication nor money creation out of thin air, which makes the economic system inherently stable (Askari & Krichene, 2014, p. 10). In Khan's (1986) view, the Islamic banking system resembles the full reserve banking approach; however, Islamic banking requires more where all loans must be based on equity participation (Khan, 1986, p. 19). Syamlan (2016) asserts that full reserve banking and the Islamic system are both equity-based and enhance financial stability more than the conventional banking system does (Syamlan, 2016, p. 17).

Ahmad and Ismail (2017) argue that full reserve banking provides no sources of inflation through credit creation. Instead, asset-backed reserves stabilise the quantity of money in circulation, which will be equivalent to existing projects and the spending value. This characteristic of full reserve banking leaves no room for inflation or speculation, conserves wealth and protects the poor. Therefore, justice and fairness in society will be maintained and Maqasid al-Shariah will be attained (Ahmad & Ismail, 2017, s. 64).

Syamlan (2016) argues that under the fractional reserve system, money is treated as potential capital, whereas Islam and the full reserve system protects money to neutral by treating it as actual capital. The full reserve system assures that demand deposits are available at any time for depositors and they are not allowed to be used for the benefit of the bank. Therefore, money being actual capital is a mere of supporting a transaction (Syamlan, 2016, p. 70).

2.1.4. The Role of Cash Waqf

The Islamic institution of waqf has been historically considered as a social service provider, providing public goods mostly to the poorer segments of the society and contributing to the fight against poverty. On the contrary, cash waqf has been considered more as a financial institution, as it has principally been involved in lending activities, serving this purpose until the emergence of banks in the Ottoman Empire. Bulut and Korkut (2016) report that the loan rates applied by cash awqaf were predetermined by the binding provisions of the foundations, and protected borrowers from the high interest rates of usurers in the market, with the rates became a balancing and determining factor. Such rates, which remain stable in the long term, have been an important factor in achieving financial stability. Introducing cash waqf into the financial system as a complement to Islamic banks, rather than as a substitute, would be advantageous for them in terms of competition against conventional banks (Bulut & Korkut, 2016).

Mohsin (2013) examined the different goods and services provided by different cash waqf schemes in various countries and concluded that it is a very powerful institution for fundraising. The potential of cash waqf in financing public goods could contribute to the welfare of society at large and save government budgets (Mohsin, 2013). According to the Global Islamic Finance Report (2015), waqf creation should be encouraged in Muslim countries as soon as possible by amending the laws concerning it. Cash waqf could be a new model of banking and financial intermediation, which could also be used to replace the interest-based financial system (Global Islamic Finance Report, 2015).

Ayub (2018) considered how the institution of waqf could be revitalised by involving banks and other financial institutions. It is suggested that banks should establish and run awqaf by donating money, which would be utilised for assisting jobless and needy people, reducing socioeconomic disparities, and redistributing wealth among income groups (Ayub, 2018). Cizakca (1998) analysed the relevance of the waqf system for modern Islamic economies and concluded that, if successfully modernised, it would cut down on government expenditure significantly and eventually eliminate riba (Cizakca, 1998). Kahf and Mohomed (2017) explored cash lending through cash waqf funds within the banking context. Since cash waqf is a non-profit based instrument, its lending would only be used for making benevolent loans and it would not generate any profit or monetary gain (Kahf & Mohomed, 2017).

The literature supports the view that the institution of waqf is a stabilising instrument, both financially and socio-economically. However, no study has yet shown any direct or indirect relationship between waqf and either fractional or full reserve banking systems. This study aims to analyse the potential impact of the institution of waqf as a stabiliser in both reserve banking systems.

2.2. Previous Studies

Ricardo (1824) made the earliest study on full reserve banking, which can be classified under pure commodity standard proposals. At the beginning of the 1900s, many new full reserve plans were proposed, especially in the aftermath of the Great Depression , amongst which the most prominent were those of Knight et al. (1933) and Simons et al. (1933), known as the Chicago plan. In the mid-1900s, full reserve banking was not yet a fashionable research area, although some influential studies were developed with original full reserve proposals, such as those of Friedman (1960), Litan (1987), Spong (1993), and Pollock (1992) . The common ground for all these studies was that they were all based on theoretical grounds and did not support their claims with quantitative analysis. This gap started to be filled by empirical studies made after the 2007/08 global crisis.

The study of Benes and Kumhof (2012) was the first to build a DSGE model to test the claims made by the Chicago Plan. However, the lack of historical data for the full reserve system hindered the development of new empirical studies in this field. Nevertheless, after agent-based modeling began to attract attention in economic and financial research, several simulation models were developed to test the arguments regarding the fractional reserve and full reserve systems[1].

All of the aforementioned studies approached the matter of economic and financial stability from the conventional perspective. From the Islamic perspective, some studies have discussed fractional and full reserve with regard to Islamic jurisprudence and Maqasid al-Shariah, as previously explained in Section 2.1.3. This study contributes to the literature by adding empirical research, which

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[1] The studies of Mallett (2015), Monett and Navarro-Barrientos (2016), Chan-Lau (2017) and Hoog and Dawid (2017) are discussed in Section 3.2. The list can be further expanded by the work of Lengnick, Krug and Wohltmann (2013), who analysed the impact of the fractional reserve system on financial stability.

involves the Islamic perspective and the institution of waqf. Nevertheless, more empirical research is needed to investigate the status of the full reserve system in an Islamic economic context, as well as its interconnection with Islamic institutions.

III. METHODOLOGY
3.1. Data
The data were produced by running simulations based on an agent-based model which was built for the study. In such models, there is a trade-off between clarity and complexity; we gave precedence to the former. With its agents, set of rules and agent characteristics, each model must preserve its own integrity.

Running the model with a large number of agents and experiments is very time consuming, as it requires supercomputers to run the simulation more quickly and more time is needed to extract and process the data. Moreover, the results would not differ if the model was run with a more reasonable number of agents and experiments.

