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# Spectrum trading: Main issues and the Australian Experience

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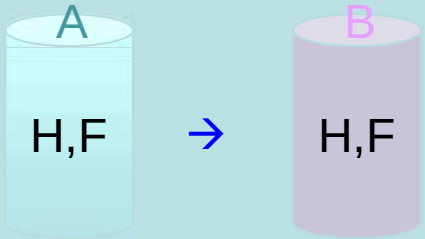
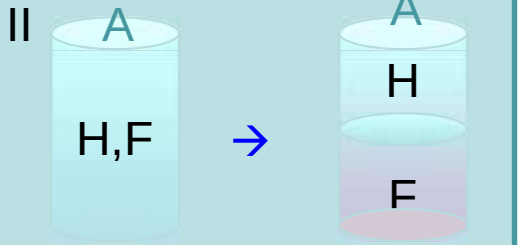
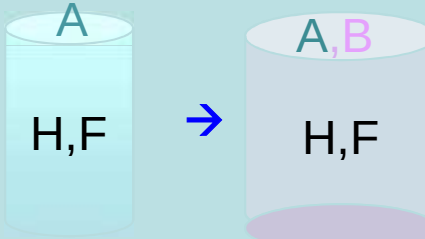
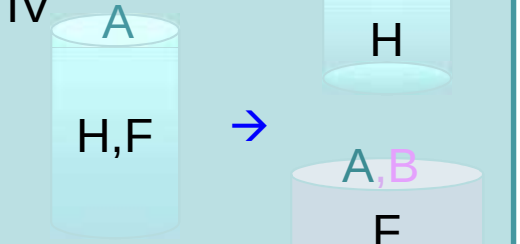
# Spectrum trading: why?

- Key vector for **efficiency (welfare)**
  - facilitates spectrum transfer faster than traditional 'return-reassign'
  - contributes to dynamic efficiency: incumbents, new entrants
  - improves allocative efficiency: balancing out value across users ($MB_i = MB_j \ \forall i,j$)
  - improves technical efficiency: incentive to sell if unused
- Key **pricing (information)** mechanism
  - spectrum value established by market forces
  - possibly the best mechanism to elicit 'true value'
- Key mechanism for the success of **property rights** regimes
  - without trading, propertized spectrum is too exclusive
  - makes a property rights regime:
    - more flexible and technically efficient
    - responsive to market needs and trends

# Spectrum trading: why not?

- Potential issues with trading:
  - Trading will be sluggish if:
    - poorly-defined usage rights and responsibilities
    - information doesn't flow (need for clearinghouse, online databanks, registries)
    - high transaction costs (taxes, red tape, time cost: notification, approval)
  - Anti-competitive behaviour (Cave 2010)
    - trading can lead to license hoarding to deny spectrum to competitors
    - ~complementary strategy to overbuying at the moment of primary issue
  - Dispute resolution:
    - under regulated assignments the regulator is also the umpire
    - legislation cannot specify all contingencies and possible arrangements
    - who resolves rights and obligations disputes in secondary markets?
  - Asymmetric information
  - Public good nature of some spectrum markets
  - Assessing the fungibility of the traded asset (Weiss et al. 2012)
  - Externalities: with subdivision: more licenses → more spillovers

# A typology of trades (analogy with land)

| Transfer type | Total | Partial |
|---|---|---|
| Outright | I   | II   |
| Concurrent | III   | IV   |

