

---

# ***Investment Considerations***

## ***World Bank Core Finance Course***

*By Dr. Arun S. Muralidhar*

*AlphaEngine Global Investment Solutions, LLC*

*Georgetown Center for Retirement Initiatives*

*May 5, 2016*

# Dr. Arun Muralidhar - Bio

---

- ❑ Pension Investments: Founder, M<sup>cube</sup> and AEGIS  
Graham-Dodd, Ed Baker (twice) award; clients won innovation awards  
Added significant value to client portfolios from beta management (especially in 2008 and 2011)  
Managed World Bank Pension Fund  
Started career issuing bonds/swaps for The World Bank  
Founding member of Univ of California DC Plan Advisory Board
- ❑ Author: *Innovations in Pension Fund Management (Stanford Univ)*,  
*SMART Approach to Portfolio Management (RoyalFern)*
- ❑ Reform: Developed innovative solutions for reforms  
Co-author, with late Prof. Franco Modigliani, Nobel Prize Winner, of *Rethinking Pension Reform, (Cambridge Univ.)*
  - ✓ Offered unique solution to solve Social Security crisisAdvisor to Overture (Consultant to CA Secure Choice IB and Govt. of Azerbaijan)  
Advisory Member, Council of Scholars - Georgetown CRI  
Testified before CT Retirement Security Board
- ❑ Academic: Adjunct Prof. of Finance, GWU

# Agenda – Two Main Points

---

- Pensions (DB or DC): It is all about the Liabilities
- Have to Deal with Investment Challenges:
  - Academic
  - Principal-Agent
  - Behavioral
  - Market
- Summary: Overcoming challenges via innovation

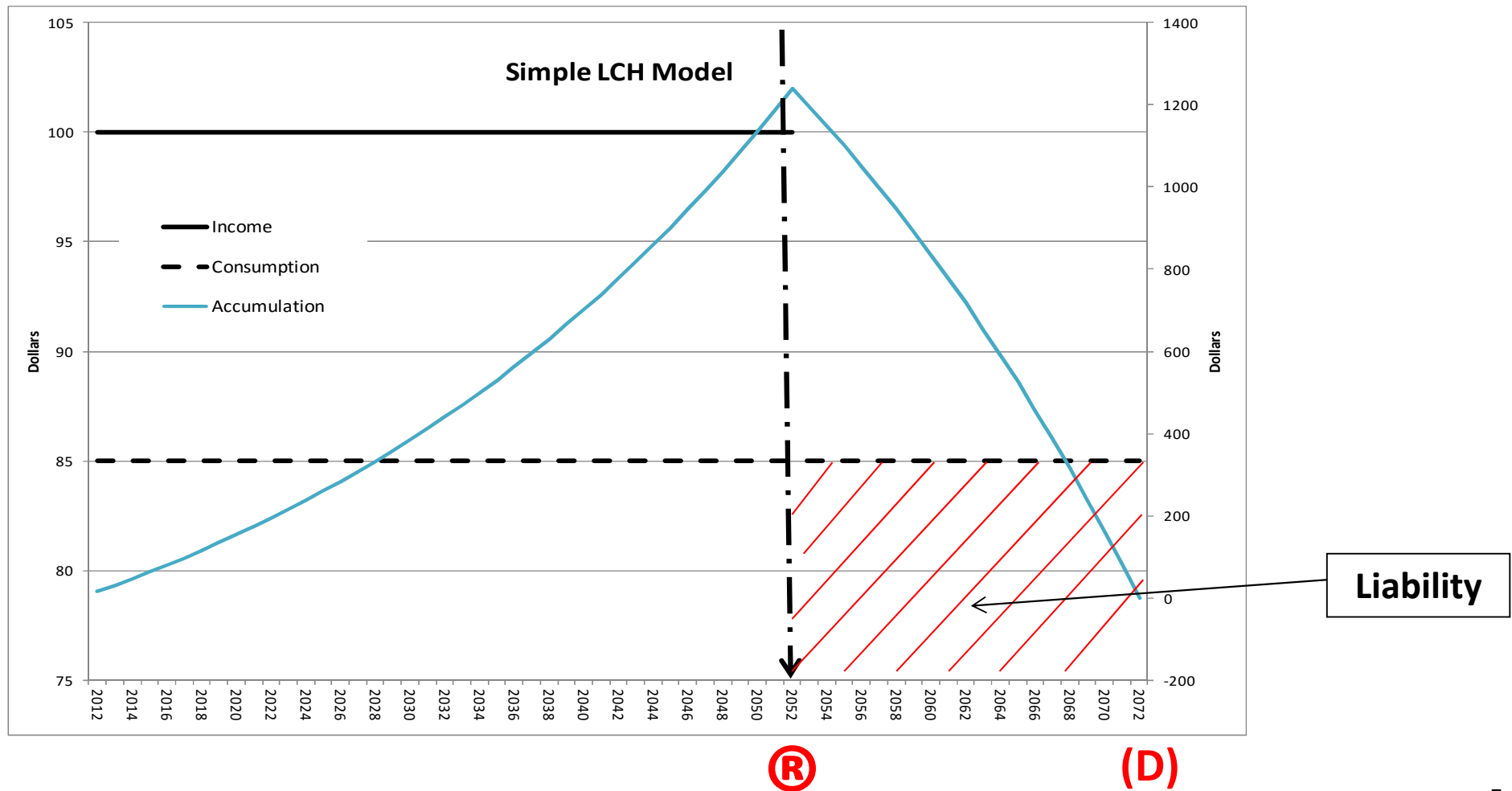
# Pensions: It Is All About the Liabilities!

---

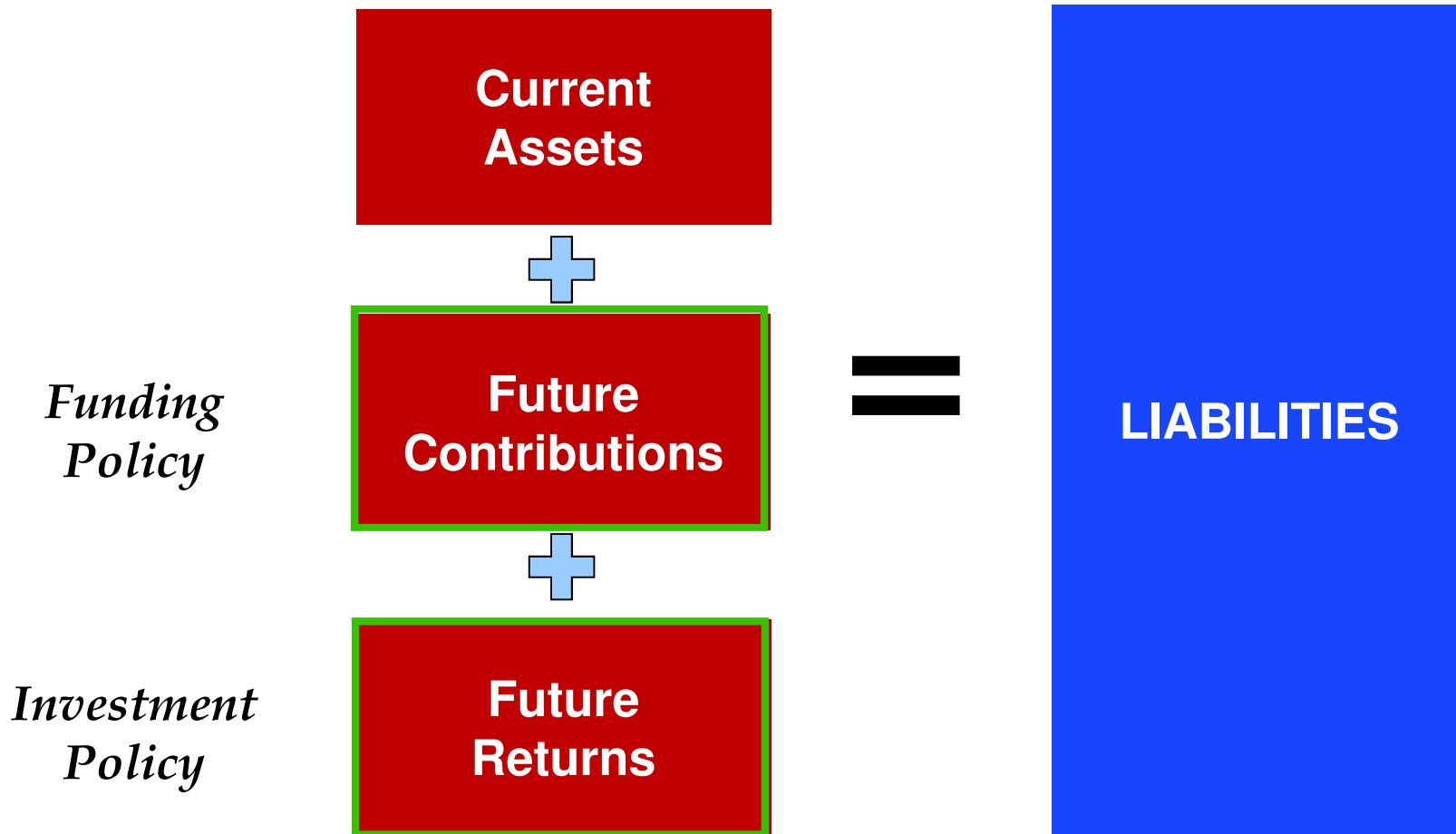
- The Pension Equation: Liabilities critical in determining investment strategies
- Underfunded plan: return on assets  $>$  return on liabilities
- What does the Liability look like
  - DB Plan = Hump shape (closed group\_
  - DC Plan = BFFS chart
- Liability proxy is the only risk-free asset; even government bonds are risky relative to these liabilities

