Financial Stability of Conventional and Islamic Banks: A Survey

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Abstract. This paper surveys the financial stability of conventional and Islamic banking. The stability of the financial system requires a greater role for equity and risk-sharing and tying the credits to the real economy. The rate of profit model (SR) proves the inferiority of the interest or fixed return (FR) contract model, and contributes significantly to the stability of a financial system; namely there is no debt expansion and contraction and the real investment might be higher in the SR model than in the FR model. Islamic Banks have shown relative stability to the first wave of the last international crisis of 2007-2008 and then contributed to reducing the volatility of global financial markets. The paper surveyed many empirical papers that use quantitative models to analyze the financial stability of the Islamic and conventional banks. The findings indicate that small Islamic banks are more stable than small conventional banks; large conventional banks are more stable than large Islamic banks; Islamic banks have been affected by the crisis; and traditional banks may be more competitive than the Islamic banks. In respect to business orientation, efficiency, risk-taking, and stability, some empirical papers find little significant differences between Islamic and conventional banks. The central bank policy to stabilize the price level or to smooth the interest rate changes seemed to enhance banking stability.

Keywords. Financial stability; Financial reform; Islamic finance; Policy analysis
JEL Class. G2

1. Introduction

Financial stability is defined as liquidity, solvability, and positive net worth of a financial institution. A bank is financially stable if it meets all payments upon it with its own or borrowed funds. It becomes financially unstable if it fails its payments obligations due to deficit of its own funds and refusal of the central bank and the interbank market to extend to it loan facilities. In such event, it may have to recapitalize or face bankruptcy. A maturity mismatch between assets and liabilities, such as financing long-term assets with short-term deposits, would threaten financial stability. Likewise, compromised assets turn net worth negative and would undermine financial stability of a bank, leading eventually to its bankruptcy. This definition of stability applies to the whole banking system. The latter is stable if it is liquid, solvable, and has a positive net worth.

Interest-based debt has been condemned in the divine revelations; it is strictly forbidden in Islam.[1] Conventional banking, because it issues interest-based debt, is inherently unstable (Quran 2:276, Itani 2012). In view of the severe periodic banking crises in the commercial nations since early 1800s, this fact needs no proof. Immense literature has covered it (Hume 1752, Gouge 1833, Carroll 1850s, Simons 1947, Minsky 1986, Reinhart and Rogoff 2008). Conventional banking was not able to operate in a commodity money environment as exemplified by the UK gold suspension in 1931 and the US gold suspension in 1971. The fiat money base and bank credit have to increase without stop to enable the debt payment and prevent a debt deflation. Conventional banking in many advanced countries required trillions of dollars in bailouts for its bailouts during the 2008 crisis; whereas thousands of banks had to disappear during the 1929 Great Depression, ruining depositors. The monetary policy in many advanced nations since 2008 has been too expansionary to enhance the stability of conventional banking and contributed to a record build-up of debt and historic stock prices bubbles which may threaten anew the conventional banking stability. In brief, conventional banking needs a central bank on a daily basis for its smooth functioning and cannot survive on its own.

Islamic finance forbids interest contracts; it is basically a risk-sharing finance. A major source of instability is removed, which is the conventional interest-based debt. As a feasible

[1] Interest-based debt has many basic shortcomings which often cause debtor's default. Considering discount, the amount borrowed could be substantially lower than the face value of debt; debt starts generating interest instantly, whereas the project in which it is invested, such as planting an apple tree, may yield return only few years later and on a seasonal basis. Hence, the debtor may not have the cash-flow for the interim interest payments. The actual rate of return may be lower than the rate of interest, or maybe a loss. Debtor needs an inflation to reduce the real debt burden. Money may not increase at the same rate as the interest rate; in such event, the debtor may be short of cash. Debt may be spent in consumptive activity, and will have no capital base for its repayment, leading to default.

form of financial intermediation, Islamic finance has been developed in Islamic and non-Islamic countries. Based on the Shariah-compliant system, Islamic finance develops many financial products substitutable to conventional products. The financial infrastructure and the financial markets with harmonized and dynamic legal, regulatory and supervisory Islamic background should strengthen the stability of the banking system. There is a straightforward creditor-debtor i.e. lender-borrower relationship in the conventional banking system, but the investor-entrepreneur relationship in Islamic banking is more multifaceted including many inherent risks, such as liquidity, credit, and market risk, associated with different types of Islamic financial contracts. The management of these inherent risks becomes important due to the Profit-Loss-Sharing (PLS) system and needs to be quantified to capture the stability level of Islamic finance.

The absence of interest-debt combined with a strong interdependence and synergies between money, capital, and equity markets lead via diverse funding mechanism and efficient distribution of risks in the short and long-run to support stability in the Islamic finance system.

In most of Islamic countries, the Islamic financial system operates in parallel with the conventional system that contains Islamic windows basis.[2] The Islamic intermediation process should conduct to more trade, business, and investment and contribute in fine to greater financial stability. Whereas, the conventional finance system through interest-based debt flows and leveraged funds conducts to more risk of instability.

2. Theoretical background of financial stability

In the conventional economic and finance literature, there is no unique and homogeneous definition of financial stability. The financial instability is defined by its impacts on the banking system and economy. This perception leads to define the financial stability in financial markets, which are evolved to reduce the ongoing asymmetric information problems of adverse selection and moral hazard (Mishkin 1999). The functioning of financial markets is perturbed when shocks occur for multiple reasons (Goodhart 2006). These shocks reduce the ability of financial markets through financial intermediation to finance productive investments and thus lead to increasing the interest rates and the level of uncertainty in economic and finance activities that could decrease the asset prices.

[2] The presence of Islamic windows in conventional banks was crucially confusing competitive reactions of conventional banks to save and attract more deposits. But, there is no Islamic bank with conventional windows. In fact, many banking system in Asia and Middle-East has eliminate this mixed financial system to allow the specificity of each bank or financial institution.

To face the shocks, the banks increase the interest rates, resort to credit rationing and enhanced safety collaterals; then, the borrowers would be the high-risk investors who probably could generate more shocks and cause more financial instability (Carroll 1850s, Fisher 1933). The monetary and financial authorities of the government could fail in supervising banks and couldn't limit the impacts of the financial crisis.

Also at the macro level, the high degree of domestic illiquidity caused by debt contraction following the rapid credit growth could explain why debtors could not meet their short-term financial foreign or domestic obligations even if inflation and budget deficit are low (Mishkin 1999). The government, if it is possible, could reassure depositors and foreign lenders, through monetary and financial authorities, by injecting some liquidity to avoid the collapse of the financial system and promote economic and financial recovery.[3] It remains that the monetary authority should allow banks to generate the credit money via the credit multiplier that depend on the legal reserves rate. This mechanism, making credit more available without real money, makes matters worse; it is an inherent core of the banking system that depends on the audacity of families and corporations to contract loans.

The financial instability affects not only the financial system (banks, non-banks, stock markets, debt markets and financial infrastructure of payments and settlements[4]) through a sudden change in different financial prices or costs, but generates many significant perturbations and disruptions in the real economy (Allen and Wood 2006, Large 2003).

Following Schinasi (2004), the financial stability is there, when the financial system could dissipate financial discrepancies happening endogenously or exogenously as unanticipated shocks. Such imbalances emerging in financial system should impede the normal evolution of the real economy and reduce the confidence of the population as individuals and firms. The financial system fails in channeling efficiently savings into productive investment and couldn't distribute or redistribute risks appropriately between contractual parties in the financial system.

