

Creating and Sharing Value from Timber Production: IRR, LEV, and Profit Maximization



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Outline

1. Wage, Rent, Interest, and profit
2. IRR, LEV and Profit maximization (PM)
3. Economic interpretation of IRR, LEV, PM
4. Why profit maximization in a changing world
 - i. The problems of LEV
 - ii. Land market available
 - iii. More flexible
 - iv. The role of entrepreneur
5. Policy implication

Wage, Rent, Interest, Profit

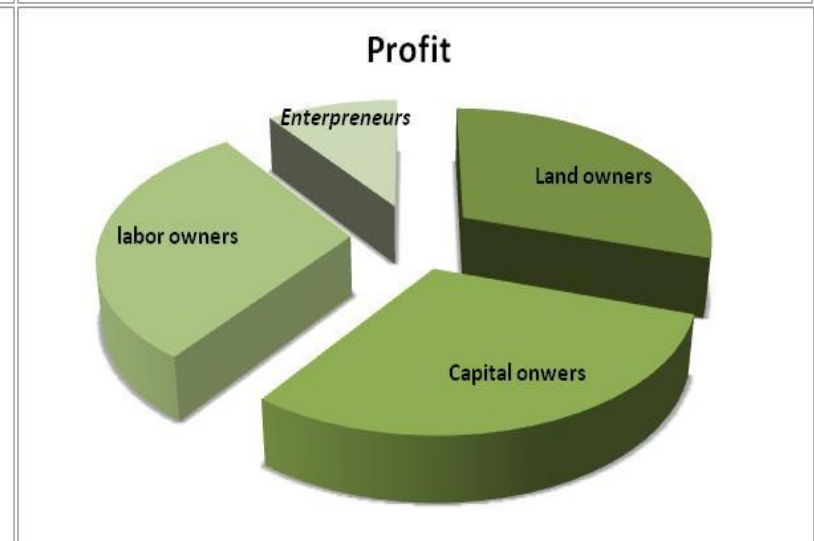
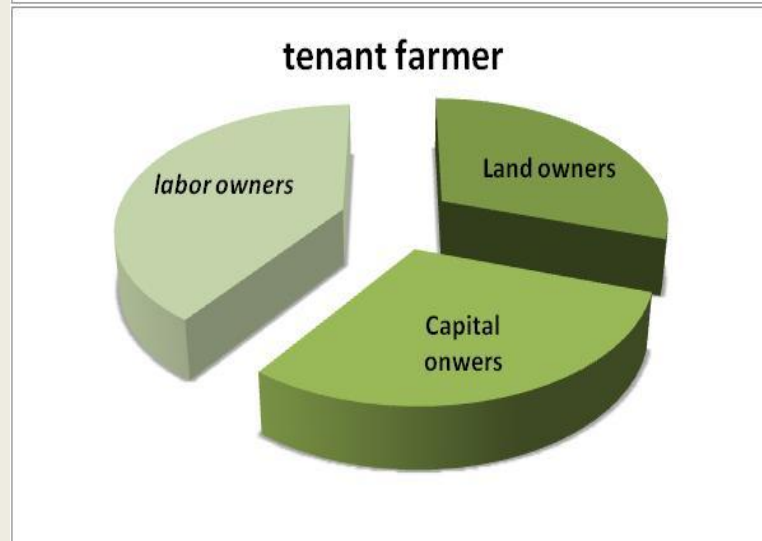
Wages: Return to labor owners in creating the goods or services

Rent: Return to land lord for the use of the powers of the soil.