Cave and Webb 2015 Ch.6

# The dimensions of trade

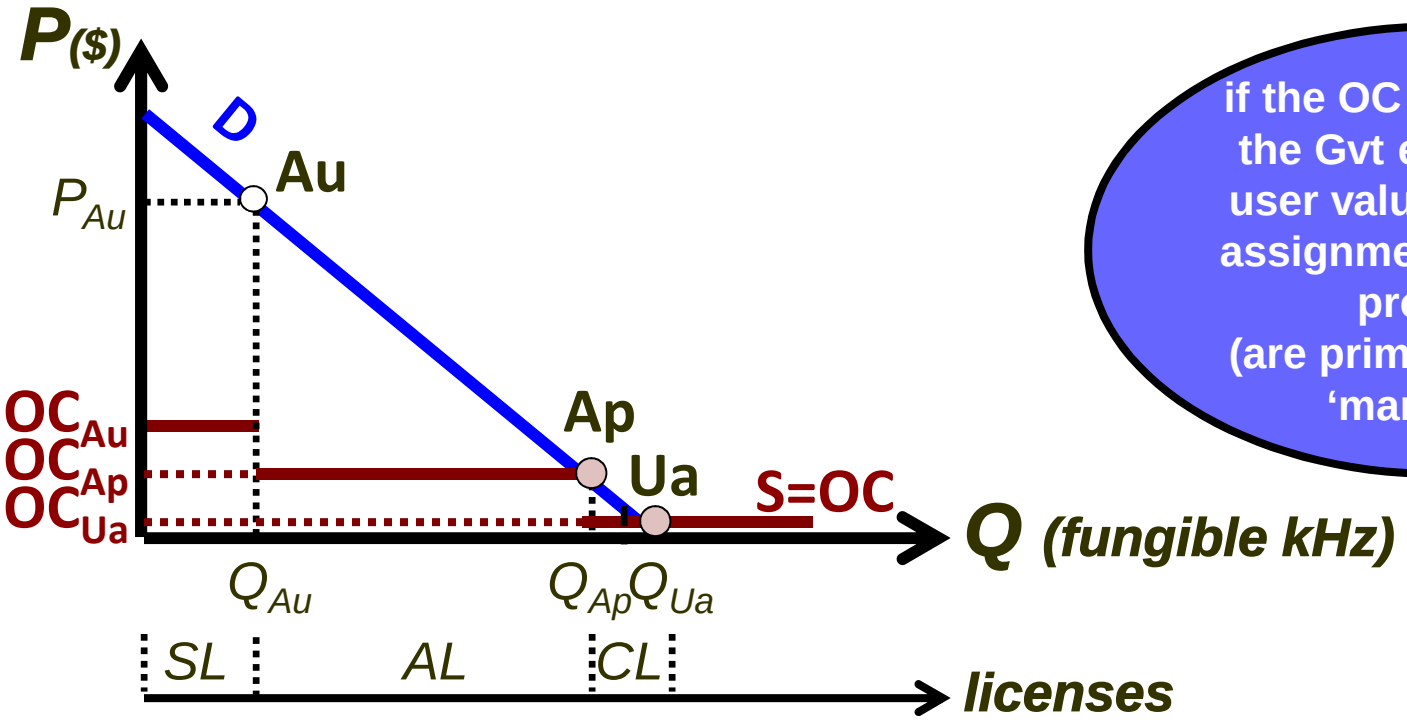
- Key dimensions: bandwidth, geography and time (leases)
- Users have different propagation and bandwidth requirements
- Users also have different tolerance to interference
  - Broadcasters: bandwidth domain
    - tolerance for symbiotic WS devices (*Freyens & Loney, TelPol 2013*)
    - intolerance for invasive WS devices
  - MNOs: geographic domain
    - tolerance for predictable or low-power applications in regional coverage areas
    - intolerance for most applications in metro areas

# The Australian licensing system

| Attributes | ALs | SLs | CLs |
|---|---|---|---|
| Regime focus | Device-centric | Space-centric | Tech-centric |
| Efficiency objective | productive (use) | allocative | dynamic |
| Exclusivity | medium to high | very high | none |
| Coordination rules | administratively set | proprietary | self-governed |
| Flexibility (tech-service) | none to moderate | high | variable |
| Individually assigned | Yes or No | Yes | No |
| Assignment by | ad-pricing, auction | auction | not assigned |
| Price | admin fee / market pr. | market pricing | free |
| Tenure and Term | up to 5 years/renew. | 15 years / renew. | Unlimited |
| Interference protection | provided | provided | not provided |
| Tradable | **Moderate** | **High** | **None** |
| Sub-division | not allowed | allowed | not possible |
| Coordination needed | low | high | very low |
| Service – tech neutrality | usually none | high | high or low |

