International Equity & Bond Markets

(for private use, not to be posted/shared online)

• **Last Class – Several & Diverse Topics**

Country Risk (Continuation)

• Incorporation of CR into a firm's valuation of a project/investment.

• Some country ("Political") Risk can be hedged by buying insurance.

Topics in International Corporate Finance

- DFI: Why DFI instead of exports?

- Multinational Capital Budgeting. Follow standard NPV process, incorporating taxes (local and foreign) & exchange rates. Use discount rates specific to the (systematic) risk of the country. Agency Problems are addressed through simulations, sometimes based on previous experience

- Capital Structure & Cost of capital. Estimating ERPs is not easy. Many ad-hoc techniques to improve quality of ERP estimates.

- **This Class**
- International Equity Markets: Information, Valuation & Diversification.

- Returns in International Equity Markets
  - Huge dispersion in ERP across markets. Not easy to explain with existing models (CAPM, Fama-French Factors, etc.)
  - Many proposed factors to explain ERPs.

- International Bond Markets
  - ◊ Organization and Issuing Techniques
  - ◊ Different Instruments
  - ◊ Valuation
  - ◊ Examples

International Stock Markets: General Overview, Differences and Practical Aspects

- **Differences** (We'll skip this part)
  - Macrostructure
    - Liquidity
    - Taxes
    - Indexes
  - Microstructure
    - Organization
    - Trading Procedures

- **International Investing from Home** (We'll skip this part too)
  - Dual Listing: ADR (*American Depository Receipts*)
  - ETFs

Financial Analysis and Valuation

• **Nothing unique** to financial analysis in an international context.

Example: Methods & data required to analyze U.S.-, Mexican, or Malaysian-type manufacturers are the same. ¶

• But, the data (information) may be of poor quality or difficult to interpret.

• ***Information***
- Frequency of data
U.S.: Firms publish quarterly earnings.
Europe and Far East: Firms publish earnings once a year.

- Quality of the disclosed information
Varies from country to country. (Brokerage houses provide guides.)

• ***Comparative Analysis***.
Another difficult problem due to:
- Different accounting principles
- Different cultural, institutional and tax differences

Example: Swiss firms stretch the definition of a liability. They tend to overestimate contingent liabilities when compared to U.S. firms.

Example: German firms create hidden reserves often equal to 100% of fixed assets. Inventories tend to be understated.

Example: U.S. firms can used LIFO for inventory valuation, something not allowed in Europe. LIFO can distort (lower) net income when prices are increasing.

• ***Comparative Analysis – Accounting Standards***

• The lack of uniform accounting standards is costly.
- Banks & investors charge higher interest rates to companies that do not adjust follow U.S. (FASB) or International (IASB), standards.

- Many firms have low access to international capital markets, since their national accounting standards are opaque. Japan ranks below Spain & South Korea on access to international capital markets.

• Lang et al. (2009): In 21 EAFE markets, moving from the 25th to 75th transparency percentile is associated with a **40%** decrease in the median bid-ask and a **17%** reduction in the number of non-trading days.

• ***Convergence***

The dream of insurance companies, investors, bankers and regulators.

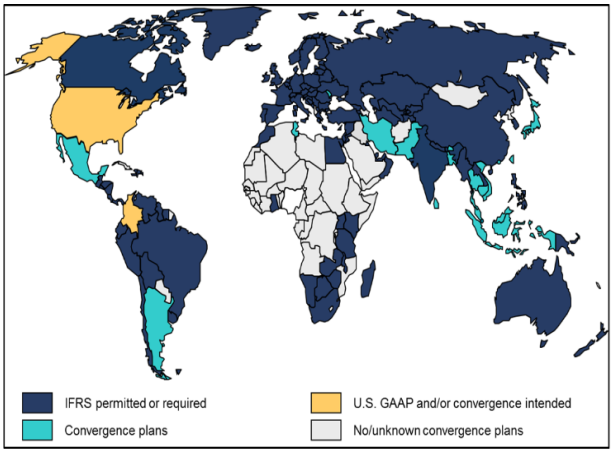
• Ongoing conversation about converging accounting standards between the International Accounting Standards Board (IASB), based in London, and the Financial Accounting Standards Board (FASB), based in the U.S.

The IASB sets and promotes the International Financial Reporting Standards (**IFRS**). The FASB caters to the development of **U.S. GAAP**.

IFRS is a more principles-based approach as opposed to GAAP, which is more rules-based. IFRS allows more flexibility (judgement, experience).

Most of the world follows IFRS. Seay (2014): "*The gold standard.*"

Changing accounting standards in the U.S. would be costly. Lin (2013) estimates that the **cost of a full switch** to be between **0.5%** to **1%** of annual revenues. ⇒ **USD 40-60 billion** for companies in the S&P 500.



Progress towards convergence has been done in many of those areas.

• Big remaining issue: Inventory valuation. US allows LIFO. Reed and Pence (2013), LIFO method is used by **36%** of companies.

• ***Company Valuation***

Companies are valued by discounting cash flows (DCF models).

Data needed for the DCF process:
- ◊ CFs to the firm.
- ◊ Expected growth from expansion.
- ◊ Discount rate.

In the usual DCF valuation process, risk is introduced through the discount rate ($k = r$).

We will discuss three company valuation methods:
(1) Dividend Discount Model (DDM)
(2) Discounting Free Cash Flows
(3) Valuation by PE Multiples

• ***Company Valuation*** **- (1) Discounted Dividend Model (DDM)**

DCF (NPV) models: The value of an asset is determined by discounting the stream of cash flows to the investor.

• DDM: Stock price (P) = Stream of discounted forecasted dividends (D).

$$P = \frac{D_1}{(1+r)} + \frac{D_2}{(1+r)^2} + \frac{D_3}{(1+r)^3} + \frac{D_4}{(1+r)^4} + \ldots$$

• Typical DDM approach: Decompose the future in 3 phases:

1) *Near future* (0 – 2 years): Earnings & D are forecasted individually.

2) *Second phase* (years 2 – 5): A general growth rate for the company's earnings & D is estimated. (revert to industry?)

3) *Third phase* (year 5+): A growth rate in earnings & D is supposed to revert to the average of all (similar) firms in the market.

• Note: $D_{\text{t-forecast}}$'s and P are known ⇒ Solve for the expected return (r).

Problems:

- Companies have discretion over their dividend payments.
  - International comparisons are difficult:
    Payout ratios vary: U.S. has a lower payout ratio than U.K.

- We need a model to calculate r. For example, the **CAPM**

$$E[r_i] = r_f + \beta_i \, E[\, r_m - r_f \,]$$

Once $E[r_i]$ is computed, for a given D, we can compute an "*equilibrium*" P.

Note: Also, once $E[r_i]$ is computed, for a given P, we can extract CF.

Company Valuation - (2) Discounting Free Cash Flows

Alternative method to the DDM: Discount free cash flows. The usual formula for calculating free cash flow is:

Free CF = EBITDA – Taxes – ΔWC – Capital Expenditures

Once Free CFs are calculated, they are discounted using the weighted-average cost of capital (WACC), k_c:

$$k_c = \frac{D}{D+E} * k_d * (1-t) + \frac{E}{D+E} * k_e$$

k_e: cost of equity (usually, risk-adjusted, based on a model, say CAPM).

k_d: before-tax cost of debt (usually, it is an interest rate or bond's YTM),

t: marginal tax rate,

E: Market value of the company's equity,

D: Market value of the company's debt

V: Market value of the firm (= E + D).

Company Valuation - (3) Valuation by Multiples (Relative Valuation)

Most popular method: Firms, bonds, etc. are value based on how similar firms/bonds/etc. are priced.

Relative valuation is done using *multiples* for "*comparable firms*." We say firm A is cheap if it trades at 5 times earnings when comparable firms B & C trading at 20 times earnings.

Usual multiples: Earnings, Book Value, Sales, Sector specific units (original visitors at internet sites, subscribers, members), etc.

Key: Defining comparable firms.

Usual definition of *comparable*: Similar CFs, growth potential, & risk.

Note: Since not two firms are the same, ad-hoc adjustments are common.

Company Valuation - (3) Valuation by Multiples (Relative Valuation)

We derive an "equilibrium (P/E) multiple" by deriving a fair (*steady state*) value for a company. We use a simple DCF model.

Calculation of fair value for firm/asset j needs:

1) Discount Rate for firm/asset j (r_j):

r_j = bond yields (**risk-free**) + **risk premium** for firm/asset j.

Example: For well-established markets, **real bond yields** are about **3%**.
No consensus about the **risk premium**: From **0%** to **12%**.

2) Cash flows for firm/asset j.

We discount free cash flows, measured by **Earnings** (=E):

E = After interest, tax & capex, but before depreciation and amortization.

Adjustments to E: Firms re-invest earnings to replace assets & to expand.

Company Valuation - (3) Valuation by Multiples (Relative Valuation)

Assumptions:

(A) Two downward adjustments (**1/3** of earnings, E):

(1) Cost of replacing worn-out assets is higher than original (10%)

(2) Companies invest also to expand (≈ 25%).

(B) Earnings grow at rate g.

- Now, we can calculate fair value stock prices, P:

$$P = \frac{CF_1}{(1+r)} + \frac{CF_2}{(1+r)^2} + \frac{CF_3}{(1+r)^3} + \ldots$$

where $CF_t = 2/3\ E_t$

$E_t = E * (1+g)^t$

$$\Rightarrow P = \frac{2}{3}E * \frac{(1+g)}{(1+r)} + \frac{2}{3}E * \frac{(1+g)^2}{(1+r)^2} + \frac{2}{3}E * \frac{(1+g)^3}{(1+r)^3} + \ldots$$

This formula simplifies to: $$P = \frac{\frac{2}{3}E * [\frac{1+g}{1+r}]}{1-[\frac{1+g}{1+r}]} = \frac{\frac{2}{3}E * (1+g)}{(r-g)}$$

• Now, we apply valuation by P/E multiple to the overall market.

Assumptions:

(1) E = Corporate Earnings (Recall, CF_t = **2/3** E_t)

(2) Corporate earnings (E) grow at the rate of the economy –i.e., trend economic growth.

Example: It is 2022. Calculating the steady state P/E for the US market.

Data:

(1) Long term, real economic trend growth (**g**) is **2.5%** a year.

(2) Real bond yield is **3%**. (= r_f)

(3) Risk premium is **3%**. (≈ β E[$r_m - r_f$], using CAPM)

From (2) and (3) ⇒ r = discount rate = **3%** + **3%** = **6%**.

$$\Rightarrow P = \frac{2/3\ E * (1 + \mathbf{g})}{(\mathbf{r} - \mathbf{g})} \quad \Rightarrow P/E = \frac{2/3 * 1.\mathbf{025}}{(.\mathbf{06} - .\mathbf{025})} = 19.52$$

Example (continuation):

P/E = **19.52** < P/E_{SP500} (trailing) = **27.4** (March 2023) ⇒ Over-valued?

Note: The generated equilibrium PE is similar to the average PE of past 70+ years, 1950-2023, which is **19.60**. ¶

Statistical remark: Beware of "*Over-valued*" or "*Under-valued*" statements. In practice, we need to take into account that the estimated average PE is a "point estimate," which has a S.E. Then, a confidence interval is statistically needed to say over-valued or under-valued!

Example: To reduce, correlation in the data, we use quarterly Pes. Assume quarterly changes follow a Normal distribution. Data:

μ = Quarterly mean = **0.0010** ≈ -0.12%

σ = Quarterly SD = **0.1126** (11.26%)

95% CI(95%) for PE changes: [**0.0010** ± **1.96** * **0.1126**] = [**-0.2219**; **0.2217**].

⇒ PE's range ≈ **19.60** * [1 ± **22%**] ⇒ At **27.4**, U.S. over-valued.¶

Problem: Global economy is not in a **steady state**. Growth rates change over time.

Example: When countries are in the advanced stages of the business cycle, wages rise at a faster pace. P/E ratios have to be **adjusted**.

Example: Ad-hoc adjustments.

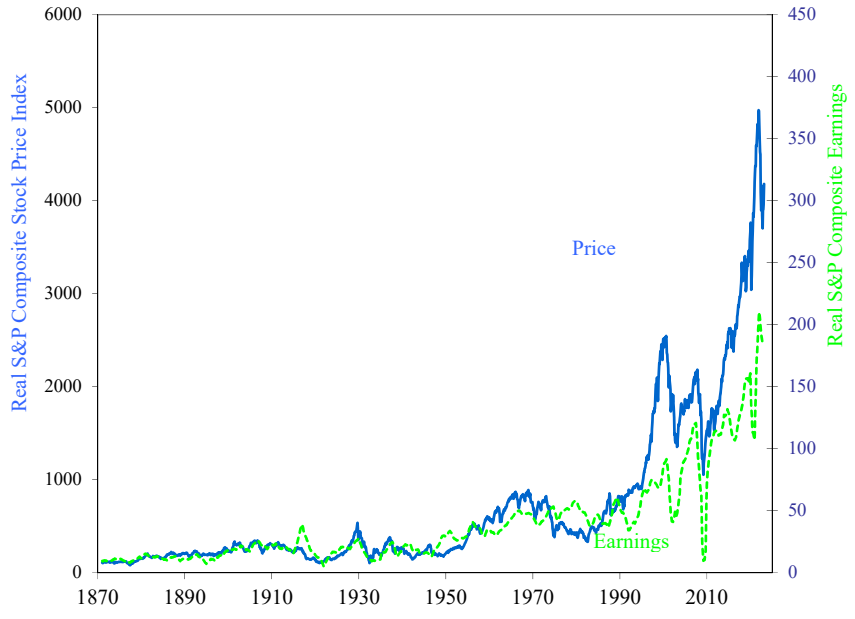
U.S. economy: Late stages of the business cycle.

⇒ Adjust steady state P/E by .80.

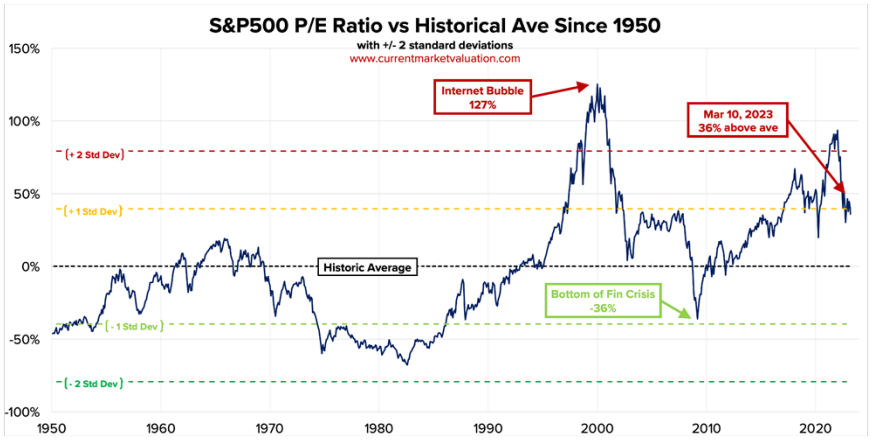
Asian Pacific Countries: room for improving the efficiency of firms.