In this sense, the numbers in our models were selected within a reasonable range. We selected 0.05, 0.1 and 0.15 reserve ratios, because in reality most central banks apply ratios within this range. This fact, coupled with the performing of five exercises for each ratio and taking averages of their data, yielded results that were closest to the theoretical conduct and ensured the robustness of the study.

Simulations were performed using 300 households, 10 banks and a single firm. For both the conventional and waqf models, a total of 32 simulation experiments were conducted; five were run at each of the five, ten and fifteen percent reserve ratios, and one was run at the hundred percent reserve ratio.

3.2. Agent-Based Models
Agent-based models use a dynamic system of autonomous agents that interact with each other, allowing macro-scale behaviour to emerge from micro-scale rules. The rules set out in the models affect the behaviour of the agents, who make decisions by evaluating their situation individually according to these rules. Agent-based modeling has a bottom-up approach; that is, the dynamics of each agent are aggregated and macro-scale outputs are obtained. However, agent-based models are not as respected by researchers as econometric or general equilibrium models. Although some agent-based models have been built to examine the fractional reserve banking system, we were unable to find any designed to make this examination from the perspective of Islamic finance, economic stability and income inequality. Discussion of some model examples at this point will enable us to compare and better understand our own model in terms of its originality and scope.

Chan-Lau's (2017) agent-based model was developed to analyse the impact of capital and reserve ratio requirements on bank failures, profitability, and interconnectedness risk in the banking system. The simulation exercise mainly showed the interplay between capital requirements and reserve requirements when the former are set at low levels.

Mallett (2015) built an agent-based model of the banking system to investigate its influence on the macro-economy, by making various assumptions concerning Basel Capital and central bank reserve regulatory frameworks, inter-bank lending and correct handling of loan defaults within the bank accounting framework. The simulation results demonstrate that, without any form of reserve or capital requirement, banks rapidly expand lending and increase the money supply.

Monett and Navarro-Barrientos (2016) modeled an agent-based fractional reserve banking system to analyse how different scenarios can lead to bank insolvency. The simulation exercises showed that the minimum reserve rate and loss of confidence made large contributions to bank insolvency, and that higher minimum reserve ratios lead to fewer bank insolvencies.

Hoog and Dawid (2017) developed an agent-based model to explore how business cycle fluctuations are affected by different types of banking and credit market regulations, by analysing the effect of capital adequacy and reserve requirements on the risk of severe downturns. The results of the experiments show that the amplitude of recessions increased with more restrictive capital adequacy ratios, whereas it decreased with more restrictive reserve requirement ratios. Moreover, very tight reserve requirement ratios generically work better to dampen severe downturns than restrictive capital adequacy ratios at any level.

Cincotti, Raberto, and Teglio (2010) explored the interplay between monetary aggregates and macroeconomic performance in a model in which money was supplied by banks through lending and by the central bank through quantitative easing monetary policy. The results show that the interplay between real economic activity and its financing through the credit market created endogenous business cycles, and that the amplitude of these cycles rose strongly when firms were more constrained in borrowing credit money to fund their activities.

3.3. Model Development

Farmer and Foley (2009) suggest that by using econometric models which fit past data, successful predictions for the short term can be made; however, such models fail to make successful predictions in the face of great changes (Farmer & Foley, 2009, p. 685). Although there has been a growing number of studies on full reserve banking in recent years, it has not been possible to test these alternative models, since the absence of practical applications of the full reserve system does not provide adequate grounds to build econometric models. Alternatively, an agent-based simulation model has been built to meet this data gap, with all the parameters other than the required reserve ratio set at constant. In the simulation model, which was designed on the basis of a fiction in which Islamic finance concept is in effect, fractional reserve system and full reserve system are compared and the effects of both systems on economic stability are observed.

A distinguishing feature of our model from other models designed on the basis of fractional reserve banking is its integration of the credit market, interbank market and the goods and services market. Rather than imitating the real world, our model reflects an abstract world that explores the impact of different reserve ratios on various variables such as price stability, consumption demand, money supply, bank durability, loan supply and loan demand. To test the accuracy of the

model, different reserve ratios were applied in a fractional reserve scenario. Two different sub-models were constructed on the basic structure of the model. The first of these, which was designed for the fractional reserve system, incorporates some of the features of the models mentioned in the previous section, and is termed the conventional model. The second model is called the waqf model. This was added as an Islamic alternative procedure, and the effect of behaviours changing according to Islamic sensitivities on the system were examined. Three types of agent which adhere to certain simple behavioural rules were defined. Although the model includes deposit and loan interest rates, which were determined endogenously, since the business model in participation banks converges with that of modern banking to a great extent, the model assumes a banking system consisting only of participation banks.

Our model presents a closed free-market economy, operating free of any interventions by excluding any type of government body or central bank. This economy is composed of a collection of households, a collection of banks and a consumption firm that represents the real sector. The number of households and the firm is fixed at all times, as is the technology, so for the sake of simplicity, economic growth is ignored.

Each household is employed by the firm, and sells its labour in exchange for a wage. In the setup stage, each household was matched with a random bank and this connection is fixed throughout the simulation. This assumption assures that the interconnection between banks is only possible from the interbank money market. Households make savings in the form of bank deposits and consume based on their income and wealth. There is no interaction between households. The nominal consumption demand function of households is as follows:

$$C_t^{nom} = f(i, w, C_{t-1}^{nom})$$

where C_t^{nom} is the nominal consumption demand for this turn, i is income, w is wealth and C_{t-1}^{nom} is the consumption demand from the previous turn. By dividing the nominal consumption demand by price level, we find the real quantity of consumption demand. If a household cannot afford its consumption demand, it applies for a loan from its bank. However, the loan demand (L_t^D) of households is constrained by the loan interest rate (r_t^L):

$$L_t^D = f(C_t^{nom}, r_t^L)$$

The firm produces homogeneous consumption goods using labour only. It can apply to its bank for loans to finance its production. It does not hold cash, because it makes all its monetary transactions via deposit accounts. The firm's production function is:

$$Y_t^{real} = f(Y_{t-1}^{real}, C_{t-1}^{real}, I)$$

which means that production is determined by the previous turn's production (Y_{t-1}^{real}), real consumption demand (C_{t-1}^{real}), and the quantity of goods ready in the inventory (I).

