

Interest-Free Treasury Bonds (IFTB)

Bijan Bidabad¹

Abstract

Purpose: Although the treasury bill is the most important monetary instrument in central banking, its application in different phases of the business cycle, especially in a liquidity trap, is not working well. To remove this obstacle “Interest-Free Treasury Bond” (IFTB) is introduced as a substitute for conventional treasury bills.

Design: IFTB is a valuable paper which is issued by government treasury through a barter contract and is sold to central or commercial banks. The issuer is a debtor to the holder and has to pay back the nominal value at maturity; in addition, the issuer is committed to lending a similar amount of money to the paper holder for an equal period. Zero interest rate is nominated for lending and borrowing.

Finding: IFTB is a zero-coupon, asset-backed note with no interest and is designed upon “debt equal to future loan”, or “loan equal to future debt” with “time-withdrawal right”. The paper holder can supply and transact her bond in the secondary market at a competitive price.

Practical implication: It can be used as a substitute for conventional treasury bills. All conventional and non-usury systems can implement IFTB.

Keywords: Treasury Bills, Foreign exchange, monetary policy, fiscal policy, usury-free banking, Islamic central banking, financial instrument

JEL: E43, E44, E52, E58, E62, E63

Introduction

Interest-free financial instruments are categorized in Islamic finance, but without the Islamic notion of the Interest-Free Bond (IFTB) that is introduced in this paper; this instrument can be used in both Islamic and conventional banking systems. Some Islamic contracts can be used as Islamic monetary instruments. The main constraint is that their operations must have a counterpart with the real project(s)/asset(s) in the real sector. However, from a conventional viewpoint, monetary operation contraction/expansion may not directly link with real projects or business activities (Rabin, 2004). For instance, monetary contraction is done by selling central bank monetary instruments (securities) which do not need to have a counterpart or asset-backed, in the real sector. This contradiction is one of the main constraints of applying Islamic instruments in an interest-free central banking system.

Islamic securities have become increasingly popular in over the last decade, both as a means of rising government finance through sovereign issues and as a way of corporate entities obtaining funding through the offer of corporate *Sukuk* (Islamic bond) (Moody's, 2007; 2008). The advantage of *Sukuk* is that they are defined to be far from usury (Wilson, 2008).

Sukuk usually refinance the assets of one in the three basic forms (or a combination) of Islamic finance (Sundarajan et al.; 1998; Jobst, 2007) - synthetic loans (*murabahah*), sale-leasebacks (*ijara*) or profit-sharing arrangements (*musharaka* or *mudharaba*) (Iqbal and Mirakhor, 2006). In his study, Ismal (2009) examines four feasible Islamic monetary instruments and claimed to be appropriate with central banking monetary operation but lacking clarity in the question of acceptability for all types of central banks. The role of an Islamic central bank is to conduct its monetary operation by using Islamic monetary instruments that need to be free from interest, links with the business sector activities and giving value added into the economy (Mills and Presley,

¹ (B.A., M.Sc., Ph.D., Post-Doc.) Professor of Economics and Humanities.

bijan@bidabad.com

<http://www.bidabad.com/>



1999).

This paper examines the potential for some of the interest-free bonds as new instruments for central banking operation, which could be attractive for generating funds by the central banks under both conventional as well as an Islamic banking system. To our knowledge, this is the first paper to address a theoretical background for such an issue.

The rest of the paper is organized as follows: Section 2 discusses conventional treasury bills. Section 3 presents the proposition of Interest-Free Bonds (IFTB) in domestic money. Section 4 assesses the economic effects of the issuance of these bonds. In this section, the effects on inflation, interest, and exchange rates are discussed. Section 5 discusses foreign exchange interest-free treasury bonds. Section 6 is about the transaction of these bonds in secondary markets based on information technology. Finally, section 6 draws a conclusion.

