THE SOCIAL VALUE OF TV BAND SPECTRUM IN EUROPEAN COUNTRIES

Thomas W. Hazlett[1]
Juergen Mueller[2]

Conference Paper
International Telecommunications Society
European Meetings * Sept. 5-7, 2004
Berlin, Germany

August 30, 2004

We offer empirical estimates of the social gains from an analog TV switch-off in 13 EU countries, focusing on the value of TV band spectrum in alternative (non-TV) uses. By using data from existing mobile phone markets, we project that retail prices for wireless voice and data service would substantially decline if approximately 43% of the TV Band were reallocated to wireless telecommunications. Consumer surplus gains offset the costs of transition by at least two-to-one, and as much as 45-to-1, despite employing assumptions that likely lower values and raise costs, producing a conservative measure of social gains. Importantly, our empirical estimates indicate that, with spectrum reallocation, producers' surplus (for wireless operators) will substantially decline due to more intense competitive pressure. This suggests a public choice explanation for the slow pace of the digital TV transition.

[1] Senior Fellow, Manhattan Institute for Policy Research (Washington, D.C.). Contact: twhazlett@yahoo.com; (202)463-6630.

[2] Professor of Economics, Berlin School of Economics. Contact: jmueller@fhw-berlin.de; (49)30-85789-145.

I. SPECTRUM COSTS AND THE EUROPEAN DTV TRANSITION

European Union countries are transitioning their analog television broadcasting systems to digital technology. The migration path has proven difficult to navigate, however, and it is unclear how rapidly the transition will occur. Policy makers believe they are politically constrained to keep analog broadcasting in place until digital reception capability is ubiquitous, maintaining a delicate migration path.

A prisoner's dilemma makes this policy course difficult. The constraint imposed on analog broadcasting switch-off is that nearly all households possess the capability of receiving TV broadcast signals when only digital over-the-air (OTA) broadcasts are available. Consumers without cable or satellite TV subscriptions must therefore be induced to buy digital receivers. They will hesitate to invest in new equipment, however, until there is a compelling reason to do so. The continued availability of analog TV signals raises the degree to which OTA digital broadcasts are considered compelling. Broadcasters and programmers could create digital content to enhance demand, but are themselves hesitant to undertake the expense until an audience for such programs is in place.

Virtually every jurisdiction is having difficulty solving this stalemate. The United Kingdom, for instance, has succeeded in inducing just 6.1% of households to purchase digital TV sets – and the U.K., with households purchasing (or not) digital receivers since 1998, has been successful in this regard relative to many other EU countries. See Table 1.

TABLE 1. DIGITAL TV RECEIVER PENETRATION IN EUROPEAN COUNTRIES

	2001 (000s)	*2003-II (000s)*	*% of Households*
UK	1,217	1,510	6.1
Sweden	83	175	4.2
Spain	150	130	1.1
Finland	5	150	6.5
Germany	0	170	0.5
Netherlands	0	8	0.1

Source: EBU estimates from Shulzycki 2003.

Analog switch-off, when digital broadcasts entirely replace analog broadcasting, can create two benefit streams. The first relates to enhanced viewer choice: digital compression typically delivers between four and six programs in the frequency space used to transmit one analog broadcast. This expansion of product diversity is available prior to switch-over, but will presumably be available to the entire market at the point of switch-over (on the logic that the switch-over takes place once household reception of digital broadcast signals is near-ubiquitous).

The second benefit is that considerable bandwidth is made available for the provision of additional wireless communications services. This stems from the elimination of the analog portion of analog-digital broadcasting simulcast regime routinely set up to enable transition, and from the fact that digital receivers can easily distinguish between adjacent frequencies. This allows digital TV broadcasts to be squeezed more tightly in spectrum space. Instead of leaving one or more "taboo" channels (idle spectrum) between broadcast frequencies, each channel can be used without materially degrading reception for viewers using standard television sets.

OTA television is allocated very substantial bandwidth in the VHF and UHF bands, frequencies highly valued for use in the delivery of wireless telecommunications. The standard European allocation consumes some 469 MHz (see Table 2), exceeding the U.S. allocation of 402 MHz (Hazlett 2001b), and far in excess of the bandwidth allocated mobile telephony, which ranges from under 200 MHz to the 355 MHz allocated in the Netherlands (Hazlett & Muñoz 2004). By entirely converting to digital terrestrial television (DTT), it is possible to utilize this bandwidth more efficiently.