Banks hold reserves (R) and deposits (D), and make loans (L) out of them; however, they need to hold sufficient reserves to obey the required reserve ratio (rr). Therefore, the amount of loanable funds or the bank-to-loan (BtL) function is:

$$BtL = f(D_t, R_t, rr)$$

There is an interbank market in the model, which enables banks to seek funds from other banks in the case of reserve deficiencies. Interbank loans are the only source of interconnectedness in the system. Banks calculate their interbank loan supply by using the BtL function.

In each turn of the simulation, agents interact by following the procedures below in order:

1. Production: the firm computes and produces its desired output level.
2. Wages: the firm computes wages according to the price level and its production level.
3. Firm's loan demand: After computing wages, the firm first repays its previous loansto the level the funds allow. It then computes its new loan demand and applies to its bank if it needs funding. If the bank has sufficient funds to lend, lending occurs.
4. Interest: Accrued interest amounts on deposits and loans are transferred between the depositor's/bank's and lender's/borrower's accounts (not applicable in waqf mode).
5. Deposit or withdraw cash: households keep 95% of their money in cash and deposit the rest in their banks.
6. Make donation: In waqf mode, the firm and wealthier households make donations to the waqf.
7. Help needy people: The waqf redistributes the donations of wealthier households to needy ones.
8. Consumption demand: Households compute their consumption demand. This procedure differs in waqf mode, because we assume households become benevolent and reduce their spending slightly to help others.
9. Loan demand: Households repay as much as they can afford of previous loans. If a household does not have sufficient funds to afford its consumption demand, it applies for a random loan amount, which decreases as the interest rate on the loan rises.
10. Consumption: Households consume and make the necessary payment to the firm.
11. Wages are paid.
12. Bank-run: After each 250 turns, households panic and run to their banks to withdraw their deposits. This panic continues for a short time, during which households tighten their consumption demand. This procedure helps us to see how resilient the banks are to this kind of shock. After this procedure, households' actions return to normal.
13. Interbank market: After repaying any previous interbank loans, banks check if they have a reserve surplus or deficit. Demanding banks seek funds from supplying banks and after matching with each other, loan transactions occur between their reserves.

14. Bank-fail: Banks which fail to meet the required reserve criteria and/or run out of reserves in a persistent manner get killed .
15. Acquisition: All the balance sheet items and customers of the killed bank are transferred to another randomly chosen bank.
   16. Interest rates: At the end of each turn, banks first compute the interest rate on loans, then, according to this, they compute the interest rate on deposits.
17. Price level: Price level is adjusted according to aggregate demand. Price is sticky; once it increases to a level, it becomes the new minimum price level.

IV. RESULTS AND ANALYSIS
4.1. Results

A total of 32 simulation experiments were conducted for the two models: five for each were run at five, ten and fifteen percent reserve ratios, and one for each was run at a hundred percent reserve ratio. For the five simulation results for each reserve ratio , their means are shown in below figures and tables . Since this study aims to compare fractional and full reserve systems within the context of economic stability, only the reserve ratio parameter was allowed to take different values. Model robustness was tested by applying different approximate reserve ratios for the fractional reserve case. For both conventional and waqf models, the interbank borrowing rate was set to zero.