⇒ Adjust steady state P/E by 1.10. ¶

• PE Values for S&P Index



• PE Values for S&P Index

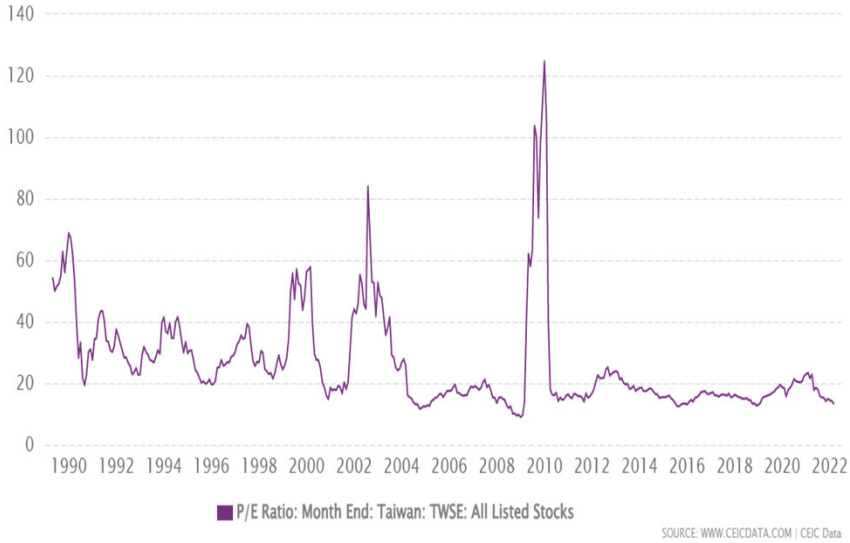


Data: Average (1871-2022) P/E = **15.98**
Average (1950-2023) P/E = **19.60** ("Historic Average")
PE Ratio (2023: March) = **27.4** ⇒ P/E is 36% higher.

• PE Values for UK FTSE All-Share Index

Data: P/E for FTSE All Shares (March 2023) = **14.42** ≈ Average P/E = **15**.

• PE Values for Taiwan FTSE All Listed Stocks (TAIEX) Index

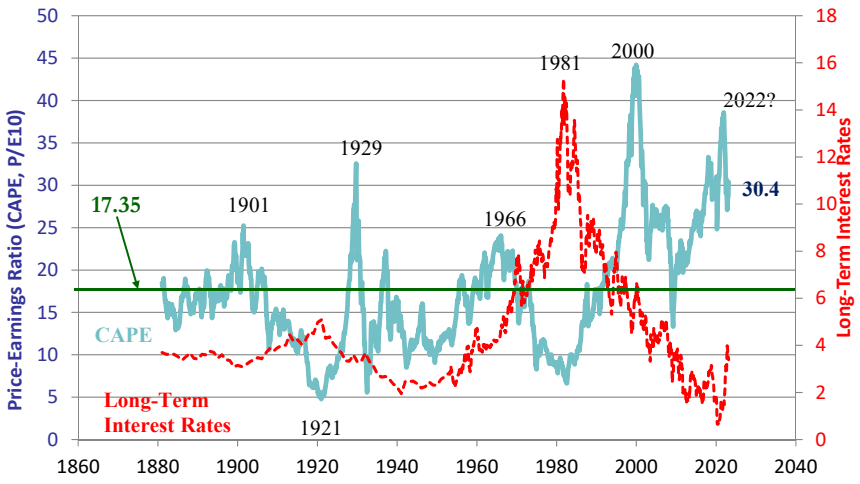


Data: P/E for TAIEX (March 2023) = **11.23** < Average P/E = **16.5.**

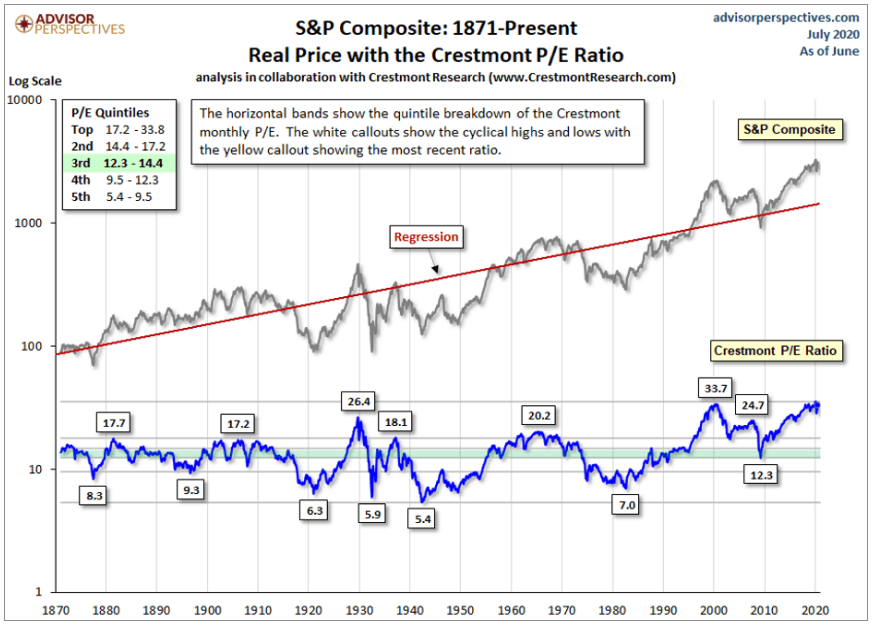
• Adjusted PE Values: CAPE (for S&P Index)

CAPE.: Schiller's Cyclically *Adjusted* PE (Average 1870:Jan-2023:Feb: **17.35**)

Adjusted PE: Price divided by the last 10-year Earnings Average



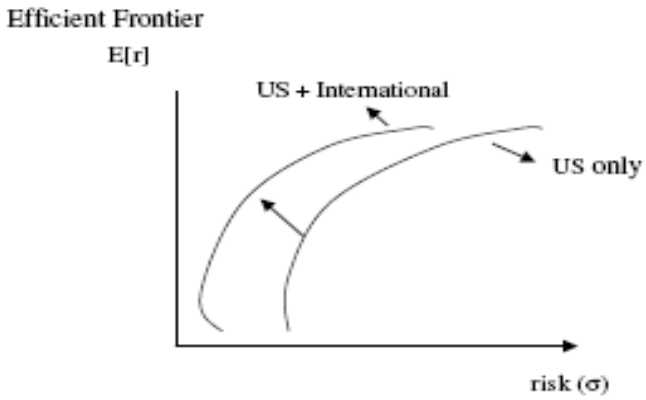
• Adjusted PE Values: Trend Adjustment (for S&P Index)



Why Go International?

• **Diversification**

If it is good to diversify in domestic markets, it is even **better** to diversify internationally.



Q: Why does the frontier move in the NW direction?

A: **Low Correlations**!

• *Empirical Fact #1: Low Correlations*

Correlations across national markets are **lower** than the correlations across securities in most domestic markets. Average is close to **0.40.**

Return correlations are **moderate to low** (many lower than .50).

There is a **regional effect**:

Correlations between neighboring markets tend to be higher:
Correlation between the US and Canada is **.74**; US and Japan is **.38.**
(Data: 1970-2020).

TABLE X.1

MSCI Indexes: Correlation Matrix (1970-2020)

A. European Markets

MARKET	Bel	Den	France	Gerrn	Italy	Neth	Spain	Swed	Switz	U.K.	Wrld
Belgium	1.00	0.59	0.72	0.70	0.54	0.75	0.57	0.55	0.68	0.60	0.70
Denmark		1.00	0.54	0.59	0.48	0.64	0.51	0.55	0.56	0.50	0.61
France			1.00	0.74	0.60	0.74	0.60	0.58	0.68	0.64	0.73
Germany				1.00	0.57	0.78	0.60	0.65	0.73	0.55	072
Italy					1.00	0.56	0.59	0.51	0.49	0.47	0.58
Netherlands						1.00	0.59	0.63	0.75	0.69	0.81
Spain							1.00	0.57	0.51	0.49	0.64
Sweden								1.00	0.58	0.53	0.70
Switzerland									1.00	0.63	0.72
U.K.										1.00	0.74
World											1.00

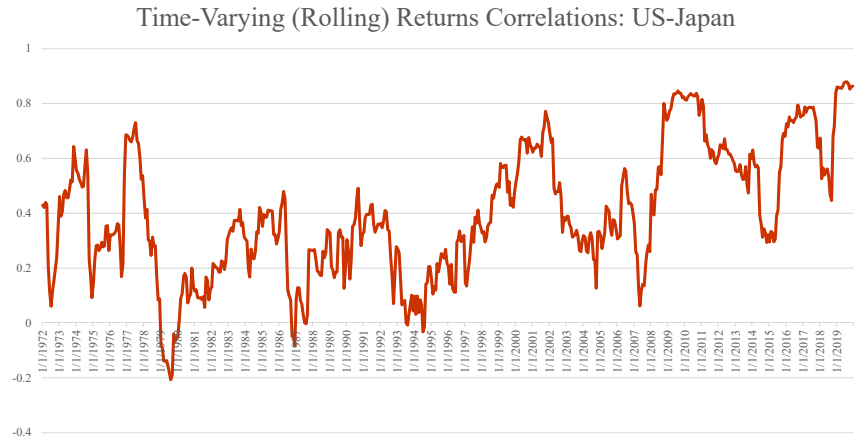
International returns correlations tend to be moderate: Average of 0.40 (Table X.1). Neighboring countries show higher numbers (Europe: 0.56)

• *Empirical fact 2: Correlations are time-varying*

International **correlations change over time**.

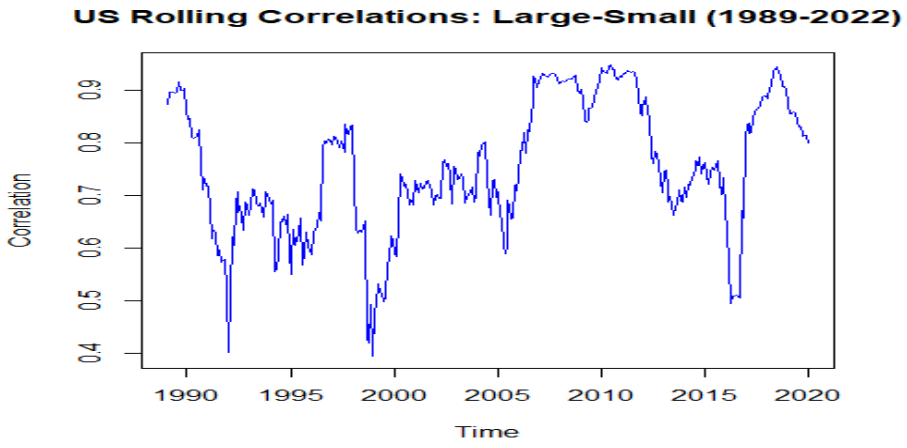
General finding: During bad global times, correlations go up

⇒ When you need diversification, you tend not to have it!



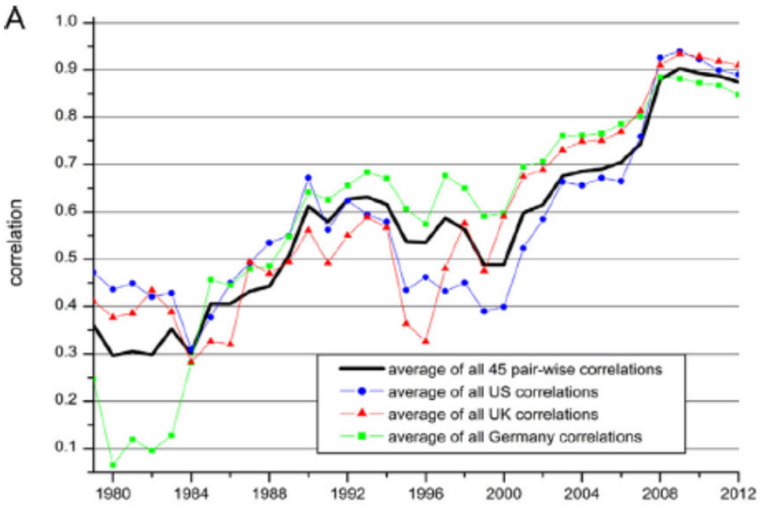
• *Empirical fact 2: Correlations are time-varying*

Correlations **change over time**: Also between U.S. stocks, but not as much as international correlations, as shown below with 24-mo rolling correlations between **S&P 100** (Large) & **S&P 600** (Small) returns. Average correlation: **0.75**.



• *Empirical fact 2: Correlations are time-varying*

Correlations change over time: For U.K. stocks, German stocks & average for 10 developed countries (solid line). And they are increasing!

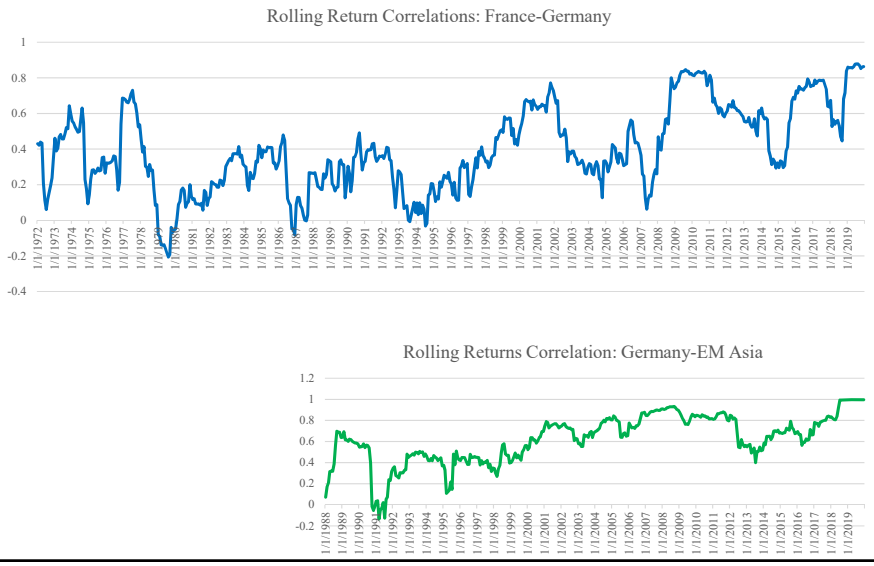


JPMorgan calls this the "*Correlation Bubble*"

• *Empirical fact 2-A: Correlations seem to be increasing*

Correlations have increased over the last **20 years**.

