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The Arithmetic Rules of Islamic Finance

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Contents:

Abstract:

Purpose:

The main aim of this paper is to establish and develop the arithmetic principles of Islamic financial engineering. This can enhance the process of financial innovation within the Islamic Financial industry. The application of the arithmetic of financial engineering is the Building blocks, which consists of the implementation, design, and development of creative solutions to the financial problems facing the economic agent.

Design and methodology:

In first, the paper presents theoretically the main basic rules and principles of Islamic finance arithmetic, and then it describes practical applications of those rules on some Islamic financial transactions.

Findings

The paper argues that like conventional finance, some arithmetic principles rule the Islamic finance that we call: the arithmetic of Islamic finance. Well understanding these rules can boost and enhance the development of new Shariah financial instruments.

Practical implications

Establishing and developing the Arithmetic Rules of Islamic Finance can boost the innovation and development of new financial products and solutions.

Originality/value

The paper tries to establish and develop the principle rules of arithmetic of Islamic finance and draws the attention of practitioners as well as of academicians in the Islamic financial industry to its importance in developing new innovative financial instruments.

Keywords: Islamic Finance, Arithmetic of finance, Cash Flows, Payoff, Building Blocks, Financial Engineering.

1. Introduction

Although it is difficult to gauge the exact size of the Islamic financial Market, current estimates suggest it will attain US$ 3.8 trillion by the end of 2019 (Deloitte 2018). Despite its resilience and good performance during the last two decades, the fact cannot be disputed that the Islamic financial market has been confronting some unsettling forces. One of these is- keeping pace with investors and customers' demand for new and innovative products. To achieve this goal, it is crucial for academicians as well as practitioners to develop some systematic rules that could accelerate the design and development of new financial tools and products. To do so, the paper proposes the building block method: an arithmetic approach. In this approach, basic assets and transactions are considered as building blocks that could be used to construct new financial bundles and combinations which are expressed using some basic mathematical operations; a term referred to as the arithmetic of financial engineering.

The lack of prior studies dedicated to developing the rules of Islamic financial engineering is obvious. Therefore, this study intends to fill this gap by proposing the very first step of the Islamic finance arithmetic as a new approach to

Islamic financial engineering. We expect this to encourage further the process of financial innovation within the Islamic finance industry.

The remaining of this paper proceeds as follows: **section** 2 discusses the meaning and the applications of financial engineering with a focus on the building block approach of financial engineering. **Section 3** establishes the arithmetic rules of Islamic finance and their applications in the industry. A summary of the research with possible implications and future horizons of research are presented in the **Conclusion**.

2. Financial Engineering and its Building Blocks.

2.1. Financial Engineering: Meaning, Scope and Aims

Financial engineering is a multidisciplinary field that involves financial sciences, mathematics, statistics, and information technology. In a broader sense, financial engineering is the development and creative application of innovative financial solutions. Financial technology includes financial theory, quantitative techniques, financial products, and financial processes (Beder, Marshall, &

Marshall, 2011). **From a corporate view**, it involves the design, development, and implementation of innovative financial instruments and processes, and the formulation of creative solutions to problems in finance (Finnerty, 1988). It can also be tied to the inter-temporal allocation of resources and the management of risk (Bodie, 2000, p294). Some scholars and practitioners consider financial innovation and financial engineering as two faces of the same coin. However, financial engineering is a means of financial innovation.

Despite its key role and importance in solving the financial challenges facing financial institutions, many practitioners consider financial engineering as a threat to financial soundness and stability. In his book titled, 'The Black Swan', Nassim Taleb, one of the known critics of financial engineering, argues that it replaces common sense and leads to disaster (Taleb, 2007). A series of economic declines have led many governments to argue a return to real engineering from financial engineering. According to (Derman, 2011) the qualitative and quantitative models of financial engineering has failed, he considered them as one of the reasons for the greatest financial crisis. Many experts have accused financial innovations and engineering as the

leading cause of vulnerability in the financial system, over complexity, opacity and a factor of regulatees-regulators confusion that reduces the effectiveness of prudent policies (Brown, 2011; Kane, 2016).

2.2. Financial Engineering via Building Block

One definition of financial engineering that serves the scope of this paper is the use of financial instruments to construct innovative asset and liability structures and to restructure an existing financial profile into one with new properties (Galitz, 2013), this is called building block. A simple definition of the term building block, is simply ‘‘one of the separate parts that can be combined together to make the whole’’; like in the field of construction or any other field, in finance, we see the basic assets* (Stocks and Bonds) as building blocks that can be combined to construct new financial instruments (new buildings).

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* A basic asset (also called primitive asset) is an instrument for which the assurance of payments depends only on the financial status of its issuer.

In fact, there are many approaches of the financial engineering process, in which (The building blocks) approach is considered the most innovative.