# Primary markets: supply and demand

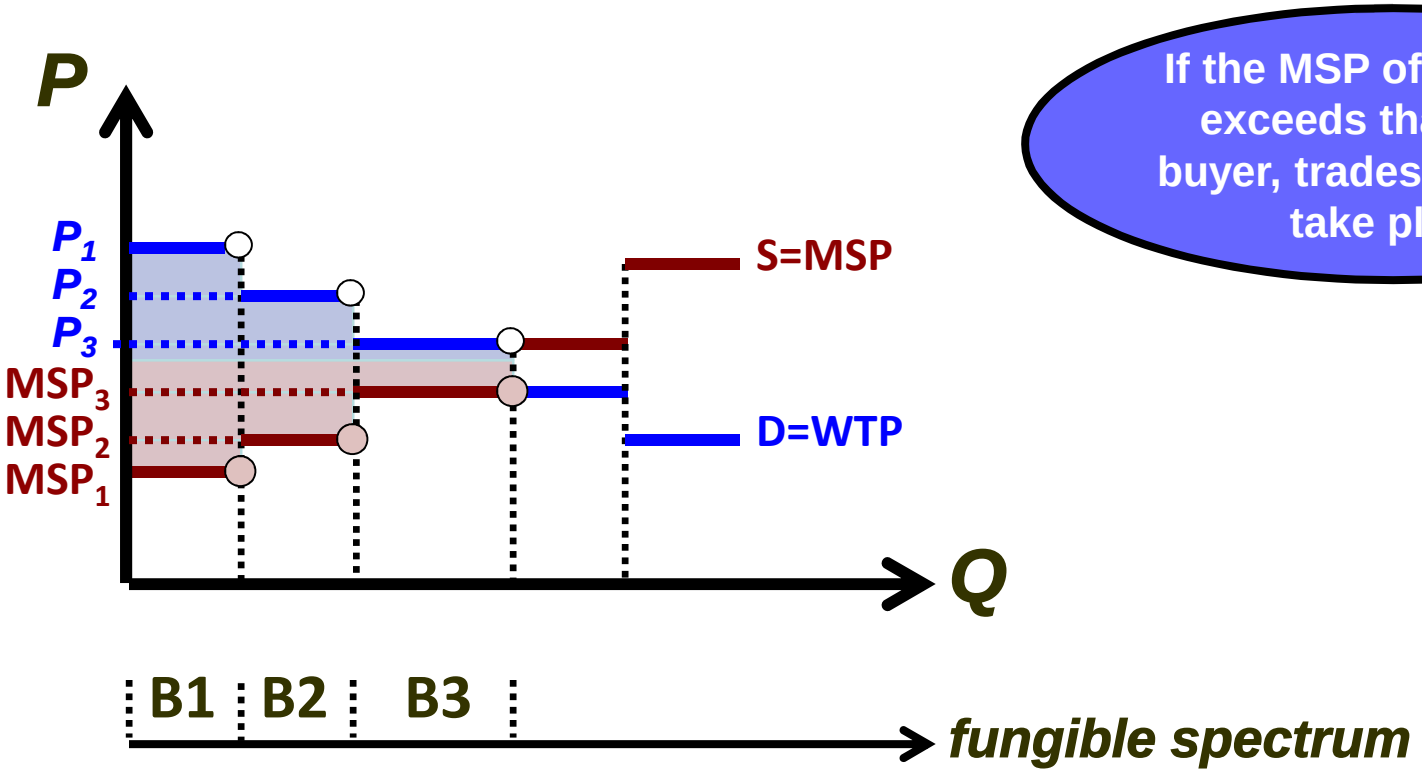
- What are the characteristics of **supply** and **demand** for use of the spectrum?
- in **primary markets**:
  - **demand** emanates from a wide-range of users / services
    - high market value, moderate value, low value or experimental
  - governments have ultimate power over spectrum rights
  - they 'supply' spectrum to users by auctions (Au), priced assignments (Ap) and unlicensed assignments (Ua): **supply** just reflects the OC of assigning the spectrum