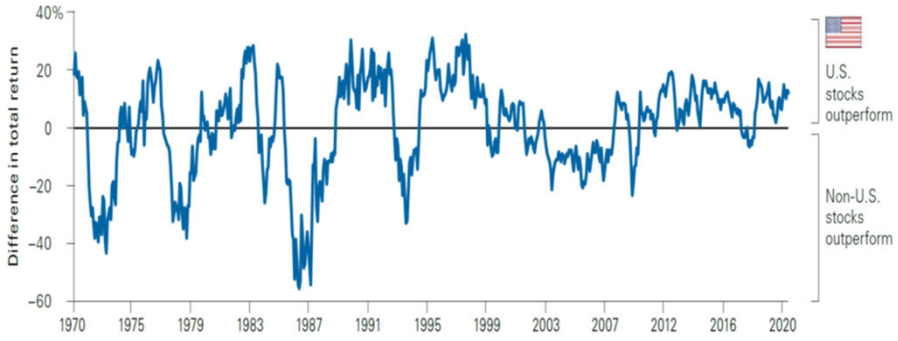
- Germany and France have become the *same* asset!



• *Empirical fact 2-A: Correlations seem to be increasing*

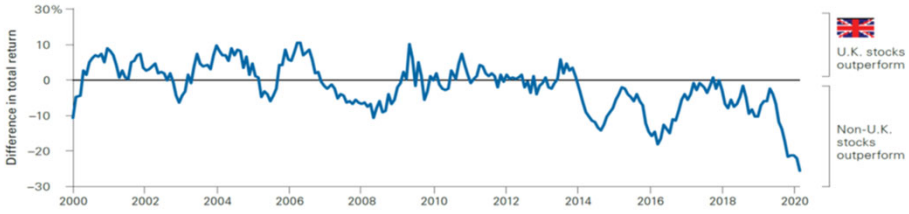
Increased correlations point out to lower benefits of international diversification. But, international markets are still not a single market. However, investors still are able to take advantage of outperforming regional markets.

Figure 6. Trailing 12-month return differential between U.S. and non-U.S. stocks



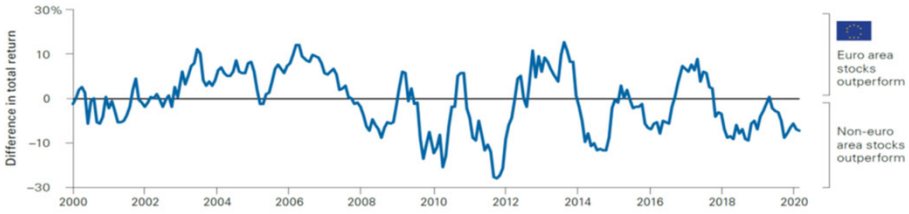
• *Empirical fact 2-A: Correlations seem to be increasing*

a. Trailing 12-month return differential between U.K. and non-U.K. stocks



Notes: Data are as of September 30, 2020, for the period from October 1, 1999, to September 30, 2020. U.K. equities are represented by the MSCI UK Investable Market Index; non-U.K. equities are represented by the MSCI All Country World ex UK Index.
Sources: Vanguard calculations, based on data from MSCI and FactSet.

b. Trailing 12-month return differential between euro area and non-euro area stocks



• *Empirical Fact 3: Risk Reduction*

Past 12 stocks, the risk in a U.S. domestic portfolio levels off, around **20%**. (large caps only, **17%**; small caps only **25%**). For international stocks, the risk levels off at **12%**.

Figure 13.1: Effect of International Investment on Risk

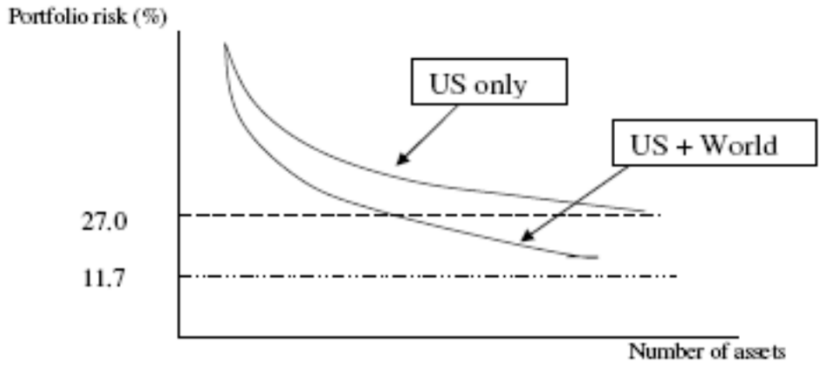


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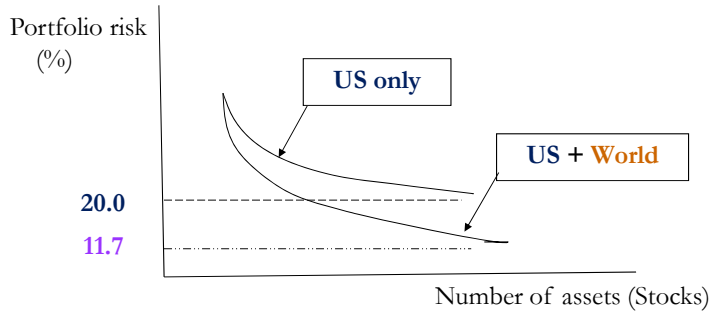
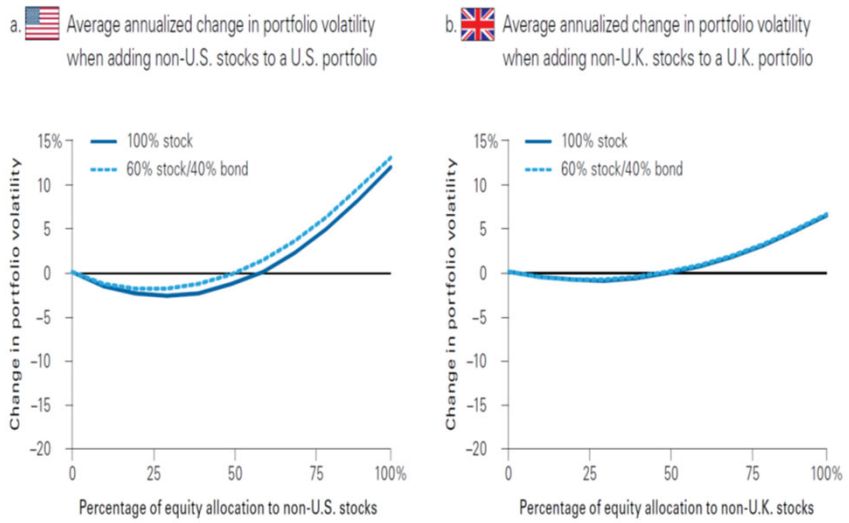
Figure: Asymptotic Risk Reduction and Number of Stocks



• *Empirical Fact 3: Risk Reduction*

As expected, diversification improves the volatility of a purely domestic portfolio. Below, (simulated) data from Vanguard (**2021**).



• *Empirical Fact 4: Returns Increase*

Portfolios with international stocks have outperformed domestic portfolios in the past years. About 1% difference.

Q: **Free lunch**?

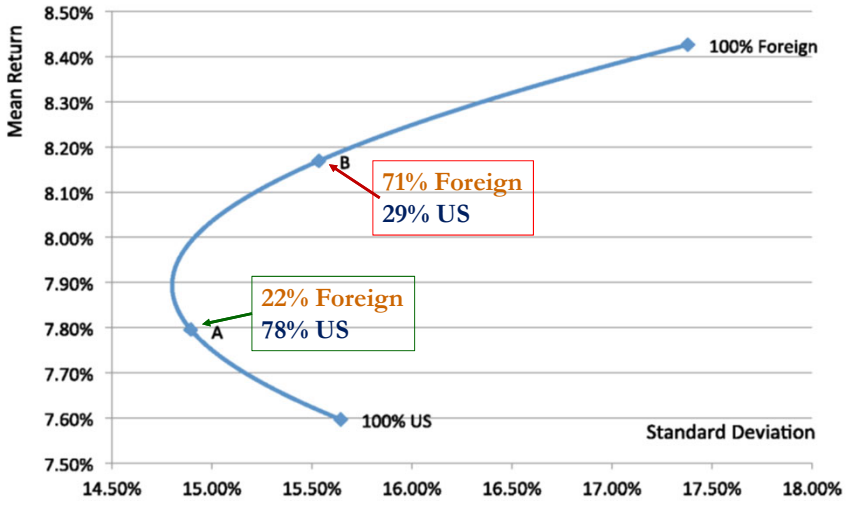
A: In the equity markets: **Yes!** Higher return (1% more), lower risks (2% less).

Q: How to take advantage of facts 2 & 3?

A: True diversification: **invest internationally**.

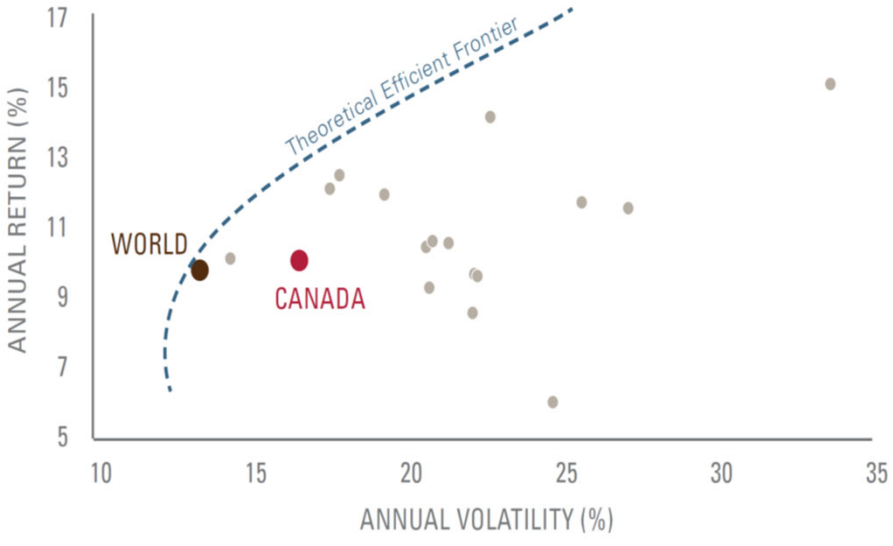
Example: Lower Risk/Higher Returns!

Efficient frontier taken from Copper et al (2012) "The Equity Home Bias Puzzle: A Survey." Data from **1970** - **2011**.



Example: Lower Risk/Higher Returns!

Taken from Vanguard "Home Bias and the Canadian Investor (**2015**)."



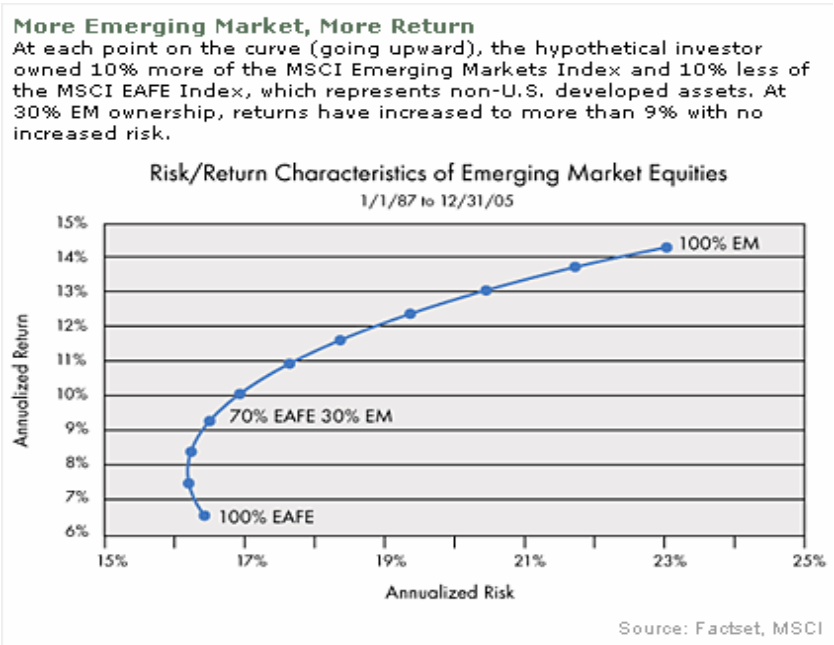
Example: Higher Returns - The Case of Emerging Markets (EM)

Annualized USD Returns (1987+ – 2021)

Country	Return	Stand Dev	Sharpe Ratio	Beta
Brazil	0.2223	0.4767	0.3722	1.4984
Russia	0.2109	0.4754	0.3491	1.7496
India	0.1210	0.2835	0.2682	0.9916
China	0.0490	0.3194	0.0129	1.0623
EM-Latam	0.14687	0.3022	0.3374	1.2494
US	0.0886	0.1523	0.2866	0.9210
EAFE	0.0781	0.1676	0.1981	1.0331
World (Ex-US)	0.0808	0.1475	0.2429	0.9984

Typical trade-off in BRICs: High risk, high return.

Example: Lower Risk/Higher Returns II -The Case of EM



• *Empirical Fact 5: Investors do not diversify enough*

Domestic investors tend to invest **at home**. A **2002** UBS survey shows the most internationally diversified investors were Netherlands (**62%**), Japan (**27%**) & the U.K. (**25%**).

⇒ The U.S. ranked at the bottom of list: only **11%**.

• Coeurdacier & Rey (**2013**) report the share of portfolio invested abroad for many countries, including **EM**, which tend to invest more domestically: South Africa (**12.2%**), Brazil (**1.4%**), China (**0.8%**).

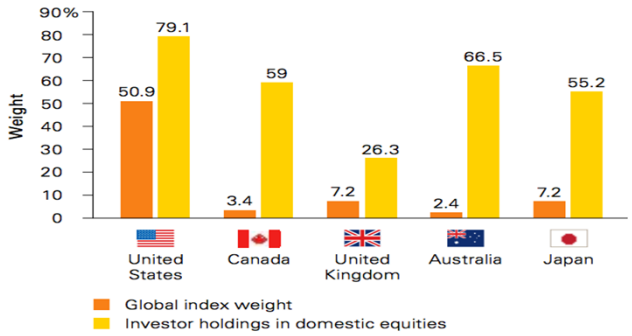
• This empirical fact is called the **Equity Home Bias**. Sometimes it is called the "*Equity Home Bias Puzzle*," since according to models like the CAPM investors should hold world market portfolios.