EU countries use analog channels allocated 7 MHz or 8 MHz. Digital multiplexing and digital adjacent-channel use in a post-transition marketplace could easily offer viewers 100 channels of OTA broadcasting while utilizing less than 200 MHz of the current TV Band allocation, leaving more than 250 MHz for the provision of new services such as mobile telephony and wireless broadband.

TABLE 2. EUROPEAN TV BAND SPECTRUM ALLOCATION

Frequencies	*Band*	*Channels*	*Bandwidth (MHz)*
47-68	VHF Band I	2-4	21
174-230	VHF Band III	5-12	56
470-862	UHF Bands IV & V	22-69	392
TOTAL BANDWIDTH			469

Source: Electronic Communications Committee (ECC) within the European Conference of Postal and Telecommunications Administrations (CEPT), *Terrestrial Broadcasting Data*, (September 2003), Appendix 1.

Yet, gains associated with the provision of new services will not likely commence until the DTT transition is complete, a constraint applied by current regulatory policies in European countries.[3] The duration of scheduled transitions, from legislation to analog shut-

[3] Reallocation of TV Band airwaves could take place in substantial part prior to the end of analog broadcasts by use, among other mechanisms, of "overlay rights." As issued in the PCS band in the United States, such licenses give entrants the opportunity to utilize unoccupied bandwidth while being obliged to limit interference to incumbent users. This means of reallocating TV Band frequencies was proposed in the United States by then-U.S. Senator Larry Pressler (the Republican Chair of the Senate Commerce Committee) in 1996, but was not adopted. See discussion in Hazlett 2001a. It should also be noted that once TV Band frequencies are available for reallocation government regulators may choose not to allow the bandwidth to be utilized by service providers. This is discussed below in the context of the "Berlin Switch."

off, is projected to last a mean of 8.7 years. See Table 3. And target dates have not typically been met.

TABLE 3. DIGITAL TELEVISION TRANSITION PLANS IN EUROPE

Operational Platforms	*Legislation*	*Soft Launch*	*Hard Launch*	*Switch Off*
UK	July 1996	Sept. 1998	Nov. 1998	2005-2010
Sweden	May 1997	April 1999	Sept. 1999	2008
Spain	Oct. 1998	May 2000	May 2000	2007-2009
Finland	May 1996	August 2001	Oct. 2002	2006
Germany	Spring 2002	Nov. 2002	1Q 2003	Until 2010
Netherlands	1999	April 2003	4Q 2003	Starting 2004
Yet to Launch	*Legislation*	*Soft Launch*	*Hard Launch*	*Switch Off*
Portugal	2000	2004	2004	2010
Switzerland	2003	2004	2005	2015
France	August 2000	2004	2005	Starting 2008
Norway	March 2002	2005	2005	Starting 2006
Austria	2001	2005	2005	2012
Denmark	Dec. 2001			2011
Belgium	2002			2005 (Flanders)
Ireland	March 2001			2010
Italy	Nov. 2001			2006

Source: Shulzycki 2003.

This paper presents estimates of the social value of reallocating TV Band spectrum to alternative uses. This allows the costs of delaying such opportunities to be evaluated. We compare the cost of transitioning to a new system, where households can receive digital broadcast signals, with the value of opportunities created when radio spectrum is available for other (non-TV) services. For purposes of this study, we ignore the programming benefits of digital TV which, in any event, may be realized prior to analog switch-off.

