Assessing the Financial Performance of Timberland Investment

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Overview

- Background
- Objectives
- Methodology
- Data
- Data analyses and results
- Comparisons and conclusions

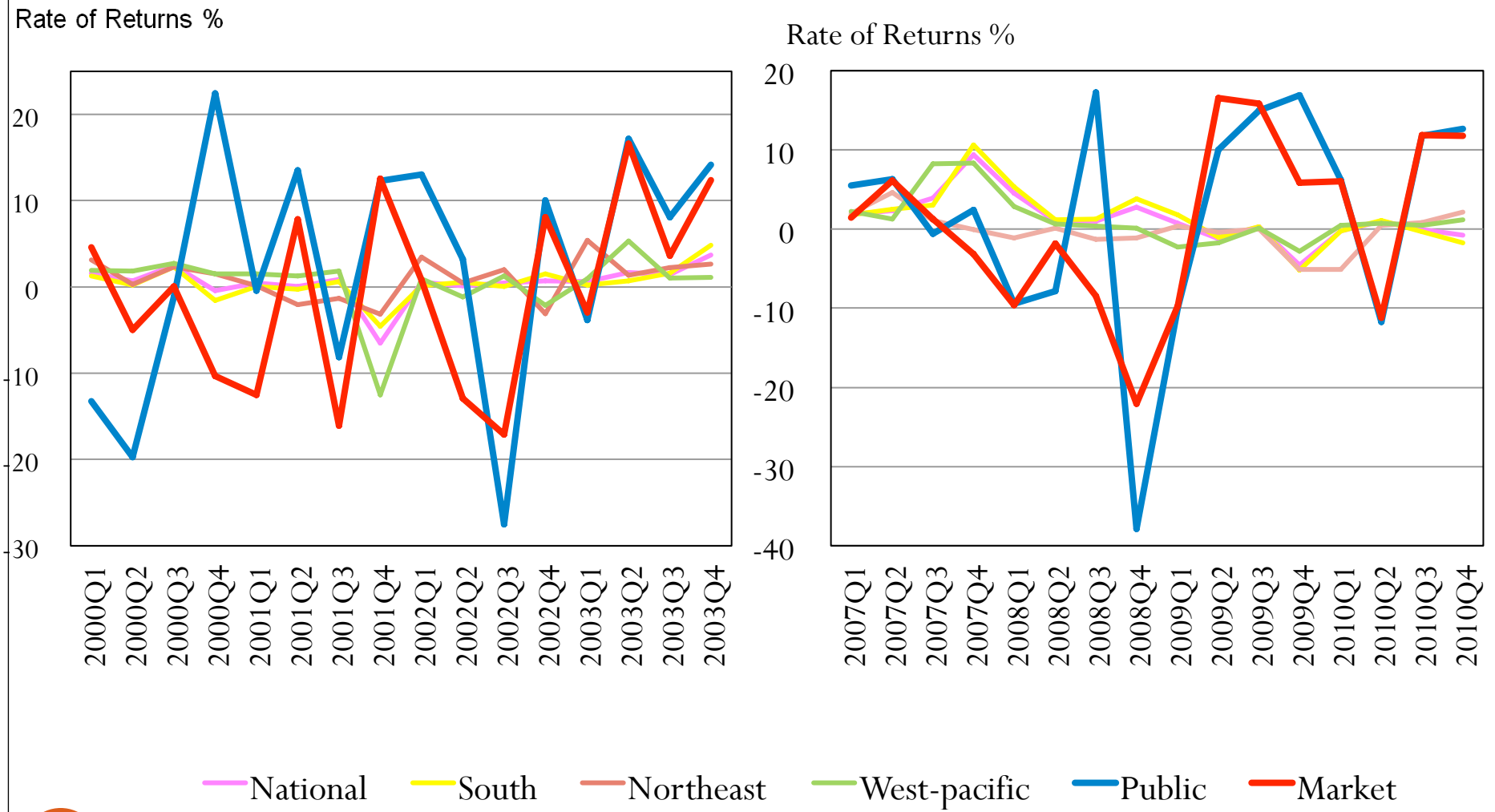
Background

- Changes in Timberland Industry
  - Supply Side
    - Vertical integrated forest products firms
    - Restructure and focus on specific products
  - Demand Side
    - Interest in timberland investment in US is growing
      - Real Estate companies bought timberlands
      - Institutional investors are allowed to diversify investment

- Financial performance of timberland investment
  - Low correlation with market financial assets
  - Effective hedge against higher-than expected inflation
  - Better and higher returns if biological growth is known
  - Relative inefficiency exist in timberland markets
  - Institutional timberland investments have low risk but excess returns
  - Cointegrated with other nontimber financial investments in long run

- Ways to invest in timberland investments
  - Own timberland directly
  - Hold lumber futures
  - Public-equity timberland investment
  - Private-equity timberland investment

- Performance during 2000-2003 and 2007-2010



Previous research

- Sun, C.Y., and D.W. Zhang. 2001. "Assessing the financial performance of forestry-related investment vehicles: Capital asset pricing model vs. arbitrage pricing theory." *American Journal of Agricultural Economics* 83(3):617-628.