For example, if the share of U.S. equity in the world capitalization is **56%** (**Jan 2021**), then U.S. investors should invest **44% abroad**.

• *Empirical Fact 5: Investors do not diversify enough*

Things have improved in the past **20 years**. But, still the Home Bias seems significant. In **2016**, the U.S. still only invested **20.9% abroad**.

Figure 5. Equity market home bias by country

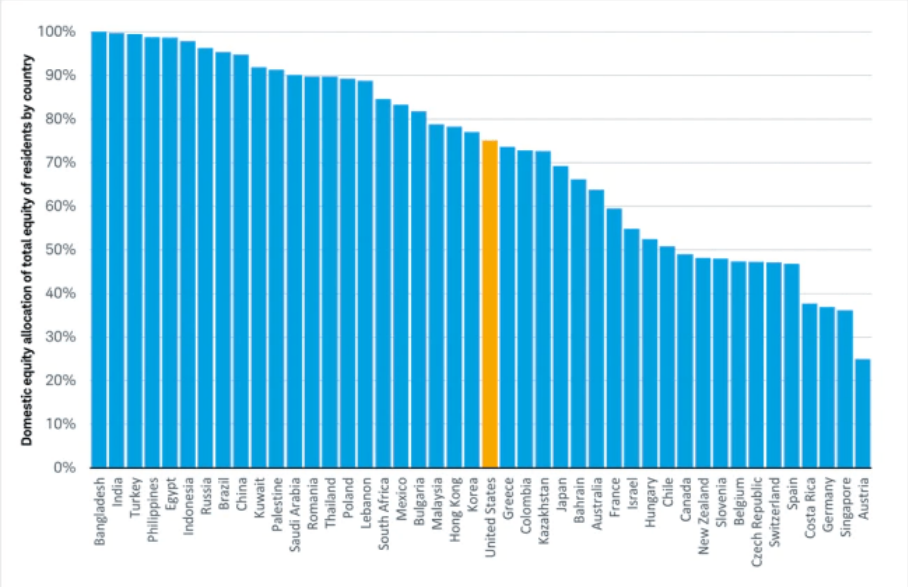


Note: The Global Index weight is the MSCI World Index.

• Goldman Sachs (**2021**) reports its U.S. clients have only **27%** invested abroad.

• *Empirical Fact 5: Investors do not diversify enough*

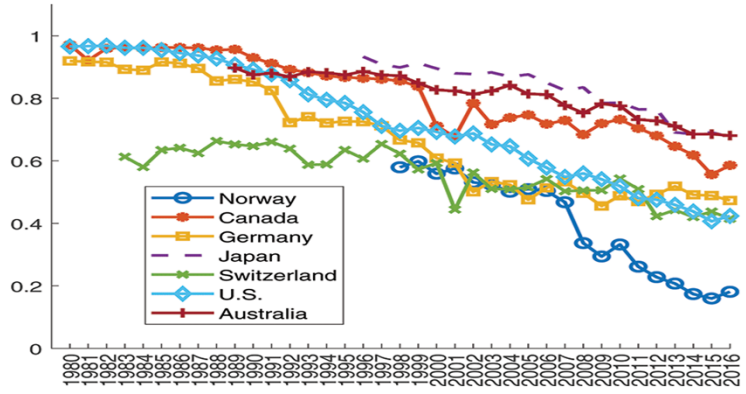
Big distribution in Home Bias (Schwab, **2021**).



• *Empirical Fact 5: Investors do not diversify enough*

A popular measure for the "Equity Home Bias" (EHB) is:

$$EHB_i = 1 - \frac{\text{Share of Foreign Equities in Country } i \text{ Equity Holdings}}{\text{Share of Foreign Equities in World Market Holdings}}$$



• *Empirical Fact 5: Investors do not diversify enough*

• Proposed explanations for home bias and low correlations:

(1) Currency risk.

(2) Information costs.

(3) Controls to the free flow of capital.

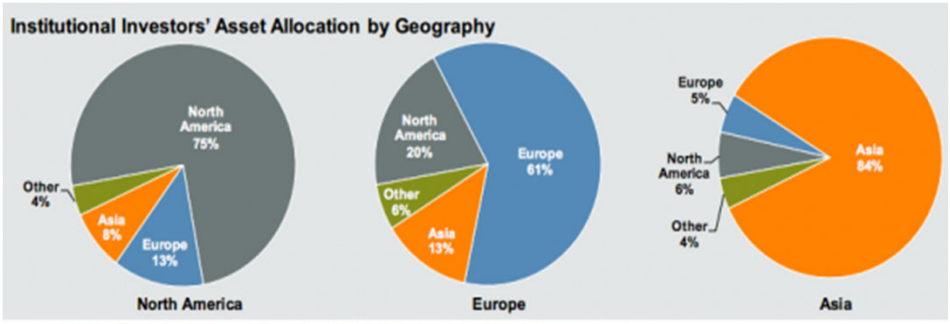
(4) Country or political risk.

(5) Behavioral issues (Cognitive bias, Aversion to *regret*).

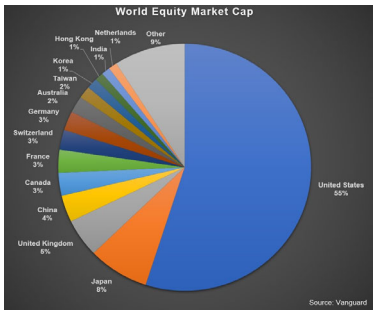
Increased correlations have also been mentioned. Levy and Levy (2014) relate the size of EHB to the **correlation** of country *i* and the world, ρ:

EHB magnifier$_i$ = ρ_i /(1 - ρ_i) ⇒ Higher ρ_i, higher EHB

• Home bias everywhere: Even for Institutional investors (**2013 data**)

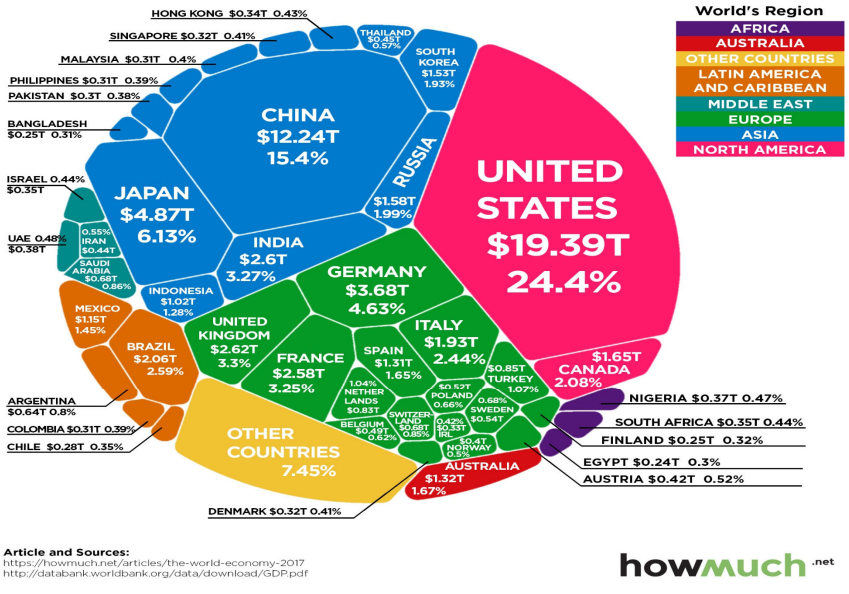


Source: Ipreo, BNY Mellon, McKinsey Global Institute, J.P. Morgan Asset Management "Guide to the Markets – Asia."



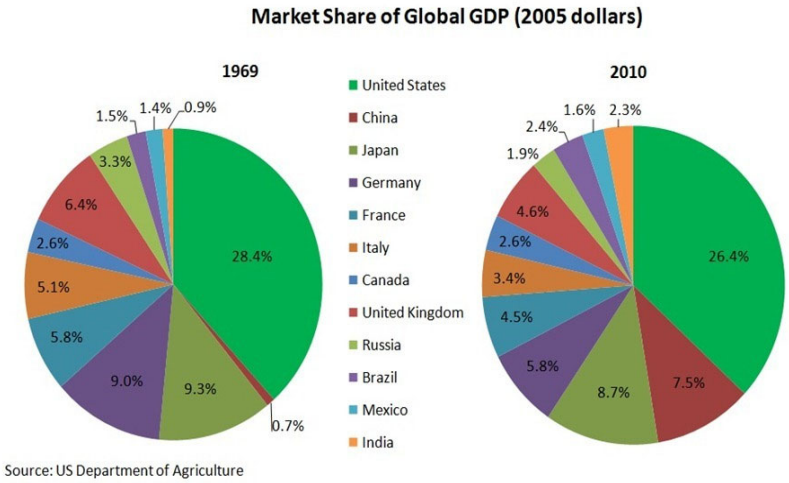
Related Question: What should be your international exposure?

- GDP weighted? ⇒ Exposure to US: ≈ 25% (2018)



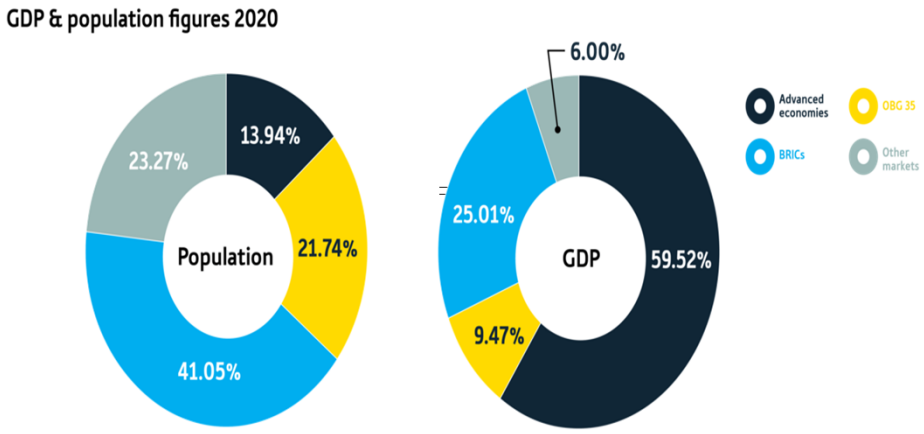
Related Question: What should be your international exposure?

- GDP weights change over time ⇒ China from **0.7%** to **15%**



Related Question: What should be your international exposure?

- Emerging Markets growing over time. Now, **40+%** of World GDP (in PPP terms is over 50%). Source: Oxford Business Group, **2021**.



Explaining International Stock Returns

Risk-Return in International Markets

No agreement on an equity risk premium (ERP) for developed markets. We do observe, as expected, **high risk** is correlated with **high return**. Table below shows returns from **1993-2021**:

Market	Return	Stand Dev	Sharpe Ratio
EM-Asia	0.0859	0.2816	**0.0620**
EM-Latin America	0.0718	0.2343	**0.0625**
Brazil	0.1506	0.3759	**0.0959**
Russia	0.2109	0.4754	**0.1194**
India	0.1210	0.2835	**0.1198**
China	0.0490	0.3194	**0.0440**
U.S.	0.0985	0.1471	**0.1021**
Japan	0.0363	0.1785	**0.0407**
World	0.0782	0.1477	**0.0761**
EAFE	0.0546	0.1612	**0.0503**

Moments in International Markets

Higher moments also matter. Association with risk:

- Standard deviation ⇒ Volatility risk
- Skewness ⇒ Crash risk
- Kurtosis ⇒ Tail risk

Evidence: Domestic **stock traders** are **compensated** when their cross-sectional domestic indices/stock portfolio returns have **high volatility**, **low skewness**, or **high kurtosis**.

Shu-Hsiu Chen (2018) finds similar results in international markets.

Moments in International Markets: **2007 – 2016** from Chen (2018)

Country	Monthly Return	Implied Volatility	Implied Skewness	Implied Kurtosis
Euro Area	0.0003	0.1057	-0.9016	6.6929
Germany	0.0043	0.1669	-0.8655	7.2734
France	0.0019	0.1493	-2.0033	11.4318
Italy	**-0.0029**	**0.2463**	**-2.5396**	**15.1776**
UK	0.0001	0.2136	-1.5305	10.4403
Australia	0.0031	0.1935	-1.1564	7.8827
Switzerland	0.0035	0.1103	-1.0811	9.1301
Japan	0.0017	0.1894	-3.1633	31.4871
Sweden	0.0040	0.1460	-1.1022	7.4215
Spain	0.0003	0.1467	-0.6460	5.8272
Canada	0.0030	0.1402	-1.2425	8.3353
Brazil	0.0045	0.1846	-0.6298	6.5996
Mexico	0.0024	0.1575	-0.3518	4.1037
Korea	0.0067	0.1679	-0.2389	3.3512
Singapore	0.0042	0.2850	-2.5537	16.7907
Malaysia	0.0038	0.2271	-1.8902	13.3735
Taiwan	0.0044	0.1880	-2.0633	17.7618
Hong Kong	**0.0064**	**0.1687**	**-1.5824**	**11.8461**
US	**0.0058**	**0.1936**	**-0.6456**	**9.8318**

CAPM in International Markets

There is a **wide dispersion** in returns in international markets (**1993-2018**), which the traditional CAPM (**ß**) cannot explain. Recall CAPM:

$(r_i - r_f) = \alpha_i + \beta_i\,(r_m - r_f) + \varepsilon_i$. (Testing CAPM – H_0: $\alpha_i = 0$)

Market	Return	Std Dev	Beta (ß)	Alpha (α_i)
Brazil	16.01	37.50	**1.5432**	**0.0749**
China	4.03	32.90	**1.6062**	**-0.0288**
Greece	-0.18	35.52	**1.4449**	**-0.0988**
India	11.26	28.70	**0.9961**	**0.0490**
Malaysia	5.94	27.43	**0.8267**	**0.0026**
Mexico	8.98	27.80	**1.2426**	**0.0166**
Pakistan	4.71	34.57	**0.4099**	**0.0068**
Poland	17.29	44.20	**1.5954**	**0.0856**
Russia	21.44	49.22	**1.8144**	**0.1185**
South Africa	9.65	26.17	**1.1541**	**0.0267**
U.S.	8.14	14.29	**0.9295**	**0.0205**
World (Market)	6.37	14.42	**1**	-
EAFE	4.59	15.96	**1.0521**	**-0.01984**

CAPM in International Markets

• Recall the CAPM: $E[r_i - r_f] \approx$ ß $E[r_m - r_f]$

Market	Return	SD	Beta (ß)	Alpha (α_i)
Brazil	**16.01**	**37.50**	**1.5432**	**0.0749**
World (Market)	**6.37**	14.42	**1**	-

• Calculations for Brazil, with r_f = **0.02416**

$\Rightarrow E[r_{i=Bra} - r_f] \approx$ **1.5432** * (**0.0637** – **0.02416**) = **0.06102**

α_i = **0.1601** – [**0.02416** + **0.06102**]= **0.0749**

Note: α_i represents the excess return (over expected CAPM). That is, according to CAPM, Brazil **overperformed**!