Conventional Treasury Bills

Various bonds/notes/bills are basically debt securities that people buy them and lend their funds to the issuer, and the issuer is committed to paying the principal and the interest back at maturity. Usually, bonds are guaranteed by the issuer, government, or government-affiliated organizations, or they are asset-backed securities so that assets such as credit cards or payable loans cover the papers. Mortgage-Backed Securities, Collateralized Mortgage Obligations (CMO), and Collateralized Debt Obligation (CDO) are kinds of these securities. These papers include government bonds, municipal securities, corporate securities, asset or mortgage-backed securities, government-affiliated organizations securities, foreign government securities, and supranational securities. Securities issued by the government are called treasury bills, treasury notes, treasury bonds, or perpetual bonds that are similar, and their differences are just in their interest rates. All of them might be sold before maturity by deducting the interest. Their maturities are from a few days to 30 years, and some of them are even perpetual or take several decades. Banker acceptance papers and commercial papers and deposit certificates are also various kinds of bonds used for short term financing. Bonds might be issued in fixed-rate, floating rate, reference-rate (usually LIBOR or EURIBOR) or zero-coupon. Interest Only (IO) and Principal Only (PO) might also be transacted in separate. In inflation-Linked (indexed) bonds, the nominal yield is adjusted by inflation rate (Treasury Inflation Protected Security "TIPS"). Some notes are linked to stocks, financial or GNP indices (Equity-Linked Notes). Bearer or anonym bonds are in opposition to registered bonds in which only the owner can claim the debt. Some bonds do not even have a written paper certificate (Book-Entry Bond). We can also mention Lottery Bonds, War Bonds, Serial Bonds, Revenue Bonds, and Climate Bonds as other kinds of bonds.

Callable Bonds allow the issuer to call the holders and buy back the bonds before maturity. Accordingly, in the case of decreasing interest rates, the issuer can prevent losses by buying back and obtain a cheaper loan. Opposing this kind of bond is Puttable Bonds (Put Bond or Retractable Bond) allow the holder to apply them to the issuer and sell them back before maturity. Some bonds are both puttable and callable. The prices of these bonds are calculated by deducting call option or put option price from the straight bond price.

Subordinated Bonds have the lowest right in liquidation when the issuer becomes bankrupt; at first, other bond's tranches (Senior Bonds) will be settled, and the remainder will be paid to Subordinated Bonds. Therefore, they have higher risk rate in comparison with other bonds.

Bond prices are set in the secondary market in comparison with other financial assets. If interest rate increases in the banking sector, the price of bonds will decrease, and if the involved risk of the other assets increase, the price of bonds will increase because bonds have collaterals and guarantees and they usually have less default risk. Variation of bank interest rates and rate of return and maturity of other assets and bonds will change the supply and demand of bonds. Inflation expectation will also decrease the real yields of bonds and their prices.

Interest-Free Treasury Bonds (IFTB)

Interest-free bond was introduced by Bidabad and Allahyarifard (2010) and Bidabad et al. (2011). Straight forward to that bond, now IFTB is defined that can be issued by government treasury. "Interest-Free Treasury Bonds" or simply IFTB that is introduced in this paper is a kind of transactable note and is not linked to tangible assets but is an asset-backed zero-coupon paper. These notes are issued by government treasury and have substantial difference with conventional treasury bills. The main difference of IFTB with treasury bills is that in the latter the interest rate is not pre-set and funds are exchanged just in the form of time-barter as "loan equal to future debt" or, "debt equal to future loan" with "time withdrawal right". IFTB can be

