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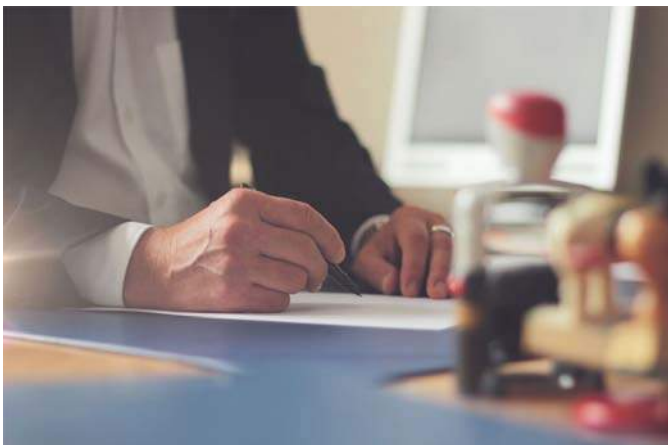
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# Advancing a Comprehensive Islamic Rate of Return Benchmark for Global Financial Integrity

Anwar Hasan Abdullah Othman & Aznan Bin Hasan

## ABSTRACT

The proposed alternative Islamic Rate of Return benchmark (IRR) is intended to address the issue of using backward-looking rates in Islamic finance that are challenging due to the *Shariah* principle of *Gharar*, which requires certainty on all fundamental contract terms. The IRR is designed to satisfy both economic and *Shariah* principles and aligns with free market principles by using general equilibrium theory to estimate a fair rate of return based on the opportunity cost (measured by EGR) and market supply-demand dynamics. It takes into account both economic fundamentals and risk considerations by combining two components: the EGR component and the risk premium component. Therefore, the IRR benchmark promotes responsible and sustainable financing or investment practices and supports the development of a robust and inclusive financial system that serves the needs of all stakeholders. However, for IRR to be a viable alternative to interest-based benchmarks, central banks and the banking industry must carefully examine, modify, engage stakeholde, and collaborate to ensure a seamless transition.

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*Classification:* JEL: G21

*Language:* English

# Advancing a Comprehensive Islamic Rate of Return Benchmark for Global Financial Integrity

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*The proposed alternative Islamic Rate of Return benchmark (IRR) is intended to address the issue of using backward-looking rates in Islamic finance that are challenging due to the Shariah principle of Gharar, which requires certainty on all fundamental contract terms. The IRR is designed to satisfy both economic and Shariah principles and aligns with free market principles by using general equilibrium theory to estimate a fair rate of return based on the opportunity cost (measured by EGR) and market supply-demand dynamics. It takes into account both economic fundamentals and risk considerations by combining two components: the EGR component and the risk premium component. Therefore, the IRR benchmark promotes responsible and sustainable financing or investment practices and supports the development of a robust and inclusive financial system that serves the needs of all stakeholders. However, for IRR to be a viable alternative to interest-based benchmarks, central banks and the banking industry must carefully examine, modify, engage stakeholders, and collaborate to ensure a seamless transition.*

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## I.    INTRODUCTION

Historically, interest rates have been charged on loans and debts since ancient civilizations such as Mesopotamia and Egypt. Interest rates have evolved over time, influenced by a variety of economic, political, and social factors (Homer & Sylla, 1996). In the medieval period, usury laws were implemented to regulate interest rates and prevent exploitation. These laws often set maximum interest rates, which varied depending on the type of loan and the borrower's social status (Homer & Sylla, 1996). Interest rates remained relatively low until the 18th century, when the Industrial Revolution led to increased economic growth and higher demand for credit (Homer & Sylla, 1996). The 19th century saw the development of modern central banking, with the creation of institutions such as the Bank of England and the Federal Reserve) Epstein, 2006). Central banks began to use interest rates as a tool for controlling inflation and stabilizing the economy (Woodford, 1998). During this period, interest rates varied widely, with some countries experiencing high inflation and others experiencing deflation (Woodford, 1998 and Bernanke, 2013). The 20th century saw significant fluctuations in interest rates, including periods of high inflation in the 1970s and 1980s. In response, central banks began to adopt more aggressive monetary policies, including tightening credit and raising interest rates (Clarida et al., 1998). This led to a period of relatively low inflation and interest rates in the late 20th century and early 21st century (Taylor, 2014). Today, interest rates continue to be influenced by a variety of factors, including economic growth, inflation, geopolitical events, and monetary policy decisions (Khumalo et al., 2017). Central banks around the world continue to use interest rates as a tool for regulating the economy, with many adopting a low-interest-rate policy in response to the economic challenges of the COVID-19 pandemic (Fischer, 2021).

The London Interbank Offered Rate, or LIBOR, began in the 1960s as a way for banks to lend money to each other in the London interbank

market (Wiggs, 2022). At the time, there was no standard interest rate for interbank lending, and each bank negotiated its own rate with other banks (Wiggs, 2022). In 1969, the British Bankers' Association (BBA) began surveying a group of banks to determine the average interest rate at which they were lending to each other. This survey became known as the BBA Libor (later simply "LIBOR"), and it was initially based on rates for five currencies and seven maturities (Hou & Skeie, 2014). Over time, the number of banks involved in the survey grew, as did the number of currencies and maturities covered. By the 1980s, LIBOR had become the dominant benchmark for interbank lending around the world, and it was also used as a benchmark for a wide range of financial products, including mortgages, student loans, and credit cards (Schrimpf & Sushko, 2019). In 2012, it was revealed that some banks had been manipulating LIBOR rates for their own financial gain, leading to a scandal and calls for reform (Bryce, 2012). In response, regulatory bodies began to explore alternative benchmarks, and in 2017 the BBA announced that it would no longer be involved in the administration of LIBOR after 2021(Manjunath & Augusty, 2021). In 2020, it was announced that LIBOR would be phased out by the end of 2021, and that banks would need to transition to alternative benchmark rates. This transition has been a complex process, with significant implications for financial markets and the wider economy (Klingler & Syrstad, 2021).

As LIBOR is being phased out by the end of 2021, a number of alternative benchmark rates have been developed to replace it. The main alternatives are: i. SOFR (Secured Overnight Financing Rate): This rate is based on the overnight borrowing and lending activity of banks in the U.S. Treasury repurchase market. It is considered a more accurate reflection of market rates than LIBOR, which is based on estimates provided by banks. ii. SONIA (Sterling Overnight Index Average): This rate is based on the average interest rate paid on overnight unsecured loans in the sterling wholesale money markets. It is administered by the Bank of England. iii. SARON (Swiss Average Rate Overnight): This rate is based on the average overnight interest rate for

unsecured transactions in the Swiss franc market. iv. TONAR (Tokyo Overnight Average Rate): This rate is based on the weighted average of unsecured overnight call rates in the Japanese money market. v. €STR (Euro Short-Term Rate): This rate is based on the overnight borrowing and lending activity of banks in the euro area. It is administered by the European Central Bank (Federal Reserve Bank of New York, 2021; Bank of England, 2021; Swiss National Bank, 2021; Bank of Japan, 2021; and European Central Bank, 2021).

Each of these rates has its own methodology and characteristics, and some are better suited for certain financial products than others. The transition away from LIBOR to these alternative rates has been a significant undertaking for the financial industry, requiring changes to contracts, systems, and processes. However, alternative risk-free rates (RFRs) have been developed to replace the LIBOR as the benchmark interest rate for financial contracts, as LIBOR is set to be phased out by the end of 2021. While RFRs have some advantages, there are also several weaknesses that could pose challenges for market participants. For example, a.) Limited historical data: Unlike LIBOR, which has been used as a benchmark for decades, RFRs are relatively new and have limited historical data. This lack of historical data makes it more difficult to develop models for predicting future interest rates. b.) Lack of term structure: LIBOR has various maturities (e.g., 1-month, 3-month, 6-month, and 12-month), which allows for a term structure of interest rates. In contrast, most RFRs only have an overnight rate, making it more difficult to price financial instruments with longer-term maturities. c.) Market volatility: RFRs are based on secured lending, which can be affected by market volatility. For example, during times of market stress, the spread between overnight RFRs and longer-term funding rates may widen, leading to increased borrowing costs for market participants. d.) Basis risk: The transition from LIBOR to RFRs may lead to basis risk, which is the risk that the value of a financial instrument changes because of differences between the benchmark rate and the actual funding rate. This basis risk could arise due to differences in the

calculation methodology, tenor, or liquidity of LIBOR versus the RFRs (Bos, 2019; and Schrimpf & Sushko, 2019).

## 1.1 Islamic Finance Benchmarks

The use of Islamic finance benchmarks is relatively new compared to conventional finance, and there are currently several Islamic finance benchmarks available in the market. These benchmarks are designed to comply with *Sharia* principles, which prohibit interest-based transactions and promote risk-sharing and ethical investments. For example: a) Islamic Interbank Benchmark Rate (IIBR): This rate is based on the average profit rate of participating Islamic banks in the interbank money market. b) Islamic Overnight Money Market Rate (IOMM): This rate is based on the average overnight rate of the Islamic interbank money market. c) Islamic Investment Rate (IIR): This rate is based on the returns generated by *Shariah*-compliant investments (Saiti et al., 2016; Nechi & Smaoui, 2019; Zainol, & Kassim, 2010).

It is worth noting that there is currently no global standard for *Shariah*-compliant benchmarks, and the use of different benchmarks may vary by jurisdiction and financial product. Furthermore, some experts argue that the Islamic finance industry still relies heavily on conventional benchmarks such as LIBOR or newly alternative RFRs, and that more work is needed to develop robust and reliable *Shariah*-compliant benchmarks (Azad et al., 2018).

## 1.2 Problem Statement

The critical difference between RFRs and IBORs, such as LIBOR, is that RFRs are backwards-looking rates based on actual transactions reported to the administrator of the relevant RFR, while IBORs are forward-looking term rates fixed and known at the start of an interest period. IBORs also include credit and liquidity premiums, which are absent in RFRs or other alternative rates such as central bank rates. The use of credit adjustment spreads is one way to deal with any potential transfer of value between the parties. Therefore, it is not simply a matter of substituting an IBOR for a currency with the chosen RFR for that currency. In addition, the use of backward-looking rates in Islamic financing products presents a significant challenge because the *Shariah* principle of *Gharar* (uncertainty) requires certainty on all fundamental contract terms. Using LIBOR as a reference rate provides certainty on pricing at the start of any contract or calculation period due to its forward-looking nature, which is not the case with RFRs. To address this issue, alternative arrangements such as using alternative rates, reconciliation payments, and rebates can be used by many Islamic financial institutions. However, these approaches also have limitations, such as the risk of rate changes during the tenor of the contract or calculation period, the introduction of uncertainty, and the potential exposure of either the bank or the customer. Therefore, alternative solutions need to be explored to ensure compliance with Islamic principles while addressing the challenges posed using alternative RFRs. The goal of this research is to introduce an alternative IRR benchmark that satisfies both the economic and *Shariah* principles as well as serves the needs of all stakeholders.

## II. LITTERER REVIEW

The Theory of Interest that developed by Irving Fisher (1930) is considered to be one of the most influential works in the history of economic thought and has had a significant impact on the development of modern monetary theory and macroeconomics (Fisher, 1930). The theory of interest rates is a fundamental concept in economics that explains how interest rates are determined in a market economy. Interest rates are the price that borrowers pay to lenders for the use of funds, and are a crucial factor in determining investment and savings decisions (Paul & Dutt, 1991). The basic principle behind the theory of interest rates is that interest rates are determined by the interaction of supply and demand in the market for loanable funds. This market includes borrowers who are seeking funds to invest in new projects or to finance their current operations, and lenders who have funds available to lend (Mishkin, 2011; and Cecchetti &

Schoenholtz, 2017). The level of interest rates is influenced by a variety of factors, including the time preference of savers and borrowers, the level of investment demand, the productivity of capital, and the level of risk associated with lending and borrowing (Temperton, 1986). In addition to these supply and demand factors, interest rates are also affected by monetary policy, including the actions of central banks and government policies related to inflation, taxation, and fiscal policy (Bernanke & Reinhart, 2004).

Islamic finance operates under the principles of *Shariah*, which prohibits the charging or paying of interest (riba) on loans and investments. Therefore, interest rate modeling in Islamic finance was discussed and studied by *Shariah* scholars and researchers to establish a model that can fulfil the *Shariah* compliance requirements and support economic growth. For instance, the study by Thomson Reuters and Accounting and Auditing Organization for Islamic Financial Institutions (AAOIFI) (2011) introduces the Islamic Interbank Benchmark Rate (IIBR) as a benchmark for Islamic finance. The study provides an overview of the IIBR, which is designed to provide a *Shariah*-compliant alternative to conventional benchmarks such as LIBOR. The IIBR is based on actual transactions in the interbank market and is calculated using a methodology that is consistent with the principles of Islamic finance. The study highlights the importance of having a robust benchmark for Islamic finance that can support the growth and development of the industry. Similarly, the study by JIBM Discussion Forum (2014) discusses the Thomson Reuters' IIBR and examines whether it is an important step forward for the authenticity of Islamic finance. They argue that the IIBR may not necessarily reflect the true nature of Islamic finance, as it relies on the same underlying principles as conventional benchmarks such as LIBOR. They suggest that the development of a true Islamic benchmark should be based on the principles of profit and loss sharing, and not rely on interest-based models.

In addition, the early study by Ebrahim & Khan (2002) proposed a model for an Islamic convertible mortgage, which can be used to finance infrastructure projects in emerging Muslim countries. The mortgage is designed as a combination of an Islamic credit facility and the inclusion of real warrants to mitigate the agency cost of debt. The authors used numerical simulation to endogenously solve for the rate of return, tenure, and fractional ownership to be conveyed to the financier upon conversion of the facility without resorting to any interest-based (Ribawi) index. They also conducted sensitivity analysis to study the impact of exogenous variables and reconcile with existing mainstream finance literature. In addition, the study by Iqbal (1999) identified a major gap in the development of Islamic financial market operations, highlighting the absence of a well-developed benchmark that could facilitate macro- and micro-level decision making with regards to cost of capital and opportunity cost of investments in comparative projects of similar risk. Islamic financial institutions are currently relying on interest rate-based indices such as LIBOR to make lending decisions, which is unacceptable according to Islamic principles that prohibit a predetermined or fixed rate of capital. The paper proposed a benchmark based on Tobin's q theory of investment, which would be useful for firms, banks, governments, and institutions to make both macro- and micro-level decisions.

The study by Omar et al (2010) aimed to replace market interest rates in Islamic finance with an Islamic pricing benchmark based on the risk profiles of real economic ventures. It proposed an endogenously determined benchmark tied to productivity and profitability of assets, aligning with Shariah principles. The study recognized sectoral differences and identified four macroeconomic variables namely, industry production growth; the money supply changes (M2); the ringgit exchange rate; and the Kuala Lumpur Composite Index returns as predictors of returns. Monte Carlo simulations demonstrated the model's strong predictive ability, and bootstrap simulations confirmed its reliability. A weighted average of sectoral benchmarks was computed to derive a final pricing rate, which was proposed as the Islamic benchmark rate for the overall market. The benchmark was Shariah-compliant, stable, and comparable to

conventional rates. The study suggested that other institutions adopt the model for independent Islamic finance in addressing the global economic crisis. Furthermore, this study of Yusof et al (2011) examined the possibility of using the rental rate as an alternative benchmark for pricing Islamic home financing products. The study analysed Malaysian data from 1990 to 2006 and uses econometric time-series analysis to compare the rental rate with lending rate and selected macroeconomic variables that could influence property value. The results indicated that the rental rate is a better alternative than the lending rate for pricing Islamic home financing products. The rental rate is found to be resilient to short-term economic volatility and reflective of economic fundamentals in the long run, making it a fair pricing mechanism for the Islamic home financing product. This study provided empirical evidence for an alternative benchmark for pricing Islamic home financing products and is the first of its kind to do so.

