

# Long-Term Global Market Correlations

*Global Linkages Conference*

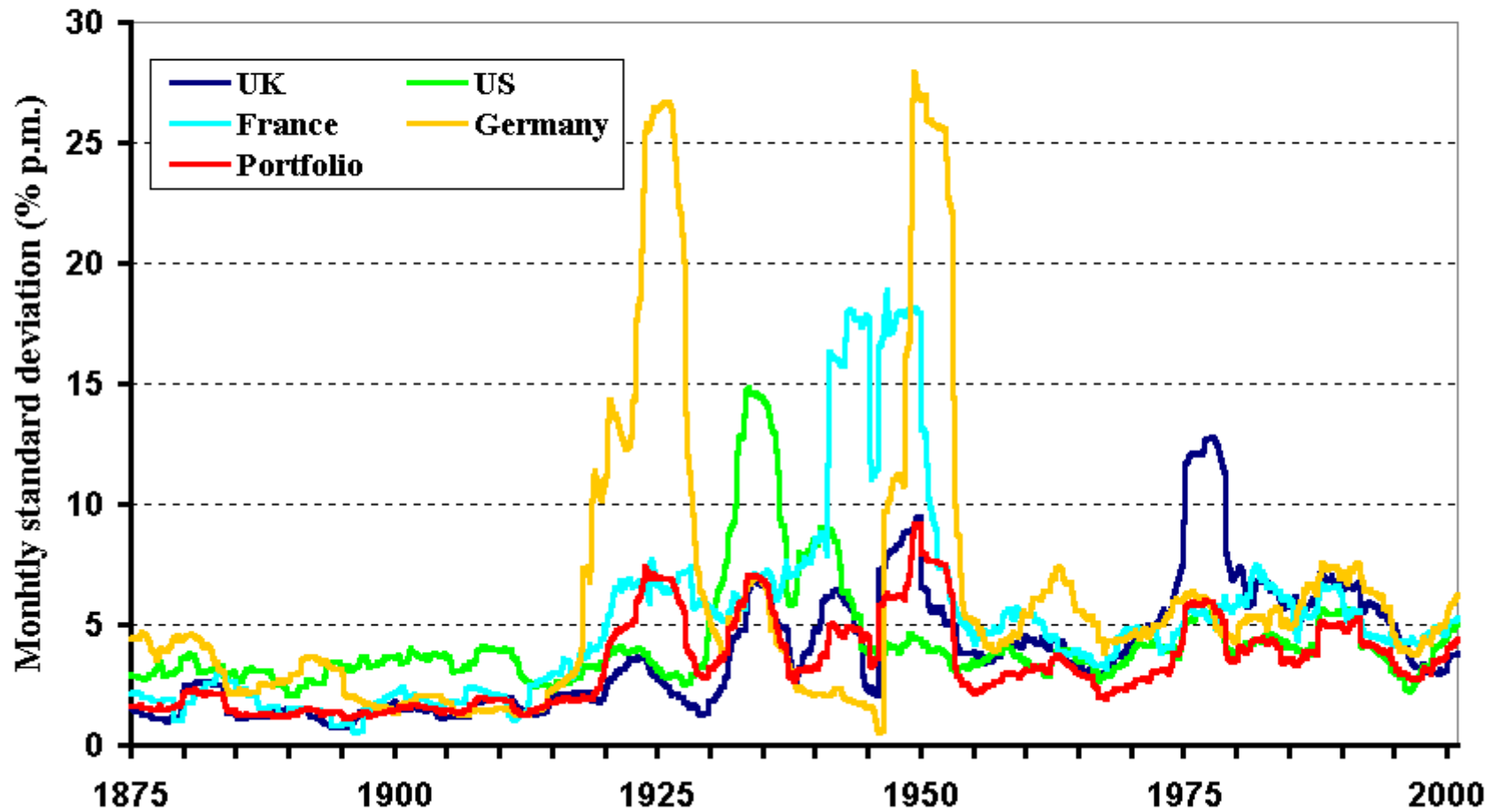
*IMF, January 30-31, 2003*

William N. Goetzmann, Lingfeng Li,

K. Geert Rouwenhorst

# Long-term USD Return Volatility

## Four "Core" Markets and EW portfolio





# Henry Lowenfeld, 1909

---

“It is significant to see how entirely all the rest of the **Geographically Distributed stocks** differ in their price movements from the British stock. It is this individuality of movement on the part of each security, included in a well-distributed Investment List, which ensures the first great essential of successful investment, namely, **Capital Stability.**”

From: *Investment and Exact Science, 1909.*



# History of Diversification

---

- First Mutual Fund: *Eendracht Maakt Magt (1774)*
  - Danish and Viennese banks
  - Danish Tolls and Holstein
  - Russia and Sweden
  - Brunswick and Mecklenburg
  - Postal services of Saxony
  - Spanish Canals of Taouste and Imperial
  - British Colonies
  - Essequibo
  - Berbice
  - Danish American Islands

