Solving Global Challenges Using Finance Science

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Role of Financial Innovation and Finance Science in Economic Growth and Development

- Well-functioning financial system is essential for sustainable economic growth and development –financial innovation drives improvement of the financial system, and finance science, technology, and economic need drive financial innovation


- Crisis can slow or even reverse financial innovation as in 2008-9. But crisis can also induce implementation of financial innovation which leads to a permanently improved financial system, as in the 1970s-1980s

- When did Finance become a science? 1950s-1960s

- When and why did finance science and finance practice become inexorably connected? 1970s-1980s
Accelerating Pace of Technological Progress in Financial Services

Sources: Arner, Barberis, and Buckley (2017); Quinn and Roberds (2008); World Economic Forum (2015).
How Intangible Innovation from Finance Can Solve Tangible Challenges to Economic Growth, Stabilization, Funding Retirement and Infrastructure

- Implementing more-efficient financial stabilization and growth policies (2019)
  - **China Example**: Capital controls, governance and local investment government stabilization policies and comparative-advantage strategy for growth, can each be executed without bearing the costly “side-effects” from inefficient diversification and improve stabilization

- Addressing multiple policy objectives with a single financial innovation (2019)
  - **Global Example**: A bond design addresses retirement income solution, efficient funding of infrastructure, reducing the risk and cost of government debt funding and improving core diversification for investors
    - SeLFIES = standard-of-living indexed, forward-starting, income-only securities
Capital-Controls Stabilization, Governance and Local Investment Policies Have “Side-Effect” Cost of Inefficient Diversification
Cost of Restricting Investing and Risk-Bearing to Domestic Holders Can be Substantial – China as a Case Study

MSCI World versus MSCI China 1993-2017

Global Diversification Pays
MSCI World versus MSCI China 1993-2017

- MSCI World:
  - Sharpe Ratio 0.4581

- MSCI China (Expected):
  - Sharpe Ratio 0.2234

- MSCI China (actual):
  - Sharpe Ratio 0.1466


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Financial Innovation Can Create Improved Policy-Objectives Implementation without the Unintended Cost of Inefficient Risk Diversification by Separating Risk Flows from Capital Flows, Investment and Governance

Before: SWF/ Pension Fund 100% invested in China A Share stocks
China SWF/Pension Fund Return = Return on Chinese A Share stocks
Concentrated Equity Risk

Enter into a Total-Return Swap contract where SWF/Pension Fund
Pays: Return on Chinese A Share stocks
Receives: Return on World stocks

After: Still 100% invested in China stocks as policy requires + swap contract which provides the efficient diversification
China SWF/Pension Fund Return = Return World stocks
Well-Diversified Equity Risk

Note: China only has a cash outflow from the swap when China market outperforms the world markets which are “good times” for China and no need for capital-flight controls and actually receives cash inflow in “bad times”. Non-Chinese counterparty gets efficient exposure to China A Shares from a credit-secure counterparty in size. May also help mitigate “asset bubble” risk in local market.
What is a Goal for a “Good” Retirement?

“An inflation-protected income for life that allows you to sustain the standard of living you enjoyed in the latter part of your working life.”

Standard of living is measured by *income*, and not by *wealth*. Standard-of-living risk is measured by income risk and not wealth risk.

*Reality everywhere*: Individuals will have to take greater responsibility for funding their own retirement in the future than in the past.

SeLFIES is a bond innovation to address this challenge.
What are SeLFIES?
Standard-of-Living indexed, Forward-starting, Income-only Securities

- SeLFIES are government bonds, designed to create a pension-like payout pattern desired by individuals for retirement.
- There is a deferred start of payouts until a specified future date (anticipated retirement date) and from that date on there are annual level payouts with indexing, until a specified ending date (longer than life expectancy at retirement).
- SeLFIES would be issued as a series with different annual starting dates. Large bond denominations would be sold at auction and traded in secondary markets as with current practice. Small denominations issued like savings bonds [exchangeable for large denomination SeLFIES].
- The payouts are indexed to aggregate per capita consumption, so that the holder is hedged against both consumption inflation and standard-of-living-change risks.
- Robust design to work in any country with a bond market.
26-Year Old Planning to Retire at Age 65 (2058) with Goal of $50,000 Retirement Income
• Each 2058 SeLFIES has the following:
  – Starts paying periodic level-payouts of $10/year in 2058 for a fixed period of 20 years, with no principal or “balloon” payout at its maturity in 2078
  – Payouts indexed to per-capita consumption
  – Protects the holder against inflation and standard-of-living changes

