

# **Alternative Indexes: Investing in a “New Normal” World**

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# Alternative Indexes and the “New Normal”

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## What’s Going On with “Smart Beta”

- » They all break the link with price and cap weight
- » They all “work” ... *cap weight* is the one big outlier
- » Ease of implementation is hugely important

## Headwinds from the “3-D Hurricane”

- » Deficit, debt and demography interact in dangerous ways
- » Low yields portend low returns ... get used to it!

## Sensible Returns are Entirely Possible

- » For those willing to think outside of mainstream
- » Use alternative markets, seek alpha, be tactical



# **The Surprising “Alpha” from Malkiel’s Monkey & Upside-Down Strategies**

# High Risk—High Reward

U.S. 1964—2012

Strategy	Return	Standard Deviation	Sharpe Ratio	Information Ratio
Volatility Wt <sup>1</sup>	12.2%	19.1%	0.36	0.34
Market Beta Wt <sup>2</sup>	11.9%	19.8%	0.34	0.29
Downside Semi-Deviation Wt <sup>3</sup>	12.1%	18.9%	0.37	0.36
U.S. Cap Wt <sup>4</sup>	9.7%	15.3%	0.29	0.00

See slide 47 for disclosures regarding individual strategies.

Source: Research Affiliates, LLC.

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U.S. Cap Wt <sup>4</sup>	9.7%	15.3%	0.29	0.00

## What about inverse strategies?

Inverse of Volatility Wt <sup>1</sup>	12.5%	15.6%	0.47	0.53
Inverse of Market Beta Wt <sup>2</sup>	13.5%	15.0%	0.55	0.53
Inverse of Downside Semi-Deviation Wt <sup>3</sup>	12.4%	15.6%	0.46	0.53
U.S. Cap Wt <sup>4</sup>	9.7%	15.3%	0.29	0.00

**Upside-down strategies also outperform ... by a bigger margin!**

See slide 47 for disclosures regarding individual strategies.

Source: Research Affiliates, LLC.

# Strong Fundamentals—High Reward

U.S. 1964–2012

Strategy	Return	Standard Deviation	Sharpe Ratio	Information Ratio
Book Value Wt <sup>5</sup>	11.2%	15.7%	0.38	0.35
5-Yr Avg Earnings Wt <sup>6</sup>	11.2%	15.1%	0.40	0.36
Fundamentals Wt <sup>7</sup>	11.6%	15.4%	0.41	0.42
Earnings Growth Wt <sup>8</sup>	12.4%	19.0%	0.38	0.38
U.S. Cap Wt <sup>4</sup>	9.7%	15.3%	0.29	0.00

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## What about inverse strategies?

Inverse of Book Value Wt <sup>5</sup>	13.9%	18.5%	0.47	0.51
Inverse of 5-Yr Avg Earnings Wt <sup>6</sup>	14.4%	18.3%	0.50	0.55
Inverse of Fundamentals Wt <sup>7</sup>	14.1%	18.8%	0.47	0.51
Inverse of Earnings Growth Wt <sup>8</sup>	10.3%	18.0%	0.28	0.10
U.S. Cap Wt <sup>4</sup>	9.7%	15.3%	0.29	0.00

**They outperform, again.**

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Source: Research Affiliates, LLC.

# Popular Smart Beta Strategies

U.S. 1964–2012

Strategy	Return	Standard Deviation	Sharpe Ratio	Information Ratio
Minimum Variance <sup>9</sup>	11.8%	11.7%	0.56	0.26
Maximum Diversification <sup>10</sup>	12.0%	14.0%	0.48	0.35
Risk-Efficient ( $\lambda=2$ ) <sup>11</sup>	12.5%	16.8%	0.43	0.53
Risk Cluster Equal Weight <sup>12</sup>	11.2%	14.6%	0.41	0.31
Diversity Weighting <sup>13</sup>	10.5%	15.5%	0.34	0.47
Fundamentals Wt <sup>7</sup>	11.6%	15.4%	0.41	0.42
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<b>Inverse of Minimum Variance<sup>9</sup></b>	<b>12.7%</b>	<b>18.1%</b>	<b>0.41</b>	<b>0.48</b>
<b>Inverse of Maximum Diversification<sup>10</sup></b>	<b>12.5%</b>	<b>17.6%</b>	<b>0.41</b>	<b>0.47</b>
<b>Inverse of Risk-Efficient (<math>\lambda=2</math>)<sup>11</sup></b>	<b>12.3%</b>	<b>17.3%</b>	<b>0.41</b>	<b>0.46</b>
<b>Inverse of Risk Cluster Equal Weight<sup>12</sup></b>	<b>13.2%</b>	<b>19.0%</b>	<b>0.42</b>	<b>0.40</b>
<b>Inverse of Diversity Weighting<sup>13</sup></b>	<b>13.4%</b>	<b>18.3%</b>	<b>0.45</b>	<b>0.48</b>
<b>Inverse of Fundamentals Wt<sup>7</sup></b>	<b>14.1%</b>	<b>18.8%</b>	<b>0.47</b>	<b>0.51</b>
<b>U.S. Cap Wt<sup>4</sup></b>	<b>9.7%</b>	<b>15.3%</b>	<b>0.29</b>	<b>0.00</b>

See slide 47 for disclosures regarding individual strategies.

Source: Research Affiliates, LLC.

# Malkiel's Monkey Throwing Darts

We randomly chose 30 of the 1,000 largest-cap stocks every year, from 1964 to 2012, and tracked the results...

We repeated the exercise 100 times, replicating 100 monkeys

Strategy	Return	Standard Deviation	Sharpe Ratio	Information Ratio
Average of 100 of Malkiel's Monkey Portfolios <sup>14</sup>	11.3%	18.3%	0.33	0.21
U.S. Cap Wt <sup>4</sup>	9.7%	15.3%	0.29	0.00

Only 2 out of 100 portfolios underperformed the cap-weighted benchmark...

**It takes an unlucky monkey to underperform the cap-weighted index!**

See slide 47 for disclosures regarding individual strategies.

Source: Research Affiliates, LLC.

# Choosing a Smart Beta Strategy

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**Cap-weight is the outlier; all smart beta strategies outperform in historical testing**

**If magnitude of historical outperformance is similar, then capacity, liquidity and turnover drive our implementation costs, hence our ultimate success**



# **Choosing a Smart Beta Strategy:** ***Capacity and Implementation Costs Matter!***

# Choosing a Smart Beta Strategy

## Research Results: Capacity/Average Size (Beginning of 2012)

Strategy	Market Cap (USD Billions)		Bid-Ask Spreads		Adjusted Daily Volume (USD Millions)	
	Global	U.S.	Global	U.S.	Global	U.S.
Market Capitalization <sup>4</sup>	66.3	80.8	0.1%	0.0%	464.9	735.4
Equal Wt <sup>15</sup>	23.9	11.5	0.2%	0.1%	175.0	132.5
Risk Cluster Equal Weight <sup>12</sup>	37.5	37.1	0.2%	0.0%	189.1	312.0
Diversity Wt <sup>13</sup>	52.4	50.5	0.1%	0.0%	368.2	477.9
Fundamentals Wt <sup>7</sup>	59.1	66.3	0.1%	0.1%	397.8	617.5
Minimum Variance <sup>9</sup>	24.0	19.6	0.4%	0.1%	128.4	136.4
Maximum Diversification <sup>10</sup>	20.1	14.8	0.5%	0.1%	122.5	124.1
Risk-Efficient <sup>11</sup>	26.9	12.1	0.2%	0.1%	193.5	140.1

Market Cap, Bid-Ask Spreads and Adjusted Daily Volume are weighted averages.

See slide 47 for disclosures regarding individual strategies.

Source: Research Affiliates, LLC.

# Choosing a Smart Beta Strategy

## Research Results: Turnover Characteristics

Strategy	Developed Markets 1987–2009	United States 1964–2009
	Average Annual Turnover	Average Annual Turnover
Fundamentals Wt <sup>7</sup>	14.9%	13.6%
Market Capitalization <sup>4</sup>	8.4%	6.7%
Equal Wt <sup>15</sup>	21.8%	22.6%
Risk Cluster Equal Weight <sup>12</sup>	32.3%	25.4%
Diversity Wt <sup>13</sup>	10.4%	8.9%
Minimum Variance <sup>9</sup>	52.0%	48.5%
Maximum Diversification <sup>10</sup>	59.7%	56.0%
Risk-Efficient <sup>11</sup>	36.4%	34.2%

See slide 47 for disclosures regarding individual strategies.

Source: Research Affiliates, LLC.

# Fundamental Index Performance

	4/30/2013	3 Month	1 Year	3 Year	Since Launch*	Launch Date
FTSE RAFI All World 3000		4.8%	18.6%	8.3%	15.1%	10/6/2008
MSCI All World		4.9%	15.7%	9.3%	13.6%	
Value Added		-0.1%	2.9%	-1.0%	1.5%	
FTSE RAFI US 1000		8.2%	22.5%	13.1%	7.4%	11/28/2005
Russell 1000		7.2%	17.2%	12.9%	5.8%	
Value Added		1.1%	5.3%	0.2%	1.6%	
FTSE RAFI US MS 1500		5.4%	18.8%	10.7%	8.0%	5/4/2006
Russell 2000		5.4%	17.7%	11.3%	5.5%	
Value Added		0.0%	1.1%	-0.6%	2.5%	
FTSE RAFI Developed ex-US 1000		3.4%	18.5%	5.3%	5.1%	11/28/2005
MSCI EAFE		5.3%	20.0%	8.0%	4.6%	
Value Added		-1.9%	-1.4%	-2.6%	0.5%	
FTSE RAFI Dev. ex-US MS 1500		5.1%	15.2%	7.9%	3.6%	8/6/2007
MSCI EAFE Small		6.9%	18.3%	9.4%	1.0%	
Value Added		-1.7%	-3.1%	-1.5%	2.6%	
FTSE RAFI Emerging Markets		-4.1%	1.2%	2.0%	2.5%	7/9/2007
MSCI Emerging Markets		-2.2%	4.3%	3.4%	1.4%	
Value Added		-1.9%	-3.1%	-1.4%	1.1%	

\*Launch date returns are calculated using the first full month of returns following index inception.

Note: The index version of the RAFI methodology, or the FTSE RAFI Indexes, is licensed globally by our partner the FTSE Group. All returns are Total Returns in USD. This material relates only to a hypothetical model of past performance of the Fundamental Index strategy itself, and not to any asset management products based on this index. No allowance has been made for trading costs or management fees which would reduce investment performance. Actual results may differ. Indexes are not managed investment products, and, as such cannot be invested in directly. Returns represent performance based on rules used in the creation of the index, are not a guarantee of future performance and are not indicative of any specific investment. Returns listed prior to the individual indexes launch dates are simulated.

