Citi GPS

THE CURTAIN FALLS

How Silicon Valley is Challenging Hollywood

Citi GPS: Global Perspectives & Solutions

October 2015

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THE CURTAIN FALLS

How Silicon Valley is Challenging Hollywood

Eric Schmidt, Google's CEO once said: "*The Internet is the first thing that humanity has built that humanity doesn't understand… the largest experiment in anarchy that we have ever had.*" An 'experiment in anarchy'... that's an interesting phrase.

Merriam-Webster defines anarchy as "wil*d behavior in which the people in a group are not controlled by rules or laws.*" 'Not controlled by rules or laws'…another interesting phrase.

We could synthesize the two quotes this way: "*The Internet allows rules to be broken*." And, virtually everything in the pre-Internet media ecosystem is governed by rules. The rules aren't arbitrary. Rather, they're dictated by the hard, profit-maximizing logic of microeconomics. Here are a few examples:

- In the past, if you wanted to sell video, you needed something scarce: Hundreds of billions in capital to pass every home with coaxial cable. Or, a fleet of geosynchronous satellites orbiting the earth. In the new, post-Internet world, to sell video you need…a web server.
- In the pre-Internet world, if you wanted to reach a large audience, only a handful of places would take your ad: the Olympics, the World Cup or the Super Bowl. Today, you use Facebook.
- In the pre-Internet world, to advertise to specific audiences, you used crude demographic measures: women over 50 years old, for example. With the Internet, you target a particular person.
- In the past, if you wanted to watch an entire season of a TV show, you needed a DVR. Or, you could buy an expensive DVD box-set. Today, you watch it on Netflix.
- In the past, if you wanted to watch a particular channel, your pay TV firm would force you to buy a bundle of 200 channels. But, increasingly, content can be acquired without a pay TV package via HBO Now, CBS All Access or Amazon Prime.

In simple terms, the Internet has done three things: 1) lowered the barriers to video entry, 2) offered advertisers a better value proposition and 3) given consumers more flexibility. For media incumbents, that's a potent cocktail that can quickly lead to value destruction.

But, when investors try to navigate the complex media/telecom ecosystem, they usually run into two problems. First, Hollywood economics are, perhaps intentionally, opaque. Second, the telecom world is steeped in complex engineering. This makes it particularly difficult for investors to assess the risks and opportunities.

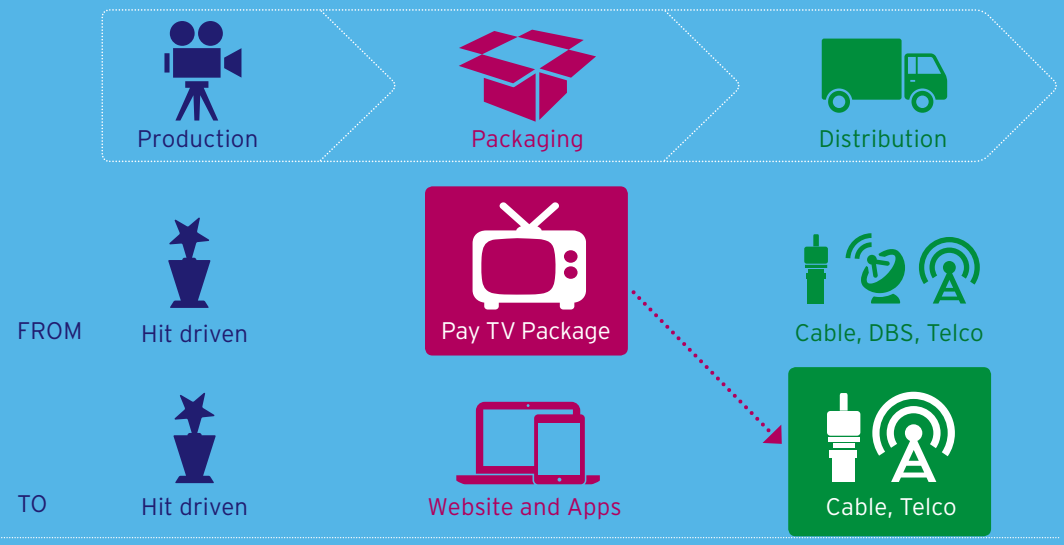
So, our aim in this note is to do something simple: explain how — and why — the media and telecom world will change as Internet video — and Internet ads — move to center stage.