The Ghauri (2015) argued that interest rate benchmarks cannot be used for pricing Islamic financial products since they do not represent real economic activities. The paper took a Shariah perspective and considered ground realities to support its argument. The viewpoint was established through a comparison of conventional and Islamic financial product pricing, as well as a comparison of interest rates with macroeconomic indicators. The paper emphasized that Islamic finance should have its own footing in terms of product development. This paper provided a new perspective on product development in Islamic financial institutions. Additionally, the study by Mirakhor (2017) focused on the development of appropriate benchmarks for Islamic asset pricing. The author explained the importance of benchmarks in financial markets and highlights the issues arising from the use of interest-based benchmarks, such as LIBOR, in the Islamic finance industry. The study established a link between the concept of benchmarking and the doctrine of market price in Islam and argues for the creation of an interest-free benchmark to replace LIBOR. The author also discussed the challenges in developing Islamic benchmarks and suggests potential solutions, such as the use of

profit-and-loss-sharing structures and the application of Islamic principles to existing benchmarks. Overall, the study provided insights into the critical role of benchmarks in Islamic asset pricing and the need for appropriate benchmarks to support the growth of the Islamic finance industry.

In their paper Sari et al (2017) argued that Malaysia's current macroeconomic policies are based on conventional risk-transfer and/or risk-shifting paradigm rather than the risk-sharing principles proposed in Islamic finance. To become a global leader in Islamic finance, Malaysia needs to develop an alternative Shariah-based monetary policy framework. One key element is to develop an Islamic Pricing Benchmark (IPB) that is free from interest rates. The paper investigated the use of equity risk premium as an incentive structure for adopting a Shariah-based monetary policy but found that it is not statistically significant. Instead, the paper proposed return on equity (ROE) as a better alternative to replace interest rates in the Islamic monetary policy framework in Malaysia. Moreso, the study by Azad et al (2018) investigated whether Islamic banks can have their own benchmark rate by examining the relationship between the Islamic interbank benchmark rate (IIBR) and its conventional counterpart, the London interbank offer rate (LIBOR). The study found that there are both long-term and short-term dynamic relationships between the two rates, and that the existence of the IIBR-LIBOR spread reflects the cost of funding and profit potential of the participating IIBR rate-setters. The authors argued that the Islamic banking industry is operating in a global context and that it is unlikely that its rates can decouple from global benchmarks. They suggested that arbitrage activities force Islamic rates to converge with global benchmark rates, given the similarity of Islamic and conventional banking products and their risk-return profiles.

The paper by Ahmed et al (2018) proposed the Islamic pricing benchmark model (IPBM) as an alternative to London Interbank Offered Rate (LIBOR) and a practical mechanism to evaluate investment projects for Islamic financial

institutions. The IPBM suggested estimating the rate of return for a project based on its expected future cash flows relative to the invested capital, rather than relying on interest-based indicators. The proposed model incorporates Shariah parameters, making it a Shariah-compliant pricing mechanism for Islamic financial products. The IPBM may bring more credibility to the Islamic financial system and contribute to finding an alternative Islamic pricing benchmark. The study provided empirical evidence for the feasibility and practical effectiveness of the IPBM as an Islamic benchmark. Further, the study by Redzuan & Kassim (2018) compared the viability of alternative pricing mechanisms for Islamic home financing products in Malaysia. The study focused on the sensitivity and fragility of the product to financial market volatility and compares the interest-based benchmark with a non-interest benchmark. The non-interest benchmark is the Housing Price Index (HPI) and economic growth is used as the indicator of economic activities. Through correlation analysis, the study found that the non-interest benchmark shows better relationships with macroeconomic variables compared to the interest-based benchmark. The findings suggest that alternative benchmarks, such as HPI, could provide stability for non-interest financing instruments and be a feasible benchmark for Islamic home financing products.

This paper of Nechi & Smaoui (2019) explored the differences between the Islamic Interbank Benchmark Rate (IIBR) and conventional interbank rates in the Gulf Cooperation Council (GCC) countries. The study found that the IIBR, developed by 17 Islamic banks in six countries, is not independently determined and shows a long-term relationship with conventional rates. The paper also suggested that market conditions like oil prices and inflation do not significantly impact the dynamics between the IIBR and conventional benchmarks. Overall, the findings highlighted the interdependence of Islamic and conventional monetary tools in the GCC region. In addition, the study by Rachmawaty (2020) discussed the issues surrounding the use of interest rates as an Islamic Pricing Benchmark (IPB) and provides a literature review of various

alternatives proposed by scholars. The paper aimed to achieve three objectives: first, to provide an overview of the literature review on existing alternatives to interest rates as IPBs; second, to present the advantages and disadvantages of using interest rates as IPBs; and third, to propose an alternative IPB based on the nature of business. The proposed alternative IPB would be categorized based on debt financing, equity financing, and combined financing. The paper suggests that adjustments in infrastructure are necessary to implement the proposed IPB, including changes in customer behavior, educating customers, changing the role of banks, and rethinking the cost of statutory reserve requirements in central banks.

The study of Setianingrum (2021) aimed to identify a benchmark for pricing returns in the Islamic financial system that can overcome business cycle in new normal. The researcher used the analytic network process (ANP) method to collect and analyze data from stakeholders and experts in the field through in-depth interviews and questionnaires. The study found that the rate of profit is the most important element for base pricing, and the actual trading index is the benchmark for pricing in the Islamic financial system. The researcher recommended the use of accounting software and big data for better analysis and suggests that the development of an Islamic pricing benchmark index will help in product development in Islamic finance. Moreover, the paper of Tahiri Jouti (2021) aimed to understand the issue of interest rate benchmarking in Islamic financial institutions (IFIs) and assess the relevance of creating a Sharīʿah-compliant profit rate benchmark to solve the issue. The paper concluded that conceiving a profit rate benchmark for the Islamic finance industry is not relevant to raising the Sharīʿah credibility of the industry. Instead, several adjustments need to be introduced in terms of the business model and economic approach for IFIs to achieve their objectives. The paper challenged the idea that creating a profit rate benchmark is the only solution for the pricing issue in IFIs and suggests a deeper understanding of the situation. The recommendations require the involvement of

financial authorities and governments for their implementation.

A recent study by Hassan, Muneeza, and Mohamed (2022) reviews the ongoing financial benchmark reforms affecting Islamic finance, such as the replacement of LIBOR with alternative reference rates. The authors examine the impact of these reforms on financial products and the challenges faced by Islamic finance institutions in adopting new benchmark rates. They propose solutions to address these challenges and highlight the importance of transparency and standardization in the development of new benchmark rates. The study emphasizes the need for collaboration between the Islamic finance industry, regulators, and industry stakeholders to ensure that the new benchmarks align with the principles of Islamic finance. Finally, study by Uddin et al (2022) proposed a basic pricing model that captures the common risks in sukuk returns, identifying sukuk market risk and information asymmetry risk as the two risk factors that require risk premiums. By using these two common risk factors, investment analysts can estimate the fair value of sukuk more precisely than using ad hoc measures like LIBOR or the Islamic interbank benchmark rate.

There have been several studies presenting different models to develop Islamic benchmarks; however, none have succeeded in developing a benchmark that can be applied across all Islamic assets, products, and instruments. In addition, most of these studies are ineffective to define the alternative opportunity cost that is economic-based to replace debt-based such as the risk-free rate. Accordingly, this study proposed an IRR Benchmark that reflects both risks and returns resulting from economic activity, thereby achieving *Shariah* principles and being generic enough to be used in evaluating and pricing Islamic products, assets, and instruments.

## III.  PROPOSED AN ISLAMIC RATE OF RETURN BENCHMARK

In Islamic jurisprudence, the market price is a commonly used term to determine a fair price in many situations. The market price is seen as the price that results from the dynamic interaction of supply and demand in a free and competitive market. It is considered to be a fair price because it reflects the value that buyers and sellers place on a particular good or service at a particular time. In Islamic finance, the concept of market price is often used to determine the price of commodities, stocks, and other assets in various transactions such as sale, leasing, and exchange. The market price is also used as a benchmark to determine the fair value of assets for accounting and valuation purposes. Moreover, the use of market prices in Islamic jurisprudence extends beyond commercial transactions to the settlement of disputes. This is especially true in cases where the price of a disputed asset or commodity is contested. Islamic courts and arbitrators often use market prices as a basis for determining a fair settlement, especially when the market price is considered a reliable indicator of the true value of the asset or commodity in question.

There are many hadiths in which the Prophet Muhammad (peace be upon him) refused to set a price for goods or services and left it to be decided by the market. This approach is in line with the Islamic principle of free market competition. It also emphasizes the idea that prices should be determined by the forces of supply and demand rather than by individuals or authorities.

One such hadith is narrated by Abu Hurayrah: *"A man came and said, "Messenger of Allah, fix prices." He said, "(No), but I shall pray." Another man came and said, "Messenger of Allah, fix prices." He said, "In fact, it is Allah Who makes [prices] low and high. I hope that when I meet Allah none of you will have any claim against me for any injustice." (Omar et al., 2010).*

*Another hadith narrated by* Anas Ibn Malik: *The people said, "Messenger of Allah, prices have shot up, so fix prices for us." Allah's Messenger (peace be upon him) replied: "Verily, Allah [determines the climate of economic affluence and gloom. I do not want to take any action to fix prices because] I do not want to meet Allah with anyone among you demanding redress for wrong done to them regarding property or blood." Omar et al., 2010).*

Overall, these and other hadiths reflect the importance of free market principles in Islamic

jurisprudence. They also reflect the belief that prices should be determined by market forces rather than by arbitrary or subjective factors.

### 3.1 The General Equilibrium Theory

General Equilibrium Theory is a widely used economic theory that analyzes the interactions between various economic agents and the prices of goods and services in an economy. It states that in a perfectly competitive market, prices are determined by the forces of supply and demand (Debreu, 1959 and Arrow & Hahn, 1971). This means that the market will eventually reach a state of equilibrium where the quantity supplied equals the quantity demanded at a particular price (Baumol & Blinder, 2015). In the context of Islamic finance, the General Equilibrium Theory can be used to establish an Islamic benchmark for financing, evaluating, or pricing financial products. By analyzing the supply and demand of funds in the market, this theory can help to determine the fair value or price of financial products, instruments or assets. Moreover, the application of General Equilibrium Theory can help to ensure that the financial system is operating efficiently and effectively, with prices reflecting the true value of assets and services. This can lead to greater transparency and fairness in the financial industry, as well as greater confidence among investors and consumers. Overall, the application of General Equilibrium Theory can provide a useful framework for establishing an Islamic benchmark for financing, evaluating, or pricing financial products, and can help to promote greater stability, transparency, and efficiency in the Islamic finance industry.

The application of General Equilibrium Theory in Islamic finance relies on several assumptions. These include:

1. Rationality: Economic agents in financial markets are rational and seek to maximize their utility or profit.
2. Perfect competition: Markets are perfectly competitive, meaning that there are many lenders and borrowers, and no single agent can influence fund prices.
3. Information efficiency: All economic agents have access to perfect information, and prices reflect all available information.
4. No market frictions: There are no transaction costs, taxes, or other market frictions that could distort prices or limit market participation.
5. Homogeneous products: All financial assets are identical, and investors are indifferent between them.
6. No externalities: The actions of one economic agent do not affect the well-being of others in the market.

While these assumptions may not always hold in practice, they provide an effective framework for analyzing the behavior of funds' supply, demand, and prices in financial markets. By understanding the underlying assumptions of the General Equilibrium Theory, Islamic finance practitioners and policymakers can identify potential sources of market failure or inefficiencies. They can also design mechanisms to promote greater efficiency, transparency, and fairness in financial systems. In addition, by using the equilibrium interest rate (that reflects the opportunity cost of funds), Islamic finance can ensure that returns on investment are based on the actual performance of the investment, and that the allocation of resources is based on the potential returns and risks involved.

### 3.2 Economic Growth Rate, Opportunity Costs and Equilibrium rate of return

The Economic Growth Rate (EGR) is a useful tool in Islamic finance for measuring opportunity costs that reflect the equilibrium rate of return. The EGR is based on the concept of *Maqasid al-Shariah*, which refers to the objectives of Islamic law. According to this concept, one of the objectives of Islamic law is to ensure the preservation of wealth. The EGR is designed to promote this objective by ensuring that the opportunity costs of financing or investment in Islamic finance are in line with the EGR. Opportunity cost refers to the cost of foregoing the best alternative investment opportunity. In Islamic finance, the opportunity cost is related to the profit or return that could be earned from the

next best investment opportunity. The EGR index provides a measure of the opportunity cost of investment in Islamic finance by taking into account the EGR.

The EGR Index is a measure of the annual percentage increase in the gross domestic product (GDP) of an economy. The EGR index is calculated by considering various economic factors, such as inflation, productivity, and investment. The index reflects the equilibrium rate of return (opportunity cost) that is consistent with the EGR. By using the EGR index as a benchmark for opportunity cost, Islamic finance practitioners can ensure that the profit and loss sharing ratios are fair and reasonable and reflect the opportunity costs of investment in Islamic finance. In addition, using the EGR Index as a measure of equilibrium rate of return in Islamic finance can promote transparency, efficiency, and fairness in financial systems. It can ensure that returns on investment are based on the potential returns and risks involved in the investment, rather than on predetermined interest rates. This promotes a more equitable and sustainable financial system that supports economic growth and development while adhering to the principles of Islamic law.
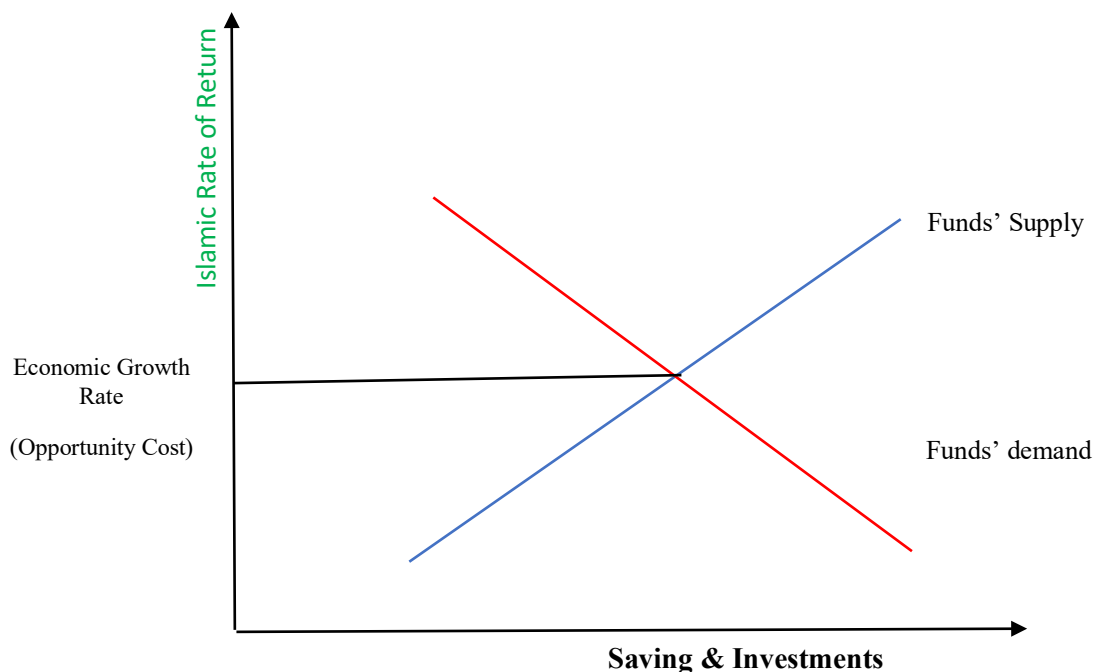


*Figure (1):* Equilibrium rate of return in Islamic Economy

### 3.3 Measuring Dynamic Interaction between Funds' Demand and Funds' Supply

Measuring the dynamic interaction between funds' demand and supply is a key component of the General Equilibrium Theory in financial markets. This interaction is captured by the change of equilibrium rate of return level, which represents the rate at which the demand for funds is equal to the supply of funds in the market. The equilibrium rate of return is determined by the intersection of the demand and supply curves for funds.

