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# Addressing Infrastructure Funding and Retirement Security through Islamic Finance: Sukuk SeLFIES

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# **Addressing Infrastructure Funding and Retirement Security through Islamic Finance: Sukuk SeLFIES**

**Dr. Mustafa Dereci, Mehmet Gerz, and Dr. Arun S. Muralidhar**

Mehmet Gerz, CEO and CIO, ATA Portfooy

Arun S. Muralidhar, Ph D, Co-founder and Client Portfolio Manager,  
AlphaEngine Global Investment Solutions LLC

Mustafa Dereci, PhD, Chairman, Hayat Finans Katılım Bankası Advisory  
Committee

## **Abstract**

*Countries in the developing and developed world and struggling with two challenges: funding infrastructure and retirement security. We propose an innovative new instrument, pioneered by Brazil in 2023, that can address both challenges with a single, simple innovation. Given the various risks embedded in infrastructure financing, this instrument is a local currency bond with a unique cash flow structure that ensures retirement security (thereby ensuring demand for bonds), but also is synergistic with funding infrastructure. More importantly, we also demonstrate how this bond could be sharia-compliant thereby expanding its use in Islamic finance to help countries in various jurisdictions achieve these two major goals.*

**Key Words:** Infrastructure Funding, Retirement Security, Financial Innovation, Demographic Infrastructure

**JEL:** G11, G23, G28

## **Introduction**

There is a massive need for infrastructure funding globally, especially for green infrastructure and the World Bank's President, Ajay Banga, has stated: The importance of the private sector cannot be under emphasised. The reality is that people say that we need a trillion dollars a year just for emerging markets.”<sup>i</sup> However, one of the authors of this papers has helped global pension funds and sovereign wealth funds make effective investment decisions, including a 4 year stint managing the World Bank's pension fund, and it is highly unlikely that these private sources of capital will provide the trillion dollars needed despite all the Net Zero commitments. This follows because of the many principal-agent issues in institutional portfolio management that make it hard for an investment officer to recommend a long-term infrastructure project, with potentially high single digit returns, in highly risky emerging markets, when their performance is measured on a quarterly or annual basis. This challenge is not limited to the developing world; even in the United States, where there is a massive need for infrastructure funding, pension funds prefer private equity, hedge funds or private credit to infrastructure investments. As OECD (2021) demonstrates, with the exception of a few Australian and Canadian pension funds with allocations above 5% of total assets, there is limited flow to either listed/unlisted equity or debt instruments to fund infrastructure.<sup>ii</sup>