# Why Do People Invest Money? Life Cycle Hypothesis (LCH)

## ■ Modigliani/Brumberg; Modigliani/Ando



# Pension Fund Balance Sheet = Manage Assets to Meet Liabilities



Funded ratio = assets/liabilities

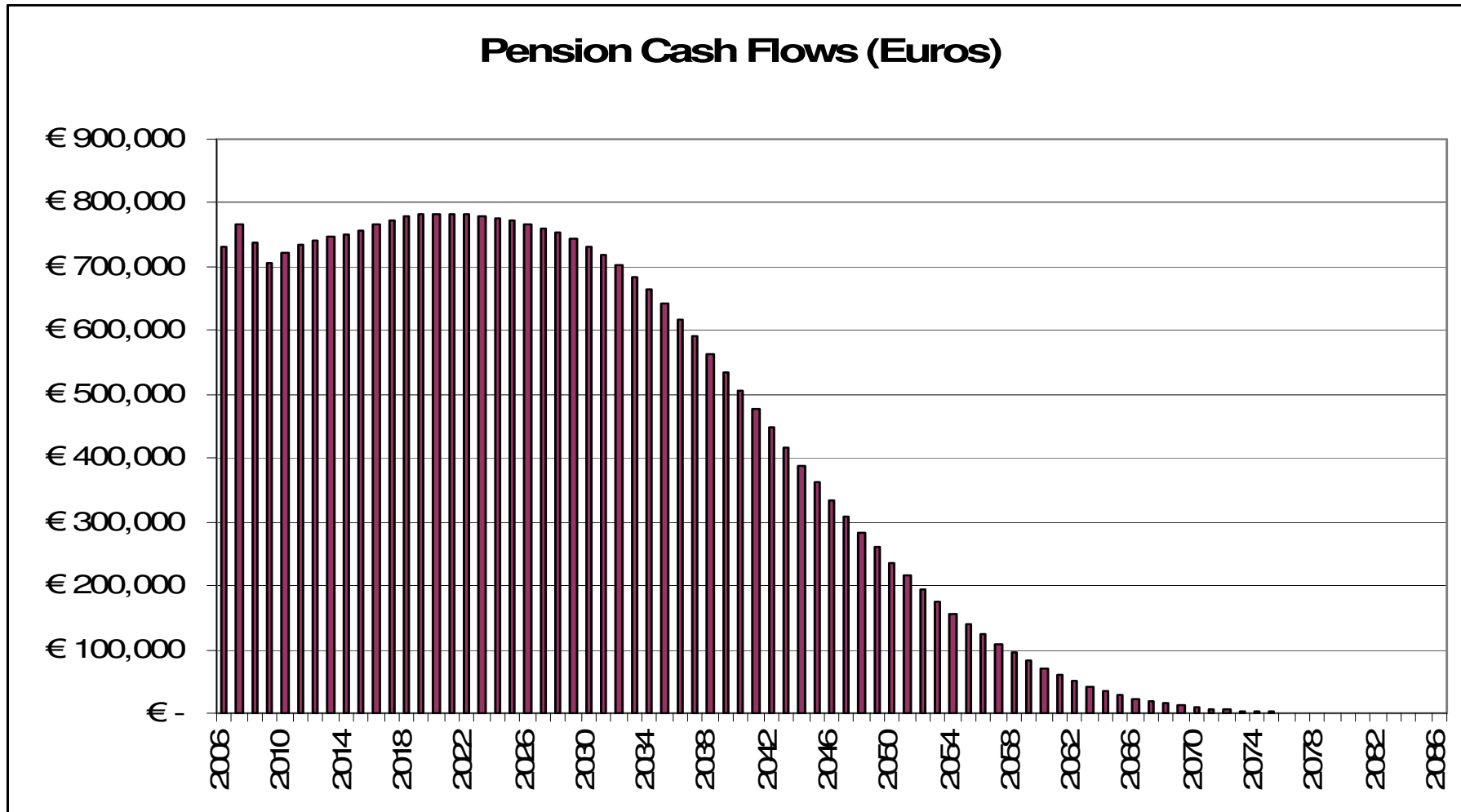
Problems with Investments = Higher Taxes or Lower Benefits

# Challenges in Managing Pension Funds

- Pension fund driven by liabilities
  - Actuarial cash flows projected once a year
  - How to track liabilities intra-year?
- How to develop investment strategies to grow funded status (ratio of assets/liabilities)?
  - Funds experience periodic cash flows – which assets should be reduced/increased?

**How to Calculate Funded Status in DC Plans?**

# The DB Liability: A European Example



**Problem: No Single Asset Has This Profile; Can Hedge with Bonds**



# The DB Liability: Creating the Liability Proxy

Liabilities Module: Solution & Statistics

PV Liabilities: €15,039,226,092

Instrument	Optimal Weights	Optimal Notional
012M SWAP	-6.29%	-€ 946,585,328
024M SWAP	7.82%	€ 1,176,410,795
060M SWAP	3.55%	€ 534,557,087
120M SWAP	16.60%	€ 2,496,188,497
240M SWAP	23.10%	€ 3,473,746,096
360M SWAP	27.29%	€ 4,103,839,938
480M SWAP	18.98%	€ 2,854,444,211
600M SWAP	6.92%	€ 1,041,095,121