The monetary base was fixed at 45,000 . From these, 30,000 were equally distributed among households and 15,000 were equally distributed among banks. No procedure was defined to cause exogenous money growth that would change the monetary base or M1 money supply during the simulation. Therefore, M1 money supply can grow endogenously through the credit and deposit creation of banks.
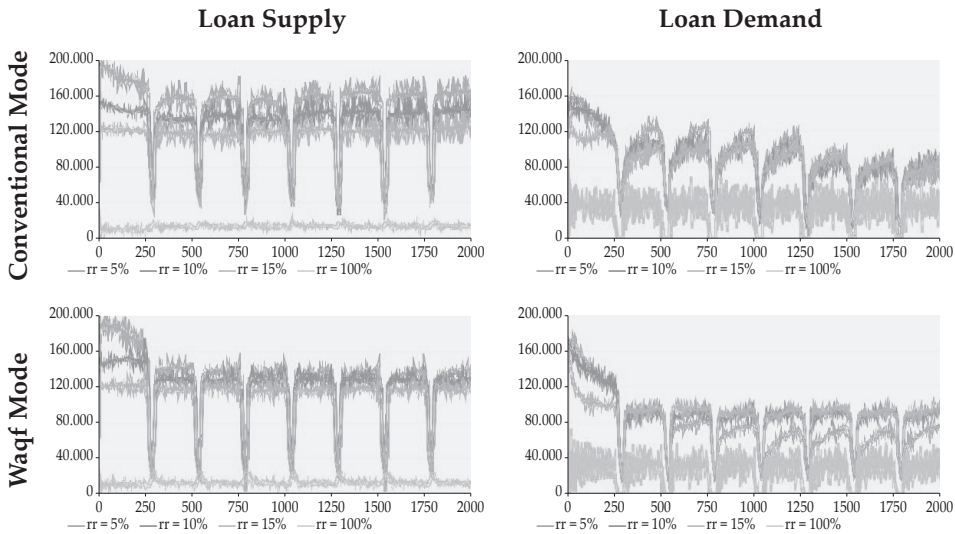
Changes in M1 money supply with respect to different reserve ratios for the conventional and waqf models are given in Figure 1. Accordingly, as banks create credit money in the form of bank deposits through lending, in the conventional model M1 money supply increases as the reserve ratio decreases. On the contrary, in the waqf model, as the reserve ratio increases from 5% to 15%, money supply increases. Less volatility in money supply at the 100% reserve ratio indicates that high reserve rates help to maintain stability.
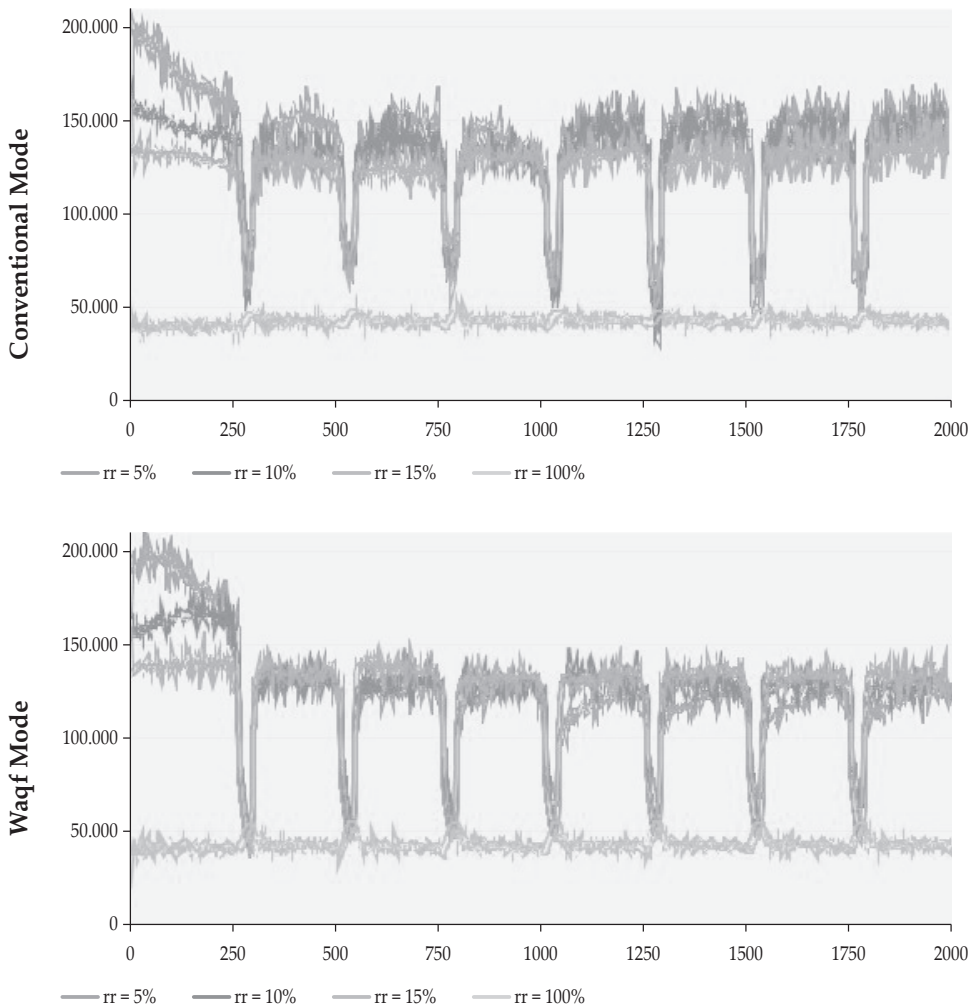
Source: Author's elaboration (2019)

Figure 1.
Changes in M1 Money Supply with Respect to the Reserve Ratio

As the monetary base is fixed, credit volume changes with the same pattern as M1 money supply. Therefore, there is no need to show outstanding loans here; instead, changes in loan supply and demand can be seen in Figure 2. Loan supply is the sum of the loanable funds that banks can grant and the loans which they have already granted. In conventional and waqf modes, it remains stable and decreases as the reserve ratio increases. However, there is an obvious pattern difference between the two modes; loan demand tends to remain stable in thewaqf mode in comparison to theconventional mode. The lower loan demand in waqf mode is due both to a slight reduction in household consumption and the financing needs of households being partly met by waqf. This is an enhancement of economic stability resulting from the waqf mode .
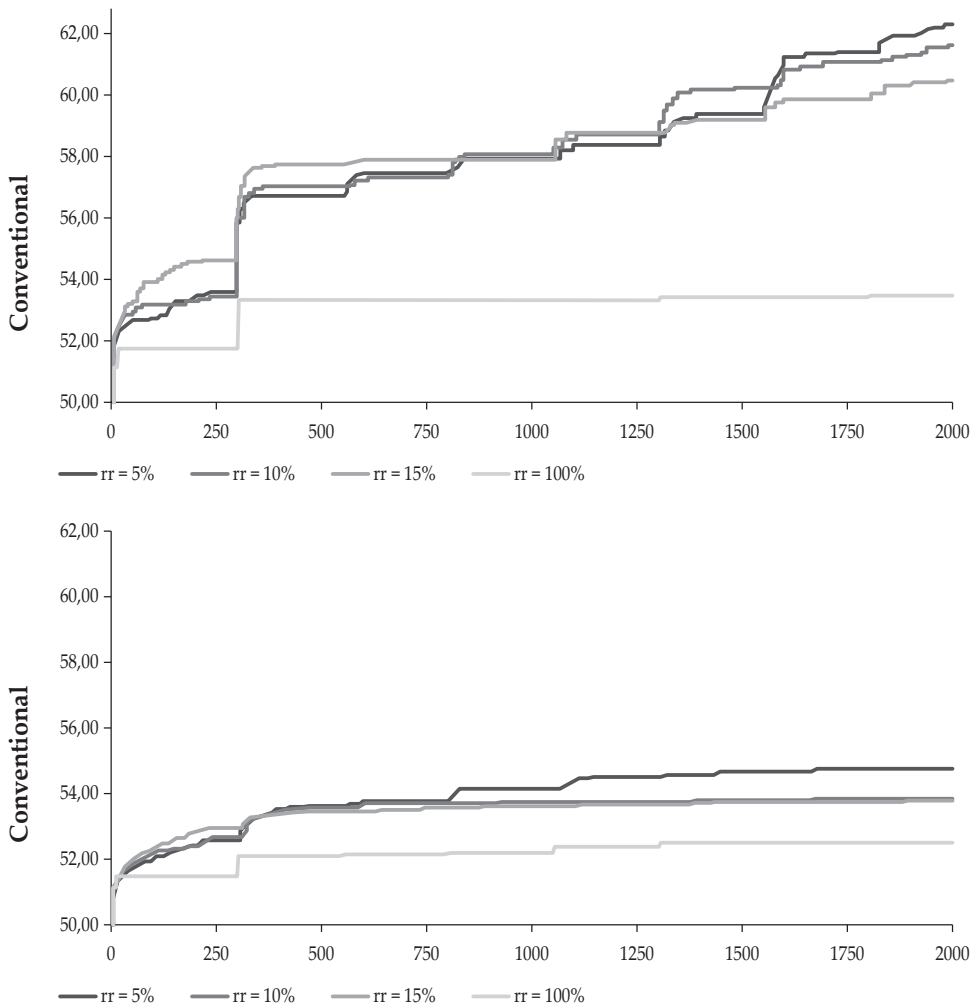
Source: Author's elaboration (2019)