Here's the punchline: We expect value to migrate from content aggregators — like cable networks — to last-mile Internet access providers. Let's see why…

Value shift in media ecosystem

Three big threats to video delivery driving the change

VALUE IN MEDIA IS SHIFTING FROM PACKAGING TO DISTRIBUTION



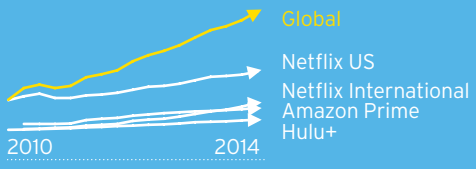
Source: Citi Research

VALUE FROM PACKAGING TV CONTENT ERODING FOR THREE REASONS:

1 Consumer threat

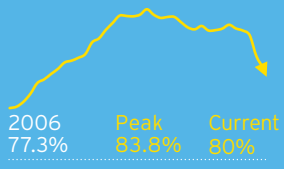
Internet streaming is up . . .

79 million subscribers in 2014

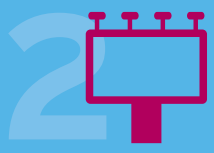


. . . and Pay TV units are falling

Residential Pay TV penetration

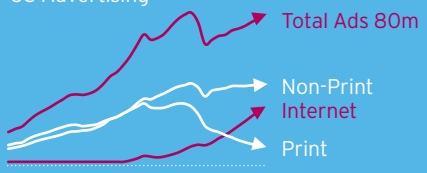


2 Advertiser threat

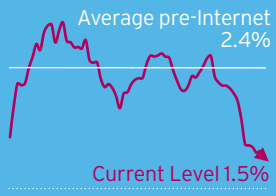


Ad spend is shifting to the internet . . .

US Advertising

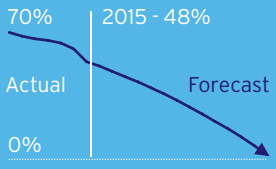


...as Ad share of economy is falling



3 Pay TV Distribution threat

Squeezed margins increase the risk of dropped content



Source: Nielsen, Magna, US Dept of Commerce, US Census, Company reports, Citi Research

VALUE TO ACCRUE TO LAST MILE INTERNET ACCESS FIRMS: **ALL RIVALS HAVE LIMITS**

	COST	SPEED	MONTHLY DATA CAPS	COVERAGE OF THE US
Cable	Deployed	100Mbps	300GB	95%
Fiber-to-the-home	$50 billion	1,000Mbps	None	50%
Fixed Wireless	$12 billion	12Mbps	200GB	90%
Satelite Broadband	$0.5 billion	12Mbps	20GB	100%
Mobile Wireless	Deployed	12Mbps	1-2GB	98%

Source: Citi Research

Contents

The Big Picture

There are two governing axes in the world of communications.

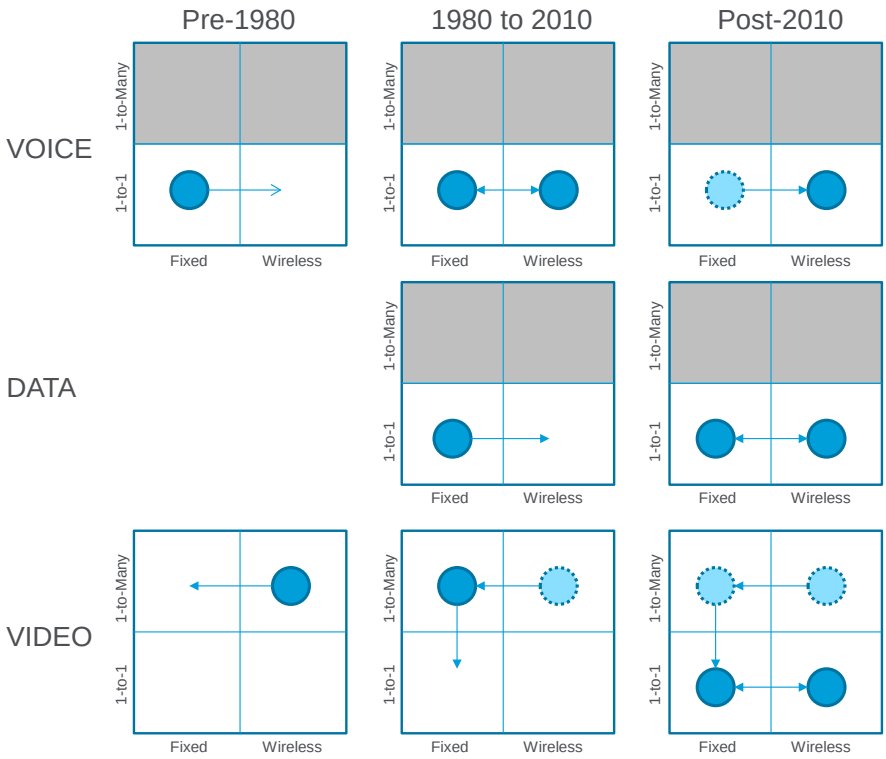
- First, 'Is the information transmitted via a fixed or mobile platform?' This axis determines where the content is consumed.
- Second, 'Does the technology facilitate one-to-many or one-to-one delivery?' One-to-many transmission - like broadcast or linear TV - means content is pushed to the consumer. With one-to-one delivery, content is pulled by the consumer. That means the user decides what to watch and when to watch it.