Tracking Error Daily	0.019%
Tracking Error Annualized	0.303%
R-Squared	99.83%

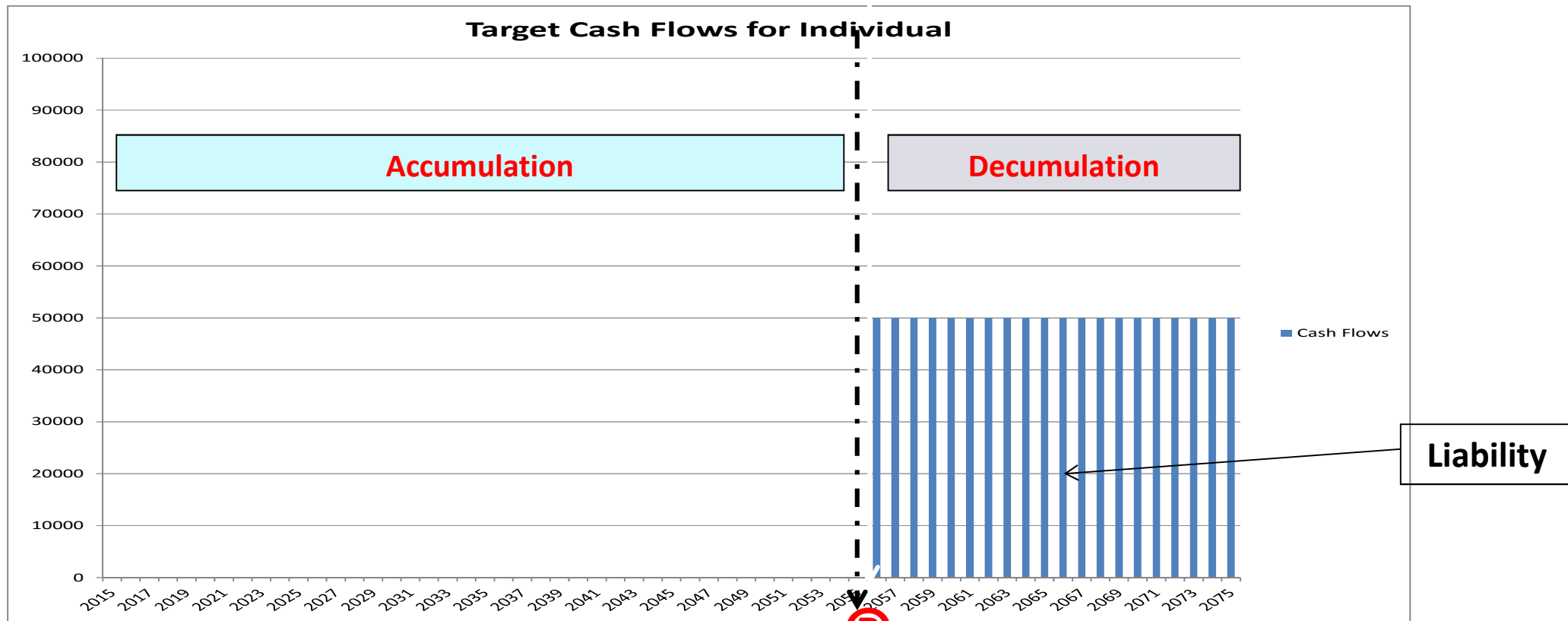
Duration Liabilities	15.14
Duration Mimic Portfolio	15.00

Goal is  
to match  
duration

**Problem: In Developing World, Not Enough Instruments**

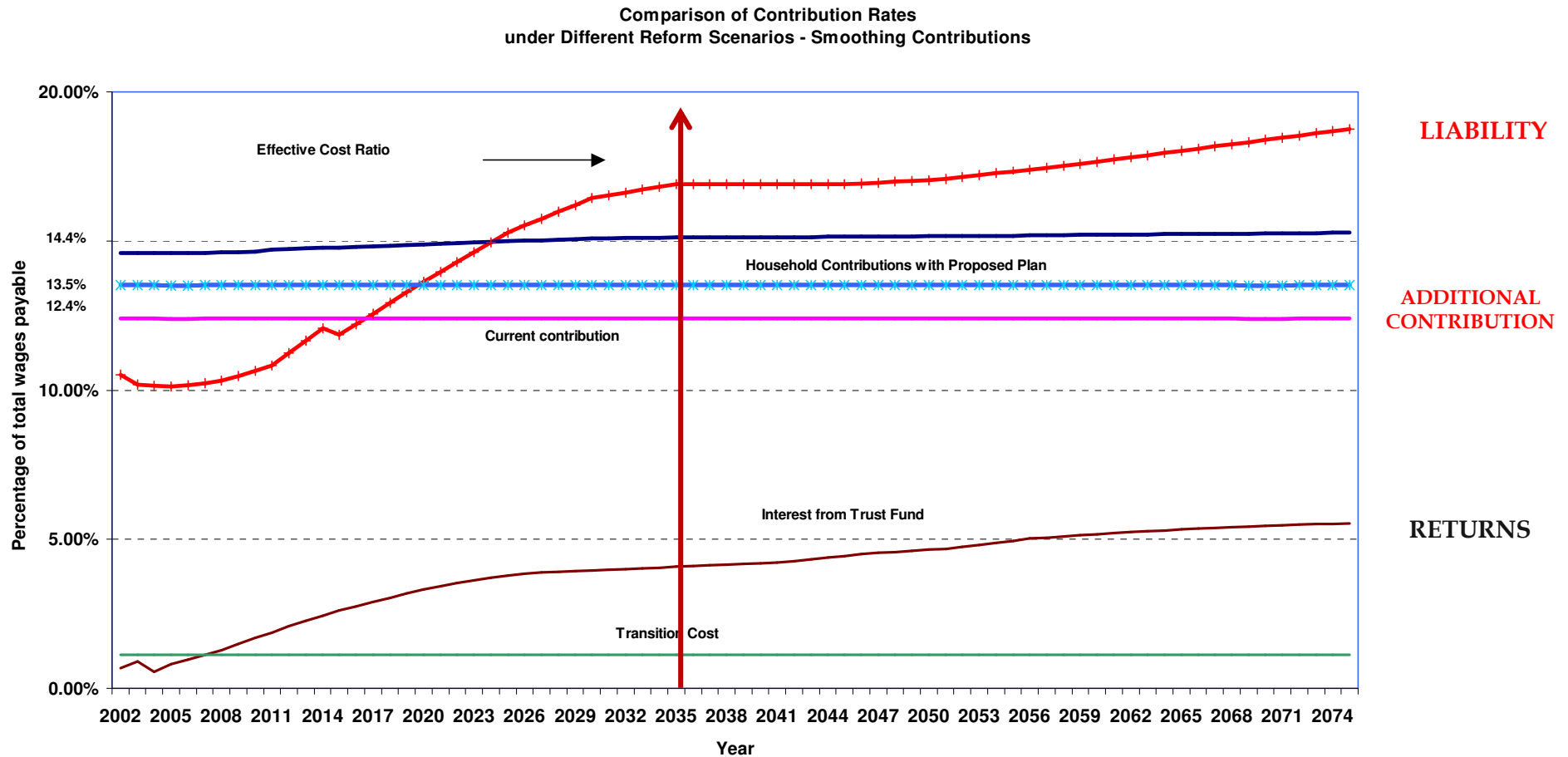
# DC Liability: Target Retired Income Till Death

## Retirement Income Stream: Simply an Individual Liability



**Problem: No Asset Has This Profile Or Bridges The Time Gap;  
Annuities Are Opaque, Complex, Expensive, Risky, and Illiquid**

# The Target Rate of Return for Partially Funded US SS – Modigliani-Muralidhar (2004)



There Is A Unique Combination of Contributions and Target Rate of Return That Keeps The System Solvent