Figure 2.
Changes in Loan Supply and Loan Demand with Respect to the Reserve Ratio

The level of loanable funds that can be granted as loans is an indicator of the extent to which loan supply, and thus money supply, can grow. Granting 100 units of loans does not mean that the number of loanable funds of a certain bank will also fall by 100 units. Since banks produces credit money, the loanable fund level increases again with the credit money produced and which can be found in bank deposits. Therefore, Figure 2 confirms that loan supply further increases as the reserve ratio falls.

Because growth is not defined in our model, while consumption is bounded only by credit creation, production can only rise to a certain point. Therefore, it is inevitable that the price level will increase as consumption demand increases. It should be remembered that price stickiness has been included in the model. The changes in price level according to the different reserve ratios can be seen in Figure 3.

Source: Author's elaboration (2019)

Figure 3.
Changes in Price Level with Respect to the Reserve Ratio

Figure 4, which shows nominal and real consumption figures, helps to better understand why the price level in waqf mode does not rise as high as that in conventional mode. The question raised is how a slight change in consumption pattern and the inclusion of an institution which represents solidarity makes it possible to provide price stability. As seen from Figure 4, consumption demand, both nominal and real, shows an increasing trend in conventional mode. However, both nominal and real consumption demands are stable in waqf mode, apart from the case of the 5% reserve ratio, in which they increase slightly.
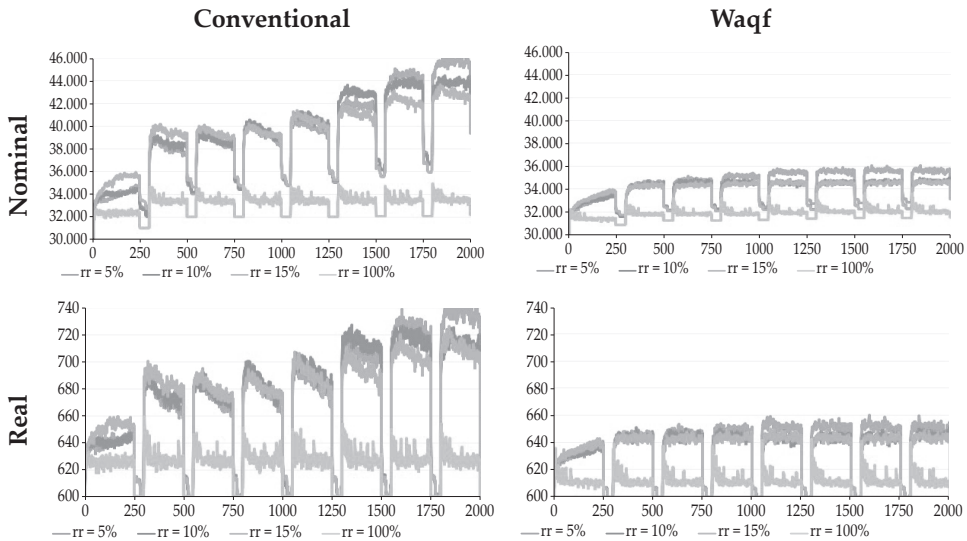
Source: Author, 2019

Figure 4.
Changes in Nominal and Real Consumption Demand with Respect to the Reserve Ratio

For both conventional and waqf modes, as previously emphasised, five simulations for each of the five, ten and fifteen percent reserve ratios were performed. To observe how fragile the fractional reserve system is, we defined a bank-run procedure in which households panicked and ran to their banks to withdraw their deposits every 250 turns. Tables 1 and 2 show the number of failed banks in each bank run, along with the number of surviving banks at the end of the simulation, respectively. We see that the number of failed banks differs for each simulation under the same reserve ratio, which underlines the stochasticity of our model. Note that banks become less fragile to shocks and have a higher probability of survival as the reserve ratio increases. More importantly, waqf mode seems to be a contributor to financial stability, as the banking system becomes noticeably more resilient.