MSCI returns information provided under license through MSCI. All returns based calculations are calculated by Research Affiliates, LLC.

Source: Research Affiliates., based on data from Bloomberg.



# Looking to the Future

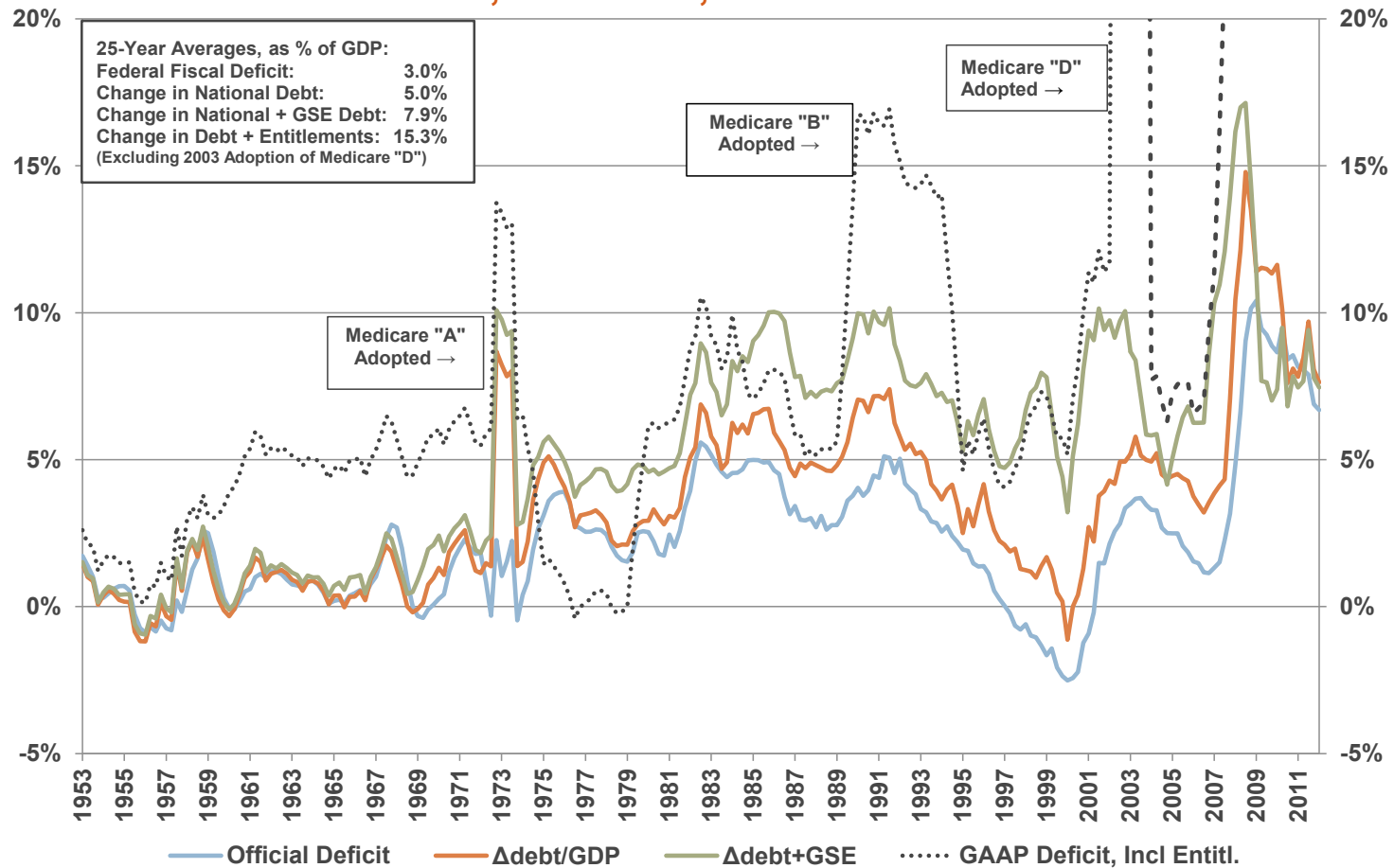
A 3-D Hurricane: Our Deficit, Debt, and Demographics

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# What's the True Deficit? Under GAAP Accounting, Far Higher Than Official Statistics

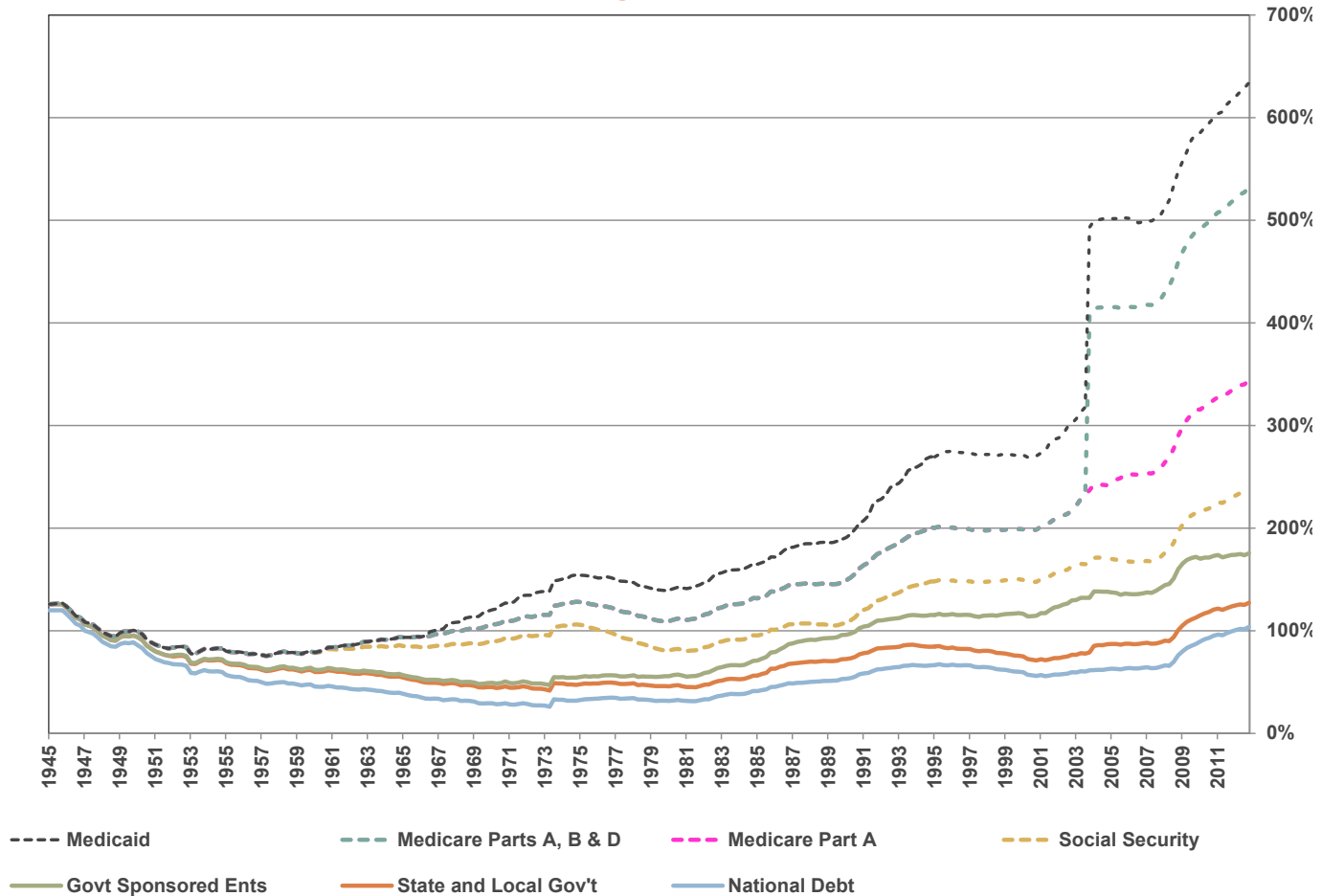
## The Debt and the Deficit: Comparing the Deficit with the Growth of the National Debt, GSE Debt, and Unfunded Entitlements



Source: Research Affiliates, based on data and projections from the U.S. Treasury Department. Through 2012 Q4.

# Public Debt and Entitlement Obligations are Growing at a Frightful Pace

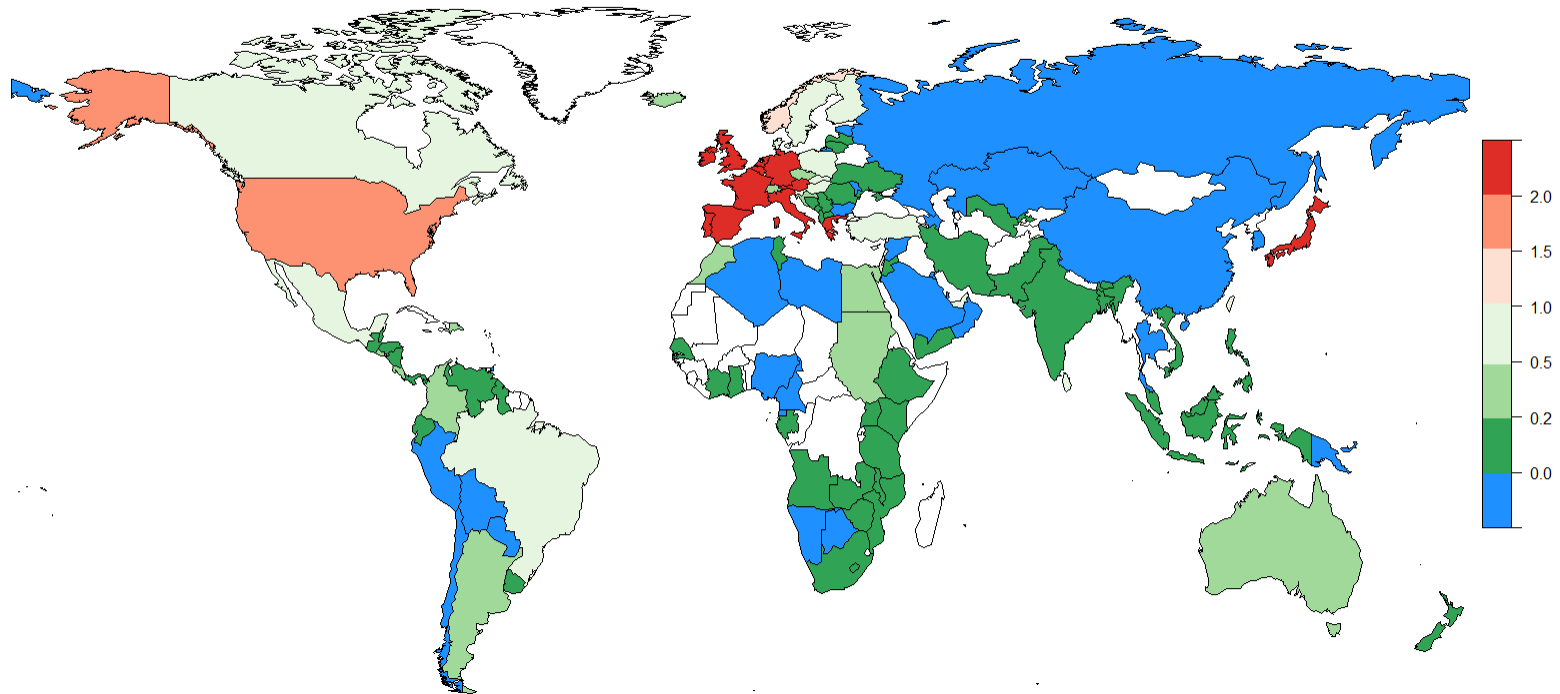
## Public Debt and Unfunded Obligations, Percent of GDP, from 1945



Source: Research Affiliates, based on data from Federal Reserve Flow of Funds, 2012 Q4.