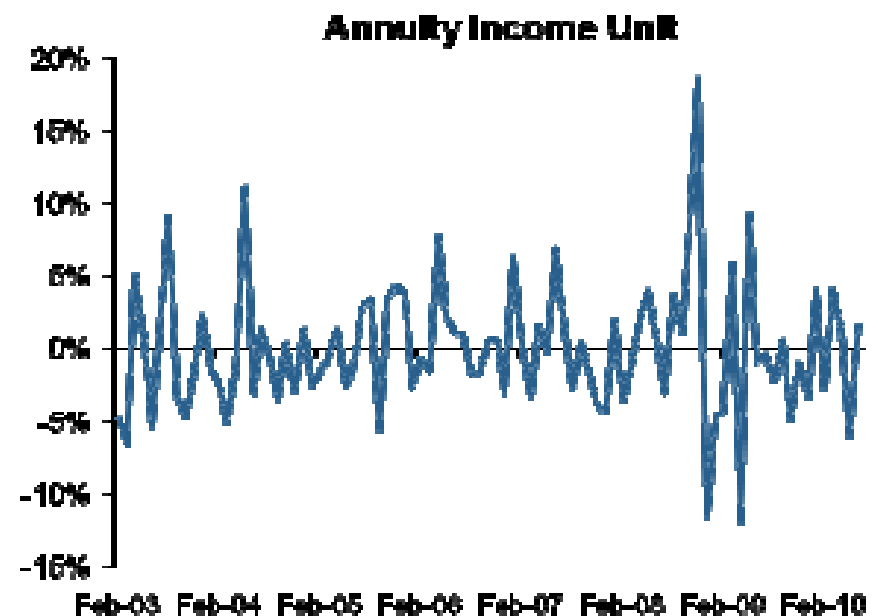
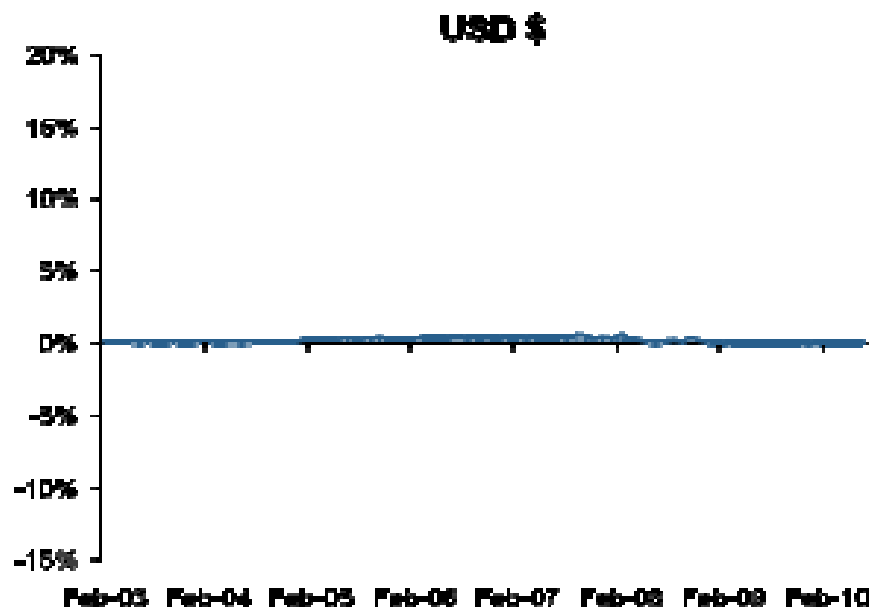
# Approach Has Been Used For Other Countries

---

- Japan: Muralidhar (2007) – demonstrates appropriate rate of return for GPIF to maintain funded status (AND NOT INCREASES TAXES)
- Spain: Analyzed in Modigliani-Muralidhar (2004)
- Luxembourg: Bouchet (2004)
- Azerbaijan: Overture Financial (2012) demonstrated that this approach can work

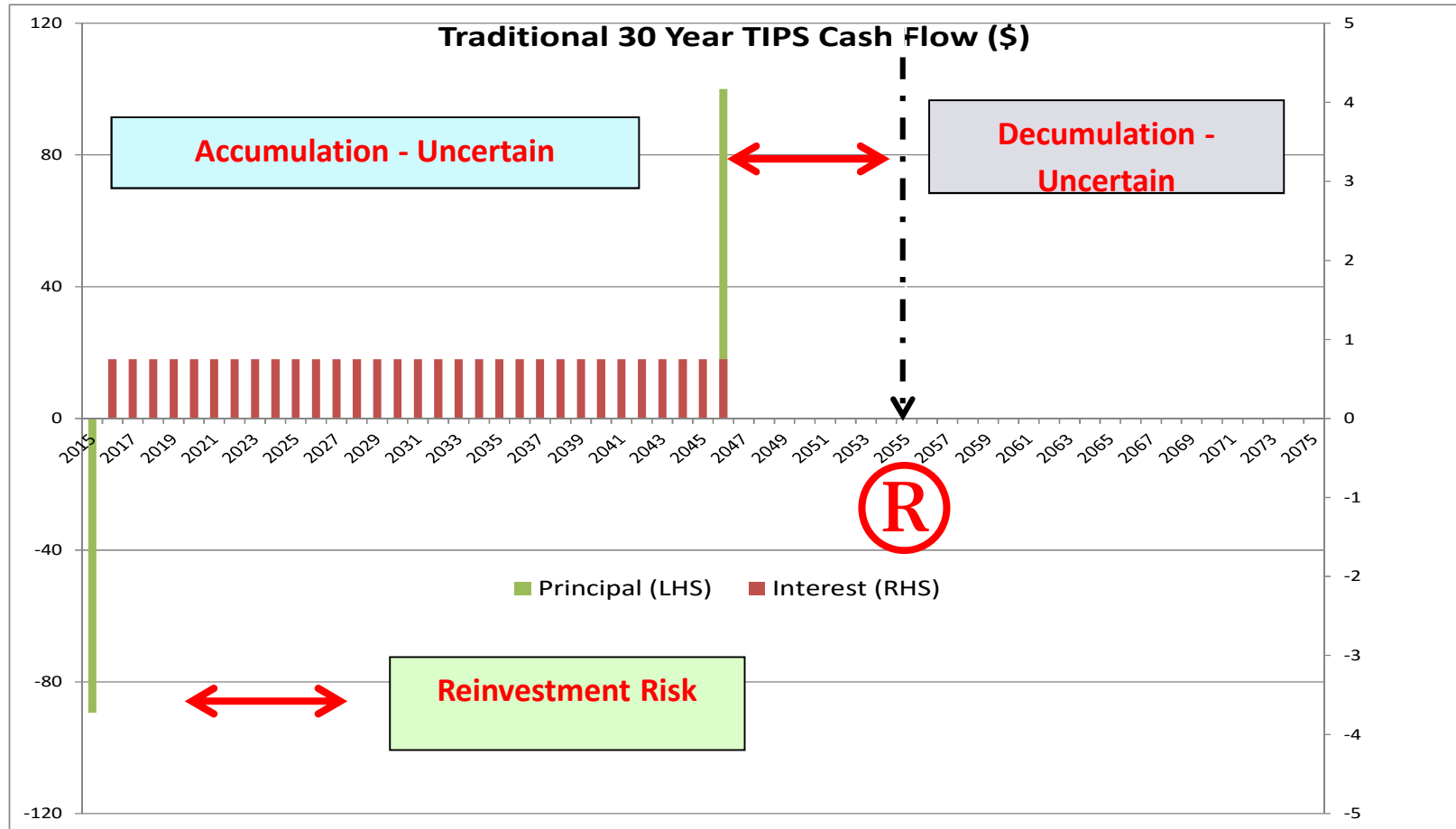
# Some Examples of Seemingly Safe Assets = Risky from a Pensions Context (T-Bills)

## Measuring Risk: T-Bills Monthly Returns



**Measuring Risk of T-Bills from an Absolute and Relative Volatility Perspective (Source Merton: 2010)**

# Some Examples of Seemingly Safe Assets = Risky from a Pensions Context....(TIPs)



(Source Muralidhar, Ohasi and Shin 2015)

# Summary on Liabilities..

---

- Liability replication assets do not exist
  - Investing in anything other than liabilities = risky
- If underfunded, must invest in risky assets
  - Trade-off excess return & funded status risk
  - Risk implies taxes could rise or benefits fall
- Starts to make retirement into a gamble.....

*Cannot Solve Retirement Investment Issues With  
Current Instruments... Without a Lot of Risk*

# Investment Challenges

---

- Academic
  - MPT = Many Problematic Technical (Issues)
- Principal-Agent
  - Delegation Introduces Unique Challenges
- Behavioral
  - Behaviorally Affected Decisions (BADs)
- Market
  - Underdeveloped Financial and FX Markets