In particular, demand for funds is typically represented by the investment opportunities available to economic agents in the market. Economic agents seek to invest their funds in opportunities that offer the highest expected returns, given the associated risks. As the expected returns on investment opportunities increase, the demand for funds increases, leading to a higher equilibrium rate of return. The supply of funds is represented by the savings behavior of economic agents in the market. Economic agents seek to save a portion of their income for future consumption or investment opportunities. As the

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consumption or investment opportunities. As the savings rate increases, the supply of funds increases, leading to a lower equilibrium rate of return. The interaction between funds' demand and supply can be measured using various tools and techniques, including econometric models, time-series analysis, and statistical inference. These methods can be used to estimate the demand and supply curves for funds, and to identify factors that affect the equilibrium rate of return, such as changes in economic policy, technological innovation, or shifts in consumer preferences. In Islamic finance, the interaction between funds' demand and supply is influenced by additional factors, such as the principles of risk-sharing and the avoidance of interest-based transactions. These principles can lead to a different equilibrium rate of return than that observed in conventional finance, as they may affect the incentives of economic agents to save and invest, and the allocation of resources across different investment opportunities. Therefore, it is a necessity to carefully consider the specific context and principles of Islamic finance when measuring the interaction between funds' demand and supply in financial markets.

For the calculation of the IRR, the relationship between funds' supply and demand must be taken into account. As mentioned earlier, the equilibrium rate of return in a financial market represents the point at which the demand for funds equals the supply of funds. Therefore, any change in the supply or demand for funds will have an effect on the equilibrium rate of return level and, subsequently, the price level of funds on the financial market. Mathematically it is calculated using the following formula:

$$\text{Interaction} = (\text{Funds' Demand} / \text{Funds' Supply}).$$
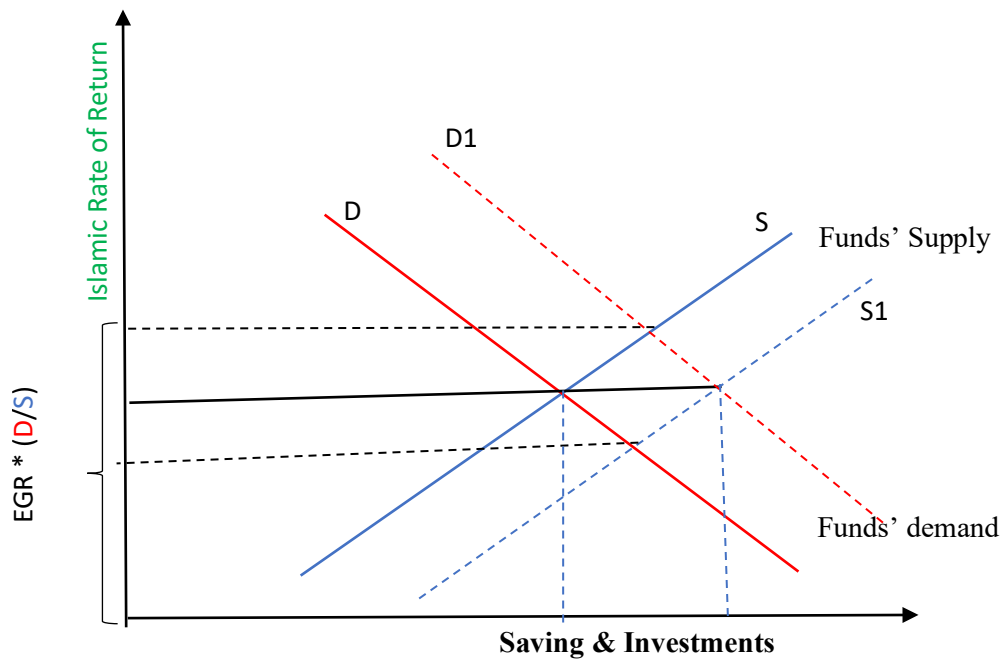


Figure (2): Measuring dynamic Interaction between Funds' Demand and Supply

## 3.4 Risk premium measurement

When calculating IRR, it is imperative to consider all the relevant market risk premiums that may influence the pricing of financial contracts and assets in Islamic financial institutions. These risk premiums may include liquidity risk, credit risk, currency risk, and other market risks that may

affect the value of financial assets. Liquidity risk refers to the risk that a financial asset cannot be traded quickly enough to prevent a loss or that it cannot be sold at its fair market value. In Islamic finance, the use of profit and loss sharing contracts and the avoidance of interest-based transactions can affect the liquidity of financial assets and may require additional risk premiums to compensate for this risk. Credit risk refers to the risk that the counterparty in a financial transaction will default on their obligation. In Islamic finance, the use of profit and loss sharing contracts may require additional risk premiums to compensate for the uncertainty of the returns generated by the investment and the possibility of losses. Currency risk refers to the risk that changes in exchange rates will affect the value of financial assets denominated in foreign currencies. In Islamic finance, the use of profit and loss sharing contracts may require additional risk premiums to compensate for the risk of currency fluctuations and the potential impact on the returns generated by the investment. Therefore, when calculating the IRR in Islamic finance, all of these market risk premiums must be taken into consideration. This will ensure that the pricing of financial contracts and assets reflects their true economic value. This can help to ensure that the returns generated by Islamic financial institutions are consistent with the principles of Islamic finance and the expectations of investors. This can be expressed mathematically as follows:

**Market Risk** = liquidity risk + credit risk + currency risk + other market risks
**Risk Premium** = Market Risks – (EGR *(D/S)).

### 3.5 Calculation of Islamic Rate of Return (IRR)

The Islamic rate of return is a concept that refers to the return on investment in accordance with Islamic principles, which prohibit charging or paying interest, as well as engaging in speculative or unethical investments. The Islamic rate of return is calculated as the sum of two components: the EGR with funds' demand and supply dynamic changes and the risk premium. Mathematically it is represented by the following formula:

**Islamic Rate of Return** = Economic Growth Rate * (Funds' Demand/Funds' Supply) + Risk Premium
IRR= **EGR***(D/S) +RP

In this formula, the EGR represents the benchmark rate of return that can be earned in the economy, while the funds' demand and supply represent the dynamic change of funds in the financial market that are required for capital investment. The Risk Premium represents the additional return required by investors to compensate them for the risks associated with the investment. However, the calculation of the Risk Premium is not a straightforward task and may involve the consideration of various factors, such as credit risk, liquidity risk, market risk, and other factors that may affect the return on financing or investment. These risk factors may vary depending on the type of financial instrument or investment being considered. By combining these two components, the Islamic rate of return provides a comprehensive measure of the potential return on financing or investment based both on economic fundamentals and risk considerations. As a result of this approach, responsible and sustainable investment practices are promoted, and the development of an inclusive and robust financial system is strengthened. A graphic representation of this IRR estimation is shown in Figure (3) below.

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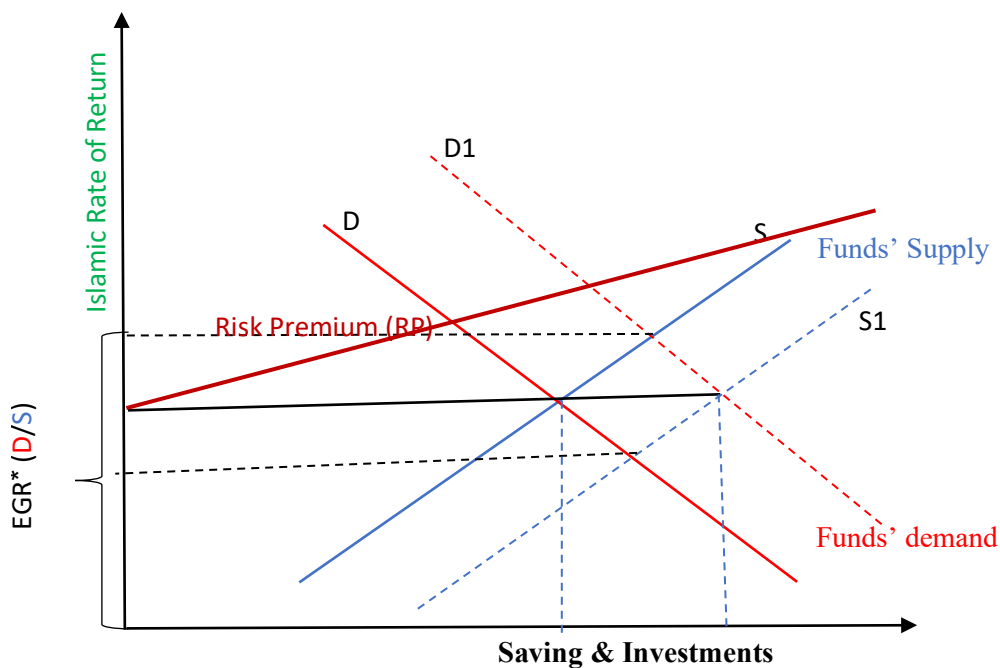
*Figure (3):* A graphic representation of the IRR estimation

## IV. A COMPARISON OF LIBOR, RFRs, AND IRR

To demonstrate a new IRR model's adequacy and efficiency, we must compare it with alternative interest rate models such as LIBOR and RFRs, and ensure it is satisfied both the economic and the *Shariah* principles. Among these are opportunity cost based and its measured, time value framework, elements of pricing (risks premium), method of estimating, the level of financing costs, the price determination, the term structure, the financing price or contract costs, the administrator, currency, the level of issue, the level of transparency, and most importantly the achievements of *Shariah* compliance. In particular, the opportunity cost in IRR is economic-based and measured by EGR, while the opportunity cost in LIBOR and RFRs is debt-based and measured by risk-free rates such as government bond or Treasury bill rates. In terms of time value framework, IRR is determined based on the time value of economic resources, while both LIBOR and RFRs are based on the time value of money. This is due to the fact that Islamic finance and conventional finance differ in their approach to determining return on investment. Islamic finance focuses on the profits generated by the underlying economic activity or asset, while conventional finance considers the time value of money, based on interest rates or discount rates. LIBOR and RFRs are examples of conventional finance that use the time value of money concept to determine the return on investment.

In addition, in terms of elements of pricing, IRR and LIBOR incorporate the elements of pricing through the addition of a risk premium, which is used to adjust the return on investment to compensate for the level of risk associated with the underlying economic activity or asset. This is not the case for RFRs, which do not include a risk premium because they represent the return on a completely risk-free investment such as a government bond. The risk premium in Islamic finance may be included in the profit-sharing ratio between the investor and the entrepreneur. In summary, IRR and LIBOR include a risk premium, while RFRs do not. Furthermore, in terms of method of estimating, the IRR is calculated by adding two components: the EGR component and the risk premium component. The EGR component is determined by multiplying the

EGR by the ratio of funds' demand to funds' supply, which reflects the level of economic activity and the demand for investment capital. The risk premium component is added to adjust the return on investment for the level of risk such as credit risk, liquidity risk, market risk, and other factors. LIBOR is estimated through a survey of banks, where each bank reports the rate at which it could borrow funds from other banks in the interbank market. The reported rates are then averaged to determine the LIBOR rate. While RFRs are estimated based on the formula [(1 + Government Bond Rate) / (1 + Inflation Rate)] − 1. This formula reflects the real rate of return on a completely risk-free investment, such as a government bond, adjusted for inflation.

Moreover, in terms of the level of financing costs, it can be said that the level of financing costs differs between IRR, LIBOR, and RFRs. In IRR, financing costs are included in the calculation of the return on investment, which is determined based on the actual profits generated by the underlying economic activity or asset. This means that the financing costs are directly related to the level of economic activity and the demand for investment capital. While LIBOR, which reflects the cost of borrowing funds in the market, and RFRs, which reflect the baseline level of financing costs in the market. In terms of price determination, it can be said that LIBOR operates as a monopoly since it is determined by a panel of only 16 member banks. These member banks submit their estimates of the rate at which they could borrow funds from other banks in the interbank market, and the LIBOR rate is then calculated based on these submissions. This means that the LIBOR rate is not determined through an open market process. On the other hand, RFRs and IRR are determined by each central bank. RFRs are determined based on the rates at which government bonds are issued, while IRR is calculated based on the EGR and the risk premium associated with the underlying economic activity or asset. These rates are determined through an open and transparent process by the central bank and are therefore not subject to the same monopoly concerns as LIBOR.

In terms of the term structure, both IRR and LIBOR offer a term structure with forward-looking tenors ranging from overnight to 12 months. This means that the rates for different maturities are projected into the future and can be used to estimate the expected return on investments with different holding periods. In contrast, RFRs only provide a backward-looking overnight rate that reflects the rate at which funds were lent or borrowed overnight in the past. As such, RFRs do not offer a term structure that can be used to estimate the expected return on investments with different holding periods in the same way that IRR and LIBOR do. Moreover, In terms of the financing price or contract costs due, with the IRR the price is typically determined at the beginning or on the spot of the contract being signed, just like LIBOR. The rate is agreed upon by the parties involved in the transaction and is fixed for the duration of the contract. However, with RFRs are not necessarily determined at the maturity date. While RFRs are backward-looking, they are typically published daily, and the rate for each day is determined by the previous day's overnight interest rate. This means that the rate is not fixed for the duration of the contract, but rather it may fluctuate daily depending on the prevailing market conditions. In some cases, the RFR for a specific maturity may be estimated based on the average of the RFRs for a certain period leading up to the maturity date.

In terms of the administrator, LIBOR was regulated by the Financial Conduct Authority (FCA) and administered by ICE Benchmark Administration (IBA), while RFRs are administered by central banks as they reflect the cost of borrowing overnight funds in a particular currency, and central banks have a key role in controlling the supply of funds in the market. The IRR is typically developed and administered by Islamic financial institutions or regulatory bodies, and it can be administered by central banks as well. Unlike LIBOR, which was susceptible to manipulation due to its reliance on bank submissions, RFRs and IRR are designed to be more transparent and representative of market conditions. Additionally, in terms of currency, LIBOR was evaluated for five major currencies

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namely the US Dollar (USD), British Pound Sterling (GBP), Euro (EUR), Japanese Yen (JPY), and Swiss Franc (CHF), while RFRs and IRR are evaluated based on the local currency of the country or region. RFRs like SONIA and SOFR are evaluated based on the British Pound and the US Dollar, respectively. Similarly, IRR and other Islamic finance benchmarks are evaluated based on the local currency of the country or region where they are used. For instance, the IIBR is evaluated based on the Saudi Riyal in Saudi Arabia and based on the Malaysian Ringgit in Malaysia. This difference highlights the importance of reflecting local market conditions when evaluating benchmark rates for financial transactions in a specific region or country.

In terms of issue and application level, LIBOR, RFRs, and IRR are all benchmark rates that are used for financial transactions. However, they differ in their issuance and application. LIBOR was an internationally issued benchmark rate, as it was used in financial transactions around the world, especially in the major financial centers of London, New York, and Tokyo. RFRs, on the other hand, are typically locally issued benchmark rates, as they are designed to reflect the cost of borrowing funds overnight in a specific currency and specific geographic region. For instance, SONIA is the RFR for the UK, SOFR is the RFR for the US, and SARON is the RFR for Switzerland. Similarly, the IRR is issued in local currencies and used for financial transactions in Islamic finance markets. However, unlike RFRs, which are specific to one country or region, IRR can also be used internationally, especially in countries with significant Muslim populations or

Islamic finance institutions. In terms of transparency, there are some differences in transparency between LIBOR, RFRs, and IRR. LIBOR was based on the submissions of a panel of banks, and its calculation was not always transparent. This led to concerns about its susceptibility to manipulation, which ultimately led to the decision to phase it out by the end of 2021. RFRs, on the other hand, are typically more transparent than LIBOR. This is because they are based on actual transactions in the underlying market, rather than submissions from a panel of banks. In addition, the central banks that administer RFRs typically provide more information about how the rates are calculated and how any changes are made. As for the IRR, it is typically fully transparent. This is because Islamic finance principles require that financial transactions are based on a transparent and fair exchange of value. Therefore, IRR and other Islamic finance benchmarks are designed to be fully transparent and compliant with Islamic finance principles.