# Comparing Debt Levels: Developed vs. Emerging Countries

**Net Debt / Debt Service Capacity, Relative to World Average**  
**Excludes All Off-Balance-Sheet Debt and Entitlement Programs**



**Net Debt is More than Double Debt Capacity**

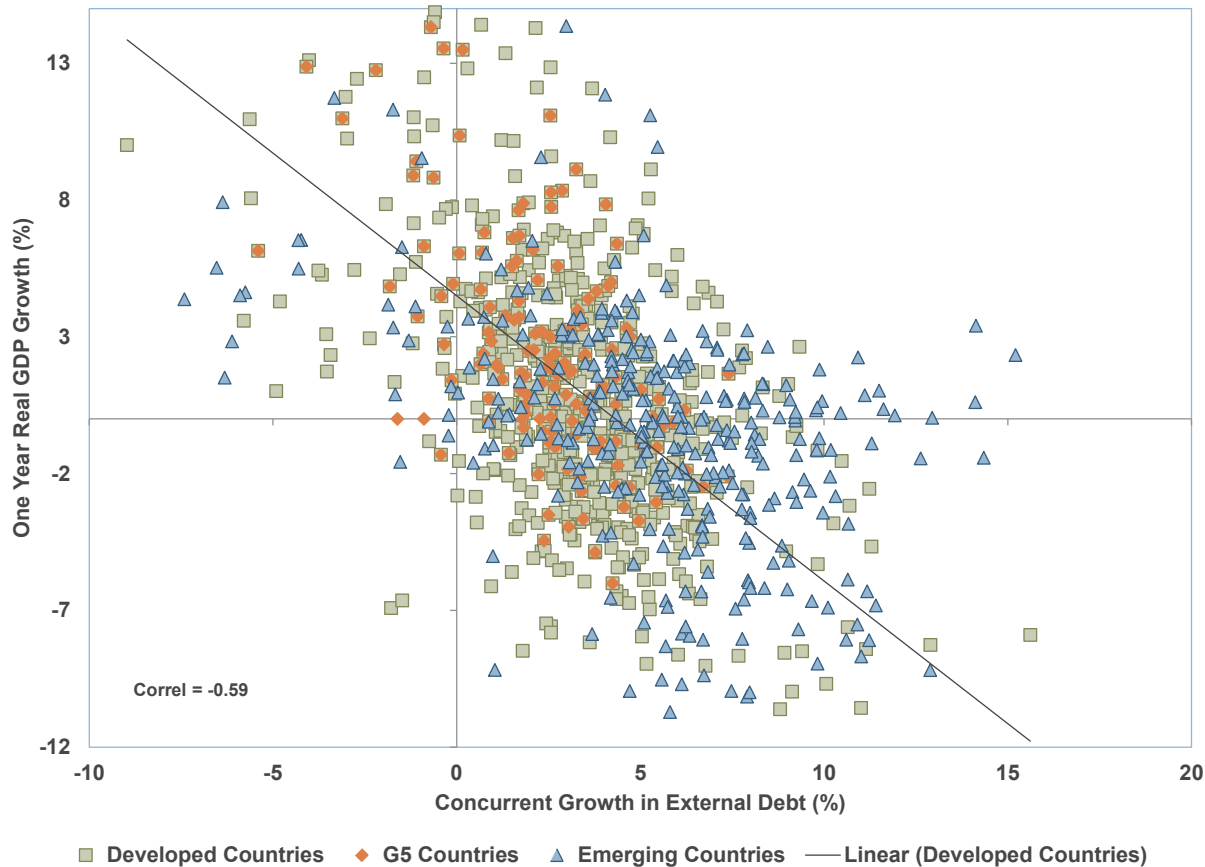
**Net Debt is less than 20% of Debt Capacity**

**Negative Net Debt**

Source: Research Affiliates, based on data from CIA World Fact Book 2010, International Monetary Fund. Note: RAFI® Scale is defined as the equal weighted average of four measures of a country's ability to repay its debt obligations: capital (GDP), labor (population), resources (land mass), and energy (energy consumption). This average is compared to the amount of a country's net debt outstanding to determine its overall debt service capacity relative to the rest of the world.

# Comparing Debt Levels: Effects on Growth

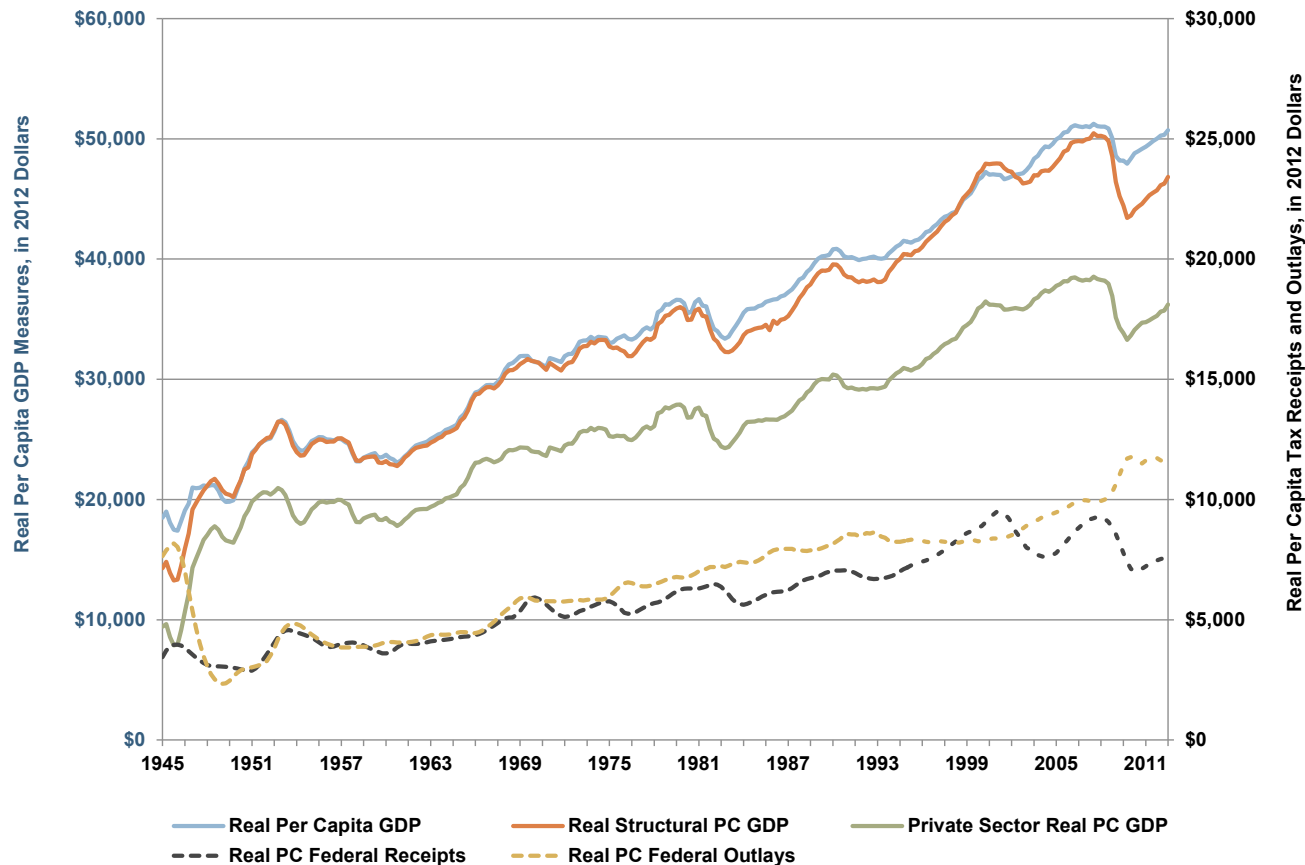
## Linkage of GDP Growth with Change in External Debt, 1980–2011



Source: Research Affiliates, based on data from CIA World Fact Book 2010, International Monetary Fund.

# GDP is the Wrong Measure for Prosperity. Structural GDP (Net of New Borrowing) is Much More Important

## Real GDP, Structural GDP, and Private Sector GDP, Per Capita, 1944–2012



Source: Research Affiliates, based on data from OMB, Department of Commerce and NIPA.