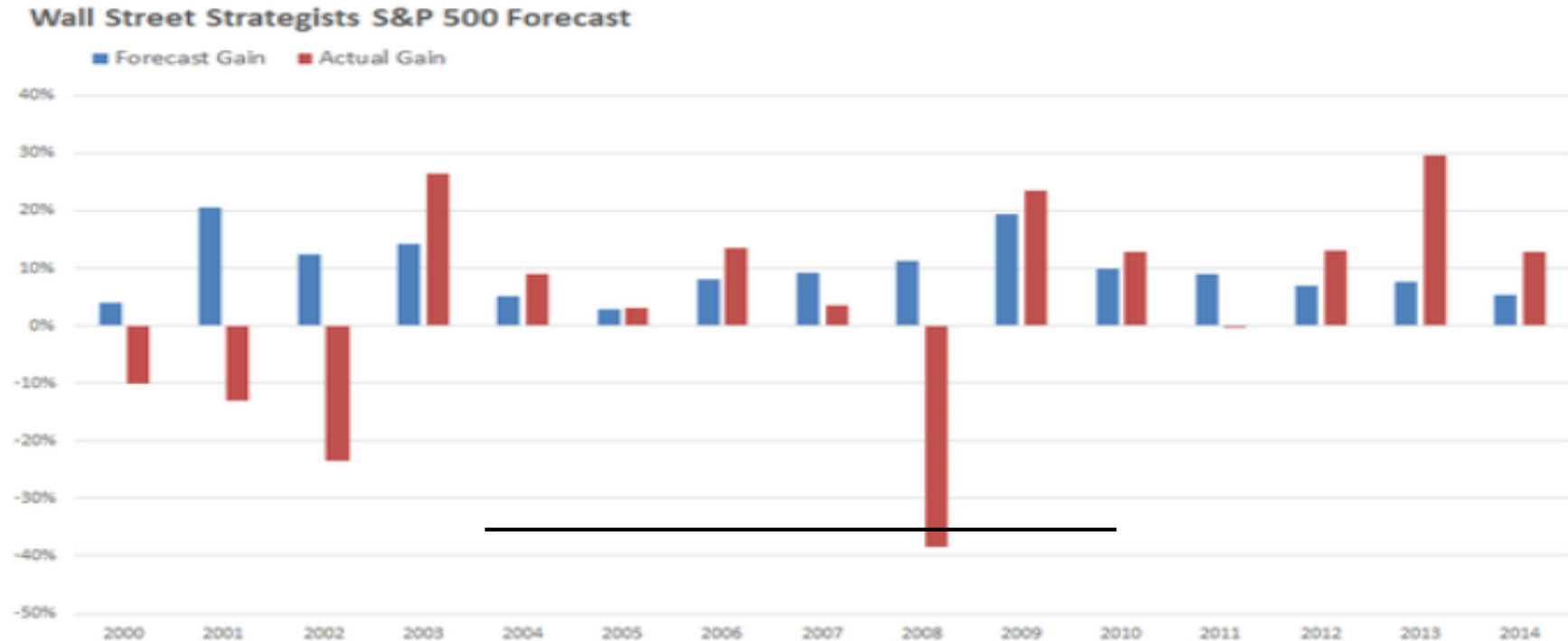


# Academic Challenges – Theory Just Does Fit..

---

- Biggest problem – CAPM ignores Liabilities!
- Optimization models to determine SAA are problematic
  - Expected return forecasts are notoriously flawed
  - Have to forecast volatilities and correlations
    - neither is static, especially correlations
- Traditional approach is to have a static allocation – markets are dynamic
- Ideal approach if fully funded = cash flow match; if underfunded, you have to take risk

# Our Ability To Forecast Expected Returns

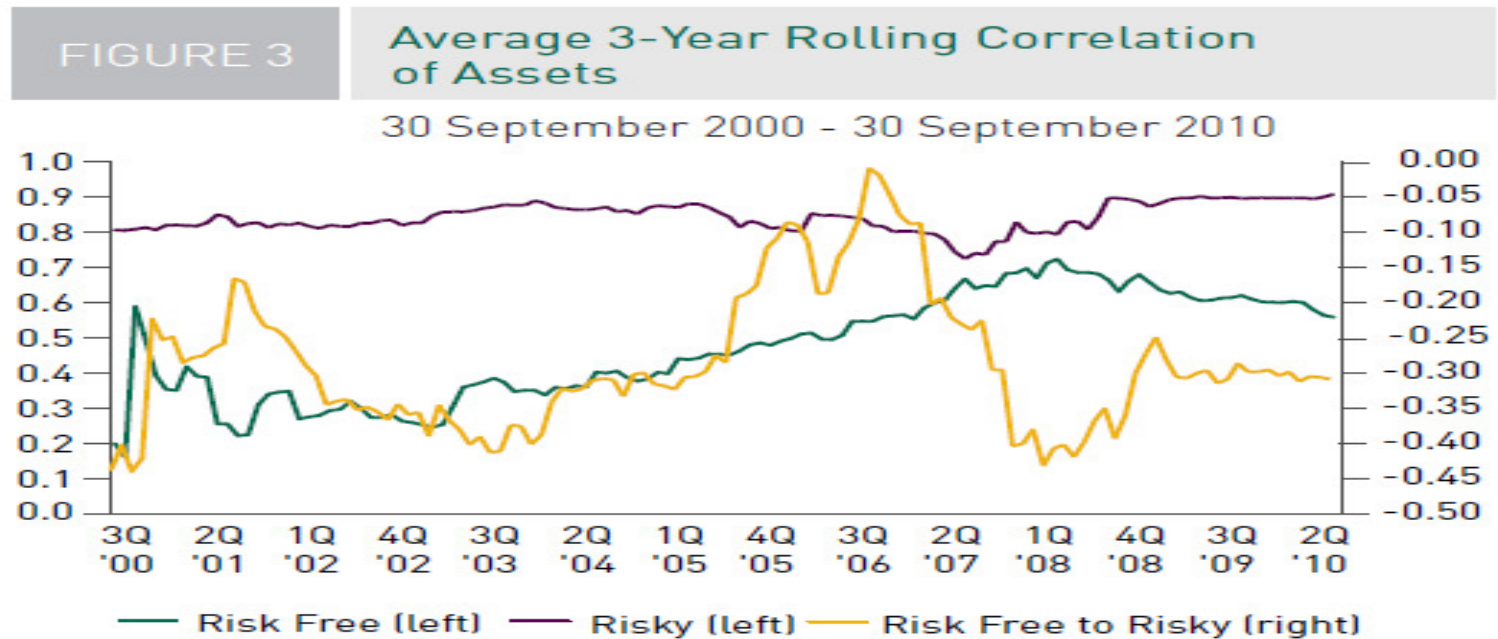


SOURCE: BIRINYI ASSOCIATES, S&P CAPITAL IQ.

## Actual vs Forecast Performance of the S&P500 – Housel (2015)

<http://www.fool.com/investing/general/2015/02/25/the-blind-forecaster.aspx>

# Parameters Are Not Static (E.g., Correlations)



Source: Bloomberg as of 29 November 2010.