Finally, and most importantly in terms of the achievements in *Shariah* compliance. LIBOR and RFRs are not designed to be *Shariah*-compliant, as they are conventional interest-based benchmark rates. In contrast, IRR benchmark is designed to be *Shariah*-compliant. Islamic finance principles require that financial transactions are conducted in a way that is fair and transparent, and that avoids interest-based transactions. IRR benchmark is designed to reflect this by being based on underlying economic activities, assets or commodities, rather than interest rates.

*Table (1):* Summary for a Comparison of LIBOR, RFRs, and IRR

| | London Interbank overnight Rate (LIBOR) | Risk-Free Rate (RFR) | Islamic Rate of Return (IRR) |
|---|---|---|---|
| Opportunity Cost Measurement | RFR | RFR | EGR |
| Opportunity Cost Based | Debt-Based | Debt-Based | Economic Based |
| Risk Premium (Element of Pricing) | Yes -Risk premium. | No - Risk premium | Yes - Risk premium |

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| Time Value Framework | Time value of Money | Time value of Money | Time Value of Economic Resources |
|---|---|---|---|
| Calculation Methodology | Survey- based | $RFR= [(1 + \text{Government Bond Rate})/ (1 + \text{Inflation Rate})] - 1$ | $IRR= EGR *(D/S) + RP$ |
| Financing Cost (FC) | High | Low | Fair |
| Price Decision | Monopoly - only 16 Members of the panel banks to decide the price. | Free – each central bank | Free – each central bank |
| Term Structure | Term structure with seven different forward-looking tenors, from overnight to 12 months | Backward-looking overnight rates only | Forward-looking tenors, from overnight to 12 months. |
| Financing Cost Due Date | At the beginning | At the maturity data | At the beginning |
| Administrator | Regulated by the FCA and administered by ICE Benchmark Administration | Local Central Bank | Local Central Bank |
| Currency | (USD, GBP, EUR, JPY and CHF) | Local currency | Local currency |
| Issue | International | Local | Local & International |
| Transparency | Exposure to Manipulations | Transparent to such degree | Fully Transparent |
| *Shariah*-Compliant | Non- *Shariah*-compliant | Non-*Shariah*-compliant | *Shariah*-compliant |

## V. CONCLUSION

RFRs and IBORs differ in that RFRs are based on actual transactions, while IBORs include term premiums. However, the use of backward-looking rates in Islamic finance can be challenging because of the *Shariah* principle of *Gharar*, which requires certainty on all fundamental contract terms. Although alternative rates, reconciliation payments, and rebates can address this issue, they have limitations. To overcome this challenge and satisfy both economic and *Shariah* principles, an alternative IRR benchmark was proposed. The General Equilibrium Theory was used in this study to establish and estimate an equilibrium rate of return that reflects the opportunity cost (which was measured by EGR) for an IRR benchmark by analyzing the dynamic interaction of supply and demand of funds in the market. This approach ensures that the pricing of Islamic financial products is aligned with the principles of free market competition and that the return on financing or investment is fair and reflects the true value of the assets and services involved. Then, the IRR was calculated as the sum of the EGR component and the risk premium component, which reflect the potential return on investment resulting from the growth of the underlying economy and the additional return required by investors to compensate for investment loss risks. By combining these components, the IRR provides a comprehensive measure of the potential return on financing or investment based on both economic fundamentals and risk considerations. As a result of this approach, responsible and sustainable investment practices are promoted, and the development of an inclusive and robust financial system is strengthened.

In light of the proposed new IRR benchmark, it is recommended that policymakers, regulators, and industry leaders in the banking sector give consideration to adopting the proposed IRR benchmark. By using IRR, sustainable investment practices aligned with Islamic finance principles can be promoted as an alternative to interest-based benchmarks. However, the adoption of IRR will require significant changes to the financial system and a thorough analysis of its costs and benefits as well as stakeholder engagement process. To ensure a smooth transition and avoid disrupting the market, it is important for central banks and the banking industry to work together, provide guidance and support, update their internal systems and procedures, raise awareness among clients, and maintain transparency and accountability when introducing the new IRR benchmark as a replacement for LIBOR or RFRs.

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# Exploring the Impact of Cultural Diversity on Work Performance in Intercultural Management Contexts

*Chihebeddine Inoubli*

## ABSTRACT

This study examines the impact of intercultural management strategies on work performance in culturally diverse organizational settings. Through an analysis of four dimensions— metacognitive, cognitive, motivational, and behavioral—this research aims to shed light on the role of cultural diversity in shaping performance outcomes. Data collected from a questionnaire distributed among 100 Tunisian enterprises were analyzed using SPSS 25. Our study offers valuable insights into the importance of intercultural management skills in driving performance outcomes. In an increasingly globalized world, where adapting to diverse cultural scenarios is crucial, our findings emphasize the advantages of leveraging cultural diversity to enhance adaptation and performance.

*Keywords:* cultural diversity, metacognitive, cognitive, motivational, behavioral, job performance, intercultural management, organizational context, globalized workforce, adaptation.

*Classification:* JEL: O13

*Language:* English

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*This study examines the impact of intercultural management strategies on work performance in culturally diverse organizational settings. Through an analysis of four dimensions—metacognitive, cognitive, motivational, and behavioral—this research aims to shed light on the role of cultural diversity in shaping performance outcomes. Data collected from a questionnaire distributed among 100 Tunisian enterprises were analyzed using SPSS 25. Our study offers valuable insights into the importance of intercultural management skills in driving performance outcomes. In an increasingly globalized world, where adapting to diverse cultural scenarios is crucial, our findings emphasize the advantages of leveraging cultural diversity to enhance adaptation and performance.*

*Keywords:* cultural diversity, metacognitive, cognitive, motivational, behavioral, job performance, intercultural management, organizational context, globalized workforce, adaptation.

## I. INTRODUCTION

The management of cultural diversity issues is becoming increasingly worrying, especially with the advent of globalization and the rapid and growing evolution of technology. The opening of the economy of countries in the world promotes the mixing of cultures, the creation within internationalized organizations of new managerial strategies, and, therefore, the implementation of adequate tools to deal with cultural complexity. Thus, any organization that has to promote innovation must deal with the resolution of problems related to the management of cultural diversity.

Indeed, "the diversification of teams can constitute a message addressed to the stakeholders likely to increase the legitimacy of the company, improve its reputation and its confidence, and by extension, increase its attractiveness and therefore its performance" (Bruna & Chauvet, 2011) and further "Another interesting argument for using cultural diversity is that it creates systemic flexibility.

In addition to complexity, the pace of environmental change requires the ability to live with and even take advantage of ambiguity to achieve maximum flexibility and adaptability. Multicultural organizations encourage various perspectives and the practice of managing ambiguity (Shneider & Barsoux, 2003).

Companies that establish themselves face day-to-day problems related to the management of cultural diversity because of the inevitable multiculturalism that prevails within them (Shneider & Barsoux, 2003). It is, therefore, in this margin of reflection that our research idea is inspired by an analysis of the impact of the management of cultural diversity on the performance of companies.

Culture, since ancient times, has been conceived as a paradigm relating to the human and socio-cultural sciences. But with globalization, the development of transport, and the collapse of barriers at the state level, migratory movements have increased considerably in all countries. Indeed, these migratory movements are explained by: the rural exodus of people to industrialized

areas in search of employment, the search for good-quality training institutions, exile, and international mobility.

All these moves have caused a specific diversity in the workforce, leading the human resources manager to think about how to make his staff more efficient by implementing management policies following the new management strategies. Thus, to respond to the diverse clientele, the manager must rely on the lever of diversity.

So, the question relating to the management of cultural diversity is of great importance given the cultural diversity - of the personnel, - but also of the communication, which is today an essential factor of any development within the organizations.

To this end, managers are pretty embarrassed to define management policies that will allow the company to improve its internal atmosphere and performance (effectiveness and efficiency) by making the most of the diversity of the workforce. Works available in their employment pool. Moreover, for some, managing diversity is associated with an investment that does not, however, have a positive impact on the company; or downright ignores it or neglects its existence. It is this order of ideas that stems from the object of our research, which isthe impact of cultural diversity on the performance of companies.

In this same context, Stahl and Voigt (2008) consider that "Intercultural management is a distinctive organizational skill that is exercised at each stage of the process: the consideration of cultural duality in due diligence serves as the basis for the formulation of an appropriate cultural strategy implemented in the integration of people and tasks and evaluated in the quality control process of integration. It is a set of systems that result from an enlightened approach to enriched management capable of creating value from a formalized consideration of cultural diversity".

On the contrary, several empirical studies have even shown that cultural diversity could hurt the effectiveness of work teams by generating a lot of conflict, to the point of threatening the

implementation of the expected synergy, or even the sustainability of projects (Snow et al., 1996; Di Stefano & Maznevski, 2000; Govindarajan & Gupta, 2001) Cited by (Désiré, 2009).

The management of intercultural work teams and the ability to manage diversity will probably be critical skills to develop for tomorrow's management. This research is part of this current concern for multicultural group work. It attempts to shed light on the conditions for improving the performance of intercultural work teams by highlighting and analyzing the impact of cultural diversity on organizational performance.

In this study, we aim to answer the following question:

### 1.1 What is the impact of cultural diversity practices on work performance?

To try to answer this question, we based research on a literature review, in which we will expose concepts relating to cultural diversity and organizational performance. Then, we aimed to validate a research proposal developed in the theoretical part, through which we will present the research methodology adopted in the context of this article as well as the discussion of the results found to test our hypotheses.

### 1.2 Cultural Diversity is a lever for performance at work

Cultural diversity can indeed be a lever for performance at work. Embracing and promoting cultural diversity within a workplace can bring about several benefits that contribute to overall organizational success. Here are some ways in which cultural diversity can enhance performance at work (Aoun, 2004); Innovation and Creativity, Broader Skill Set, Enhanced Decision-Making, Adaptability and Flexibility, Global Market Understanding, Employee Engagement and Retention, Better Problem Solving, Expanded Customer Base.

However, it's important to note that realizing the benefits of cultural diversity requires more than just having people from different backgrounds on the team (Popescu, 2014). Organizations must

also create an inclusive and respectful work environment where diverse voices are genuinely heard and valued. This involves implementing diversity and inclusion initiatives, providing cultural competency training, and addressing potential challenges or conflicts that may arise due to cultural differences (Malek & Budhwar, 2013).

Overall, when managed effectively, cultural diversity can contribute significantly to improved performance, innovation, and success in the workplace (Lee & Kartika, 2014).

Multicultural competence encompasses a collection of analytical and strategic abilities that broaden individuals' capacities for understanding and engaging with individuals from alternative cultures in interpersonal scenarios. These proficiencies contain a fundamental grasp of diverse cultures, leading to shifts in attitudes and behaviors. Moreover, individuals attuned to multicultural competence are conscious of the manifold advantages of such skills.

To delve further into this, the components of multicultural competence, as outlined by Dinges and Baldwin (1996), encompass the following aspects:

a. *Emotional Attitudes:* The foundation of intercultural competence lies predominantly in social competence, impacting personality traits and the inclination to express genuine interest in others. It's worth noting that this skill is pertinent not only within cross-cultural scenarios but also holds relevance in mono-cultural contexts.
b. *Cognitive Knowledge:* Multicultural competence entails possessing precise knowledge about culture, history and value orientations, as well as the structure and operation of economic, social, and organizational systems in partner cultures.
c. *Behavioral Skills:* The effectiveness of cognitive and affective skills hinges on their integration during multicultural interactions. Demonstrating intercultural competence necessitates applying this acquired

knowledge while adeptly adapting to foreign cultural situations. This involves:

- *Raising Awareness and Encouraging Assessment and Behaviors:* The individual needs to be mindful of cultural differences, prompting reflection and guiding appropriate actions.
- *Assimilating and Systematizing Knowledge:* Assimilation of information is vital, leading to a systematic understanding of diverse cultural facets.
- *Developing and Practicing Skills:* Proficiency is honed through practice, enabling seamless navigation of multicultural scenarios (Popescu, 2014).

In essence, multicultural competence amalgamates emotional, cognitive, and behavioral dimensions, fostering effective intercultural interactions by encompassing sensitivity, knowledge, and practical application.

Reports on organizational practices related to expatriation (Livermore, 2011) point out that few organizations have structured and targeted procedures for selecting, training, and supporting expatriates. In contrast, employees are expected to have an exemplary level of performance. Most often, future expatriates are identified informally or based on their performance in the task in the domestic organizational context.

The integration issues into the new cultural context are not systematically addressed (Aycan et al., 2014). However, poor cultural adjustment is at the origin of the poor performance of expatriates and an early return to international assignment. Several authors highlight the positive link between cultural adjustment and intercultural teamwork performance (Malek & Budhwar, 2013; Bhaskar-Shrinivas et al., 2005; Hechanova, Beehr, & Christiansen, 2003; Lu, 2012 ; Nunes, Felix, & Prates 2017; Wu & Ang, 2011). This effect is nuanced in two studies (Malek & Budhwar, 2013; Wu & Ang, 2011). According to this, the general and interactional facets of cultural fit contribute to contextual performance. However, the relationship between cultural adjustment and work performance must be

clarified (Malek & Budhwar, 2013; Tucker, Bonial & Lathi, 2004).

In general, performance at work is like the set of behaviors or actions consistent with organizational objectives (Campbell, 1990), or like the total value expected by the organization of the episodes of discrete behaviors an individual exercises during a given period at work (Motowidlo, 2003). In the literature linking cultural adjustment and performance, the latter is often operationalized through two aspects (Burakova & Filbien, 2019):

- Task performance, which refers to success in carrying out assigned tasks and achieving the objectives set by the organization;
- Contextual performance, which indicates effectiveness in establishing and maintaining good relations with local employees (Motowidlo & Van Scatter, 1994; Shaffer, Harrison, Gregersen, Black, & Ferzandi, 2006; Sonnentag & Frese, 2001 Sonnentag, Volmer, & Spychala, 2008).

Such an approach seems simplistic to us. It seems important to be interested in aspects relating to the interaction between the expatriate and his local entourage. The model developed by Sonnentag et al. (Sonnentag & Frese, 2001; Sonnentag et al., 2008) and operationalized by Lee and Donohue, (2012) to study work performance more specifically in expatriation comes as a relevant solution concerning this questioning. These are eight skill categories responsible for cross-cultural team performance:

- Skills in job-specific tasks;
- Skills in tasks not specific to the job;
- Written and oral communication;
- Effort in the activity;
- Maintenance of personal discipline;
- Contribution to the performance of the team and colleagues;
- Oversight;
- Management and administration (Lee & Donohue, 2012; Sonnentag & Frese, 2001; Sonnentag et al., 2008).

Based on these theoretical frameworks, we have formulated our research problem, which is stated as follows: "What is the impact of Cultural diversity on Job performance? »

To this problem, we can attach the following expected hypotheses:

*Hypothesis 1 (H1):* Cultural diversity has a positive impact on job performance.

*H1-1:* Metacognitive has a positive effect on job performance

*H1-2:* Cognitive has a positive effect on job performance

*H1-3:* Motivational has a positive effect on job performance

*H1-4:* Behavioral has a positive effect on job performance

## II. METHOD

For our present research, we will try to test and verify the possible relationship between Cultural diversity and work performance. In other words, the different relationships that may exist between Cultural diversity practices and job performance.

Based on our research being grounded in a positivist paradigm, we have opted for the questionnaire as our data collection method. To develop our questionnaire, we reviewed existing literature and identified relevant measurement scales used in previous studies. By utilizing established measurement scales, we can ensure the reliability and validity of our data. We have also outlined our statistical methodology for analyzing the data collected, which is crucial for transparency and the ability to reproduce our results.

### 2.1 Population, Sample, and Data Collection

This study aimed to examine the causal relationship between Cultural diversity and job performance; using a quantitative deductive method. Our sample consists of 100 companies in Greater Tunis, North, North-West, South-West, and East of Tunisia. The Sample of this study is carried out by interviews (face to face) and thus by the technique of the so-called Self-administration (the e-mail address of companies).