Therefore, the **building blocks** in finance forms the creation of new instruments by combining basic and derivative securities into new security. There are three main uses of Financial Building Blocks: viz: managing risks exposures, redesigning financial instruments and designing new products.

In practice, we can apply different methods of building blocks such as the payoff profile method or the arithmetic approach. **The payoff Profile method**, also referred to as **Risk Profile** is the slope or the trend of a line graphed according to the value of an underlying asset on the horizontal axis and the value or changes in value (profits and losses) of a position taken, on the vertical axis. **Figure 1** shows payoff profiles of long and short positions in an asset and a long position in a call option.

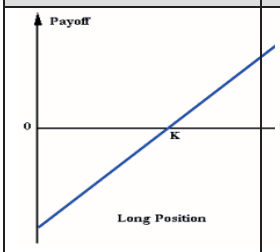
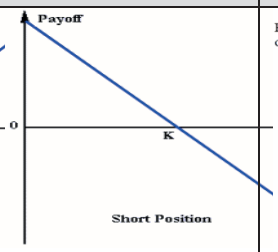
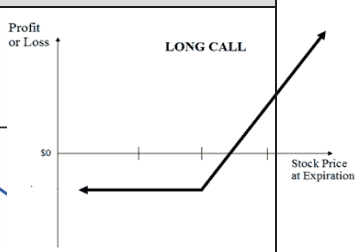
The payoff Profile of Buying an asset at price K.	The payoff Profile of Short Selling.	The payoff Profile of Long Call
		

Figure (1): Payoff Profiles of some Financial Transactions

Smith (1989) established the rules of the Arithmetic approach, as demonstrated in the next section, this approach consists of basic mathematical (arithmetic) operations.

2.3. Combination of Building Block Facility: A new Factor of Diffusion

One of the main reasons why some financial tools have enjoyed huge diffusion and global acceptance is their flexibility to be combined with other financial instruments. According to (Galitz, 2013) "options have enjoyed extraordinary growth since the 1980's due to their tremendous versatility; options can be assembled in myriad combinations and permutations. As such, they can be

thought of as elemental building blocks which can be put together to form a wide range of financial structures."

3. Building Blocks in Islamic Finance: An Arithmetic approach

3.1. The Arithmetic of Finance

The arithmetic of finance is not mathematical finance, the well-known field of finance. **Mathematical finance** also known as quantitative finance or Financial Mathematics is the application of mathematical methods to financial instances; it draws on advanced tools from mathematics (derivatives, integrals…), probability, statistics, stochastic processes, and economic theory. On the other hand, the arithmetic of finance is the use of Arithmetic (the most elementary branch of mathematics) in the field of finance; it uses only the most common processes used in mathematics, i.e. the four arithmetic operations: addition, subtraction, multiplication, and division.

We can express a combination or a bundle of two securities A and B that results to a new security C, as follows:

$$A + B = C \qquad (1)$$

In the arithmetic framework of finance, the "equals" sign means identical characteristics only to the extent of cash flows in terms of amount, currency and timing, the "+" sign indicates a long position and a "-" sign means a short position (Smith, 1989). Here are some examples on this approach:

+A	-B	=	-C
Long Security Position	Short Call		Short Put
+A	+B		+C
Long Security Position	Long Put	=	Long Call

3.2. The Arithmetic Rules

The arithmetic statement in equation (1) is subject to the following rules:

- The (+) sign indicates a long position which means to buy or own a security. The (-) sign indicates a short position which means issue, sell or write a security.

- It is subject to the basic arithmetic operations: addition, subtraction, multiplication, and division. Equation (1) can thus be rewritten as follows: (- A – B = -C) or (+B = + C - A) and so on.
- The more the number of securities introduced on the left side of equation (1), the more combinations of new products can be made.

3.2. Building Blocks via the arithmetic of finance

In many cases, a shift in volatility is the aim of the financial combinations. At other times, a new combination of risk-return is at the core of the financial bundling. Table (1) shows some financial combinations in conventional finance.

Table (1): Some Financial Combinations in Conventional Finance

	Financial Strategy	CF	Combination	Synthetic Asset
Simple Combinations	Covered Call	(+)	Buy Asset (Long) (S)	Short Put Option (X)
		(-)	Short Call Option (X)	
	Protective Put	(+)	Buy Asset (Long) (S)	Long Put Option (X)
		(+)	Long Put Option (X)	
Complex Combinations	Short Straddle	(-)	Short Call Option (X)	Short Position in Asset (S), Short 2 Calls
		(-)	Short Put Option (X)	
	Long Strangle	(+)	Long Call (Y)	Long Call (X), Long Put (Y)
		(+)	Long Put (X)	
More Complicated Combinations	Short Selling	(+)	Share Borrowing	Repurchase Agreement
		(+)	Share Selling	
		(-)	Share Purchasing	
		(-)	Share Return	

(S): Market Price, (X) and (Y): Exercise Prices

Another example of using a building block approach is in structured products; they are financial products based on an underlying asset and differ meaningfully from the assets (Day, T. A. (2011). Structured products).