It is not easy to detect an early macroeconomic impact of financial instability in the short run unless the financial system has experienced a similar previous financial crisis. The standard and specific data are needed to elaborate many empirical studies serving to understand the spreading of the financial instability, ascertain if this instability is transitory or permanent, and

[3] This is indeed the policy of the US Federal Reserve, the European Central Bank, and the Bank of Japan. Moreover, swap facilities between central banks insure plentiful foreign exchange in every major financial market.
[4] In principle, the financial infrastructure includes legal frameworks, accounting, auditing, external monitoring and corporate governance.

assess its impacts on the financial system and short and long-run effects on the real economy (Ghassan, Taher and Adhailan 2011).

The available econometric modeling, considering different stylized facts, could help to identify many of these short and long-run effects on the financial system and real economy. Even if it is based on ad-hoc hypotheses related to parameters, the structural vector autoregressive model (SVAR, Amisano and Giannini 1997) and the factor vector autoregressive model (FAVAR, Bagliano and Morana 2008) could help to evaluate over time the impulse responses of variables of interest, combining financial and economic variables, to a structural shock (For more details see Appendix A below). The Basel 3 framework (2008) defines that banks have to maintain a minimum capital requirement, ensuring that they can meet their obligations and face unexpected losses following shocks of financial fragility, instability or crisis. This framework aims to make banks responsible in the first line against shocks without resorting to regulatory changes by the central bank.

3. Modeling Islamic financial risk-sharing

Many eminent western economists as Fisher (1945), Simons (1947) and Friedman (1969) have argued that the current (one-sided liability) interest-based financial system is fundamentally unstable. Also, the new economists as in the Institute for the new economic thinking (INET 2012) consider that the current economic and financial theories, based on risk-shifting paradigm, have many deficiencies and require new concepts and principles to face new economic and financial challenges. The stability of the financial system requires a greater role for equity and risk-sharing and tying the credits to the real economy. Such conditions in a new paradigm of the financial framework (Chapra 2005) and a new paradigm of the social-economic system (Hassan and Kayed 2009) would preserve the market discipline leading to stabilize the financial system and to promote socio-economic well-being of the society.

In principle, the rate of profit, called here the stochastic return (SR), model seems to be a Pareto-Optimal Contract and proves the inferiority of the interest-based debt, called here the fixed return (FR) contract model.[5,6] But the debt market dominates throughout the world. Furthermore, the Pareto-optimal solution could improve the payoff of the financier in the FR model if the payoff of SR model has been increased and the additional profits would be shared

[5] Pareto optimum market allocation is an allocation that improves the welfare of a number of traders without diminishing the welfare of any other trader.

[6] Presently, stock returns in the US are about 22% per year versus 2.4% on US government bonds (For more details, see Mehra and Prescott 1985).

with the other investors operating in FR model. The SR model spreads risk more evenly than the FR model; considering the risk aversion of the investors, the SR model dominates the FR model and the higher outcomes should be associated with the active one i.e. the SR investor (For more details see Appendix B and Ghassan 2012).

Besides, the SR model has far-reaching impacts on the stability of a financial system; namely there is no debt expansion and contraction. So, this result is very opportune for the financial policy purposes. The real macroeconomic investment might be higher in the SR model than in the FR model at least because it doesn't require imperative collateral and it could reward the riskier agent. This is the case when the bank operates a discount on the loan.

The whole Islamic system of risk-sharing is not fully applied to allow the setting up of real Islamic finance except in few countries such Malaysia and Sudan, in addition to the ethical dimension that requires a sincere implementation of Islamic theory of finance allowing to solve expected financial crises (Hassan and Adebayo 2010). Islamic banks are still in the stage of shaping themselves to operate in thorough Shariah-complaint models. Furthermore, the economic and financial behaviors still are affected by the greed, inequality and excessive consumption. Nevertheless, the implementation of a mixed-financial system in most of Islamic countries makes it not easy to prove the stability of Islamic banks empirically in comparison with conventional banks. Also, in the competitiveness mixed-financial framework, Islamic banks seem to not be able to reach an optimal size.

4. Islamic versus conventional financial system

Islamic banks have several specific alternatives as financial products to conventional banking products such as Murabahah, Musharakah, Mudarabah, Sukuk and Amanah (Khan 2010). These financial contracts prove that Islamic finance is a systematic alternative banking system. The Islamic financing has two families of contracts; the first (like Musharakah, Mudarabah) is related to PLS system where the return is stochastic and depends on the ultimate outcome of the investment. The second family (like Murabahah, Ijarah, Salam, Sukuk) is associated with the sale of goods and services on credit, or the rental of an asset (Sukuk), and leads to the indebtedness of the party purchasing those goods and services at a fixed price of sale including commercial profit (Hassan and Lewis 2007). The first family features show that Islamic banks' doings are more closely correlated to the real economy and then could help to reduce the likelihood of financial crisis. The multiplicity of financial products methods could lead to the misinterpretation of the terms of contracts, named legal ambiguity, which increase operational risk. Likewise, for the second family.

Many papers like (Sundararajan and Errico 2002, Iqbal and Llewellyn 2002, Cihak and Hesse 2010, and Ghassan and Taher 2012) discuss theoretically and empirically if the Islamic banks are stable compared to conventional banks. The features of each system need to be considered when estimating comparative stability.

Studying the theoretical stability of Islamic banks requires the distinction between banks according to the asset structure in their balance sheets. Firstly, Islamic banks adopted single layer Mudarabah, where they mobilize their liabilities directly in different investment opportunities. This model was faced with a lot of operational risks.[7] Accordingly, Islamic banks switched to the use of multi-layers Mudarabah Islamic model, i.e., Mudarabah of assets (sources) and liabilities (uses), where all assets are financed through PLS system.

In this system, the investment depositors (equity investors) bear credit risk proportionally to their share in the financed project, but also the overall degree of risk on the asset side of banks' balance sheet is increased. This system is then based on risk sharing instruments and could bring market discipline and stability to the financial system. In contrast, banks holding debt in case of failure lose part of their investment portfolio. Intrinsically based on the stochastic return of investment, the PLS system is not exempted of credit risk, because at least the collateral is not required. Also, the Islamic banks use fewer risk-hedging instruments than conventional banks. But the expansion of Islamic money market instruments, in addition to the implicit commitment of the central bank, could make available the required liquidity to support all Islamic banks during exceptional events.

Nonetheless, many factors contribute to making Islamic banks more stable than conventional banks. The risk sharing arrangements on the deposit side of Islamic banks provide an important layer of protection, in addition to their book capital. The difficult access to liquidity and the achievement of competitive return to investment depositors could compel Islamic banks to have a conservative behavior. In such cases, the Islamic banks may have higher liquidity reserves. Knowing that Islamic investments seem to be riskier than conventional investments, in financial stability perspective the issue is to test if the returns of investments absorb or compensate the shocks of higher risks.

The main feature of Islamic financial system is the prohibition of interest rate system; this feature contributes to an inherent stability of Islamic banking system. Islamic banks do not create and destroy money through the credit multiplier as under conventional banks, but attract

[7] The importance of operational risk in Islamic finance, as Shariah compliance risk, reveals the complexities related to the implementation and the monitoring of PLS modes to avoid the negligence and misconduct of the entrepreneurs.

the savings and generate incentive mechanism to stimulate investment depositors (Iqbal and Mirakhor 2011). An Islamic bank is assumed to match deposit maturities with investment maturities i.e. longer-term deposits are used for long-term investments. Also, under the Islamic financial system, maturities of assets and liabilities are assumed to be matched.