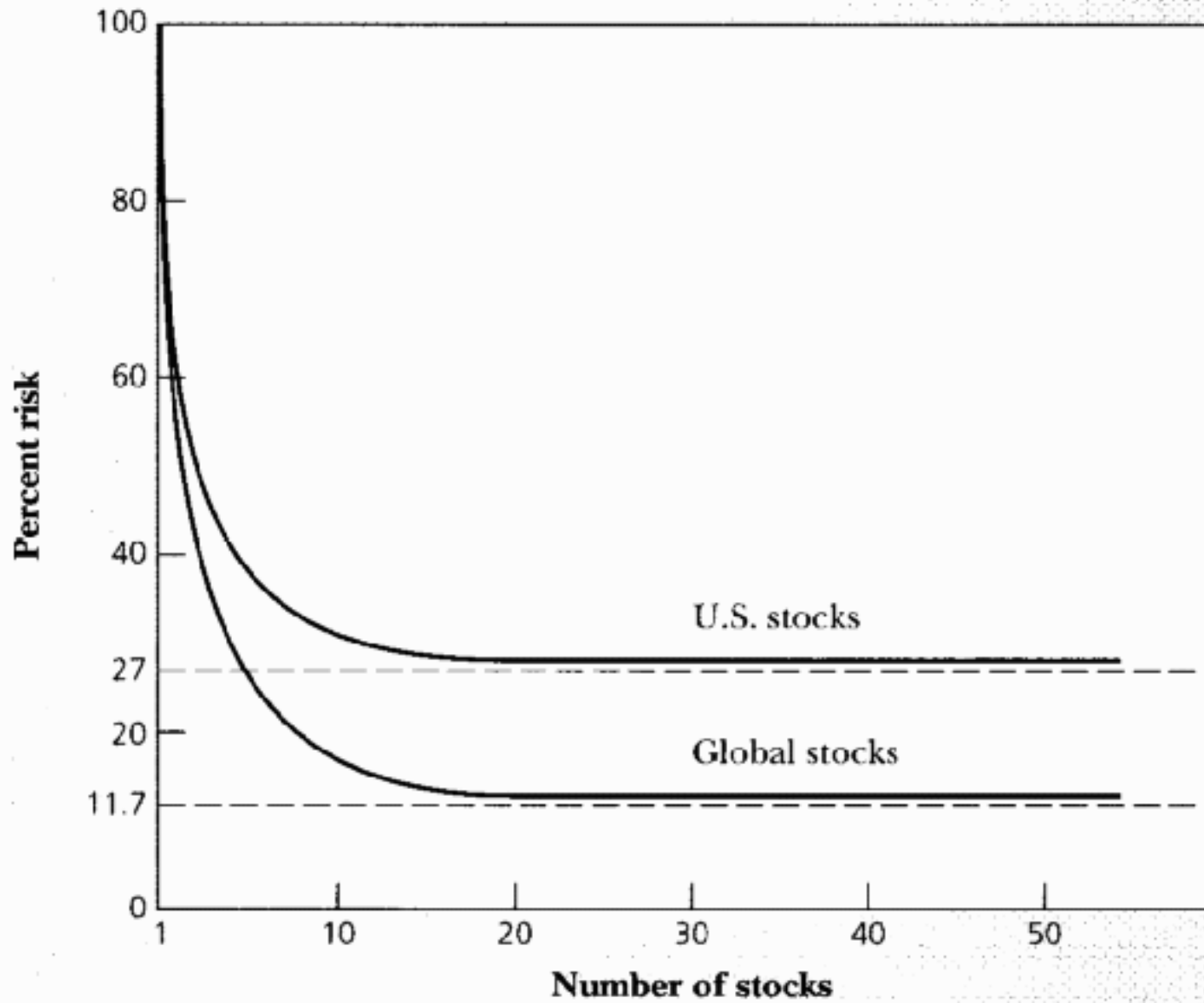


# Diversification: 1774 Mutual Fund

---

- In the portfolio construction the fund “will observe as much as possible an equal proportionality”
- “Because nothing is completely certain, but subject to fluctuations, it is dangerous to allocate all capital to a single security”
- “Nobody will have reason to believe that all securities will stop paying off at the same time thereby losing the entire invested capital”

# International Diversification





# Determinants of Diversification

---

- Correlation between the assets in the portfolio
  - Take a long-term look at market correlations over time
- The number of assets in the portfolio
  - Markets have disappeared and (re-)emerged over time
- What is the relative contribution of changing correlations and evolution in the investment opportunity set for diversification benefits?



# Preview of Results

---

- Major shifts in correlations through time.
- Correlations are lower during periods of capital market segmentation than during integration.
- Benefits of diversification among core markets are currently lower than in the 1930's.
- Decomposition shows that currently about half the benefits come from opportunity set growth and half from correlation structure of markets.
- Recent globalization has not diminished the diversification benefits for the “average” investor



# Data

---

- Monthly equity market index returns for about 50 countries, converted to USD.
- Sources: Jorion and Goetzmann (1999), Global Financial Database, Ibbotson Associates, IFC.
- Simulate perspective of the U.S. based global investor.