**if the OC of supply to the Gvt exceeds the user value (WTP) the assignment shouldn't proceed (are primary markets 'markets'?)**

# Secondary markets: supply and demand

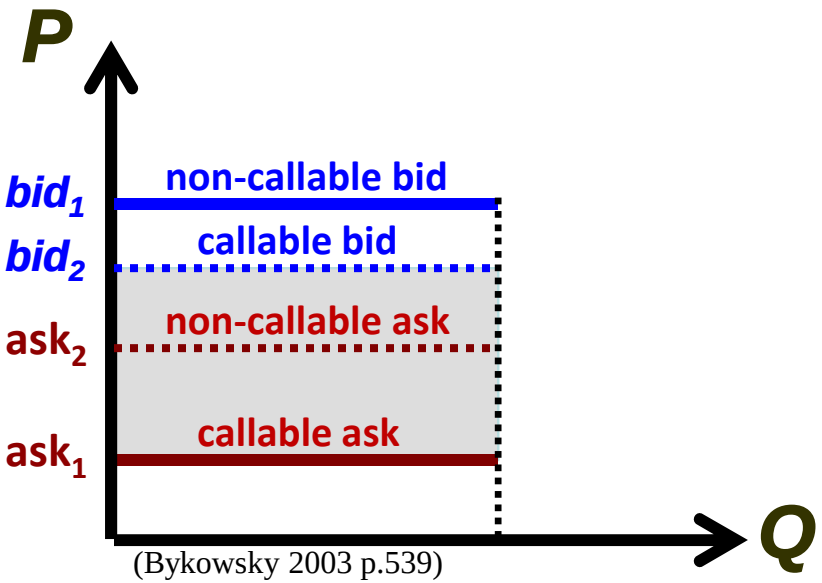
- **Efficient ('liquid') trading** could rely on electronic call markets (*Bykowsky 2003, IEP*)
- 'invisible hand' → sequence of **asks** and **bids** step functions
  - The **market price** clears the market (between $P_1$ and $MSP_3$)
  - he blue and red areas capture **trading surplus**




**If the MSP of the seller exceeds that of the buyer, trades no longer take place**

# Secondary markets: improving liquidity

- **Call options:** can be weaved into secondary trading to increase **liquidity**
  - conditions enabling the issuer (seller) to regain the asset against an agreed set price
  - call options transfer risk onto buyers → require ex ante payment of **risk premiums**
  - trades can be made on callable (favoured by seller) or non-callable basis
  - In this case, more efficient on callable basis (trading surplus is larger)



(Bykowsky 2003 p.539)

**Users such as PPDR services could be enticed to trade their 'non-seasonal' spectrum on a callable basis with WBS buyers**

# Secondary markets: improving liquidity

- **Ex ante** or **ex post** assessment of competition issues? (*M. Cave 2010 TelPol*)
  - spectrum trading can lead to deliberate hoarding to crowd out competitors
  - eventually leading to higher consumer prices and lower welfare
  - need for regulatory oversight
- **Ex ante** oversight:
  - each trade must be notified and authorized before proceeding
  - protects third-parties (consumers and competitors)
  - risk of **type I error**: preventing efficient trades (regulator's test too restrictive)
  - adds 'barriers to trade'

# Secondary markets: improving liquidity

- **Ex post** oversight:
  - trades proceed without authorization but are reviewed later (possibly reversed)
  - risk of **type II error**: allowing anti-competitive trades that should have been prevented
  - post-trade reviews may come with considerable lags → poor protection for third parties
  - post-trade reviews may be hard to conduct after the facts (confounding factors)
  - encourages trade (innovators etc.)
- Is **anti-competitive** behaviour in ex-post trading effectively checked by:
  - spectrum caps? arbitrary, artificially constrain firms' investment and expansion
  - use it or lose it clauses? non-usage is not akin to anti-competitive behaviour:
    - licensee may be unsure: of its future needs, and its ability to buy back spectrum it needs
    - concern that a partial sale would reduce the value of a larger package.
    - licensee may attach a high 'option value' to the license—licensees may hold licenses predicting a rise in value that outweighs depreciation due to the elapsing term.
  - both measures tend to reduce welfare (*Freyens & Yerokhin 2011 TelPol*)