Table 1.
Number of Failed and Surviving Banks in Each Simulation - Conventional Mode

Reserve Ratio		Conventional Model							Number of Surviving Banks
		1st run	2nd run	3rd run	4th run	5th run	6th run	7th run	
	1st sim.	3	3	1	1	-	-	1	1
	2nd sim.	5	2	1	1	-	-	-	1
5%	3rd sim.	4	2	1	1	1	-	-	1
	4th sim.	6	-	1	-	2	-	-	1
	5th sim.	4	1	2	1	1	-	-	1
	1st sim.	1	3	3	2	-	-	-	1
	2nd sim.	3	2	2	2	-	-	-	1
10%	3rd sim.	4	1	2	1	-	-	1	1
	4th sim.	3	3	-	2	-	-	1	1
	5th sim.	3	3	-	1	2	-	-	1
	1st sim.	4	-	2	1	1	1	-	1
	2nd sim.	4	1	1	-	-	1	1	2
15%	3rd sim.	3	1	3	1	-	-	-	2
	4th sim.	2	3	3	-	1	-	-	1
	5th sim.	3	1	2	-	1	-	-	3

Source: Author's elaboration (2019)

Table 2.
Number of Failed and Surviving Banks in Each Simulation - Waqf Mode

Reserve Ratio		Waqf Model							Number of Surviving Banks
		1st run	2nd run	3rd run	4th run	5th run	6th run	7th run	
	1st sim.	4	1	-	1	-	-	-	4
	2nd sim.	4	-	-	-	1	-	1	4
5%	3rd sim.	3	1	1	-	-	-	-	5
	4th sim.	4	1	-	-	-	-	-	5
	5th sim.	5	1	-	1	1	-	-	2
	1st sim.	2	-	1	-	-	2	-	5
	2nd sim.	2	1	1	1	-	-	-	5
10%	3rd sim.	3	1	-	-	-	1	-	5
	4th sim.	-	1	-	1	1	-	-	7
	5th sim.	1	1	1	-	1	-	1	5
	1st sim.	-	1	-	1	-	-	-	8
	2nd sim.	-	-	1	-	1	-	1	7
15%	3rd sim.	-	-	-	-	-	1	-	9
	4th sim.	-	1	-	-	-	-	1	8
	5th sim.	-	-	-	2	-	1	-	7

Source: Author's elaboration (2019)

4.2. Analysis

The study provides compelling justification for the credit and money creation of each bank out of nothing and conforms to the credit creation theory, which was validated by Werner's (2014) empirical study. It is assumed that each household is connected with only one bank to deposit money or take out loans, which made interconnection between banks only possible on the interbank money market. This assumption served to test the fractional reserve theory, which proposes that money is created by the joint efforts of banks in the banking system, and shows that banks can create money individually.

The results of the study match the findings of Chan-Lau (2017) and Monett and Navarro-Barrientos (2016), showing that higher reserve ratios lead to fewer liquidity failures and fewer bank insolvencies, as well as Mallett's (2015) finding that lower reserve requirements allow banks to expand lending rapidly, and those of Tedeschi, Mazloumian, Gallegati, & Helbing (2012) and Lengnick, Krug, & Wohltmann (2013), that higher bank reserve requirements stabilise the economic system, whereas the creation of money by banks inevitably produces instability.

With specific reference to Figures 3 and 4, it can be deduced that both the full reserve system and waqf have stabilising effects on the economy. Consumption demand is induced more in the conventional mode than in the waqf mode, which is an indicator of the stabilising effect of waqf. Accordingly, price levels rise more rapidly in the conventional model. The significance of waqf for stability can be seen in Table 2, as banks become more resilient to bank runs when waqf is introduced into the system and plays the role of financial stabiliser. However, it can be inferred that even if Islamic financial institutions and products are introduced to a conventional riba-based system, their contribution to the achievement of Islamic socioeconomic goals would be limited, as suggested by the results.

V. CONCLUSION AND RECOMMENDATIONS

5.1. Conclusion

Based on the results of the research and the analysis conducted, the following conclusions are drawn:

- In the fractional reserve system, debt and price levels are more volatile; however, in the full reserve system, these indicators remain more stable.
- The fractional reserve system weakens banks' resilience to shocks, while increasing the reserve requirement would only help to postpone possible liquidity crises.
- Establishment of Islamic institutions such as waqf within the riba-based fractional reserve system improves the economic indicators, but imbalances in these indicators continue to be observed.
- Waqf has stabilising effects on the economy in both banking systems, but these effects are more obvious in the fractional reserve system, as the full reserve system already provides a more stable base.

It is concluded that in the fractional reserve banking system, banks are capable of producing a significant amount of credit money and they tend to use this capability to counteract fluctuations in the economic cycle, where they ultimately cause instability rather than stability in the economy. The full reserve system proved to be a better solution than waqf, since the results show that it had greater stabilising effects.

5.2. Recommendations

The way forward requires a paradigm shift that complies with Islamic socio-economic goals, which is necessary to unleash the full potential of Islamic social and financial institutions. Considering that Islamic banks are subject to the same legal framework as conventional ones, new regulations and control mechanisms

should be introduced to ensure that they do not operate based on the fractional reserve system. The full system is seen as an important step or tool on the path to achieving the goals of well-performing zakah and waqf institutions, together with the complete elimination of riba. The transition to a full reserve system in the banking sector will not be enough alone to solve problems; it is also necessary to ensure that the Islamic financial system is built and operated by its original institutions. As many studies have emphasised, Islamic economic models offer a plausible alternative to conventional ones. In this respect, policymakers could benefit from the advantages of the waqf model to build a more stable and robust economic system.

In general, Islamic banks are subject to the same regulations and international standards as conventional ones, which enables them to produce credit money through fractional reserve. However, they can avoid this by maintaining a full reserve and showing preference for the risk sharing modes of Islamic finance, instead of covering up conventional methods. Even though they claim that their operations are based on real assets, the creation of credit money is inevitable, even in a fractional reserve system consisting entirely of Islamic banks. Conventional banks aim to maximise their profits by focusing solely on capitalist motives. Islamic banks, however, should not only operate under market dynamics, but also take into consideration Islamic socioeconomic goals.