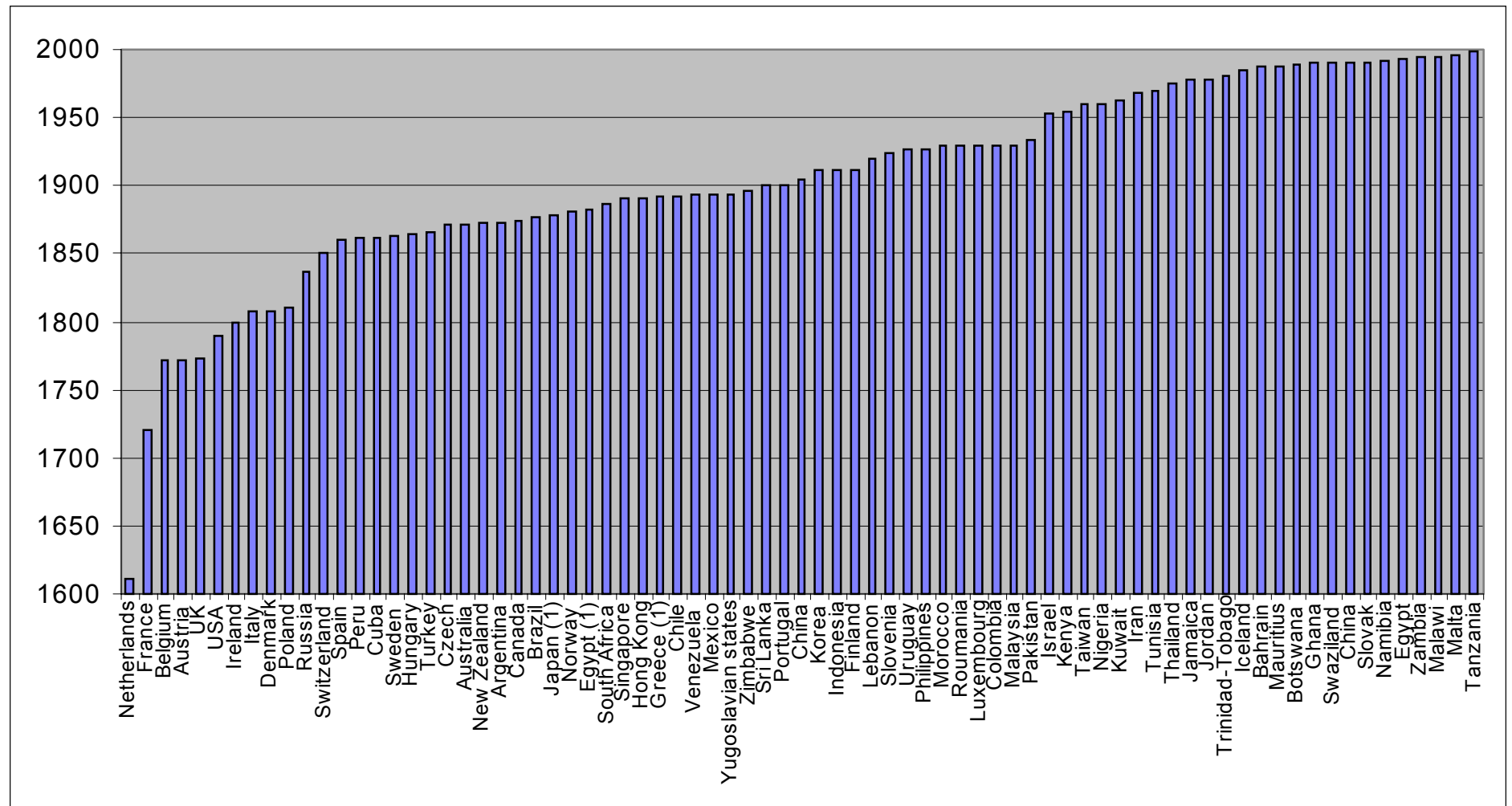
# Data Issues

---

- Missing countries, missing data
  - Little data before 1850
  - Russia in 19th century, China, Japan
  - Dividend information often unavailable
- Which markets were investable and when?
  - Portfolios assume that foreign markets investable
- Transactions costs?
- Prices accurately recorded?
- Cap-weighted vs. equal-weighted?



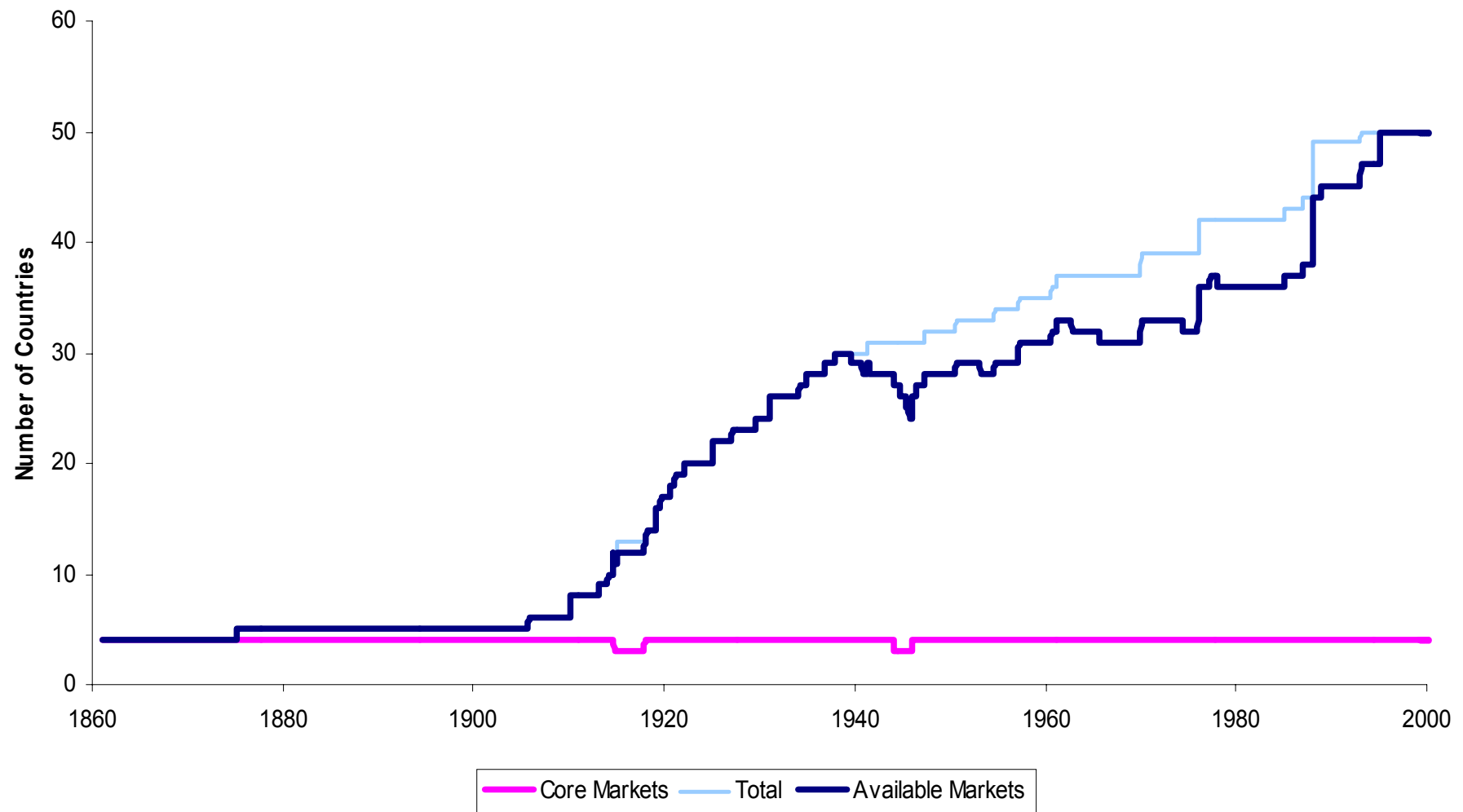
# Founding Dates For World Equity Markets