Over the last four decades, the evolution of voice and data followed boring, predictable paths: they moved from fixed to mobile applications. This makes perfect sense. With mobile platforms, voice and data could be consumed anywhere.

The evolution of video, however, is far more complex. It began as a TV station, a wireless one-to-many platform. It then migrated to cable TV, a fixed-line one-to-many platform. Now, with the Internet, video is migrating once again: one-to-one delivery via both fixed and mobile platforms.

In effect, unlike voice and data, video delivery currently spans all four quadrants of our matrix: one-to-one and one-to-many in both fixed and mobile environments. That's a fairly dramatic change. But, for consumers, moving from the upper right to the lower right-hand quadrant means something simple: **you can watch what you want, when you want, where you want.**

Figure 1. The Evolution of Video



Source: Citi Research

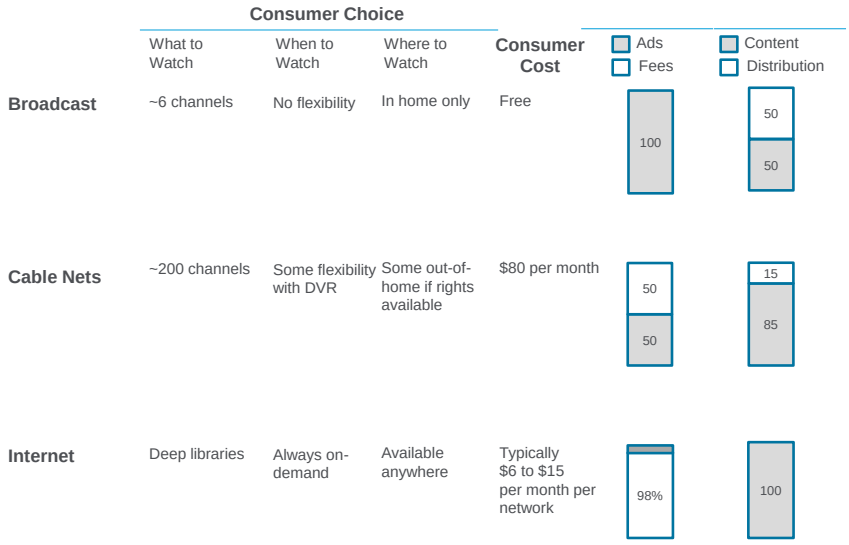
Where It Began

The television business was born in the 1940s. For consumers, the content was free. The business generated revenues solely from advertisements. Since distribution was relatively scarce (there are a fixed number of TV station licenses), the networks actually paid the TV station owners to carry their content. And, advertising revenues were roughly split evenly between the local TV station and the broadcast network.

Because free-to-air (FTA) TV stations had limited reach – based on the TV station's transmitting power – entrepreneurs began to lay coaxial cable with the express intent of plugging a coaxial wire into a TV station to expand the station's reach. After all, greater reach meant more ad revenues. Fortunately, these family-run cable firms laid down thick coaxial wires that had extra capacity for future uses.

By the 1980s, media firms began to develop TV programming to use this excess coaxial capacity. And, the cable network business was born. The cable network business was different from FTA in two ways: 1) consumers paid for the service and 2) the bulk of the ad revenues were kept by the cable network. Over time, more households began to sign up for pay TV services and ratings for free broadcast TV began to fall.

Figure 2. Shifting Viewership Channels



Source: Citi Research

Of course, in parallel, the Internet was taking form. While early Internet access used phone lines (via dial-up modems), by the late 1990s, the cable industry realized that it could allocate a portion of its excess coax capacity to broadband Internet access.

By 2008, Netflix began to adjust its business model from shipping DVDs by mail to delivering video content over the Internet. Since then, other services have followed Netflix's lead. Today, there are about a dozen web-based video firms. They come in three flavors:

- First, there are the subscription video on demand (SVOD) players – like Netflix, Amazon and Hulu. These firms give consumers library content and some original shows. Costs are low, usually around $10 per month.

- Second, there are web-based firms that offer a linear feed of traditional cable network content. Today, Dish's Sling and Sony's Vue are in the market. Apple may also launch a service in late 2015 or 2016.
- Third, consumers can stream individual channels over the web. HBO Now, Showtime Anytime, CBS All Access and Viacom's Noggin are all examples of the content firms offering their content directly to consumers without a fat bundle of channels in tow.