• Super simple to figure out what you need to own to meet your goal
  Goal = $50,000/$10 = need to own 5,000 bonds

• Super simple to figure out how close you are to your goal
  Where am I? Own 3,000 bonds = $30,000. You are 60% to your goal

• Addresses the challenge of a lack of financial literacy for savers to take responsibility for their own retirement outcomes
Why Do SeLFIES Have a Payout Time Pattern Different from Traditional Bonds with Periodic Coupon Payments and a Principal “Balloon” Payment at Maturity?

Cash Flows of 2058 SeLFIES
Match Pension Payouts –
No Transactions and
No Reinvestment Risk

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Why Index Cash Payouts to Consumption Per Capita Instead of Just to Inflation (CPI) ?

Goal for retirement is referenced to sustaining the standard of living experienced in the *latter* part of work life just before retirement –

Average Compound Growth Rates: Singapore

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Consumption per Capita*</th>
<th>Inflation (CPI)**</th>
<th>Standard of Living (SoL)</th>
<th>Goal Short-Fall CPI Only / (CPI &amp; SoL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007-2017</td>
<td>3.1%</td>
<td>2.3%</td>
<td>0.8%</td>
<td>0.92 10 Years</td>
</tr>
<tr>
<td>1997-2017</td>
<td>3.0%</td>
<td>1.5%</td>
<td>1.5%</td>
<td>0.74 20 years</td>
</tr>
<tr>
<td>1987-2017</td>
<td>4.4%</td>
<td>1.8%</td>
<td>2.6%</td>
<td>0.46 30 years</td>
</tr>
<tr>
<td>1961-2017</td>
<td>5.7%</td>
<td>2.5%</td>
<td>3.1%</td>
<td>0.18 56 years</td>
</tr>
</tbody>
</table>

*Covers both inflation (CPI) and standard of living (SoL)  **Covers inflation (CPI) only

Source: Singapore Department of Statistics
Note: Consumption per Capita is calculated using Private Consumption Expenditure at Current Market Prices (Annual) divided by total population Inflation is derived from the CPI Index, Base Year 2014 = 100 (Annual)
Standard of Living Growth in Singapore 1961-2017
Annual Inflation-adjusted per Capita Consumption

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### Average Compound Growth Rates: Singapore

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Consumption per Capita</th>
<th>1-Year T-Bills*</th>
<th>Stock Market STI**</th>
<th>Growth Short-Fall STI / (CPI &amp; SoL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007-2017</td>
<td>3.1%</td>
<td>0.6%</td>
<td>-0.2%</td>
<td>0.72 10 Years [0.79 T-Bill]</td>
</tr>
<tr>
<td>1997-2017</td>
<td>3.0%</td>
<td>1.2%</td>
<td>4.1%</td>
<td>1.22 20 years [0.70 T-Bill]</td>
</tr>
<tr>
<td>1987-2017</td>
<td>4.4%</td>
<td>1.7%</td>
<td>4.8%</td>
<td>1.13 30 years [0.45 T-Bill]</td>
</tr>
</tbody>
</table>

Source: Singapore Department of Statistics, Monetary Authority of Singapore, Singapore Exchange
*Based on benchmark average yield of the Singapore Government Securities 1 Year T-Bills
**Based on FTSE Straits Times Index closing price as at 31 December
Who Will be the Users of SeLFIES?
Individual Retail and Institutional Investors

- Individuals who are uncovered by any public or private pension plan and must accumulate assets for retirement through personal saving
- Individuals who are covered by a pension plan but the plan benefits are inadequate to provide for a good retirement and they must accumulate additional assets for retirement through personal saving
- Individuals who are covered by a pension plan but at least part of the plan requires their personal decision-making and responsibility as to what to invest the plan assets in, as in a defined-contribution (DC) plan
- Institutional investors such as pension funds and insurance companies who have pension and annuity benefit liabilities, and want to hedge them effectively and at low cost
- General institutional and retail investors who would want an efficient and low-cost core “best-diversified” portfolio, according to finance theory [Consumption Capital Asset Pricing Model, Breeden 1979]
Why Government Should be the Issuer of SeLFIES?