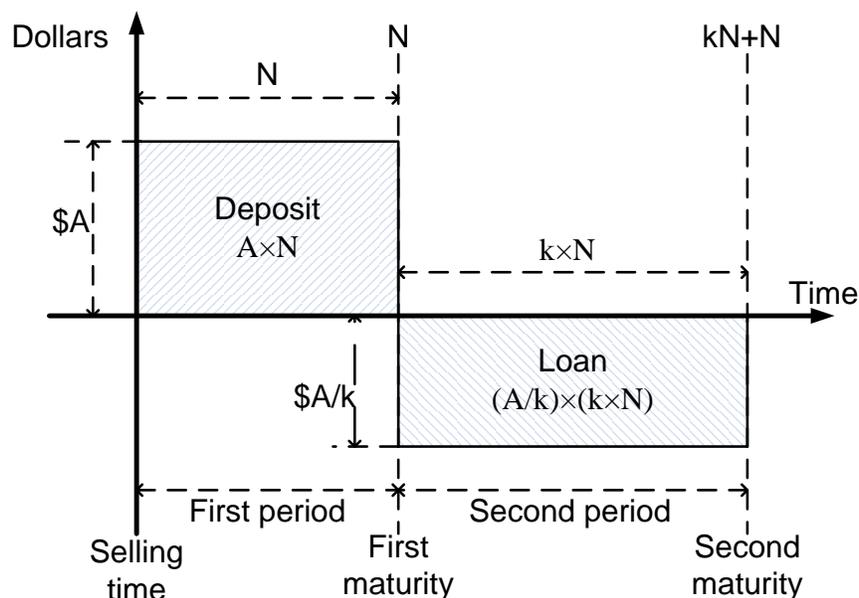


transacted by central and commercial banks, financial institutions. The price of IFTB is set at the secondary market according to supply and demand, and therefore, its yield rate will change proportional to the capital rate of return in the economy; and by considering its characteristics, it has no usury content.

IFTBs are issued with defined nominal prices. Central, commercial, specialized and development banks and money and credit institutions and financial funds which have prudential and legal reserves at the central bank, can purchase these bonds and will become rightful to obtain interest-free loans equal to their purchase of these notes at maturity and pay back the loan to the issuer at the end.

Accordingly, by buying \$A bonds with a maturity of N months, the buyer will have the right to obtain \$A interest-free loan for a period of N months from the issuer of the bonds. The buyer and seller will agree on fixing combinations of \$A and N months so that the buyer can choose smaller, equal, or larger than one ratios from \$A in proportion with N months. That is, the amount of money multiplied by time will be equal to $A \times N$. In other words, for example, buyer instead of A Dollars can borrow $A/2$ Dollars for $2N$ months at the N^{th} month, or $A/3$ for $3N$ months at the N^{th} month. Where, in all cases, the result will be equal to $A \times N$. That is: $(A/2) \times (2N) = (A/3) \times (3N) = A \times N$ or generally speaking, instead of \$A, we will receive A/k for $k \times N$ months after the N months. The parameter k can be any agreed figure accepted mutually by the parties or offered by the buyer.

Figure I. Two-Phases of Interest-Free Treasury Bond (IFTB)



Generally, these bonds have two time periods and two maturity dates, as shown in figure I. The first period is equal to N months from the selling time to the first maturity, and the second time period is from the first maturity date (N) until the payback date of funds ($kN+N$) or second maturity date. The first maturity is when the seller of papers is obliged to provide the loan equal to A dollars for N months, or A/k dollars for kN months to the buyer. Therefore, the first maturity occurs at the end of N months. The second maturity is at the end of the contract when the seller will receive back his funds after $kN+N$ months after selling time.

Since banks have prudential and legal reserves at the central bank, they will not face loan defaults. In this regard, they can transact these papers in the "Interest-Free Secondary Market". The buyers and sellers at this market generally may be commercial, specialized and development banks and money and credit institutions and reputable funds that are supervised by the central bank and have prudential and legal reserves at the central bank. In addition, government and private sector can enter this market by considering certain conditions.

Accordingly, by buying these notes with defined maturity, the buyer will have the right to obtain an interest-free loan for the same period from the seller at maturity. The buyer and seller will agree to select a combination of the amount and maturity so that the buyer can select ratios less/more or equal to one of the amounts in proportion to maturity time by which the result of multiplications of the amount and time for both loans become equal. In practice, these two loans have two different maturity times. Actually, there are two periods and two maturities. The first period starts from the selling time of bonds until the first maturity in which the seller becomes a debtor and the buyer becomes creditor, and the second period starts from the first maturity date and ends after the payback of the interest-free loan. The receiver of the interest-free loan will become a debtor, and the one who has provided the loan becomes a creditor in the second period.

Essentially, IFTB is a document which defines two different rights pertaining between two transacting parties. The seller of the notes commits to provide the buyer a loan equal with the amount he has bought, and for the same period of time. The simple description of the subject is that two persons decide to render equal funds to each other for equal periods as a deposit. In this case, no extra privilege is considered for neither parties. On the other hand, since the holder of the bonds obtains the right to receive an interest-free loan at maturity, he can transfer his right to a third party. These bonds are transferable over the internet.