# **Demography Matters... More Than We Might Expect**

# Our Findings

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## GDP per capita growth

- » Highest GDP growth associated with young adults 20–39
- » Young children hurt GDP growth—a little
- » Senior citizens hurt GDP growth—a lot

# Our Findings

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## **Stocks perform better**

- » When there are many in the 35–59 age cadres
- » And, much worse, when there are many senior citizens or children
- » When 45–64 age cadres are growing faster
- » But, much worse, with young adult or 70+ age cadres growing fast
- » Age shift for rates of demographic change



# Our Findings

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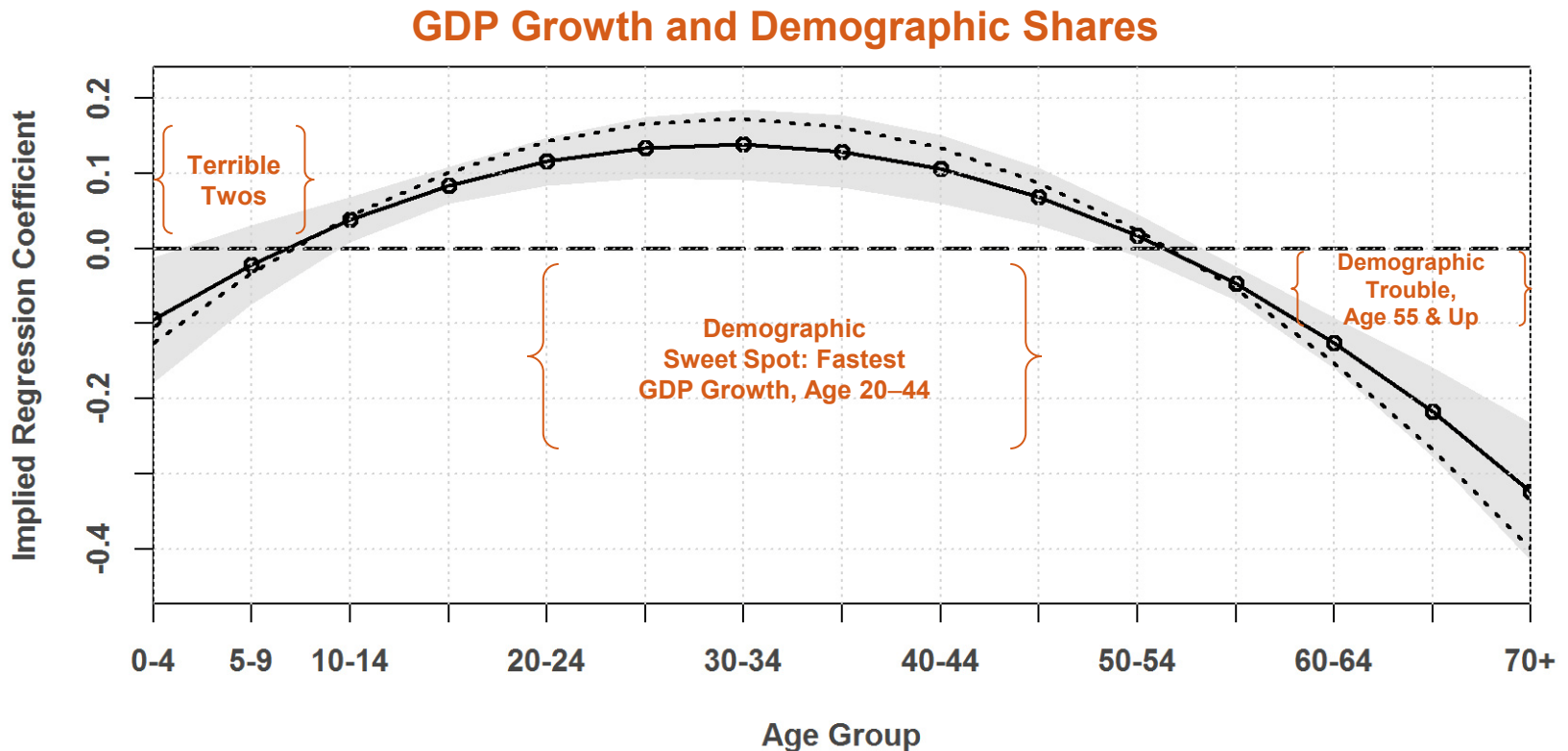
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## **Demography affects bonds**

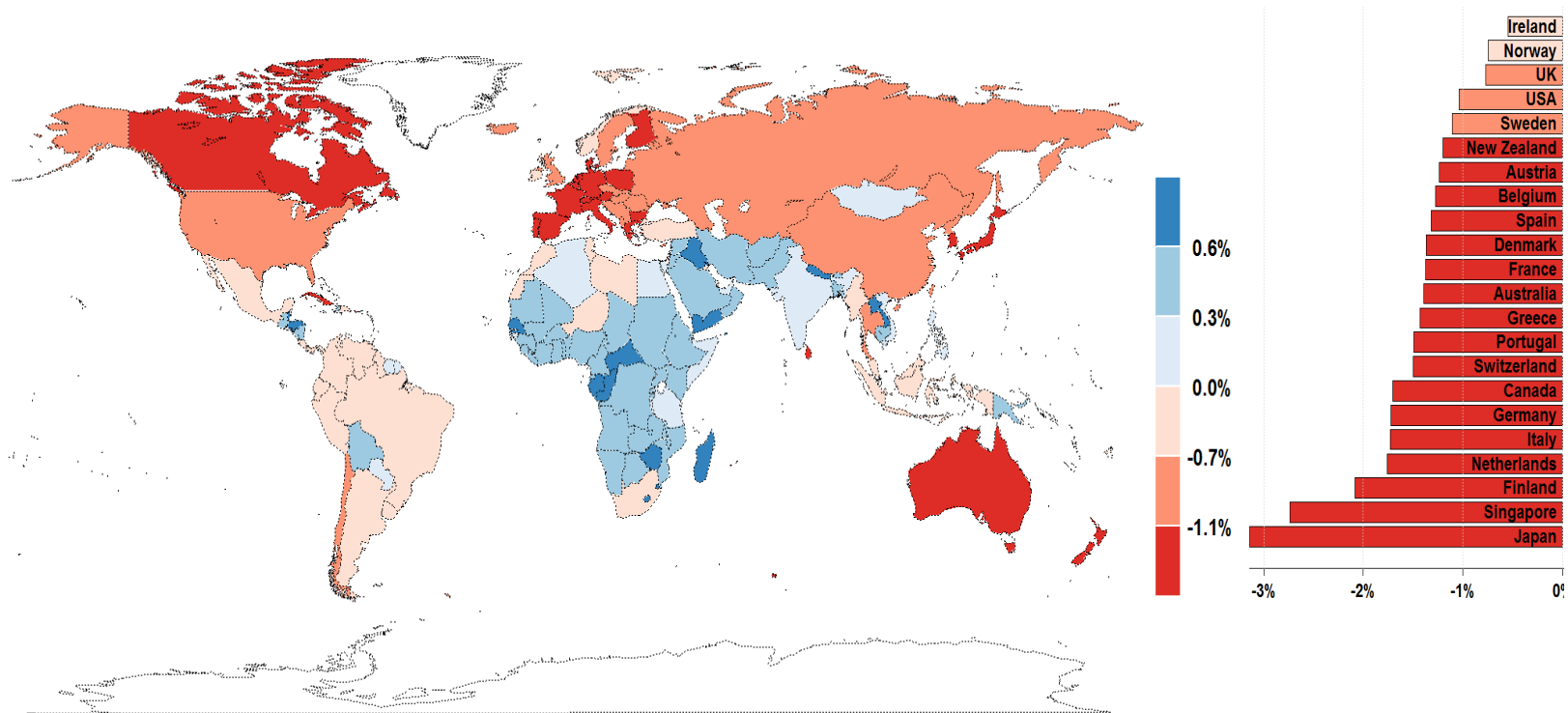
- » With roughly a five-year age difference from stocks
- » With greater statistical significance than stocks

# Relationship between GDP Growth and Demographic Composition ( $R^2 = 0.30$ ), Net of Valuation Effects



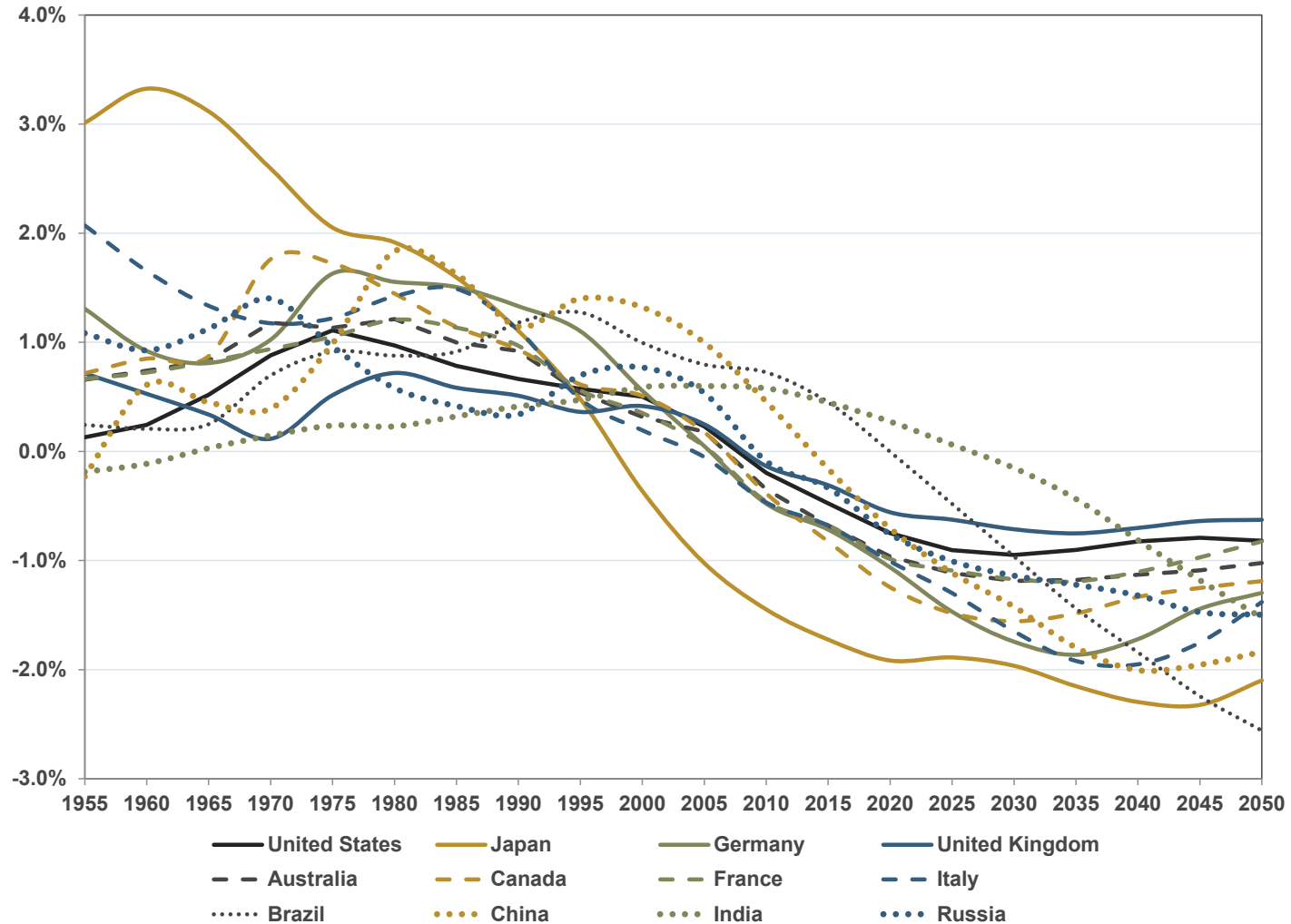
Source: Research Affiliates, based on data from United Nations, Penn World Table, and Global Financial Data.

# Forecasts for GDP Growth, Based on Demographic Composition, 2011–2020



Source: Research Affiliates, based on data from United Nations, Penn World Table, and Global Financial Data.

