

On the Role of Financial Innovation and Quantitative Finance in Financial Stability and Economic Growth: 50 Years of the Past into the Impending Future

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50th Anniversary Q Group Spring Seminar

Washington DC

April 18, 2016

Overview of remarks

- Well-functioning financial system is essential for sustainable economic growth and development –RM Solow and D North
<https://www.ubs.com/microsites/nobel-perspectives/en/robert-solow.html>
- Financial innovation drives improvement of the financial system
- Finance science, technology, and economic need drive financial innovation
- Crisis breeds implementation of innovation which leads to an improved financial system: observations from the 1970s in US
- Financial innovation can solve real-sector challenges: case of Leipzig gas pipeline in 1990s
- Derivative markets and quantitative finance tools are fundamental to a modern well-functioning financial system
- Derivative-based innovation : present and future
- Derivatives innovation can improve policy objectives implementation by removing unnecessary dysfunctional unintended “side effects”
- Country swaps can lower the cost of capital with increased global risk-bearing of local risks without sacrificing local governance or taking capital-flight risk
- Future innovations to improve the global financial system and economic growth

Major Financial and Economic Crisis 1970s: Risk Explosion and Stagflation in USA

- Multi-dimensional explosion of volatilities in the western economies reflected in financial systems
- Fall of Bretton Woods currency system
- First oil crisis in 1973-4 and a second one in 1979
- Double-digit inflation in the US highest since Civil War
- High unemployment ~9%:
- “Stagflation” unknown, and still unsolved, economic disease
- Stock market fell 50% in real terms mid 1973 – 1974
- Double-digit interest rates , highest since Civil War
- No mortgage money available: Regulation Q
- 1973-1975 recession was really a 1970s recession because its effects extended into the 1980s

Risk Explosion and Crisis 1970s Drives an Explosion of Extraordinary Financial Innovation in USA, Subsequently Adopted Throughout the World

- Option exchange: financial value insurance
- Financial futures for currencies, interest rates, stocks
- NASDAQ , first electronic stock market
- Money market funds, high-yield and floating rate bonds
- Index funds Stage Coach Fund 1970 & Vanguard 1975
- TIAA-CREF international diversification in stocks 1972
- ERISA 1974 modern employer-funded pension system
- May Day 1975 negotiated commissions & Vanguard created
- Debt securitization and creation of a national mortgage market
- Interest rate swap –eliminates the largest bank risk
- Eliminate destructive regulations: deposit rate ceilings
- Foundation set for globalization of capital markets: global diversification
- Quantitative finance: portfolio theory; asset pricing models ; non-linear derivative/option-pricing models; large-scale stock price data bases

Using Contracts as Substitutes for Physical Assets for Greater Efficiency and a Greener World: Leipzig Gas Pipeline 1990s

German reunification created rapid economic development and an increased power demand. To meet this demand, a natural gas power station in Leipzig had two options:



Option 1

Spend **\$50M** for a pipeline to the European gas grid and buy UK, Norwegian and Dutch gas at spot prices indexed off the USD price of heating oil at the Upper Rhine delivery point

Option 2

Spend **\$300M** for a new pipeline to connect to the Russian gas grid and enter a 15 year fixed price contract in Deutsche Marks

Contractual Synthesis of Assets: Leipzig Gas Pipeline (cont.)

	Option 1	Option 2
Capital Investment	\$50M	\$300M
Advantages	Reduced political risk by avoiding dependence on Russians Lower capital investment	Stable prices of power potentially useful to population accustomed to price controls
Disadvantages	Gas price volatility	High capital investment

Option 1 was more attractive with hedging, but had two significant problems:

1. **Limited hedge instruments available:**
 2. Crude oil call up to 5 years in USD
 3. Crude/heating oil basis swaps up to 2 years
 4. FX Options up to 5 years
 5. Currency swaps up to 10 years

2. **Limited sophistication of the city administration**

Solution

A bank provided a 15 year cap on European gas prices at a strike price equal to the Russian fixed price contract in exchange for a premium of \$125 MM. The cap is effectively a “synthetic pipeline”.

The price is half of the incremental cost of a physical pipeline to Russia and compensates the bank for hedge mismatches and the need to dynamically adjust hedges over 15 years.

Derivative Financial Innovation: Present and Future

- Derivatives are efficient “adapters” between heterogeneous financial systems, which improve global financial integration and diversification
- Derivatives provide efficient implementation of the three methods of managing risk: diversification, hedging and insurance
- Derivatives permit efficient risk diversification while implementing other objectives by separating risk-bearing choices from comparative advantage, cash investment, governance, liquidity, expropriation, and tax issues.
- Development of derivative markets for equities, interest rates, currencies and commodities promotes financial stability by multiple channels for risk transfer and information-extraction from prices
- Derivatives can improve the efficiency of open-market and stabilization operations
- Intelligent regulation to realize the benefits of financial innovation while managing its risks.

Capital Market Globalization Benefits Economic Growth

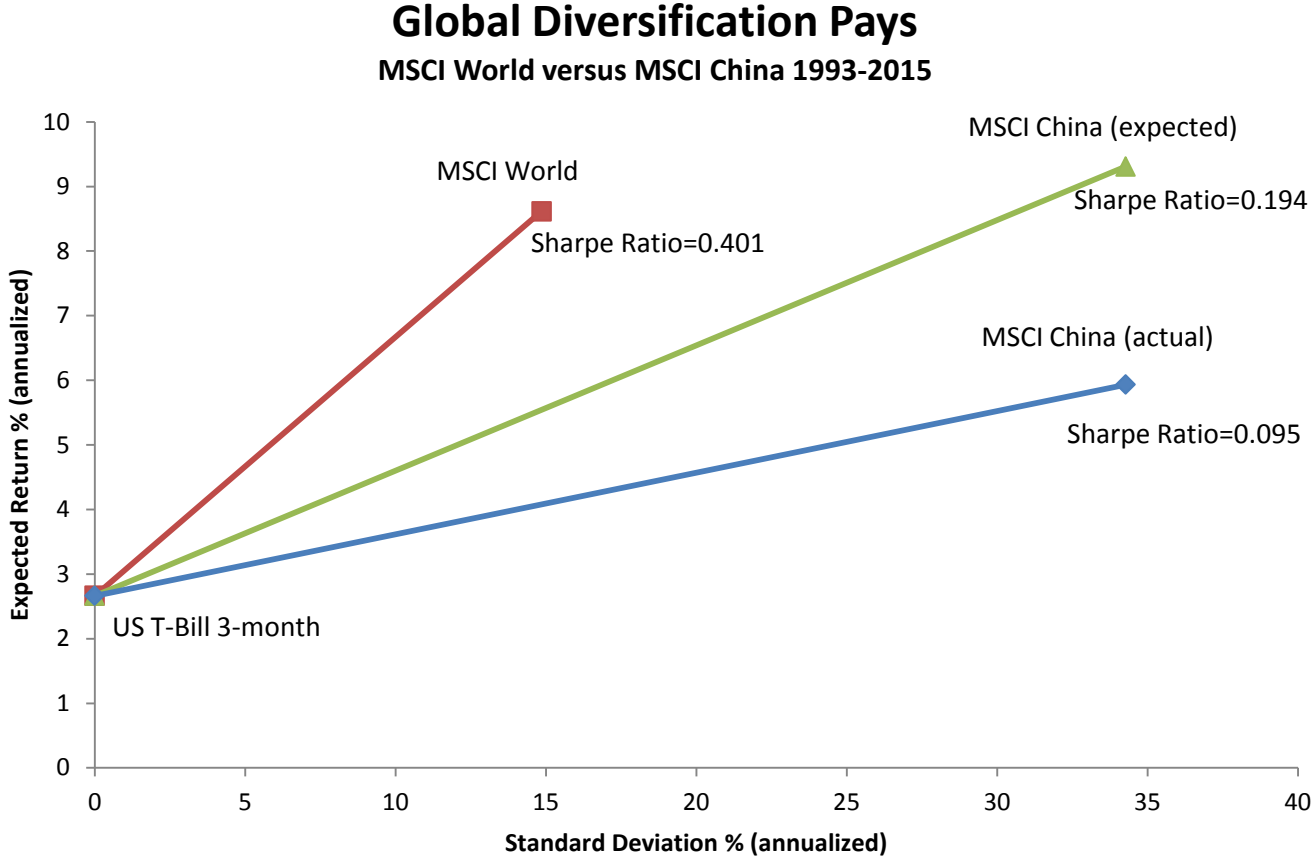
Global Diversification Pays: A “free” Alpha