Q: Given the noisy data, is $\alpha_i \neq 0$ (statistically speaking)?

Noisy data: Large S.E. (& imprecise estimation) $\Rightarrow$ S.E. = SD/sqrt(*T*)

$S.E._{Bra}$ = **37.50**/sqrt(25) = **7.5%** ($\approx \alpha_{Bra}$).

$\Rightarrow$ 95% C.I.: [**16.01** – 1.96 * **7.5** ; **16.01** + 1.96 * **7.5**] = [**1.31%**; **30.71%**]

CAPM in International Markets

• Difficult to test asset pricing models with such a **noisy data**. In general, we **use portfolios** to test models (CAPM, FF).

For example, we form ("**sort**") portfolios based on Beta, Size, BM. Why? Portfolios help to increase the **precision** in the estimation (& reduce S.E.)

• Then, we tests the CAPM (or the Fama-French 3-factor model) using these sorted portfolios. Usual finding: Alpha is significant.

• Usual response to significant alphas: The CAPM is a *misspecified* model – i.e., alpha is capturing **missing risk factors** (for example, **HML** & **SMB**).

Risk-Return in International Markets

Usual response: The CAPM is **misspecified** –i.e., alpha is capturing missing risk factors.

Several papers try to explain these differences, among them:

◊ Global economic risks	– Ferson and Harvey (1994).
◊ Currency risk	– Dumas and Solnik (1995).
◊ Inflation risk	– Chaieb and Errunza (2007).
◊ Momentum & global CF/P factors	– Hou, Karolyi and Kho (2011).
◊ Liquidity risk	– Karolyi, Lee & van Dijk (2012), Malkhozov, et al. (2014).
◊ Investment restrictions	– Karolyi and Wu (2014).
◊ Regional Factors (Market & HML)	– Fama & French (2015).

• Not a trivial matter: We use risk-return models to estimate the cost of equity (k_e) and the cost of capital (k_c).

- **Q: What kind of factors explain security returns?**
  - (1) International
  - (2) Domestic
  - (3) Industrial

Domestic vs. International Factors

- To determine the relative importance of factors, we separately correlate each individual stock with:

i. World stock index (⇐ *international* factor)
ii. Appropriate industrial sector index (⇐ *international* factor)
iii. Currency movement (⇐ *international* factor)
iv. Appropriate national market index (⇐ *domestic* factor)

And compare with all factors together. (⇐ *joint 4*-factor model)

Example: Regress each individual stock against each factor & get its R^2 ⇒ Average R^2

	Single-Factor Model				All Factors
Market	**World**	**Indust**	**Curren**	**Domestic**	
Belgium	.07	.08	.00	.42	.43
Germany	.08	.10	.00	.41	.42
Norway	.17	.28	.00	.84	.85
Spain	.22	.03	.00	.45	.45
Sweden	.19	.06	.01	.42	.43
France	.13	.08	.01	.45	.60
Italy	.05	.03	.00	.35	.35
Netherlands	.12	.07	.01	.34	.31
U.K.	.20	.17	.01	.53	.55
U.S.	.26	.47	.01	.35	.55
Canada	.27	.24	.07	.45	.48
Australia	.24	.26	.01	.72	.72
Hong Kong	.06	.25	.17	.79	.81
Japan	.09	.16	.01	.26	.33
Singapore	.16	.15	.02	.32	.33
All	**.18**	**.23**	**.01**	**.42**	**.46**

⇒ **Domestic factors** are the most important.
Currency factor almost negligible (hedging adds value?)

Fama-French Regional Factors in International Markets

Fama-French (2012) tested their 3-factor model using Global factors: Global Market ($r_{m=W} - r_f$); Global SMB; & Global HML.

Finding: 3-factor global model **does not explain** international returns.

• Fama-French (2015) tested a *regional* 5-factor model, adding to the 3 standard factors (Market; SMB; & HML) a profitability factor (*RMW:* robust minus weak **operating profitability**, OP); and an investment or style factor (*CMA:* conservative minus aggressive **investments**).

The regional model should explain returns of firm j in market i (i= North America, Europe, Japan, Asia-Pacific):

$r_{it} - r_{ft} = \alpha_i + ß_1\ Mkt_{it} + ß_2\ SMB_{it} + ß_3\ HML_{it} + ß_4\ RMW_{it} + ß_4\ CMA_{it} + \varepsilon_{it}$.

Fama-French test the model using sorted portfolios (based on size, BM, OP and CMA).

CAPM, 3- & 5-Factor Regional Factor Models: Test Model - H_0: α_i=0

From Sundqvist (2017, for Nordic stock data) – Sorts by Size-B/M (**16 portfolios**: Smallest & Lowest BM; Small 2 & Low BM 2; etc.):

CAPM

α	Low	2	3	High
Small	0.17	0.15	0.17	0.15
2	-0.39	0.32	0.27	0.13
3	-0.04	0.55	0.50	0.51
Big	-0.27	0.28	0.59	0.64

$t(\alpha)$	Low	2	3	High
Small	0.41	0.55	0.76	0.59
2	-1.17	1.18	1.07	0.49
3	-0.15	**2.22**	1.88	1.65
Big	-1.51	1.36	**2.23**	**2.10**

R^2	Low	2	3	High
Small	0.45	0.49	0.38	0.32
2	0.61	0.51	0.44	0.44
3	0.73	0.58	0.52	0.42
Big	0.87	0.70	0.57	0.54

3-Factor Model

	Low	2	3	High
Small	0.61	0.17	0.12	-0.04
2	-0.03	0.25	0.11	-0.17
3	0.09	0.40	0.30	0.19
Big	-0.03	0.05	0.17	0.11

	Low	2	3	High
Small	1.85	0.80	0.64	-0.23
2	-0.12	1.28	0.60	-1.16
3	0.41	**1.97**	1.44	0.86
Big	-0.24	0.29	0.90	0.53

	Low	2	3	High
Small	0.68	0.68	0.58	0.71
2	0.79	0.76	0.73	0.84
3	0.78	0.73	0.72	0.71
Big	0.94	0.77	0.79	0.78

5-Factor Model

	Low	2	3	High
Small	0.60	0.36	0.22	0.09
2	0.12	0.45	0.18	-0.04
3	0.26	0.46	0.44	0.35
Big	0.02	0.18	0.22	0.18

	Low	2	3	High
Small	1.78	1.70	1.17	0.52
2	0.58	**2.73**	1.09	-0.29
3	1.22	**2.36**	**2.17**	1.70
Big	0.12	1.02	1.16	0.87

	Low	2	3	High
Small	0.69	0.72	0.62	0.74
2	0.86	0.84	0.77	0.87
3	0.83	0.77	0.75	0.76
Big	0.94	0.81	0.80	0.82

Tests results: 3-factor model only one α_i different from 0. Not bad!

CAPM, 3- & 5-Factor Factor Models: Test Model - H_0: α_i=0

From Sundqvist (2017, for Nordic stock data) – Sorts by Size-OP.

	α				$t(\alpha)$				R^2			
CAPM												
	Low	2	3	High	Low	2	3	High	Low	2	3	High
Small	-0.40	0.28	0.84	0.62	-1.36	1.26	**3.67**	**2.25**	0.45	0.38	0.36	0.42
2	-0.73	0.19	0.50	0.61	**-2.16**	0.82	**2.02**	**2.50**	0.54	0.53	0.51	0.54
3	-0.19	0.51	0.43	0.45	-0.58	**2.12**	1.78	1.88	0.54	0.57	0.56	0.67
Big	0.48	0.11	-0.11	0.07	0.93	0.48	-0.54	0.37	0.45	0.68	0.80	0.86
3-Factor Model												
	Low	2	3	High	Low	2	3	High	Low	2	3	High
Small	-0.31	0.18	0.67	0.54	-1.37	1.09	**3.92**	**2.49**	0.68	0.65	0.65	0.66
2	-0.67	0.09	0.40	0.58	**-2.56**	0.58	**2.50**	**3.34**	0.73	0.79	0.81	0.78
3	-0.23	0.43	0.23	0.35	-0.77	**2.26**	1.19	1.76	0.63	0.74	0.74	0.79
Big	0.43	0.00	-0.32	0.22	0.84	-0.01	-1.75	1.24	0.47	0.70	0.84	0.88
5-Factor Model												
	Low	2	3	High	Low	2	3	High	Low	2	3	High
Small	-0.14	0.36	0.68	0.61	-0.72	**2.23**	**3.81**	**2.75**	0.78	0.71	0.65	0.67
2	-0.27	0.26	0.44	0.52	-1.76	1.95	**2.73**	**2.96**	0.92	0.86	0.81	0.78
3	0.03	0.56	0.28	0.43	0.15	**3.09**	1.48	**2.13**	0.80	0.78	0.75	0.80
Big	0.76	0.40	-0.18	0.09	**2.75**	**2.20**	-0.99	0.60	0.86	0.83	0.85	0.91

Tests results: Many α_i**'s ≠ 0**. A problem for model! Similar results for Size-Inv.

Findings: In general, the **5-factor model performs OK** (better/not worse than 3- & 4-factor model).

- Except for Japan, the **value premium** is larger for **small stocks**.
- **Expected investment premium** for **small stocks** is stronger, at least for the two regions with the largest market cap (NA and Europe).
- **HML** is important for describing average returns **in all regions**.
- **SMB** seems **redundant** everywhere except NA.
- **RMW** is important for describing **NA**, **European** & **AP** average returns. (For Japan maybe a marginal role).
- The evidence for **CMA** is **mixed**. It works only in NA and AP.
- CMA may play the role of absorbing the low average returns of high-investment small stocks.
- **Correlations** the 4 non-market factors: **HML returns** of Europe and NA are **most correlated** (0.61); next is CMA (0.57), SMB (0.31), and RMW (0.21). **RMW** is **least correlated** across regions (0.21 correlation for Europe and NA is the largest).

Fama-French Regional Factors in International Markets

From Fama-French (2015) – Test redundant factor: H_0: Intercept=0.

Table 3 – Using four factors in regressions to explain average returns on the fifth: July 1990 – October 2015, 304 months

Mkt is the value-weight return on the market portfolio of the stocks of a region, minus the one- month Treasury bill rate; *SMB* (small minus big) is the size factor; *HML* (high minus low *B/M*) is the value factor; *RMW* (robust minus weak *OP*) is the profitability factor; and *CMA* (conservative minus aggressive *Inv*) is the investment factor. The factors are constructed using separate sorts of stocks into two *Size* groups and three *B/M* groups (*HML*), three *OP* groups (*RMW*), or three *Inv* groups (*CMA*).

	Coefficient						*t*-statistic						
	Int	*Mkt*	*SMB*	*HML*	*RMW*	*CMA*	*Int*	*Mkt*	*SMB*	*HML*	*RMW*	*CMA*	R^2
North America													
Mkt	1.00		0.01	0.52	-0.53	-1.01	4.74		0.10	4.95	-5.22	-8.23	0.30
SMB	0.35	0.00		0.13	-0.49	-0.12	2.28	0.10		1.65	-7.06	-1.22	0.17
HML	-0.27	0.15	0.07		0.29	0.95	-2.37	4.95	1.65		5.47	20.26	0.65
RMW	0.47	-0.16	-0.29	0.31		-0.11	4.04	-5.22	-7.06	5.47		-1.43	0.36
CMA	0.31	-0.18	-0.04	0.61	-0.06		3.35	-8.23	-1.22	20.26	-1.43		0.68
Europe													
Mkt	0.75		-0.41	0.82	-0.54	-1.43	2.87		-3.75	5.92	-2.82	-9.19	0.30
SMB	0.15	-0.11		0.05	-0.13	-0.10	1.06	-3.75		0.67	-1.31	-1.07	0.04
HML	0.34	0.13	0.03		-0.56	0.72	3.30	5.92	0.67		-8.12	12.95	0.53
RMW	0.52	-0.05	-0.04	-0.32		0.05	7.15	-2.82	-1.31	-8.12		0.89	0.29
CMA	0.10	-0.15	-0.04	0.50	0.06		1.19	-9.19	-1.07	12.95	0.89		0.45
Japan													
Mkt	0.36		0.14	-0.56	-1.06	-0.27	1.10		1.43	-4.11	-5.29	-1.33	0.13
SMB	0.04	0.05		0.08	-0.10	0.20	0.22	1.43		1.04	-0.79	1.67	0.05
HML	0.31	-0.10	0.04		-0.02	0.63	2.31	-4.11	1.04		-0.21	8.32	0.35
RMW	0.18	-0.08	-0.02	-0.01		-0.59	2.02	-5.29	-0.79	-0.21		-13.41	0.51
CMA	0.05	-0.02	0.05	0.30	-0.63		0.59	-1.33	1.67	8.32	-13.41		0.59
Asia Pacific													
Mkt	1.28		-0.21	-0.07	-0.68	-1.02	4.33		-2.21	-0.59	-4.94	-8.72	0.35
SMB	0.13	-0.08		-0.10	-0.32	-0.09	0.72	-2.21		-1.28	-3.90	-1.10	0.05
HML	0.65	-0.02	-0.06		-0.73	0.32	4.79	-0.59	-1.28		-14.79	5.63	0.45
RMW	0.54	-0.11	-0.15	-0.58		0.20	4.55	-4.94	-3.90	-14.79		3.94	0.53
CMA	0.30	-0.20	-0.05	0.30	0.24		2.23	-8.72	-1.10	5.63	3.94		0.34

Valuation of MNCs

• The extent of foreign operations for many MNCs raises the question: Can a portfolio of MNC stocks achieve true international diversification?
A: No!
⇒ MNCs do not provide all the benefits available from direct investment in foreign securities.

Example: We examined firms from nine countries.