# Secondary markets: improving liquidity

- **Incentivising government users**
- **Possible measures:**
  - propertize their spectrum endowments and associated proceeds from any sale
  - or allow them to retain a fixed percentage of any sale
  - but trading profits typically reduce future agency funding
  - allow barter in spectrum amongst agencies and other operators?

# Trading of SLs in Australia: procedures

Spectrum Licenses (SLs) were designed specifically to permit trading.

SLs are highly fungible financial assets:

- sub-dividable and combinable at STU level
- service and technology neutral
- LT property rights

| | | |
|---|---|---|
| 1. | **Identify the licensed spectrum space you want to buy or lease.** | **Search the Radiocommunications Licence Register on the ACMA website to locate the owner of the licence or licences for that spectrum and the licence conditions that apply to it.** |
| 2. | Initiate discussions with the licensee or licensees. | Open discussions with a view to reaching agreement on mutually acceptable terms for sale or lease of the relevant spectrum. |
| 3. | **Agree on the terms of sale or lease.** | **Obtain agreement on the terms of sale or lease at a mutually acceptable price. If you cannot negotiate acceptable terms, consider seeking a third party authorisation from the licensee, whereby they retain legal rights to the spectrum but grant you authority to use for the period and purposes you require subject to you meeting licence conditions.** |
| 4. | Complete and sign the ACMA R036 form. | Both parties complete and sign application form R036 and submit it to the ACMA along with a payment of the relevant fee. The trade becomes effective from the date the changes are notified in the Radiocommunications Licence Register, usually within a week of the ACMA receiving the completed form. |

# Trading in Australia 2001-2016: SLs initially issued in each band (ACMA 2016)

| | | | |
|---|---|---|---|
| **500 MHz*** | **273** | **3.4 GHz** | **87** |
| **800 MHz** | **36** | **27 GHz*** | **3** |
| **1800 MHz** | **77** | **28/31 GHz*** | **3** |
| **2 GHz** | **170** | **700 MHz** | **2** |
| **2.3 GHz** | **62** | **2.5 GHz** | **8** |

**Total spectrum licences issued 721**

*^ As part of the expiring spectrum licence process, multiple licences were transferred to a single licence for licensees. For example, in the 1800 MHz band licences the 77 licences were transferred to 8 individual licences.*
**500 MHz, 27 GHz, 28/31 GHz bands are no longer spectrum licenced*