- Three ways to manage risk: diversification, hedging and insurance
- Diversification is “free” and improving diversification is thus a “free” alpha
- The best-diversified portfolio is the World market portfolio
- The cost of not diversifying is measured in terms of a reduced Sharpe Ratio
- Asian experience 1993-2015 : Japan, China, Hong Kong, Singapore, Thailand, Malaysia, Indonesia, Philippines, and Korea
- Portfolios of a superior-performing countries will generally benefit from global diversification
- Conflicts with other policy objectives of the government: Implementation of policy objectives to protect against adverse capital flows, preserve domestic governance of industries , and channel investment into domestic industries often impose an “unintended” cost on domestic investors from inefficient diversification
- Conflict solution: Derivative contracts can be used to reduce or eliminate this cost by altering risk flows instead of capital flows, while preserving the policy objectives

Capital Market Globalization Benefits Economic Growth

Cost of Restricting Investing to Domestic Assets Only and Investor Home Bias Behavior Can be Substantial - China

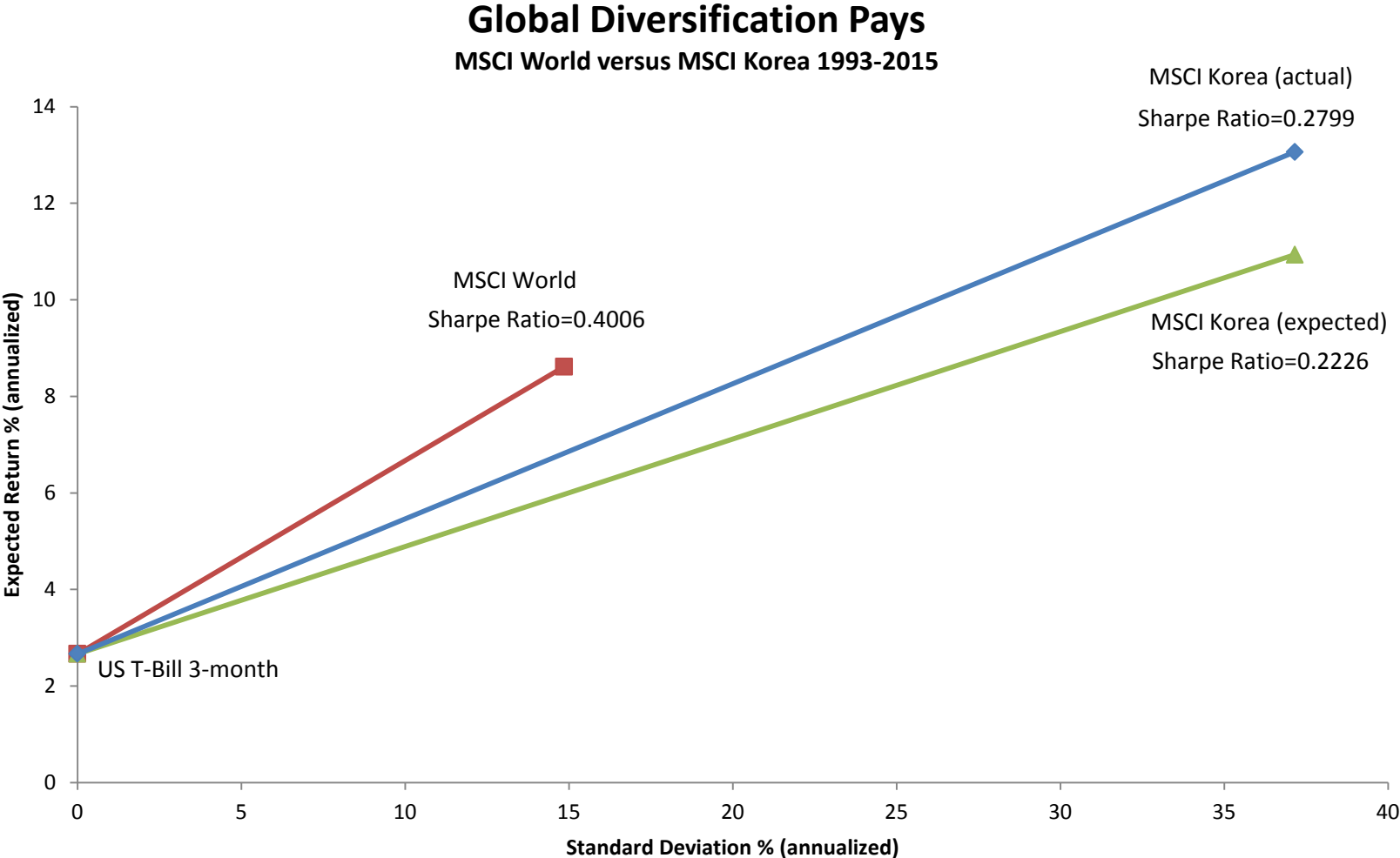
MSCI World versus MSCI China 1993-2015



Source: MSCI China total return index, MSCI World total return index, U.S. 3 month T-Bill rate, 1993-2015. Returns in USD. "Expected" = ex post 0-alpha, conditional on World realized return

Global Diversification Pays Even for a Superior-Performing Country

MSCI World versus MSCI Korea 1993-2015



Source: MSCI Korea total return index, MSCI World total return index, U.S. 3 month T-Bill rate, 1993-2015. Returns in USD. "Expected" = ex post 0-alpha, conditional on World realized return