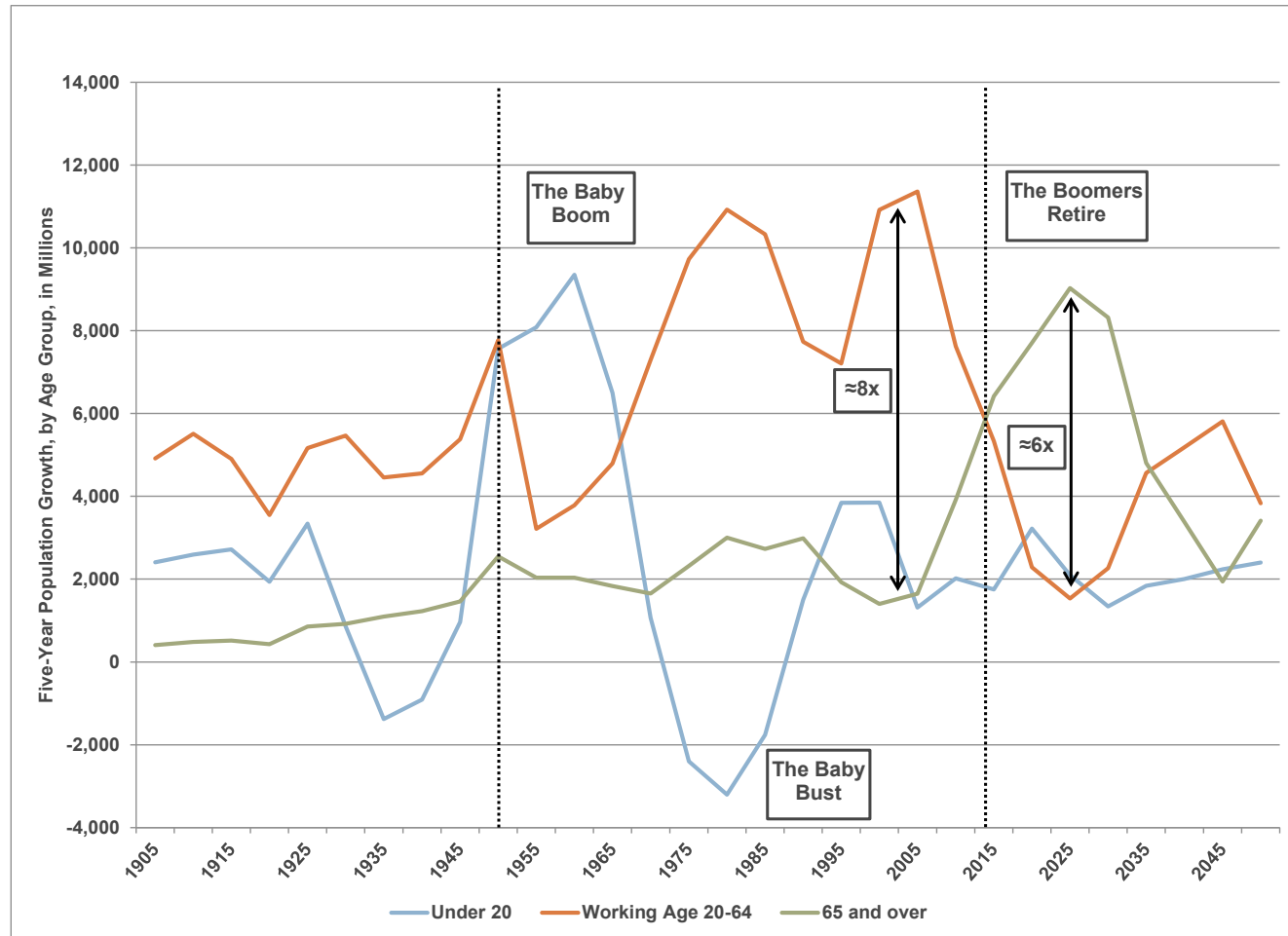
# Abnormal GDP Growth, Relative to 1950–2050 Norms, Based Solely on Shifting Demography



Source: Research Affiliates, based on data from United Nations, Penn World Table and Global Financial Data.

# Demographics Won't Make Our Debt and Deficit Any Easier in the Years Ahead

## Inflection Points, Demographic Seismic Shifts

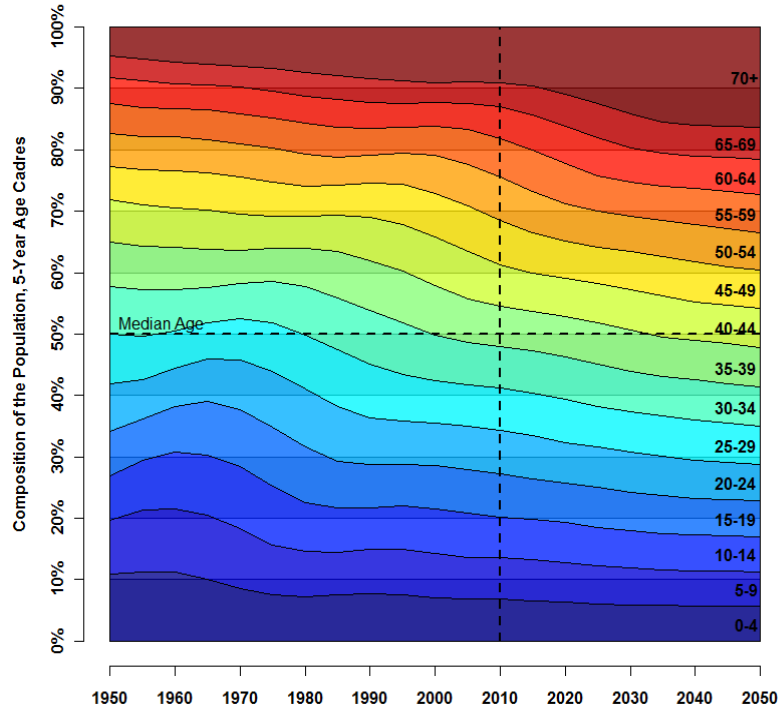


Source: Research Affiliates, based on population data and projections from the U.S. Social Security Administration.

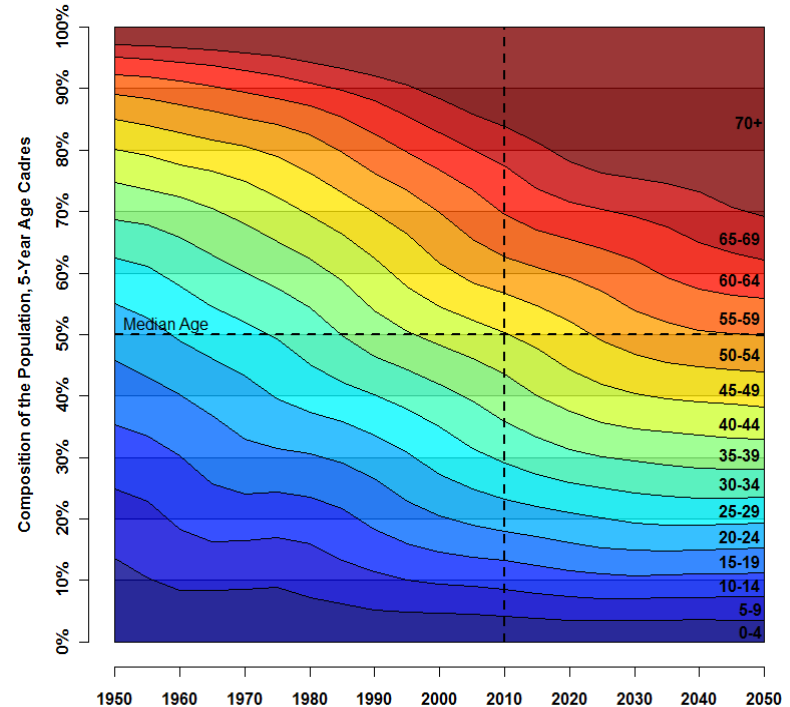
# And Demographics Won't Make This Any Easier in the Years Ahead

## Whither US? Whither Japan?

United States - Distribution of the Population, 1950-2050



Japan - Distribution of the Population, 1950-2050



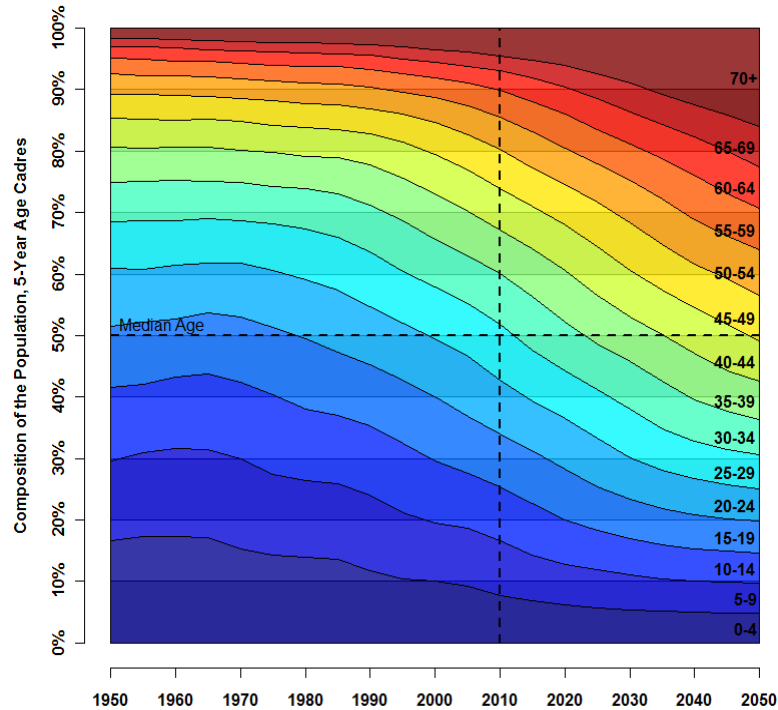
Source: Research Affiliates, based on data from U.S. Census, United Nations.