Since banks have obligatory and prudential deposits at the central bank, they will not be faced with defaults for the loans and therefore, can transact these notes in the secondary IFTBs market. The buyers and sellers of these bonds are central, commercial, specialized and development banks and those money and financial institutions and funds that have obligatory and prudential deposits at the central bank.

Economic Effects of IFTB

Fiscal policies are generally a collection of policies applied to fulfill macro-economic targets or to prevent losses causing from government fiscal performance. Government treasury in managing government income and expenditure flows uses different instruments to adjust government budget in such a way that the government not to be faced with deficit/surplus and provide necessary maneuvers for expansionary/contractionary fiscal policies. Treasury bill cannot be implemented in usury-free systems because it involves usury.

The central bank can also affect liquidity through open market operations by buying or selling treasury bonds and changes the volume of high powered money and liquidity via monetary expansion mechanism. The central bank can also oblige other banks to keep a portion of their assets in the form of treasury notes at the central bank to prevent monetary base expansion. The discount rate is also another quantitative measure through which commercial banks can finance their liquidity needs by discounting their treasury bills at the central bank. The central bank can affect free reserves of the banking system by changing the discount rate.

Issuance of IFTBs provide necessary conditions for financing the government, and the government can adjust his budget policies by transacting these notes. If the central bank buys these papers, in the first period has increased the supply of high powered money in the economy and creates a commitment for the government to deposit the same amount with the central bank at the second period. After the second maturity, receiving back the deposited funds by the central bank, the issued notes will get out of circulation. Since these activities affect high powered money, it will have an expansionary effect in the first period and a contractionary effect in the second period. On the other hand, in the first period, because of the increase of government fiscal resources, it will have an expansionary effect on government budget and contractionary fiscal effect in the second period. These effects are shown in figure 2 through the IS and LM curves. At first, the equilibrium is at point E1 and moves to point E2 after the issuance of IFTB and then at the beginning of the second period moves back to point E1 again. Therefore, in the first period, the interest rate (r) will decrease, and production (y) will increase, but in the second period, the effects are reversed.

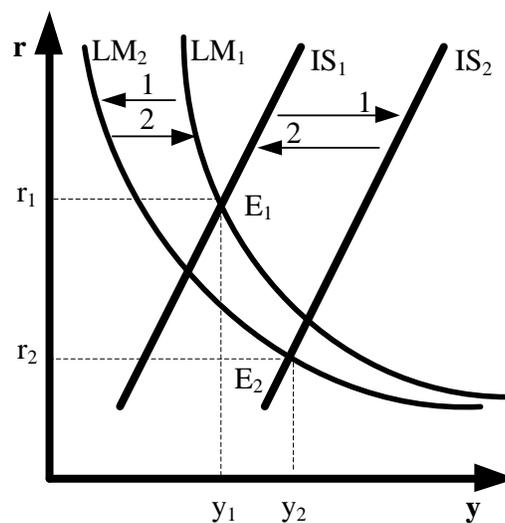


Figure 2

Considering the phases of recovery, prosperity, recession and crisis conditions in business cycles and the duration of positioning economy in each phase, the central bank can define A, N, or k parameters of IFTB in such a way to dampen fluctuations of the business cycle. This policy is similar to the monetary fine-tuning policy in conventional central banking.

Since these bonds can be transacted in secondary Interest-Free Bonds market, they can have adjusting effects through the relation between the IFTBs prices and interest rate. Whenever interest rate is high, the transacting price of IFTBs will decrease in the first period and will increase banks' incentives to deposit their funds with the government by buying IFTBs to obtain resources in the second period. Thereof, during economic prosperity phase of the cycle, when the interest rate is high, transacted IFTBs restricts banks' free reserves and prevents widening of cycle range. Inversely, whenever the interest rate is low, the price of IFTBs increases during the first period and decreases the incentive for banks to deposit their resources at the treasury for receiving future resources in the second period. This leads to expanding free reserves of banks during the economic crisis when the interest rate is low and prevent the widening of the cycle and exacerbation of the crisis. On the other hand, by adjusting buy and sale of IFTBs, the central bank can affect liquidity through changing the supply of high powered money and thereof, interest rate. Accordingly, IFTBs can substitute the prevailing treasury bills in conventional banking.