The higher capitalization of Islamic banks, in addition to their higher liquidity reserves, could explain the relatively better performance in terms of profitability and stability mainly during the recent international financial crisis. Islamic Banks have shown relative stability to the first wave of the last international crisis of 2007-2008 and then contributed to reducing the volatility of global financial markets (Beck, Demirgüç-Kunt and Merrouche 2013). One possible explanation of the relatively better performance in terms of stability during the recent international financial crisis is the higher capitalization and liquidity reserves of Islamic banks. Another potential explanation is the only partial integration of Islamic banks into the global financial system, as Islamic banks are prohibited from dealing with the sale of derivatives and loans (Hassan 2006).

The interest-bearing modes through debt and leveraging mechanism are the major source that cause instability, and the like of equity financing as in Islamic finance may support the system to enhance its immunity against financial shocks. In an Islamic finance framework, the financial institutions will bear only probable loss proportionally to the fraction of its share in the invested capital. Furthermore, the absence of debt and leveraging (excluding hedge funds and securitization) make financial failure limited to client investor and does not endanger other institutions. The Islamic Financial System is based on a risk-sharing model, because returns to invested funds can be positive or negative, they are determined only after there are realized profits or losses. Returns are distributed to depositors as if they were shareholders of equity capital. Then, returns are directly associated with real activities. Therefore, in Islamic finance, there is an organic relationship between the financial sector and the real economic growth. Since debt, and therefore debt default, are absent, depositors do not risk losing their assets.

In the conventional system, there are multi-layers of ownership, which may leave the final investor without any recovery of deposit in case of default. In the Islamic system, there are strict requirements of no ambiguous ownership rights for the investor and the investor's returns are linked to the profit or loss of a collection of assets.

5. Empirical tests of stability

There are few papers that use quantitative models to analyze the financial stability of the Islamic and conventional banks. Cihak and Hesse (2010) analyze, via z-score as a criterion of

stability, a sample of twenty countries extracted from the BankScope database, which contains the Islamic banks and conventional commercial banks. The Islamic banks are classified into small and large banks according to their assets size with a threshold of one billion dollars and having at least 1% of the total assets of banks in the country. The findings of Cihak and Hesse (2010) indicate that small Islamic banks are more stable than small conventional banks; large conventional banks are more stable than large Islamic banks; and small Islamic banks are more stable than large Islamic banks. They don't show if the large conventional banks are less stable than small Islamic banks.

The Islamic banks could be affected positively or negatively by financial crisis or banking crisis or bankruptcies of conventional banks even if the Islamic banks operate in respect to their assets according to Islamic finance principles. So, Standard & Poor's (S&P) Credit Rating indicates that the Islamic financial institutions satisfy 15% of Muslims needs of financial services and that the size of assets compatible with Islamic-Shariah reached 400 billion dollars in 2009 i.e. approximately 10% of the international market, which was around 4 trillion dollars. According to S&P Credit ratings, at the end of 2016, the Islamic assets reached $2.1 trillion.[8] Reuters reported that around $1.3 trillion of these assets were held by Islamic commercial banks, and that Islamic finance sector accounted for over 15% of total financial assets.[9]

Hasan and Dridi (2010) analyzed the effects of the recent international financial crisis, especially during the period (2007-2008), on the conventional and Islamic banks in eight countries, including the GCC countries. Using a range of banking indicators such as profitability, loan growth, asset growth and the external credit rating, they found that Islamic banks had been affected by the crisis but in a different way comparatively to conventional banks. The Islamic banks profitability in 2008 reduced the negative impact of the international financial crisis. Also, the growth rate of credits and investments assets (loans granted in the PLS system) exhibited that the performance of Islamic banks was better than that of conventional banks, given the large losses incurred by conventional banks following the international financial crisis. Hence, the Islamic banks contributed to realizing the financial stability. However, the Islamic banks had some weaknesses related to their risk management. In this respect, they are exposed to potential financial shocks, which require reliable financial instruments to resolve the risk management above all liquidity risk. Abedifar et al. (2013) find that the small Islamic banks are more stable than the small conventional banks. Also, there is

[8] http://www.spratings.com/en_US/topic/-/render/topic-detail/the-positive-outlook-for-islamic-finance
[9] http://www.reuters.com/article/islamic-finance-imf-idUSL8N1G7034

little evidence that the Islamic banks (IBs) charge rents to their customers. In contrast to the findings of Abedifar et al. (2013), the small IBs, as Bank AlBilad in Saudi Arabia, appear less stable. Thus, it is not evident that the IBs, based in Muslim countries, have lower credit risk.

The study of Imam and Kpodar (2010) identifies the factors affecting the world expansion of Islamic banks, which, in the case of success, could be a new alternative financial model for the finance industry. They use many factors affecting the international spread of Islamic banks such as the proportion of Muslim population per country, technology of the domestic financial system, competitiveness of the domestic financial system, average of per capita income, real interest rate, events of September 11, 2001, crude oil price, and integration degree to Middle East countries. The findings show that the average of per capita income and the competitiveness of the banking system have significant positive impacts on the spread of Islamic banks, expressing the increasing need for Islamic financial intermediation across the world. Also, the decrease in real interest rates less than 3.5% led to more deposits with the Islamic banks.

The paper of Turk Ariss (2010) focuses on competitiveness conditions of Islamic and conventional banks by using several indicators such as PR H-statistic index and Lerner index (market power of bank). Using annual data, from 2000 to 2006, the findings indicate that the weak competitiveness is related significantly and positively to the higher level of profitability and that traditional banks are more competitive than the Islamic banks.

Beck, Demirgüç-Kunt, and Merrouche (2013) formalize the bank stability via several indicators, (i) z-score, (ii) return on assets, (iii) equity assets ratio and (iv) maturity matching. They use BankScope annual data provided by VanDyck, and many other empirical papers. The scale economies at their optimal levels would lead to more efficiency for large banks, but following Beck, Demirguc-Kunt and Levine (2006) and Beck (2008) the relationship between size and stability remains ambiguous theoretically and empirically. Several writers have also related stability of financial systems to bank concentration (Berger, Demirgüç-Kunt, Haubrich and Levine 2004, and Beck 2006). Beck, Demirgüç-Kunt, and Merrouche (2013); they conclude that theory suggests significant effect of the equity-like nature of Islamic banking on business orientation, efficiency, risk-taking, and stability. But, their empirical estimations exhibit little significant differences between Islamic and conventional banks. They suggest that disaggregated data on specific products in the balance sheet and income statements are crucial to understanding better the differences in financial service between conventional and Islamic banks. Also, the use of banking products by firms and enterprises could rationalize the comparison between Islamic and conventional banks.