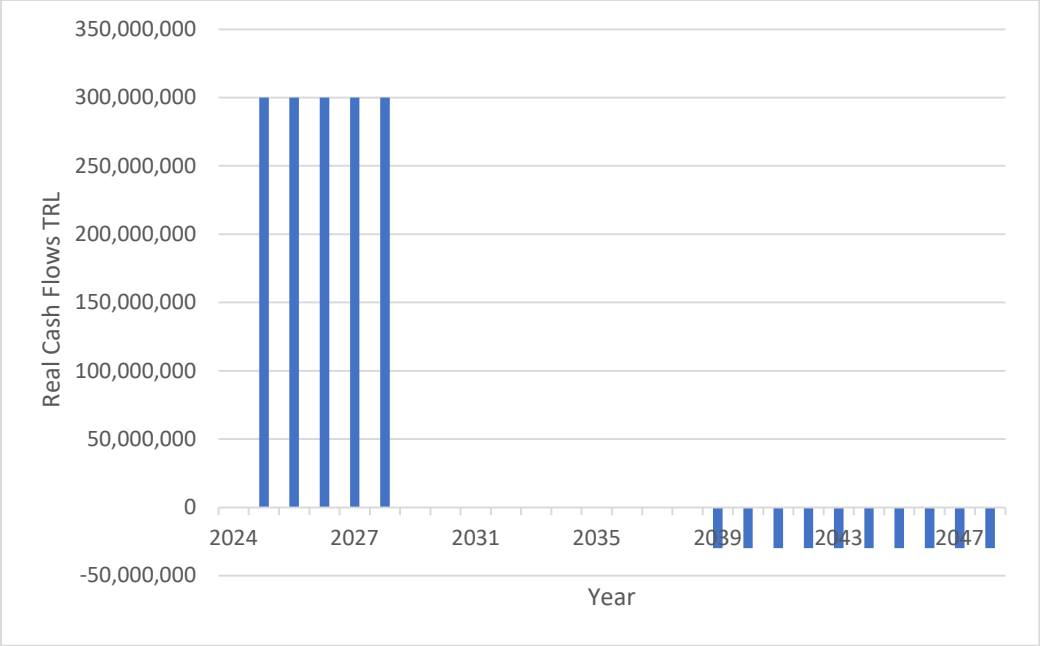
We will argue in this paper that there is a simpler way to fund infrastructure and address another critical challenge globally, retirement security. Countries as diverse as India (in its 2018 budget and subsequently), Turkey, the United Kingdom and the United States have argued that these two twin challenges will hobble economic growth and we will demonstrate a simple financial instrument that can capture local currency private sector funding might be the solution. Brazil pioneered the creation of this instrument at the recommendation of one of the authors and Nobel Laureate Prof. Robert C. Merton, and have provided a blueprint for other countries to follow. It also achieves financial inclusion

through digitalization (and can be used to also improve “Demographic Infrastructure” based on our current work with Brazil). More importantly, this paper demonstrates a sharia-compliance with this instrument which then makes it available to the Islamic world to also consider. For simplicity, we use Turkish data to make the case, but one can easily see how this can be adapted more generally.

### **I. The Infrastructure Funding Challenge**

For now, we focus on physical/digital infrastructure and return to demographic infrastructure later in Section. Consider the construction of say a major port or highway in Turkey or even the reconstruction of cities destroyed by the recent earthquake. Assume for simplicity the project starts in 2024. These investments require periodic capital investments now, but will only be able to generate cash flows possibly 15 – 30 years into the future. Figure 1 provides a possible example of the cash flows of an infrastructure project, whether government or private sector initiated.

“According to cost studies from Turkey, 1km of a new highway costs between \$4 million and \$8 million whereas expanding an existing two-lane road into a divided four-lane dual carriageway costs around \$1 million (Gerçek, 2001)”<sup>iii</sup> A reasonable sized road in Turkey is approximately 100 km indicating a new road could cost say \$500 mn or TRL 15,000 bn (assuming an exchange rate of 30 TRL/USD).<sup>iv</sup> For simplicity, assume that it requires \$100mn for 5 years for capital investment, though this could be staggered beyond and it will not change the case we are making. Also, assume that after construction for 5 years, it will be able to generate cash flows from tolls etc after 10 years.



**Figure 1: TRL Cash flows for a hypothetical infrastructure investment**

*Risks of Funding this Project for Private Investors in Developed World*

Some of the risks for a foreign investor making such an investment in Turkey, assuming away the business risk of owning and operating a highway (and is not meant to be comprehensive, but more to make the case for domestic currency funding) include: political risk, regulatory risk, and currency risk. In the case of Turkey, borrowing in foreign currency exposes the country to currency risk as well making the match unsuitable.

*Turkey’s Infrastructure Needs*

According to Global Infrastructure Hub (GIH) and Türkiye Investment Office, Türkiye’s need for infrastructure investment between 2022 and 2040 is US Dollar 975 billion, but based on current trends, Türkiye can only finance US Dollar 569 billion of this large sum, leaving an investment gap of US Dollar 405 billion. Most of the need for investing is in Transport: \$581bn, Energy: \$242bn, Telecom: \$99bn and Water: \$53bn.