When expected inflation and interest rate are different in the first and second time periods, the economic effects will be different. If the real expected natural interest rate for the second period is more or less than the first period, its effects on supply and demand of IFTBs will be different. The more is the expected natural rate of interest for the second period, the more will be the price of IFTBs during the first period and on the contrary, the less the natural, expected rate of interest in the second period, the less will be the price of IFTBs during the first period. This phenomenon is very important for the central bank to adjust monetary policies to stabilize economic activities and on the other words; IFTBs cause the expectation to play a basic role in controlling banks' credit behavior. That is to say, if banks expect an increase (or decrease) of a natural interest rate for the second period, then they will take increasing (or decreasing) IFTBs supply policy. Regarding the changes of natural interest rate during recovery, prosperity, recession, and crisis, from an economic point of view, this mechanism can be a factor in shortening business cycle range.

In continuous inflationary conditions, the effects of IFTBs do not change much. If expected inflation rates are similar in both periods, inflation will not affect the transaction of IFTBs; but if expected inflation rates are different in the two periods, we should expect different prices for IFTBs in the secondary market. Accordingly, by assuming a fixed interest rate, we may have the following cases for IFTBs prices, the average expected inflation rate in the first period is less than in the second period; the price

of IFTBs in the first period will be higher than in the second period, and if the average expected inflation rate in the first period is higher than of the second period, the condition is reversed, and the price of IFTBs papers will be lower in the first period.

Deposit and credit interest rates have also significant effects on IFTBs prices. These effects can be considered for the first and second time periods of IFTBs regarding periods' length and position of the economy at different phases of business cycles to apply suitable monetary and fiscal policies to adjust the economy.

Issuing IFTBs (in domestic money) affects foreign exchange rate through monetary effects. Money supply change in relation to foreign currency supply affects the economy through monetary channels and interest rates parity.

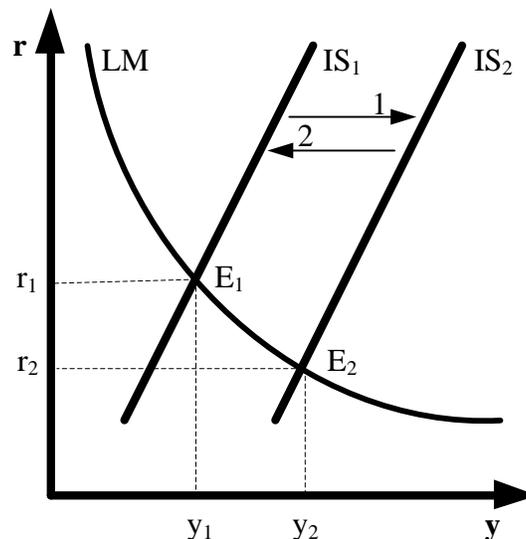


Figure 3

When commercial banks buy IFTBs, in addition, to increasing the volume of IFTBs in the market in the first period, lead to increase government fiscal resources in the same period, but the volume of liquidity is not affected. In the second period, the same amount of banks' free reserves, which had been reduced in the first period will increase and will have a fiscal contractionary effect on the government budget. The volume of liquidity in the economy will change in neither of periods. This effect is shown by the movement of the IS curve in figure 3. Equilibrium of the economy is at E_1 at the beginning and after the issuance of IFTBs by government and its purchase by banks, will move the equilibrium to point E_2 . The IS curve will return to E_1 at the beginning of the second period. Therefore, it decreases interest rate (r) and increases production (y) in the first period, but in the second period, the reaction will be reversed.

Foreign Exchange Interest-Free Treasury Bonds

Foreign exchanges nominated bonds are used very much. Development of internet communication network in international bonds markets and the possibility of foreign exchange and interest rate swaps have created new possibilities to hedge future exchange rate changes. Foreign exchange bonds are exposed to exchange rate risk and sovereign risk as a result of laws and regulations changes in different countries. Foreign exchange nominated bonds can have coupons in other currencies. Some of these notes that are guaranteed by international organizations and unions² can be transacted at international markets. The interest rate of foreign exchange nominated bonds is usually LIBOR plus a margin which covers the changes of national currency and sovereignty risk of the country that has committed the payback of the principal of the bond.