- Mei, B., and M.L. Clutter. 2010. "Evaluating the Financial Performance of Timberland Investments in the United States." *Forest Science* 56(5):421-428.

Objectives

- Evaluate the financial performance of timberland investments in the US from 1987 to 2010
- Assess the returns of public- and private-equity timberland investment
- Compare the financial performance of timberland investment in two different sub-periods

Methodology

- Capital Asset Pricing Model (CAPM)
- Arbitrage Pricing Theory (APT)

- CAPM

$$E[R_i] = R_f + \beta_i E[R_m - R_f]$$

Excess return form:

$$R_i - R_f = \alpha_i + \beta_i (R_m - R_f) + \mu_i$$

If $\alpha_i > 0$, outperforms the market

$\alpha_i < 0$, underperforms the market

If $\beta_i > 1$, more risky than the market

$\beta_i < 1$, less risky than the market

Methodology

- APT
  - $R_i = E[R_i] + \beta_{i1}\delta_1 + \beta_{i2}\delta_2 + \ldots + \beta_{in}\delta_n + e_i$

    β_{in}: sensitivity of asset i to factor n

    δ_i : common factor

    e_i: random error to asset i

  - Extract common(risk) factors: Factor analysis
    - ✓ **Principle Component Factor Analysis (PCFA)**
    - ✓ Maximum Likelihood Factor Analysis (MLFA)

Data

- Historical quarterly returns from 1987-2010
  - Five timberland investment returns
    - Private: NCREIF National, South, Northeast, Pacific northwest
    - Public: Value-weighted portfolio
  - Fifteen investment portfolio or price index returns
    - Exchange, Gold, Steel, Aluminum, LT bond
    - PNSPA, Paper, Chair, Wood, SSPA, Lumber Future, JHTI, NonUS, Global

All the data are in % of rate of returns

Data analyses and results

Table 1. Estimation of CAPM using five timberland return proxies (1987Q1 – 2010Q4)

CAPM	α		β		
Asset	Coefficient	P	Coefficient	P	R^2
National	2.3075	**<0.0001**	-0.0042	0.9307	0.0005
South	1.5737	**<0.0001**	-0.0120	0.5931	0.0030
Northeast	0.9731	**0.0534**	0.0662	0.2269	0.0220
Pacific northwest	3.2742	**<0.0001**	0.0057	0.9465	0.0000
Public	0.5902	0.5210	0.9469	**<0.0001**	**0.4753**

- APT
  - Step1 Extract factors using PCFA

Eigenvalues of the Covariance Matrix

# of Factors	Eigenvalue	Difference	Proportion	Cumulative
1	782.31	147.60	0.3569	0.3569
2	634.70	329.04	0.2895	0.6464
3	305.65	100.14	0.1394	0.7859
4	205.50	138.35	0.0937	0.8796
5	67.15	17.45	0.0306	**0.9102**
6	49.69	7.49	0.0227	0.9329

  - Step2 Calculate factor scores

- Step3 Calculate sensitivity coefficients

Asset	β_1	β_2	β_3	β_4	β_5	R^2
National	-0.3882	1.0813	0.1125	-0.1964	-0.2030	**0.1718**
South	-0.5251	0.8544	0.0573	-0.4369	-0.3089	**0.1160**
Northeast	0.2074	1.4620	0.3558	-0.1778	-0.5168	**0.1537**
Pacific northwest	-0.2446	1.5129	0.2850	0.2958	-0.0550	**0.1705**
Public	11.4632	0.9477	0.1366	0.1591	0.5003	**0.9081**

- Step4 Calculate risk premium associated with each factor

$$E(R_i) = 1.9605 + 0.1245*\beta_{i1} + 0.1040*\beta_{i2} - 0.0407*\beta_{i3} + 0.0523*\beta_{i4} + 0.0547*\beta_{i5}$$

