

# Allocating Radio Spectrum

Thomas Hazlett

[tw hazlett@yahoo.com](mailto:tw hazlett@yahoo.com)



MANHATTAN INSTITUTE FOR POLICY RESEARCH

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# Right and Wrong

In papers published in 1959 and 1960, Dr Coase asked why valuable radio spectrum was going to waste. He suggested that the problem was the lack of **private property rights over spectrum**, which prevented the formation of a market to allocate spectrum efficiently. The answer, he proposed, was to open the allocation of radio spectrum to market forces. His proposal was derided, but radio spectrum is now routinely allocated by auction...

-- The Economist (Dec. 4, 2003)

# Three Choices

- Exclusive Use
- Unlicensed Commons
- Command & Control

# Practical Result: More Unlicensed

The Commission's rules for unlicensed transmitters have been a tremendous success.... The success of our unlicensed device rules... shows that there could be significant benefits to the economy, businesses and the general public in making additional spectrum available for unlicensed transmitters.

FCC, TV NOI (Dec. 02)

# Three Actual Choices

- C & C: licensed flavor
- C & C: unlicensed flavor
- Market allocation of radio spectrum
- Rights here are
  - Exclusively assigned
  - Flexible use
- EAFUS

# CMRS

- 7% of spectrum under 3 GHz
- Intense sharing
  - 163,647,129 subscribers
  - 800 billion MOU per year
  - \$90 billion annual revenues
  - 150,000 base stations
  - hundreds of applications, devices
- Consumer surplus (2003) ~ \$81 billion

# Marginal Social Value of CMRS Bandwidth

- PRICE of 10 MHz nationwide ~ \$5 Billion
- SOCIAL VALUE > 10X

# What Really Matters in Spectrum Allocation Design

- with Roberto Muñoz (April 2004)
- Economic lit. focus: license rent extraction
- Efficiency question in output markets
  - Price
  - Quantity
  - Innovation (Korean EV-DO music market)

# 29 Countries (18 with Auctions)

- Auction countries: prices not lower
- Two very significant drivers of lower prices:
  - More competition (lower HHI)
  - More spectrum
    - Marginal costs lower
    - Decreases HHI