# Demographic Picture Brightens in EM

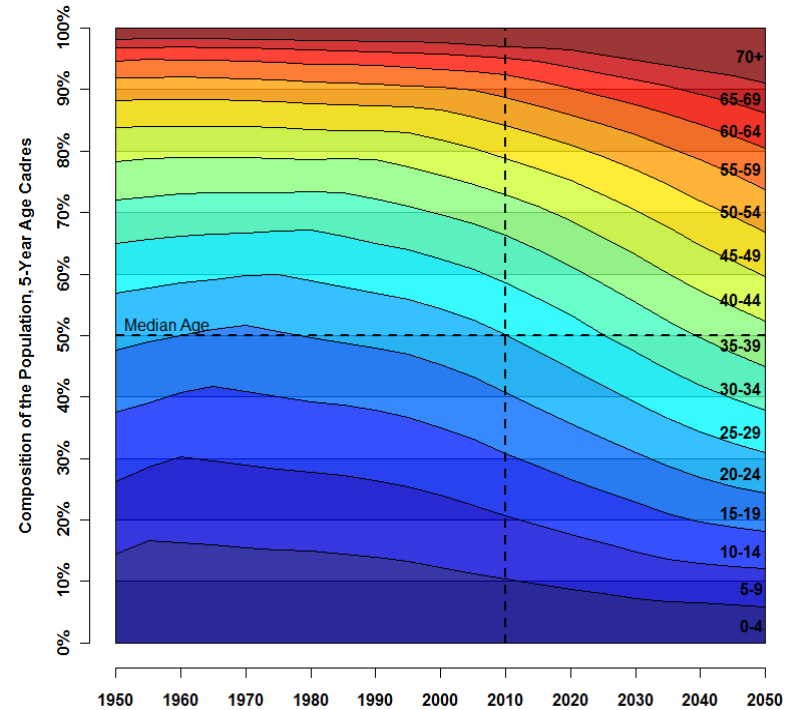
## Our Headwinds are their Tailwinds

### Brazil and India are in an Entirely Different League

Brazil - Distribution of the Population, 1950-2050



India - Distribution of the Population, 1950-2050



Source: Research Affiliates, based on data from U.S. Census, United Nations.

# Recap of the Headwinds

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## » Deficit **spending creates phony GDP**

- » Cutting 10% deficit to zero in 5–10 years reduces GDP growth by 1–2% per year



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- » National debt up from 50% to 100% of GDP in the past 30 years implies 0.83% slower GDP growth until debt is reduced

# Recap of the Headwinds

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## » Demographic **aging slows GDP growth**

- » GDP growth = growth in work force + productivity growth
- » Slower work force growth costs the difference, 0.8%, in GDP

# Recap of the Headwinds

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## » Real GDP growth: **2.4% over the past 30 years**

- » With these headwinds, 2% GDP growth is a home run
- » 1% is far more likely. ***New Normal, Indeed!***

# Investment Implications of the 3-D Hurricane

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**If our debt burden is too large, choices are:**

- » Pay the debt, abrogate, or reflate

**Most investors on two “pillars,” stocks and bonds**

- » Both pillars, already weakened by low yield, crumble with inflation

**The “Third Pillar” should be considered:**

- » The first two pillars, stocks & bonds, crater during reflation
- » Diversifying into EM, alternative markets, and inflation hedges

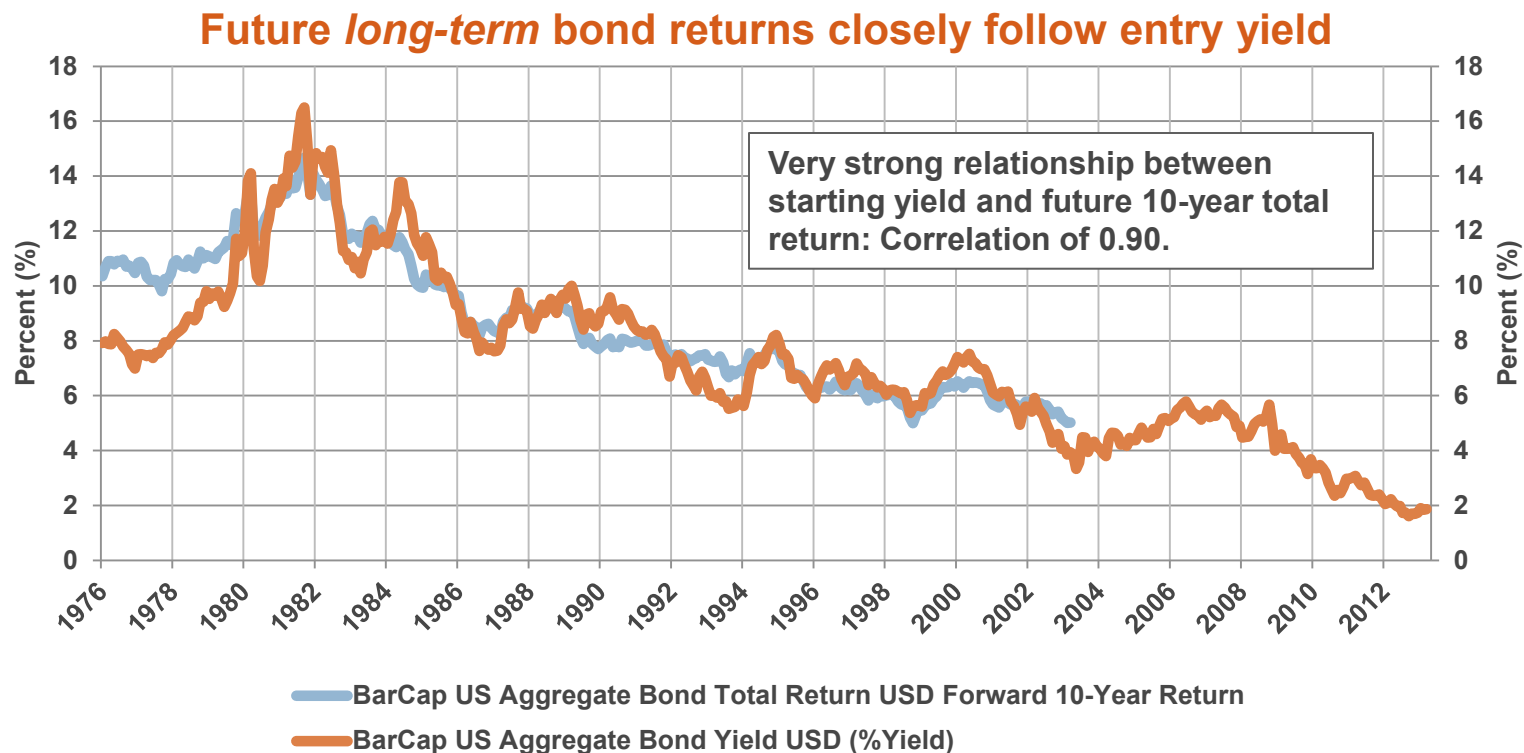


# **Where are the Opportunities Today?**

How Do We Set Bond and Stock Market  
Expectations?

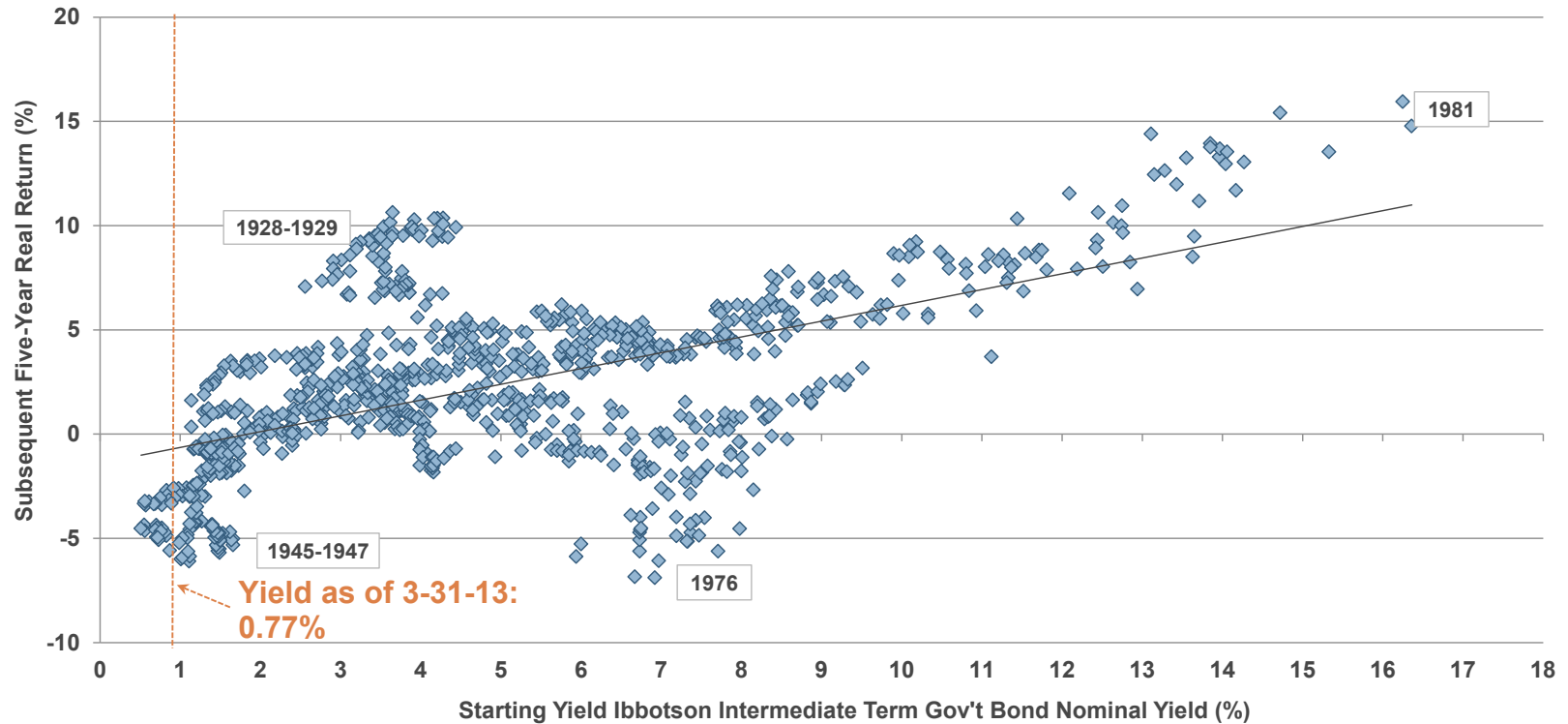
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# Bond Market Returns Follow Yields



Source: Research Affiliates based on data from Ibbotson and Barclays Capital as of December 31, 2012.