# Trading of SLs in Australia 2001-2016 (genuine trades in bold)

| *Year* | *Band* | *Number of licences (bandwidth)* | *Description of trade* |
|---|---|---|---|
| 2001 | 2 GHz | 8 (2x 2.5 MHz) | Internal Vodafone aggregation |
| **2002** | **500 MHz** | **2 (2x100 kHz)** | **2 small trades (1 internal)** |
| **2002** | **500 MHz** | **2 (2x40 kHz)** | **Aust Document Exchange to Toll Holdings** |
| **2002** | **500 MHz** | **51 (less than 200 khz)** | **Simico (Land Mobile provider in administration) to Motorola (Aust)** |
| 2003 | 3.4 GHz | 2 (2 x 36 MHz) | Internal Unwired trade |
| 2004 | 28/31 GHz | 1(2 x 850 MHz) | Internal AAPT trade |
| | | 1 (2 x 300 MHz) | |
| 2004 | 800 MHz | 19 (2x5 MHz) | Internal AAPT trade |
| 2004 | 800 MHz | 6 (2x10 MHz) | Internal Hutchison trade |
| **2005** | **2.3 GHz** | **58 (a mixture of 98 MHz and 42 MHz)** | **Austar and Unwired engaged in a spectrum swap. Austar traded the portions of its 2.3 GHz spectrum holding covering capital cities to Unwired;** |
| 2005 | 2.3 GHz | 47 ( a mixture of 98 MHz and 42 MHz) | Internal Unwired transfer for outer metropolitan licences |
| **2005** | **3.4 GHz** | **49 (2x17 MHz)** | **Unwired traded the portions of its 3.4 GHz spectrum, held via its subsidiary BKAL, to Austarcovering Austar's regional subscription-television areas.** |
| **2005** | **500 MHz** | **2 (2x2 MHz)** | **Motorola (Aust) to WA Police Service** |
| 2006 | 2.3 GHz (MDS) | 1 (7 MHz) | Internal CFM Technology transfer (WA) |
| **2006** | **500 MHz** | **2 (100 kHz)** | **Optus to Connex** |
| **2006-07** | **1800 MHz** | **23 (mixture of 2.5 MHz and 5 MHz)** | **Sale of One.Tel spectrum by liquidator to State Rail authorities** |
| **2007** | **1800 MHz** | **19 (2x5 MHz)** | **AAPT to Hutchison** |
| **2008** | **1800 MHz** | **8 (2x2.5 MHz)** | **One –Tel to South Australian rail authority** |
| 2011 | 1800 MHz | Multiple (2x 2.5MHz and 2 x 5 MHz) | Internal 1800 MHz aggregation for Vodafone and rail authorities |
| 2013 | 1800 | 1 (2x5 MHz) | Rail Corp traded internally to Sydney Trains |

# Where to next for spectrum trading in Australia?

- Trading generally disappointing in Australia (as in UK, NZ etc)
- Some alleged factors:
  - Market is quite **illiquid** → fear of not being able to regain spectrum in the future inhibits selling
  - **Low OC** of holding spectrum unused for large budget organisations (e.g Gvt)
  - The market is **thin** –few buyers and sellers, with different structures and abilities to fund trades
  - **Stamp duty** and **CGT** are barriers to spectrum licence trading (high tax country)
  - Uncertainty regarding how licences would be priced (or repriced) if buyer seeks a change of use
  - Constraints from international harmonisation
  - Downstream competition → even a small perceived benefit to a competitor inhibit trades
  - Geographical dimension – little trade potential in regional areas because of the lighter demand, yet even there owners are reluctant to share or authorise third party access for small users.
  - some licensees hold on to spectrum 'just in case' it is useful later if a new technology arises
  - Government spectrum rights holders have no incentive, to share or sell spectrum.
  - Other spectrum rights holders, such as FTA broadcasters, also have few incentives to trade

# Opportunities for spectrum trading in Australia?

- Potentially high value spectrum is held and used inefficiently by some users.
- Greater certainty/predictability may increase confidence in spectrum trading:
  - of future planning arrangements, including ability to convert licences to a different use in the future
  - of tenure and/or renewal
- More flexible technical conditions on licenses may promote secondary trading
- Less use of ‘bespoke’ approaches to licensing – the more specifically tailored to a particular use, the less tradable is the license.
- defragmentation of bands (e.g. 2GHz spectrum).
- an extreme degree of technological neutrality and/or transferability of licences may not be achievable
- spectrum exchange model – a system of rules that would be applied if a holder of a set of one licence type (eg ALs in an area) sought to replace them with another (eg, a spectrum or wide area licence). Such rules would address issues such as spectrum re-pricing.

# What does spectrum best compare to and what can we learn from it?

- Wrong perceptions of spectrum trading as stock market trades
- Many comparisons to land...
- Spectrum more akin to a **commodity**
  - radio waves as seams of mineral ore of different purpose and quality
  - require expensive investments in infrastructure to ‘mine’ the spectrum
  - requires long-term certainty about usage rights
  - like commodities, spectrum-using industries are highly exposed to market vagaries
  - (many successes, many failures)
  - Australia uses a **royalty system** to extract rents on highly lucrative mining operations
  - could a royalty system both simplify and improve **spectrum pricing**?