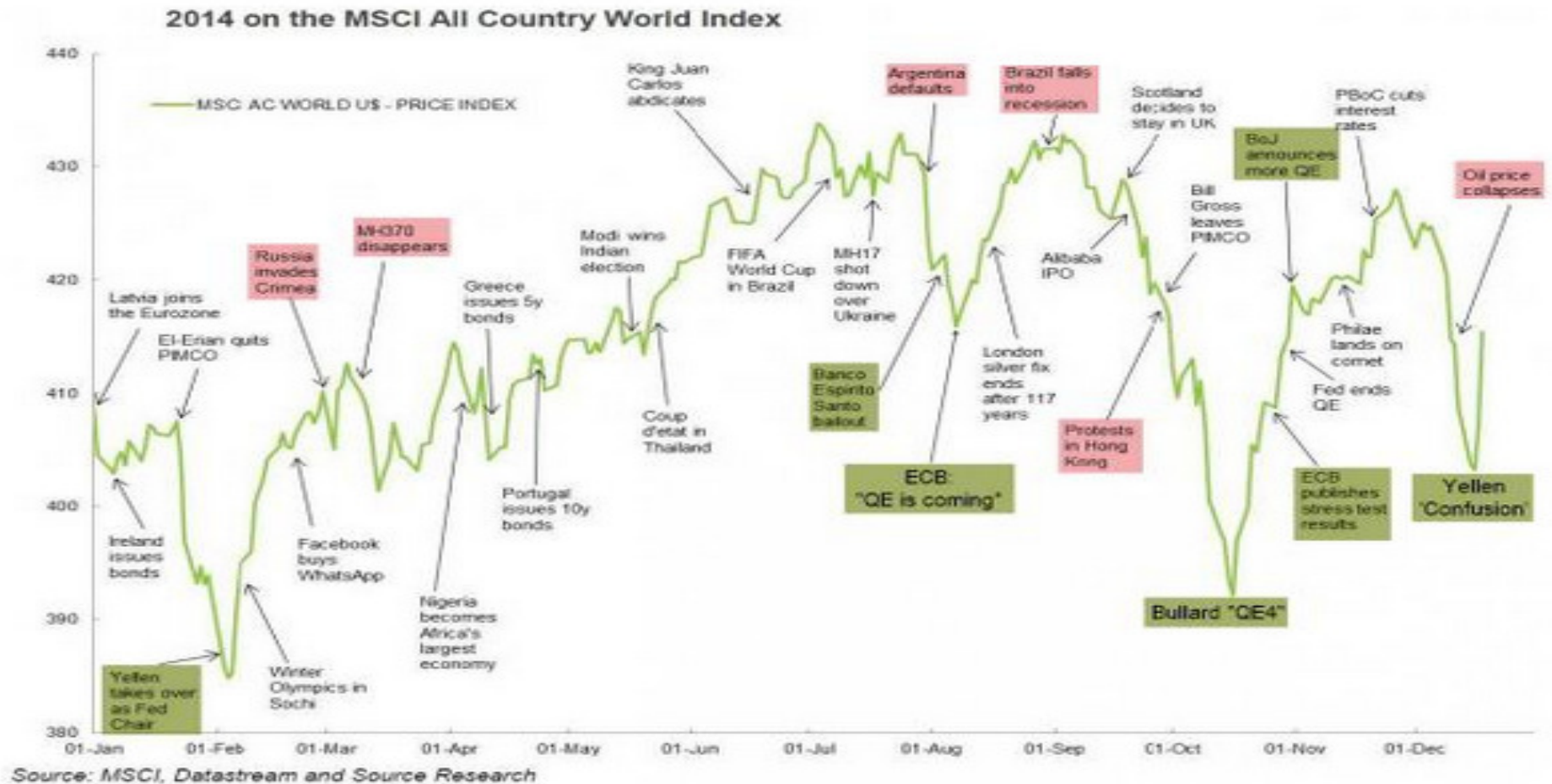
**A Static Number for Correlation Will Mask This Relationship**

# Static? Market Loses Money 45+% Of Time....

Percentage of Days Markets Were Positive				
<b>EQUITIES</b>			<b>BONDS</b>	
S&P500	54%		US 2 Year	51%
Russell 2000	52%		US 5 Year	52%
UK FTSE	51%		US 10 Year	53%
Euro Stoxx	51%		US 30 Year	53%
Nikkei	52%		Japanese 10 Year	53%
Emerging	53%		UK Gilts	51%
<b>COMMODITIES</b>			<b>FX</b>	
WTI Crude	52%		Japanese Yen	50%
Brent Crude	53%		Euro	53%
Gold	53%		UK Sterling	51%
Silver	54%		Canadian Dollar	51%
			Australian Dollar	54%

•Source: Bloomberg. Data for this table is based on futures contracts for each of these markets and is based on data from 12/10/1998 - 1/31/2013 . 20

# Static? Market Driven By Many Factors/Events



Source: Zerohedge.com . <http://www.zerohedge.com/news/2014-12-27/how-central-banks-saved-world-stocks-2014>

# Markets Are Dynamic/Theory Static!

**FIGURE 1: WHY PENSION FUNDS GET INTO TROUBLE**



Source: Bloomberg

**My Mistake in 1998.....**

# Academic Challenges Summary

---

- MPT Ignores Liabilities – Can we use inputs from CAPM for Pensions which are anchored in Liabilities?
- Optimization models require inputs – very hard to forecast (are we trading on errors?)
- Recommendations are static; markets are dynamic
- Need a really good investment operation to overcome these challenges

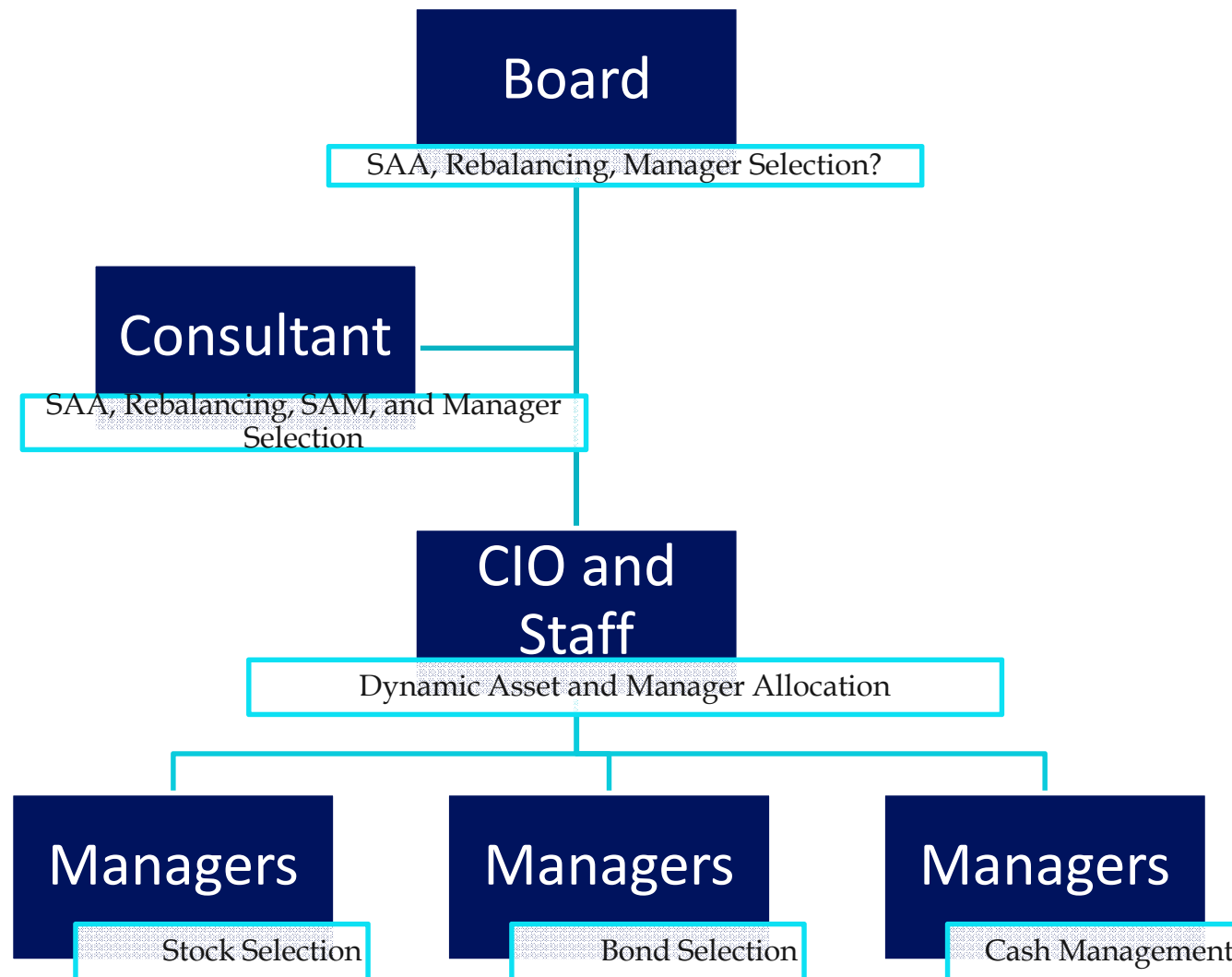
# Principal-Agent Challenges

---

- Boards are in-charge = PRINCIPAL
- Hire Investment officers but do not trust them (AGENTS)
- Often hire consultants, who have little to no investment experience, but provide political cover to the Board members
- How do you get the best outcomes from Agents given Delegation?



# Structure Compounds the Challenge – Have to Be Clear Who Is Responsible for What



# Boards – Most Important; Often Least Compensated and Sophisticated

---

- Not always financially sophisticated
- Meet infrequently; markets move daily
- State key objectives and risk measures and then delegate
  - Even in the US and Netherlands, the delegation has been limited (Canada is much better)
- Maybe pay them for their expertise? Maybe require basic knowledge of finance and markets?