Capital Market Globalization Benefits Economic Growth

Global Diversification Pays – Asian Experience 1993-2015

	<u>Realized Alpha</u>	<u>Realized Sharpe Ratio</u>	<u>Expected Sharpe Ratio</u>
World	0.00%	0.40	0.40
• Japan	- 3.61%	0.08	0.27
• China	- 3.38%	0.10	0.19
• Hong Kong	+ 2.38%	0.36	0.26
• Thailand	- 0.74%	0.19	0.21
• Malaysia	+ 1.00%	0.21	0.18
• Indonesia	+ 4.14%	0.29	0.19
• Singapore	- 0.43%	0.26	0.28
• Philippines	+ 0.74%	0.21	0.19
• Korea	+ 2.13%	0.28	0.22

Derivative Innovation for Better Policy Objectives Implementation

Efficient Diversification of Risk, Governance, and Cash Capital Investment Objectives: Case of The Pension Funds of Canada

Before: 90% cash invested in Canada stocks and bonds required

Canada Pension Return = Return on Canada 90% + Return World All Industries 10%

Concentrated Risk Well-Diversified Risk

Enter into a Total-Return Swap contract where Pension

Pays: Return on Canada

Receives: Return World All Industries

After: 90% cash invested in Canada stocks and bonds required + swap

Canada Pension Return = Return World All Industries 100%

Well-Diversified Risk

Comparative Advantage vs. Efficient Risk Diversification: Managing Country Risk and Broaden Capital Base Using Country Swaps

Before

Taiwan Return = Return World Chip Industry + Return Taiwan-Specific Chip
Concentrated generic risk Comparative-advantage risk

Enter into a total-return Swap contract where Taiwan

Pays: Return World Chip Industry

Receives: Return World all Industries

After:

Taiwan Return = Return World All Industries + Return Taiwan-Specific Chip
Diversified generic risk Comparative-advantage risk

Relative Advantage of Country Swaps for Diversifying Risk

- *Lower Cost of Capital* through increased global risk-bearing of local risks
- *Can be combined to efficiently address another major country issue*: Pension system design and reform and efficient risk-bearing
- *Minimizes Moral Hazard* of expropriation, repudiation, taxes or accounting
- *Locals perform* industrial governance, trading in shares in local market, receive benefits/losses of local-country-specific component of industry returns, thus avoids political risk of “selling off the crown jewels of the country”
- *Credit Risk*: no principal amounts at risk; set frequency of payments (.25, 0.5, 1.0 years); “right-way” contract [pay when country is better able]; potential for credit guarantee and/or two-way-marked-to-market collateral
- *Policy is non-invasive*: doesn’t require change in employment patterns and behavior, changes in industrial structure or changes in financial system design
- *Policy is reversible* by simply entering into an off-setting swap
- *Robust* with respect to local financial system design: works with capital controls, pay-as-you pension system, or no local stock market at all
- *Insurance version*: country swaptions
- *How to measure country risk*: Patterned after BIS model for banks

Future Innovations to Improve the Financial System and Growth

- Employ bitcoin technology of hash functions and transaction block chains (global ledgers) to provide efficient non-centralized and simplified clearing and settling
- Real estate and other title-search-sensitive transactions could be vastly simplified with potential huge cost reduction by transaction block chains technology
- ECU-like diversification model for regional common currency to reduce local currency risk without the Euro-like risk
- Using derivative market prices to extract forward-looking versus historical-based probability estimates to assess the impact of monetary and other government policy announcements on beliefs about the future and identify potential “hot spots” of connectedness.
- Taking account of the interactions of monetary, fiscal and financial stability policies and unintended consequences of those policies

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Appendix Global Diversification Pays – Asian Experience 1993 – 2015