$r_i = \alpha_i + ß_{US}\, r_{US} + ß_{GER}\, r_{GER} + ß_{BEL}\, r_{FRA} + ß_{NL}\, r_{SWIT} + ß_{BEL}\, r_{NL} + \ldots$

Nationality of MNF	Multiple Index						Single Index	
	US	GER	FRA	SWI	UK	R^2	beta	R^2
Amer. MNF	**.94**	-.01	.02	-.01	-.07	.31	1.02	.29
German MNF	.24	**1.18**	.10	-.15	-.11	.74	1.18	.65
French MNF	-.10	.18	**.95**	-.22	.03	.62	1.08	.45
Swiss MNF	-.12	-.09	-.11	**1.74**	.16	.75	1.39	.52
British MNF	-.10	-.09	-.09	.07	**.84**	.49	1.06	.44

Conclusion: MNC stock prices are more affected by domestic factors. ¶

Valuation of MNCs

Possible explanations of results:
- National control
- Management policy
- Government constraints

International Booms and Crashes

Taken from Goetzman (2015). Study of 21+ world markets **1900-2014** (annual data = 3,470 observations)

• **Bubbles**

Definition: A bubble is defined as a **boom followed by a crash**.

A crash is a large increase (**boom**) + rapid decline (**bust**) in market prices.

Q: What is boom? A single year (or 3-yrs) of cumulative return of 100%

What is bust? A drop of at least 50% over the next 5 years.

- **Boom**: **8.33%** of sample had 100%+ annual growth in **1-yr** (**72 mkt-yrs**)
- After 1-yr - **4.17%** of boom markets **crashed.**
- After 5-yrs - **15.28%** of boom markets **crashed**.
  - **26.93%** of boom markets had **at least doubled again**.

- **Boom**: **14.06%** of sample had 100%+ annual growth in **3-yr** (460 mkts)
- After 1-yr - **4.57%** of **boom** markets **crashed**
- After 5-yrs - **10.42%** of boom markets **crashed**
- **21.73%** of boom markets had at **least doubled again**.

Bust: **2.48%** of sample has a -50% annual return in **1-yr**
- After 1-yr - **6.58%** of bust markets **crashed again** (**5 mkts-years**)
- After 1-yr - **13.16%** of bust markets **doubled** (**10 mkts-years**)

Conclusions:
- Stock market **bubbles are rare**.
- The overwhelming proportion of **price increases** in global markets were **not followed** by crashes.

Interesting details:
- Long-run return for 21 Developed Mkts (**1900 - 2014**): **12%** (SD = 31%)
- Long-run return for 20 EM (**199+ - 2014**): 11% (SD = 51%)

Table 3: Markets that doubled in value in dollar (or real) terms in a calendar year

This table reports the cumulated dollar-valued capital appreciation return to markets following a calendar year in which the dollar-valued index level at least doubled. Subsequent event-years in which the index value doubled again are highlighted in green. Subsequent event years in which the index gave back all or more of its one year gain at some point in the next five years are highlighted in pink. Values are sorted on event-year five cumulative capital appreciation returns.

Country	year	-1	0	1	2	3	4	5
Germany	1949	0.12	1	1.01	2.35	3.52	4.43	8.08
Peru	1989	0.31	1	0.77	1.61	3.54	4.43	6.41
Portugal	1985	0.38	1	3.05	8.82	6.24	8.04	6.09
Chile	1986	0.47	1	1.25	1.53	2.22	2.67	5.49
Peru	1991	0.48	1	2.20	2.75	3.98	4.85	4.72
Germany	1951	0.43	1	1.49	1.88	3.43	4.01	3.77
Brazil	1991	0.37	1	1.05	1.84	3.02	2.38	3.28
Austria	1985	0.33	1	1.22	1.21	1.30	2.90	3.28
Colombia	2004	0.44	1	2.02	2.24	2.53	1.83	3.23
United Kingdom	1975	0.47	1	0.86	1.48	1.76	2.14	3.08
Russia	1999	0.26	1	0.68	1.05	1.45	2.54	2.91
Pakistan	2002	0.45	1	1.31	1.42	2.23	2.19	2.90
Egypt	2004	0.46	1	2.54	2.92	4.53	2.09	2.77
Peru	1992	0.46	1	1.25	1.81	2.21	2.15	2.53
Colombia	2005	0.49	1	1.11	1.25	0.90	1.59	2.24
Italy	1985	0.42	1	1.71	1.45	1.64	2.35	2.18
Brazil	1969	0.30	1	1.79	3.45	1.84	1.94	2.15
Chile	1977	0.49	1	1.96	3.59	6.84	4.22	2.15
Brazil	2003	0.49	1	1.30	1.96	2.75	4.82	2.04
Portugal	1986	0.33	1	2.90	2.05	2.64	2.00	1.92
Spain	1986	0.40	1	1.38	1.63	1.88	1.67	1.89
Japan	1952	0.43	1	1.00	1.01	1.47	2.06	1.87
Argentina	1976	0.18	1	0.48	1.28	4.48	3.98	1.82
Australia	1933	0.48	1	1.15	1.41	1.60	1.98	1.77
Germany	1985	0.44	1	1.37	1.09	1.27	1.82	1.75
Finland	1933	0.45	1	1.12	1.26	1.84	1.85	1.75
Germany	1923	0.23	1	1.09	0.71	1.69	1.57	1.74
Chile	1991	0.49	1	1.18	1.55	2.19	2.05	1.71
Colombia	1991	0.35	1	1.22	1.61	2.11	1.51	1.61
South Africa	1933	0.35	1	1.31	1.52	1.94	1.62	1.58
Switzerland	1985	0.49	1	1.39	1.29	1.35	1.61	1.57
Denmark	1972	0.48	1	1.12	1.03	1.33	1.48	1.54
Czech	1922	0.47	1	1.17	1.03	0.98	1.05	1.52
China	2003	0.45	1	0.91	1.02	1.97	3.18	1.50
Greece	1933	0.27	1	1.17	1.18	1.20	1.49	1.39
Philippines	1986	0.14	1	1.37	1.64	1.88	1.35	1.38
Italy	1933	0.46	1	1.26	1.33	1.19	1.35	1.34
Belgium	1940	0.44	1	1.77	1.92	1.75	1.36	1.33
Hungary	1996	0.49	1	1.95	1.77	1.96	1.42	1.28
Japan	1972	0.46	1	0.84	0.73	0.85	1.08	1.28
Portugal	1942	0.45	1	0.94	1.15	1.30	1.43	1.20
Egypt	2005	0.39	1	1.15	1.78	0.82	1.09	1.19
Ireland	1977	0.48	1	1.55	1.55	1.68	1.41	1.16
New Zealand	1933	0.42	1	1.15	1.19	1.18	1.24	1.09
India	2009	0.50	1	1.19	0.74	0.92	0.87	1.06
South Africa	1979	0.49	1	1.56	1.22	1.50	1.51	1.02
Austria	1989	0.45	1	1.13	0.94	0.75	0.99	1.00
Norway	1979	0.35	1	0.81	0.69	0.49	0.88	0.96
Mexico	1991	0.46	1	1.23	1.82	1.08	0.79	0.93
Argentina	1991	0.20	1	0.61	0.95	0.71	0.78	0.91
Argentina	1978	0.38	1	3.51	3.12	1.43	0.55	0.79
Portugal	1980	0.37	1	0.64	0.39	0.29	0.30	0.78
Austria	1946	0.49	1	1.12	0.53	0.53	0.44	0.75
Finland	1999	0.44	1	0.85	0.56	0.44	0.58	0.67
Netherlands	1940	0.43	1	0.72	0.80	0.97	0.73	0.67
Austria	1923	0.40	1	0.48	0.36	0.48	0.60	0.63
Russia	2009	0.49	1	1.23	0.97	1.08	1.11	0.59
Venezuela	1996	0.44	1	1.27	0.60	0.61	0.62	0.56
Portugal	1987	0.35	1	0.71	0.91	0.69	0.66	0.54
Italy	1944	0.40	1	0.53	0.49	0.42	0.47	0.52
Brazil	2009	0.45	1	1.04	0.78	0.75	0.61	0.51
New Zealand	1986	0.47	1	0.64	0.57	0.63	0.40	0.48
Norway	1973	0.44	1	0.60	0.51	0.58	0.45	0.48
Poland	1993	0.12	1	0.45	0.43	0.67	0.51	0.47
Venezuela	1990	0.20	1	1.34	0.59	0.69	0.58	0.44
Philippines	1993	0.45	1	0.92	0.81	0.94	0.35	0.39
Germany	1926	0.42	1	0.93	1.03	0.78	0.57	0.36
Chile	1933	0.46	1	0.98	0.46	0.44	0.44	0.33
France	1941	0.48	1	0.57	0.99	1.14	1.06	0.28
Poland	1927	0.47	1	0.88	0.57	0.39	0.21	0.20
Argentina	1979	0.28	1	0.89	0.41	0.16	0.23	0.18
Germany	1940	0.49	1	1.15	1.07	0.88	0.75	0.16

International Bond Markets

The bond market (debt, credit, or fixed income market) is the financial market where participants **buy and sell debt securities**, usually bonds.

Size of the world bond market ('20 debt outstanding): **USD 128 trillion**.

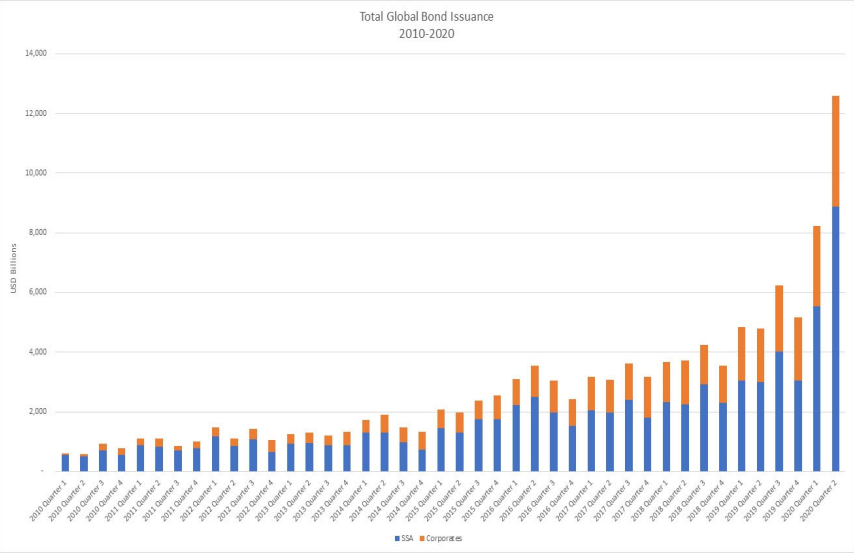
- Governments and International Organizations: USD 87 trillion (68%).
- U.S. bond market debt: **USD 49.8 trillion** (**38%**).

Organization

- Decentralized, **OTC market**, with brokers and dealers.
- Small issues may be traded in exchanges.
- Daily trading volume in the U.S.: **USD 822 billion**
- **Government debt dominates** the market.
- Used to indicate the shape of the yield curve.

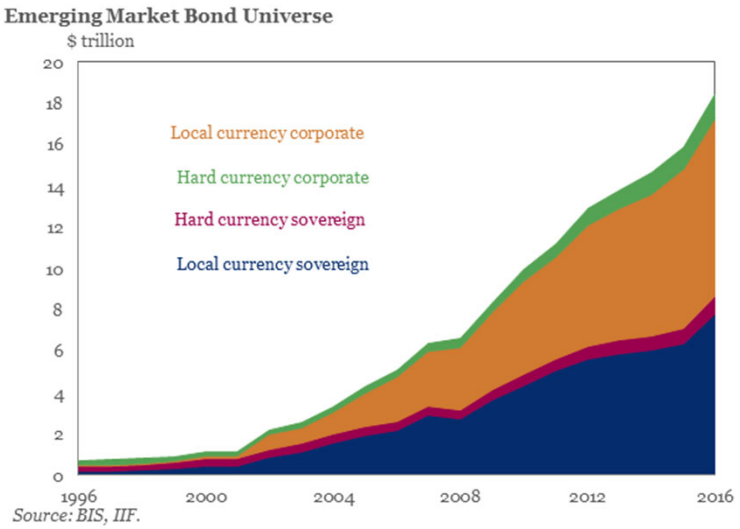
• **Evolution of Global Bond Market**:

Huge increase in issuance in **2020** (pandemic & very low interest rates).
Government issues dominate.



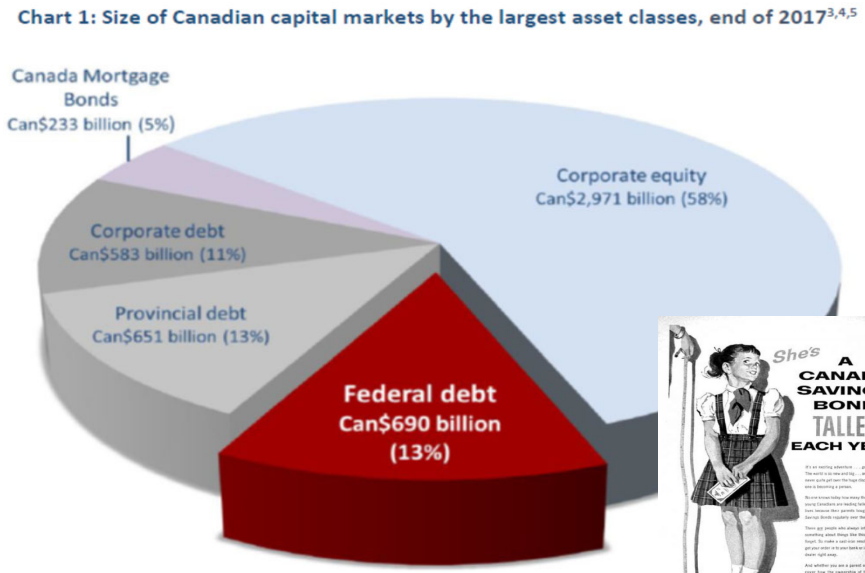
• Evolution of Global Bond Market

EM issues have significantly **increased** over the **past 20 year**. EM play a significant role.



• Typical Bond Market: Canada

Dominated by government issues.



• The world bond market is divided into three segments:

- *Domestic bonds*: Issued locally by a **domestic borrower**.
  Usually denominated in the **local currency**.
  Largest segment: **71%** of the bond market (2008).
- *Foreign bonds*: Issued on a local market by a **foreign borrower**.
  Usually denominated in the **local currency**.
- *Eurobonds*: Placed mainly in countries other than the one in whose currency the bond is denominated.

Example: Distinction between bond markets.

(A) *Domestic bonds*.

In February 2015, Apple, the U.S. tech giant, issued bonds for **USD 6.5B** in the U.S. for placement in the U.S. domestic market.

(B) *Foreign bonds*.