We stopped at 100 companies, given the constraints of time, means, and refusal to answer the questionnaires.

Our study is based on the non-probability sample method. According to O.Aktouf (1987), "This method is said to be common sense, insofar as it is content to ensure at the level of the sample a transposition as exact as possible of the specific characteristics and proportions present in the basic population" (Aktouf 1987:74).

## 2.2 Measures

The questionnaire used in this study consisted of 52 items adapted from previous studies. —adaptation of the questionnaire of earlier studies aimed to ensure its validity and reliability.

The establishment of questionnaire was composed of two scales: the scale of the cultural quotient (CQS) (Ang et al., 2007) was used to measure Cultural diversity; the performance scale (Lee & Donohue, 2012) was chosen to measure work performance, as well as questions relating to the signage of the Tunisian company surveyed. (Sector of activity, size, multicultural dimension, and concept of interculturality);

"The Cultural Quotient Scale (CQS)" by Ang et al. (2007) (French version validated during the study) was used to measure Cultural diversity. The scale has 20 items and consists of 4 facets: metacognitive, MC (4 items), cognitive, COG (6 items), motivational, MOT (5 items), behavioral, and BEH (5 items). The response scale is a 7-point Likert scale ranging from (1) strongly disagree to (7) strongly agree. Example of object: "I am aware of the cultural knowledge on which I rely during my intercultural exchanges. "

The Lee and Donohue scale (2012) was chosen to measure expatriate job performance for two reasons. First, it is based on Campbell's work performance model (1990). Second, it is specific to the situation of intercultural exchanges. The scale includes 32 items and is composed of 6 dimensions: performance in the task, TP (7 items); performance in communication, CP (4 items); demonstration of effort, DE (2 items); maintenance of discipline, MD (5 items),

teamwork and leadership TL (8 items), performance in administrative and managerial tasks MA (6 items). Responses are recorded on a 5-point scale, from (1) very poor to (5) excellent. Sample item: "Encourage subordinates to achieve set goals. "

The questionnaire was pilot tested before mass distribution. Therefore, feedback from respondents was collected, and changes were made to improve the questionnaire.

Data processing via SPSS 25 (descriptive statistics, reliability indices, correlations, and regression).

## III. RESULTS

### 3.1 The Description of the Sample

The choice of companies to be surveyed was made on the basis of criteria such as the sector of activity, the workforce, the multicultural dimension and also the concept of interculturality within the company.

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Table 1: Sample Description

| Categories | | Percentage |
|---|---|---|
| Sector of activity | secondary sector<br>tertiary sector | 62.5 %<br>37.5 % |
| Size | Small business (1 to 49 employees)<br>Medium-sized company (50 to 300 employees)<br>big company (more than 300 employees) | 15 %<br>52.5 %<br>32.5 % |
| multicultural dimension | Presence of different cultures within the same team<br>Managing subsidiary teams remotely<br>Joint-venture<br>International group promoting mobility between countries<br>Other | 62,5 %<br>25,0 %<br>10,0 %<br>2,5 %<br><br>0,0 % |
| Intercultural concept | Yes<br>No and it is not necessary<br>No, but she should<br>Yes, but could do better | 52,5 %<br>17,5 %<br>10,0 %<br>20,0 % |

For this research, we have selected two sectors of activity, namely the secondary sector (industrial) and the tertiary sector (service sector). Indeed, the sample chosen is distributed as follows: 62.5% of companies belonging to the industrial sector and 37.5% of companies belonging to the service sector.

About company size, the sample is structured as follows: 15% small companies, 52.5% medium-sized companies, and 32.5% large companies.

For the statistical analysis of the "multicultural" dimension in companies, we note that most of the companies in our sample verify this dimension: different cultures within the same team (62.5%), management of remote subsidiary teams (25%) and the rest is in the form of a joint venture and international group promoting mobility between countries.

Is interculturality taken into account in the managerial actions of your company? For this question we have, more than half of the companies questioned (52.5%) affirm that interculturalism is taken into account in the managerial actions of their company. This rate explains the importance of this term. Similarly, we note that a non-negligible rate (17.5%) of the companies questioned do not take this concept into account. Subsequently, 10% of the companies surveyed do not take this concept into account, but they should. However, a significant percentage (20% of companies) consider the idea of interculturality, but could do better. We note that these results demonstrate the interest of Tunisian companies in this new concept.

## 3.2 Exploratory Factor Analysis

*Table 2:* ACP of the measurement scale «(CQS)».

| Variables | Number of items | KMO index | Chi-square index | Bartlett's sphericity test | Total variance explained | Cronbach's Alpha |
|---|---|---|---|---|---|---|
| Metacognitive (MC) | 2 | ,500 | 43,186 | ,000 | 79,910 | ,742 |
| Cognitive (COG) | 3 | ,560 | 48,413 | ,000 | 58,983 | ,620 |
| Motivational (MOT) | 2 | ,500 | 46,091 | ,014 | 62,305 | ,782 |
| behavioral (BEH) | 3 | ,660 | 44,505 | ,000 | 60,564 | ,657 |

The exploratory factor analysis under SPSS confirmed the four-dimensional structure of cultural diversity. "Assessment of the fit indices of the competing models tested allowed us to conclude that the four-factor model is the one that best explains the CI construct" (Burakova & Filbien, 2019).

Indeed, the KMO test indicates a more significant or an equal value to 0.5, the Chi-square value is relatively high, and the Bartlett sphericity test is significant because the risk threshold obtained from this test is less than 0.05. The PCA revealed four factors; for the first factor, which represents "Metacognitive" 79.910%. The second factor, which means "Cognitive" 58.983%, the "Motivational" dimension 62.305% and finally, 60.564% for the last element, which means "Behavioral.".

Cronbach's Alpha, which ranges between 0.7 and 0.6, exceeding the value of 0.6,shows a good level of reliability for each dimension and good internal consistency of the cultural Cultural diversity scale.

*Table 3:* ACP of the measurement scale «job performance ».

| Variables | Number of items | KMO index | Chi-square index | Bartlett's sphericity test | Total variance explained | Cronbach's Alpha |
|---|---|---|---|---|---|---|
| performance in the task (TP) | 3 | ,750 | 181,143 | ,000 | 83,292 | ,898 |
| performance in communication (CP) | 4 | ,767 | 102,460 | ,000 | 60,002 | ,772 |
| demonstration of effort (DE) | 2 | ,500 | 13,011 | ,000 | 67,672 | ,622 |
| maintenance of discipline (MD) | 3 | ,507 | 75,523 | ,000 | 63,070 | ,685 |
| teamwork and leadership (TL) | 4 | ,674 | 147,036 | ,000 | 63,202 | ,786 |
| performance in administrative and managerial tasks (MA) | 5 | ,660 | 275,535 | ,000 | 63,449 | ,851 |

To evaluate the effectiveness of the work performance measurement scale, we conducted an initial principal component analysis (PCA) using the items presented in Table 3. Our study revealed a Kaiser-Meyer-Olkin (KMO) test value ranging between 0.7 and 0.5, which is greater than the acceptable threshold of 0.5. The chi-square value was also quite large, and the

Bartlett sphericity test was significant for all dimensions of performance, indicating a risk threshold of less than 0.05. Concerning the factors on which the performance depends, we can retain six axes which represent; 83.292% (TP), 60.002% (CP), 67.672% (DE), 63.070% (MD), 63.202% (TL), and 63.449% (MA), the "work performance" variable is thus multidimensional.

Our work performance measurement scale demonstrated good reliability, as indicated by Cronbach's Alpha coefficient, which ranged from 0.8 to 0.6 and exceeded the acceptable value of 0.6. This initial indication of construct validity was further supported by our exploratory factor analysis, which revealed that the number of factors aligned with the number of supposed dimensions or constructs. Additionally, the items associated with each size contributed homogeneously to represent that dimension. However, to validate the construct of our scale, further confirmatory analyses are necessary.

### 3.3 Validation of the Analytical Model

Table 4: Study Results

| Impact | | job performance | | | | | |
|---|---|---|---|---|---|---|---|
| | *Relationship between variables* | performance in the task (TP) | performance in communication (CP) | demonstration of effort (DE) | maintenance of discipline (MD) | teamwork and leadership (TL) | performance in administrative and managerial tasks (MA) |
| **C u L T U R A L  d I V E R S I T y** | **Metacognitive (MC)** | $R_2$ = ,056<br>$R_2$ ajusté = ,046<br>F = 5,761<br>β = ,236<br>T = 2,400<br>**sig = ,018** | $R_2$ = ,104<br>$R_2$ ajusté = ,095<br>F = 11,359<br>β = ,322<br>T = 3,370<br>**sig = ,001** | $R_2$ = ,000<br>$R_2$ ajusté = -,010<br>F = ,023<br>β = -,015<br>T = -,152<br>**sig = ,879** | $R_2$ = ,041<br>$R_2$ ajusté = ,031<br>F = 4,201<br>β = ,203<br>T = 2,050<br>**sig = ,043** | $R_2$ = ,057<br>$R_2$ ajusté = ,047<br>F = 5,902<br>β = -,238<br>T = -2,429<br>**sig = ,017** | $R_2$ = ,025<br>$R_2$ ajusté = ,015<br>F = 2,531<br>β = ,159<br>T = 1,591<br>**sig = ,115** |
| | **Cognitive (COG)** | $R_2$ = ,233<br>$R_2$ ajusté = ,225<br>F = 29,695<br>β = ,482<br>T = 5,449<br>**sig = ,000** | $R_2$ = ,218<br>$R_2$ ajusté = ,210<br>F = 27,241<br>β = ,466<br>T = 5,219<br>**sig = ,000** | $R_2$ = ,052<br>$R_2$ ajusté = ,043<br>F = 5,409<br>β = ,229<br>T = 2,326<br>**sig = ,022** | $R_2$ = ,098<br>$R_2$ ajusté = ,089<br>F = 10,659<br>β = ,313<br>T = 3,265<br>**sig = ,002** | $R_2$ = ,041<br>$R_2$ ajusté = ,031<br>F = 4,150<br>β = -,202<br>T = -2,037<br>**sig = ,044** | $R_2$ = ,012<br>$R_2$ ajusté = ,002<br>F = 1,206<br>β = ,110<br>T = 1,098<br>**sig = ,275** |
| | **Motivational (MOT)** | $R_2$ = ,278<br>$R_2$ ajusté = ,271<br>F = 37,766<br>β = ,527<br>T = 6,145<br>**sig = ,000** | $R_2$ = ,240<br>$R_2$ ajusté = ,232<br>F = 30,947<br>β = ,490<br>T = 5,563<br>**sig = ,000** | $R_2$ = ,203<br>$R_2$ ajusté = ,195<br>F = 24,954<br>β = ,451<br>T = 4,995<br>**sig = ,000** | $R_2$ = ,048<br>$R_2$ ajusté = ,038<br>F = 4,914<br>β = ,219<br>T = 2,217<br>**sig = ,029** | $R_2$ = ,013<br>$R_2$ ajusté = ,003<br>F = 1,258<br>β = -,113<br>T = -1,122<br>**sig = ,265** | $R_2$ = ,008<br>$R_2$ ajusté = -,002<br>F = ,791<br>β = -,089<br>T = -,889<br>**sig = ,376** |
| | **behavioral (BEH)** | $R_2$ = ,001<br>$R_2$ ajusté = -,009<br>F = ,141<br>β = -,038<br>T = -,375<br>**sig = ,708** | $R_2$ = ,014<br>$R_2$ ajusté = ,004<br>F = 1,366<br>β = ,117<br>T = 1,169<br>**sig = ,245** | $R_2$ = ,114<br>$R_2$ ajusté = ,105<br>F = 12,561<br>β = ,337<br>T = 3,544<br>**sig = ,001** | $R_2$ = ,005<br>$R_2$ ajusté = -,005<br>F = ,532<br>β = -,073<br>T = -,729<br>**sig = ,468** | $R_2$ = ,142<br>$R_2$ ajusté = ,133<br>F = 16,217<br>β = ,377<br>T = 4,027<br>**sig = ,000** | $R_2$ = ,003<br>$R_2$ ajusté = -,007<br>F = ,315<br>β = -,057<br>T = -,561<br>**sig = ,576** |

A multiple linear regression analysis was appropriately used to determine the influence of Cultural diversity on job performance and to test the developed hypotheses.

Based on the results of table N°4, the dimension (MA) of job performance was excluded from the analysis, because no significant correlation between this variable and the dimensions of Cultural diversity was obtained in this study. From this table, we can see that the data matched the model statistically well. Thus, the relationship between Cultural diversity and job performance was statistically significant (H1). The results also showed that on the four dimensions of Cultural diversity, the Cognitive factor (statistic F greatly exceeds the critical value threeread in the table of Fisher's law and for a significance level of 5%) had a positive influence and significance on all job performance variables. Cognitiveness was a more critical factor.

However, the Metacognitive, Motivational and Behavioral factor has a mixed impact on job performance. Indeed MC has a significant influence onTP, CP, MD, and TL is not substantial for the DE dimension (F=.023; sig=.879). For the third factor of intercultural management, MOT admits a positive relationship with TP, CP, DE, MD (F= 37.766; sig = .000 / F = 30.947; sig = .000 / F= 24.954; sig = .000 / F = 4.914; sig = .029) and not significant with TL. Finally, the Behavioral dimension has a positive relationship with DE and TL and has no impact on TP, CP, or MD (sig > 5%).

Based on these results, Cultural diversity had a positive and significant influence on work performance, all hypotheses (H1-1, H1-2, H1-3, and H1-4) are validated.

## V. DISCUSSION
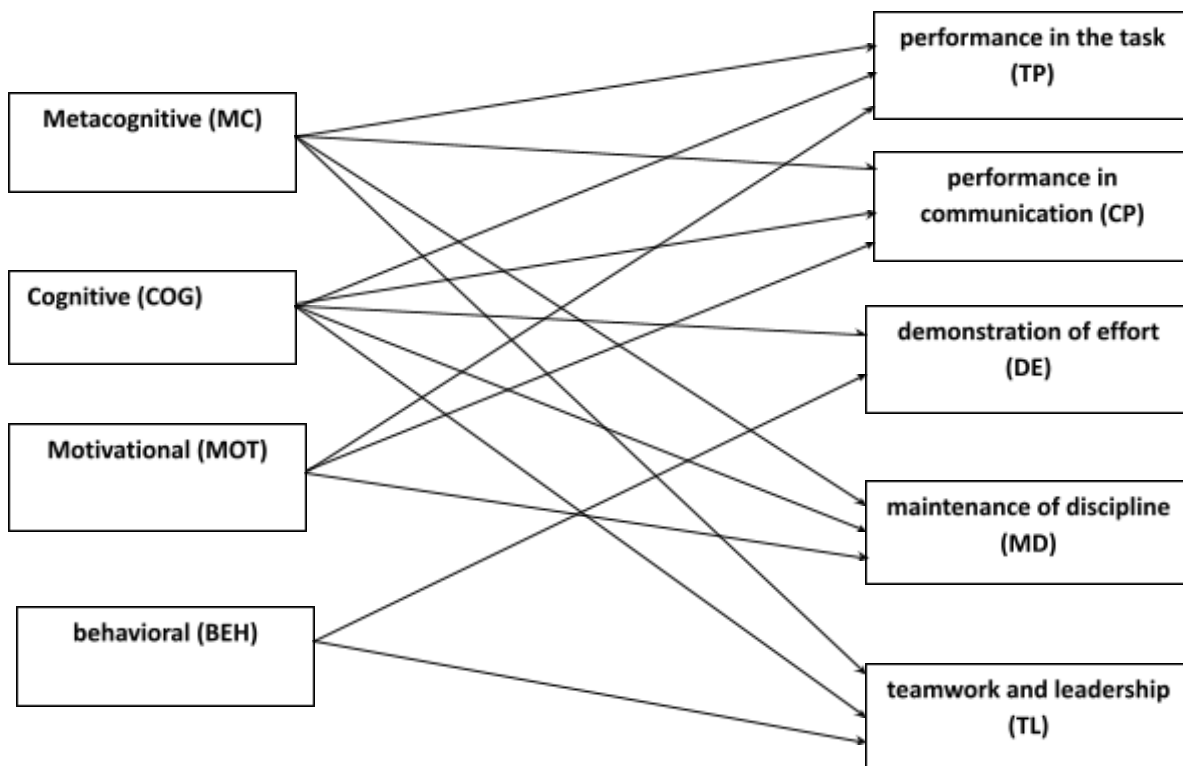


*Figure 1:* Effects of Cultural Diversity on Job Performance.