Japan

China

Hong Kong

Thailand

Malaysia

Indonesia

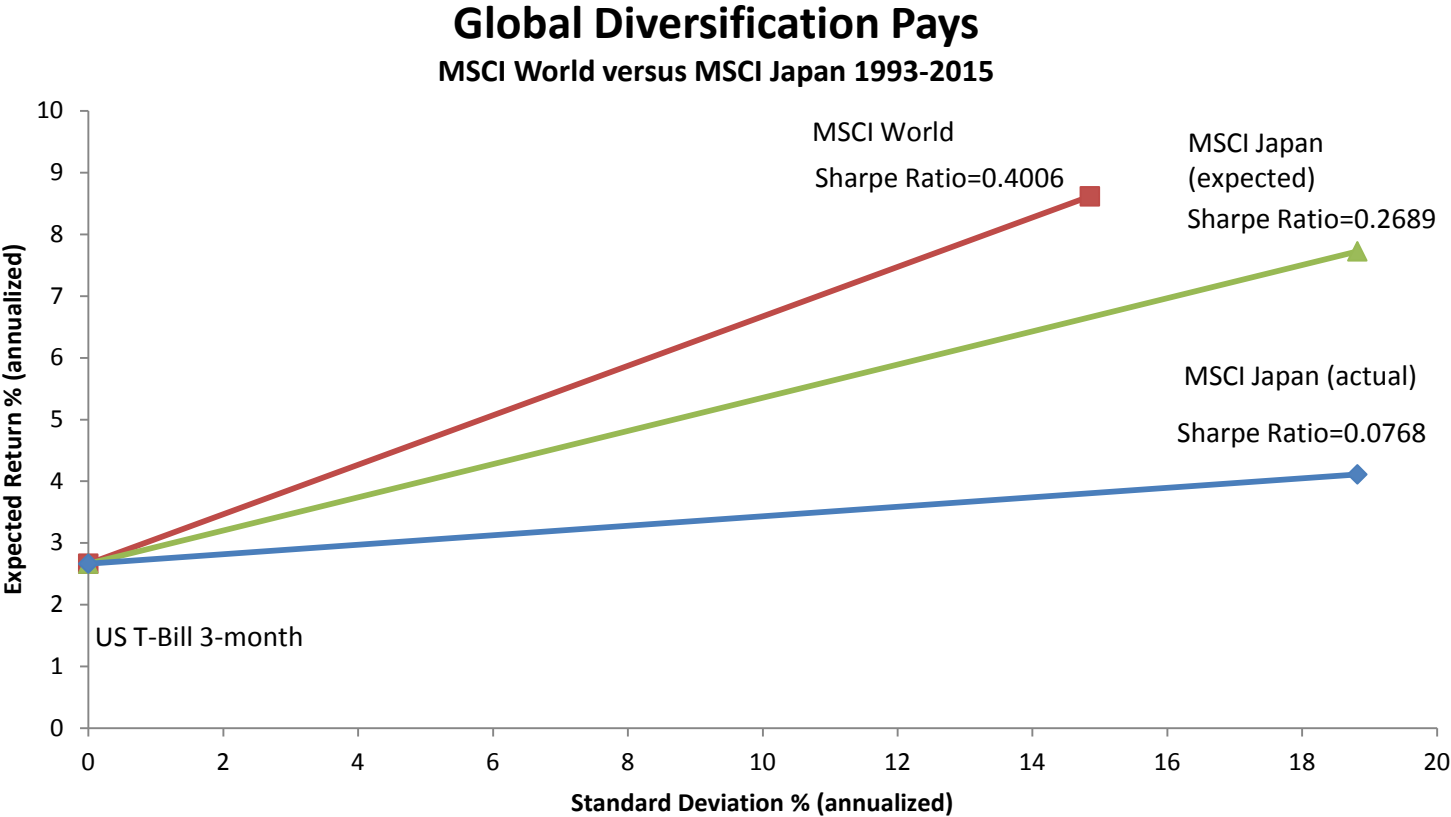
Singapore

Philippines

Korea

Capital Market Globalization Benefits Economic Growth-Japan

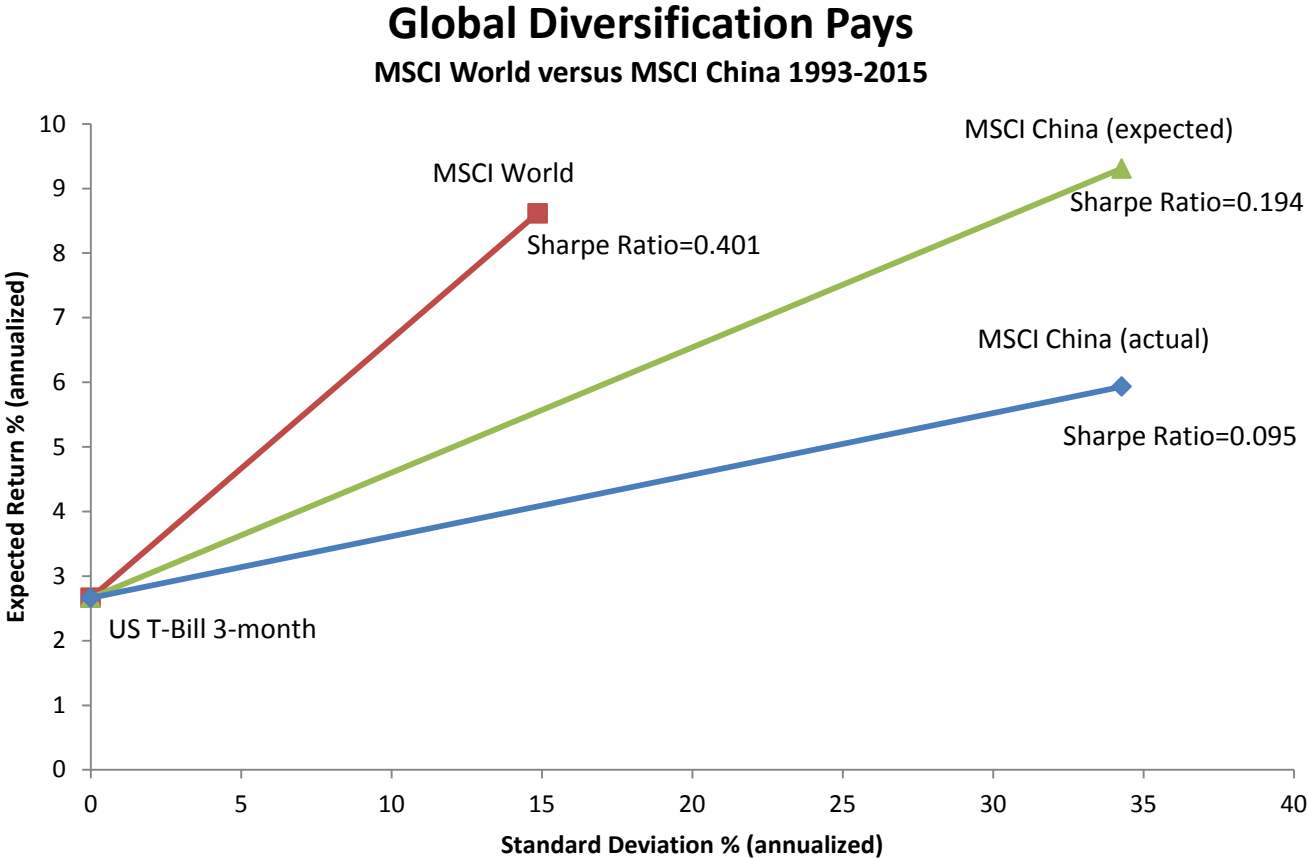
MSCI World versus MSCI Japan 1993-2015



Source: MSCI Japan total return index, MSCI World total return index, U.S. 3 month T-Bill rate, 1993-2015. Returns in USD. "Expected" = ex post 0-alpha, conditional on World realized return