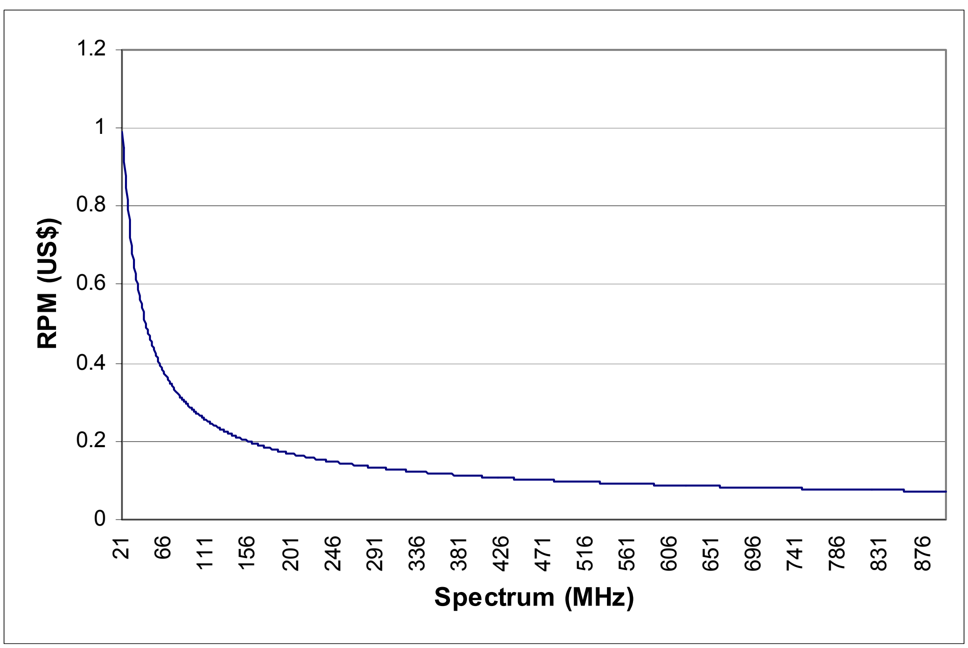
II. MODELING A DIGITAL TV TRANSITION

We offer a simplified version of a switch to digital television, and then estimate how much the TV Band spectrum that is made available by the move to all-digital broadcasting is worth in Consumer Welfare (= Consumers' Surplus + Producers' Surplus). The costs of completing the transition in each country are assumed to include investments in customer premises equipment (CPE) that will give households the ability to receive a multi-channel subscription service (cable or satellite TV), or off-air digital TV signals. The cost of retrofitting TV stations for digital transmissions is not considered a cost of transition, in that these costs have already been mandated (as per the decision to switch to all-digital broadcasting) and are incurred no matter when analog switch-off occurs.

The value of additional spectrum for alternative wireless services is projected using a simulation model developed in Hazlett & Muñoz (2004). This model was calibrated by predicting mobile telephone prices in a 3-equation model (demand, mark-up, and an instrument for quantity) using an international dataset of mobile phone prices and minutes of use across 29 countries (quarterly data, 1999-I – 2003-II). After adjusting for demand and supply variables, retail prices are strongly, and negatively, related to the quantity of spectrum allocated to mobile phone licenses. Expanded bandwidth both lowers operating costs and invites entry, increasing competitiveness. With inclusion of non-linear terms in the model, the relationship between spectrum and service rates (with average revenue per minute of use serving as the proxy) can be estimated, holding other variables at mean values. See Figure 1.

Empirical results obtained from the estimated regressions allow one to predict how wireless voice prices respond when additional spectrum is allocated to mobile phone licenses. This is a conservative empirical approach in the current application. Because TV band spectrum could be used for a variety of innovative applications, improvements (price reductions and usage expansion) in existing mobile phone markets represent a lower bound. Innovative applications, however, are not observed, nor are their revenue flows. Hence, plausible estimates are most likely to be generated using data from existing markets.

FIGURE 1. ESTIMATED PRICE-BANDWIDTH RELATIONSHIP IN GLOBAL MOBILE PHONE MARKETS IN HAZLETT & MUÑOZ (2004)



In August 2003, Berlin-Brandenburg became the world's first jurisdiction to turn off analog broadcasters in favor of all-digital television.[4] Regulators presented a choice to the approximately 180,000 households (approximately 9% of local homes) that did not subscribe to cable or satellite TV service: either buy an off-air digital signal receiver or subscribe to a multi-channel video provider. With a subsidy program offering vouchers (for one DTT tuner) to about 10,000 low-income households (about 6,000 of which were claimed), political opposition to the switch-over was mitigated.

Viewers were instantly rewarded in terms of increased viewing choices: twelve analog broadcast channels had been available, but 27 digital stations replaced them (taking advantage of digital compression techniques). Meanwhile, channels allocated to television broadcasting diminished from twelve to seven. See Table 4. This implies a 286% increase in spectral efficiency.[5]

TABLE 4. SUMMARY OF "BERLIN SWITCH"

	Pre-switch	*Post-switch*	*% Change*
Allocated broadcast channels	12	7	-42
Video program channels	12	27	+125

This paper analyzes the consumer gains available from an analog TV switch-off, in large measure using the experience of the "Berlin Switch," country by country. The assumptions made are as follows.

<u>COSTS</u>

- Every household possesses CPE sufficient to either receive subscription television (cable or satellite) or DTT. The source of this payment (household expenditure or government subsidy) is not considered.

- Only households not currently subscribing to a multi-channel video program distribution (MVPD) service make these additional outlays. This price is assumed to be $300 per household (one time capital expense). For this amount, a non-MVPD household could be connected to an existing cable or satellite system to receive broadcasting signals (Hazlett 2001b).[6] Costs for European subscribers are approximately the same.[7] This

[4] Thomas W. Hazlett, *Finally Something Good on German TV*, SLATE (Oct. 7, 2003), www.slate.com. See also: GAO (2004).