In many cases, the bundling using financial derivatives and basic underlying assets is done to meet the need for risks management. At other times, the need is to find synthetic securities that can realize an extra return and/or is cost efficient, for example, a call option can be synthesized from forward contracts and riskless securities. A swap can also be synthesized from an appropriate strip of futures or from a strip of futures-like option combinations (Marshall, 1992:535).

3.4. Rules of Islamic Financial contract combinations

Contrary to the building blocks in conventional finance in which there are no limit to the contracts and financial instrument combinations, some restrictions rule the combination of financial products in Islamic Finance. First, each contract in the bundled contracts must be individually

Shariah compatible; this can stated as follow using the arithmetic rules of finance:

$$\forall B; A_{n.c} + B = C_{n.c}$$

Where: $A_{n.c}$ means a non-Shariah compatible instrument (Asset), (B): Asset, $(C_{n.c})$: Non-Shariah compatible combination.

Second, even if all contracts (instruments) bundled are Shariah Compatible, the new bundle (instrument) must not violate the purpose of Shariah or considered explicitly prohibited. Some examples of explicitly prohibited combinations include the combination of two or more sales contracts in a single contract, the combination of a Sale and Loan (Qardh) contracts, bundling two contradicting purpose contracts.

Examples of Shariah compatible bundles include Sale and Leasing (Ijarah), Musharakah and Mudharabah, Musharakah and Murabaha. In the next section, we will apply the arithmetic rules of financial engineering to some Islamic financial products.

Some Clarifications of the Arithmetic equations:

We will use the following terms of the arithmetic of Islamic finance:

(S): Buying an asset at the current price (spot price) (Long Position)

($\bar{S}$): Selling an asset at the current price (Short Position)

(F): Buying an asset at a differed price (future price)

($\bar{F}$): Selling an asset in the future.

3.5. Applying the Arithmetic of Financial Engineering in Islamic Finance

Tawarruq via Murabaha

Technically, Classical Tawarruq is the purchase of an asset at a deferred price, in order to sell it in cash. Selling the asset must be to a third party i.e. the market. There is no dispute between Muslim Scholars on the permissibility of this contract. However, in the contemporary banking system, a new product based on classical Tawarruq has been engineered, it is referred to as Organized Tawarruq or Banking Tawarruq in which a financial institution buys a specific asset (real or financial, but not monetary) for immediate payment, then offers the commodities to their

clients for deferred payment with extra sum. The financial institutions propose to the clients to be the agent(s) or involve other agents to sell the commodities again to the market for immediate payment. At the end, the financial institution credits the money into the clients' accounts.

Let us now use the arithmetic of Islamic finance illustration:

Table (2): The building blocks in Organized Tawarruq

Financial Strategy	CF	Combination	Synthetic Asset
Organized Tawarruq	(-)	Buy Asset (Long) (S)	Credit with cost (C=S-S')
	(+)	Sell Asset (Short) (S')	

Organized Tawarruq is an Islamic alternative to conventional financing, however financing via Tawarruq can be expensive (when S > S'), free (when S = S') or profitable (when S < S'), this depends on the selling price of the asset in the market.

A special case of Tawarruq is observed when reselling the asset to the first seller, that is the prohibited ('Ina), in which

there is a conflict of interest (or agency problem) between the principal (Mustawriq) and the agent (Mutawarriq). In this case, because of the conflict of interest, the financing (from the agent view) cannot be with profit or free (i.e. the cases of S = S' and S < S' are excluded).

Parallel Contracts

Parallelization of contracts is a good example of the building blocks in Islamic finance. It involves the combination of two or more contracts with the same characteristics (volume, underlying asset, and contract specifications).

In parallel Salam for example, a financial institution enters into two Salam contracts. In one of them, the financial institution buys an item(s) and in the second one, it sells the item(s).

In two Shariah-compliant Salam contracts, the two conditions that should rule the new bundled contract (Parallel Salam) are the independence of the two contracts in their rights and obligations (i.e. each contract should have its own force and its performance should not be contingent on the other), and the second contract (Parallel Salam) should be with a third party. This financial

bundling can be expressed using the arithmetic rules of Islamic finance as shown in the table (3):

Table (3): Building Blocks via Parallelization: the example of Salam

Blocks	CF	Combinations	Synthetic
Salam	(-)	Long Position in an Asset (S)	Normal sale with profit ($\bar{S} - S$)
	(+)	Future (F)(*)	
Parallel Salam	(+)	Short Position in Asset ($\bar{S}$)	
	(-)	Future Delivery of Asset at (F)	

(*) We ignored the value of the assets here because the contracts are on the quantity notwithstanding costs.