Capital Market Globalization Benefits Economic Growth-China

MSCI World versus MSCI China 1993-2015

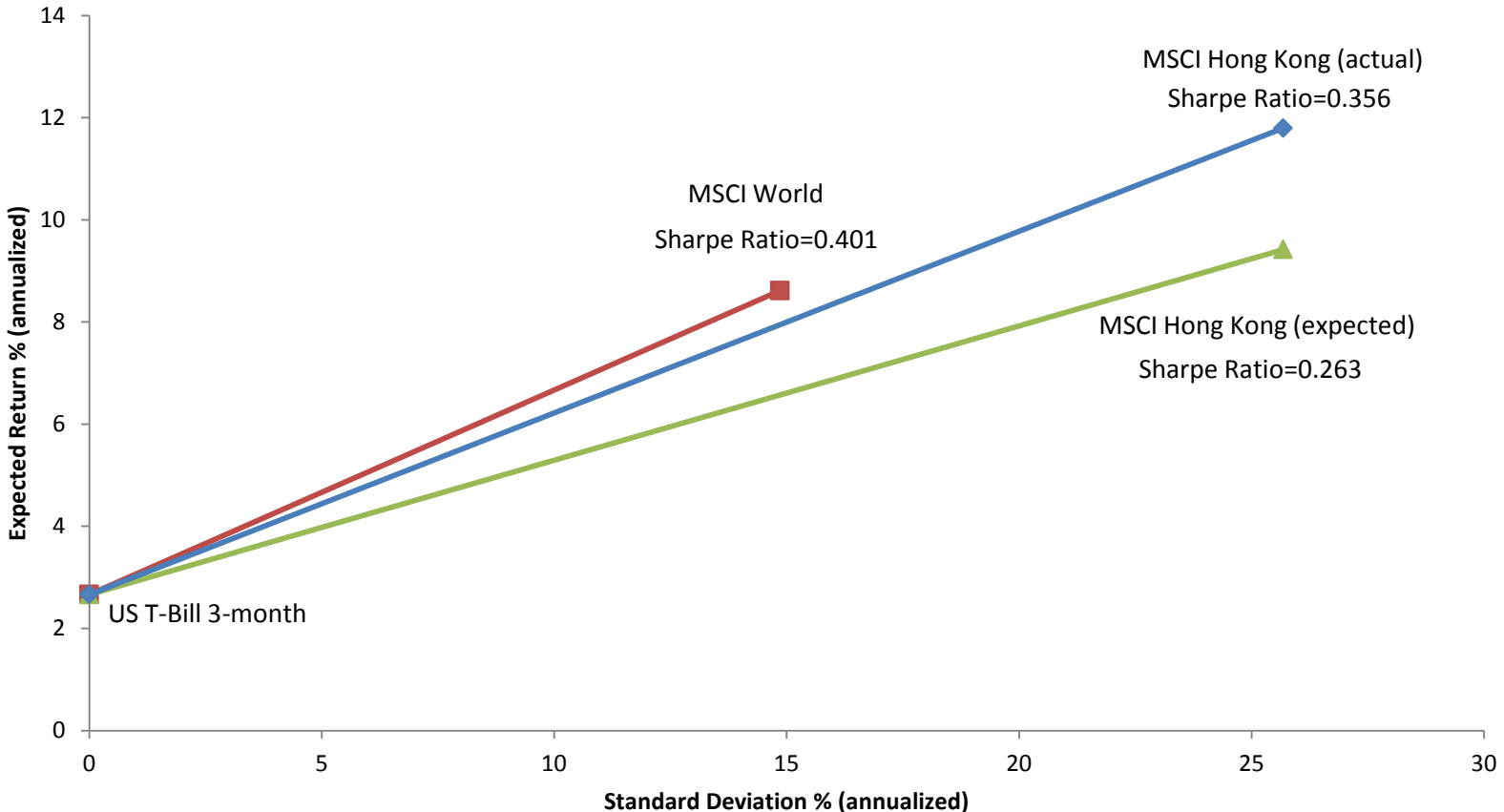


• Source: MSCI China total return index, MSCI World total return index, U.S. 3 month T-Bill rate, 1993-2015. Returns in USD. "Expected" = ex post 0-alpha, conditional on World realized return

Capital Market Globalization Benefits Economic Growth-Hong Kong

MSCI World versus MSCI Hong Kong 1993-2015

Global Diversification Pays MSCI World versus MSCI Hong Kong 1993-2015



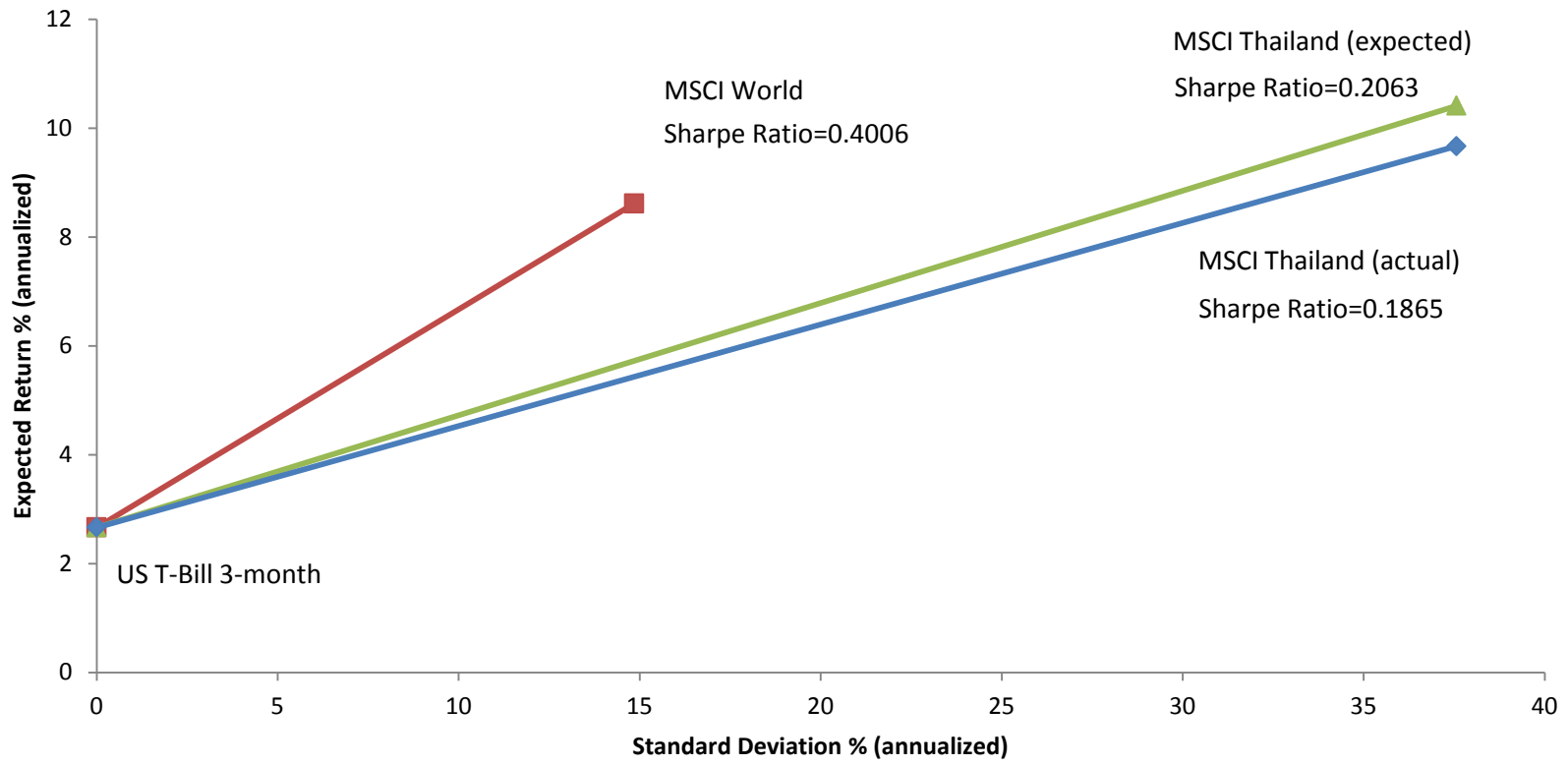
Source: MSCI Hong Kong total return index, MSCI World total return index, U.S. 3 month T-Bill rate, 1993-2015. Returns in USD. *Expected* = ex post 0-alpha, conditional on World realized return

