

Pricing Radio Spectrum

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Introduction

This case asks students to design economically efficient prices for radio spectrum using the Smith-NERA approach.

Context

The country United People (U.P.) is assigning radio spectrum for new commercial wireless services. U.P. successfully liberalized telecommunications 15 years ago by opening its fixed line market to competition and licensing three mobile operators for second generation (2G) mobile services. The incumbent fixed line operator, UPTel, received one of the mobile licenses. The other licenses went to OneMobile and NewMobile, both of which were newly formed telecom operators at the time. The demand for telecommunications services was much greater than anyone had anticipated in U.P., so UPTel, OneMobile, and NewMobile all experienced impressive growth.

The industry regulator, U.P. Communications Commission or UPCOM, is in charge of spectrum management. It conducted an auction for the 3G spectrum licenses, but after several accusations of corruption, the auction process was abandoned. The operator that appeared to be central to the scandal went out of business.

As a result there were five potential providers of commercial wireless services in the country and

five available licenses. In addition to the three incumbent mobile providers, there are two other companies interested in licenses, namely FourCom (a newly formed telecommunications company financed by local bankers) and BigCom (an international mobile carrier that provides service in many developed countries).

Holding an auction for five licenses with only five bidders seemed futile, so the regulator assigned licenses and said it would adopt an annual administrative licensing fee regime based on the Smith-NERA approach to license pricing. The license assignments were as follows:

- Band A. UPTel
- Band B. OneMobile
- Band C. NewMobile
- Band D. FourCom
- Band E. BigCom

The three incumbents gave up their 2G license and the former 2G spectrum is incorporated into the new assignments.

The regulator issued general licenses for commercial wireless services, specifying neither the technologies nor the services so that operators could adapt as customers and technologies change. The spectrum bands to which the licenses will apply vary in their bandwidth and location in the radio spectrum. Exhibit 1 provides details.

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Establishing Prices for Licenses

The regulator must now establish annual prices for the licenses. Based on the auction results, the regulator has estimated each operator's willingness to pay for each license. These may not be exact, but the regulator believes they are close. These are shown in Exhibit 1.

Based on these estimates of willingness to pay, the regulator calculated each operator's likely marginal benefit from each license. This was done by calculating an annuity payment for each auction willingness to pay, using a 15 year period and a 15 percent return on capital. These are shown in Exhibit 2.

Now the regulator needs to establish annual license fees that encourage efficient use of the spectrum. The regulator has determined to use the Smith-NERA method. This approach has the following steps:

1. Identify all frequency bands and their uses.
2. Calculate the marginal benefit for each cell in the resulting table.
3. Determine the direction that assignment should change.
4. Identify the highest marginal benefit in each band
5. If highest marginal benefit is for a non-user, set the spectrum price between highest marginal benefit and current marginal benefit
6. If the highest marginal benefit is for a current

user of that band, set the spectrum price equal to this value

Assignment 1

1. Estimate a schedule of license fees using the Smith-NERA method assuming each operator will use only one license.

Assignment 2

1. Now assume that OneMobile has leased a portion of its spectrum to UPTel. How does this affect your prices?

Assignment 3

1. Design a policy of spectrum trading and spectrum license fees that will allow operators to efficiently trade spectrum. Incorporate features that prevent an overly high market concentration.

Discussion Questions

1. Do you think the regulator used an appropriate method for estimating marginal benefits? How would you improve it?
2. What plans should the regulator make for adjusting the license fees in future years to improve their efficiency properties?

References

Cave, Martin, Chris Doyle, and William Webb. 2007. *Essentials of Modern Spectrum Management*. Cambridge: Cambridge University Press.

Exhibit 1. Specifications for Spectrum Licenses and Estimates of Willingness to Pay

License	A	B	C	D	E
Spectrum	1850 MHz	1870 MHz	1900 MHz	1915 MHz	1930 MHz
Bandwidth	15 MHz	20 MHz	10 MHz	10 MHz	10 MHz
Current Assignments	UPTel	OneMobile	NewMobile	FourCom	BigCom
UPTel's Auction Value (millions UP)	131	135	70	80	73
OneMobile's Auction Value (millions UP)	122	144	75	84	75
NewMobile's Auction Value (millions UP)	135	132	84	75	86
FourCom's Auction Value (millions UP)	130	151	85	83	80
BigCom's Auction Value (millions UP)	146	138	85	81	80

Exhibit 2. Estimates of Marginal Benefits

License	A	B	C	D	E
Spectrum	1850 MHz	1870 MHz	1900 MHz	1915 MHz	1930 MHz
Bandwidth	15 MHz	20 MHz	10 MHz	10 MHz	10 MHz
Current Assignments	UPTel	OneMobile	NewMobile	FourCom	BigCom
UPTel's Marginal Benefit (millions UP)	22.4	23.1	12.0	13.7	12.5
OneMobile's Marginal Benefit (millions UP)	20.9	24.6	12.8	14.4	12.8
NewMobile's Marginal Benefit (millions UP)	23.1	22.6	14.4	12.8	14.7
FourCom's Marginal Benefit (millions UP)	22.2	25.8	14.5	14.2	13.7
BigCom's Marginal Benefit (millions UP)	25.0	23.6	14.5	13.9	13.7