Interest: Paid for the use of money or stock

Profit: Revenue exceeding the opportunity cost of inputs

IRR, LEV, Farmer, Profit

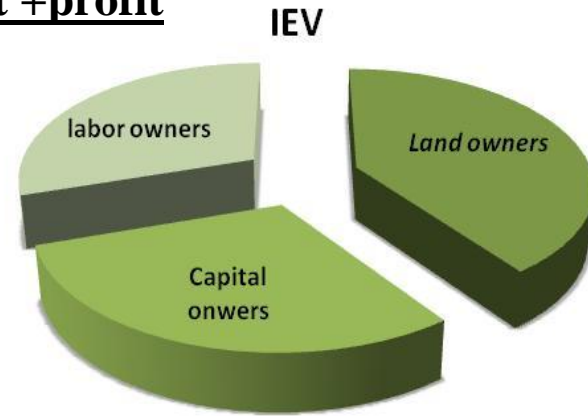


IRR, LEV, Farmer, Profit

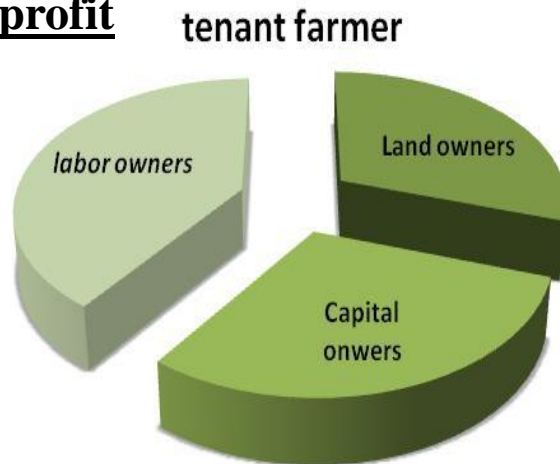
= interest + profit



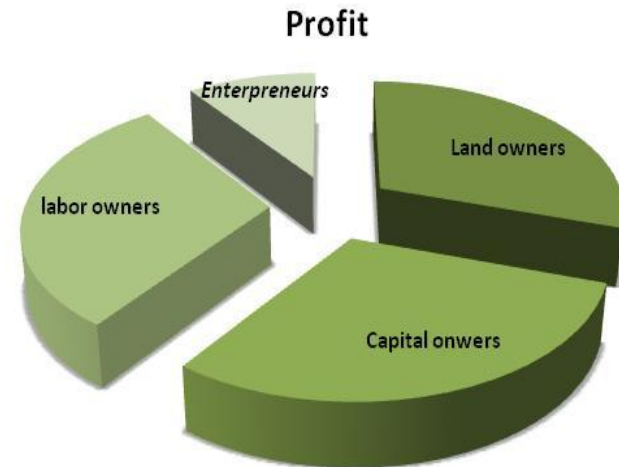
= Rent + profit



= wage + profit



= total revenue - (rent+wage+interest)



Comparison: LEV, IRR, PM

	Objective function	F.O.C. for optimization
LEV	$R = r \frac{PV(T, E)}{(e^{rT} - 1)} - r \frac{wE}{(1 - e^{-rT})}$	$PV_T(T, E) = \frac{r PV(T, E)}{(1 - e^{-rT})} + \frac{rwE}{(1 - e^{-rT})}$ $V_E(T, E) e^{-rT} = w$
IRR	$r = \frac{[\ln[PV(T, E)] - \ln(wE)]}{T}$	$PV_T(T, E) e^{-rT} = wE r$ <p>or $V_T(T, E) / V(T, E) = r$</p> $PV_E(T, E) e^{-rT} = w$
IRR	$PV(T, E) =$ $wE e^{rT} + Rr^{-1} (e^{rT} - 1)$	$PV_T(T, E) = PV(T, E) r + R$ $PV_E(T, E) e^{-rT} = w$
PM	$Max_{T, E, A} \pi = PV(T, E, A) r (e^{rT} - 1)^{-1}$ $- wE r (1 - e^{-rT})^{-1} - AR$	$R = PV_A(T, E, A) r (e^{rT} - 1)^{-1}$ $w = PV_E(T, E, A) e^{-rT}$ $PV_T(T, E, A) = r [PV(T, E, A) - wE]$ $+ r [PV(T, E, A) - wE] (e^{rT} - 1)^{-1}$

Comparison: LEV, IRR, PM

LEV	IRR	PM
<i>Objective</i>		
Land value	Capital value	Firm value
<i>Who</i>		
Land owners/managers	Capital owners/managers	Entrepreneur/ firm managers
<i>Assumptions</i>		
<ul style="list-style-type: none"> • C.R. to land • Land market is perfect, or nonexistent • All residual value from production goes to land owners. 	<ul style="list-style-type: none"> • C.R to land and capital • Capital market is perfect, or nonexistent • All residual value from production goes to capital owners. 	<ul style="list-style-type: none"> • Both capital and land markets are not perfect and available from marketplace • All residual value goes to the entrepreneur.
<i>When</i>		
<ul style="list-style-type: none"> • Land market is not active; • T.C. is high; • Land use is static. 	<ul style="list-style-type: none"> • Capital market is not active; • TC. for capital is very high. 	<ul style="list-style-type: none"> • Land & capital markets are active • T.C. is low; • Land uses are heterogeneous
<p>-----></p> <p>Before 1900s</p>	<p>-----></p> <p>1900s to 1950s</p>	<p>After 1950s</p>

Approach in a Changing world

Profit maximization

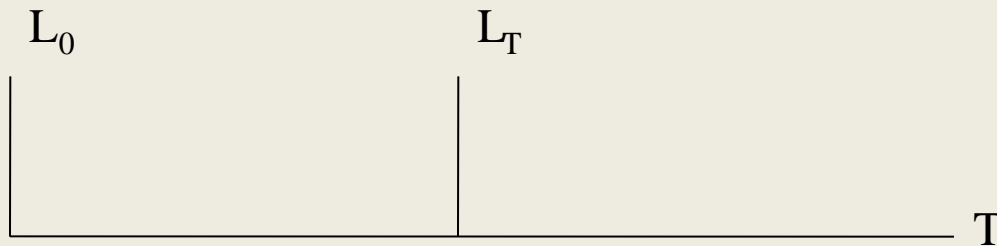
Why Profit Maximization?

1) The problems of LEV

- LEV is not pure land value maximization:
but rent +profit+ cost of the manager
- LEV has not addressed the land scale issue of land, which is becoming critical in timber or other land management

Why Profit Maximization?

2) More flexible to deal with cost of land, e.g.,



$$\pi = PV(T, E, A) e^{-rT} - wE - R(A)$$

$$R(A) = L_T(A) * e^{-rT} - L_0(A)$$

- A is the area of land
- $L_T(A)$ is the land price (or expected price)
- $L_0(A)$ is the current land price

Why Profit Maximization?