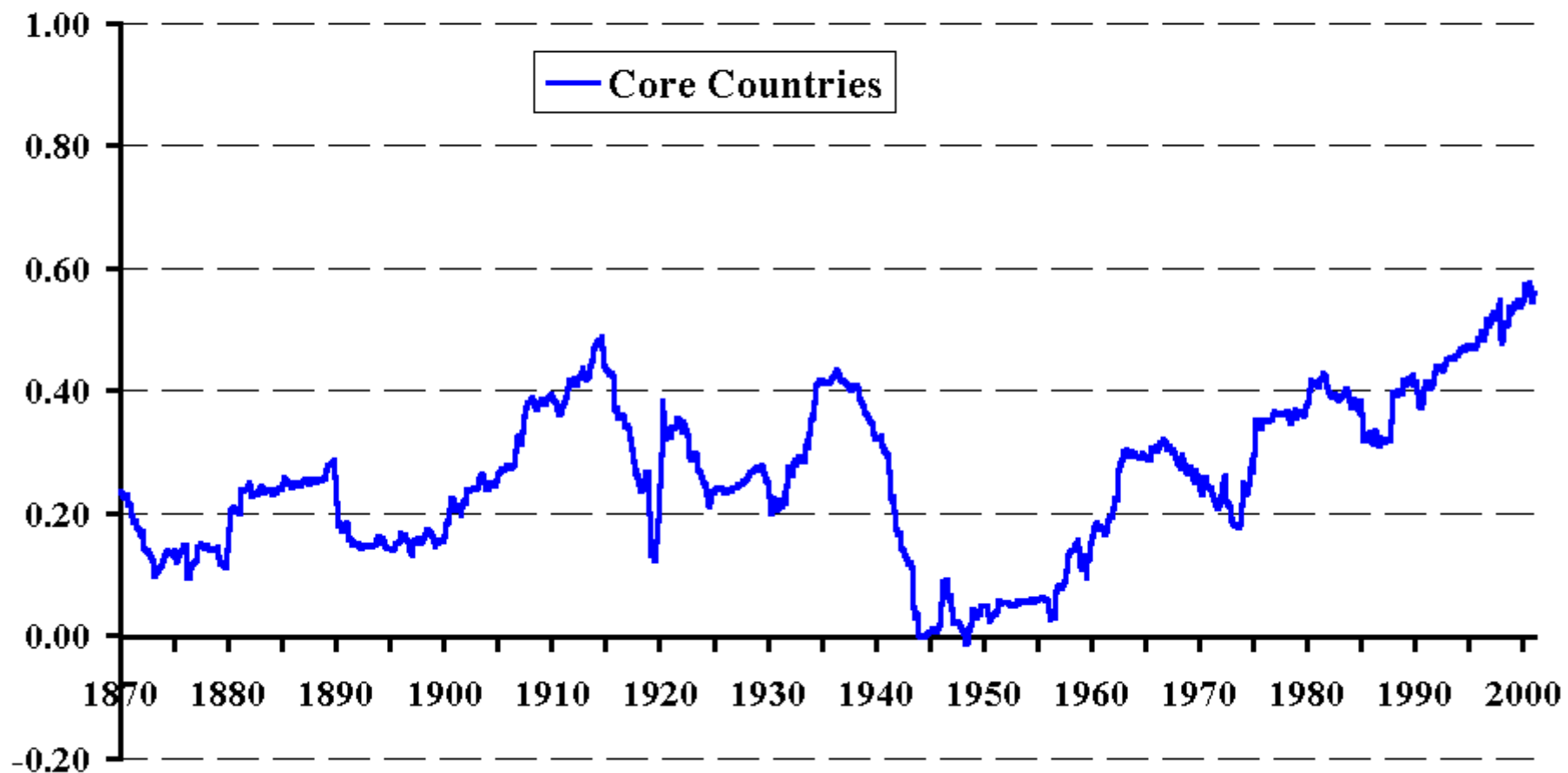




# Sample Market Entry and Exit



## Average Correlation Core Markets 120 month moving average



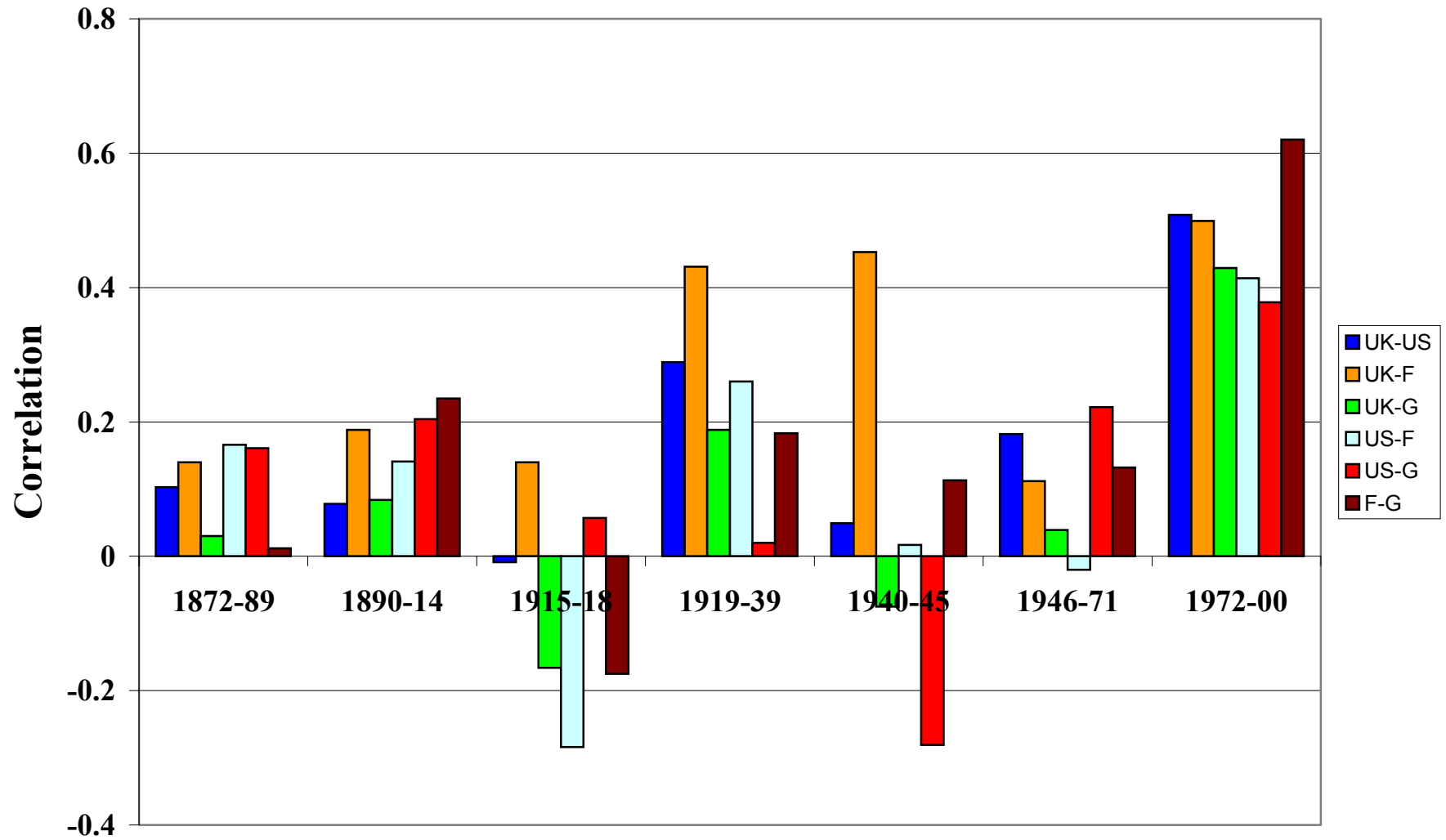


# Basu -Taylor (1999) Episodes

---

- 1872-1889: Early Integration
- 1890-1914: Turn of the Century
- 1915-1918: World War I
- 1919-1939: Between the Wars
- 1940-1945: World War II
- 1946-1971: Bretton Woods
- 1972-2000: Present