Using Pakistan bi-banking loans and deposits with panel weekly database between July 11, 2008 and January 2, 2009, Farooq and Zaheer (2015a) show that the Islamic banks branches are less prone to deposit withdrawals and allow more loans during financial panics. They attribute this behavior to the religious features of their customers, and that bank and the customer share approximately identical ethical values. In addition, they find that greater financial inclusion of faith-based groups may improve the financial stability of the banks. Also, by using Pakistan Banks' branches quarterly data from Q2 2002 to Q1 2010 for 21 conventional banks (CBs), 6 IBs and 13 mixed banks, and considering for IBs two versions of the z-score index depending on treating PLS saving and investments (S&I) accounts as liabilities or as equity.[10] Based on the PLS as a part of equity (capital), Farooq et al. (2015b) find that IBs show sound financial stability and have a better asset quality than CBs. At the branches level and based on the PLS as a part of liabilities for the IBs, they exhibit that the IBs branch z-score index is lower than that of conventional part of the mixed banks. They conclude that the presence of IBs improves the financial stability.[11]

Dawood et al. (2016) use a dynamic model of z-score to capture the persistence of the bank behavior about financial stability. After the international financial crisis, the Basel Committee on Banking Supervision introduced a new regulatory framework. It consists on dealing with the financial instability through two new regulatory tool-measures checking on funding stability as the Liquidity Coverage Ratio (LCR) and the Net Stable Funding Ratio (NSFR). The Islamic Financial Services Board agrees to the new rules of the Basel III accord, but modified the last measure to make it more conform to the Islamic banking features. Using a panel data from 136 IBs between 2000 and 2013, Dawood et al. (2016) find that the NSFR has a significant positive effect on the IBs stability index. This result qualifies the NSFR as tool for controlling the soundness of IBs. But, they exhibit also a negative effect of size-NSFR interaction on z-score. There is a contradiction between the negative z-score-NSFR correlation and the positive estimate of the parameter associated to NSFR in explaining z-score.[12]

The z-score is a well-known index of insolvency; it combines the indices return on assets, and equity assets ratios. The maturity match (iv) is measured as the ratio of liquid assets to

[10] When the PLS S&I accounts are considered as equity, the capital asset ratio (car or k) tends to be greater than when such accounts are treated as liabilities. It is not obvious that the z-score index will be greater in the first case, because it depends on the volatility of the return on assets ratio.

[11] A detailed review of the literature related to the financial stability in Islamic finance is descriptively well-documented in Belouafi et al. (2015).

[12] In contrast to the regression analysis, the correlation analysis works with random variables without distinction between dependent and explanatory variables, but the algebraic signs of the partial estimate and the correlation coefficient are the same. Gideon (2010) proved the similar signs between coefficients-based correlation and estimates slopes-based regression.

short-term deposits to evaluate the sensitivity to bank runs. In fact, when the bank liabilities exceed the market value of its assets, the bank becomes insolvent; this insolvency is a more serious problem than liquidity. But, a bank may become illiquid even when it is solvent, if its assets are held in illiquid assets (long-term financial assets or real assets) that can only be liquidated at a high cost. The bank may be forced to sell such assets at a considerable loss, by selling it at lower than its nominal value. The z-score indicator can be applied to conventional and Islamic banks as well, using banks' accounting data. But, if the z-score index is widely used as a measure of the conventional banks, it would be more reliable to measure the stability of Islamic banks using a specific index. Knowing that the Islamic banks follow different contracts form of investments such as the PLS system and that Islamic banking products are closer to economic and financial conditions, we expect that an alternative indicator reflects multiple risks of Islamic banks by considering the importance of illiquid assets.

The z-score bank's stability index is used for predicting financial distress. It is based on a standard indicator of financial soundness of a group of different financial institutions and focuses on bank's risk of insolvency.[13] The z-score reflects the probability of insolvency or bank liabilities exceed market value of assets. Assuming a normally distributed bank returns μ, then the probability of default is as follows:

$$p(\mu \leq -k) = \int_{-\infty}^{-k} \mathrm{N}(0,1)\mathrm{d}\mu \Leftrightarrow p\left(\frac{R}{A} \leq -\frac{E}{A}\right) = p\left(\frac{\frac{R}{A} - \mu_{\frac{R}{A}}}{\sigma_{\frac{R}{A}}} \leq -k\right) = \Phi(-k)$$

where k is the ratio of (equity capital + total reserves) to assets i.e. $\frac{E}{A}$. μ represents the ratio of average returns to assets. σ stands for the standard deviation of returns to assets i.e. $\frac{R}{A}$, and measures the volatility of returns on assets. The z-score indicates the distance from insolvency, combining accounting measures of profitability (return on assets, ROA), leverage (capital-asset ratio, CAR) and volatility (standard deviation of ROA).[15]

[13] In fact, insolvency is more serious and dangerous problem than liquidity, which means that the bank liabilities exceed its assets, or the bank become insolvent. A bank may become illiquid even when it is solvent, if its assets are held in illiquid assets (long term financial assets or real assets) that can only be liquidated at high cost. The bank may be forced to sell such assets at considerable loss, by selling it at lower than its nominal value. The concept of financial distress, widely used to make financial analysis of banks data, indicates the negative performance of banks. The case of financial distress occurs when the bank becomes insolvent even if bank assets exceed its liabilities. While the concept of economic failure shows that the return rate of investments is less than the interest rate on short loans. Also, the financial failure happens when the enterprise is unable to pay its debts and short-term obligations. The bankruptcy indicates the inability of a company to pay its debts and short-term obligations and the difficulty to manage their financial needs from external funding sources.

[15] Strobel (2010) shows that the best measure of standard deviation requires high frequency such the branch banks data.

The z-score measures the number of standard deviations that a return on assets realization must fall below its expected value before equity is depleted and the bank is insolvent (Cihak 2007, De Nicolo 2000, Boyd, Graham and Hewitt 1993, Hannan and Henwick 1988). The greater z-score indicates the lower likelihood of bank insolvency risk i.e. more stability; the index will take high value when capitalization, measured in terms of risk error, is large.

Defining insolvency as a state where losses exceed equity i.e.

$$-R \geq E \Leftrightarrow R \leq -E \Longrightarrow \frac{R}{A} \leq -\frac{E}{A}$$

the probability of insolvency could be formalized by $p\left(\frac{R}{A} \leq -\frac{E}{A}\right)$ and if returns follow a normal distribution, then $p\left(\frac{R}{A} \leq -\frac{E}{A}\right) = p\left(\frac{\frac{R}{A}-\mu_{\frac{R}{A}}}{\sigma_{\frac{R}{A}}} \leq \frac{-\left[\frac{E}{A}+\mu_{\frac{R}{A}}\right]}{\sigma_{\frac{R}{A}}}\right) = p(Z \leq -z) = \Phi(-z)$

where Φ is called z-score and corresponding to tail-distribution or exceedance. The argument z is the inverse of the probability of insolvency. The significant lower z-score for a group of banks indicates that this group is closer to insolvency than another group of banks.

Most research on this topic uses annual data, Ghassan and Taher (2012), Ghassan and Fachin (2016) paper by using quarterly data contributes to enriching the previous research modeling the financial stability of banks in face of shocks due to financial crises. The panel data feature is that the sample from 2005 to 2011 represents an important part of 64% of the Saudi banking sector with Islamic and conventional banks. It covers close to two-thirds of banks whose shares are traded on the Saudi stock market (Tadawel All Shares Index, TASI), and secondly that the sample contains the events of the recent global financial crisis (2007-2009).

The paper of Alkholy (2009) by using several stability bank indices concludes that the Saudi Islamic and conventional banks have been supported by SAMA and reflect fragile stability. He shows that the Saudi banking sector has successfully absorbed the shocks of international financial crisis. This shock absorption increased the customer confidence and contributed to avoiding a local financial crisis and its detrimental repercussion on the real economy. Saudi banks reserves have been increased by more than three times to face the loan losses, SAMA policy and credit rationing by banks reduce the negative effects of the international financial crisis on Saudi banks significantly. During the first nine months of 2009, the profitability of Saudi banks indicates a tenuous decline around 2.6% (18.86 billion Riyals in 2009 versus 19.37 billion Riyals in 2008). At the same period, AlBilad Bank and Saudi British Bank recorded some losses as reported in their audited income statements; the losses of AlBilad Bank would be more related to home factors.