[5] This means that 27 TV programs are delivered in 42% less bandwidth previously used to transmit 12 program channels. Economic efficiency judgments require further cost data.

[6] Cable or satellite subscribers are able to access broadcast stations; in an all-digital, post-analog marketplace, these services would continue to deliver broadcast signals. Moreover, the marginal social cost of reception via these systems equals zero. While some government policy might be crafted to guarantee no-cost availability of broadcast TV retransmission via cable or satellite, we note that satellite broadcasting in Europe already operates primarily without subscription fees for viewers. (GAO 2004, p. 9)

transition cost could, alternatively, be used for household purchase of multiple digital boxes (adding a roof top antenna, if needed) given unit prices now promised by Motorola of $67[8]. In Berlin, boxes were sold in 2003 for about €129, or $158 (GAO 2004, 17). Set top boxes have been sold throughout Europe for between €99 and €299 in 2003 (Shulzycki 2003, 34).

- The transition to digital and/or subscription TV is assumed to be self-sustaining after investment in initial CPE is made.

- Hence, the cost of transition = (1-MVPD pen.) * Total TV Households * $300.

- TV broadcasters, which have been mandated to broadcast in digital formats, continue to transmit OTA signals. With digital multiplexing, there is an increase in the number of distinct programs broadcast. We do not estimate the increase in value implied by the additional program choices, and assume it to be zero in the cost-benefit comparisons.

BENEFITS

- The bandwidth made available for new services by analog switch-off is determined by analogy to the Berlin Switch, where 12 analog channels were replaced by 7 digital signals. This reallocation is proportionally applied to the entire TV band.

- European countries allocate 469 MHz of VHF and UHF frequencies to television broadcasting. Applying the 7-to-12 ratio observed in the Berlin Switch, we assume that the end of analog broadcasting would make approximately 200 MHz available in each country. We assume that this bandwidth would be immediately allocated to licenses that allow mobile phone operators to provide 2G and 3G voice and data services.[9]

- The social value of this additional 200 MHz to provide wireless telecommunications is projected using the simulation model calibrated in Hazlett & Muñoz (2004). We simulate the effect of an additional of 200 MHz in each of the thirteen EU countries which appear in our database (taken from Merrill Lynch 2003).[10]

- Consumer surplus gains are estimated to be equal to the incremental area beneath the demand curve (and above market price) when prices are lowered and output expands. (Prices are measured in mean revenue per minute of use; output in minutes of use.)

---

[7] "The costs for a satellite dish and related equipment are estimated at less than 200 Euro ($246.04). Satellite television service provides viewers in Germany with approximately 125 channels, about 60 of which are in German." (GAO 2004, p. 9)

[8] Ted Hearn, *NAB: 73M TV Sets Need DTV Boxes*, MULTICHANNEL NEWS (Aug. 12, 2004).

[9] This is not a policy recommendation, but an assumption made to establish a lower-bound estimate of the value of spectrum in alternative (non-TV) uses. More flexible use would allow even greater social value to be created, raising our opportunity cost (of delaying the transition) estimates.

[10] Some countries in the Merrill Lynch database were not included due to other data being unavailable. These include the Czech Republic, Hungary, Norway, Sweden, and Switzerland. No countries with available data were excluded.

- Producer surplus gains are estimated to be equal to the incremental revenues received (from increased minutes of use, given that demand is elastic across all markets in the sample) minus incremental operating costs. These costs are assumed to equal the same percentage of incremental revenues as observed with initial revenues (using Merrill Lynch data for the ratio of operating expense to total revenue).

- Social welfare is the sum of consumers' surplus and producers' surplus. Where social welfare gains exceed consumers' surplus, producers' surplus over the increment is positive. Where, conversely, the change in consumers' surplus exceeds social welfare gains, producers' surplus is negative as per the assumed change in allocated bandwidth.

DISCUSSION

The logic of this analysis is straightforward. Bandwidth no longer used for analog TV transmissions may be productively utilized in supplying alternative outputs. We have estimated the costs and benefits of such a reallocation of radio spectrum, relying on the evidence revealed in the first and only digital TV transition to have been completed, the so-called Berlin Switch. We assume that consumers continue to have access to broadcast television signals, receiving them either by digital OTA transmissions, or via cable or satellite TV links. This implies that there is no cost associated with the transition excepting the investment in equipment to enable reception of these (additional) substitute television signals.