Capital Market Globalization Benefits Economic Growth-Thailand

MSCI World versus MSCI Thailand 1993-2015

Global Diversification Pays

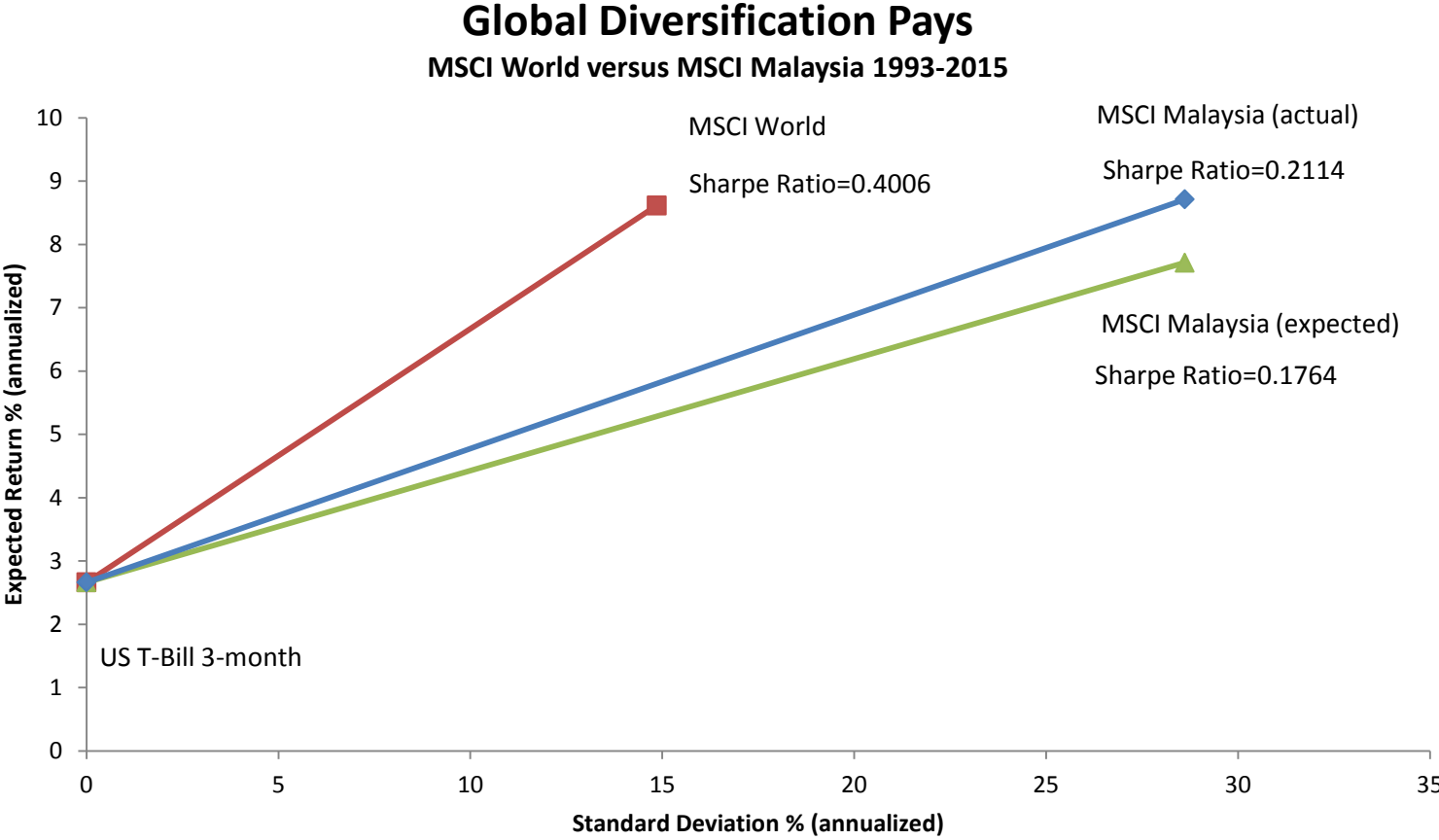
MSCI World versus MSCI Thailand 1993-2015



Source: MSCI Thailand total return index, MSCI World total return index, U.S. 3 month T-Bill rate, 1993-2015. Returns in USD. "Expected" = ex post 0-alpha, conditional on World realized return

Capital Market Globalization Benefits Economic Growth-Malaysia

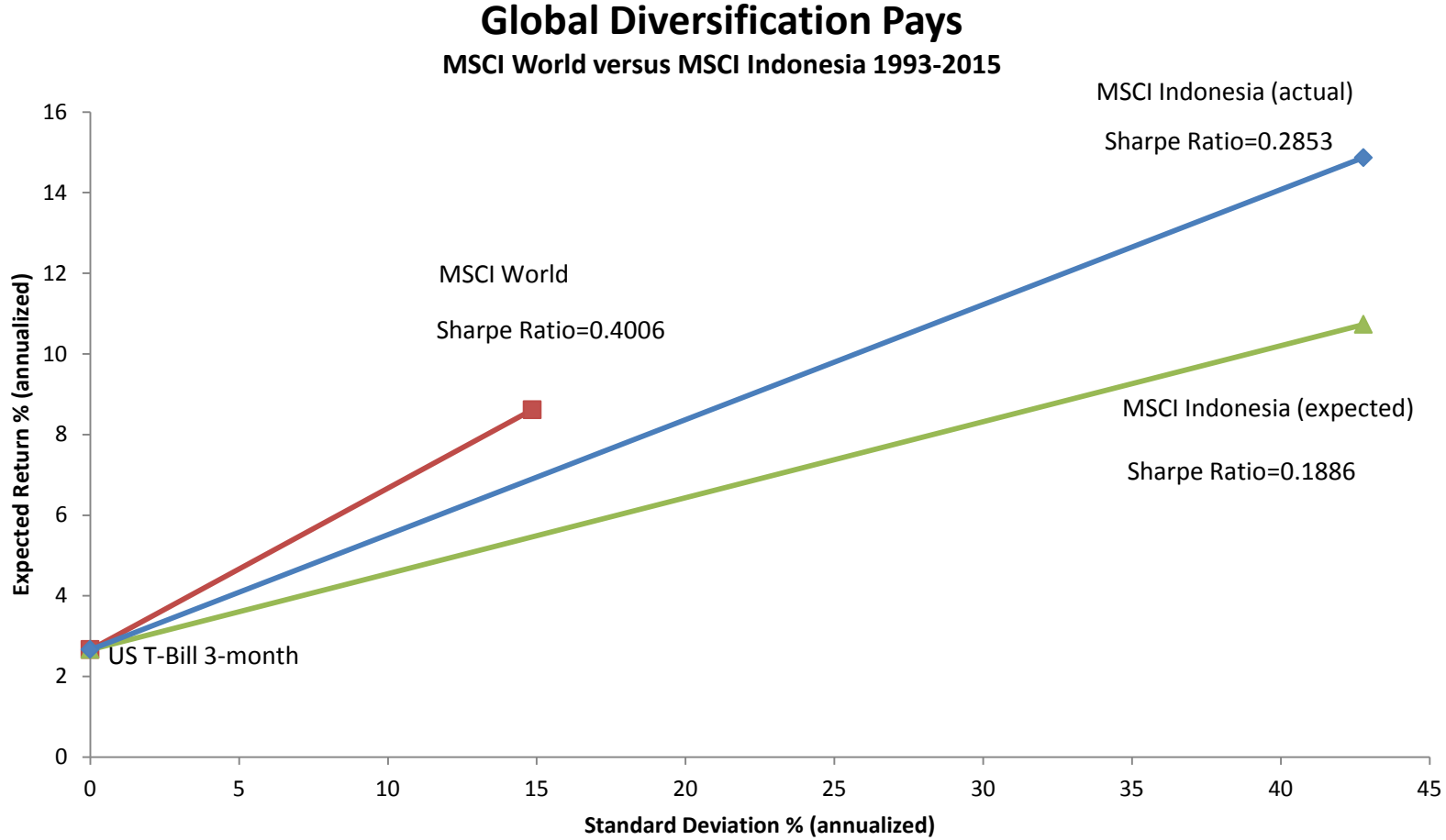
MSCI World versus MSCI Malaysia 1993-2015