Comparison

- Compare annual historical and required returns with APT in 1987-2010

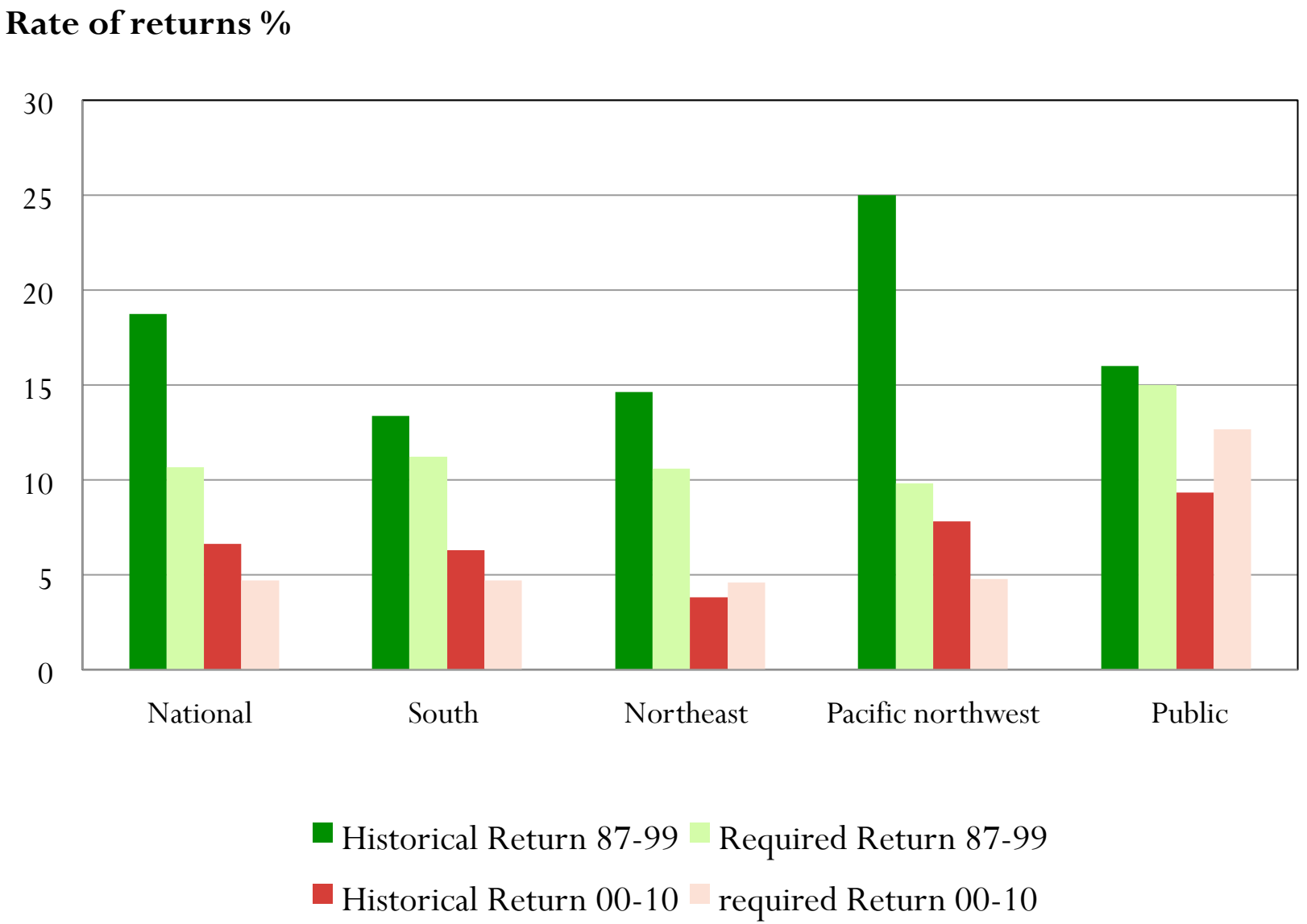
Asset	Historical Annual Rate of Return	Required Annual Rate of Return with APT	Excess Return Percentage with APT
	I	II	(I-II)/II
National	13.18	7.99	65
South	10.14	7.77	31
Northeast	7.63	8.35	-9
Pacific northwest	17.11	8.35	105
Public	12.95	14.07	-8

Comparisons

- Compare Annual Historical and required returns with APT in different time periods

Asset	Historical Annual Rate of Return		Required Annual Rate of Return with APT	
	1987-1999	2000-2010	1987-1999	2000-2010
National	18.74	6.61	10.66	4.70
South	13.38	6.31	11.21	4.69
Northeast	14.63	3.82	10.60	4.59
Pacific northwest	24.98	7.81	9.81	4.77
Public	16.00	9.34	14.99	12.67

Comparisons



Conclusions

- Private-equity timberland investment:
  - Outperforms the market but have lower systematic risk
  - Has excess returns
  - Higher average historical and expected returns in 1987-1999
- Public-equity timberland investment:
  - Performs similarly to the market
  - Does not have excess returns
  - Changes are not significant in two periods

Thank you !