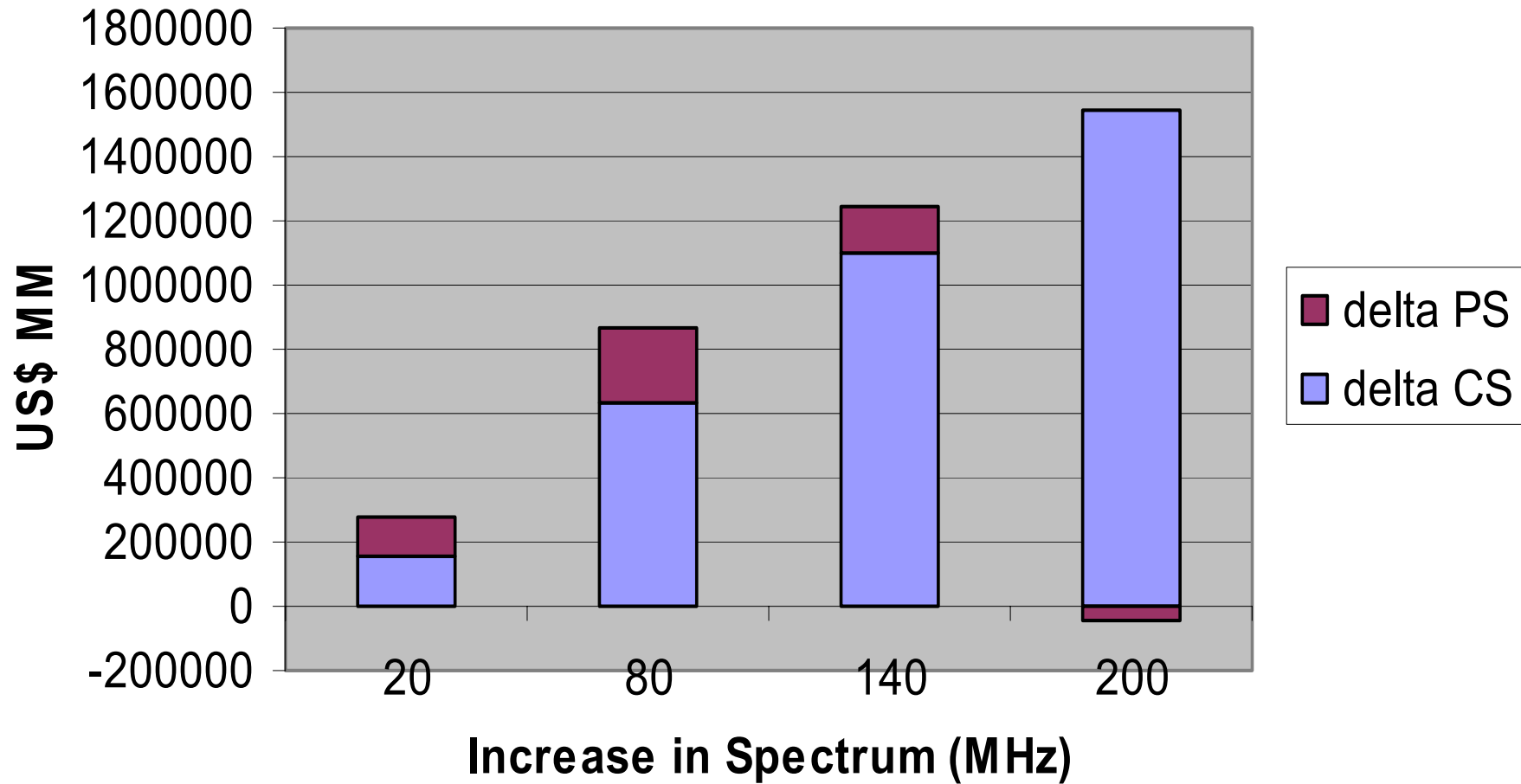
# USA Simulation

	UNITS	START	END
TOTMIN	MM./mo.	78340	
Spectrum	MHz	170	230
HHI	0-10,000	1648	1576
Density	Pop/km <sup>2</sup>	30.27	30.27
Auction	0-1	1	1
NotCPP	0-1	1	1
GDPPC	\$US/year	37,312	37,312

# Social Gains from an Increase in CMRS Spectrum

	START	END	$\Delta$
\$Price/min.	0.1116	0.0901	-19.28%
Output (Bil. min./mo.)	78.3	107.2	-36.79%
$\Delta$ Welfare (\$Bil./yr)		34.8	
PV( $\Delta$ CS) @5% (\$Bil.)		478.9	