3) Land market is available

- Faustmann formula is redundant
- LEV is not consistent with principle of land market

Evidence of land market: 1

Retail v. Wholesale land values: about 5,000 acres.

- Retail (smaller tracts) values are typically higher.
- Retail land values (small tracts) are exceeding \$1,000 per acre, and often rising to \$3,000, \$4,000 or more in 2002.

- **Warren A. Flick (2003)**

Evidence of land market: 2

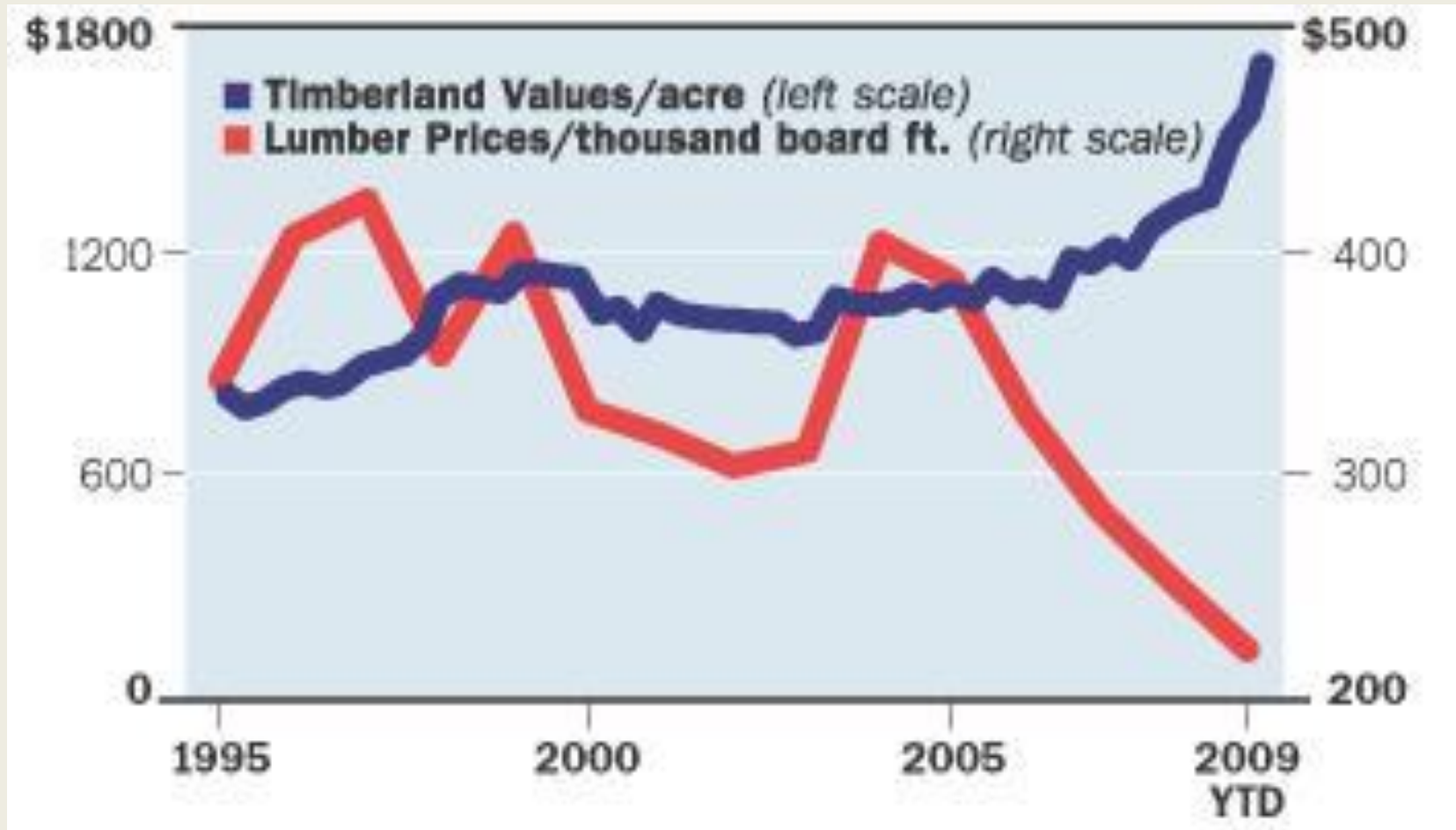
\$800/acre	2002, South, mostly pine plantations, wholesale tracts,
\$1,016/acre	2001, U.S.-wide, wholesale tracts, 6.4 mm acres,
\$750/acre	1995-2000, U.S.-wide, wholesale tracts, totaling 15 mm acres.

Source: Pulp and Paper North American Fact Book, 2002. San Francisco: Paperloop.com, 2003.