Source: MSCI Malaysia total return index, MSCI World total return index, U.S. 3 month T-Bill rate, 1993-2015. Returns in USD "Expected" = $\text{expost } 0\text{-alpha}$, conditional on World realized return

Capital Market Globalization Benefits Economic Growth-Indonesia

MSCI World versus MSCI Indonesia 1993-2015

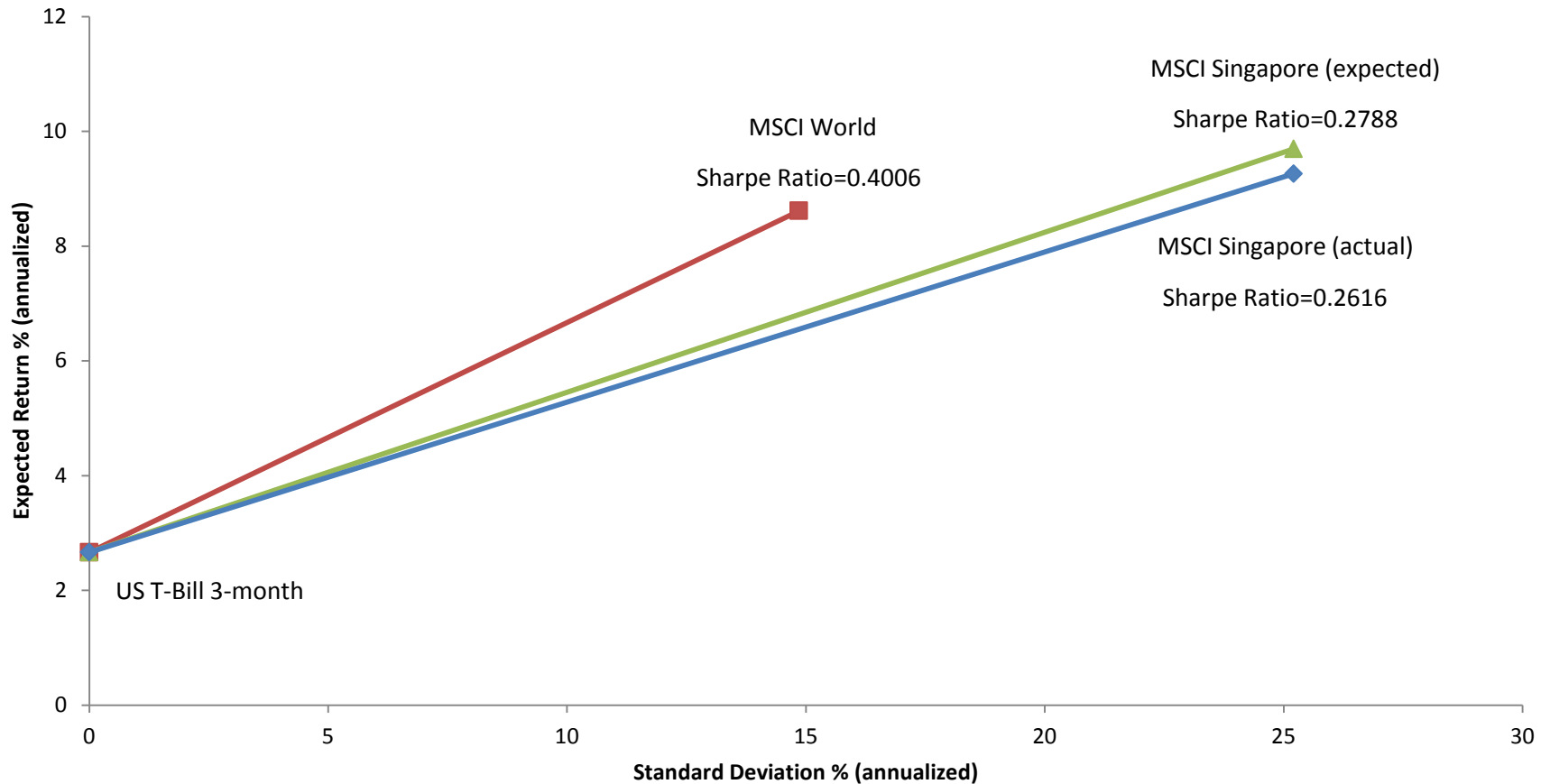


Source: MSCI Indonesia total return index, MSCI World total return index, U.S. 3 month T-Bill rate, 1993-2015. Returns in USD. "Expected" = ex post 0-alpha, conditional on World realized return