The study has limitations, as it ignores many other actors and markets in the economy, which could also be included to enable a more accurate and elaborate analysis. Agent-based modeling enables researchers to build bottom-up models in order to see the results of major changes in parameters quickly. However, expanding a model by including more agents could make it difficult to interpret the results, as the interactions between the agents will become more complicated. It might be interesting to enhance the lending channel by relaxing the assumption of matching each household with a single bank, thus allowing for a more interconnected banking network. Similarly, a more complicated waqf model could be designed by attributing waqf as a financial intermediary which provides various financial instruments, just like the Ottoman cash waqfs. Finally, lender of last resort and deposit insurance schemes could be introduced to the model to analyse how government interventions contribute to economic stability and what possible tradeoffs there would be because of these interventions.

REFERENCES

Ahmad, Z., & Ismail, A. (2017). Full Reserve System and the Maqasid Shariah. *Journal of Emerging Economies & Islamic Research, 5*(2), 58-66.

Ahmed, H. (2004). *Role of Zakah and Awqaf in Poverty Alleviation.* Jeddah: Islamic Research & Training Institute.

Askari, H., & Krichene, N. (2014). Islamic Finance: An Alternative Financial System for Stability, Equity, and Growth. *PSL Quarterly Review, 67*(268), pp. 9-54.

Ayub, M. (2018). Institutionalising Waqf for Realising the Shared Development Objective by Islamic Banks and Financial Institutions. *Journal of Islamic Business and Management, 8*(2), 330-343. Retrieved from https://doi.org/10.26501/jibm/2018.0802-001

Benes, J., & Kumhof, M. (2012). *The Chicago Plan Revisited.* IMF working paper.

Bulut, M., & Korkut, C. (2016). Financial Stability and Cash Waqfs: Samples of Rumelia Cash Waqfs. *İslam Ekonomisi ve Finansı Dergisi,1*, 55-76.

Chan-Lau, J. A. (2017). *ABBA: An Agent-Based Model of the Banking System.* IMF Working Paper No: WP/17/136.

Cincotti, S., Raberto, M., & Teglio, A. (2010). Credit Money and Macroeconomic Instability in the Agent-based Model and Simulator Eurace. *Economics: The Open-Access, Open-Assessment E-Journal, 4*(2010-26), 1-32. doi:http://dx.doi.org/10.5018/economics-ejournal.ja.2010-26

Cizakca, M. (1998). Awqaf in History and Its Implıcations for Modern Islamic Economies. *Islamic Economic Studies, 6*(1), 43-70.

Dixhoorn, C. V. (2013). *Full Reserve Banking: An Analysis of Four.* Utrecht, The Netherlands: A study for the Sustainable Finance Lab. Retrieved 8 October 2019 from http://sustainablefinancelab.nl/wpcontent/.

Dow, S., Johnsen, G., & Montagnoli, A. (2015). A Critique of Full Reserve Banking. *Sheffield Economic Research Paper Series.* Retrieved from https://ideas.repec.org/p/shf/wpaper/2015008.html

Dyson, B., Greenham, T., & Ryan-Collins, J. (2010). *Towards a Twenty-first Century Banking and Monetary System.* Centre for Banking, Finance and Sustainable Development The New Economics Foundation, Positive Money. Location of centre? What "Positive Money" refer to?

Farmer , J., & Foley, D. (2009). The Economy Needs Agent-based Modelling. *Nature* (460), 685-686.

Fisher, I. (1935). *100% Money.* New York: Adelphi Company. Retrieved from http://fisher-100money.blogspot.com

Fisher, I. (1936). *100% Money and the Public Debt.* (2. ThaiSunset Publications, Ed.) Economic Forum.

Friedman, M. (1960). *A Program For Monetary Stability.* New York: Fordham University Press.

García, V., Cibils, V., & Maino, R. (2004). Remedy For Banking Crises: What Chicago And Islam Have In Common. *Islamic Economic Studies, 11*, 2-22.

Global Islamic Finance Report. (2015). *Waqf and Islamic Banking and Finance: The Missing Link.* 5.

Goodhart, C., & Jensen, M. (2015). Currency School versus Banking School: An Ongoing Confrontation. *Economic Thought, 4*(2), 20-31. Retrieved from http://eprints.lse.ac.uk/id/eprint/64068

Hatta, M., & Dien, M. (2014). Examining the Dominance of Islamic Debt-based Products in the Economy. *International Journal of Arts and Commerce, 3*(6), 51-68.

Hatta, M., Dien, M., & Mohamad, S. (2014). Examining the Impact of Islamic Products on Debt Expansion and Inflationary Pressure. *International Interdisciplinary Journal of Scientific Research, 1*(2), 13-28.

Hauner, T. (2017). Essays on Inequality and Macroeconomic Stability (CUNY). Retrieved from https://academicworks.cuny.edu/gc_etds/2173

Hoog, S., & Dawid, H. (2017). Bubbles, Crashes and the Financial Cycle: The Impact of Banking Regulation on Deep Recessions. Retrieved from https://www.researchgate.net/publication/321917107

Jackson, A., & Dyson, B. (2012). *Modernising Money: Why Our Monetary System is Broken and How it Can be Fixed.* UK: Positive Money.

Kahf, M., & Mohomed, A. (2017). Cash Waqf: An Innovative Instrument of Personal Finance In Islamic Banking. *Journal of Islamic Economics, Banking and Finance, 13*(3), 13-29.

Khan, M. S. (1986). Islamic Interest-Free Banking: A Theoretical Analysis. *International Monetary Fund Staff Papers, 33*(1), pp. 1-27. Retrieved from http://www.jstor.org/stable/3866920

Knight, F., Cox, G., Director, A., Douglas, P., Hart, A., Mints, L., … Simons, H. (1933). *Memorandum on Banking Reform*.