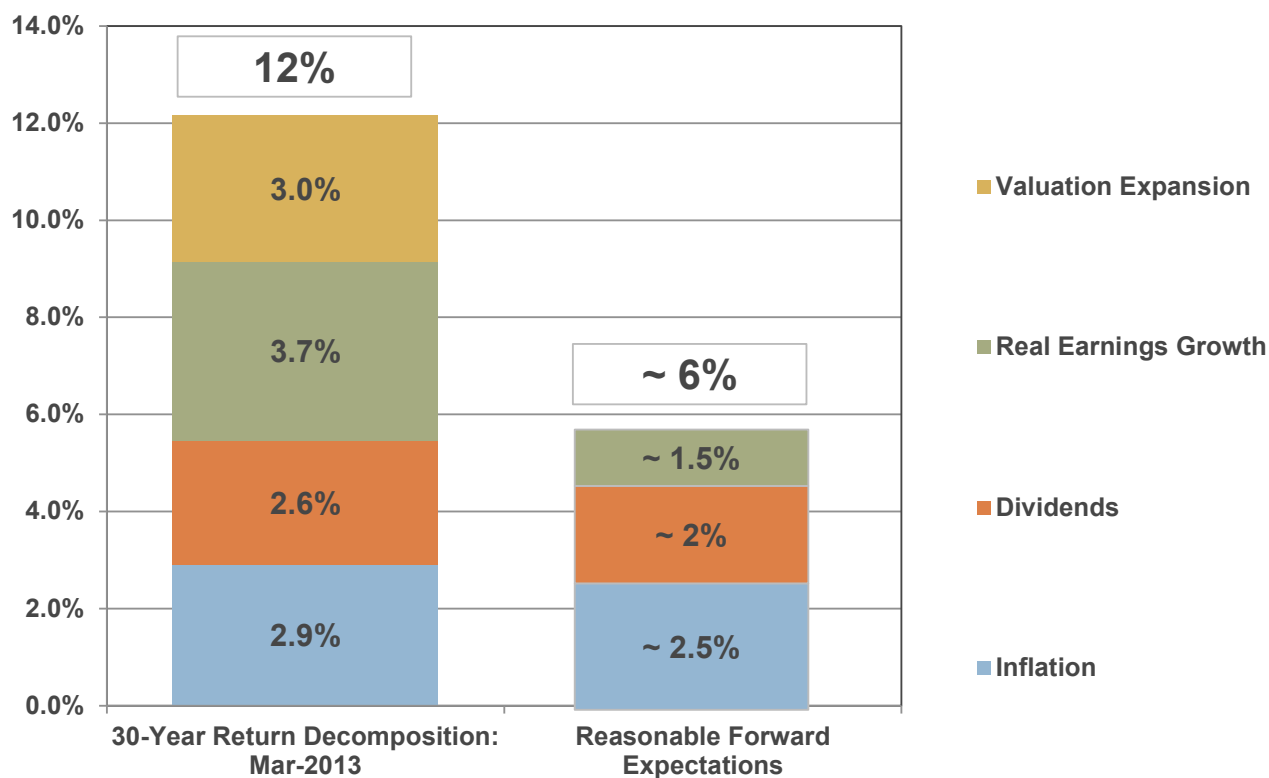
# Government Bonds Are Poor Inflation Protection from Today's Skinny Yields



Source: Research Affiliates using Encorr. As of December 31, 2012.

# Forward Stock Returns Set to be Half of Past Returns

- » 30-year returns of S&P 500 stocks: 12%!\*
- » Should we expect that for the next decade?? No!
- » This past period was driven by strong valuation multiple expansion:



\*Actual S&P return (Ibbotson).

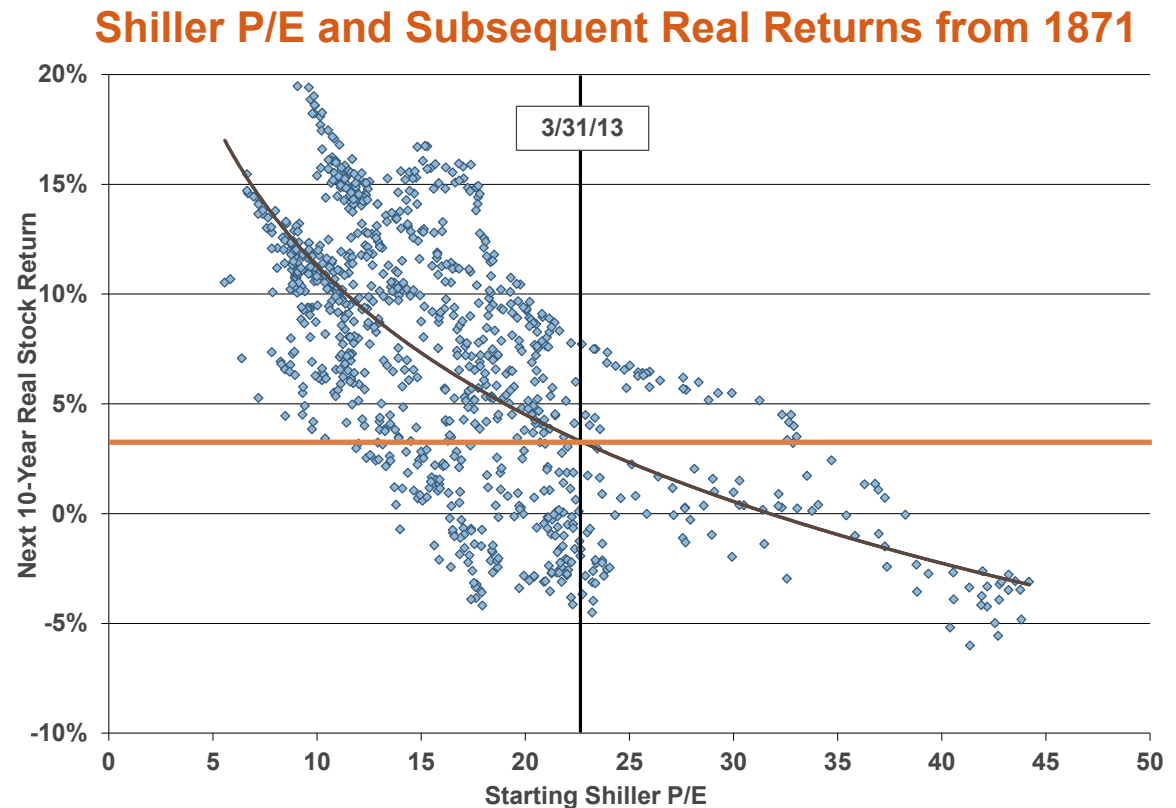
As of December 31, 2012

Source: Ibbotson, Research Affiliates based on data from Ibbotson and Robert Shiller of Yale. Sub-components do not equal total return due to compounding effects.



# Future Valuation Expansion Not Promising

- » The only way to meet nominal expected returns of 8–10% for equities is for valuation multiples to rise
- » Based on current valuation levels, that outlook is not promising
- » Especially if we enter a reflationary environment that typically punishes valuation multiples



Source: Research Affiliates based upon data from Morningstar and Robert Shiller.

# A Spectrum of Returns

## “The First Shall Be Last and the Last Shall Be First”

Asset Class	Cumulative Returns				1993–2012	
	2008–2012	2003–2007	1998–2002	1993–1997	Standard Deviation	Correlation with 60–40
Emerging Markets Stocks	-3	391	-21	44	24	0.71
International Stocks	-15	171	-12	74	17	0.79
REITs	29	131	23	118	21	0.55
Large Cap U.S. Stocks	9	83	-3	152	15	0.00
Commodities	-23	95	21	58	16	0.33
Convertibles	22	66	20	92	13	0.83
Unhedged Foreign Bonds	32	43	27	47	8	0.16
TIPS	41	36	52	—	6	0.15
High Yield Bonds	61	67	3	75	9	0.64
Long Government Bonds	58	32	52	62	10	-0.02
Emerging Markets Bonds	64	82	44	—	9	0.61
Core Bonds	33	24	44	43	4	0.21
Mortgages	32	25	43	42	3	0.17
Money Market	2	16	23	26	1	0.07

Red = worst three

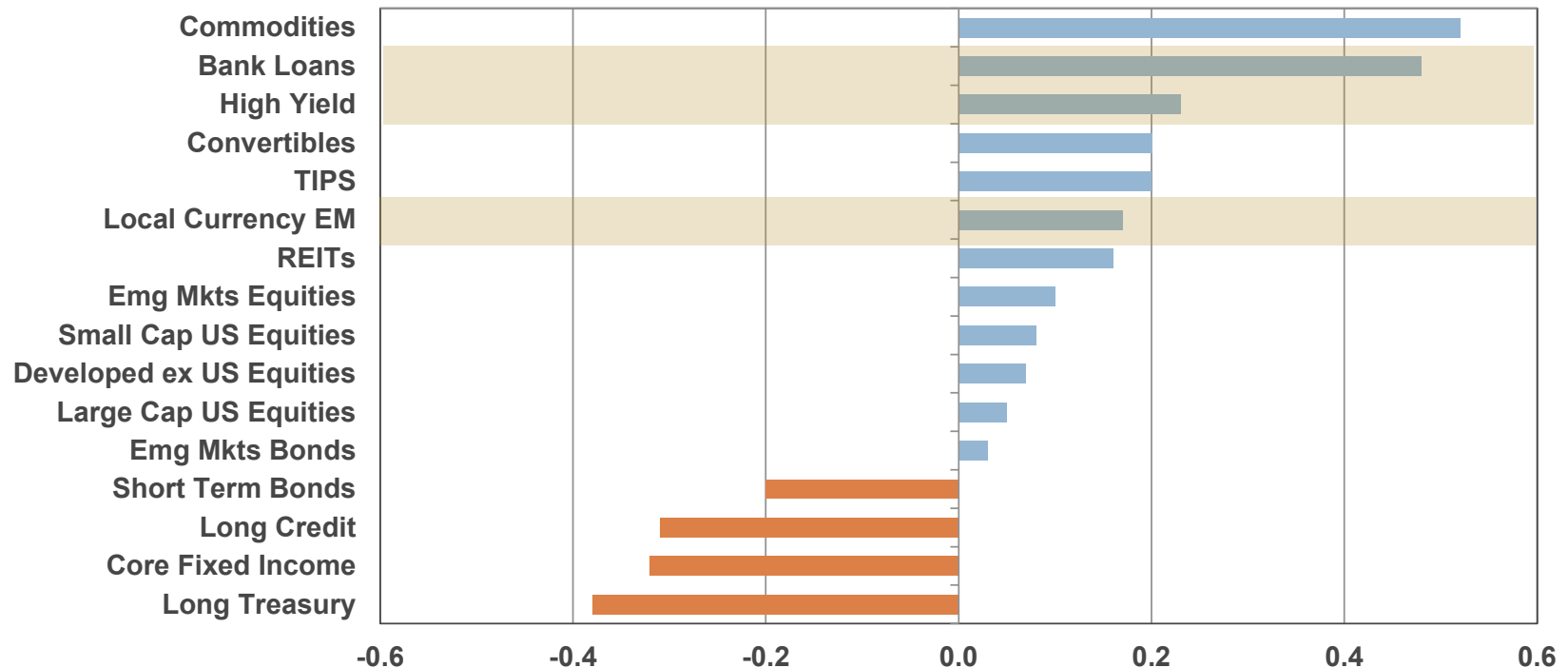
Blue = best three

Note: Emerging markets and TIPS standard deviations and correlations are for the 13 years ended December 2012.