Figure 3. Internet Video Services

Internet Video Service	Content			Consumer Cost ($ / mo)	Channels Available								
	Library	Originals	Linear Feed		AMC	CBS	DIS	DISCA	FOX	NBCU	SNI	TWX	VIA
Subscription VOD													
Netflix	X	X	-	$10 w/o ads	-	-	-	-	-	-	-	-	-
Amazon Prime	X	X	-	Free w/ Prime	-	-	-	-	-	-	-	-	-
Hulu	X	-	-	~$8 w/ ads	-	-	-	-	-	-	-	-	-
Internet Based Bundled Linear TV													
Dish: Sling	-	-	X	~$20	X	-	X	-	-	-	X	X	-
Apple: Apple TV	?	?	?	?	?	?	?	?	?	?	?	?	?
Sony: Play Station Vue	-	-	X	~$50	X	X	-	X	X	X	X	X	X
Internet Based Channels													
HBO Now	X	X	-	~$15	-	-	-	-	-	-	-	X	-
Showtime Anytime	X	X	-	?	-	X	-	-	-	-	-	-	-
CBS All Access	X	-	X	~$6	-	X	-	-	-	-	-	-	-
Viacom Noggin	X	-	-	~$6	-	-	-	-	-	-	-	-	X
NBC	?	?	?	?	-	-	-	-	-	X	-	-	-

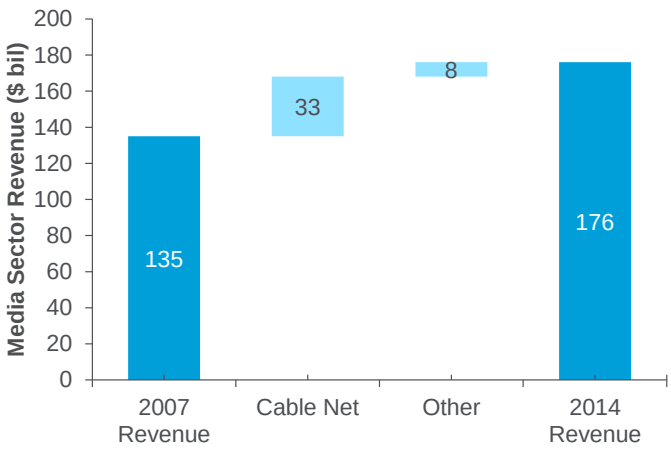
Source: Citi Research

While the migration from cable networks to Internet video may seem like a small change, it isn't. Sure, the broader US media sector is complex. It spans broadcast TV, cable networks, movie studios, theme parks, outdoor advertising, book publishing, TV production, magazines, TV stations, consumer products and video games.

But, if you look at the sources of revenue and EBITDA[1] growth, one thing stands out: most of the sector's growth comes from cable networks. To wit, in the last seven years — 2007 to 2014 — cable networks accounted for 81% of the revenue growth and 73% of the EBITDA growth within the entire US media sector.

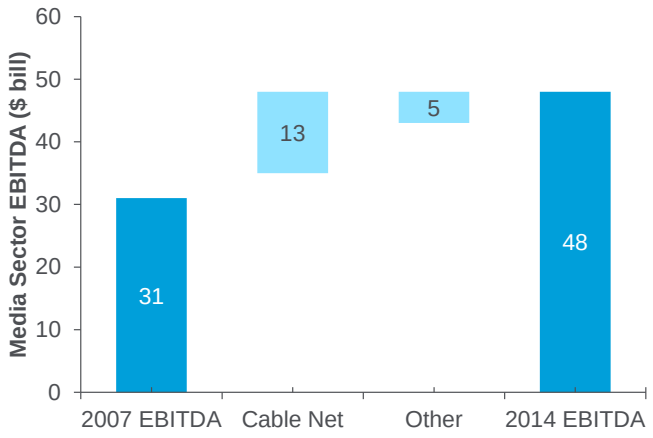
[1] EBITDA = Earnings Before Interest, Tax, Depreciation & Amortization

Figure 4. Media Sector Revenue Walk (2007-2014)



Source: Company reports, Citi Research

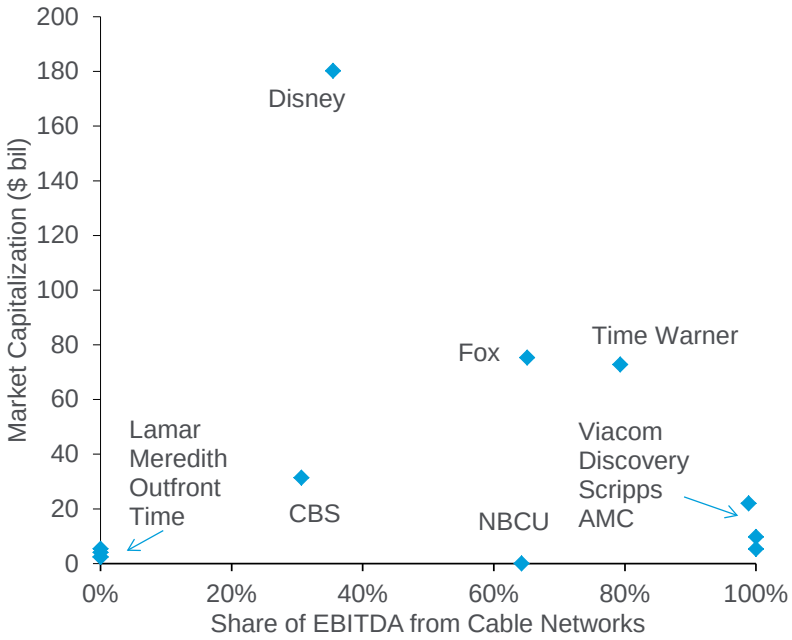
Figure 5. Media Sector EBITDA Walk (2007-2014)