# Staff = Both Agent and Principal

---

- Limit the amount they can deviate from the SAA
- Investment officers can have a very complex role
  - If they hire external managers – then they are PRINCIPALS in this relationship and the external managers are now AGENTS
- Have to deal with consultants less qualified than them
- No upside for taking career risk

# Principal-Agent Challenges Summary

---

- Must have clear delegation of roles and responsibilities
- Attribution must capture the “Who” in decision-making
- Compensate key participants to do the best for fund
- Change compensation so that only skill-based (and not lucky) decisions are rewarded
- Empower staff....(delegation to outside parties is costly and leads to loss of governance)

# Behaviorally Affected Decisions (BADs)

---

- Loss Aversion – dislike losses by 2x like gains
- Endowment Effect – assign a greater value to assets you own...
- Short Termism/Recency Bias – tend to be short term investors/tend to overweight recent data over past data
- Over-Confidence – tend to believe that we are better than we are

**Compounded By The Fact That Retirement = Gambling**

# Market Challenges – Fixed Income

---

- Liability hedging
  - DB Plans - Absence of long-duration fixed income
  - DC Plans – absence of the liability hedge
  - Very few inflation-indexed instruments (exception – South Africa has 50 year TIPS)
- Low yields; market not deep enough
- If Social Security buys government bonds, are they just funding government spending?
- Even Japan has diversified into foreign bonds

# Market Challenges – Domestic Equity

---

- Are typically not deep enough for large allocation
  - Even Japan has diversified into foreign stocks
- Do not want the SS fund to dominate the market as it could remove market discipline
  - Should allocations be passive or active (can SS fund manipulate management)?
- Can be volatile (short-termism)

# Market Challenges – Foreign Equity

---

- Can serve as a hedge, but it involves a currency transaction
  - Buying foreign assets = sell local currency (weakens it)
  - The central bank may not want this impact as exporting capital = importing inflation
  - Should these assets be left unhedged or be hedged?
- Tough call – if the local currency will appreciate, then you want it fully hedged
  - Insufficient market liquidity to conduct hedging trades
  - Hard to hire external managers to do engage in such narrow mandates



# Market Challenges – Currency Risk

---

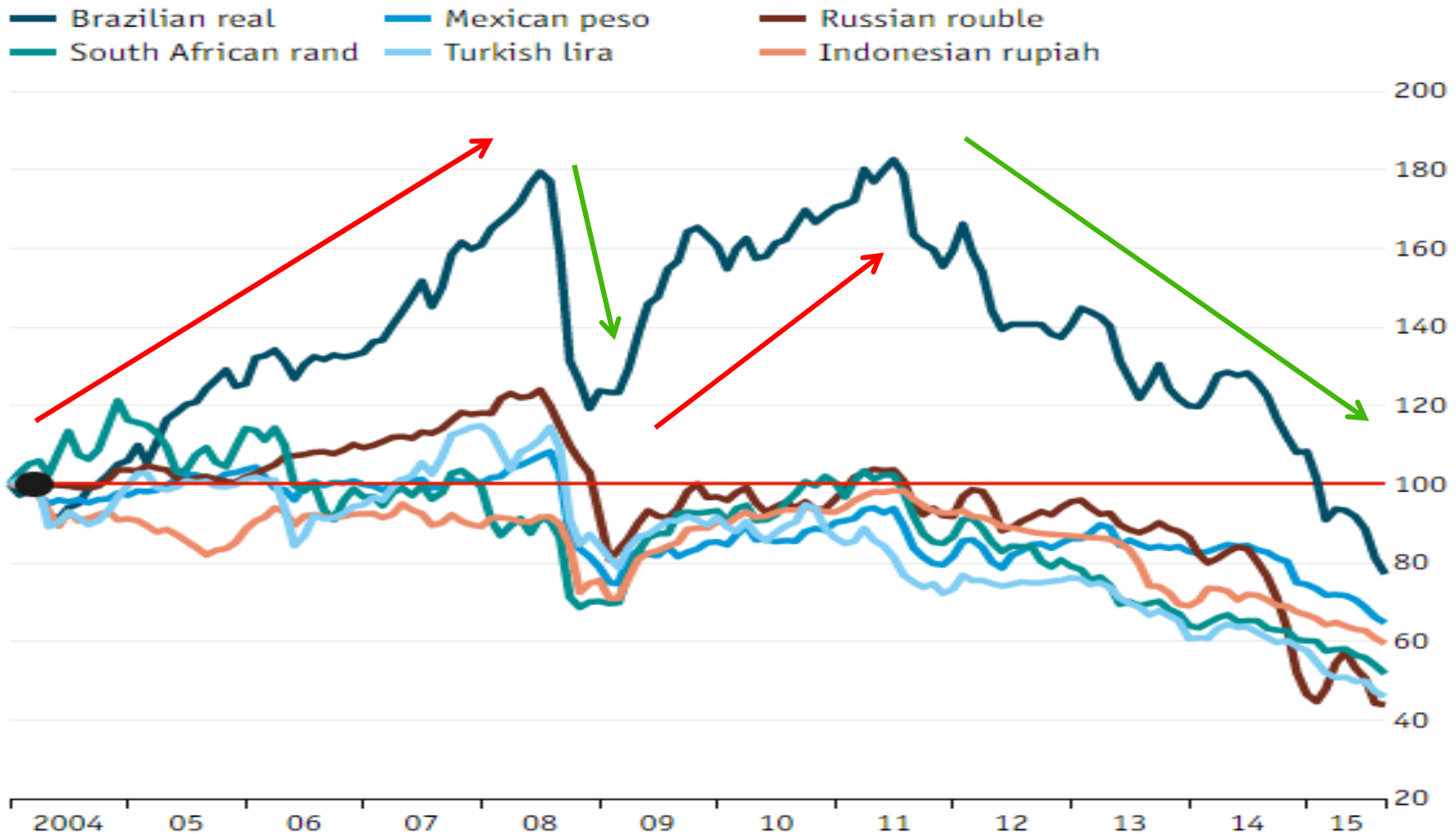
- Domestic Return (S&P500) = US\$ Return (S&P500) + Return of \$/Local Currency
  - First trade in buying foreign assets = currency trade
  - Convert local currency into US\$
  - Has been a tendency for US\$ to appreciate
- In Developed Markets, long term Currency Risk is a wash
  - No systematic return from being unhedged
  - Being hedged reduces return volatility, but increases cash flow volatility
  - Emerging markets is a different world....
  - Higher growth countries FX should appreciate...

# Market Challenges – Currency Risk (Can Help in Crises, But Can Snap Back.....)

## Emerging and retreating

Currencies against the dollar, January 2004=100

Source: <http://www.economist.com/>



Source: Thomson Reuters

# Market Challenges – Alternatives

---

- Hedge funds – waste of time....Rhino joke
- Real estate – lack of transparent price
- Private equity – lack of transparent price
- Infrastructure – this could be a potential option, but have to worry about political risk

**Alternative, Because of Lack of Daily Pricing Lends Itself to Political Patronage**

# Summary.....1

---

- Can ensure good governance and delegation through clear reporting
  - e.g., we designed an iPad app that would provide the Board with just the most critical data
  - Was designed to prevent a focus on monthly performance but on long-term objective achievement
  - The objectives have to be liability focused
  - Attribution has to clearly show not only which decisions, but who in the organization (Board, CIO, external managers, consultants) are adding/subtracting value