As many other empirical papers, the financial stability model is explained by variables related to individual banks, banking sector and macroeconomic data. The models are designed for both pooled and panel data, the pooled model is as follows (Ghassan and Taher 2012):

$$z_{it} = \alpha_i + \beta_i B_{it-1} + \gamma_i S_{t-1} + \omega_i M_{t-1} + \pi_i D_i + \varepsilon_{it}$$

where B_{it-1} stands for banks variables, S_{it-1} and $M_{i,t}$ represent banking sector and macroeconomic variables, respectively. We use also D_i as a dummy variable to exhibit to distinguish between the impacts of conventional and Islamic banks on the financial distress on bank i. The term ε_{it} indicates the unobserved stochastic errors. The variables in the RHS of z-score equation are considered with one lag length to capture their effects on the expected z-score index. To exhibit the global effect on banking sector, we formulate a Panel data model and using numerous estimation methods:[16]

$$z_{it} = \alpha_i + \beta B_{it-1} + \gamma S_{t-1} + \omega M_{t-1} + \pi D_i + \varepsilon_{it}$$

The two types of models are estimated by several methods.[17]

The summarized results of the pooled data model show that SAIB (Saudi Investment Bank) and SABB (Saudi British Bank) and mainly AlBilad bank contribute positively to its financial stability index, while SAMBA (Saudi American Bank) group, AlRajhi Bank and, mostly, Riyad Bank have a negative impact on its financial stability index. However, panel data model shows that Islamic banks reduce the value of the financial stability index relatively; meanwhile, they contribute efficiently to enhance the financial stability through the diversification of their assets. The fixed cross effects on z-score indicate that AlBilad Bank had the greatest negative contribution to the financial stability index, followed by SAIB and the SABB, this latter has the least negative impact on z-score. Results also show that Riyad Bank and SAMBA group efficiently support the financial stability of banking sector, while AlRajhi Bank has a positive but relatively moderate role in enhancing the banking sector stability.

The empirical evidence indicates that the ratio of operating cost to income has almost neutral role in improving the financial stability index. AlBilad Bank has a high and unstable ratio of cost to income, while AlRajhi Bank proved to be highly competitive over Riyad Bank. This ratio appears to be more unstable and less competitive in both SAIB and SABB. Conventional banks with high ratio of loans to assets or Islamic banks with high finance (indebtedness

[16] Obviously, when we consider panel banks, the fixed effects are less appropriate than the stochastic effects, but the small number of banks in our sample does not authorize such hypothesis.

[17] Such the Pooled Least Square (PLS) method, without cross-section weights and using standard errors and covariances; the Generalized Pooled Least Squares (PGLS) method, with cross-section weights (correcting for both cross-section heteroscedasticity and contemporaneous correlation) and using SUR errors and covariances; the P2GLS method, with cross-section weights and using SUR errors and covariances, and set of common, cross-section specific and period specific instrumental variables.

through Islamic contracts) to assets ratio, mostly have lower stability indices, as for instance AlBilad bank and SAIB. The competitiveness index seems to be negatively high and strongly significant, which indicates that the Saudi banking sector has relatively less level of competitiveness, that negatively affecting the financial stability. Because of their limited share in the Saudi banking sector Islamic banks do not improve significantly the financial stability index of Saudi banks.

According to Ghassan and Fachin (2016), the analytical features of a panel of Saudi Arabia Islamic and conventional banks allow to reach several interesting conclusions. First, from Saudi banks sample, the variables typically used in financial stability studies appear to be largely non-stationary, a feature heretofore ignored in the literature. This suggests that the available results based on stationary panel regressions, as in Cihak and Hesse (2010) and Abedifar et al. (2013), should be treated with caution. Ghassan and Fachin (2016) conclude that the examination of the cointegration properties of the variables led to find that all the banks included in their sample but one managed to keep their z-scores stationary around some long-run desired level determined by total assets, credit-assets ratio, the competitiveness of the banking sector and the share of Islamic banking in the banking sector. The only exception proved to be a single conventional bank, Saudi British Bank, which somehow supports the view of this type of bank as comparatively less stable than an Islamic bank. However, a comparison of the long-run average z-scores, as estimated by the constants of Fully Modified-OLS regressions of the cointegrating banks, suggests that individual heterogeneity may matter more than the conventional or Islamic nature of the banks. Also, since that each group of banks has specific attitude towards risk and stability, the Saudi Arabia Monetary Authority (SAMA) should apply different regulation and legislation systems. The running of such policies would generate more competitiveness and efficiency in the banking system. Clearly, further work is needed, for instance applying GARCH models to the analysis of volatility in z-scores.

6. Policy programs for financial stability

6.1. Financial reform policy

Considering that banks are essential intermediaries in payments and investment, they should not have prerogative for money creation. Askari and Krichene (2016) show that the condition for a country to have sound money and long-term financial stability and sustained economic growth is to establish via the monetary authority a one hundred percent reserve banking.[18] Such

[18] Historical examples were the Bank of Amsterdam (1609) and the Bank of Hamburg (1619).

system means to not authorize debt money which is created by banks in the fractional reserve banking framework. Furthermore, they argument that the adoption of gold standard monetary system leads to a stable monetary system. They explain that debt money by banks caused (i) excessive government debt; (ii) speculative bubbles; (iii) fueled inflation and exchange rate instability; (iv) reduced investment; (v) economic recession; (vi) unfair distribution of wealth.

Askari and Krichene (2016) explain that the debt-money system cannot persist without the intervention of a central bank for liquidity and government bailouts as for instance since the last international financial crisis from 2008. The debt-based money rise at rates that far exceed the real economic growth. Through leverage process, the bank earned interest income on capital which it did not possess.[19] It has resulted in adverse social implications around the world. According to the US data the money supply reached around $13 trillion versus debt with $46 trillion as of March 2016.[20] Setting interest rates close to zero is most distortive banking policy. Such policy leads to huge borrowing by real estate markets, incites to more consumption via loans, and causes distortions in investment processes. To reduce the depletion of capital, volatility and unjust redistribution of wealth via inflation process, Askari and Krichene suggest that the required reform to do these is to abolish gradually the fractional reserve banking system and to restore a gold standard by a purely a political decision. Such reform involves relating variations in money to the flows of gold and foreign exchanges until the local currency becomes a stable rate in terms of gold.

Askari and Krichene (2016) emphasize that eminent economists as Rothbard (1962) proposed a gold standard with the dollar always tied to gold at a fixed weight. Also, Simons (1947) deplored money as an instrument policy and considered discretionary policy as a form of lawlessness; he emphasized that the best investment banking is the one that has no fixed money contracts at all, viz. Islamic finance. Rothbard advised to replace the name of "dollar" by gold ounce or gold gram. According to Rothbard the abolition of the Federal Reserve and the restoration of gold standard would at least strongly reduce the business cycles and the inflation. Askari and Krichene indicate that the gold standard system allows to implement a financial deepening as in Simons's (1947) statement and Shaw's (1973) model. Simons preferred that investment banks issue more equities than interest-bearing loans in attracting

[19] A classical leverage was the Bank of England which had a paid-in capital of £72,000 and lent to the Treasury £1,200,000 in 1694 in form convertible banknotes.
[20] https://www.federalreserve.gov/releases/h6/current/ and https://fred.stlouisfed.org/series/totalns

savings; and Shaw stated the importance of the financial deepening through the investment banks and more generally the financial sector. Such investment banks can borrow, issue bonds or Sukuks for real economic purposes, and commercialize equity securities. Therefore, with such financial scheme, the investment banks, operating in the long-term, could reduce the moral hazard between debtors and creditors, and reduce their risks by connecting the costs of their resources to their assets returns.