Source: Company reports, Citi Research

So, if you're going to have a view about most firms within the media sector, you must have a view about the health of cable networks. Indeed, virtually every large capitalization (large cap) media conglomerate – from Disney to Viacom – is exposed. Only small cap firms – like Lamar, Meredith, Outfront and Time – are not exposed.

Figure 6. Media Company Exposure to Cable Networks



Source: Company reports, FactSet, Citi Research

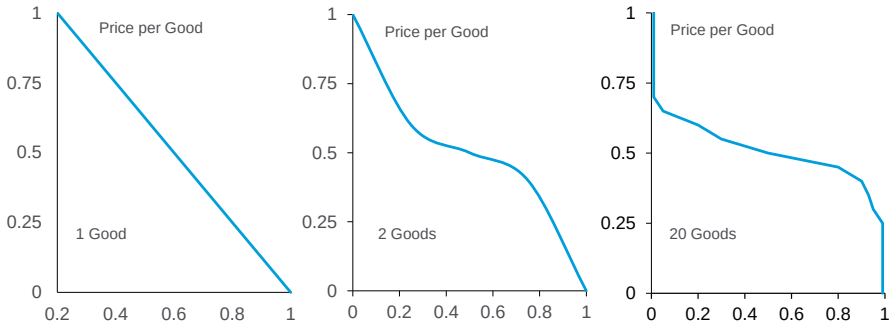
Why Cable Networks Over-Earn

Today, when you say the name Yellen, most investors think of the Federal Reserve. But, back in 1976, Janet Yellen teamed up with William Adams and wrote a seminal paper called "Commodity Bundling and the Burden of Monopoly".[2]

Since then, other economists have built on this work. More recently, two economists – Yannis Bakos and Erik Brynjolfsson – described the economic benefit of bundling information goods (or goods with low marginal costs). Back in '96, they wrote an intriguing paper.[3] The basic idea goes something like this:

If you created a demand curve for a single cable channel (left side of Figure 7), an owner of a cable channel would maximize revenues (and profits) by selling it to 50% of homes at $0.50 per month. But, if you bundle a bunch of channels together (right side of Figure 7), nearly every household will subscribe to your service and still pay $0.50. In effect, bundling flattens the demand curve, increasing penetration rates and maximizing revenue.

Figure 7. Demand from Bundling Information Goods



Source: NYU Stern

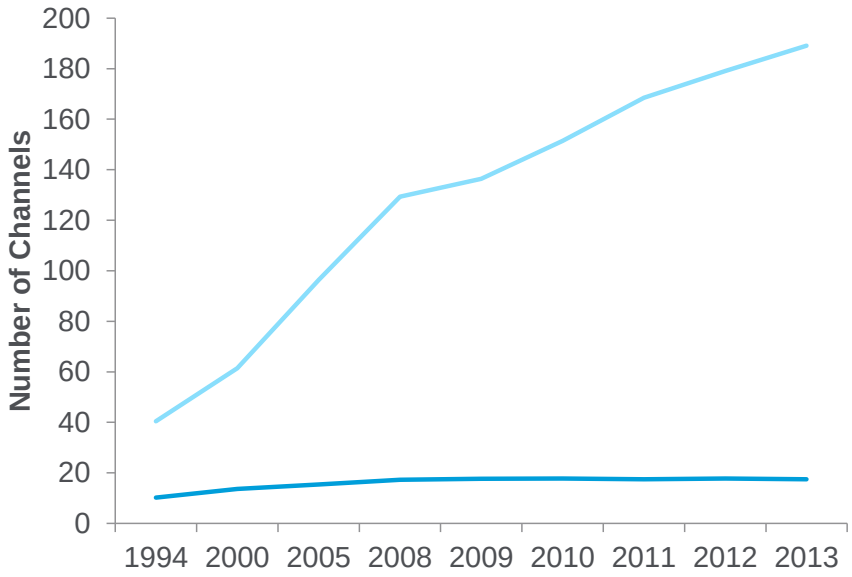
There are two helpful excerpts from the Bakos and Brynjolfsson paper:

> "*The key intuition behind the power of bundling is that consumer's valuation for a collection of goods…has a probability distribution with a lower variance per good compared to the valuations of the individual goods. The larger the number of goods…the greater the typical reduction in the variance. Because uncertainty about consumer valuations is the enemy of effective pricing…this predictive value of bundling can be very valuable.*
>
> *The intuition [behind* Figure 7*] is that as the number of information goods in the bundle increases…the distribution for the valuation of the bundle has an increasing fraction of consumers with moderate valuations near the mean of the underlying distribution. Since the demand curve is derived from the cumulative distribution function for consumer valuations, it becomes more elastic near the mean and less elastic away from the mean."*

[2] William James Adams; Janet L. Yellen, "Commodity Bundling and the Burden of Monopoly", *The Quarterly Journal of Economics,* Vol. 90, No. 3 (Aug., 1976), 475-498.
[3] Yannis Bakos, Erik Brynjolfsson, "Bundling Information Goods: Pricing, profits and Efficiency", *Management Science". Vol. 45, No. 12 (Dec 1999), 1613-1630*

In lay terms, this means that when cable networks sell their content to pay TV firms in a bundle, they increase penetration and reduce consumer surplus. That helps maximize profits. But, back in 1994, US consumers watched about 25% of the channels they could receive. By 2013, there were nearly 200 channels, but the average household watched just 17 channels. In effect, US consumers are paying for a lot of channels they don't watch. And, that suggests cable networks might be overearning.

Figure 8. Number of Cable Channels Received vs. Viewed

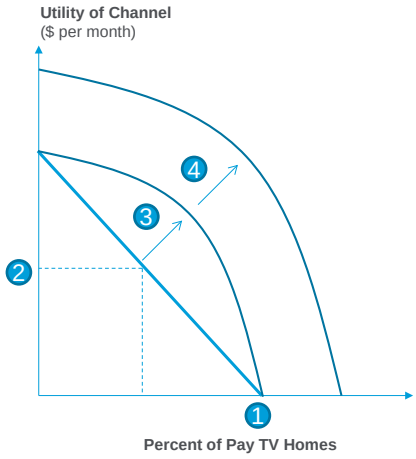


Source: Nielsen

But, can we quantify the magnitude of over-earning? It isn't easy. That's because you need to build a demand curve for every cable network. We did this in four steps:

- First, we obtained the network cume from Nielsen. This is the portion of pay TV households that tune into a particular channel in a given week. Any household that doesn't tune into the channel doesn't derive utility from the content. As such, this gives us the x-intercept of the channel's demand curve.
- Second, we use the average cost per minute of TV consumption. By marrying the utility of an average minute of cable TV with a particular network's ratings, we can estimate the mid-point of the demand curve. With two data points — the x-intercept and the mid-point — we can draw a simple, linear demand curve.
- Third, when we performed this analysis for an existing a la carte channel like HBO, we learned something: the demand curves are not linear, they are concave. Otherwise HBO's existing retail price would not be profit-maximizing (an unlikely prospect).
- Fourth, we know that some types of content — like HBO or the NFL Sunday Ticket — are worth more per minute than typical linear TV. That is, the retail price points for these a la carte channels suggests consumers value a minute of premium content 70% more than average TV content. And, sports content fetches a 280% premium to average TV content.

Figure 9. Methodology for Creating Cable Channel Demand Curves

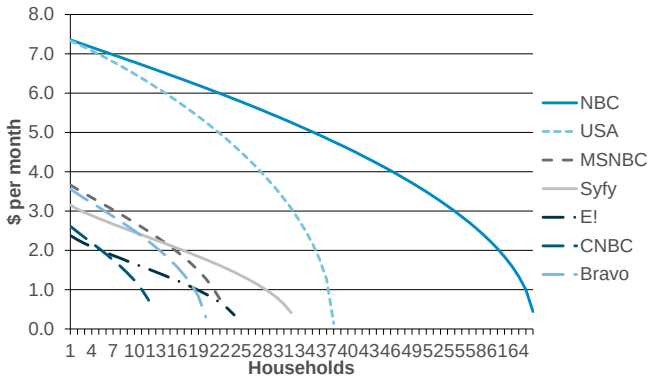


Step	Description	Source
1	**Network cume**: homes that don't tune into channel derive no utility from the content.	Nielsen
2	**Average utility**: Use average cost per minute of TV viewing x average viewing per channel. Should represent the average utility of the content.	Nielsen and company reports
3	**Concave demand curve**: Adjust all demand curves so they are convex (not linear).	Citi
4	**Utility of content**: Some genres more valuable than typical linear content. Sports worth 3.8x more than non-sports. Premium worth 1.7x more than non-sports.	Citi analysis based on current *a la carte* offerings (NFL Sunday ticket, HBO Now)