The model resulting from our study (Figure 1) confirms the hypothesis formulated in a general way and which does not specify the effects relating to the different facets of the constructs examined about the absence of consensus in the empirical literature. This model also highlights several specific effects of Cultural diversity on job performance. Given the lack of impact of the dimension (MA) of performance. On the other hand, we differentiate the effects of four sizes of Cultural diversity: Metacognitive, cognitive, motivational, and behavioral. Thus, the impact of cognitive Cultural diversity on performance relative to TP, CP, DE, MD, and TL.

As for the Metacognitive dimension of Cultural diversity, it directly predicts all performance dimensions except demonstration of effort (DE). The motivational facet affects three forms of performance : performance in the task, communication, and maintenance of discipline. In the end, the behavioral dimension positively affects only two forms of performance, which are: demonstration of effort and teamwork and leadership (Figure 1).

We have demonstrated that all the facets of the cultural quotient adopted to measure intercultural management do not have the same degree of importance for work performance. This is contrary to the postulate of Ang et al. (2007) and Burakova, Filbien (2019). We put forward a general hypothesis of the positive effect of intercultural management on work performance. For this hypothesis, four facets of the cultural quotient (metacognitive, cognitive, motivational, and behavioral) directly affect five facets of performance (related to the task, maintenance of discipline, communication, maintenance of effort and leadership). The performance facet in administrative and managerial tasks is unimportant in the confirmed empirical model (Table 4). The other four aspects of cultural intelligence seem to diverge in terms of their ability to explain different forms of performance, contrary to some findings (Ang et al., 2007; Duff et al., 2012; Burakova & Filbien, 2019).

Generally, our results align with the model of the effects of Cultural diversity on performance (Jyoti

& Kour, 2015; Lee & Sukoco, 2010; Lu, 2012; Sri Ramalu et al., 2012). Beyond this observation, they offer a nuanced look at the effect of different cultural facets on various aspects of performance. In this sense, our results confirm a specification of hypothesis H1 according to which "Cultural diversity has a positive impact on the performance at work." In this context Ott, and Michailova (2016) point out in their systematic review, cultural intelligence has more effects on aspects of expatriation experience that do not have direct links with technical expertise at work. As for the specificity of cultural intelligence, some researchers consider the behavioral dimension as resulting from the three other facets of cultural intelligence (Gooden, Creque, & Chin-Loy, 2017; Ott & Michailova, 2016). It would therefore be more proximal to work performance.

According to our study, performance depends more on the Metacognitive, cognitive, motivational and behavioral facets of Cultural diversity. This means that the interest in other cultures, the manager's ability to direct his efforts towards the acquisition of new culturally specific knowledge, the marriage system of other cultures, patterns of consumption in a different culture, as well as his ability to implement behavior (non-verbal language, oral expression, dress code) appropriate to the cultural context in which he operates will enable him to be effective in establishing, and managing work relationships, communicating his expectations and orientation of his team towards the achievement of the formulated objectives.

This conclusion would have repercussions on the selection, training and support of managers and intercultural teams. The evaluation criteria should be less about technical skills and previous work experience and more about the (motivational) willingness and ability of the manager to acquire new (behavioral) patterns of interaction. To discriminate between employees, the cultural quotient scale could be used during selection (Burakova & Filbien, 2019). As for training, its different modalities also need to be re-examined. Pre-departure movement, which aims to develop the metacognitive and cognitive facets of Cultural

diversity, is not very practical compared to on-site training, which reinforces behavioral intercultural management and, therefore, performance (Wurtz, 2014).

We hope that the question of the success of Cultural diversity practice will be of a great interest to national and multinational companies and that we will be able not only to study the effects of cultural diversity from the temporal perspective, but also, to test the effectiveness of different training devices on the reinforcement of Cultural diversity; hence, improving cultural fit and job performance.

Our study, although it contributes to the nuanced understanding of the effects of Cultural diversity on performance and makes it possible to compare this knowledge with the results obtained from Tunisian companies, is not without limits.

Indeed, it is also necessary to underline its transversal and non-probabilistic character. Unfortunately, we could not obtain an agreement to carry out a longitudinal study with a company. Data collection was possible thanks to the benevolence of the groups of Tunisian leaders to whom the questionnaire was distributed. Collecting data via an electronic questionnaire is now considered a method in its own right, with its advantages and limitations (Callegaro, Lozar Manfreda, & Vehovar, 2015). Research with specific target populations whose structure remains unknown, and difficult to access requires accepting several biases and limits (idem).

## IV. CONCLUSION

Initially, our statistical examination enables us to characterize the study's sample through a univariate analysis, explicitly focusing on 100 companies. The majority of these companies fall within the medium-sized category, with workforces ranging from 50 to 300 employees, predominantly situated in the industrial sector—subsequently, a secondary step involved assessing the overall significance of the model using linear regression techniques. However, our investigation primarily centered on comprehensively exploring the influence of Cultural diversity practices on job performance

categorizations. From this vantage point, we can assert that Cultural diversity practices wield a favorable impact on work performance.

Globalization, being considered as the opening of the economic barriers of countries to the world, has brought about a sudden change on all fronts. So at the socio-cultural level, this change has not only generated a cultural mix but also a new way of viewing things. A new way of life is taking hold with new management strategies that managers must refer to for long-term performance. Thus, the management of cultural diversity to which managers are always trying to find an answer within their organizations, constitutes an essential subject for dealing with the cultural complexity presented by their workforce. It is in the same logic as our study, the general objective of which is to highlight the reality of cultural differences and their implications for business performance.

The presence of multiculturalism within an organization can be a determinant of success, given that it fosters an environment conducive to the cultivation of cultural diversity. Intercultural conflicts typically arise in human organizations where biases have tainted the foundational structure. Consequently, upcoming managers need to excel in communication and motivation compared to the past, employing a fresh approach that adapts to diverse global cultures and emerging technologies (Aoun, 2004).

Taking a more pragmatic perspective, this study introduces a novel approach for indirectly assessing intercultural skills. Furthermore, it can potentially enhance leadership qualities within heterogeneous groups, addressing specific challenges. For instance, it facilitates improved alignment between prevalent emotional and cognitive profiles, irrespective of individual peculiarities. However, quantifying multicultural skills presents a challenge. The intricacy of intercultural proficiency stems from the reality that each participant in these interactions embodies distinct personal attributes, primarily rooted in their personality and subsequently shaped by their cultural background and experiences up to the present (Popescu, 2014).

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# Multiple Contracts with Simple Interest: The System of Constant Amortization

*Clovis de Faro & Gerson Lachtermacher*

## ABSTRACT

Repeatedly, the Brazilian Judicial System has determined that home-financing contracts written in terms of compound interest, both in the case of constant payments and in the case of the system of constant amortization, should be substituted by contracts specifying simple interest. This has resulted, for the case of the system of constant amortization, in the adoption of a variant of a procedure that has been named the "Gauss' Method". It is shown that the implementation of a multiple contracts' version may imply substantial fiscal gains, depending on the financial institution opportunity cost.

*Keywords:* multiple contracts scheme; amortization constant system in simple interest.

*Classification:* JEL: G21

*Language:* English

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Clovis de Faro[1] & Gerson Lachtermacher[2]

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## ABSTRACT

*Repeatedly, the Brazilian Judicial System has determined that home-financing contracts written in terms of compound interest, both in the case of constant payments and in the case of the system of constant amortization, should be substituted by contracts specifying simple interest. This has resulted, for the case of the system of constant amortization, in the adoption of a variant of a procedure that has been named the "Gauss' Method". It is shown that the implementation of a multiple contracts' version may imply substantial fiscal gains, depending on the financial institution opportunity cost.*

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## I.    INTRODUCTION

Similar to the case of constant payments, which in terms of multiple contracts, was recently analyzed in de Faro and Lachtermacher (2023), the Brazilian Judicial System, cf. Jusbrasil (2023), has repeatedly determined that the System of Constant Amortization (SAC, with the acronym as written in Portuguese), which was introduced in the Brazilian System of House Financing (SFH) in 1971, and which is based on compound interest, should also be substituted by a version based on simple interest.

For this purpose, Rovina (2009) proposed a variant of the so called "Gauss' Method," cf. Nogueira (2013), to consider that in the system of constant amortization, the periodic payments follow an arithmetic progression.

Although promulgated in several sentences, the above-mentioned procedure violates a law established in 1964. For this reason, besides considering the afore-mentioned variant of the so called "Gauss' Method," which considers the end of the contract as the focal date, cf. Ayres (1963), we will also consider the case where the focal date, complying with the 1964 law, specifies the beginning of the contract as the focal date.

## II.    THE ROVINA'S PROPOSAL

Consider a house-financing contract of $F$ units of capital, with terms of $n$ periods, specifying the periodic rate $i$ of compound interest, in accordance with the system of constant amortization.

Denoting by $\overline{P}_k$ the $k$-th payment, it can be seen, for instance in de Faro and Lachtermacher (2012, p. 267), that we will have:

$$\overline{P}_k = F \times (i + 1/n) - F \times i \times (k-1)/n, \quad \text{for } k = 1, 2, \ldots n \tag{1}$$

That is, the periodic payments will follow an arithmetic progression, with initial payment $\overline{P}_1 = F \times (i + 1/n)$ and negative ratio equal to $- i \times F/n$.

Consequently, the outstanding debt at the end of the $k$-th period, just after the $k$-th payment, denoted $\overline{S}_k$, will linearly decrease. That is:

$$\overline{S}_k = F \times (1 - k/n), \quad \text{for } k = 1, 2 \ldots, n \tag{2}$$

with $S_0 = F$.

On the other hand, in the case where the interest rate, $i$, is of simple interest, we must specify a particular focal date.

In general, if the end of the contract is specified as the focal date, denoting by $P_k$ the $k$-th periodic payment, we must have:

$$F \times (1 + i \times n) = \sum_{k=1}^{n} P_k \times \{1 + i \times (n-k)\} \tag{3}$$

According with Rovina (2009), who extended the so called "Gauss' Method," as in Nogueira (2013), to the case where the periodic payments follow an arithmetic progression, the first step is to introduce a weight factor, $I$, defined as:

$$I = 3i \times F / \{n \times (2n \times i - 2i + 3)\} \tag{4}$$

Consequently, the $k$-th periodic payment will be:

$$P_k = (F/n) + [(n - k + 1) \times I], \quad \text{for } k = 1, 2, \ldots, n \tag{5}$$

That is, the periodic payments follow an arithmetic progression with first payment $P_1 = (F/n) + [(n - k + 1) \times I]$ and with ratio $- I$, which can be shown to satisfy equation (2).

Furthermore, as in the SAC with compound interest, we will have constant amortization, with the $k$-th parcel of interest, $J_k$, being made equal to:

$$J_k = (n - k + 1) \times I, \quad \text{for } k = 1, 2, \ldots, n \tag{6}$$

As shown in de Faro (2014), we have $\overline{P}_1 > P_1$, if $n \geq 2$. Therefore, the recipient of the loan is always benefited if the contract originally written in terms of compound interest, is substituted by one, at the same rate $i$, written in terms of simple interest.

Before proceeding, it should be noted, as pointed out by De-Losso et al. (2020), that the specification of the end term of the contract as the focal date, violates a Brazilian law of 1964, which stipulates that the focal date must be the beginning of the contract. This point will be further addressed in section 6.

Notwithstanding, although this peculiar variant of the "Gauss' Method" is plagued by several financial deficiencies, as discussed in de Faro (2014), it is still being judicially supported.

### III.     A SIMPLE NUMERICAL EXAMPLE

Fixing at 1% the periodic interest rate, *i,* of simple interest, consider a loan of 10,000 units of capital with a single contract specifying 12 periodic payments in accordance with this variant of the "Gauss' Method." The weight factor, *I*, in this case is equal to 7.76397516.

In Table 1, using formulas (4) and (5), and the fact that the parcel of amortization is constant, we present the evolution of the debt $S_k$, as given, recursively, as $S_k = S_{k-1} - A_k$ with $S_0 = F$. Consequently, as in the case where *i* is a rate of compound interest, $S_k$ also decreases linearly.

*Table 1:* Evolution of the Debt According with the Rovina's Variant of the "Gauss' Method" – Focal Date = *n*

| $k$ | $J_k$ | $A_k$ | $P_k$ | $S_k$ |
|---|---|---|---|---|
| 0 | | | | 10,000.00 |
| 1 | 93.17 | 833.33 | 926.50 | 9,166.67 |
| 2 | 85.40 | 833.33 | 918.74 | 8,333.33 |
| 3 | 77.64 | 833.33 | 910.97 | 7,500.00 |
| 4 | 69.88 | 833.33 | 903.21 | 6,666.67 |
| 5 | 62.11 | 833.33 | 895.45 | 5,833.33 |
| 6 | 54.35 | 833.33 | 887.68 | 5,000.00 |
| 7 | 46.58 | 833.33 | 879.92 | 4,166.67 |
| 8 | 38.82 | 833.33 | 872.15 | 3,333.33 |
| 9 | 31.06 | 833.33 | 864.39 | 2,500.00 |
| 10 | 23.29 | 833.33 | 856.63 | 1,666.67 |
| 11 | 15.53 | 833.33 | 848.86 | 833.33 |
| 12 | 7.76 | 833.33 | 841.10 | 0.00 |
| $\Sigma$ | 605.59 | 10,000.00 | 10,605.59 | |

Before proceeding, it is imperative to point out that the determination of the outstanding debt at time $k$, $S_k$, as given by the recursion mentioned above, does not agree with the results that would be derived by the well-established concepts of either the retrospective method or by the prospective method, which, following Kellison (1991), states that:

a)      according to the prospective method, the outstanding loan balance at any point in time is equal to the present value on the date of the remaining payments.

For instance, at time 10, just after the 10th payment, as we are using simple interest, we would have:

$$S_{10} = \frac{848.86}{1+0.01} + \frac{841.10}{1+2\times0.01} = 1,665.06$$
units of capital;

while, according to Table 1 we would have $S_{10}$=1,666.67 units of capital.

According to the retrospective method, the outstanding loan balance at any point in time is equal to the original amount of the loan accumulated to that date less the accumulated value on the date of all payments previously made.

Thus, for instance, the outstanding loan balance just after the second payment, would have to be:

$$S_2 = 10,000\times(1+2\times0.01) - 926.50\times(1+1\times0.01) - 918.74 = 8,345.50$$
units of capital.

On the other hand, the results presented in Table 1 would imply that $S_2 = 8,333.33$ units of capital.

To remedy this incongruence, which may result in judicial arguments, Lachtermacher and de Faro (2023) extended the work of Forger (2009) providing a financially consistent procedure. This point will be further addressed in section 6.

However, given that the parcels of interest are not affected, we will proceed with the analysis accordingly.

## IV.    IMPLEMENTING MULTIPLE CONTRACTS

Rather than engaging in a single contract, the financial institution has the option of requiring the borrower to adhere to $n$ subcontracts - one for each of the $n$ payments that would be associated with the case of a single contract.

If the rate $i$ were of compound interest, the principal of the $k$-th subcontract, as proposed in De-Losso et al. (2013), in what can be deemed as an adaptation of the master thesis of Sandrini (2007), the principal of the $k$-th subcontract would be taken to be equal to the present value of the $k$-th payment of the original single contract – a procedure that was also used in de Faro (2022) and in de Faro and Lachtermacher (2023 a and b).