6.2. Policy Analysis

Many policy proposals such as Dodd-frank US legislation, Basle III, and others have been offered to regulate more the conventional financial system. According to the monetary approach of Friedman, the 100 percent reserves against deposits and a steady growth in the money stock would help the conservative objective of monetary policy to reduce the money supply volatility and the part of the business cycle caused by monetary instability. During the recent international financial crisis, discounts and advances to banking system played a key role for central banks to liquefy the financial system. The crisis 2007-2010 shows that the Basle risk-based capital requirements were very low; the third Basel accord have raised capital and liquidity requirements in relation the risk-weighted assets. The central banks and the regulatory authorities have made considerable progress in every country in the implementation of the Basel III standards. Obviously, there are empirical questions related to the macroeconomic impacts of Basle III that await empirical insights from future economic and financial research.

According to Krainer (2013), the advantage of 100 percent reserve banking system aside tighter monetary policy is that the government would not need an expensive regulation requiring deposits insurance in addition to the costly supervision and monitoring of banks. He indicates that there is a dilemma for central banks between price-level stability and financial stability. To deal with the recent international financial crisis, they focus on achieving financial stability even if there is a danger of increased inflation in the future. He considers that the full reserve banking system is one solution to the incompatibility between safeguarding deposit money and risk intermediation leading to financial stability. The goal of this solution is to stabilize the growth rate of the money stock.

Krainer (2013) shows that the financial system presumably stimulates growth by enhancing real business investment, and reducing asymmetric information and moral hazard problems between savers and investors. The full reserve banking system would be a more efficient allocation of saving and real investment i.e. Pareto efficient allocation of saving to real investment. The cyclical variability in terms of expansions and recessions, partly caused by

bank credit creation, explains that the financial system is oriented to finance risky real investments in addition to speculative investments. The idea of Krainer (2013) is that checking account money would become national money like currency, and then both currency and checking account money would be a liability of the government, with cost borne by taxpayers. In such cases, the financial system would generate more non-bank financial institutions than commercial banks. The former institutions would make business loans, allow consumer loans and invest in risky securities.

The central banks focus an increasing attention to the monetary objective of financial stability related to the dynamics of interest rates, inflation, and the output gap. Obviously, the volatility of real GDP represents a proxy for macroeconomic-risk facing firms. The stylized facts indicate that interest rates move gradually in reaction to changes in macroeconomic conditions. By making interest-rate variability smaller, the central bank could lower the risk of bank insolvency and then decrease the volatility of banks' profits. There are many studies, going from institutional analysis to theoretical and empirical exploration, considering the interactions between financial stability and the price stability as a goal of central banks.

The paper of Di Giorgio and Rotondi (2011) offers a new rationale for why central banks should smooth interest rates based on the target to stabilize basis risk (BR, the residual risk that remains, after all, hedging precautionary) as a practical contribution to preserving the stability of financial markets. They observe that the considerations about the risk management of interest-rate risk by banks are absent in the literature analyzing the relationship between monetary policy and financial stability as basis risk stabilization in the central bank reaction function.

Di Giorgio and Rotondi (2011) follow the standard literature on new Keynesian micro-founded dynamic general equilibrium models, and assume that the monetary policy is expressed in terms of a feedback rule for setting the nominal short-term interest rate:

$$r_t = \phi_\pi \pi_t + \phi_y y_t + \phi_{BR}[(\log P_t^A - \log F_t) - (\log P_{t-1}^A - \log F_{t-1})]$$

$$r_t = \phi_\pi \pi_t + \phi_y y_t + \phi_{BR}\left[\log\left(\frac{P_t^A}{P_{t-1}^A}\right) - \log\left(\frac{F_t}{F_{t-1}}\right)\right]$$

where r_t is the current real interest rate related negatively to the output-gap y_t, and π_t is the inflation related positively to the output-gap and the future expected inflation. F_t is the price of a one-period Eurodollar future contract. P_t^A is the price of the asset underlying such future i.e. a one-period Eurodollar deposit. They also assume complete financial markets and no arbitrage opportunities i.e. $r_t = \log(R_t)$ where R_t is the gross nominal interest rate on a risk-free one

period bond. The last term in the policy rule equation captures the basis risk stabilization goal of the central bank. This term supposes that financial institutions manage their risk by using Eurodollar futures. They suppose that central bank smoothes the ratio P_t^A over F_t instead of the spread since the variables are in logarithms.

According to the second form of policy rule equation, the central bank is concerned about the deviation of the spread between the growth of asset prices and the growth of the price of a one-period Eurodollar future contract. This concern reveals that failure to adjust reserves in response to unexpected rate variations would have a direct effect on their balance sheet and profitability.

By assuming that future and forward prices are perfect substitute i.e. $F_t = P_t^A e^{\log R_t}$, Di Giorgio and Rotondi (2011) develop the following equilibrium policy rule:

$$r_t = \rho r_{t-1} + \Phi_\pi \pi_t + \Phi_y y_t$$

$$r_t = \rho r_{t-1} + (1-\rho)\phi_\pi \pi_t + \phi_y y_t$$

with the coefficients $\rho = \frac{\phi_{BR}}{1+\phi_{BR}}$; $\Phi_\pi = \frac{\phi_\pi}{1+\phi_{BR}}$ and $\Phi_y = \frac{\phi_y}{1+\phi_{BR}}$. The coefficient ρ is between $0 \leq \rho < 1$, it measures the implied degree of interest-rate smoothing coherent with basis risk stabilization goal.

The main result of Di Giorgio and Rotondi paper (2011) is the following proposition: Assuming that $r_t = \phi_\pi \pi_t + \phi_y y_t + \phi_{BR}\, E_t(\log R_{t+1}^E - \log R_t^E)$, where $E_t(R_{t+1}^E)$ corresponds to the expected future level of the underlying interest rate i.e. the one-period Eurodollar Libor, is the monetary policy rule for $\rho = 0$ and any fixed positive values ϕ_π, ϕ_y and ϕ_{BR}. The introduction of excessive concern for financial stability i.e. $\phi_{BR} \to +\infty$ and $\rho \to 1$ leads to indeterminacy.

This proposition exhibits in monetary policy that there is a trade-off between macroeconomic stability and financial stability. When the basis risk stabilization is taken into consideration by a forward-looking interest-rate smoothing of central bank leading to the stability of financial markets, this could reduce the ability to attain price stability in macroeconomic level (Smith and Van Egteren 2005).

The money market funds (MMF), as non-bank institutions named "shadow banking", which manage high levels of liquidity and considered as the main contributor to financial stability, suffered largely from asset price drops during the recent international financial crisis in US and EU. The panic of MMF spreads through transmission channels to the banking sector and leads to financial instability.

According to Fitch Ratings (2008), the MMFs allocation is more attractive for banks and other investors; it offers competitive returns compared to ordinary bank accounts. It also offers diversification across securities and issuers that are not covered by deposit guarantee schemes. The Investment Company Institute (ICI 2009) indicates that a large majority of investors in MMFs are institutional investors, and most of the remainders are high net worth individuals.