Source: Citi Research

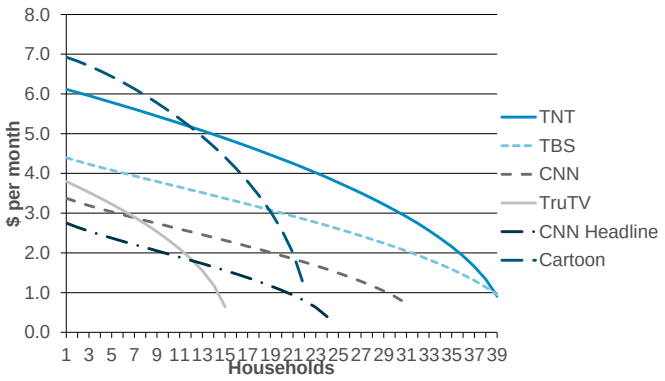
And, when we complete this analysis for the top US cable networks, there are some interesting observations. For Comcast, we see that NBC (a broadcast network), USA and SyFy (two cable networks) are the three most popular channels. CNBC — near and dear to Wall Street — is the least valuable channel among Comcast's top-eight networks.

Figure 10. Comcast-NBCU Demand Curves



Source: Citi Research

Figure 11. Time Warner Demand Curves

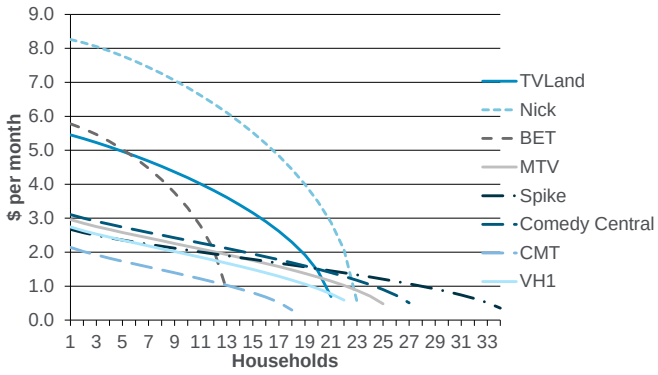


Source: Citi Research

For Time Warner, HBO (a premium channel) is the most valuable network. This is followed by TNT and TBS (both Turner cable networks). The least valuable network within the Time Warner stable is Cartoon Network.

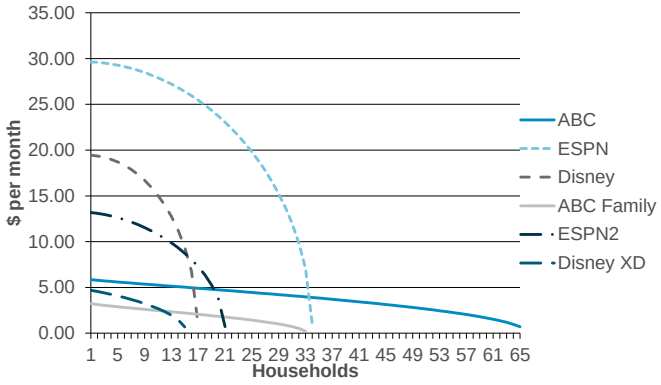
Viacom has the largest collection of channels among the US media firms. And, Viacom's most popular network is Nick. But, the next most popular channel is TV Land. The once iconic MTV actually ranks toward the bottom of Viacom's most valuable channels.

Figure 12. Viacom Demand Curves



Source: Citi Research

Figure 13. Disney Demand Curves

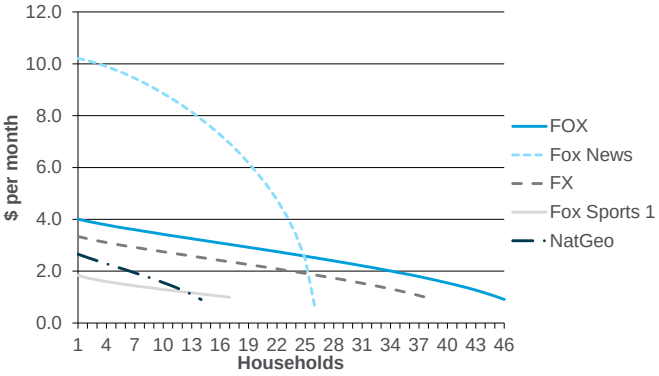


Source: Citi Research

It will come as little surprise that at Disney, the most valuable channel is sports-centric ESPN. But, ABC and Disney Channel both fare reasonably well.