However, as we are considering the case where the rate $i$ is of simple interest, and the focal date is taken to be the end of the contract, we must make an adaptation, which was suggested in Lachtermacher and de Faro (2023). In this case, the principal of the $k$-th subcontract, denoted as $F_k$, will be:

$$F_k = P_k \times [1 + i \times (n-k)] / (1 + i \times n), \quad \text{for } k = 1, 2, \dots, n \tag{7}$$

In this manner we are assured that the sum of the principal of the $n$ subcontracts will be exactly equal to the principal $F$ of the original single contract.

As for the component of amortization that is associated with the $k$-th subcontract, we will have:

$$\overline{A}_k = F_k, \quad \text{for } k = 1, 2, \dots, n \tag{8}$$

On the other hand, and this is the key factor which justifies the financing institution's gain for substituting a single contract by $n$ subcontracts, the component of interest, associated with the $k$-th subcontract, denoted as $\overline{J}_k$, will now be:

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$$\overline{J}_k = P_k - \overline{A}_k = P_k \times \left[ 1 - \frac{1 + i \times (n-k)}{1 + i \times n} \right], \quad \text{for } k = 1, 2, \dots, n \qquad (9)$$

Therefore, considering our simple numerical example of section 3, Table 2 presents the sequence of the 12 constant payments, which is the same in both the case of a single contract, as well in the case of the 12 individual subcontracts.

Additionally, Table 2 also presents the sequences $J_k$ and $\overline{J}_k$, as well as the sequence of differences $d_k = J_k - \overline{J}_k$.

As previously pointed out, it should be noted that the original debt of 10,000 units of capital is fully amortized, since:

$$\sum_{k=1}^{n} F_k = \sum_{k=1}^{n} \overline{A}_k = F \qquad (10)$$

in this case with $n = 12$.

Formally, however, we do not have a system of constant amortization anymore as the parcels of amortization $\overline{A}_k$ are not equal.

*Table 2:* The Sequences of the Parcels of Interest and its Differences (Focal Date = *n*)

| $k$ | $F_k$ | $\overline{A}_k$ | $\overline{J}_k$ | $P_k$ | $d_k$ |
|---|---|---|---|---|---|
| | | Multiple Contracts | | | |
| 1 | 918.23 | 918.23 | 8.27 | 926.50 | 84.90 |
| 2 | 902.33 | 902.33 | 16.41 | 918.74 | 69.00 |
| 3 | 886.57 | 886.57 | 24.40 | 910.97 | 53.24 |
| 4 | 870.95 | 870.95 | 32.26 | 903.21 | 37.62 |
| 5 | 855.47 | 855.47 | 39.98 | 895.45 | 22.14 |
| 6 | 840.92 | 840.92 | 47.55 | 887.68 | 6.79 |
| 7 | 824.92 | 824.92 | 54.99 | 879.92 | -8.41 |
| 8 | 809.86 | 809.86 | 62.30 | 872.15 | -23.48 |
| 9 | 794.93 | 794.93 | 69.46 | 864.39 | -38.40 |
| 10 | 780.14 | 780.14 | 76.48 | 856.63 | -53.19 |
| 11 | 765.49 | 765.49 | 83.37 | 848.86 | -67.84 |
| 12 | 750.98 | 750.98 | 90.12 | 841.10 | -82.35 |
| $\Sigma$ | | 10,000.00 | 605.59 | 10,605.59 | 0,00 |

Strictly from an accounting point of view, there is no gain for the financial institution granting the loan if a single contract is substituted by multiple contracts, since the sums of the corresponding parcels of interest is the same. That is:

$$\sum_{k=1}^{12} J_k = \sum_{k=1}^{12} \overline{J}_k = 605.59 \quad \text{units of capital.}$$

Yet, depending on the opportunity cost of the financial institution, which will be denoted as ρ, and is usually of compound interest, and which is supposed to be relative to the same period of the simple interest rate, *i,* that is being charged, the financial institution may derive substantial gains in terms of tax deductions.

In other words, it is possible that:

$$V_1(\rho) = \sum_{k=1}^{n} J_k \times (1+\rho)^{-k} > V_2(\rho) = \sum_{k=1}^{n} \bar{J}_k \times (1+\rho)^{-k} \tag{11}$$

where $V_1(\rho)$ denotes the present value, at the rate ρ of the sequence of the parcels of interest in the case of a single contract, and $V_2(\rho)$ denotes the corresponding present value in the case of the adoption of multiple contracts.

Moreover, at least in the case of our simple numerical example, as the sequence $d_k$ of differences has only one change of sign, thus characterizing what is termed a conventional financing project, cf. de Faro (1974), whose internal rate of return is unique, and in this particular case is null, it follows that $\Delta = V_1(\rho) - V_2(\rho) > 0$ if $\rho > 0$.

Figure 1 outlines the evolution of $\Delta$, for $0 \le \rho \le 5\%$ per period, for $F = 10.000$ units of capital and $n = 12$. Additionally, we also have the evolution of $\Delta$, where the simple interest rate, *i,* is equal to 0.5%, 1%, 1.5%, 2%, 2.5% and 3% per period.



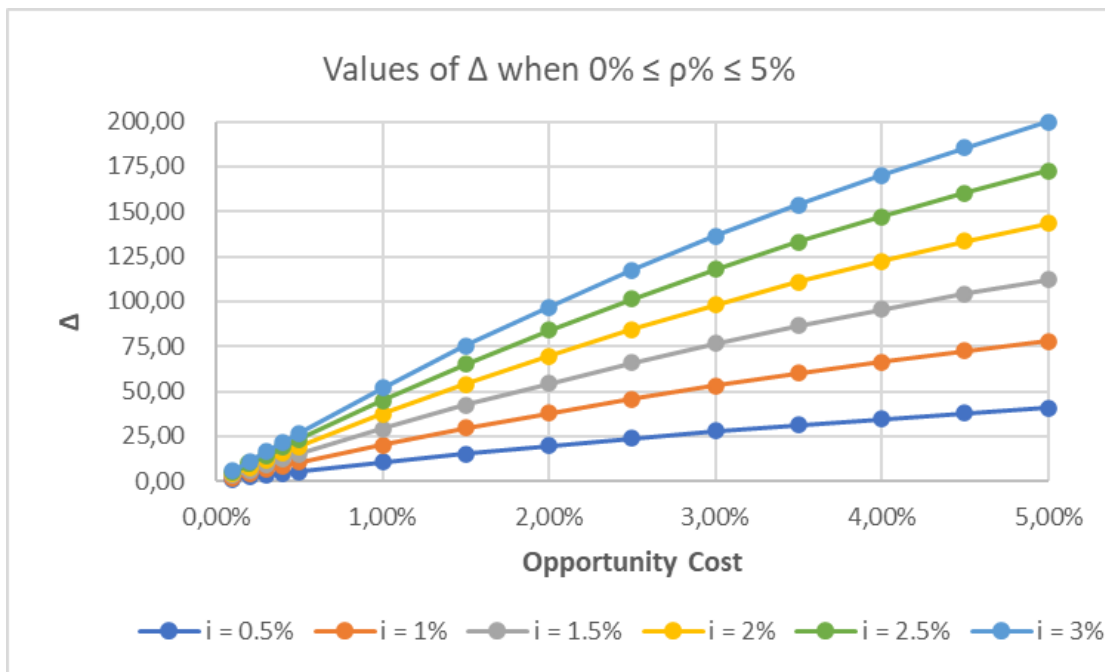*Figure 1:* Values of $\Delta$, $F =$10,000 units of capital and $n =$12

## V.  GENERAL ANALYSIS - DATA FOCAL AT TIME *N*

In the previous section, focusing attention on our simple example, with only 12 periods, it was verified that the sequence of differences of the interest payments present just one change of sign, thereby assuring us of the uniqueness of the corresponding internal rate of return, which is known to be null.

Furthermore, this inference appears to always be true, as supported by the evidence provided in Figure 2, which presents the evolution of the sequence $d_k$ for the case where $F = 1,200,000$ units of capital of a single contract with 180 periods and with the simple interest rate, $i$, being as high as 3% per period.
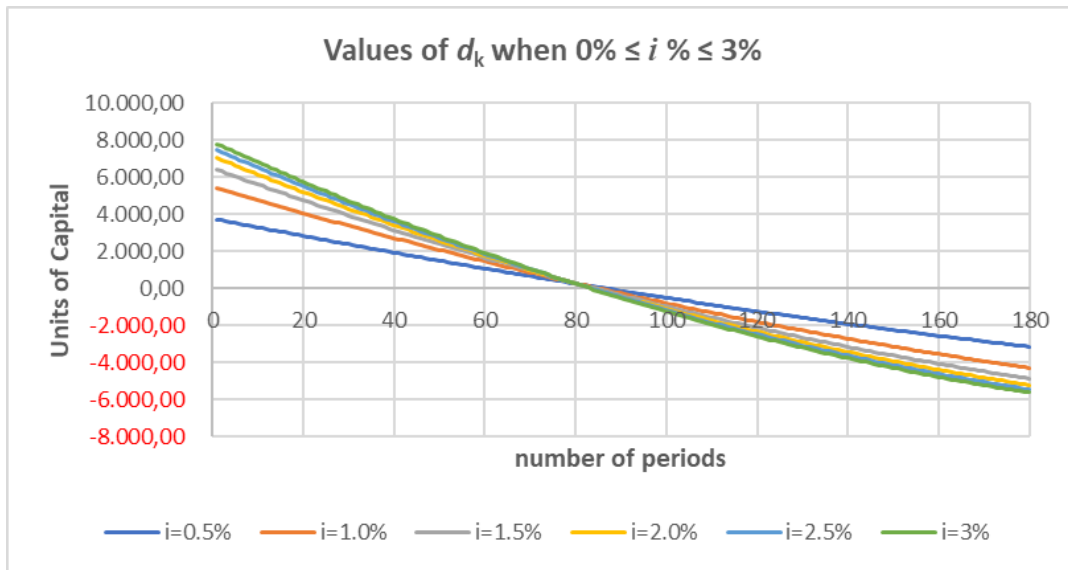


Figure 2: Values of $d_k$, $F$ =1,200,000 units of capital and $n$ =180.

Consequently, it can be inferred that the financing institution is always better off if a single contract is substituted by multiple contracts - one for each one of the $n$ payments of the original contract.

Taking into account that in Brazil the monthly interest rates charged do not exceed 2% per month, in real terms, we are going to analyze the behavior of the percentage increase of the fiscal gain $\delta = \left[ V_1(\rho)/V_2(\rho) - 1 \right] \times 100$ for some values of the corresponding annual opportunity cost $\rho_a$, with each contract with a term of $n_a$ years.

Table 3: Fiscal gain $\delta$, the end term of the contract as the focal date, $i$ = 0.5%p.m.

| $n_a$ | $\rho_a(\%)$ | | | | | |
|---|---|---|---|---|---|---|
| | 5% | 10% | 15% | 20% | 25% | 30% |
| 5 | 7.9719 | 16.1314 | 24.4507 | 32.9031 | 41.4632 | 50.1072 |
| 10 | 16.2389 | 33.9052 | 52.8273 | 72.8069 | 93.6337 | 115.0988 |
| 15 | 24.8052 | 53.2265 | 84.7246 | 118.6077 | 154.1421 | 190.6437 |
| 20 | 33.7337 | 74.1080 | 119.7820 | 169.0355 | 220.2051 | 271.9532 |
| 25 | 43.0539 | 96.4714 | 157.4421 | 222.6120 | 289.1879 | 355.3285 |
| 30 | 52.7773 | 120.1807 | 197.0807 | 278.0298 | 359.2563 | 438.7897 |

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*Table 4:* Fiscal gain $\delta$, the end term of the contract as the focal date, $i = 1.0\%$p.m.

| $n_a$ | $\rho_a(\%)$ | | | | | |
|---|---|---|---|---|---|---|
| | 5% | 10% | 15% | 20% | 25% | 30% |
| 5 | 7.7552 | 15.6718 | 23.7228 | 31.8826 | 40.1269 | 48.4330 |
| 10 | 15.6890 | 32.6551 | 50.7238 | 69.7007 | 89.3852 | 109.5827 |
| 15 | 23.9269 | 51.1075 | 80.9942 | 112.9219 | 146.2102 | 180.2417 |
| 20 | 32.5457 | 71.0942 | 114.3113 | 160.5803 | 208.3928 | 256.5663 |
| 25 | 41.5726 | 92.5563 | 150.2096 | 211.4310 | 273.7177 | 335.4564 |
| 30 | 51.0157 | 115.3712 | 188.1381 | 264.3247 | 340.5672 | 415.1392 |

*Table 5:* Fiscal gain $\delta$, the end term of the contract as the focal date, $i = 1.5\%$p.m.

| $n_a$ | $\rho_a(\%)$ | | | | | |
|---|---|---|---|---|---|---|
| | 5% | 10% | 15% | 20% | 25% | 30% |
| 5 | 7.6074 | 15.3594 | 23.2297 | 31.1934 | 39.2270 | 47.3088 |
| 10 | 15.3771 | 31.9511 | 49.5475 | 67.9753 | 87.0402 | 106.5558 |
| 15 | 23.4807 | 50.0420 | 79.1365 | 110.1156 | 142.3264 | 175.1843 |
| 20 | 31.9849 | 69.6895 | 111.7900 | 156.7216 | 203.0461 | 249.6486 |
| 25 | 40.9094 | 90.8278 | 147.0548 | 206.6009 | 267.0851 | 326.9859 |
| 30 | 50.2576 | 113.3324 | 184.3928 | 258.6363 | 332.8607 | 405.4327 |

*Table 6:* Fiscal gain $\delta$, the end term of the contract as the focal date, $i = 2.0\%$p.m.

| $n_a$ | $\rho_a(\%)$ | | | | | |
|---|---|---|---|---|---|---|
| | 5% | 10% | 15% | 20% | 25% | 30% |
| 5 | 7.5001 | 15.1333 | 22.8736 | 30.6966 | 38.5797 | 46.5019 |
| 10 | 15.1762 | 31.4996 | 48.7962 | 66.8775 | 85.5535 | 104.6434 |
| 15 | 23.2107 | 49.4007 | 78.0243 | 108.4433 | 140.0218 | 172.1943 |
| 20 | 31.6584 | 68.8766 | 110.3394 | 154.5123 | 199.9972 | 245.7168 |
| 25 | 40.5332 | 89.8540 | 145.2875 | 203.9075 | 263.3997 | 322.2919 |
| 30 | 49.8357 | 112.2056 | 182.3341 | 255.5224 | 328.6544 | 400.1461 |

As shown in Tables 3 to 6, the fiscal gain is substantial, although it decreases when the interest rate, $i$, increases.

## VI.    AN ALTERNATIVE

As pointed out in section 2, the Rovina's Proposal, even though supported by several judicial sentences, violates a still prevailing Brazilian law promulgated in 1964.

Therefore, it seems more adequate to also consider the case where the focal date coincides with the date of the contract, which is the date stipulated in the 1964 law.

In this case, the value of the $k$-th payment, now denoted as $\widehat{P}_k$, must satisfy the following equation:

$$F = \sum_{k=1}^{n} \frac{\hat{P}_k}{1 + i \times k} \qquad (12)$$

Before proceeding, it should be pointed out, as shown in de Faro (2014), that we will have $\hat{P}_1 > P_1$, if $n \geq 2$.

For the special case under scrutiny, where we are assuming constant amortization, it is appropriate to make use of the work of Forger (2009), which introduced the concepts of capitalized and non-capitalized components.

Following the above-mentioned reference, the parcel of interest at time $k$, now denoted as $\hat{J}_k$, is:

$$\hat{J}_k = F \times f \times i \times (n - k + 1)/n, \text{ for } k = 1, 2, \dots, n \qquad (13)$$

where $f$ is a weigh factor which decomposes de principal $F$ in a capitalized component, $F^C$, and in a non-capitalized component, $F^N$; $0 \leq f \leq 1$.

For our case where the focal date is time zero, there is, in general, no analytical solution to equation (12). It is necessary to make use of an algorithm as the one suggested in de Faro (2014), or the one proposed in Lachtermacher and de Faro (2022), which also provides the value of $f$.