Past performance is no guarantee of future results. 60-40 represents a composite of the S&P 500 (60%) and Barclays Government/Credit Bond Index (40%). Standard deviation is an absolute measure of volatility measuring dispersion about an average which, for an index, depicts how widely the returns varied over a certain period of time. The greater the degree of dispersion, the greater the risk. Correlation w/60-40 measures the correlation, or tendency to move in tandem, of the performance of the listed asset class with the 60/40 portfolio for the 18-year period ended 12/31/10. A higher number indicates a greater correlation. Emerging Markets Stocks represented by MSCI Emerging Markets Gross Index. Commodities represented by Dow Jones UBS/AIG Commodity Index. REITs represented by Wilshire REIT Index. Emerging Markets Bonds represented by JP Morgan Emerging Markets Bond Index Global. TIPS represented by Barclays U.S. TIPS Index. High Yield Bonds represented by Merrill Lynch High Yield Master II Index. Long Term Govt Bonds represented by Barclays Long-Term Treasury Index. Mortgage Bonds represented by Barclays Mortgage Index. Convertible Bonds represented by Merrill Lynch ALL US Convertible Securities Index. Unhedged Foreign Bonds represented by Citigroup World ex-U.S. Government Bond Index. Money Markets represented by Citigroup 3-Month T-Bill Index. Intl Stocks represented by MSCI EAFE Gross Index. S&P 500 Equal Weighted (SPEW) reflects the performance of the S&P 500 Index with component stocks equally weighted rather than capitalization weighted. The Standard & Poor's 500 Stock Index (S&P 500) is an unmanaged, capitalization-weighted index of U.S. companies generally representative of the U.S. Stock Market. The Barclays US Aggregate Bond Index is generally considered to be representative of the domestic, investment-grade, fixed-rate, taxable bond market. Returns are not indicative of the past or future performance of any investment product.

# Identifying “Stealth Inflation Fighters” to Build a Third Pillar

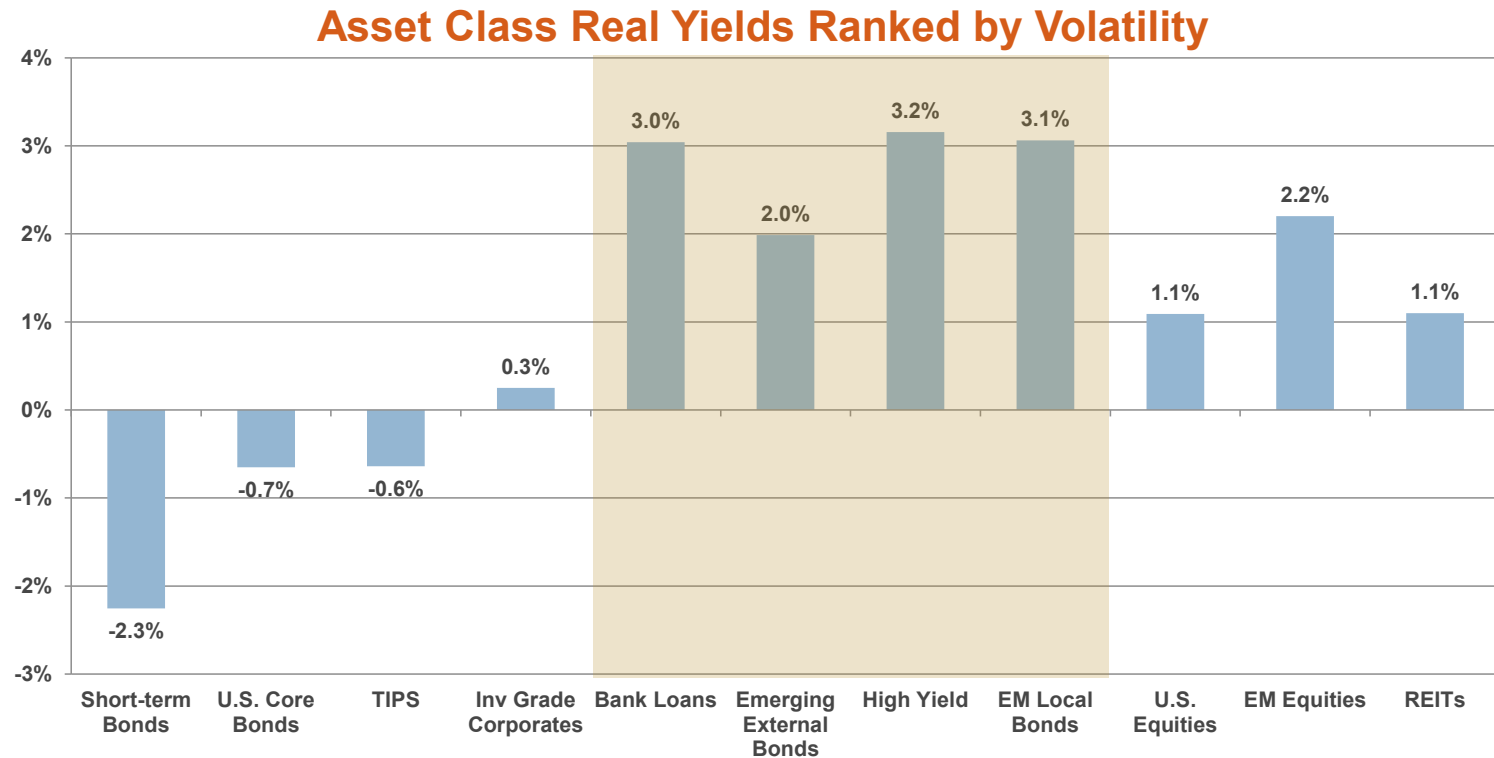
## Quarterly Correlation of Returns to U.S. Inflation, March 1997–March 2013



Long treasury: Barclays U.S. Long Treasury; Core fixed income: Barclays U.S. Aggregate Index; Long credit: Barclays U.S. Long Credit; Short-term bonds: Barclays U.S. Aggregate 1-3 yrs; Large cap U.S. equities: S&P 500; Emerging market bonds: JPM EMBIG Diversified; Developed ex U.S. equities: MSCI EAFE (Gross); Small cap U.S. equities: Russell 2000; Emerging market equities: MSCI Emerging Markets (Gross); REITs: FTSE NAREIT All REITs; Local currency EM: JPMorgan ELMI+; TIPS: Barclays U.S. TIPS; High yield: Barclays U.S. Corporate High Yield; Bank loans: Credit Suisse Leveraged Loan Index; Commodities: DJ UBS Commodity Total Return Index

Source: Research Affiliates, LLC., based on data from Bloomberg and Encorr.

# The Middle of the Volatility Spectrum Offers the Highest Real Yield Potential



5-Year Annual Volatility* (%)	1.2	3.7	7.6	8.1	10.9	11.6	15.7	16.1	20.4	30.2	34.8
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\*Measured by the standard deviation of monthly returns, annualized, for the 5 years ended March 31, 2013.

Emerging markets is represented by the Barclays Global Emerging Markets Index; EM local is represented by JPMorgan GBI-EM Global Diversified Unhedged Index; high yield is represented by Barclays High Yield Index; bank loans measured by YTM of Powershares BKLN ETF; U.S. equities are represented by the S&P 500 Index; EM equities represented by MSCI EM Index; REITS represented by the FTSE NAREIT Index ; U.S. core bonds represented by the Barclays U.S. Aggregate Index; IG corporates represented by the Barclays U.S. Aggregate Credit Index; short-term represented by T-bills; TIPS represented by the Barclays U.S. TIPS Index

Source: Research Affiliates, LLC., based on data from Bloomberg and Encorr. As of March 31, 2013.

# Three Paths to Improved Return Potential

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## Consider Other Asset Classes

- » Stocks and bonds are not the only choices
- » Unconventional assets can be priced to offer better returns

## Seek Alpha

- » Conservatively, focusing on avoiding negative alpha, or
- » Aggressively, if you have confidence in the opportunities

## Actively Manage the Asset Mix

- » *Include* alternative markets in these decisions
- » Seek assets which are out of favor, priced for better returns

**We Believe All Three Paths Can Be Pursued in Parallel!**

**Our fourth alternative—leverage—boosts risk far more than it improves prospective returns**

# Thank You

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# Notes: Strategy Simulation Descriptions

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<sup>1</sup>Volatility weighted: Weighted based on the standard deviation of monthly returns over the five year window prior to index construction.

<sup>2</sup>Market Beta Weighted: Weighted based on CAPM betas using market factor kindly provided by Kenneth French on his website.

The market beta loading is estimated using monthly returns data over five years window prior to index construction.

<sup>3</sup>Downside Semi-Deviation Weighted: Weighted based on downside semi-deviation of the monthly returns over five year period prior to index construction.

<sup>4</sup>Cap-Weighted: Weighted based on market capitalization. The market capitalization is computed using December close of the year prior to index construction.

<sup>5</sup>Book Weighted: Weighted based on the book value of equity. We use the book value from the fiscal year two years prior to index construction. We introduce delay to avoid forward-looking bias.

<sup>6</sup>Five-year Average Earnings Weighted: Weighted based on the average of the five-year earnings. The averaging period covers the five fiscal years ending with the fiscal year two years prior to index construction. We introduce delay to avoid forward-looking bias.

<sup>7</sup>Fundamentals Weighted: Weighted based on the five year averages of cash flows, dividends, sales and the most recent book value of equity. We introduce two year delay to avoid forward-looking bias. Following the original method, we select top stocks with the largest fundamental weight. For details see Arnott, Hsu, and Moore (2005).

<sup>8</sup>Earnings Growth Weighted based on five-year average dollar change in earnings divided by the average absolute dollar value of earnings over the five-year period. The last fiscal years of the measuring window is taken two years prior to index construction. We introduce delay to avoid forward-looking bias.

<sup>9</sup>Minimum Variance: To construct the minimum variance strategy we use the method of Clarke, de Silva, and Thorley (2006).

<sup>10</sup>Maximum Diversification Portfolio optimized to maximize expected diversification ratio, which is defined as the ratio of weighted average risk to the expected portfolio risk. For details see Choueifaty and Coignard (2008).

<sup>11</sup>Risk-Efficient ( $\lambda=2$ ) Mean-variance optimized portfolio assuming that expected excess returns are proportional to the stocks' downside semi-deviation, and with stringent constraint to limit portfolio concentration. For details see Amenc et al (2010).

<sup>12</sup>Risk Cluster Equal Weight Applying statistical methods to identify major market risk factors, assumed to be driven by industries and geographies, and then equally weight these uncorrelated risk clusters.

<sup>13</sup>Diversity Weighting: Weighted based on the market capitalization weight raised to the power of a constant that is between zero and one to tilt the portfolio towards small cap stocks while limiting tracking error. We used the value of 0.76 in our simulation.

<sup>14</sup>Malkiel's Monkey: Average of 100 portfolios, where each of the individual portfolios is rebalanced annually by randomly selecting 30 stocks out of the universe of the largest 1000 stocks by market capitalization.

<sup>15</sup>Equal Weighting: Equally weighted portfolio of 1000 largest stocks by market capitalization

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