Türkiye is actively investing in its airways, maritime, roads and railway infrastructure to better utilize its strategic location between Asia, Europe and Africa. To this end, Türkiye invested US Dollar 194 billion into transportation infrastructure and plans to invest as much as US Dollar 168 billion until 2053. Of particular importance is building the fast rail roads to connect the Middle Corridor to European rail roads through Bosphorus Strait.

The devastating earthquakes in February 2023 increased the need for reconstruction, estimated initially by the World Bank to be \$34.2bn billion, but Türkiye's Strategy and Budget Office estimates that this can go up to \$104 billion (11% of GDP) in the long-run with the inclusion of indirect costs and losses.

### *Background on Turkish Capital Markets*

Turkish capital markets have a history of almost 40 years. Türkiye has a market-based economy with some government intervention. Financials markets are dominated by banks but capital markets have recently been developing thanks to government's low interest rate policies. Borsa Istanbul is among the most liquid among emerging markets owing to a large number of domestic traders, but volatility is high. Foreign participation used to be very high but in the last five years the foreign ownership of Turkish stocks declined from 65% to below 30%. Government's reversion to orthodox economic policies since mid-2023 has helped bring back some of the foreign investors, but Türkiye's credit rating is still too low to lure back large foreign funds.

Borsa Istanbul has 539 company listed with a market capitalization of \$ 350 billion, but average free float is around 42%. Number of investors in the stock market has recently surged to 7.4 million thanks to an IPO euphoria. Corporate bond market has a capitalization of \$10 bn, with nearly 50.000 investors. Turkey's mutual fund industry has grown in recent years to \$ 64 bn with nearly 4.4 million investors. Private pension system ("BES") has a 20 year history with 8.7 voluntary participants and \$25 bn assets under management. The auto-

enrollment system (“OKS”) has not been as successful as “BES” with 7.3 million workers having only \$2 bn in assets.

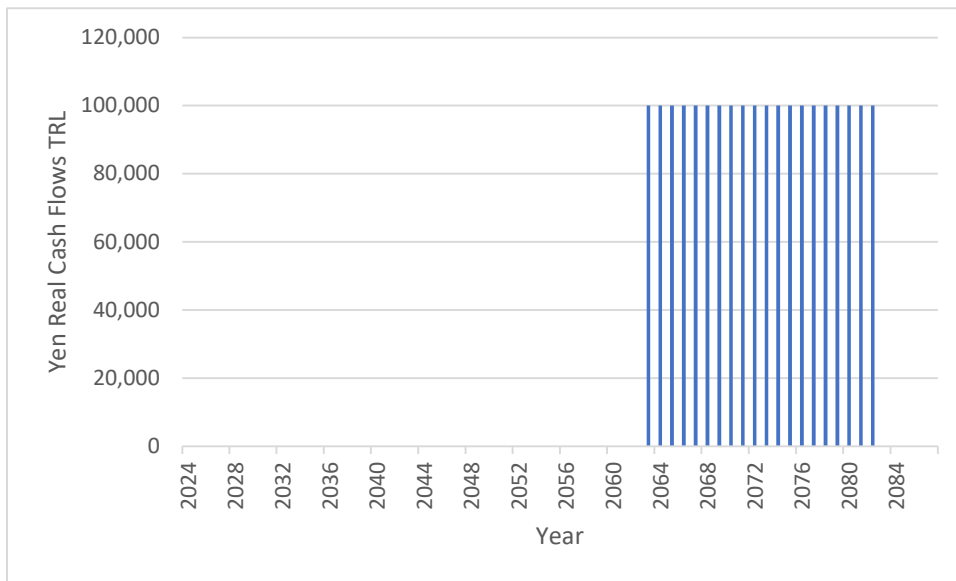
## **II. The Looming Retirement Crisis**

There is a looming retirement crisis around the globe in developed and developing countries, as individuals are increasingly being asked to take responsibility for their own retirement planning and a majority of these individuals are financially unsophisticated. Yet, these individuals are being tasked with the responsibility for three complex, interconnected decisions: how much to save, how to invest, and how to decumulate one’s portfolio at retirement. Additionally, many individuals, called “uncovered workers” do not have access to pension funds and hence do not have an appropriate vehicle to save for retirement.