After the recent crisis, the MMFs are regulated and supervised by a new reform package of the Securities and Exchange Commission (SEC) in early 2009 (SEC 2009, Financial Stability Board, FSB 2011). This package includes information requirements, diversification requirements, credit risk and maturity limits. Such measures, aiming to improve liquidity management, would help to limit, but not necessarily, the contagion and difficulties in the MMF sector being transmitted to the banking sector.

According to Bengtsson (2013), in times financial instability, there is no investor runs on MMFs, because MMFs have relatively high transparency compared to banks. But, there is a lack of transparency in the asset composition of MMFs. It appears mainly for U.S. and E.U. that low probability of future runs on MMFs leads to intensify the financial stability. Bengtsson (2013) explains the persistence of such risks by the facts that the credit rating agencies lately have given more emphasis in their ratings, and that - under the Basel III liquidity framework- banks will be forced to hold liquid assets as support to MMFs within the banking group. Obviously, the better understanding of the repercussions of non-bank financial intermediaries on financial stability is more needed to attenuate the effects of a potential next financial crisis.

Granville and Mallick (2009) define the financial stability in terms of changes in (i) interest rate spreads, (ii) share prices, (iii) nominal effective exchange rate, (iv) house price (property price) inflation and (v) deposit-loan ratio in banks. Their empirical work (2009) tries to resolve "the paradox of credibility" of monetary policy as referred to Borio (2006). This paradox means that the policy of decreasing interest rates to increase liquidity can lead to higher volatility of asset prices with negative macroeconomic impacts.

The theoretical background is that the monetary policy shocks on the real sector require long time lags, and when it is oriented towards price stability, it could enhance over time the financial stability. Based on the experience of twelve EMU (European Monetary Union) countries, Granville and Mallick (2009) test if the policies implemented recently (by a negative inflation shock) and designed to reach price stability could support financial stability. They establish, by using structural VAR model within the sign restriction identification procedure due to Uhlig (2005), that there is a pro-cyclical relation between monetary stability and the stock market because a negative inflation shock leads in the long-run to a decrease in share

prices. They suggest that financial stability is influenced by financial markets shocks or economic policy changes.

As monitoring consumer price inflation by the central bank may have contributed to financial stability, via the interest rate instrument, the long-run stability of inflation –supporting a loose monetary response– will be that the asset prices react negatively, which may cause financial instability. Consequently, in the long-run there is a pro-cyclical nexus monetary and financial stability. Granville and Mallick (2009) indicate that the monetary stability through interest-rate spread adjustment constitutes a pre-condition for financial stability.

Besides, the crisis in global financial markets requires finding out the best policy to control liquidity conditions. Granville and Mallick (2009) introduce the bank variable deposit-loan ratio to identify both a decline in inflation and an increase in stock and property prices on financial stability variables. Symmetrically, an increase in inflation and a decline in stock and property prices could reflect financial instability.

But, a trend of increase in stock prices could turn into an asset price bubble damaging financial markets and leading then to financial instability (e.g., 1929 crash and 2008 crash). Granville and Mallick (2009) recognize that this question is outside the scope of their paper, and require others research papers. Nevertheless, they conclude that there is no trade-off between monetary and financial stability in the long-run. Empirically, this question still is open because there is no consensus comparing at least the papers of Rotondi (2011) and Poloz (2006). The pro-cyclical relation holds only in the absence of asset price shocks. If there is a shock to asset prices from speculative behavior viz. not from macroeconomic fundamentals, the government must take many actions to stabilize the asset prices. Otherwise, a trade-off will exist in the long-run (Granville and Mallick 2009).

On the other hand, according to Celasun and Harms (2011) using a panel data covering 65 developing countries and emerging markets for the years 1989-2005, it seems during the recent years the private sector has contracted a substantially larger share of the external debt than the public sector. According to Hallak (2013), the effects of such a major phenomenon in international financial markets remain largely unexplored. Hallak (2013) finds that, in the presence of international capital market distortions, larger private sector share of external debt has a positive impact on interest spreads. For that reason, private sector external debt turns into a factor of financial instability whenever the government does not act to remove the capital market distortions regardless of economic fundamentals (Hallak 2013). He shows that private sector share of external debt has a positive and significant impact on real economic growth. Also, if the public-sector assets have legal immunity, the private sector assets are exposed to

liquidation threat as a self-monitoring device. This could explain partially the efficiency in the use of borrowed foreign funds. Hallak (2013) concludes that the best policy to improve financial stability is to promote the private sector. But in fact, the private sector could take advantage of distortions in financial markets and generate international financial instability.

Obstfeld, Shambaugh and Taylor (2008) argue that, in the context of increasing financial globalization, foreign reserve accumulation is a key tool to manage domestic financial instability as well as exchange rates. They suggest a new financial stability model including the following explanatory variables: (i) log of the ratio of money supply (M2) to Gross Domestic Product (GDP); (ii) financial openness based on the Edwards 2007 index and scaled from 0 to 1; (iii) pegged exchange rate dummy based on the de facto Shambaugh 2004 coding with annual bands around 2%; (iv) soft-peg exchange rate dummy based on bands around 5%; (v) advanced country dummy; (vi) log of the ratio of foreign trade (imports plus exports) to GDP. The output of this model is compared to a traditional model for which the regressors are (i) log of population; (ii) log of the imports-GDP ratio; (iii) monthly exchange rate volatility; (iv) log of real GDP per capita. They find empirically that financial stability variables are strongly correlated with reserve holdings and that recently the insertion of financial stability variables improves the statistical explanation of the reserve-GDP ratio. However, they suggest considering more explicitly into future research the effects of financial stability variables on the demand for international reserves.

According to Obstfeld, Shambaugh and Taylor (2008) the recent huge accumulation of reserves by emerging markets with pegged or quasi-pegged exchange rates still be empirically inexplicable (e.g., China). The practice of emerging central banks does not follow any coherent theory; then there is an economic puzzle, if not a policy problem.

7. Conclusions

Concern about financial stability has been a main topic of money since the eighteenth century, simply because a financial crisis had ruinous effect on the economy and population. Preserving financial stability would spare the economy the disruptive effects of a financial crisis. Conventional banking is inherently unstable, simply because it deals with interest-debt, a principle repudiated in all divine revelations. As illustrated by 2008 financial crisis, some major central banks had to undertake massive bailouts and force near-zero interest rate to forestall general banking collapse. Unorthodox monetary policy contributes to record debt build-up, explosive stock prices, and consequently creates high uncertainties. Islamic banking, free of

interest, faces less risks of instability, simply because it is based on risk-sharing; thus, changes in the value of assets entail identical changes in the value of liabilities.

The paper surveyed empirical research on the conventional and Islamic banking stability. Findings point that Islamic banks may be negatively affected by a financial crisis as happened in 2008-2009. Shadow banking is also vulnerable to a financial crisis in view of its high leverage. The money market funds (MMF), as non-bank institutions named "shadow banking", which manage high levels of liquidity and are considered as the main contributor to financial stability, suffered largely from asset price drops during the recent international financial crisis in US and EU. The panic of MMF spreads through transmission channels to the banking sector and leads to financial instability. The recent trend of increase in stock prices could turn into an asset price bubble damaging financial markets and leading then to financial instability. Likewise, the private sector in some advanced countries has become highly indebted, which poses a risk of banking instability.

In terms of policy, notwithstanding the regulatory strengthening under Basle III, and tighter bank supervision, the theory advanced under the Chicago Plan (1933) and embraced by Islamic finance is that there is a need to separate money from debt by establishing 100% reserve banking and abolish interest-based debt by establishing risk-sharing investment banking. Such theory was propounded repeatedly during the 19th-20th centuries. This type of banking is earnestly needed to step up financial deepening, increase investment, and sustain economic growth.