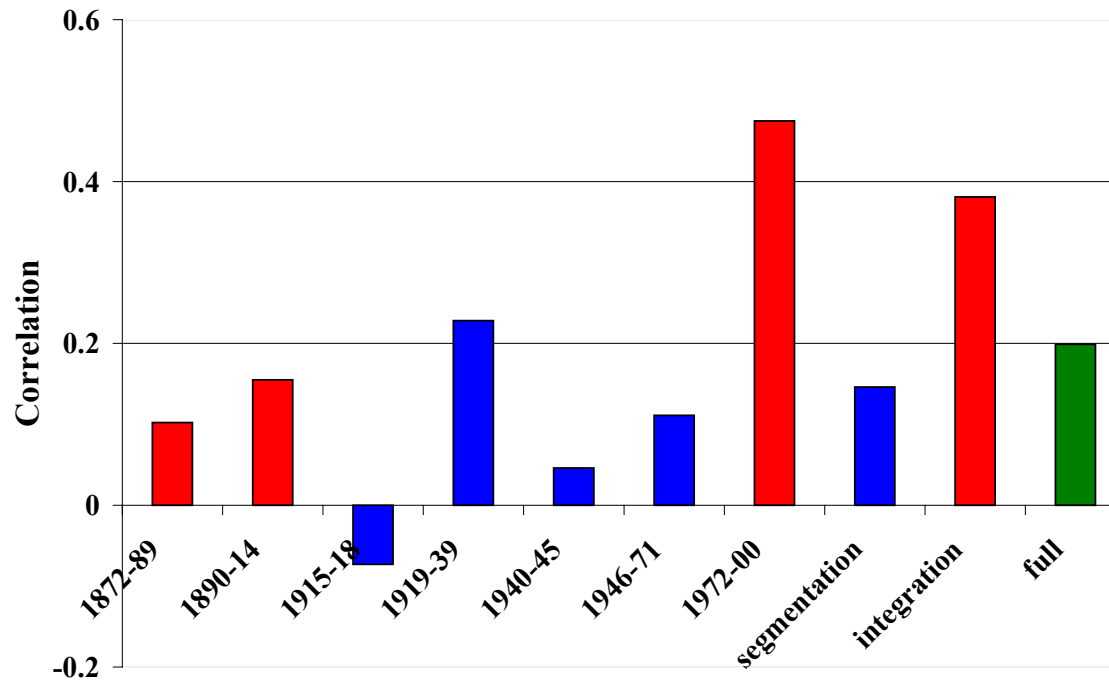
## Pairwise Correlations Core Countries





# Average Correlation

US UK Germany France



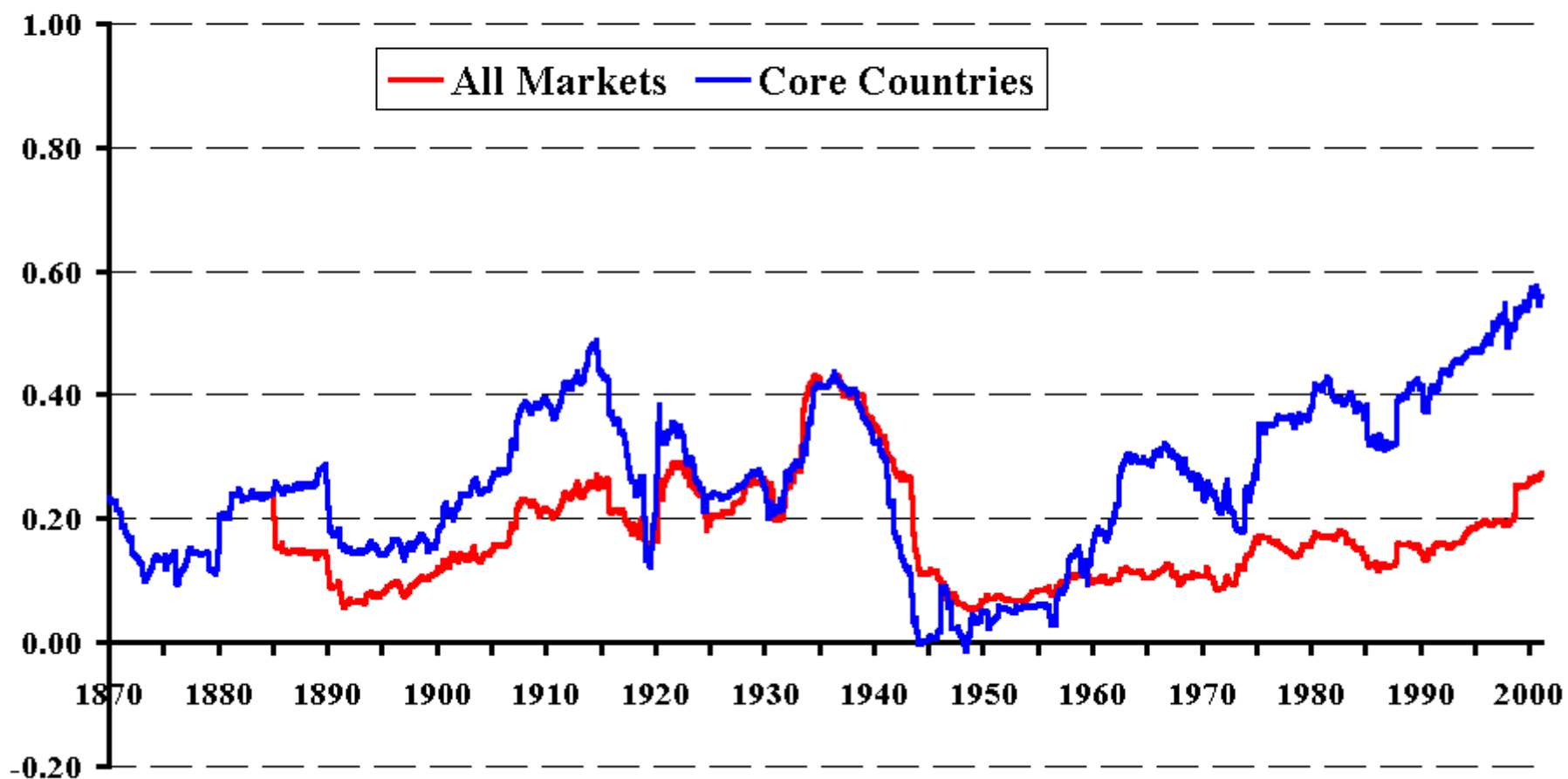


# Decomposing diversification benefits

---

- Benefits of diversification extends far beyond core markets
- Recent era shows high average correlation among core markets, but there are currently many more markets available for diversification.
- Does increase in opportunity set compensate for increase in average correlation?

## Average Correlation Equity Markets 120 month moving average





# Diversification measure - 1

$$\begin{aligned} \frac{\text{Var}\left(\sum_{i=1}^n x_i / n\right)}{\frac{1}{n} \sum_{i=1}^n \text{Var}(x_i)} &= \frac{\frac{1}{n^2} \sum_{i=1}^n \text{Var}(x_i)}{\frac{1}{n} \sum_{i=1}^n \text{Var}(x_i)} + \frac{\frac{1}{n^2} \sum_{i \neq j} \text{Cov}(x_i, x_j)}{\frac{1}{n} \sum_{i=1}^n \text{Var}(x_i)} \\ &= \frac{1}{n} + \left(\frac{n-1}{n}\right) \times \frac{\overline{\text{Cov}(x_i, x_j)}}{\overline{\text{Var}(x_i)}} \end{aligned}$$