Evidence of land market: 3

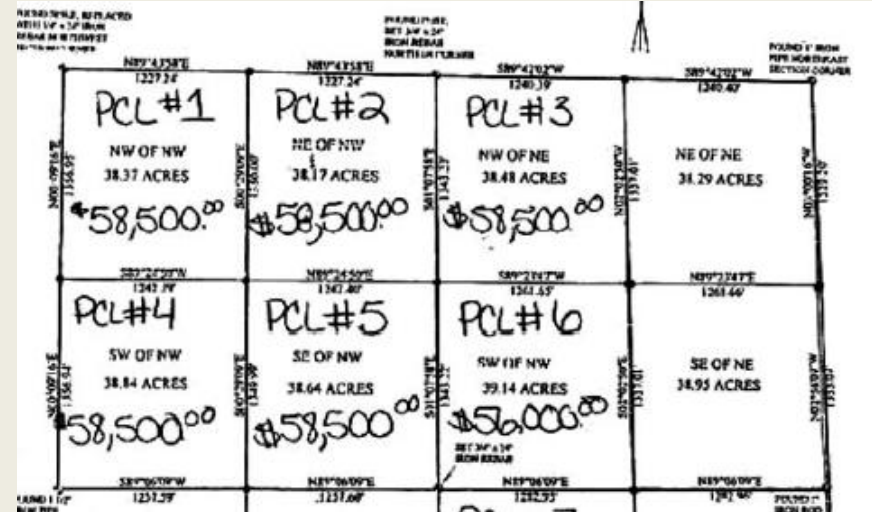
\$700-800/acre	2002, South, wholesale tracts, Timber Mart-South, Market Newsletter, Q1, 2003.
\$812/acre	2002, South, wholesale tracts, Timberland Markets, Feb. 2003. (6,200 – 300,000 ac. Tracts).
\$880/acre	Through mid-2003, South, wholesale tracts, Timberland Markets, August 2003.
\$630/acre	2002, Southeast, Bare Land Values, F & W Forestry (May be a mix of retail/wholesale).

Evidence of land market:4



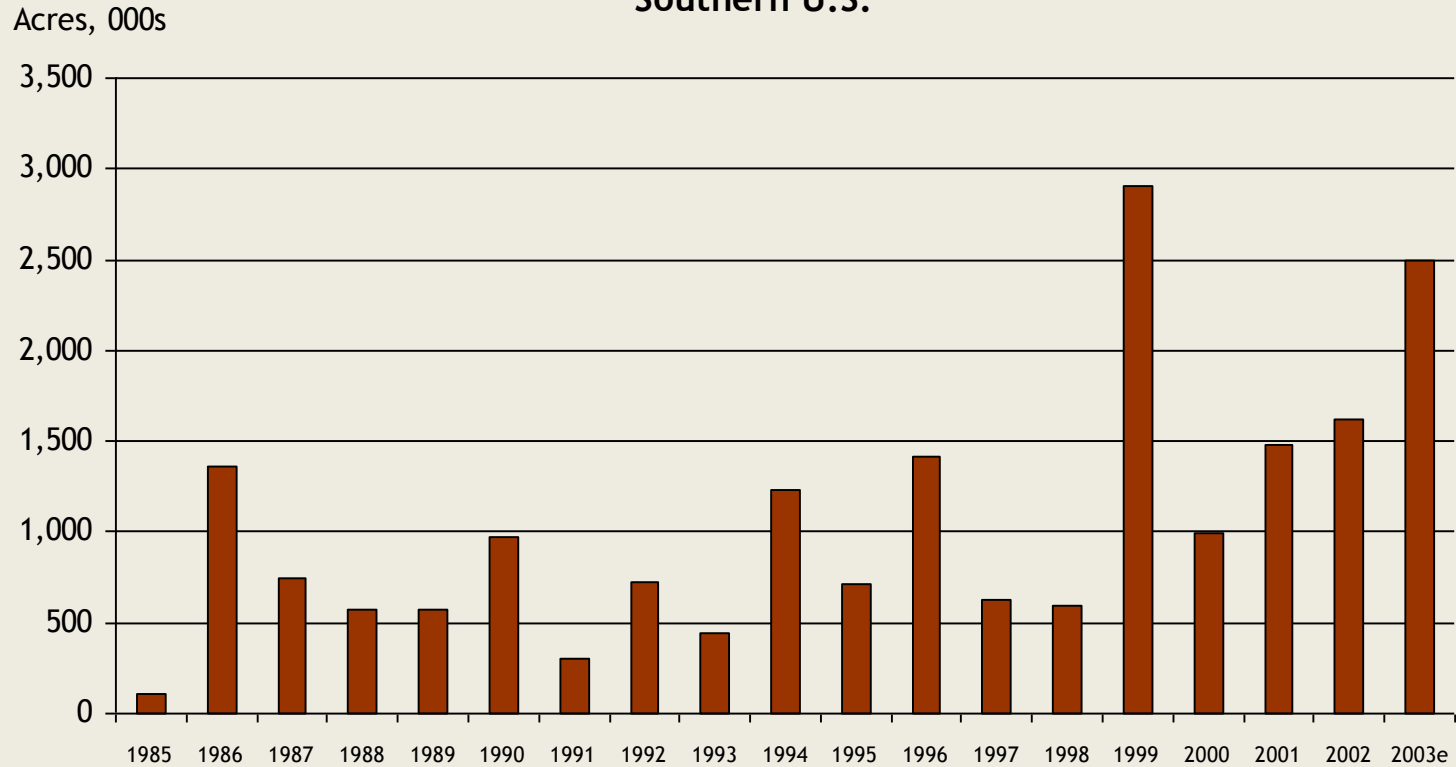
Sources: NCREIF and Hancock Timber Resource Group

Evidence: Parcelization



Evidence of land market:5

Commercial Grade Forestland Sales
Southern U.S.