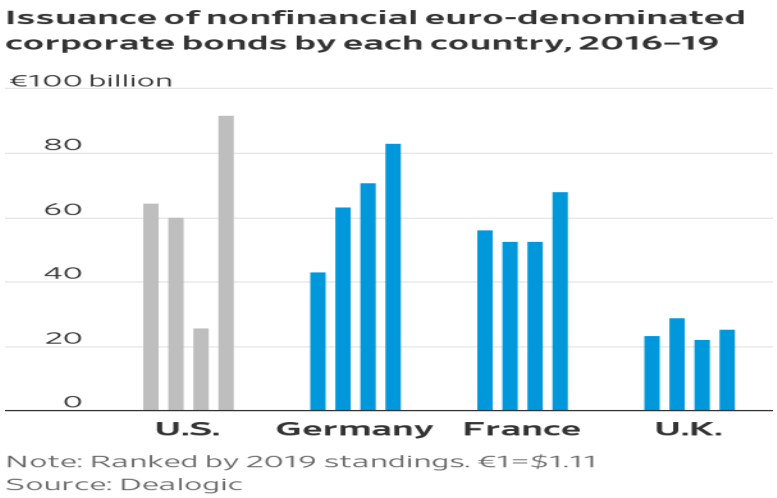
In August 2015, Apple issued bonds for **AUD 2.25B** for placement in the Aussie market alone.

(C) *Eurobonds*.

In September 2015, Apple issued bonds for **EUR 2.8B** in London. The issue was underwritten by an international syndicate of securities houses, led by Goldman Sachs and Deutsche Bank. ¶

⇒ Foreign bond + Eurobond markets = International Bond Market.

• **Eurobond Issuances in Euro**



• International debt issuance is close to **12%** of total debt issuance by U.S. companies.

Type of Instruments

Popular Instruments in International Bond Markets

i. Straight or fixed income bonds. (Most common type, by far)
ii. Partly paid bonds.
iii. Zero-coupon bonds. (Not very popular with investors)
iv. Floating rate notes (FRNs). (Second most common type)
v. Perpetual FRNs.
vi. Convertible bonds.
vii. Bonds with warrants.
viii. Dual-currency bonds.

Example: Straight bond

4.375% May 2015 Slovak Republic EUR bond

Amount =	**EUR 2 billion**
Issue date =	May 14. 2009
Face value: FV =	EUR 1,000
Coupon: **C** = **4.375%** =	**EUR 43.75**
Maturity: T =	**6 years** (**May 2015**)
Interest payment dates:	May 14

Every May 14, the Slovak Republic pays **EUR 43.75** to bondholders, for **6 years**. At maturity, May 14, 2015 it also pays back the principal. ¶

• Tombstone of Slovak Republic's Eurobond

Example: Zero-coupon bonds ("zeros").

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Example: FRNs ("floaters").

LIBOR + 1/8 March 2024 Swedish Government USD bond.

Amount =	**USD 500 million**.
Issue date =	March 1 1984
T =	**March 1, 2024** (**40 years**).
FV =	USD 1,000
Coupon: C =	**6-mo. LIBOR + 1/8**
Interest payment dates:	March 1 and September 1

At the time the notes were offered (3/84), 6-mo. LIBOR was **10(7/16)%**
First Coupon = **10(7/16)%** + **(1/8)%** = **10(9/16)%** (known at issue).

Afterward, at the end of each 6-mo. period the interest rate on the notes is updated to reflect the current 6-mo. LIBOR rate for dollars. ¶

Example: Convertible bonds ("convertibles").

8% May 2002 Cantim (a Canadian firm) convertible USD eurobond.

Amount:	**USD 100 million**
Issue date =	May 1995
T =	**May 2002** (**7 years**)
FV =	USD 1,000
C =	**8%**.
Conversion price =	**CAD 23.125**
Conversion S_t =	**1.2007 CAD/USD**
Conversion period:	Any time after first interest payment

Principal is convertible into Cantim common stock at a conversion price per share of **CAD 23.125**, where each USD of face value would be convertible to CAD at **S_t = 1.2007 CAD/USD**.

⇒ Each bond can buy 51.92 shares. (A bond + call option.) ¶

Example: Bonds with equity warrants.

4% May 1995 Cannon Euro-USD bonds with equity warrants attached.

Amount:	**USD 370 million**.	
T =	**May 31, 1995** (**5 years**).	
FV =	USD 5,000	
C =	**4%**	
Number of warrants:	74,000	
Warrants per bond:	1	(=[**370M**/5,000]]/74,000)
Shares per warrant:	468.06	
Exercise price:	JPY 1487	
Conversion S_t:	139.2 JPY/USD	
Exercise period:	At any time after the first interest payment	

⇒ Almost all Japanese Euro-USD bond with equity warrant attached (USD Eurowarrants) have similar terms. ¶

Example: *Dual-currency* bonds.

Note: Dual-currency bonds are purchased in terms of one currency but pay coupons or repay principal at maturity in terms of a second currency.

10% July 1995 First City Financial CHF Eurobond.

T = **July 1995** (**10 years**).

FV = CHF 5,000.

C = **10%** (= **CHF 500**).

Feature = At maturity, the bond is repaid in the amount of **USD 2,800**.

At the time of the issue, this bond represented a combination of

(a) a 10-year CHF bond that repays principal: CHF 5000

+

(b) a 10-year forward contract to buy **USD 2,800** at 1.7857 CHF/USD

= (CHF 5000/**USD 2800** = $S_{7/01/95}$ = 1.7857 CHF/USD). ¶

Note: An investor benefits if: i_{CHF} ↓, S_t (CHF/USD) ↓, & S_T (CHF/USD)↑.

Eurobond Markets

Euro-what?

- Euro-*zzz*: The currency of denomination of the *zzz* instrument is not the official currency of the country where the instrument is issued.

Example: A Malayan firm deposits USD not in the U.S. but with a bank outside the U.S., for example in Singapore or in Switzerland. This deposit is classified as a *eurodeposit*. ¶

Euromarket

- Offshore money market
- Low costs and lack of regulations
- Instruments traded in any currency.

The **Eurobond** market is just **one segment** of the Euromarket.

Characteristics of Eurobonds

• A Eurobond is an international debt security.

Structure: Similar to **standard debt security** used in **domestic markets**.

Basic characteristics:

- **Transferable** (usually, *bearer*).
- **Tradable**.
- **Medium- to long-term debt security**.
- Generally launched through a **public offering**.
- Generally **listed** on a stock exchange.
- **No** formal **government regulations.**

Transferability should be simple:

- **Bearer bond** (you have it, its yours)
- **Registered bond** (your name should be in a book to own the bond)

⇒ the majority of Eurobonds are bearer bonds.

• Attractive characteristic of Eurobond markets for issuers:

The Eurobond & Foreign bond markets seem to be **segmented**.

Example: The World Bank has issued in the U.S. foreign bond market and in Euromarkets. Issues of similar maturity have yielded 10 to 20 bps less.

Usual explanation: **No requirement** of registered form for Eurobond. ¶

⇒ Formal characteristics of Eurobonds: No different from domestic or foreign bonds.

⇒ The structure of the underwriting syndicate is the main difference between other bonds and Eurobonds.

Issue Procedures

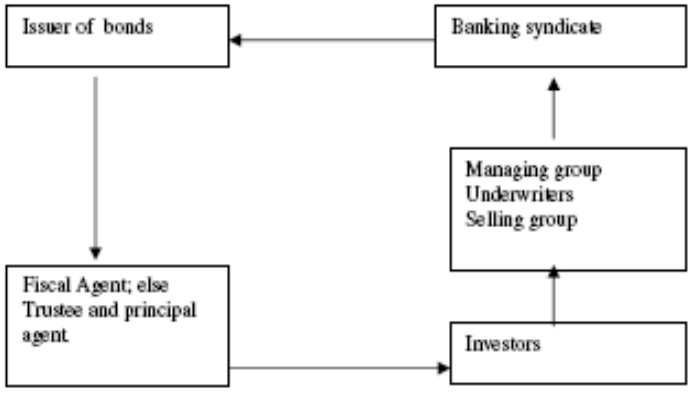
Organization of a Traditional Eurobond Syndicate

- Eurobonds are issued and sold through *underwriting syndicates*.
- Participants in these syndicates are investment banks:
- Players:
  - *lead manager* (organizes the managing group).
  - *managing group* (buys the bonds).
  - *underwriters* (commitment to buy ahead of time at a set price).
  - *selling group* (no commitment to buy at a set minimum price).
  - *principal agent* (responsible for receiving and making payments).
  - *fiscal agent* & *trustee* (represent borrowers & bondholders, respectively).

Note: Roles in a Eurobond syndicate are nested: Managers are also underwriters & sellers, and underwriters are usually also sellers.

• Roles in a Eurobond syndicate are nested: Managers are also underwriters & sellers, and underwriters are usually also sellers.

Role players in a new eurobond issue



Selecting a Lead Manager

• Market for Lead Managers is **very competitive**. Usually, lead managers are large banks/investment banks (Citi, JPMorgan, UBS, HSBC, etc.).

• The selection of a professional issuing house to lead-manage the issues is a critical decision for the borrower.

• Factors:

- Established relations
- **Price**
- Market making ability
- Coordination of the syndicate
- Derivatives products

⇒ The advantage of a Eurobond issue may not be the cost: It may be preferred in terms of longer maturities, early call options, issue sizes, etc.

Fee Structure for new Eurobond Issues

• *Fees*: **Extracted by discounts** on the prices provided to syndicate.

Example:

A French company issues **USD 1,000** bonds at 100 (100% of FV, "par").
Managing group pays the borrower **USD 975** for each USD 1,000 bond.
The **USD 25** discount (**2.5%**) is the *flotation cost*. ¶

• Syndicate members really receive the full flotation cost if the bonds are actually sold to retail at the issue price. This might not happen.

Reasons:

- unenforceable contracts.
- competition.
- price discrimination.

Example:

Lead manager pays borrower **USD 975** per **USD 1,000** bond.

Lead manager makes bonds available to underwriters at USD 980

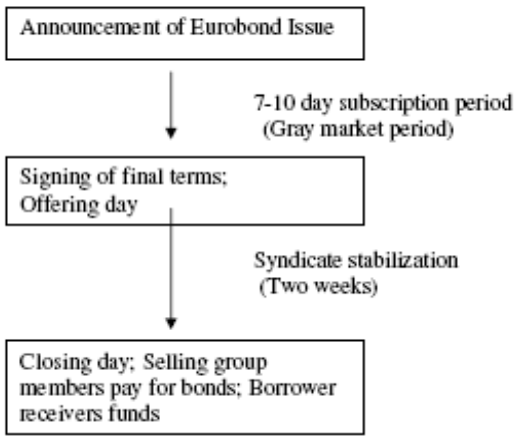
Lead manager makes bonds available to sellers at USD 985

$1,000 - $975 = **$25**	"*Flotation cost*" or "*spread*"	(100% of spread)
$1,000 - $985 = **$15**	"*Selling concession*"	(60% of spread)
$985 - $980 = **$5**	"*Underwriting allowance*"	(20% of spread)
$980 - **$975** = **$5**	"*Management fee*"	(20% of spread)

- Typical spread for USD Eurobonds:
  - **2%** for issues **10+ years**.
  - **Less than 2%** for **shorter** maturities.

Traditional Time Schedule for a New Offering

Timetable of New Eurobond Offering



U.S. Legal Aspects of Eurodollar Bond Issues

• No attempt to control issuing of USD-denominated eurobonds by **foreigners**.

• U.S. regulations affect the management and sale of USD eurobonds.

• Only **U.S. investment banks** get involved in **USD Eurobond** issues.

• U.S. banks can participate in Eurobond issuing syndicates only if they guarantee that **U.S. investors cannot purchase** the bonds.

• A Eurobond offering could be structured under the "*private placement*" exemption of the U.S. Securities Act.

Then, it can be sold to U.S. nationals at issue. But, purchasers of the bonds must meet strict requirements (with capital, *sophisticated*, informed, etc.)

• In 1984, the U.S. government deregulated bond & money markets:

- **No U.S. withholding tax** on payments to foreigner holders of US debt.

- U.S. corporations can issue bearer bonds to **non-U.S. residents.**

Eurobond secondary market

• The secondary bond market handles the reselling of bonds by investors.

- It is almost entirely an OTC market. Most trades are conducted on closed, proprietary bond-trading systems or via phone.

- It is self-regulated. Participants follow **ICMA**'s market standards.
ICMA: International Capital Market Association, similar to US NASD

• **ICMA**

◊ ICMA has over 400 members, located in over 50 countries.

◊ Majority of the members are in the U.K. (more than 50%), the U.S. and Luxembourg.

• Eurobond issues are listed on one or more stock exchanges (mainly, Luxembourg & London; but, usually, also the home stock exchange).

• There is no legal obligation to deal on the exchanges ⇒ OTC market.

Microstructure

- Market-makers & dealers in Eurobonds are members of the ICMA.
- A market-maker quotes a net *bid-ask* price (no commissions charged).
- Bid-ask spreads on Eurobonds are around **.50%** (USD & EUR domestic spreads close to **.10%**).
- Settlement takes place on the *value date*, approximately a week later.
- Standard-size transaction is 100 bonds (with USD 1,000 of face value).
- Quoted prices apply to standard-size transactions, smaller transactions are negotiated at higher spread costs.
- Two international securities clearing systems (now linked):
  - Euroclear was the first, set up in Brussels (1968).
  - Clearstream, first established in Luxembourg (1970).

Liquidity problems

- For certain issues, liquidity is still a big problem.
  - Not a problem of unreliable market making.
  - Problem: Poor access to established and liquid bond markets.
- It is estimated that 50% of the yield premium is a *liquidity premium*.
- Issuers take liquidity considerations into account:

The bigger the size of the issue, the more liquid in the secondary market:

⇒ Issues tend to have sizes larger than **USD 50M** equivalent.

⇒ *Mega issues* (bigger than **USD 1B**) are common (10% of total)

Example: In September 2013, Verizon issued a **USD 15B** 30-year bond & a **USD 11B** 10-year bond. ¶

- But, price impact (due to the big size) is a problem for Mega issues!

Foreign Bond Markets

Yankee Bonds

- It used to be the largest and most important foreign bond market.
- Yankee bonds must be registered under the Securities Act of 1933.
- Yankees issues are usually rated by a bond rating agency.
- No withholding tax on coupon payments to foreigners.
- Secondary market for Yankee bonds is *more liquid* than that for USD Eurobonds and bid/ask spreads are smaller.

German Eurobonds and German Foreign Bonds

- Investment banking and commercial banking are not separated. International EUR bond market is dominated by German banks.
- A German Eurobond is legally the same as a German foreign bond.