Combined Contracts

Combination of contracts is the fusion of two or more contracts with different features and legal consequences into a single arrangement by the contracting parties to achieve a specific objective (Al-Omrani, 2010; Hammad, 2005). It has been widely used in Islamic finance for many

purposes, such as product development and risk management. All legal effects and consequences from the hybrid contract agreement, as well as the rights and obligations thereof, is seen as an integral and undivided legal effect of a combined contract" (Hammad, 2005). Many Islamic financial engineers see the combination of contracts as a potential mechanism of product development in Islamic finance (Arbouna, 2007). In practice, contracts such as lease and purchase agreements have been combined; Hibah and Wakālah, Qardh and Muzara'ah, Sarf (currency exchange), Mushārakah, Mudhārabah, etcetera

Organized Salam

The Salam contract is one of the most restricted contracts in Islamic finance as it is subject to many strict conditions (for example, the necessity of paying the price in full to the seller at the point of contracting, the full details with respect to the quality and quantity of goods sold, the specification, and the exact date and place of delivery, etc.)

Table (4): The building blocks in Organized Salam

Financial Strategy	CF	Combination	Synthetic Asset
Organized Salam	(+)	Short Position in Asset at (S)	Credit (Cost: F-S)
	(-)	Future Long Position at (F)	

4. Conclusion

In contrast to Islamic finance, the development of new financial product or instruments in conventional finance is consistently dynamic and upgrading; attributed to financial engineering. There are many approaches to using financial engineering; one of them considers financial engineering as the construction of innovative asset and liability structures; this is the building block approach. The building blocks of financial engineering include traditional instruments, such as fixed-income assets and securities, as well as the off-balance sheet tools (especially options and swaps). The role of the financial engineer is to combine these instruments to provide new financial bundles and combinations to meet a specific aim.

One important aspect of developing new Islamic financial products is the understanding of the arithmetic rules of Islamic Finance. In this paper, we established some arithmetic rules of Islamic Finance which could enhance the design and development of new Islamic financial instruments, however, there is a need to establish other rules.

Finally, Future Prospects of Research in the field of Islamic financial engineering will focus on two main directions; first is the application of the arithmetic rules of Islamic finance to distinguish prohibited products from the Shariah-compliant ones; and secondly, the establishment of a theory of financial innovation in Islamic finance which can describe and justify the creation and diffusion of new financial products.

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5. References

1. Al-Omrani, A. (Ed.). (2010). *Combined financial contracts* (2nd ed.). Riyadh: Kunuz Ishbilia.
2. Arbouna, M. B. (2007). The combination of contracts in Shariah: A possible mechanism for product development in Islamic banking and finance. *Thunderbird International Business Review, 49*(3), 341.
3. Beder, T. S., Marshall, C. M., & Marshall, C. M. (2011). *Financial Engineering: The evolution of a profession*. Hoboken: John Wiley & Sons, Incorporated.
4. Bodie, Z. (2000). Financial engineering and social security reform. In J. Campbell, & M. Feldstein (Eds.), *Risk aspects of investment-based social security reform* (pp. 291-320) University of Chicago Press. doi:10.7208/chicago/9780226092560.003.0009
5. Brown, A. (2011). *Red-blooded risk : The secret history of wall street* (1st ed.). New York: John Wiley & Sons, Incorporated.
6. Derman, E. (2011). Models Behaving Badly.: Why confusing illusion with reality can lead to disaster, on wall street and in life (1st ed.). New York: John Wiley & Sons Inc.
7. Finnerty, J. D. (1988). Financial engineering in corporate finance: An overview. *Financial Management, 17*(4), 14-33. doi:https://doi.org/10.2307/3665764
8. Galitz, L. (2013). The financial times handbook of financial engineering: Using derivatives to manage

risk (Third; 3 ed.). Harlow: Ft Publishing International - M.U.A.

9. Hammad, N. (Ed.). (2005). *Al-uqud al-Murakkabah fi al-Fiqh al-Islami* (1st ed.). Damascus: Dar al Qalam.
10. Kane, E. J. (2016). A theory of how and why central-bank culture supports predatory risk-taking at megabanks. *Atlantic Economic Journal, 44*(1), 51-71. doi:10.1007/s11293-016-9482-x
11. Smith, D. J. (1989). The arithmetic of financial engineering. *Journal of Applied Corporate Finance, 1*(4), 49-58. doi:10.1111/j.1745-6622.1989.tb00173.x
12. Taleb, N. N. (2007). *The black swan: The impact of the highly improbable* (1st ed.). New York: Random House.

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