Why Profit Maximization?

4) Increasing role of entrepreneur

Land value is created by people more than the land.

- Land is only stage, people is players
- Same land has different value to different people, because
- Innovation in land use

Different value to different people

Timberland
Management
Company

Timber production

~~Family legacy~~

✓ ~~Wealth preservation /
tax avoidance~~

~~Conservation~~

~~Recreation~~

~~Aesthetics~~

~~Commercial / residential
real estate development~~

Wealthy Private
Landowner

? Timber production

✓ Family legacy

✓ Wealth preservation /
tax avoidance

✓ Conservation

✓ Recreation

✓ Aesthetics

~~Commercial / residential
real estate development~~

Real Estate
Developer

~~Timber production~~

~~Family legacy~~

~~Wealth preservation /
tax avoidance~~

~~Conservation~~

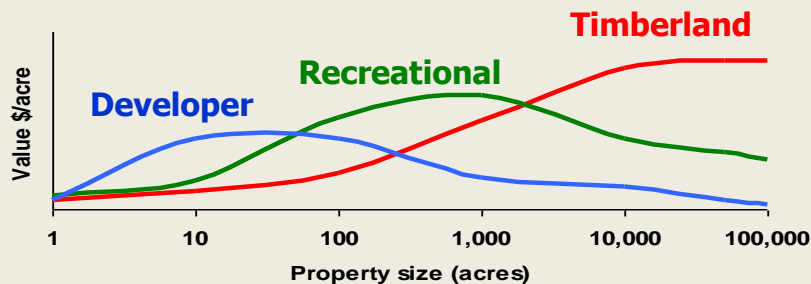
~~Recreation~~

~~Aesthetics~~

✓ Commercial / residential
real estate development

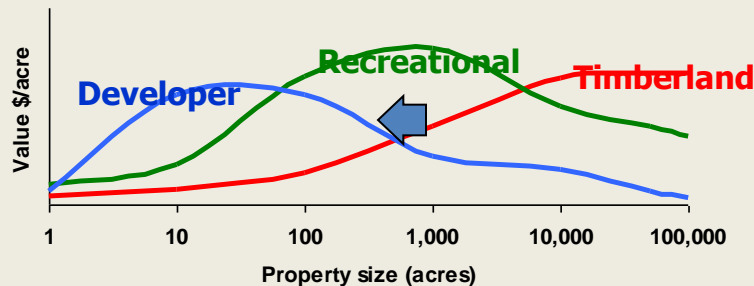
Source: Chung-Hong Fu, Timberland Investment Resources LLC, April 2007

From Industrial Timberland to Developed Real Estate



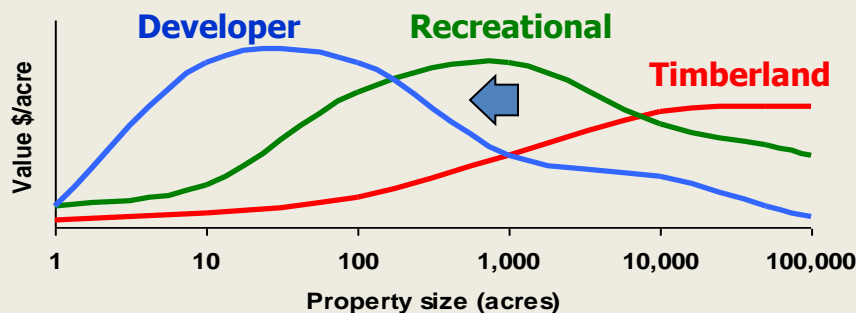
Undeveloped Rural Area <50/sq.mi.

Timberland Investment Manager	\$800/ac.
Wealthy Private Landowner	\$500
Developer	\$400



Semi-Rural 50-100/sq. mi.

Timberland Investment Manager	\$790/ac.
Wealthy Private Landowner	\$1,500
Developer	\$1,200



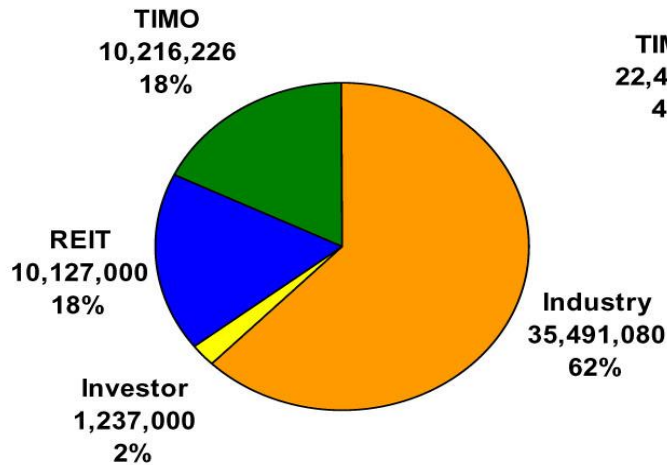
Urban Encroachment >100/sq. mi.