The cost of equipping households without such capability is likely to be far less than the $300 CPE investment we assume.[11] Moreover, the benefits of receiving digital signals and/or subscription television service include far greater choice given a much larger complement of programs (compared to analog OTA broadcasts); these benefits are assumed to be zero. These assumptions bias the analysis against transitional gains.

There are additional transition costs that are correctly ignored. In that terrestrial TV stations have already been mandated, throughout EU countries, to adopt digital TV transmission technology, these costs are now irrelevant in looking forward to the benefits of spectrum reallocation. In fact, by ending simulcasts (i.e., with analog switch off), public TV stations in the United States estimate that they will make significant savings in operating costs.[12]

---

[11] We also assume that the transition to digital, once undertaken, is self sustaining. Once consumers have DTV sets or subscribe to cable or satellite services, that the system costs no more than current analog broadcasting services, ceteris paribus.

[12] "Analog Switch Off (ASO) would save public stations $36 million a year in the electricity costs normally incurred on analog transmission. That figure… represents almost 20 percent of the total funding the Corporation for Public Broadcasting distributed to public television stations in Fiscal Year 2003 as Community Service Grants." There are 349 public TV stations in the United States.

III. EMPIRICAL RESULTS

Before presenting our empirical estimates of the opportunity cost of TV Band spectrum, we present an example of how our simulation model is used. Here, we project how an incremental allocation of radio spectrum will be likely to affect price and output in the mobile phone market in the United States (a country not included, unsurprisingly, in our

---

Public TV stations study viability of early Analog Switch Off, BROADCAST ENGINEERING (Nov. 17, 2003); http://broadcastengineering.com/news/ broadcasting_public_tv_stations/. A small number of public stations have already ceased analog transmissions in order to save money. One example is WNVT, located about sixty

miles from Washington, D.C. "   The prohibitive cost of operating both an analog and digital transmitter simultaneously has caused public television station WNVT-TV, in Goldvein, Va., to shut off its analog transmitter and commit its limited resources to digital television (DTV) transmission... Dave Hurd, chief engineer at WNVT-TV, said the move will save them about $5,000 per month in electricity expenses--necessary to operate the analog system alone. The station is not worried about loosing viewers because most people in the station's northern Virginia coverage area are getting their TV via cable or satellite. *Hard economics cause WNVT to return to analog spectrum,* BROADCAST ENGINEERING (Jul 21, 2003); http://broadcastengineering.com/news/broadcasting_hard_economics_cause/.

EU sample). Using parameter estimates from the model estimated in Hazlett & Muñoz (2004), which regresses price against a number of variables using quarterly data from 29 countries, we then estimate how increases in spectrum availability reduce price in the U.S. (or other selected country) by using U.S.-level values for significant explanatory variables such as per capita GDP and the mean price of a 3-minute peak hour call over the fixed line network. (Dichotomous variables for whether or not the country assigns wireless licenses by auction, and whether the country uses a 'calling party pays' rule are included.) The concentration of supply, measured by the Herfindahl-Hirschman Index, is partly a function of allocated spectrum, and is estimated to decrease when incremental bandwidth is added.

Starting values for price and quantity are then predicted at the initial (actual) values and price is then predicted given changed values for spectrum (assumed) and HHI (implied by the spectrum change). The new price is then used, with the demand elasticity estimated in Hazlett-Muñoz (2004), to predict a new level of output (minutes of use). This yields estimates for changes in consumer surplus (the incremental area under the demand curve and above price) and revenue. The change in producers' surplus is taken from the increase (which may be negative) in revenues minus the increase in operating costs (which is positive, given the increase in minutes of use). This calculation assumes that incremental operating costs are equal to the proportion of operating costs (gross profit ratio) initially observed in the market applied to revenues for additional units of output following the price reduction.

The result of this simulation approach is seen in Table 5. In the U.S. example, the original price per minute of use (MOU) is estimated to be about 11 cents for about 78 billion MOU per month. An additional 200 MHz of bandwidth allocated to wireless licensees results in prices declining to an estimated 5.5¢ per MOU, with MOU increasing to about 153 billion monthly. The gain in consumer surplus is projected to be about $77 billion per year. This assumes a five percent social discount rate (which is what we assume in our later simulations).[13] Producers' surplus is negative, meaning that social welfare increases slightly less – about $75 billion per year. The decline in profits is attributed to the more intense price competition, which more than offsets the cost-savings to producers from additional bandwidth.

[13] This is a standard assumption, although it is not without controversy in some instances (Hahn 2004). Critics actually propose lower real social discount rates, which would tend to increase the benefits of spectrum reallocation in this analysis (Parker 2003).