Similar to Domestic Money IFTBs, foreign exchange nominated IFTBs can also be issued. The issuer of these notes is also the

² - Global bond, Eurobond, Yankee bond, Bulldog bond, Kangaroo bond, Maple bond, Bond Samurai.

government, and their buyers are similar to the buyers of Domestic Money IFTBs. The only difference is that the nominal value of exchange bonds can be in one currency and in two different currencies for the first and second periods.

The monetary effect of issuing Foreign Exchange IFTB is similar to issuing IFTBs in domestic money and in addition, it has a stabilizing effect on supply and demand of foreign exchange. The central bank can use this issue to manage the exchange rate and by changing the supply of various foreign exchanges in the short term. This instrument has different effects when the foreign exchanges are similar or different in the two time periods of IFTB. If the exchange rates are the same in both periods, it will hedge the buyer for future fluctuation of the exchange rate in the second period, and if different exchanges are used in the two periods, the hedging effect will be on the second-period exchange. Except for the central bank, other banks can obtain this hedging by buying these notes.

IFTB Market

IFTBs are issued over the Non-usury Scripless Security Settlement System (NSSSS) with certain nominal prices as a bid for auction with no base price. The issuer (government) puts a deadline for accepting bids. Then, notes are sold to the highest bidder after the deadline. Since the issuer has not defined any base price below the nominal price, competitive prices are formed through the buyer's and sellers' perceptions of the present and future interest rate and inflation rate expectations. The bought IFTBs can be transacted again in the secondary market website (Bidabad, Allahyarifard 2010). The designed mechanism for the transaction of IFTBs increases market efficiency and convergence of their yields rates to real sector rate of return.

Summary and Conclusion

One of the effective financial instruments is treasury notes which capable the government and central bank to apply monetary and fiscal policies. This paper introduced a substitute for treasury bills, which, in addition to being interest-free, can be used in monetary and fiscal policies efficiently. IFTBs can be issued by the government for fiscal policies purposes, and central bank can buy these bonds to perform her monetary policies. Commercial banks can buy or sell these bonds to adjust their financial flows as well.

The secondary market of these notes is over the web without any base price. No lower price than its nominal price is considered by the issuer (government) and the competitive prices offered by buyers on the basis of interaction of expected interest rate and inflation, will form the price.

All governments and central banks of both groups of countries that are and are not willing to prohibit usury can apply IFTBs without any problem.

References

Bijan Bidabad, Abul Hassan, Ben Ali Mohamed Sami, Mahmoud Allahyarifard. Interest-Free Bonds and Central Banking Monetary Instruments. *International Journal of Economics and Finance*. Vol. 3, no. 3, August 2011, pp. 234-241.

DOI: <http://dx.doi.org/10.5539/ijef.v3n3p234>

<http://www.ccsenet.org/journal/index.php/ijef/article/download/11665/8300>

Bijan Bidabad, Abul Hassan, Ben Ali Mohamed Sami, Mahmoud Allahyarifard. Interest-Free Bonds Financial Innovation, A Monetary Instrument for Economy at Crisis. *Journal of Economic Cooperation and Development (JECD)*. 32, 1, 2011, 55-70.

http://www.sesric.org/jecd/jecd_articles/ARTI0102201-2.pdf

Bidabad, Bijan; M. Allahyarifard. IT-Based Usury-Free Financial Innovations. *Proceeding of ECDC 2010, 5th International Conference on e-Commerce in Developing Countries: with focus on e-Banking & e-Insurance*. ECDC 2010, 15-16 September 2010. *American Finance & Banking Review*, 4(1), 39-49, 2019.