A commonly-accepted retirement goal for a healthy pension is for it to sustain the relatively higher standard-of-living of the latter part of one’s working life throughout retirement (and that they do not outlive their assets). Compounding the earlier noted challenges, current financial instruments and products (e.g. T-Bills, TIPs, Equities, Gold, or Target Date Funds) are risky because they focus on the wrong goal - wealth at retirement, as opposed to how much real retirement income can be guaranteed to support pre-retirement standard-of-living. Moreover, while annuities are an effective means for providing income in retirement with longevity protection for those not in a pension plan, they are too illiquid and inflexible to employ during the accumulation period. Financial innovation and a change in the metric for measuring retirement success could address some of these challenges and help individuals achieve their retirement goals – a financially and socially desirable outcome for any country.

What is the desired retirement income stream or cash flow of an individual? A 45 year-old Turk in 2023 would typically plan to work for 20 more years and would like to receive say TRL100,000 real/year for 20 years in retirement

(assuming death is known). TRL 100,000 is the average salary in Turkey and hence just used as an indicative number. Figure 2 plots the likely real retirement cash flow of this 45-year old. It shows that the goal requires no cash flows for 20 years (through 2043) and then a steady stream of real income for 20 years. This is very different from a single wealth number that individuals are asked to think about as their “retirement number.”



**Figure 2: Projected Real Retirement Cash Flows of a 45 year-old in 2024 – work 15 more years; live for 20 years.**

### **III. The Solution - SeLFIES**

Fortunately, the creation and successful launch, in Brazil, of the RendA+ (or “Retirement Extra”) bond, issued through their Treasury Direct facility, is a very effective instrument that might serve as a model for other countries, especially Turkey to adopt/adapt.<sup>v</sup> This bond was designed along the lines of the “SeLFIES” (Standard-of-Living indexed, Forward-starting, Income-only Securities) first proposed in 2015 (Muralidhar 2015; Merton and Muralidhar (2016))<sup>vi</sup>. More specifically, Merton and Muralidhar (2018) specifically recommended their

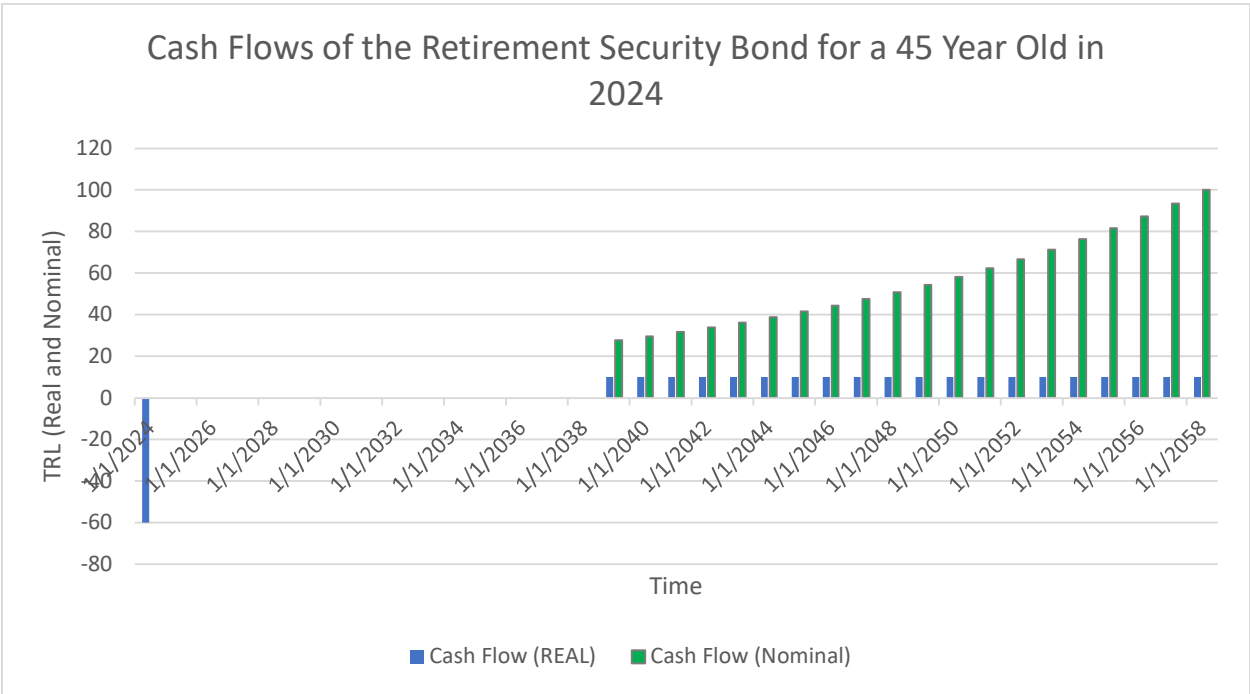
creation in Turkey.<sup>vii</sup> What is this unique instrument and how does it help improve retirement security? Moreover, given that the Islamic world has the same challenges and would like a solution to be sharia-compliant, is it feasible to design a “Sukuk SeLFIES”?