Samurai Bonds and JPY Eurobonds

- Japanese and non-Japanese corporations make public Euroyen issues.
- Foreign banks are allowed to serve as lead managers.

Swiss Franc International Bonds

- Government does not allow issues in CHF outside Switzerland.
- Switzerland has the largest foreign bond market in the world.
- Common scenario: Foreign savers lend to foreign borrowers in CHF.
- Swiss foreign bonds are bearer bonds and have annual coupons.

Differences Among Bond Markets

	US Market	Non-US Market	Eurobond Market
Regulation	Yes (SEC)	Yes (Local SEC)	No (Informal Rules)
Disclosure	High (regulated)	Varies (according to local SEC)	Usual Market Practices
Issuing cost	0.75%-1%	Varies (1%-4%)	**1.5%-2.5%**
Speed of issue	Slow: 2-4 weeks.	Varies.	**Fast: 14 days or less**
Currency	USD, but no restrictions.	Usually local, but with some restrictions.	Any. No restrictions.
Rating?	Yes	Varies.	Not required, but it is common.
Bearer Bonds?	No	In general, no.	**Yes.**
Listing?	Some (NYSE).	Many.	**Very Rare.**
Liquidity	Very liquid.	Varies, according to size.	**Not very liquid.**

Quotations

Bonds are usually quoted:

Cash price = **Quoted price** + **Accrued Interest**.

Exception: U.K. bonds (gilts) with more than five years to maturity.

Cash price = **Quoted price**.

Accrued Interest

Bonds also differ in the way accrued interest is calculated.

Example: U.S.

An investor holding a U.S. straight bond for February 2021 receives 30/360 or 1/12 of the annual coupons (1/6 of the semiannual coupon).

Example: Japan

An investor holding a Japanese straight bond for February 2021 will receive 28/365 of the annual coupon.

Yields

Financial institutions around the world calculate YTM on bonds.

The methods differ across countries ⇒ YTM are not comparable.
- U.S.: Institutions publish a semiannual actuarial yield.
- Europe: Annual actuarial YTM using the ICMA-recommended formula.

Example: 12% 2010 IBM USD bond

- U.S.: It pays USD 6% semiannually and it has a **YTM** of 12% (s.a.).
- Europe: It has a (annual) YTM of **12.36%** = (1.06)*(1.06) – 1 = .1236. ¶

Coupons

Coupons are usually paid **annually** on markets where straight bonds are issued in *bearer form* (cost reasons):
- Eurobond coupons in all currencies are paid this way.
- U.S. coupons are paid semiannually.

BOND PRICING

Pricing Bonds: Brief Review

• Price of a Bond

The price of a bond (P) is determined by computing the NPV of all future cash flows generated by the bond discounted at an appropriate interest rate –i.e., the yield-to-maturity, or **YTM**.

$$P = C_1/(1+YTM) + C_2/(1+YTM)^2 + C_3/(1+YTM)^3 + ... + C_T/(1+YTM)^T$$

C_t = Cash flows the bond pays at time t. (C_T = $Coupon_T$ + Face $Value_T$)

• One-to-one relation between P and the **YTM** of a bond:

⇒ You know the **YTM**, you know P –given that you know the C_i's.

Example: A straight Eurodollar bond matures in 1 year.

C = 10%

FV_1 = USD 100

1) P = USD 95 ⇒ **YTM** = ?

$$P = (C + FV_1)/(1+YTM) \Rightarrow 95 = 110 / (1+YTM).$$

⇒ **YTM** = 110/95 – 1 ⇒ **YTM** = .1578947

2) **YTM** = **.1578947** ⇒ P = ?

⇒ P = 110/1.**1578947** = 95. ¶

• Terminology

– P = 100 (or 100% or 1) ⇒ "par" or "face value."

⇒ Simple mathematical fact: P = 100 ⇒ **YTM** = **C**.

– 100 bps = 1%

• **YTM**

YTM is determined by:

YTM = Base Rate (k_f) + ***Spread*** (Risk of Company)

$k_f = r_f$ = risk free rate = government bond (of similar maturity)

Spread (in bps) = Risk of company = determined by investment bank

The spread is related to **credit risk**. Given a risk category, there is a corresponding risk spread.

Other factors:

- **Liquidity** (50% of bond spread?)
- **Size of issue** (*price pressure* or *price impact*)

• Huang & Huang (2013): Corporate bond spreads are unusually high, given the low probability of default ("*credit spread puzzle*").

• **Technical detail**

Straight Eurobonds pay annual coupons, with annual **YTM**s (p.a.). But, reference yields are usually expressed s.a. (6-mo **YTM**).

⇒ Adjustments needed to align **YTM**s.

Example: A company issues a new Eurobond.

Data: A similar bond has a 6-mo **YTM** (s.a.) = **7.365% s.a.**

⇒ Transform a 6-mo **YTM** (s.a.) into an annual **YTM** (**p.a.**):

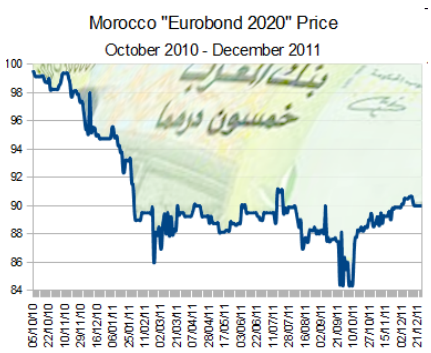
YTM (p.a.) = $(1 + 0.\mathbf{07365}/2)^2 - 1$ = 7.501% p.a.

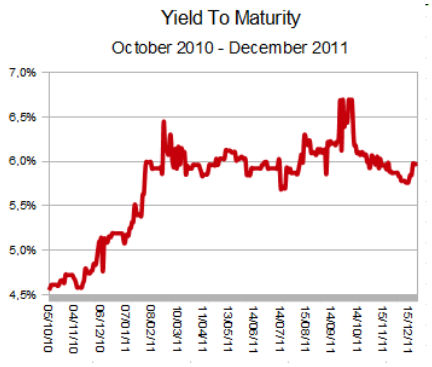
If in addition, the bond sells *at par* at inception –i.e., P=100–, then,

$\mathbf{C_{ST}}$ = **YTM** (p.a.) = **7.50%**.

• **Bonds: YTM and Prices Move A Lot (Like any other financial asset)**

Example: 4.5% October 2020 Morocco EUR Eurobond





• As expected, there is an inverse relation.

Pricing and Selection of a New Eurobond Issue

Situation: Issuing house needs to price a new bond issue.

• Same domestic pricing techniques and models.

◊ **Pricing mistakes** are common:

- Tight competition
- Issues are too complex.
- Poor distribution.
- Weak market conditions.

◊ Pricing process involves:

(1) Collection of information

(2) Evaluation of information

• **Information**

Borrowing Requirements

– **Amount to be raised** over a certain period.
– **Currency** of exposure.
– **Maturity range**
– Call options
– Target cost of funds.

Preliminary Analysis of the Issue

Guide to pricing a new issue:

(1) Assessment of the borrower's outstanding issues.
(2) Benchmark issues.

Market Conditions

Place an issue in relation to relevant markets:

– Bond Markets (International and Domestic)
– Derivative Markets
– Swap Markets

Perception of the Issuer

For issuers with outstanding issues: Check **YTM** on secondary market.

Caution: An issue maybe trading poorly because of bad design; not negative perception.

For first-time issuer: More analysis needed:

– Perception of the borrower by its competitors.
– Relative perception of the issuer within its domestic market
– Perception of the borrower, if any, in the Euromarkets.

Evaluation

- Sometimes, pricing looks like informed guesswork.
- In established markets, however, pricing proposals tend to **converge**.
- **Benchmarking** is the key.

Case Study I: Merotex

Pricing a New Straight Bond: Merotex

The Borrower

- Leading construction firm, based in Gorizia, Italy.
- Recently bought two U.S. construction companies.
- Financed by bank loans: USD 250 million

Borrowing requirements

- Amount: **USD 250 million**
- Currency of exposure: **USD**
- Maturity: *Medium-term* (**5 to 7 years, preferred 7 years**) USD debt.
- Preference: *Simple straight bond* with no early call options.

• **Information**

Market conditions:

- **Good** for a USD Eurobond issue.
- U.S. economic conditions are above expectations
- USD is currently very strong.
- **Recent successful placement** of 10-year Euro-USD issue by Fica, a competitor.

Merotex's Perception:

– Merotex has issued **GBP Eurobonds**: obtained *best terms*.

– Merotex has **no outstanding Euro-USD issues**.

• Perception of similar international borrowers ("Benchmarking")

(1) Comenti: **Italian construction company**

- Several Eurodollar issues.
- Last issue has 6 years of remaining life.
- Currently trading at **40 bps** over 6-yr U.S. Treasuries.
- Excellent reputation in Euromarkets

(2) Fix Constructions (FC): **major U.S. competitor** in Florida.

- Launched a 10-yr Eurodollar issue five years ago.
- It has a *call option* two years from now.
- Currently trading at a **65 bps** over 5-year U.S. Treasuries.
- Well-regarded but *performance* has been *just average*.

(3) **Other large Italian companies**:

- Many Euro-USD bonds with 5-year maturity
- Currently trading within a range of ***40-70 bps***.

Evaluation

• Merotex's track record is limited but **very good**.

– Merotex's GBP bonds have been **well received** in the market.

– Merotex plans to include one **UK** house in management group.

⇒ **Size:** sufficient to promote liquidity; but not so much as to make the placement process difficult. Proposed size: **USD 200 million**.

⇒ **Maturity:** Merotex is a first-timer on USD-Eurobond segment: For first timers shorter maturities are better: ***5 years***.

• Concern: The FC issue is trading at a **relative high spread**. But,

– Issue might suffer from poor design.

– Deterioration of FC's perception

– Call provision.

⇒ **Yield:** Lead manager suggests setting **spread** on the low-end of range ("aggressive spread"): ***40-70 bps***.

Proposed Issue

Amount:

– Proposed size: **USD 200 million**, with a possible increase.

Maturity:

– Shorter maturity than preferred: ***5 years***.

Yield spread:

– Aggressive spread = **40 bps** over 5-yr U.S. Treasuries.

– First-time issue: Add a small premium: ***Spread = 45 bps***.

The lead manager is able to formulate a pricing scheme:

U.S. Treasury: 6.915% s.a. (semiannual)

Merotex spread: **0.45% s.a.**

Merotex yield (**YTM**): **7.365% s.a.**, or **7.501% p.a.** (annual)

⇒ Terms for investors: a 5-year Eurobond at a price to yield **7.50% p.a**.

Fees

Selling concession: ¾%	(Sellers buys the issue at 99¼).
Underwriting allowance: ¾%	(Underwriters pays 98½)
Managing fee: ¼%	(Lead manager pays (98¼)
Total fees: **1¾% (= USD 3.5M)**	

Final terms:

Competitive bidding: Issuing house sells the issue at **99.24**

Coupon required to yield **7½%** is lower.

Assuming **YTM** = **7½**, T = 5, P = **99.24**, and FV = 100, solve for **C**

⇒ **C** = **7.3113%.**

Rounding up, the coupon rate is set at **7 (5/16)**.

Total coupon payment = (7 + 5/16) * **200 M** = **USD 14.625 M**

The issue is priced *at the selling concession.*

Expenses

1.- Paying Agency:	**100,000 bonds** in **USD 1,000 denominations**
	10,000 bonds in **USD 10,000 denominations.**
Total number of bonds:	**110,000**.
Coupon charge p.a.:	USD .07 per coupon payment (USD 7,700)
Redemption charge:	USD .70 **per bond** or USD 77,000
Authentication:	USD 4,000 on delivery of bonds.
Administration:	USD 2,000 (p.a.).
2.- Listing:	USD 20,000 payable in advance.
3.- Trustee:	USD 8,000 (p.a.) payable in advance.
4.- Other expenses:	USD 80,000.

Pro Forma of the Issue

Borrower:	Merotex C.A.
Guarantor:	None
Amount:	**USD 200 million**
Maturity:	**5 years**
Coupon:	**7 (5/16)** (= **7.3125%**)
Issue price:	100%
Amortization:	Bullet repayment on final maturity date
Issuer's call option:	None
Listing:	London
Denominations:	**USD 1,000** and **USD 10,000**
Form:	Bearer securities
.....	
Commissions:	**1¾% flat**
Yield:	**7.3125%** (at issue price), **7.5% p.a.** (at 99.24%)

Cash Flows of Merotex C.A. (in USD million):

Year	**0**	**1**	**2**	**3**	**4**	**5**
Principal	**200**	-	-	-	-	**-200**
Interest	-	**-14.625**	**-14.625**	**-14.625**	**-14.625**	**-14.625**
Commissions	**-3.500**	-	-	-	-	-
Paying Agency	-	-0.0077	-0.0077	-0.0077	-0.0077	-0.0847
Auth. & Adm.	-0.004	-0.002	-0.002	-0.002	-0.002	-0.002
Listing	-0.020	-	-	-	-	-
Trustee	-0.008	-0.008	-0.008	-0.008	-0.008	-0.008
Reimburs. exp.	-0.080	-	-	-	-	-
Cash Flow	**196.39**	**-14.6427**	**-14.6427**	**-14.6427**	**-14.6427**	**-214.7117**

⇒ Cost of funds (IRR) = **7.7778% p.a.**

Note: Sometimes, IRR is calculated by *excluding* annual & minor expenses (listing, trustee, authentication, etc.). Under this method,

IRR = **7.7580%**.

Cost of Funds Exclusive Annual and Minor Expenses: Details

• This figure takes account:

- Coupon payments (**USD 14.625 M**)
- Commissions of **1¾%** flat on the issue amount (**USD 3.5 M**)
- Reimbursable managers' expenses (USD 80,000)

The issuer receives the net proceeds of:

USD 200,000,000 - USD 3,580,000 = **USD 196,420,000** (or 98.21%)

• All-in cost: IRR of a 5-year project:

- Positive cash flow of **USD 196.42 M** in year zero.
- Negative cash flows of **USD 14.625 M** every year.
- Negative cash flow of **USD 200 M** in year 5.

IRR = **7.7580%**. (Merotex obtains financing at a cost of 7.7580% p.a.)

⇒ Small difference between both IRRs.

Cost of Funds Inclusive Annual and Minor Expenses: Details

This figure takes account:

- Coupon payments
- Commissions of **1¾%** flat on the issue amount
- Reimbursable managers' expenses
- Commissions and Expenses

⇒ IRR = **7.7778% p.a.** (Merotex obtains financing at an annual cost of 7.7778%.)