<https://www.cribfb.com/journal/index.php/amfbr/article/view/289>

<http://www.bidabad.com/doc/non-usury-finance-it-en.pdf>

Bidabad, Bijan. (2014). *New Operational Islamic Banking System, Volume One, Theoretical Foundations*, LAP Lambert



- Academic Publishing, OmniScriptum GmbH & Co. KG, ISBN: 978-3-659-54463-7.
- Bidabad, Bijan. (2014). *New Operational Islamic Banking System, Volume Two, Applicational Issues*, LAP Lambert Academic Publishing, OmniScriptum GmbH & Co. KG, ISBN: 978-3-659-55210-6.
- Bidabad, Bijan (2018), *General Regulatory Framework in Rastin Profit and Loss Sharing Banking (Part I-Operational Context)*. *Journal of Business and Finance in Emerging Markets*, JBFEM, [S.I.], v. 1, n. 1, p. 11-26, May. ISSN 2580-5568.
<https://doi.org/10.32770/jbfem.vol111-26>
<http://www.bidabad.com/doc/rastin-regulatory-en-I.pdf>
- Bidabad, Bijan (2018), *General Regulatory Framework in Rastin Profit and Loss Sharing Banking (Part II-Legal Groundwork)*. *Journal of Business and Finance in Emerging Markets*, JBFEM, [S.I.], v. 1, n. 2, p. 109-126, Nov. ISSN 2580-5568.
<https://doi.org/10.32770/jbfem.vol1109-126>
<http://www.bidabad.com/doc/rastin-regulatory-en-II.pdf>
- Bidabad, Bijan (2019), *General Regulatory Framework in Rastin Profit and Loss Sharing Banking (Part III-Auxiliary Provisions)*. *Journal of Business and Finance in Emerging Markets*, JBFEM, May, Vol 2, No. 1, pp. 51-65. ISSN 2580-5568.
<https://doi.org/10.32770/jbfem.vol251-66>
<http://www.bidabad.com/doc/rastin-regulatory-en-III.pdf>
- Bidabad, Bijan (2014) *Bijan Bidabad, General monetary equilibrium*. Lap Lambert Academic Publishing, OmniScriptum GmbH & Co. KG, ISBN: 978-3-659-54045-5, Spring.
- Bidabad, Bijan; M. Allahyarifard (2009). *IT based usury free financial innovations*
<http://www.bidabad.com/doc/non-usury-finance-it-en.pdf>
- Bijan Bidabad, (2019) *Interest-Free Treasury Bonds (IFTB), Islamic Finance and Legal Clarifications, 2011*. *International Journal of Islamic Business & Management*, 3(1), 21-29.
<http://www.bidabad.com/doc/interest-free-t-bond-feqhi-en.pdf>
<https://www.cribfb.com/journal/index.php/ijibm/article/view/258/353>
- Komijani, Akbar.; Bidabad, Bijan (1992); *Appropriate monetary policy for economic stabilization in Iran*. Research project no. 111. Ministry of Finance and Economic Affairs, Deputy of Economic Affairs, Tehran, Iran, Phase I.
<http://bidabad.com/doc/siyasathayepooli-volI.pdf>
- Ismal, Rifki. (2009). *Central Bank Islamic Monetary Instruments: A Theoretical Approach*. *Journal of Studies in Finance and Economics*, forthcoming
- Iqbal, Z and Mirakhor, A. (2006). *An Introduction to Islamic Finance: Theory and Practice*. John Wiley and Sons, Hoboken, NJ.
- Jobst, A.A.(2007). *The Economics of Islamic Finance and Securitization*. *Journal of Structured Finance*, Vol. 13 (1), pp.1-12.
- Mills, P. and Presley, J. (1999). *Islamic Finance: Theory and Practices*. Palgrave MacMillan, USA.
- Moody's (2007). *Focus on the Middle East*. *Inside Moody's*, Winter, p. 4.

Moody's (2008). Focus on the Middle East. *Inside Moody's*, Winter, p. 4.

Rabin, Alan. (2004). *Monetary Theory*, Edward Elgar Publishing, Massachusetts, USA.

Sole, J.(2007). Introducing Islamic banks into conventional banking system. Working Paper No. 07/175, IMF, Washington, DC.

Sundarajan, V; Marston, D; and Gaiath, S.(1998). Monetary Operations and Government Debt Management Under Islamic Banking. IMF Working Paper No. 98/144, IMF, Washington, DC

Wilson, Rodney. (2008). Innovative in the Structuring of Islamic Sukuk Securities. *Humanomics*, Vol. 24 (2), pp.170-181

Copyrights

Copyright for this article is retained by the author(s), with first publication rights granted to the journal. This is an open-access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/4.0/>).