### *The Design*

We recommend an easy, quick and efficient solution for countries to address all these challenges and improve retirement security by creating and issuing SeLFIES. SeLFIES is a single, liquid, low-cost, low-risk (government-issued) instrument, easy-to-understand for even the most financially unsophisticated individual, because it embeds accumulation, decumulation, and inflation-adjustments.

Since the safe asset in defined contribution plans (focused on target retirement income) does not exist, SeLFIES are designed to mimic pension payments in Figure 2 and RendA+ actually pays investors on the same date on which they receive their Social Security payments. Governments can issue SeLFIES and they can be purchased directly by any individual (to create a type of “individual DB”) or institution. SeLFIES start paying investors upon retirement (i.e., forward-starting), and pay real income-only (e.g., TRL10 real/year), indexed to aggregate per capita consumption (to hedge standard-of-living risk) or inflation (an alternative choice for convenience because of the existence of a TIPS market), for a time period equal to a period linked to the average life expectancy at retirement (e.g., 20 years). Figure 3 shows a very simple cash flow chart of SeLFIES that start paying in 2039 for 20 years (i.e., for someone aged 45 who seeks to retire at age 60). The sharp negative bar in 2024 is the potential payment made today to acquire the desired retirement cash flow stream (i.e., the price of SeLFIES), assuming indexation of 5% p.a. SeLFIES are a purely market-based instrument and the market forces at the time of issuance will determine its issue price and its secondary market price. Most importantly, instead of current securities that

index solely to inflation, ideal SeLFIES would cover both the risk of inflation and standard-of-living improvements by indexing to per-capita consumption to ensure that retirees preserve their standard of living and can participate in the growth of the economy as well. This is critical especially since retirement planning is potentially a 60-year process and standard-of-living risk is a key unmanaged risk globally today. RendA+ currently is indexed to the IPCA – the local inflation index to which TIPs are set, as that is currently a liquid and well-accepted market.



**Figure 3: Real Cash Flows of 2039 SeLFIES: Pay TRL10 real from retirement date (2039) for 20 years (2059)**

SeLFIES are designed to pay people *when* they need it and *how* they need it, and greatly simplify retirement investing. A 55-year-old in 2024 would buy the 2029 bond, which would start paying coupons at age 65, and keep paying, for say 20 years, through 2049. SeLFIES caters to all individuals independent of retirement date. For example, if our 45 year-old in 2024 wants to guarantee TRL 100,000 annually, risk-free for 20 years in retirement as in Figure 2, to maintain their

current standard of living, they would need to buy 10,000 SeLFIES (TRL100,000 divided by TRL10) over their working life. Periodic DC plan statements can easily inform individuals as to how much retirement income they can expect to receive based on current holdings of SeLFIES (and conversion of other assets into SeLFIES-equivalents), relative to the target (10,000), thereby allowing easy course corrections prior to retirement. In addition, SeLFIES can be bequeathed to heirs (who can then either continue to collect the coupons or sell the SeLFIES in the secondary market). If SeLFIES are well-designed, they can also ensure longevity risk protection.