Timberland Investment Manager	\$750/ac.
Wealthy Private Landowner	\$2,500
<u>Developer</u>	<u>\$3,500</u>

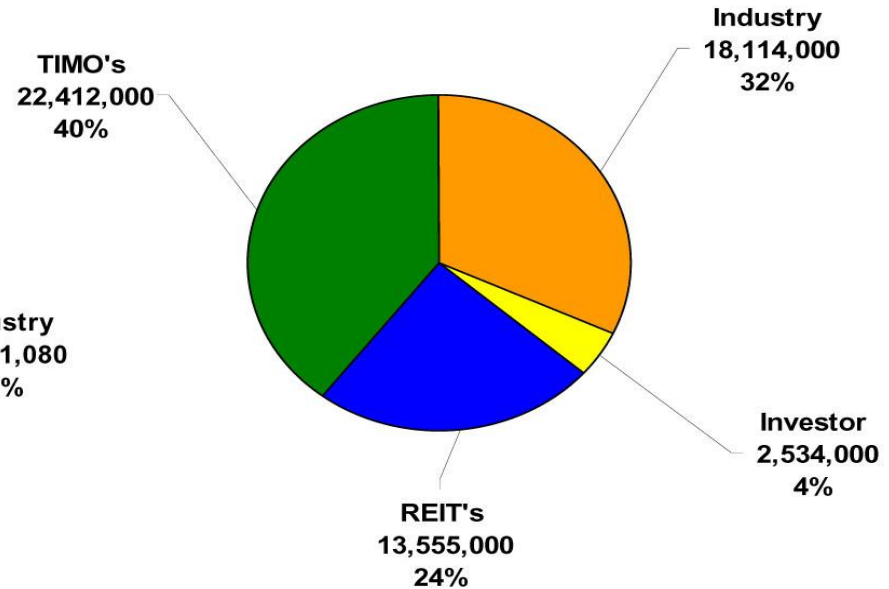
Evidence: Changing ownership

The New Forest Landowners

2004 Timberland Ownership by Type
57,071,000 Acres
Source: Forestweb



2007 Timberland Ownership by Type
56,615,000 Acres
Source: RISI Timberland Markets



Evidence: Changing ownership

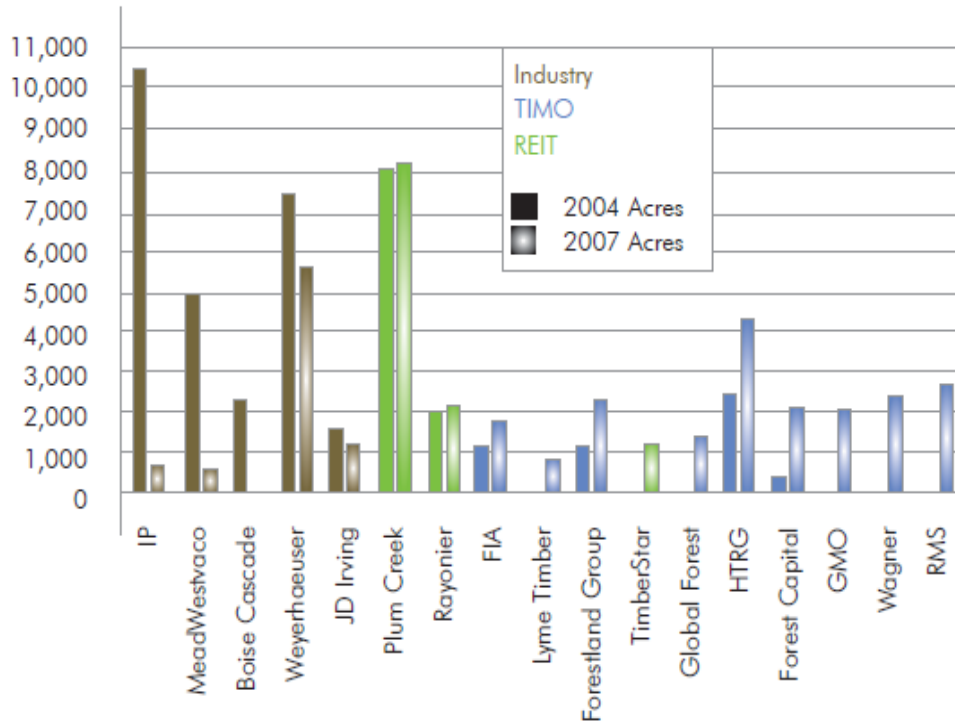


Figure 3: Major land ownership changes 2004 to 2007.
Source: RISI Timberland Markets.