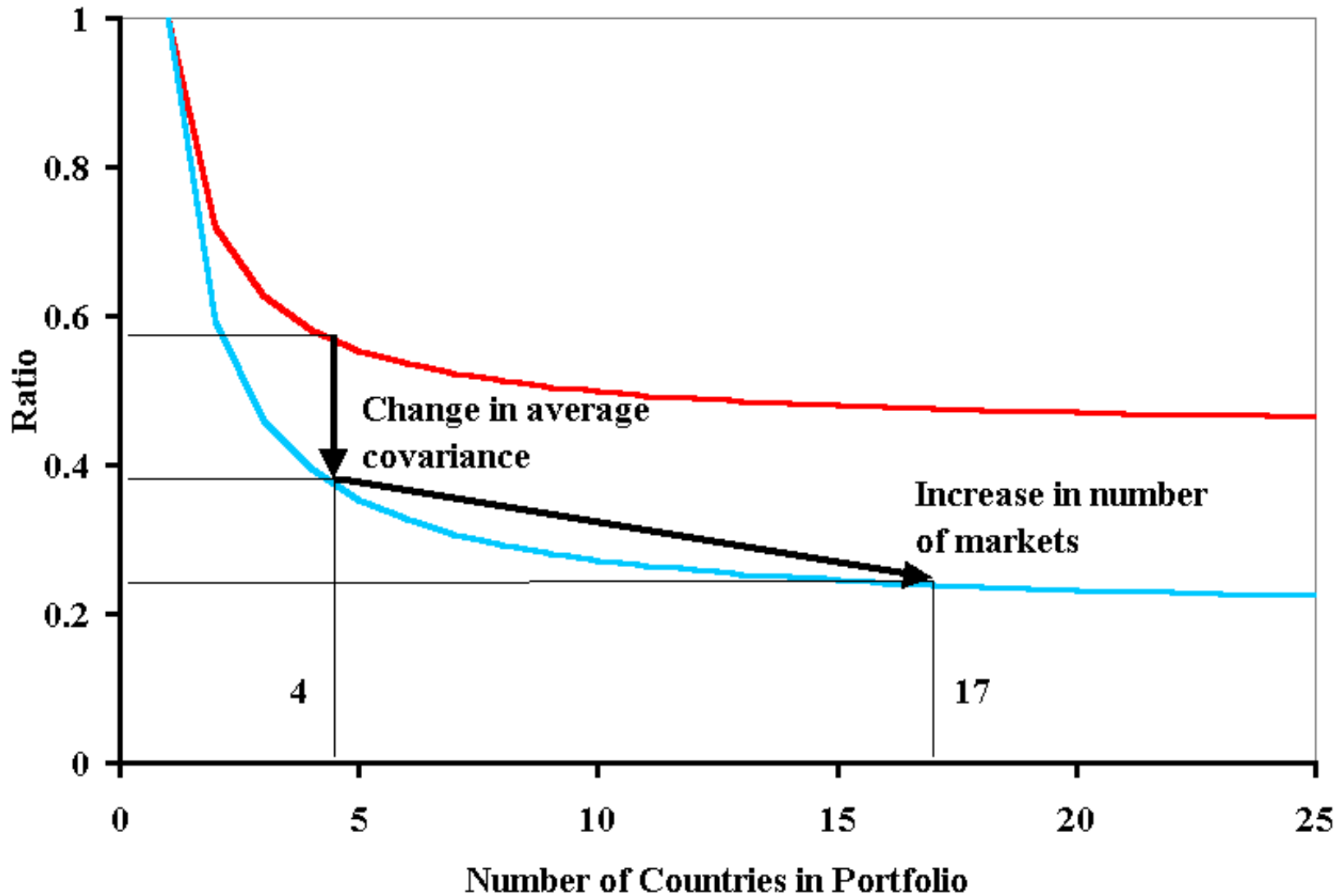
# Diversification measure - 2

---

- Diversification benefits measured by the ratio of :
  - return variance of a diversified portfolio
  - average return variance of the assets in the portfolio
  
- Ratio lies between 0 and 1 :
  - 1: perfect correlations
  - 0: uncorrelated returns

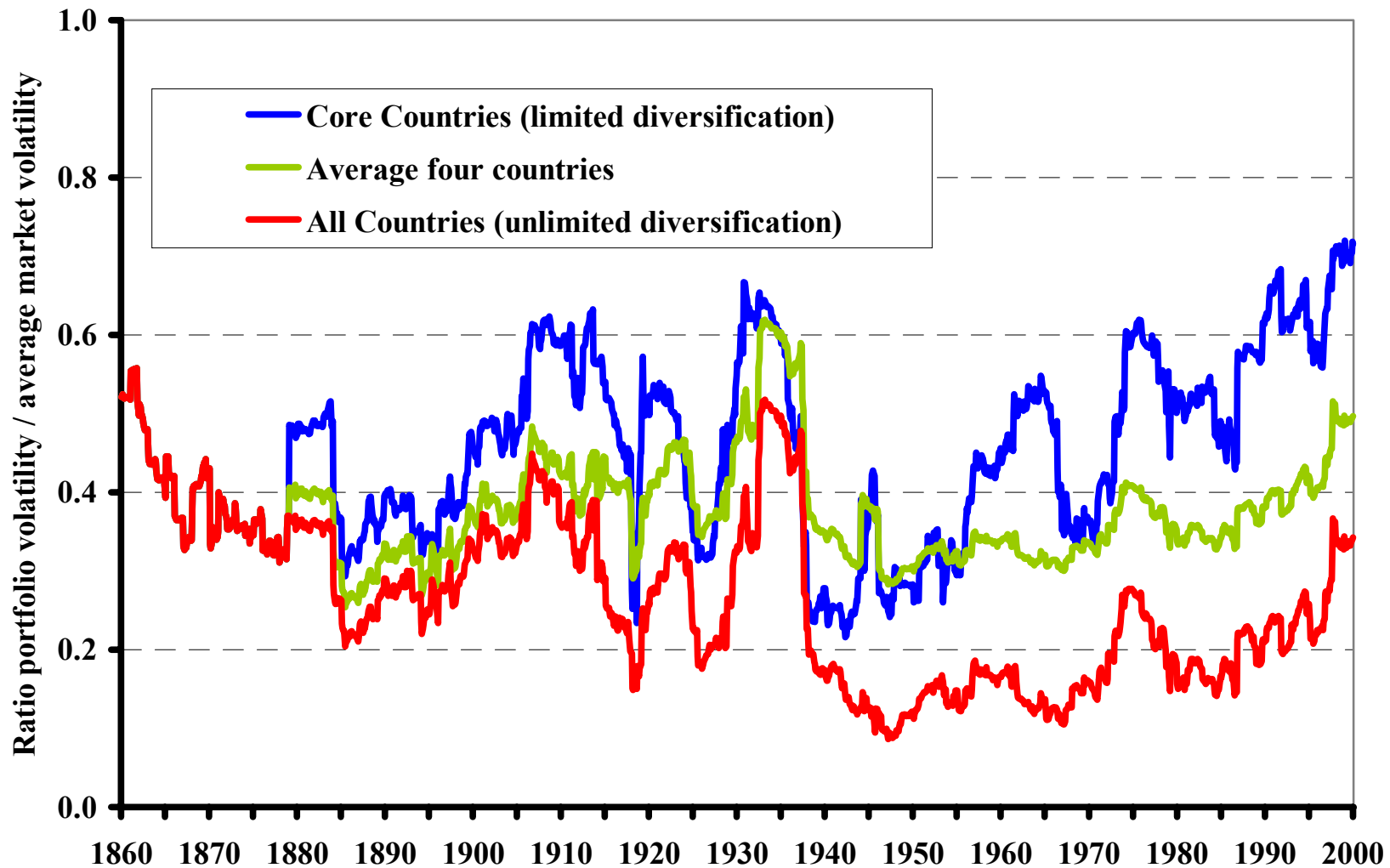
# Decomposing the Benefits of International Diversification