TABLE 5. SIMULATING THE VALUE OF 200 MHZ OF REALLOCATED TV BAND SPECTRUM (USING THE UNITED STATES AS AN EXAMPLE)			
Control Variables	*Units*	*Start*	*End*
minutes of use	millions/month	78340	
HHI	0-10000	1648	implied
spectrum	MHz	170	370
auction	inhabitants/sq(km)	30.27	30.27
notcpp	0-1	1	1
gdppc	0-1	1	1
fixed line price	US$	37312	37312
Predicted Variables	*Initial*	*Final*	*change*
price per minute	$0.112	0.055829	-49.97%
minutes of use	78,340	153,038	95.35%
Consumer surplus	$billions/year		+77,419
Social Welfare	$billions/year		+75,037

We apply this basic simulation format to each of the thirteen European countries for which we have data. The results of this exercise are reported in Table 6. Two aspects are important to our analysis. The first is that, across all countries, there are very substantial estimated net consumer benefits in making analog TV spectrum available for wireless telecommunications service (see column (e) and Figure 2). This is true for countries like Belgium, having near ubiquitous deployment of cable TV service, and it is true for countries like Italy, where cable penetration is near zero. This latter situation raises the cost of transitioning, yet Italian consumers would still benefit enormously from reallocation. From about $500 to $2100 per capita would be generated in net consumer surplus (present value) by transitioning 200 MHz to non-TV services in European countries. These estimates account for the cost of transitioning every household to a digital OTA or subscription TV service, and would yet leave abundant bandwidth (269 MHz) for DTT.

The second important result is that net benefits are distributed to consumers rather than producers. Wireless carriers (service providers) are negatively impacted by reallocating spectrum from TV to wireless telecommunications. This is seen in the degree to which incremental consumer surplus (ΔCS) is estimated to be considerably higher than Social Welfare (ΔSW) gains, which includes PS changes. Across countries, ΔCS is from two to five times larger than $|\Delta SW|$ (see Figure 3), meaning that industry profits sharply decline with retail prices due to the newly available spectrum capacity.[14]

[14] While lower retail prices will reduce profits ceteris paribus, here the relationship between profits and prices is ambiguous. Additional spectrum availability lowers costs and, for a given level of retail prices, increases profits.

Taken together, these results offer a description of the current digital TV transition in Europe and elsewhere. Very substantial gains would be realized were a generous increment of bandwidth to be reallocated from TV to alternative services, yet the gains would go entirely to consumers. Incumbent wireless suppliers would see profits very substantially decline. This could explain why, despite large efficiency gains, the path to all-digital television is such slow going. In addition to the Prisoners' Dilemma, well organized constituencies expect to be significantly harmed were large increments of bandwidth to be made available for alternative services following analog TV switch-off.

TABLE 6. ESTIMATED SOCIAL BENEFITS OF RE-ALLOCATING 200 MHZ OF EUROPEAN TV BAND SPECTRUM (NPV)[15]

Country	*(a) ΔCS ($MM)*	*(b) ΔSW ($MM)*	*Total HHs*	*Cable TV HHs*	*Sat TV HHs*	*Non MC HHS*	*(c) Cost NonMC HHS ($MM)*	*(d) Population (2002, MM)*	*(e) Net ΔCS/person [(a–c)]/d] ($)*
AUS	10,830	3,578	3.3	1.3	1.8	0.2	60	8.0531	1337.43
BEL	13,517	6,612	4.2	3.7	0.1	0.4	120	10.2964	1301.13
DEN	6,762	1,479	2.4	1.3	0.1	1	300	5.3872	1199.50
FIN	11,414	5,119	2.4	1	0.3	1.1	330	5.2130	2126.31
FRA	91,282	41,069	24	2.8	2.7	18.5	5550	59.4660	1441.69
GER	52,733	23,499	39.2	20.6	12.8	5.8	1740	85.5246	596.24
GRE	10,892	4,381	3.8	0.8	0.1	2.9	870	10.9640	914.10
IRE	8,105	3,879	1.2	0.5	0.1	0.6	180	3.9789	1991.64
ITA	78,010	46,490	19.4	0.1	1.2	18.1	5430	57.6086	1259.88
NET	14,866	5,504	7	6.1	0.3	0.6	180	16.2172	905.59
POR	10,062	3,578	3.4	0.8	0.4	2.2	660	10.3558	907.94
SPA	26,240	14,866	12.8	0.5	1.6	10.7	3210	40.8474	563.81
UK	68,396	25,133	24.6	3.2	5.4	16	4800	58.7892	1081.77

[15] Data sources: BDRC, *The Development of Broadband Access Platforms in Europe* (August 2001); European Conference of Postal and Telecommunications Administrations (CEPT), *Planning and Introduction of Terrestrial Digital Television (DVD-T) in Europe*, (Dec. 1997).