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Appendices

Appendix A. SVAR and FAVAR modeling

The vector autoregressive (VAR) system can be rearranged as a structural VAR (SVAR) model by imposing restrictions on the matrices A and B of the following form (Breitung et al. 2004):

$$AX_t = c_0 + \sum_{i=1}^{p} A_i^* X_{t-i} + Bu_t$$

$$\text{and} \quad \varepsilon_t = A^{-1}Bu_t$$

where the vector X_t represents economic and financial variables, such as economic growth, net export, international liquidity, prices, exchange rates. A^* is the matrix of structural coefficients, A and B are the coefficient matrices with restricted and nulled parameters. ε and u represent the reduced and structural errors, respectively. The matrix B associated to the structural errors is subject to many restrictions to identify the other parameters of the model. This so-called AB-model cannot be estimated without combining the restrictions on A and B that are consistent with a-priori theoretical expectations (Amisano and Giannini 1997). This SVAR methodology leads to several explanations using the framework of the Impulse Response Functions (IRF) as results of structural shocks (financial or real).

Also, the factor vector autoregressive model (FAVAR, Bagliano and Morana 2008) could be efficient regarding the need to reduce a large data set to a small number of factors that can be used to improve the VAR models:

$$X_t = c + \Lambda F_t + \sum_{i=1}^{p} A_i X_{t-i} + \varepsilon_t$$

and

$$F_t = d_0 + \sum_{j=1}^{r} D_j F_{t-j} + \eta_t\,, \quad \xi_t = H\eta_t\,, \qquad \psi_t = \Phi\varepsilon_t$$

where Λ is the corresponding matrix of loading coefficients capturing the weight of each factor for each variable in X. D_j are the coefficients associated to the dynamic factors. ε is the vector of the reduced-form idiosyncratic errors. H and Φ are invertible matrices of transformation allowing to get idiosyncratic structural shocks from reduced errors. Thus, ξ represent the global structural shocks, and η are the common or global shocks driving the common factors. Moreover, ψ denote the structural idiosyncratic shocks and ε are the reduced shocks or errors. The vector moving average form (VMA) in structural form $X_t = B^*(L)\xi_t + C^*(L)\psi_t$

corresponds to the main framework leading to implementing many types of financial and economic shocks on X.

Appendix B. Pareto Optimal Contract

The following proposition proves the global efficiency of the Islamic finance model in comparison to the conventional finance (Ghassan 2012):

Proposition:

Considering L as the total supply of investment funds where Z_i is the amount of funds financing investment projects according to the i model; $i = 1$ corresponds to the stochastic rate model and $i = 2$ represents the fixed model. R_i stands for a stochastic rate of return on investment with $R_i \sim$ i. i. d. (μ_R, σ_R^2) and $0 < R_i < 1$:

$$L = Z_1 + Z_2; Z_1 = \beta L \quad Z_2 = (1-\beta)L \quad \text{with} \quad 0 < \beta < 1$$

Considering that D is the interest rate charged by the bank, and that P and Y are the stochastic aggregate payoffs for financiers (with a share $1-\alpha$) and investors respectively.

Considering that the mean-preserving spread of $S_Y(R_1)$ is $S_Y(R_2) = \max(R_2 - D_Y, 0)$ and $S_P(R_2) = \min(R_2, D_Y)$ where S_Y and S_P verify the conditions (i) to (iii) as in Merton (1992), and Levy (2006):

(i) $0 < S(R) < R < 1$

(ii) $E(S(R)) = \alpha E(R) = \alpha \mu_{S(R)}$ where α is the sharing rate for investors.

(iii) $\sum_k S_k(R) = 1$ where k stands for the shareholder in risk investment.

Then, for any concave and bounded utility function U and any $\alpha-$sharing rule $S(R)$ particularly $S_Y(R_1)$, we have

$$E[U(S_P(R_2))] > E[U(S_Y(R_1))] > E[U(S_Y(R_2))].$$

Proof:

Letting $S_Y(R_1)$ the random $\alpha-$sharing rate, and U the utility function of $S(R)$ which is assumed with risk averse i.e. $U''(S(R)) < 0$. The expected utility of $S(R)$ is $E[U(S(R))]$.

$$U(S_Y(R_2)) = U(S_Y(R_1) + Z_2)$$
$$\approx U(S_Y(R_1)) + U'(S_Y(R_1))Z_2 + \frac{1}{2}U''(S_Y(R_1))Z_2^2$$

Then, the expected value gives:

$$E\left[U\left(S_Y\left(R_2\right)\right)\right]=E\left[U\left(S_Y\left(R_1\right)\right)\right]+E\left[U'\left(S_Y\left(R_1\right)\right)Z_2\right]+\frac{1}{2}E\left[U''\left(S_Y\left(R_1\right)\right)Z_2^2\right]$$

$$=E\left[U\left(S_Y\left(R_1\right)\right)\right]+\frac{1}{2}E\left[U''\left(S_Y\left(R_1\right)\right)\right]E\left(Z_2^2\right),\quad E\left(Z_i\right)=0$$

$$E\left[U\left(S_Y\left(R_1\right)\right)\right]>E\left[U\left(S_Y\left(R_2\right)\right)\right],\quad E\left[U''\left(S_Y\left(R_1\right)\right)\right]<0 \text{ and } \sigma_{Z_2}^2>0$$

In the same way, the second inequality shows that $S_Y\left(R_1\right)$ is more riskier than $S_P\left(R_2\right)$. By using a MPS there exists Z_1 is a random variable such that $S_Y\left(R_1\right)=S_P\left(R_2\right)+Z_1$ which $S_P\left(R_2\right)$ is a random $\alpha-\text{sharing}$ rate. The expected utility gives:

$$E\left[U\left(S_Y\left(R_1\right)\right)\right]=E\left[U\left(S_P\left(R_2\right)\right)\right]+E\left[U'\left(S_P\left(R_2\right)\right)Z_1\right]+\frac{1}{2}E\left[U''\left(S_P\left(R_2\right)\right)Z_1^2\right]$$

$$=E\left[U\left(S_P\left(R_2\right)\right)\right]+\frac{1}{2}E\left[U''\left(S_P\left(R_2\right)\right)\right]E\left(Z_1^2\right),\quad E\left(Z_i\right)=0$$

$$E\left[U\left(S_P\left(R_2\right)\right)\right]>E\left[U\left(S_Y\left(R_1\right)\right)\right],\quad E\left[U''\left(S_P\left(R_2\right)\right)\right]<0 \text{ and } \sigma_{Z_1}^2>0. \quad \blacksquare$$

We can prove separately the double inequality straightforwardly by using a Mean Preserving Spread (MPS) of $\alpha-\text{sharing}$ and the Taylor expansion at degree two. This result exhibits that any risk aversion agent would prefer the $\alpha-\text{sharing}$ of $S_P\left(R_2\right)$ to $\alpha-\text{sharing}$ of $S_Y\left(R_1\right)$. In consequence, $S_P\left(R_2\right)$ is preferred to $S_Y\left(R_1\right)$ which is preferred to $S_Y\left(R_2\right)$. The proposition also exhibits by transitivity that the $\alpha-\text{sharing}$-investor of $S_Y\left(R_1\right)$ would be preferred to the $\alpha-\text{sharing}$ of $S_Y\left(R_2\right)$. This result shows that in terms of $\alpha-\text{sharing}$ and of expected payoff the SR model seems to be better than the FR model.