SeLFIES require only the most basic information and offer choices for buyers of any educational strata. The two required inputs are anticipated date of retirement (i.e., the SeLFIES payment start date) and target income goal for a good retirement, which determines the number of SeLFIES needed to reach this goal. If they change their retirement date, they could easily sell/buy the relevant SeLFIES with little effort and cost. The three (current) complex decisions of saving, investing and decumulation are simply folded into an easy calculation of how many bonds to buy. Even the most financially illiterate individual can be self-reliant with respect to retirement planning. Since SeLFIES do not make payments until the retirement date, the buyer does not need to make any further transactions or decisions to reinvest coupon or principal payments during the entire accumulation period. One transaction, one time, for each SeLFIES purchased minimizes costs, decision effort and errors.

## *The Brazilian Success with RendA+*

Additionally, RendA+ bonds can be purchased cheaply through the Treasury Direct facility, via a cell phone, and is liquid and can be sold back to the government and within the first 5 months had raised over R\$1.2 bn through 60,000 investors (including at least 12,000 who had never purchased a Treasury Direct security). In effect, the solution can be boiled down to: “SeLFIES on a Cell Phone.” A more detailed paper discusses how SeLFIES facilitates the hedging of longevity risk through multiple avenues.

### **IV. Why SeLFIES are a Good Deal for Governments**

#### *a. Funds Infrastructure and Improves Overall Balance Sheet Management*

SeLFIES are a good deal for governments, too. In fact, governments are the biggest beneficiaries. SeLFIES not only improve retirement outcomes for all citizens saving for retirement (reducing the need for bailouts), but also have spill-over benefits, as the bond, improves balance sheet management (as governments with value-added taxes have a hedge against future SeLFIES payments), and funds infrastructure and green transitions which is a major challenge globally (as the cash flows of SeLFIES are synergistic with these long-term investments as can be seen from comparing Figure 1 with Figure 3). Most importantly for Turkey, it “de-dollarizes” its debt and removes a key risk that prevents foreign private capital from funding these investments.

As a result, SeLFIES have been proposed for countries as diverse as the United States, France, Italy, Japan, India, Brazil and Turkey.<sup>viii</sup>

#### *b. Sharia Compliance*

How can one ensure that this instrument is Sharia-compliant and what is Sukuk SeLFIES? “A *sukuk* is an Islamic financial certificate, similar to a bond in Western finance, that [complies with Islamic religious law](#) commonly known

as [Sharia](#). Since the traditional Western interest-paying bond structure is not permissible, the issuer of a sukuk essentially sells an investor group a certificate, and then uses the proceeds to purchase an asset that the investor group has direct partial ownership interest in. The issuer must also make a contractual promise to buy back the bond at a future date [at par](#) value.”<sup>ix</sup> There are two possible ways in which we can easily consider these as sukuks. For example, the Central Bank of Bahrain has issued Sharia-compliant zero coupon securities called Sukuk al-Salam<sup>x</sup>. SeLFIES are nothing more than a package of zero-coupon securities. Alternatively, the IMF noted that, “Sukuk are seen as well-suited for infrastructure financing because of their risk-sharing property could also help fill financing gaps”.<sup>xi</sup> Since we have argued that Sukuk SeLFIES could be used to finance infrastructure, especially for earthquake or flood reconstruction in countries like Turkey, Morocco, and Libya, another case can be made for these to be considered sharia-compliant. Finally, in Brazil, investors have been able to sell their RendA+ holdings back to the government and since the investor earns a participation in the performance of the economy, through the link to per capita consumption (or proxied by a value-added tax index) ensures that individuals have a participation in the economy.