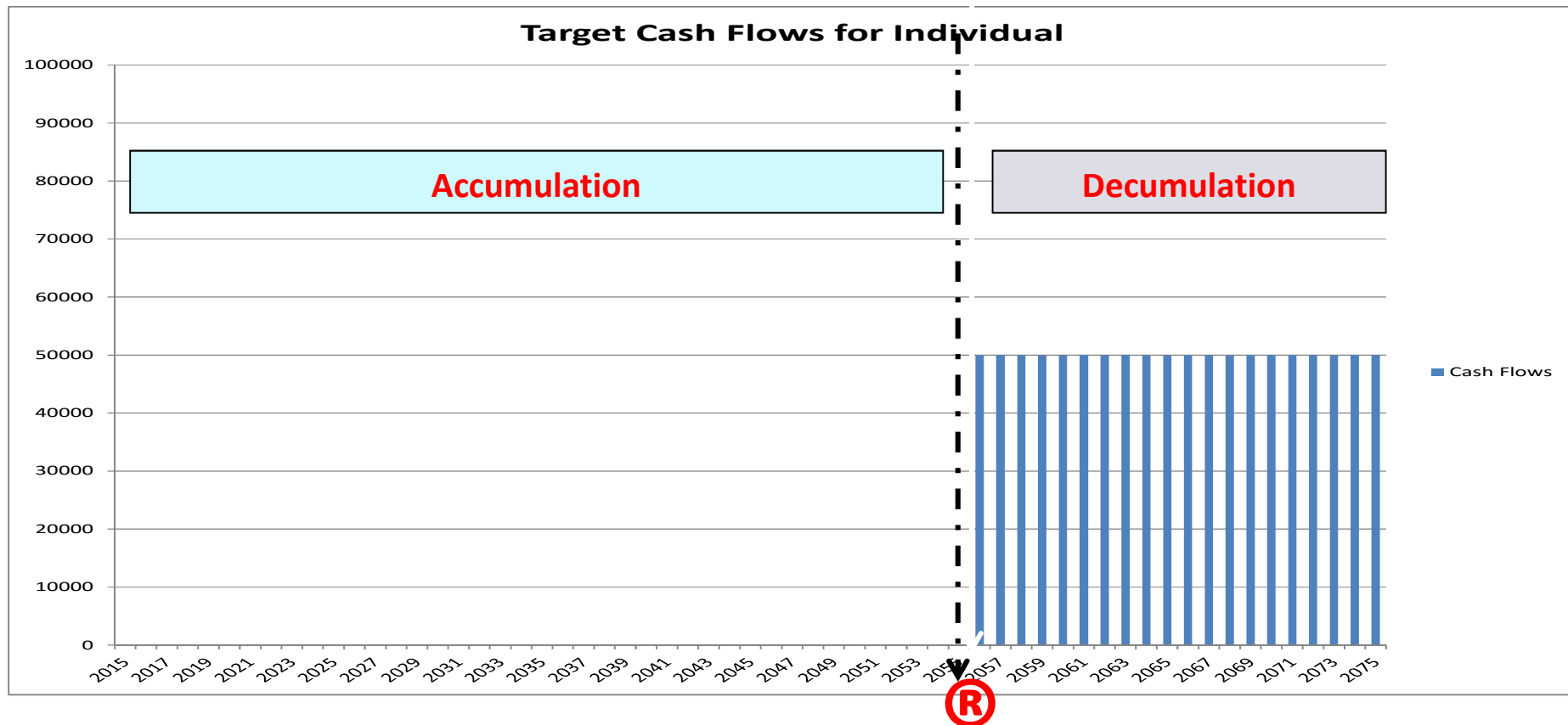
# Summary.....2

---

- Cannot be static in managing portfolios in a dynamic world
  - Asset allocations have to be responsive to market conditions = SMART (Systematic Management of Assets using a Rules-based Technique)
  - We made our clients money in 2008 by ensuring that they dynamically changed their portfolios
- Changing portfolio allocations = RISK MANAGEMENT (you can get paid to manage risk); generating risk reports = RISK MEASUREMENT. Focus more on management than measurement.

# Going to Need New Instruments

## Need Bonds that Mimic Desired Cash Flow



Can Be Issued By Local Governments or By World Bank and Use Proceeds to Fund Infrastructure

# Summary.....3

---

- Behavioral and Market Challenges
  - Need market innovation – e.g., special retirement bonds
  - The World Bank/IFC can play a role in issuing unique bonds that help meet the needs for retirement as well as potentially fund infrastructure
- Without these unique financial instruments, designed to hedge liability risk, retirement investment = gamble....
- Must attack all 4 challenges to ensure retirement success

# Disclaimer

---

This presentation contains the views of AlphaEngine Global Investment Solutions' (AEGIS) Research Team as of the date on the cover. It is provided for limited purposes, is not definitive investment advice, and should not be relied on as such. The information presented in this report has been developed internally and/or obtained from sources believed to be reliable; however, AEGIS does not guarantee the accuracy, adequacy, or completeness of such information. References to specific securities, asset classes, and/or financial markets are for illustrative purposes only and are not intended to be recommendations. All investments involve risk and investment recommendations will not always be profitable. AEGIS does not guarantee any minimum level of investment performance or the success of any investment strategy. As with any investment there is a potential for profit as well as the possibility of loss.

This information is not meant to provide guidance with respect to pension plan administration in any country. AEGIS makes no representation that the techniques described in this document comply with the law of any country. This information is not intended as legal or investment advice.

General Disclosures: The simulated performance presented may differ from live performance experienced using the strategy for the following reasons:

The simulation assumes that we adjust the allocations to each asset on a daily basis after the close and at the closing price on that day, whereas the live product may not adjust the allocations exactly at that time or at that price and may have execution lags that affect the execution prices.

The simulation assumes certain transaction costs with respect to trades made, whereas the live portfolio might incur different transaction costs.

The simulation assumes implementation of the allocation shifts by buying and selling the underlying indices, whereas live portfolios may use other instruments (i.e. futures, forwards, active or passive managers) with a different return or cost.

Hypothetical or simulated performance results have certain inherent limitations. Unlike an actual performance record, simulated results do not represent actual trading. Also, since the trades have not actually been executed, the results may have under or over compensated for the impact, if any, of certain market factors, such as lack of liquidity. Simulated trading programs in general are also subject to the fact that they are designed with the benefit of hindsight. No representation is being made that any account will or is likely to achieve profits or losses similar to those shown.



# References

---

## ■ Social Security Reform

- Modigliani, F. and A. Muralidhar. 2004. *Rethinking Pension Reform*. Cambridge University Press, London, UK.
- Muralidhar, A. 2007. Rethinking Pension Reform. A Simple Application to GPIF in Japan. *Center for Advanced Research Foundation Working Paper, CARF-0-90*, University of Tokyo, Japan
- Overture Financial LLC. 2012. Final Report for The State Social Protection Fund of the Republic of Azerbaijan Technical Assistance on the Pension Reforms Project. In *Final Report to the US Trade and Development Agency on Institutional Capacity Building for The State Social Protection Fund of the Republic of Azerbaijan Technical Assistance on the Pension Reforms Project*, Baku, Azerbaijan, May 31, 2012.
- Shin, S. 2010. An ALM Study on Target Fund Returns of Korean National Pension Service, *Journal of Money and Finance*, Vol.24, No. 1, 2010. Pp 1 – 31.

# References

---

- Improving DC Plans (New Bond and Effective Plan Design)
  - Muralidhar, A. 2015b. New Bond Would Offer a Better Way to Secure DC Plans. *Pensions and Investments*, December 14, 2015.
  - Muralidhar, A. 2015c. The Most Basic Missing Instrument in Financial Markets: The Case for Forward Starting Bonds. *Unpublished Working Paper*, [www.ssrn.com](http://www.ssrn.com)
  - ***Fifty States of Grey: An Innovative Solution to the DC Retirement Crisis***, Unpublished manuscript
- Liability Driven Investing
  - Muralidhar, A. and J. W. van Stuijvenberg. 2005. Devising an Investable Liability Index, *Investments and Pensions Europe*, October 2005, pp 46-47.
- Effective Management of Portfolios
  - Muralidhar, A. (2001). *Innovations in Pension Fund Management*, Stanford University Press, Palo Alto, CA.

# References

---

## ■ Currency Management

- Muralidhar, A. (2003). “Where Overlay Comes In,” in *Currency Management: Overlay and Alpha Trading*, edited by Jessica James, Risk Books, London

## ■ Dynamic Management of Portfolios

- Barrett, T., D. Pierce, J. Perry, and A. Muralidhar. 2011. Dynamic Beta: Getting Paid to Manage Risk. *Journal of Investment Management Consulting* 12, no. 2: 67–78
- Muralidhar, A. 2011. *A SMART Approach to Portfolio Management*, Royal Fern Publishing, LLL, Great Falls, VA, USA.