- SeLFIES will have no credit risk and so made very simple for buyers because do not worry about risk of default and all the associated disclosures
- Reliable supplier—to be successful most be prepared to issue bonds in good and bad times and have the capacity to provide large volume on regular basis
- Governments with VAT are “natural” issuers because the bond payments can be hedged by VAT revenues, since VAT is a tax on consumption
- Issuing SeLFIES ensures more domestic holding of government debt, a material benefit, especially for emerging market countries
- A security issued by government to improve financial market “completion” similar to 2007 issuing of JGB 40-year “ultra longs” or 1997 issuing of US Treasury inflation-indexed bonds “TIPS,” could also reduce debt funding cost
- Governments doing infrastructure financing improve maturity-matching of funding for infrastructure investments which reduces re-financing risk and issuing costs; can also be used to management government tax-revenue risk
Addressing Multiple Market Needs and Policy Objectives with a Single Bond Innovation: Retirement Income, Funding Infrastructure, and Improving Investors’ Core Diversification… all by Issuing SelFIES

• Principle: match the “best” issuers with the “best” holders and improve to maximize scale and minimize cost
• Retirement funding improvements for individuals and institutions; improve maturity-matching of funding for infrastructure investments to reduce re-financing risk and issuing costs; control government tax-revenue risk; large domestic holding of government debt is more stable funding than foreign holders.
• Pattern of delayed payouts for many years and then level payouts match infrastructure cash inflow pattern and provides a precise match to cash flow needs of retirees, so no further transactions are needed by either issuer or buyer
• Finance science predicts that an asset which is perfectly correlated with aggregate consumption would be an ideal diversification asset for all investors. The Consumption CAPM
Appendix

- Scientific papers underlying China Country Swaps
- Scientific papers underlying SeLFIES
- Survey of professional interest in SeLFIES—Actuarial Society of South Africa 2018
- Global interest in SeLFIES—op-ed and news articles


• ______________, “Swapping Countries”, Insights, ICBI 2002 Conference Highlights, PricewaterhouseCoopers, 2002


Scientific Papers Underlying SeLFIES Concept


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Survey of Interest in SeLFIES -
What feature(s) of SeLFIES appeal to you?

A. Forward Starting / Deferred payment
B. The in-force payment pattern
C. The indexing feature
D. Some or all of the above
E. None of the above

Voted: 136
Survey of Interest in SelfIES: Assuming it was possible, would you take retirement SelfIES?

A. Definitely interested – Assuming the economics makes sense

B. Slight interest – Can’t really see the investment merit here

C. No Interest

Voted: 136

Actuarial Society of South Africa Conference 2018
Interest In Selfies: OP-ED & Articles

- USA/Europe: Op-ED Pensions & Investments Europe & PLANSPOONOR
- UK: The Economist Will Selfies Stick?
- France: OP-ED Le Monde
- Japan: Nikkei
- Australia: Investment Magazine
- India: Times of India
- Turkey: RÖPORTAJ
Time for retirement ‘SeLFIES’?

Robert Merton & Arun Muralidhar

To address the looming retirement crisis, many governments are introducing new pension programmes tied to employment for uncovered workers (NEST in the UK and Secure Choice in some US states). These attempts to improve access to pensions, and continue a trend of transferring responsibility for retirement security from governments and employers (via defined benefit [DB] plans) to the individual (via defined contribution [DC] plans), as neither governments nor companies are willing to bear the liabilities associated with pension obligations. This shift requires new thinking about how portfolios are managed and which instruments are available to investors. Our proposed SeLFIES (Standard of Living Indexed, Forward-starting, Income-only Securities) make individuals self-reliant and are also advantageous for governments.