### *c. Currency of Retirement*

SeLFIES also serve a useful purpose by becoming the “currency of retirement.”; namely, a simple way to gauge the impact of changes in current economic policy on future retirement outcomes. For example, substantial monetary stimulus (as was being experienced in 2020) has potentially raised the cost of securing retirement income and had SeLFIES existed, this would have been transparent. Further, one of the challenges with inadequate savings is that other assets owned by individuals will need to be considered to bolster the retirement pot – with one asset in particular, one’s house – holding potentially the greatest promise. SeLFIES will allow individuals to clearly understand how much potential

retirement income (and protection of pre-retirement standard of living), their current assets are likely to generate.

## **V. Improving Demographic Infrastructure (Brazil)**

Muralidhar, Miranda and Vitorino (2024)<sup>xii</sup> note that “The most interesting aspect is that more than 17.000 investors never bought a bond from Tesouro Direto prior to RendA+. This means that innovation and digitalization has led to financial inclusion, given the ability of individuals to access this instrument in savings of as little as R\$ 30 at a time. Also, the percentage of women purchasing this bond is 34%, well under 51,5% of Brazilian population represented by women according to IBGE – Census 2022 – but a slightly improved percentage compared to 33% of Brazilian investors that are female, as surveyed by Anbima (an association that gathers information on Brazilian investment companies). It also led to Brazil being awarded the runner-up prize for innovation at the recently concluded Global Pension Summit, held in the Hague in October 2023.

Interestingly, with all infrastructure available to Brazil through the creation of RendA+ (computer systems, apps etc.), Brazil launched another financial innovation for another key social issue: safe financing of a child’s college education. Educa+, much like RendA+, has targeted payments that start when one’s child turns 18, and pays monthly amounts for 5 years (or 60 payments) – once again using a simple app for planning the correct purchase.

In addition to all the attractive features of Educa+, Brazil went three steps further: creating a “Collective Investment Scheme” where a simple QR code allows grandparents, friends or employers to buy Educa+ for a child they know; besides a lottery scheme among investors and most recently free life insurance for women (especially single women).

The collective investment scheme can also be used to help poor children living in favelas and other low-income communities to have funds reserved to give them the ambition of studying hard and breaking the cycle of poverty. The lottery

scheme rewards regular savers with a chance to win cash prizes and in the future Educa+ for their children, rather than playing the regular lottery or on illegal gambling on games/sports. The first winner was a single mother and while she was saving for her child (with no interest in the lottery aspect), it was pleasant for her to receive such an additional gift. As of October 26, 2023, 26.186 investors purchased Educa+ for an outstanding volume of R\$86,39 M. Again, the proceeds of Educa+ can be used to improve the public education infrastructure of Brazil and help improving the quality of schools and colleges in poorer parts of the country.

These two innovations allow Brazil to address another global social challenge and the government is already thinking about this issue; namely, ensuring gender equality of pensions or compensation, because women are critical to the most important resource for any country – demographics.

Many countries in Asia and Europe have experienced and are experiencing a decline in population growth. And so is Brazil where annual average population growth rate has been reducing since the 1960's, according to IBGE. It reached 0,52% recently - its lowest level since 1872, when census started in the country!

The reasons for this decline are complicated, but there are a well-known set of fact: first, that women typically earn less than men for the same work; second, women often have to take a break in work when they have children or spend their income for child-support when the child is young; third, they are often the caretakers for parents, again interrupting the regular income, and finally, their life expectancy is on average longer than that of men, and hence they need retirement resources for longer than men do. As a result, having a child becomes “expensive” for a woman and hence many women choose either to not have children or have few children. Each of the three authors have experienced this in their own family situations so we are keenly aware of the sacrifices women make to bear and raise children. However, this affects what we term

“Demographic Infrastructure”. A shortage of young people leads to many bad social consequences in aging societies.