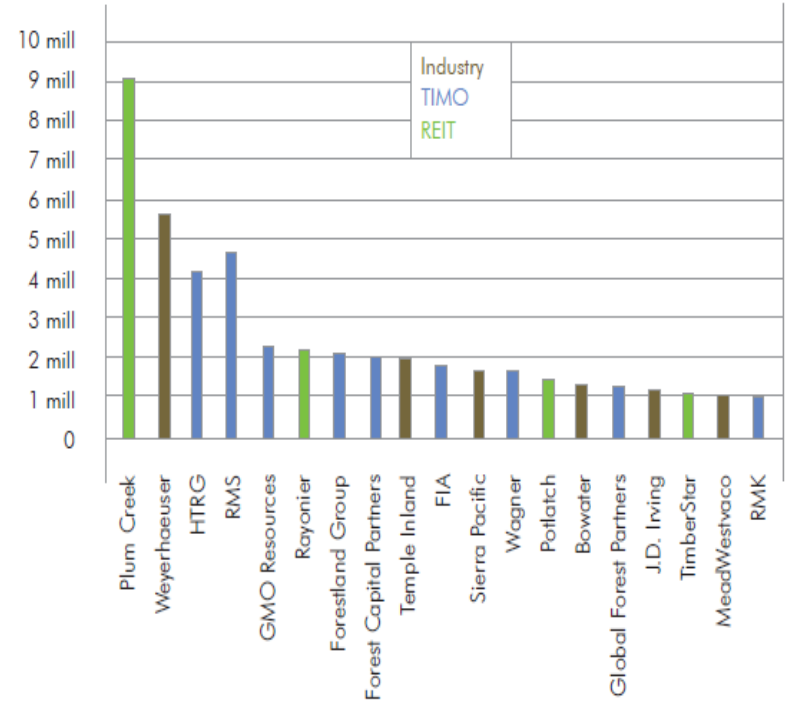


Figure 4: 2007 timberland owners with +1 million acres.
Source: RISI Timberland Markets.

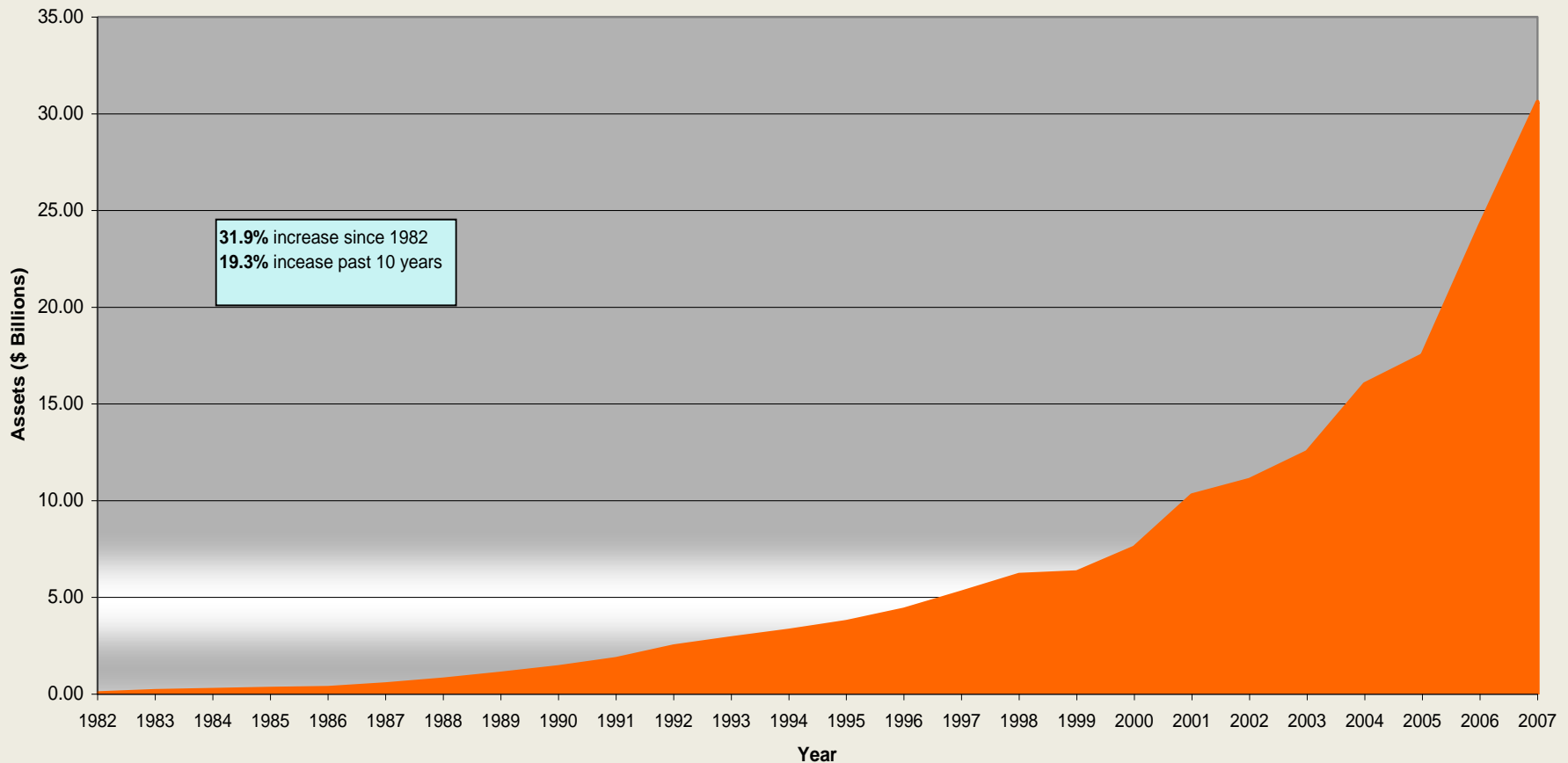
Evidence: Profit maximization

New players for profit

- Institutional investors (about 120 in the US, 75% public and private pensions, 25% endowments, foundations, individual participants (Gilleland 2003))
- Increasing number of small-scale forestland and non-traditional owners
- Investment advisors, forest management companies, contractors, consultants etc.
- Buying and selling land becoming more and more easier, compared to earlier times