Lainà, P. (2015). Proposals for Full-Reserve Banking: A Historical Survey from David Ricardo to Martin Wolf. *Economic Thought, 4*(2), 1-19. Retrieved from https://ssrn.com/abstract=2719438

Lengnick, M., Krug, S., & Wohltmann, H.-W. (2013). Money Creation and Financial Instability: An Agent-Based Credit Network Approach. *Economics: The Open-Access, Open-Assessment E-Journal, 7*(2013-32), 1-44. doi:10.5018/economics-ejournal.ja.2013-32

Litan, R. (1987). *What Should Banks Do?* Washington, DC: Brookings Institution.

Mallett, J. (2015). Threadneedle: An Experimental Tool for the Simulation and Analysis of Fractional Reserve Banking Systems. Retrieved from https://ideas.repec.org/p/arx/papers/1502.06163.html

McLeay, M., Radia, A., & Thomas, R. (2014). Money creation in the modern economy. *Quarterly Bulletin 2014 Q1*.

Meera, A., & Larbani, M. (n.d.). Ownership Effects of Fractional Reserve Banking: An Islamic Perspective. Retrieved from http://www.ahamedkameel.com/wp-content/uploads/2014/01/FRBEffects.pdf

Minsky, H. (1992). *The Financial Instability Hypothesis.* Levy Economics Institute Working Paper 74. Retrieved from http://www.levy.org/pubs/wp74.pdf

Mohsin, M. I. (2013). Financing Through Cash-waqf: A Revitalization to Finance Different Needs. *International Journal of Islamic and Middle Eastern Finance and Management, 6*(4), 304-321.

Monett, D., & Navarro-Barrientos, J. (2016). Simulating the Fractional Reserve Banking Using Agent-based Modelling with NetLogo. *Federated Conference on Computer Science and Information Systems (FedCSIS),* (pp. 1467-1470). Retrieved from https://annals-csis.org/proceedings/2016/pliks/373.pdf

Pamuk, S. (2004). The Evolution of Financial Institutions in the Ottoman Empire, 1600–1914. *Financial History Review, II*(I), 7-32. doi:10.1017/S0968565004000022

Pollock, A. J. (1992). Collateralized Money: An Idea Whose Time Has Come Again. *Challenge, 35*(5), 62–64. Retrieved from http://www.jstor.org/stable/40721381

Qaradāghī, A. M.-D. (1995). The Fluctuating Value of Paper Currency and Its Impact On Rights And Obligations In Light Of The Principles Of Islamic Jurisprudence. *Paper Presented at the Ninth Session of the International Islamic Fiqh Academy of the OIC, April 1995.* Abu Dhabi, UAE.

Ricardo, D. (1824). *Plan for the Establishment of a National Bank.* London: John Murray. Retrieved from https://books.google.com.tr/books?id=jozAQAAMAAJ

Sani, M., Arfah, S., Meera, A., & Aziuddin, A. (2012). Fractional Reserve Banking and Maqasid al-shariah: An Incompatible Practice. Retrieved from https://ssrn.com/abstract=2071164

Shapiee, R., & Zahid, A. (2010). Addressing Economic Meltdown: An Evaluation of Fiat and Credit Money from Islamic Perspective. *Proceedings of ASBBS Annual Conference*, (pp. 768-783). Las Vegas.

Sigurjonsson, F. (2015). *Monetary Reform – A Better Monetary System for Iceland.* Reykjavik: Report Commissioned by Prime.

Simons, H., Cox, G., Director, A., Douglas, P., Hart, A., Knight, F., … Schultz, H. (1933). *Banking and currency reform*.

Spong, K. (1993). Narrow Banks: An Alternative Approach to Banking Reform. In *Federal Reserve Bank of Kansas City* (No. 90). https://doi.org/10.2139/ssrn.142832

Syamlan, Y. T. (2016). The Epistemological Perspective of Fractional Reserve Banking System and 100% Reserve Banking System: Where Should Islamic Banks Stand? *Tazkia Islamic Finance and Business Review*, 61-80. Retrieved from http://tifbrtazkia.org/index.php/TIFBR/article/view/98/103

Syammon, J., Abdullah, A., & Meera, A. K. (2017). Fiat money: from the Current Islamic Finance Scholars' Perspective. *Humanomics, 33*(3), 274-299. doi:https://doi.org/10.1108/H-01-2017-0013

Tedeschi, G., Mazloumian, A., Gallegati, M., & Helbing, D. (2012). Bankruptcy Cascades in Interbank Markets. *PLoS ONE, 7*(12), 1-10. doi:10.1371/journal.pone.0052749

Tekdogan, O. F. (2019). An Islamic Economics Perspective to the Role of the Fractional Reserve Banking in Economic Instability and the Potential of Full Reserve Banking as a Remedy. *Ph.D. Thesis*. İstanbul: İstanbul University.

Tekdogan, O. F., & Sarac, M. (2019). The Problems with Fractional Reserve Banking and Proposing a New Shariah Compliant Full Reserve Banking Model. *7th Islamic Economics Workshop: Monetary Issues in Islamic Economics, 5-7 April 2019.* İstanbul.

Tobin, J. (1967). Commercial Banks as Creators of Money. In J. T. ed. D.D. Hester, *Financial Markets and Economic Activity* (pp. 2-11). New York: Wiley. Ehttps://www.librarydevelopment.group.shef.ac.uk/referencing/apa.html

Werner, R. A. (2014). Can Banks Individually Create Money out of Nothing? — The Theories and the Empirical Evidence. *International Review of Financial Analysis, 36*, 1-19.

Zaman, A. (2015). *On The Nature Of Modern Money.* Retrieved from https://ssrn.com/abstract=2535697