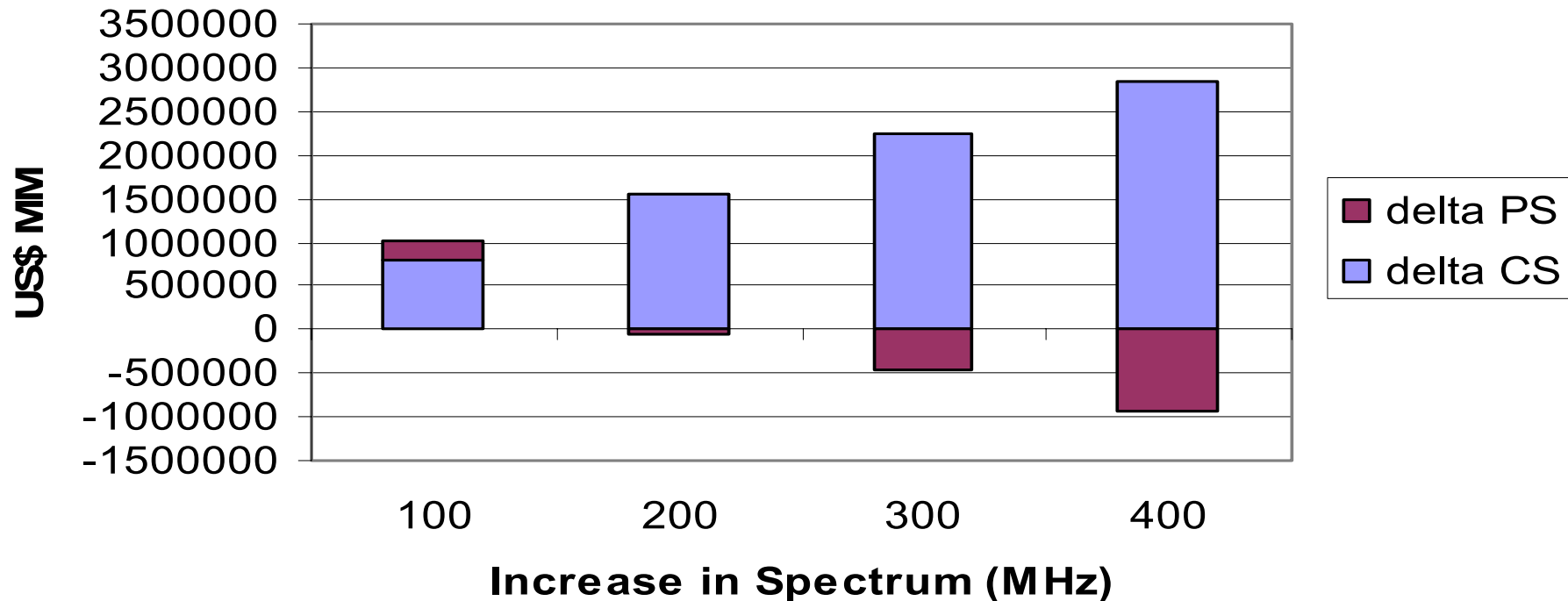
# Effect on Welfare of Increases in Spectrum (USA Simulation)



# Social Gains from Productive Use of TV Band Spectrum: USA

(Hazlett-Muñoz 2004)

**Figure VII.2: Effect on Welfare of Increases in Spectrum (country type USA)**



# A Spectrum Starvation Diet

- 175 US vs. EU mean > 250
  - UK 340
  - Netherlands 355
  - Germany 302
- No 3G in USA
  - EU licensed in 2000
  - USA still trying to get out 2G licenses
  - Australia now has 4G

# Licensed v. Unlicensed

- Conflicting spectrum demands
- Coordination valuable
  - FCC power limits and (other) sharing rules
  - Market competition using EAFUS
- Power limits relatively benign for short range application (cordless phones, LANs)
- Power limits destructive for WANs
  - Hotspots v. EV DO

# Unlicensed Congestion

- WISPs plead for ‘homestead’ rights
- FCC argues more spectrum and higher power limits needed for rural unlicensed broadband
- Where’s the big city unlicensed broadband?
- Where’s WiMAX?

# Where's McCaw?

**Clearwire got its start in the wireless business using 2.4 GHz unlicensed spectrum in several markets. The company decided to sell its businesses in several markets and switch to using licensed spectrum in Jacksonville because “that’s where the future and all the new technology is,” according to White.**

Annie Lindstrom, *Carrying the MDS/ITFS Torch*, Shorecliff Comm Mag (Sept/Oct 2003).

# Conclusion

- Liberalization => EAFUS => market allocation of radio spectrum
- C & C for licensed or unlicensed high risk
- Allocations have opportunity costs
- Mandating spectrum for more “tremendous successes” not liberalization



**May 3, 2002**

# **Spectrum Auction Delay Hits Fast Track**

**By Roy Mark**