We therefore recommend that women be compensated for having children. Countries like Ghana have contemplated/implemented “Baby Bonds” to pay women when they have a child. Others have argued for better parental leave terms and equal pay for equal work.

Since Brazil has two social inclusion purpose bonds with transparent and market-based prices, a third bond to this series could compensate women who improve Demographic Infrastructure by having children and raising them.

This new bond would help mothers with complementary income so necessary at home, as much of them – added to their professional gender inequality issues - pay alone for the house expenses like rental, energy, water supply and food. The extra income granted by the new bond would help mothers providing kids a safe environment in order to raise them with quality conditions at home to, as a conclusion of the cycle, offer them a college education.

Brazil’s experience with Bolsa Familia has shown the advantages of sending payments to women and hence Renda+ and Educa+ help women and families plan not just for the short term, day-to-day payments, but also for their long-term future and those of their children.

The cost of this compensation is transparent and one can measure the returns to education and secure retirement, to ensure that the country is earning a good social rate of return (and can be tracked by government agencies, academics, think tanks and multilateral development banks).

This idea takes the collective investment scheme of Educa+ (which is typically oriented to family and friends) to a national level to ensure investments in robust demography.

## VI. Conclusions

SeLFIES is a win-win for all. The time to act is NOW - the longer the delay, the higher the cost of ensuring retirement security for future generations and increasing the burden and cost to government. Brazil has shown how this innovation, through digitalization has also led to financial inclusion and hence the Islamic world would benefit enormously by issuing Sukuk SeLFIES. With these award-winning and globally sought after innovations and out-of-the-box thinking, developing countries can simultaneously achieve funding of physical infrastructure, retirement security, education funding, self-reliance, funding of green projects, funding education infrastructure improves and most importantly demographic infrastructure.

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<sup>i</sup> <https://cio.economictimes.indiatimes.com/news/corporate-news/world-bank-president-ajay-banga-on-digital-infrastructure/103566906>

<sup>ii</sup> OECD (2021), Annual Survey of Large Pension Funds and Public Pension Reserve Funds 2020, [www.oecd.org/finance/survey-large-pension-funds.htm](http://www.oecd.org/finance/survey-large-pension-funds.htm)

<sup>iii</sup> [https://theforum.eref.org.eg/2018/03/18/highways-growth-impact-road-upgrades-turkish-trade/#:~:text=According%20to%20cost%20studies%20from,million%20\(Ger%C3%A7ek%2C%202001\).](https://theforum.eref.org.eg/2018/03/18/highways-growth-impact-road-upgrades-turkish-trade/#:~:text=According%20to%20cost%20studies%20from,million%20(Ger%C3%A7ek%2C%202001).)

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<sup>v</sup> <https://borainvestir.b3.com.br/tipos-de-investimentos/renda-fixa/tesouro-direto/tesouro-renda-brasil-pode-ter-um-sistema-previdenciario-mais-sofisticado-que-o-de-outros-paises/>

<sup>vi</sup> <https://www.pionline.com/article/20151214/PRINT/312149974/new-bond-would-offer-a-better-way-to-secure-dc-plans>

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<sup>viii</sup> <https://selfiesforall.wordpress.com/2019/02/05/country-op-eds/>

<sup>ix</sup> <https://www.investopedia.com/terms/s/sukuk.asp>

<sup>x</sup> <https://islamicmarkets.com/education/sukuk-al-salam>

<sup>xi</sup> IMF. 2015. Islamic Finance: Opportunities, Challenges, and Policy Options. *IMF Staff Discussion Note*. April 2015. Washington DC. SDN/15/05.

<sup>xii</sup> Muralidhar, A. L. Miranda and A. Vitorino. 2024. Leveraging Renda+ and Educa+ to Improve Demographic Infrastructure. *Unpublished Working Paper*.