Evidence: Profit maximization

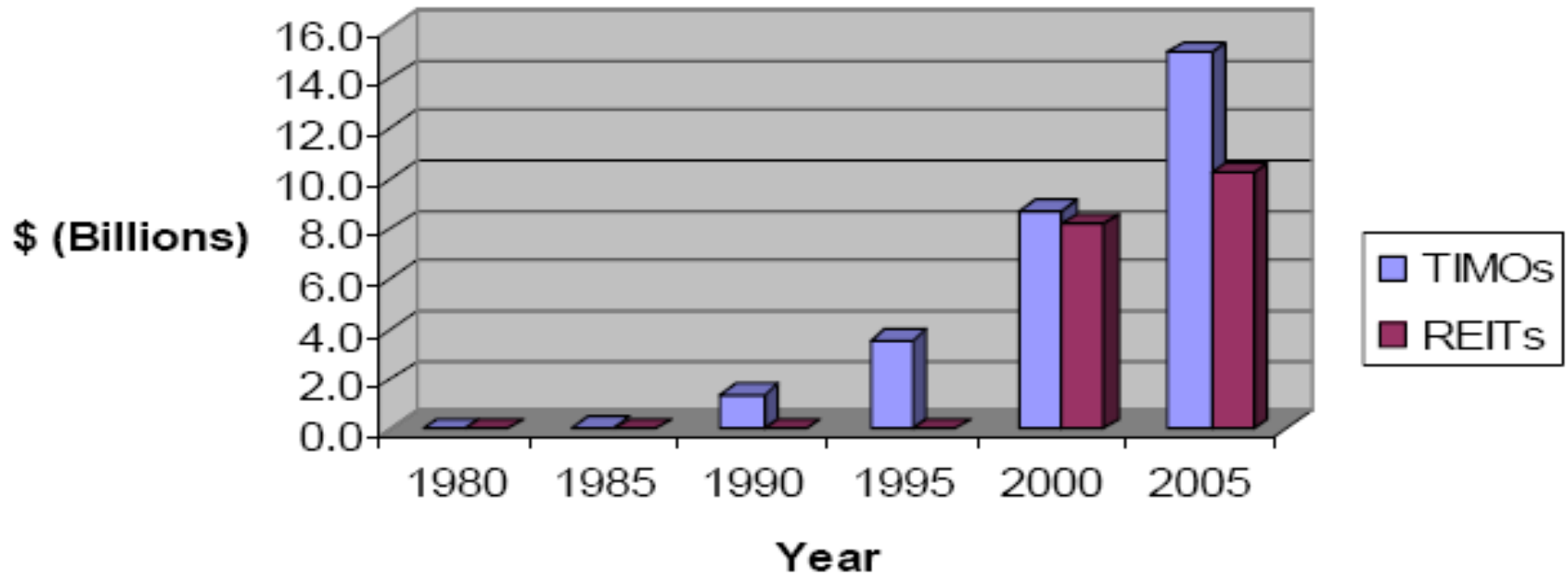
Growth in Timberland Investments



Source: FIA internal research

Evidence: Profit maximization

Trend in US Forestland Investments by TIMOs and REITs

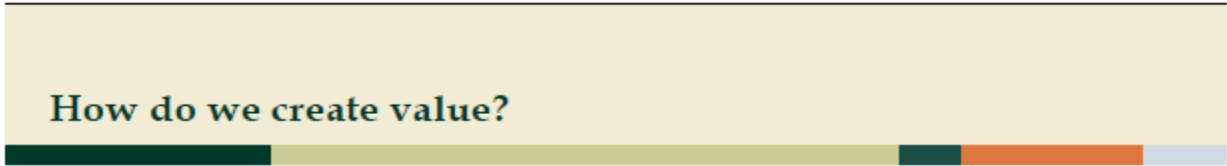


Implications

1. Let market (not FM) tell you cost and value of your land;
2. Use PM (not FM) to calculate land holding and optimal rotation (buy and sell);
3. Let market tell you when you should buy or sell land, and what kind of land;
4. Optimal rotation is a minor decision, buying and selling land where, when and how much is a BIG decision;
5. Land trading is NOT speculation, but moving land to right person for right use and at right time;
6. All policies should be designed to promote the innovation of land use to higher and better use.

Implications

How do we create value?



Buy Well

Manage Well

Sell Well



Summary

- 1) LEV ignore the scale issue
- 2) LEV ignore the opportunity cost of owner or manager time value
- 3) LEV ignore the existence of land market
- 4) LEV ignore the innovation in value creation
- 5) The changing world call for profit maximization
- 6) Value is created more by man than by land

THANKS!