Considering the simple numerical example of section 3, and taking into account that the value of the weigh factor can be determined to be $f = 0.966126423$, Table 5 presents the sequence of payments that represents the solution of equation (12), as well as the sequence of the parcels of interest, as given by expression (13).

It should be noted that, as the parcel of amortization $\hat{A}_k$ is equal to the difference $\hat{P}_k - \hat{J}_k$, for all $k$, we are satisfying the requisite of constant amortization as shown in Table 5.

Additionally, Table 7 also presents the evolution of the outstanding debt $\hat{S}_k$ which decreases linearly.

*Table 7:* Evolution of the Payments and of the Parcels of Interest (Focal Date = 0)

| $k$ | $\hat{J}_k$ | $\hat{A}_k$ | $\hat{P}_k$ | $\hat{S}_k$ |
|---|---|---|---|---|
| 0 | | | | 10,000.00 |
| 1 | 96.61 | 833.33 | 929.95 | 9,166.67 |
| 2 | 88.56 | 833.33 | 921.89 | 8,333.33 |
| 3 | 80.51 | 833.33 | 913.84 | 7,500.00 |
| 4 | 72.46 | 833.33 | 905.79 | 6,666.67 |
| 5 | 64.41 | 833.33 | 897.74 | 5,833.33 |
| 6 | 56.36 | 833.33 | 889.69 | 5,000.00 |
| 7 | 48.31 | 833.33 | 881.64 | 4,166.67 |
| 8 | 40.26 | 833.33 | 873.59 | 3,333.33 |
| 9 | 32.20 | 833.33 | 865.54 | 2,500.00 |
| 10 | 24.15 | 833.33 | 857.49 | 1,666.67 |
| 11 | 16.10 | 833.33 | 849.44 | 833.33 |

| 12 | 8.05 | 833.33 | 841.38 | 0.00 |
|----|------|--------|--------|------|
| $\Sigma$ | 627.98 | 10,000.00 | 10,627.98 | |

Before proceeding, it should be noted that, as shown in Lachtermacher and de Faro (2022), the Forger (2009) procedure also satisfies the concept of financial consistency as proposed in de Faro (2014). That is, the determination of the outstanding debt at any point in time can be achieved by any of the classical methods.

## VII. MULTIPLE CONTRACTS IN THE CASE OF FOCAL DATE AT TIME ZERO

In this case, analogously to the case where the interest rate $i$ is of compound interest, the principal of the $k$-th subcontract, now denoted as $\widehat{F}'_k$, is taken to be equal to the present value, now at the rate $i$ of simple interest of the $k$-th payment of the single contract.

That is:

$$\hat{F}'_k = \frac{\hat{P}_k}{1+i \times k} \quad , \quad \text{for } k = 1, 2 \dots , n \tag{14}$$

with the corresponding parcel of amortization, now denoted as $\widehat{A}'_k$, being exactly equal to the principal of the subcontract. Namely:

$$\hat{A}'_k = \hat{F}'_k \quad , \quad \text{for } k = 1, 2, \dots , n \tag{15}$$

as for the corresponding parcel of interest, denoted as $\widehat{J}'_k$, since $J'_k = \widehat{P}_k - \widehat{A}'_k$, we will have:

$$\hat{J}'_k = \frac{\hat{P}_k \times i \times k}{1+i \times k} \quad , \quad \text{for } k = 1, 2 \dots , n \tag{16}$$

In Table 8, still considering our simple numerical example, we show the sequences of values of the constant payment $\widehat{P}_k$, the sequence of the interest payments $\widehat{J}'_k$, as well as the sequence $\widehat{J}_k$, and the sequence of the values of the differences $d'_k = \widehat{J}_k - \widehat{J}'_k$.

*Table 8:* The Sequences of the Parcels of Interest and its Differences (Focal Date = 0)

| | Multiple Contracts | | | | |
|---|---|---|---|---|---|
| $k$ | $F'_k = \hat{A}'_k$ | $\hat{P}_k$ | $\hat{J}'_k$ | $\hat{J}_k$ | $d'_k$ |
| 1 | 920.74 | 929.95 | 9.21 | 96.61 | 87.41 |
| 2 | 903.82 | 921.89 | 18.08 | 88.56 | 70.49 |
| 3 | 887.23 | 913.84 | 26.62 | 80.51 | 53.89 |
| 4 | 870.95 | 905.79 | 34.84 | 72.46 | 37.62 |
| 5 | 854.99 | 897.74 | 42.75 | 64.41 | 21.66 |
| 6 | 839.33 | 889.69 | 50.36 | 56.36 | 6.00 |
| 7 | 823.96 | 881.64 | 57.68 | 48.31 | -9.37 |
| 8 | 808.88 | 873.59 | 64.71 | 40.26 | -24.45 |

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| 9 | 794.07 | 865.54 | 71.47 | 32.20 | -39.26 |
|---|---|---|---|---|---|
| 10 | 779.53 | 857.49 | 77.95 | 24.15 | -53.80 |
| 11 | 765.26 | 849.44 | 84.18 | 16.10 | -68.08 |
| 12 | 751.24 | 841.38 | 90.15 | 8.05 | -82.10 |
| $\Sigma$ | 10,000.00 | 10,627.98 | 627.98 | 627.98 | 0,00 |

Comparatively to the case where the focal date is the end period of the contract, we have the same amount for the total of the interest payments.

However, the financing institution may likewise derive substantial gains in terms of tax deductions.

This is because, denoting by $V'_1(\rho)$ the present value, at the interest rate $\rho$ in the case of a single contract, and by $V'_2(\rho)$ the corresponding present value in the case of multiple contracts, it is possible to have:

$$V_1'\left(\rho\right)=\sum_{k=1}^{n}J_k'\times\left(1+\rho\right)^{-k}>V_2'\left(\rho\right)=\sum_{k=1}^{n}\hat{J}_k'\times\left(1+\rho\right)^{-k}$$

(17)

Moreover, in this case of our simple numerical example, and in several others cases, with different values of $i$, $n$ and $F$ tested, the sequence $d'_k$ of differences also characterizes a conventional project, whose internal rate of return is unique, and which in this particular case is null, it follows that $\Delta = V'_1(\rho) - V'_2(\rho) > 0$ if $\rho > 0$.

Figure 3 outlines the evolution of $\Delta'$, not only when $i = 1\%$ per period, but also when $i$ assumes the values of 0.5%, 1.5%, 2% and 3%, and when $0 \leq \rho \leq 5\%$ per period.
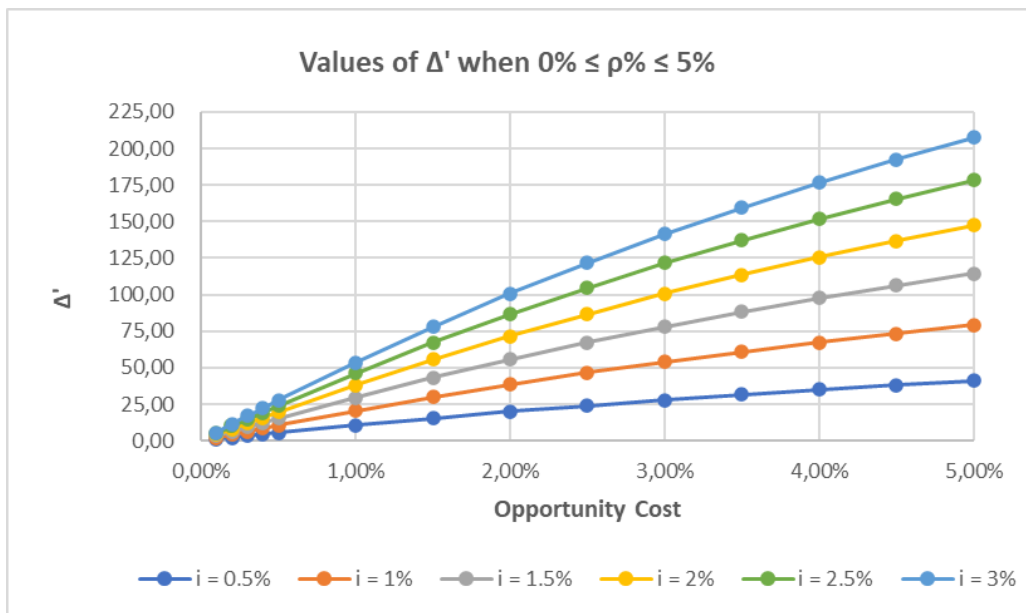


*Figure 3:* Values of $\Delta'$ , $F$ =10,000 units of capital and $n$ =12

Hence, as it was seen in the case where the focal date is time $n$, the value of $\Delta'$ increases both regarding $i$ and $\rho$.

## VIII.  GENERAL ANALYSIS - DATA FOCAL AT TIME ZERO

As illustrated in Figure 4, which concerns the case where $n = 180$ periods, we also have just one change of sign in the sequence $d'_k$ .
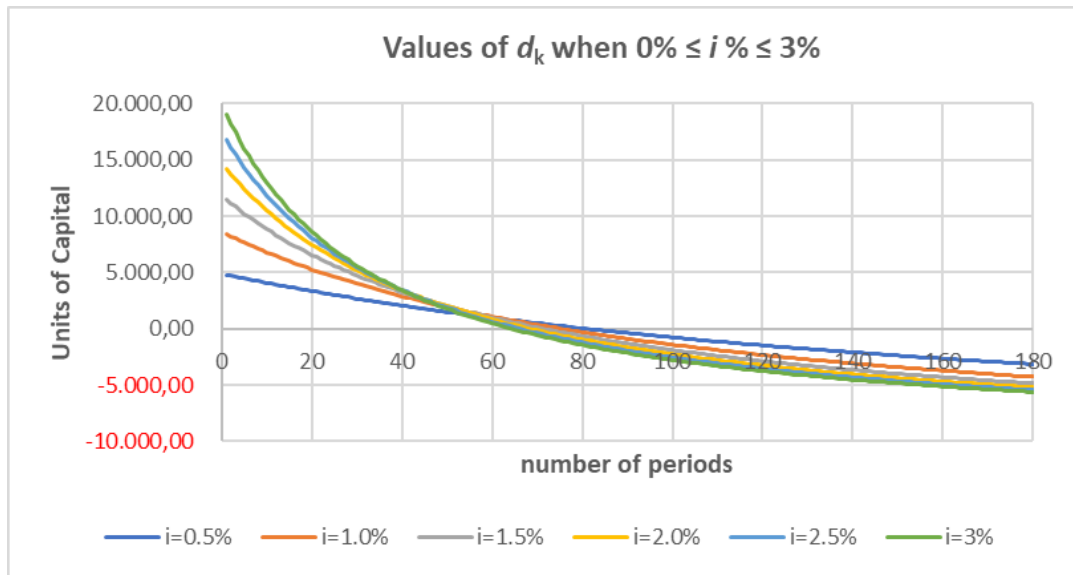


Figure 4: Values of $d'_k$ $F$ =1,200,000 units of capital and $n$ =180.

Consequently, we have a clear indication that we always have $\Delta' > 0.$ This means that, also in this case, the financing institution should prefer to use multiple contracts instead of a single contract.

To give a numerical evidence of the values of the fiscal gain, Tables 9, 10, 11, and 12 provide the percentage values of the increase of the fiscal gain $\delta' = \left[ V'_1(\rho)/V'_2(\rho) - 1 \right] \times 100$, where $\rho_a$ expresses the annual value of the opportunity cost, and where $n_a$ expresses the length of the contract in years.

Table 9:  Fiscal gain $\delta'$, beginning of the contract as the focal date , $i$ = 0.5% p.m.

| $n_a$ | $\rho_a(\%)$ | | | | | |
|---|---|---|---|---|---|---|
| | 5% | 10% | 15% | 20% | 25% | 30% |
| 5 | 7.5385 | 15.2110 | 22.9912 | 30.8542 | 38.7769 | 46.7380 |
| 10 | 14.4790 | 29.9006 | 46.0843 | 62.8441 | 80.0004 | 97.3886 |
| 15 | 20.8174 | 43.6344 | 67.8898 | 93.0180 | 118.5191 | 143.9946 |
| 20 | 26.6334 | 56.2731 | 87.6870 | 119.7630 | 151.6785 | 182.9162 |
| 25 | 31.9818 | 67.7404 | 105.1330 | 142.5263 | 178.9776 | 214.0710 |
| 30 | 36.9046 | 78.0270 | 120.2101 | 161.5131 | 201.1316 | 238.8904 |

Table 10:  Fiscal gain $\delta'$ , beginning of the contract as the focal date , $i$ = 1.0% p.m.

| $n_a$ | $\rho_a(\%)$ | | | | | |
|---|---|---|---|---|---|---|
| | 5% | 10% | 15% | 20% | 25% | 30% |
| 5 | 6.9406 | 13.9511 | 21.0079 | 28.0897 | 35.1771 | 42.2530 |
| 10 | 12.6124 | 25.7559 | 39.2682 | 52.9979 | 66.8105 | 80.5926 |

| 15 | 17.3770 | 35.7323 | 54.6099 | 73.6175 | 92.4539 | 110.9110 |
| 20 | 21.4769 | 44.1958 | 67.2778 | 90.0806 | 112.2184 | 133.5060 |
| 25 | 25.0559 | 51.3787 | 77.6256 | 103.0167 | 127.2335 | 150.2221 |
| 30 | 28.2097 | 57.4769 | 86.0521 | 113.1885 | 138.7521 | 162.8518 |

*Table 11:* Fiscal gain $\delta$', beginning of the contract as the focal date , $i$ = 1.5% p.m.

| | $\rho_a$(%) | | | | | |
|---|---|---|---|---|---|---|
| $n_a$ | 5% | 10% | 15% | 20% | 25% | 30% |
| 5 | 6.4621 | 12.9496 | 19.4423 | 25.9218 | 32.3724 | 38.7801 |
| 10 | 11.2941 | 22.8849 | 34.6338 | 46.4190 | 58.1392 | 69.7143 |
| 15 | 15.1473 | 30.7727 | 46.5152 | 62.0946 | 77.3177 | 92.0672 |
| 20 | 18.3449 | 37.1686 | 55.8321 | 73.9320 | 91.2690 | 107.7805 |
| 25 | 21.0602 | 42.4137 | 63.1610 | 82.8826 | 101.4772 | 118.9960 |
| 30 | 23.4010 | 46.7501 | 68.9679 | 89.7395 | 109.1230 | 127.2862 |

*Table 12:* Fiscal gain $\delta$', beginning of the contract as the focal date , $i$ = 2 % p.m.

| | $\rho_a$(%) | | | | | |
|---|---|---|---|---|---|---|
| $n_a$ | 5% | 10% | 15% | 20% | 25% | 30% |
| 5 | 6.0665 | 12.1266 | 18.1627 | 24.1594 | 30.1038 | 35.9848 |
| 10 | 10.2954 | 20.7404 | 31.2173 | 41.6279 | 51.8947 | 61.9600 |
| 15 | 13.5477 | 27.2897 | 40.9374 | 54.2848 | 67.2032 | 79.6259 |
| 20 | 16.1830 | 32.4468 | 48.3122 | 63.5134 | 77.9472 | 91.6081 |
| 25 | 18.3820 | 36.5870 | 53.9823 | 70.3341 | 85.6390 | 99.9876 |
| 30 | 20.2520 | 39.9559 | 58.4040 | 75.4830 | 91.3246 | 106.1087 |

Similar to the case of the focal date at the end of the financing period, the fiscal gains are also substantial, although they also decrease when the interest rate, $i$,is increased.

## IX.    CONCLUSIONS

Given that, repeatedly, the Brazilian judicial system has determined that home-financing contracts written in terms of compound interest should be substituted by contracts making use of simple interest, we have analyzed the possibility that the financing institution granting the loan decides to substitute a single contract by $n$ subcontracts - one for each one of the payments of the single contract.

Focusing attention on the case of constant amortization, which is one of the most employed, and which in Brazil is known as "SAC," we have concluded that the financing institution granting the loan should always prefer the multiple contracts option since this can result in significant tax gains.

It was shown that the tax gains are higher if the focal date is the end period of the contract, which is the usual case, even though it violates a Brazilian law of 1964.

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