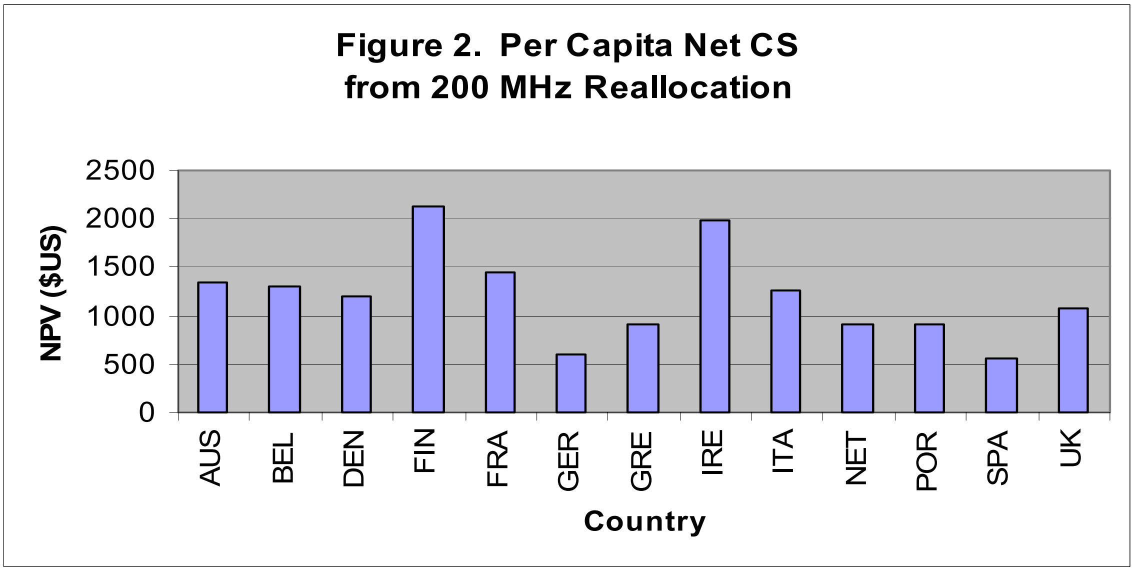


Figure 2. Per Capita Net CS
from 200 MHz Reallocation
NPV ($US)
2500
2000
1500
1000
500
0
AUS
BEL
DEN
FIN
FRA
GER
GRE
IRE
ITA
NET
POR
SPA
UK
Country

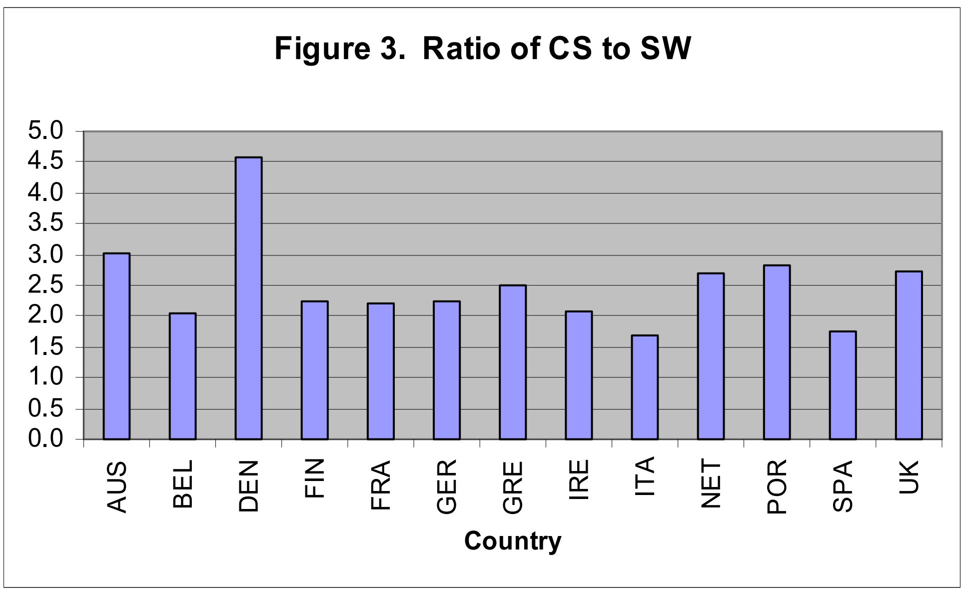


Figure 3. Ratio of CS to SW
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
AUS
BEL
DEN
FIN
FRA
GER
GRE
IRE
ITA
NET
POR
SPA
UK
Country