## Average Covariance versus Investment Opportunity Set



## Decomposing the Benefits of International Diversification

equally-weighted portfolio variance / average market variance





# Current diversification benefits -1

---

- Variance of a portfolio of 4 core markets is currently about 70% of the average individual country variance (30% reduction)
- Core markets have higher correlation than emerging markets: average portfolio of 4 markets provides 50% risk reduction
- Maximum global diversification offers 65% risk reduction
- Expansion of opportunity set contributes about half of the total diversification benefits



# Current diversification benefits -2

---

- Effect of increase in the investment opportunity set has been twofold:
  - “Emerging” markets have lower correlation than developed markets: risk reduction rises from 30% to 50%
  - The increase in the number of markets: risk reduction rises from 50% to 65%
- Expansion of opportunity set doubles diversification benefits (from 30 to 65%): about half comes from lower correlations have from increase in the number of markets



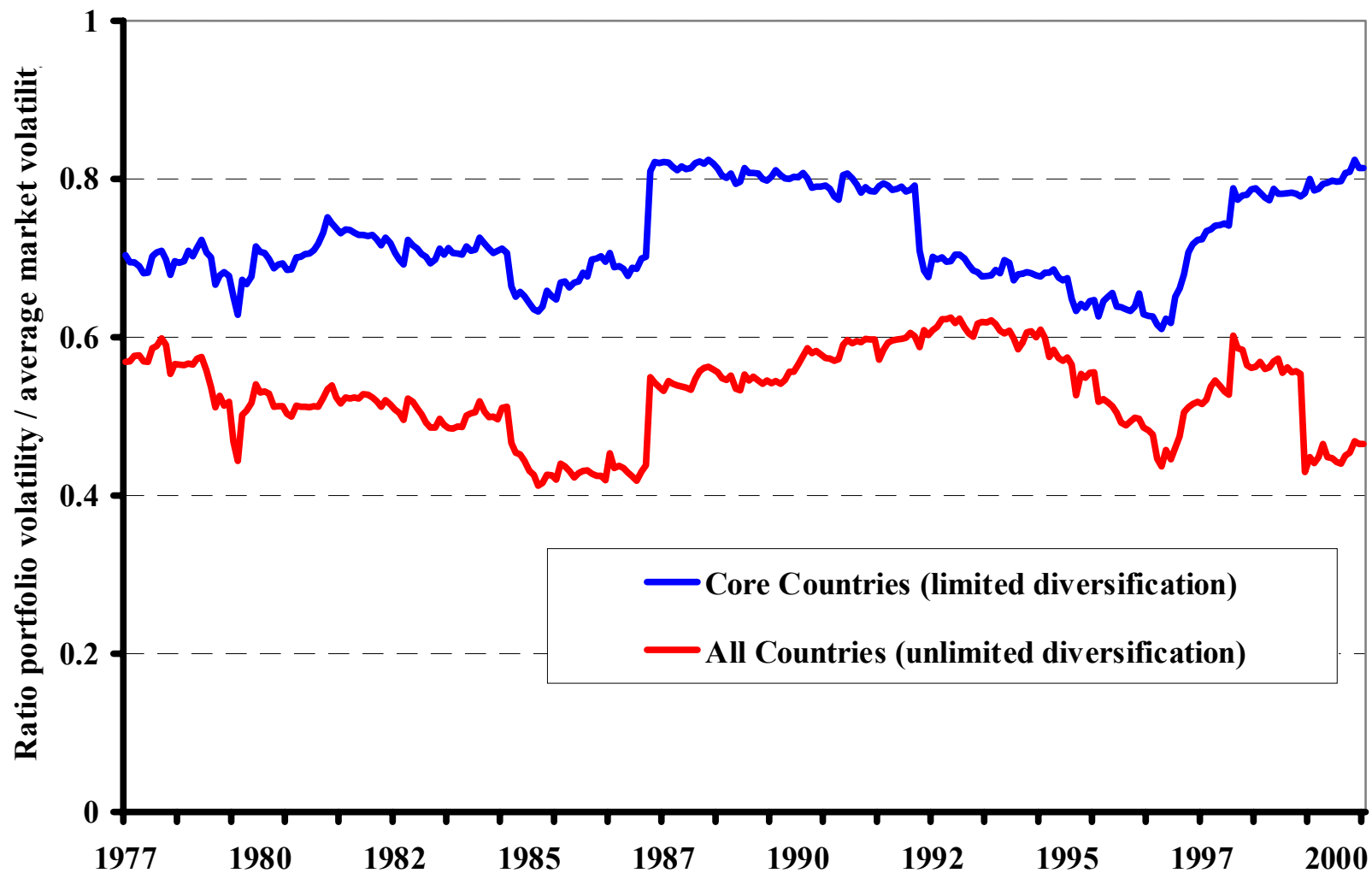
# Equilibrium diversification benefits -1

---

- Not every investor can hold an equally-weighted portfolio
- Assets have to be held in proportion to market weights
- Weight of smaller/emerging markets needs to be reduced
- What do equilibrium benefits of diversification look like?

## Recent Benefits of International Diversification

value-weighted portfolio variance / market variance





# Equilibrium diversification benefits -2

---

- Benefits are generally lower because value-weighted portfolios are less diversified.
- Despite the slow rise in return correlations, the benefits to international diversification have been remarkably stable over last 25 years
- “Emerging markets” double the benefits to diversification across core markets.



# Conclusions

---

- Longer view reveals shifts in correlations.
- Integration is associated with high market correlation
- While correlations are at highpoint in history, investors benefit from an expansion of the investment opportunity set
- About half of current benefits stem from expansion of opportunity set.
- Diversification benefits have been remarkably stable for “average investor” over last 25 years.