Global Diversification Pays

MSCI World versus MSCI Singapore 1993-2015

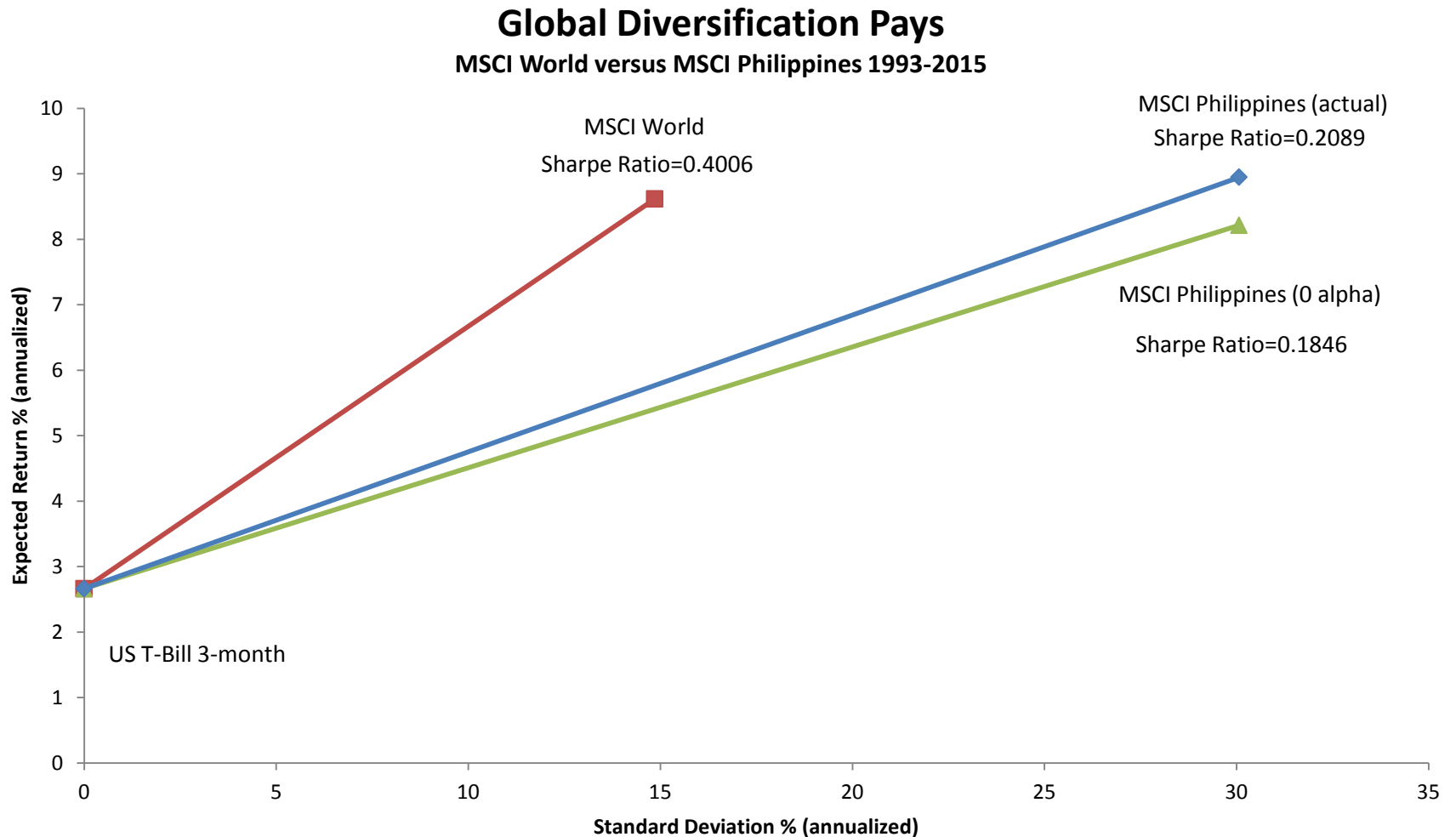
Global Diversification Pays
MSCI World versus MSCI Singapore 1993-2015



• Source: MSCI Singapore total return index, MSCI World total return index, U.S. 3 month T-Bill rate, 1993-2015. Returns in USD. "Expected" = ex post 0-alpha, conditional on World realized return 1
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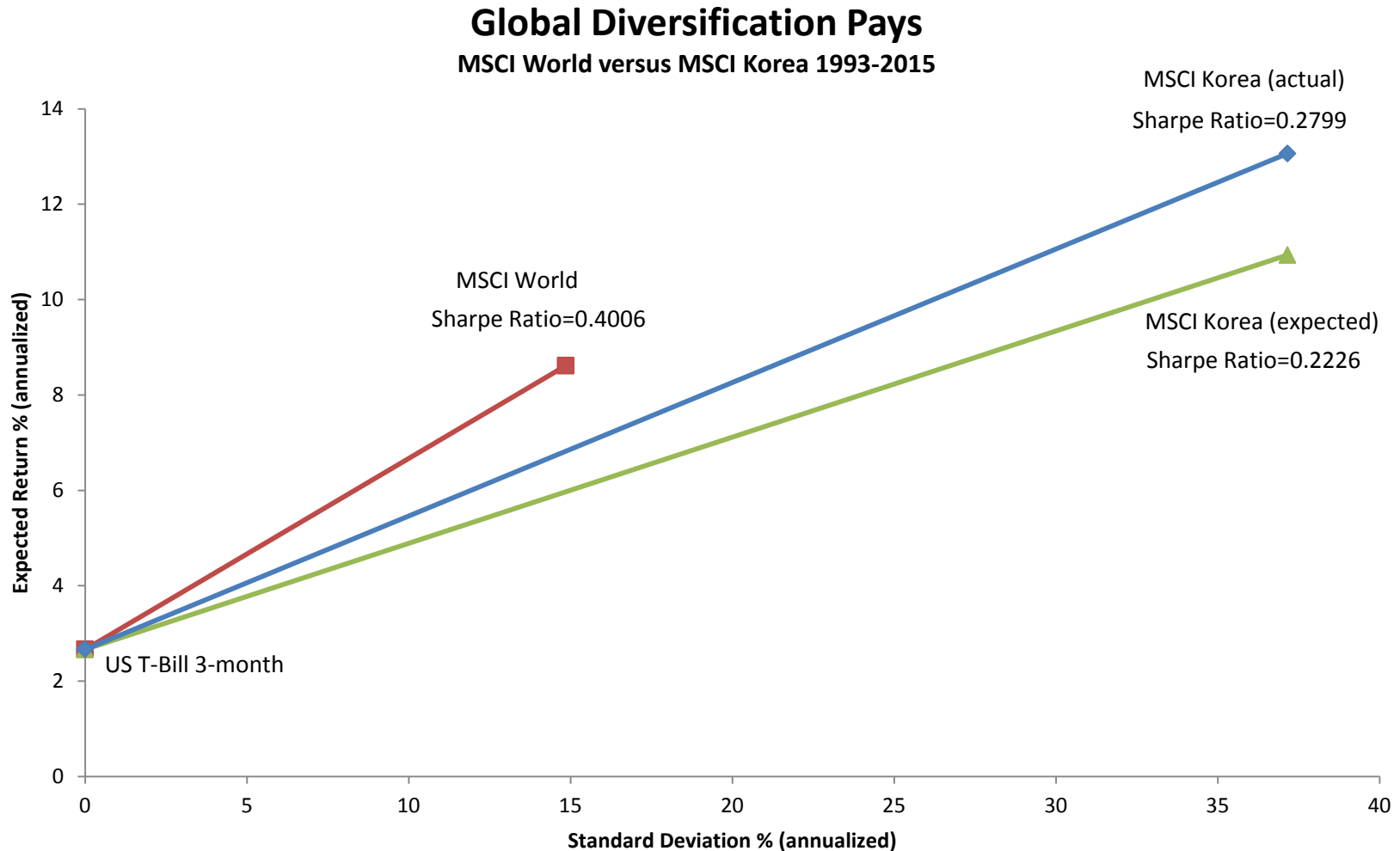
Global Diversification Pays

MSCI World versus MSCI Philippines 1993-2015



Global Diversification Pays

MSCI World versus MSCI Korea 1993-2015



Source: MSCI Korea total return index, MSCI World total return index, U.S. 3 month T-Bill rate, 1993-2015. Returns in USD. "Expected" = ex post 0-alpha, conditional on World realized return