V. CONCLUSION

A transition to all-digital television broadcasting could yield social gains conservatively estimated to fall between about $500 and $2100 per person. In addition, a transition for analog TV would yield greater program diversity. Yet, the lure of these social benefits are weak relative to the forces supporting a decades-old equilibrium in spectrum allocation. Indeed, the one country making visible progress with DTT, with Berlin-Brandenburg actually completing the transition (eliminating analog broadcasts) in August 2003, is not moving to reallocate vacated analog TV bands:

> In Germany, government officials and industry participants are implementing the DTV transition largely for the purpose of improving the viability of terrestrial television; officials do not expect to recapture radio spectrum after the transition. (GAO 2004, Abstract)

The simulated market results of TV band reallocation in European countries helps explain this regulatory inertia. While the prisoners' dilemma involved in coordinating customer purchases of digital CPE and broadcasters' investments in digital content is well known, it is shown here that incumbent wireless carriers may also fear substantial reallocations of radio spectrum. Such additional bandwidth inputs would lower retail prices substantially. While this produces sizeable consumer surplus gains, it is predicted to lower industry profits (over the 200 MHz increment studied). A further incentive for incumbent carriers to lobby against the transition to DTT is that licenses could be auctioned, offering service providers a choice between paying substantial sums to obtain access to additional bandwidth, or lose market share to those rivals who do.[16]

In addition to the opposition of incumbent wireless networks, it is commonly observed that incumbent TV licensees tend to strongly resist TV Band reallocation. This behavior is best understood as an example of exercising regulatory leverage. While television stations have resisted the use of TV Band frequencies for more TV stations, they may develop quasi-property rights that can be used to veto the assignment of rights to others. The "digital TV transition" began in the U.S. in the mid-1980s, in fact, when incumbent broadcasters sought to block cellular manufacturers and public safety agencies from using idle TV Band frequencies. The promotion of what was initially called "advanced" or "high definition" television was not driven by consumer demand, but as a strategic reaction to resist spectrum reallocation (Hazlett & Spitzer, 2000). Only when compensated in regulatory favors will parties that have the ability to obstruct productive rights assignments have the incentive to cooperate. The TV Band, with exceedingly valuable rights highly fragmented by regulation, results in a classic tragedy of the anti-commons (Heller 1998; Fennell 2004; Hazlett 2005). While the status quo may therefore be explicable, our estimates indicate it is far from optimal.

[16] Even countries not implementing auctions now typically distribute common carrier licenses in exchange for fees. Depending on the level of the extraction, this resembles an auction bid.

References

General Accounting Office (GAO). 2004. German DTV Transition Differs from U.S. Transition in Many Respects, but Certain Key Challenges Are Similar, GAO-04-926T (July 21, 2004).

Fennell, Lee Anne. 2004. *Common Interest Tragedies*, 98 NORTHWESTERN U.L.R.

Hahn, Robert W. 2004. *The Economic Analysis of Regulation: A Response to the Critics*, 71 UNIVERSITY OF CHICAGO LAW REVIEW 1021.

Hazlett, Thomas W. 2001a. *An Essay on Airwave Allocation Policy, 14 Harvard Journal of Law & Technology* 335-567 (Spring).

_____. 2001b. *The U.S. Transition to Digital Television: Time to Toss the Negroponte Switch*, AEI-Brookings Joint Center for Regulatory Studies Working Paper No. Working Paper 01-15 (Nov.).

_____. 2005. *Spectrum Tragedies.* YALE JOURNAL ON REGULATION (forthcoming, Spring).

Hazlett, Thomas W., and Roberto Muñoz. 2004. *A Welfare Analysis of Spectrum Policies*, Working Paper (August).

______. 2004. *What Really Matters in Spectrum Allocation Policy*, Working Paper (August).

Heller, Michael. 1998. *The Tragedy of the Anticommons: Property in the Transition from Marx to Markets,* 111 HARVARD LAW REVIEW 621.

Merrill Lynch. 2003. *Global Wireless Matrix 2Q03* (Sept. 22).

Parker, Richard W. 2003. *Grading the Government*, 70 UNIVERSITY OF CHICAGO LAW REVIEW 1345.

Shulzycki, Alexander. 2003. *DTT in Europe: Market Overview and Assessment,* Presentation to DigiTAG Exploratory Meeting (Sept.).