For optimal portfolio management, members of DC plans should focus on maximising funded status or retirement income (not wealth, as in traditional investment approaches). Further, unlike multi-generational DB plans, DC plans must achieve their objectives in a single lifetime, and it is hard to pool risks because these plans are inherently flexible: (a) participation is often voluntary; (b) participants may require liquidity; (c) retirement ambitions, risk tolerance and life expectancy vary; and (d) employment patterns change over time (i.e., the gig economy does not treat an individual to a single company). A new financial instrument is needed to enable financial security for retirees in the current environment.

DC investors seek to ensure a guaranteed, real income, ideally from retirement to death. It is also reasonable to assume they would want to lead a lifestyle comparable to pre-retirement. Investing in existing assets (stocks, bonds, or REITs) is risky because these do not provide a simple cash flow hedge against desired retirement income. For example, viewed through the retirement income lens, a portfolio of traditional, ‘safe’ government securities, unless heavily financially engineered, would be risky because of the cash flow (and potential maturity) mismatch between traditional bonds and the desired income stream.

There is thus a need for governments to issue a new ‘safe’ bond instrument, which we call SeLFIES. These will ensure retirement security and the government is a natural issuer.

**The innovative SeLFIES design**

A default-free bond offers certainty about two characteristics critical for DC retirement portfolios: (i) a commitment to pay over a particular time horizon (how/when one is paid); and (ii) a specific cash flow (what is paid). DC investors require a guaranteed cash flow that protects their real purchasing power in retirement. Two simple innovations could create the ‘perfect’ instrument. The first innovation addresses (i) ‘how/when one is paid’ by creating forward-starting, income-only bonds. These would start paying investors upon retirement, paying coupons-only for a period equal to the average life expectancy.
SeLFIES a good look for Australian retirement

By Robert C. Merton and Ameet S. Murthi | 06/06/2018

The Treasury Department has issued a report seeking comment on ways to improve retirement income security in Australia (Retirement Income Covenant Position Paper: Stage one of the Retirement Income Framework, May 2018).
SeLFIES - India

SeLFIES For India
These long-term bonds can fund India’s infrastructure needs and improve retirement security

The Indian government unveiled its Budget and recognises that the infrastructure sector needs investments of Rs 50 lakh crore to boost GDP (allocating Rs 5.9 lakh crore as a primary step). Simultaneously, certain provisions in the budget seek to improve the lives of retirees and finance minister Arun Jaitley specifically noted that: “a life with dignity is a right of every individual, in general, more so for the senior citizens.”

The major challenges that India will face in ensuring the income security of its senior citizens, especially in a country where financial literacy is relatively low. The government is keenly fund infrastructure, especially since it has given permission to the National Highways Authority of India (NHAI) and other institutions to issue bonds, and have an immediate impact on the retirement challenge by issuing a new type of long-term bond, what we call SeLFIES – Standard of Living Indexed, Forward-starting, Income-only Securities.

SeLFIES address many of the challenges raised in the Budget and are also advantageous to the ministry of finance, especially in light of the recent implementation of a Goods and Services Tax (GST).

A “life with dignity” would ideally include guaranteed, real income, from retirement through death, and the ability to lead a lifestyle comparable to pre-retirement. The Indian government and documentation because they are largely financially illiterate.

The complexity of retirement planning leaves many confused about what constitutes adequate savings for retirement. This includes survival benefits and the benefit of diversification. Investing in existing assets is risky relative to the retirement objective, because those assets fail to provide a simple or low-cost cash flow.

SeLFIES are designed to pay people when they need it and how they need it. Even the most financially illiterate individual can be self-reliant with respect to retirement planning.

First, cash flows from SeLFIES reflect synergic capital flows for infrastructure spending; namely, huge cash flows support for capital expenditure, followed by delayed, inflation-indexed payments, once projects are online. Financing infrastructure has been challenging, and a priority for the current government, especially as given the current budget.

Second, SeLFIES gives the Indian government a natural hedge of revenues against the shocks, through GST.

The looming retirement crisis needs
SeLFIES - Turkey

Dr. Arun Muralidhar

"Onediozım Yenilik, ABD, Avustralya, Japonya ve Hindistan'da Olduğunu Gibi, Türkiye'de De Emeikitlik Sistemini Yükseltirip, Milonlarla Katılımcıya, Düşük Malıyetli Kolya ve Küçüklerin Birlikte Katılımını Yolu Açabilir."