



Gradual Transition to Modified Lease Auction: A Proposal for Reallocating Radiowave Spectrum

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I. Allocation of Radiowave Spectrum in Japan

A. History

B. Present situation

C. Alternative Systems for Spectrum Assignment

A. History

- 1. allocation and assignment controlled by the Japanese government – central planning**
- 2. licensed on first-come basis or by discretion**
- 3. no rent paid by users for spectrum use**
- 4. increase in demand for spectrum due to technological progress**

B. Present situation

1. **shortage of spectrum supply --- frontier exhausted**
2. **extreme inefficiency of spectrum use -----**
imbalance in productivities (MP's) of spectrum
3. **incumbents have no incentive to save spectrum**
incumbents have strong incentive to keep
spectrum
4. **need for a new system of spectrum allocation**

C. Alternative Systems for Spectrum Assignment and Reallocation

- 1. control by government – present system**
- 2. spectrum as private property**
- 3. spectrum as commons (open spaces)**
- 4. modified lease auction with gradual transition**

II. Modified Lease Auction (MLA) ----- A New System

A. Simple lease auction (SLA)

B. Advantages of SLA compared with central planning

C. Advantages of SLA compared with property ownership system

D. Disadvantages of SLA

E. Modified Lease Auction (MLA)

A. Simple lease auction (SLA)

- 1. spectrum resources owned by government and leased to users, private or public, by auction; lease system to be applied to all users --- no exception**

A. Simple lease auction (SLA)

2. licenses for spectrum lease:

- a. license period --- predetermined (5-10years)
- b. license conditions: power, area, etc.,
--- predetermined
- a. licenses are given by auction on lease price
- b. resale of licenses --- permitted

B. Advantages of SLA compared with central planning

- 1. efficient use of spectrum resources (both in allocation and assignment)**
- 2. give incentive to save spectrum use --- substitution by other means (fibers, e.g.) for spectrum**
- 3. remove barriers against entry of new business using spectrum**
- 4. provide transparency (information disclosure)**

C. Advantages of SLA compared with property ownership system (1/3)

1. decrease uncertainty

2. give more flexibility in spectrum use

prevents “holding up”

lower transactions cost (negotiation cost)

C. Advantages of SLA compared with property ownership system (2/3)

- 3. lower bid prices**
- 4. discourage speculation on spectrum**
 - a. prevent bubbles (winner's curse)**
 - b. lower macroeconomic disturbances**
- 5. prevent windfall profits**

C. Advantages of SLA compared with property ownership system (3/3) – wrt “transition”

- 6. make possible smooth implementation of lease auction by means of gradual transition from the current system**
- 7. decrease inequality between incumbents and newcomers at time of transition**
- 8. give incentive to release spectrum**

D. Disadvantages of SLA

- 1. risk of discontinuation (ROD) of spectrum use**
 - a. arising from newcomers outbidding incumbents**
 - b. arising from government decision to discontinue current spectrum allocation (for, e.g., large-scale spectrum sharing, e. g., uwb)**
- 2. cost of administering auction (with modifications)**

E. Modified Lease Auction (MLA) (1/7)

For protecting incumbents against ROD to an appropriate degree

- 1. against ROD from newcomers**

- a. discount of lease price to incumbents

- b. auction to be held years before the beginning of license period

E. Modified Lease Auction (MLA) (2/7)

- c. use of pre-auctions (winners obtain discount)
- d. increasing lease price during license period
- e. lease auction with variable license period (needs decision on parameters)
- f. creation of options markets for leasing spectrum

E. Modified Lease Auction (MLA) (3/7)

2. against ROD from government decision to discontinue spectrum allocation

· create “**spectrum insurance**”

a. spectrum users

i. determine amount insured --- to be paid in case of discontinuation

ii. pay insurance fee (= insurance-fee rate * amount insured)

E. Modified Lease Auction (MLA) (4/7)

b. government

- i. determines insurance-fee rate (so as to balance long-term revenues and payments)
- ii. chooses spectrum blocks for discontinuation of allocation so as to minimize the sum of insurance payments

F. Points for future research (1/2)

1. why not perpetuity (property ownership system) ?

- a. presence of externalities (scale economies) in the use of spectrum
- b. Coase's theorem does not work because of negotiating time/cost arising from uncertainty
(a Nash equilibrium with different information sets)

F. Points for future research (2/2)

2. why not SLA ? (why are modifications needed?)

- a. ROD exists everywhere; so why not SLA?
if spectrum is indispensable, too much ROD may discourage investment to a suboptimal level.
- b. economics of “optimal protection against ROD”?
subjects for future research?

III. Gradual Transition from the Current System to the Long-term Target, MLA

A. Need for gradual and informed transition

B. Transition periods

C. Transition process

D. Policies for “income compensation”

E. Forecast of results of transition system

B. Transition periods

1. **preparation period (m years) (m=15)**
 - a. establishing “benchmark lease prices (**BLP**)”
 - b. periodic revisions of BLP
2. **execution period (n years) (n=10)**

C. Transition process (1/3)

1. preparation period

a. MLA to be applied to new assignments

zero lease price to incumbents

b. BLP: to be set at auction price if available

else to be calculated by interpolation

Establishing “benchmark lease prices (BLP)”

Areas

A					
Band:	I	II	III	IV	V

C. Transition process (2/3)

2. execution period

a. MLA for new assignments

b. partial lease price (PLP), equal to

$((k/n) * \text{BLP})$, to be paid by incumbents in

k-th year ($k=1,2,\dots,n$)

C. Transition process (3/3)

3. completion of transition process

- a. traversing smoothly to a full-scale MLA
- b. all licenses to be issued under MLA with payment of full lease price (FLP) thereafter

D. Policies for “income compensation”

1. overview

- a. (possible) compensation to incumbent spectrum users for the payment of PLP and FLP

- b. complete separation of spectrum allocation and income distribution

D. Policies for “income compensation”

2. determination of compensation

a. compensation period : $t=1,2, \dots, T$; no compensation for $t > T$

b. base amount of compensation (BAC): the value of the spectrum held at $t=0$ evaluated in terms of *current* PLP or FLP.

D. Policies for “income compensation”

c. the degree of compensation for period t : $d(t)$

$(0 \leq d(t) \leq 1)$.

may be different for different user categories

$d(t) = 0$ for $t > T$.

d. actual amount of compensation in period t :

$d(t) * BAC(t), \quad t = 1, 2, \dots, T.$

D. Policies for “income compensation”

e. Net payment in period t :

$$ALP(t) - d(t) * BAC(t), \quad t = 1, 2, \dots, T.$$

$$ALP(t) = 0, \quad \text{if the spectrum is returned,}$$

$$= PLP(t), \quad \text{otherwise (if lease continues).}$$

$$BAC(t) = PLP(t).$$

D. Policies for “income compensation”

3. policies for compensation:

- a. government determines $d(t)$ for each user category
- b. near-full compensation: military and security users
- c. partial compensation : government users, public utilities, public transportation operators, welfare agents, etc.
- d. no compensation : profit-seeking entities, individual users

D. Policies for “income compensation”

4. neutrality

- choice of a compensation policy does not affect the incentive to save spectrum

E. Forecast of results of transition system

1. high lease price initially
2. lower lease prices later
3. (possible) discount of PLP to incumbent users
releasing spectrum voluntarily during transition

IV. Functions of government under MLA

(*: functions under balanced budget)

A. Allocation of spectrum

B. Maintenance of database of registered licenses, etc.

(*)

C. Protection of spectrum users (*)

D. Conducting MLA (*)

IV. Functions of government under MLA

(*: functions under balanced budget)

E. Determining the level of ROD

F. Maintenance of spectrum insurance (*)

**G. Planning and conducting income-compensation
program**

H. As the owner of spectrum

A. Allocation of spectrum

1. into different objectives, areas
2. decision whether to continue or terminate allocation
 - a. deregulation -----spectrum sharing
 - b. minimize the insurance payment at the time of termination

B. Maintenance of database of registered licenses, etc. (*)

1. license registration
2. collection of registration fees
3. disclosure of information
4. create and publish spectrum-usage statistics

C. Protection of spectrum users (*)

1. monitoring spectrum use
2. enforcement of rules
3. collection of spectrum-user fees

D. Conducting MLA (*)

1. designing and executing auction system
2. collection of fees for auction participation

E. Determining the level of ROD

(→II.D.1)

- balancing ROD and the benefit of new entries

F. Maintenance of spectrum insurance system (*)

(→II.D.2)

1. collection of insurance fees
2. payment of insurance money
3. determination of insurance-fee rate

G. Planning and conducting income-compensation program

(→III.D)

- government determines $d(t)$ for each user category

H. As the owner of spectrum

1. **spectrum owner** (landlord): government
2. receives PLP and FLP (possibly adjusted wrt $d(t)$)