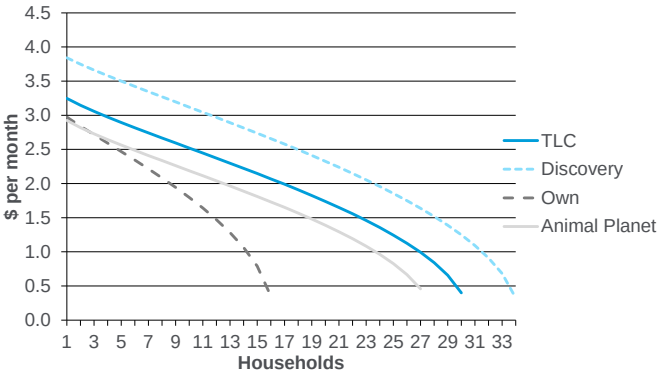
At 21st Century Fox, Fox News scores well, followed by FOX (the broadcast network). National Geographic is still niche oriented. And FS1 (Fox's fledgling sports network) is still nascent and doesn't come close to matching ESPN.

Figure 14. Fox Demand Curves



Source: Citi Research

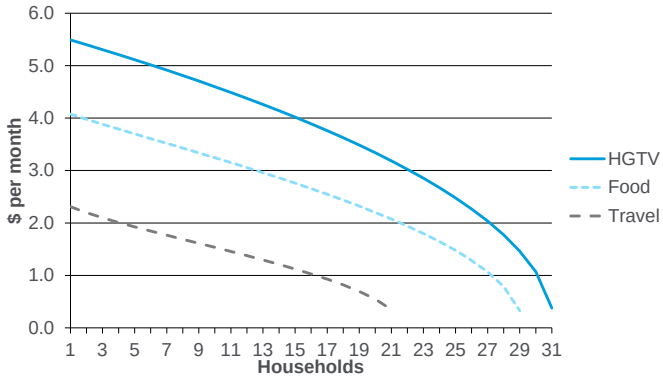
Figure 15. Discovery Demand Curves



Source: Citi Research

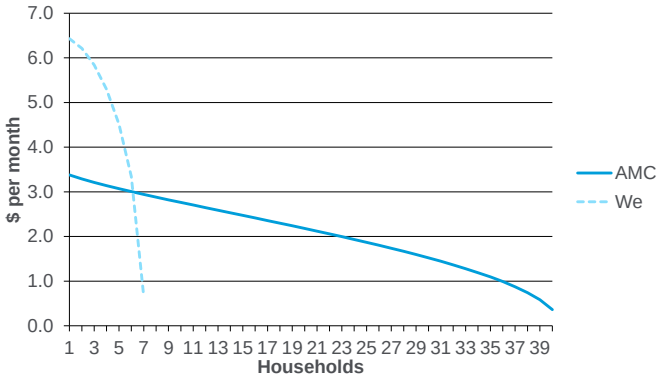
Discovery has three popular networks – Discovery Channel, Animal Planet and TLC – and one niche network, OWN. While Scripps has one standout network – HGTV – and two niche networks, Food and Travel.

Figure 16. Scripps Demand Curves



Source: Citi Research

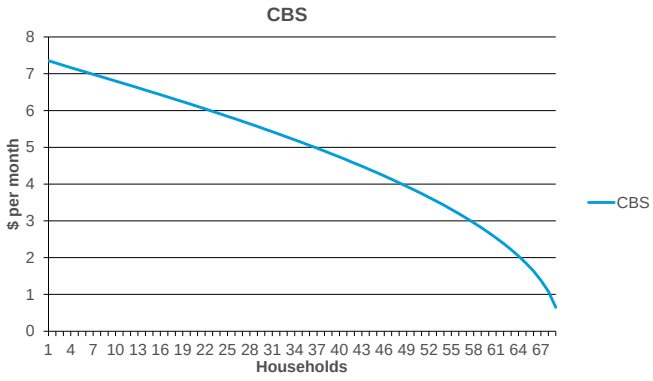
Figure 17. AMC Demand Curves



Source: Citi Research

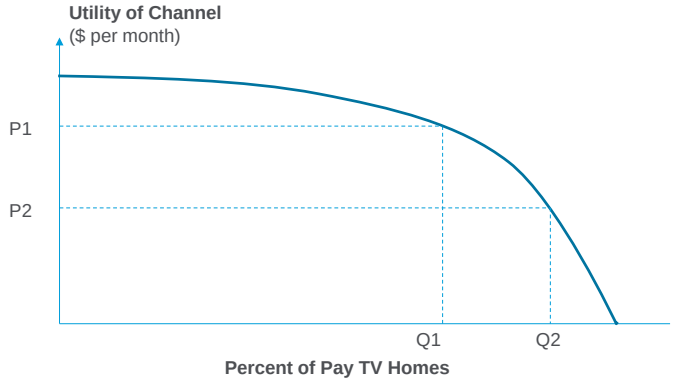
AMC has two popular networks: AMC and We. But, shows like The Walking Dead help AMC standout among this firm's cable networks. Finally, CBS' broadcast network is a remarkably popular channel.

Figure 18. CBS Demand Curve



Source: Citi Research

Figure 19. Profit Maximizing Price including Advertising

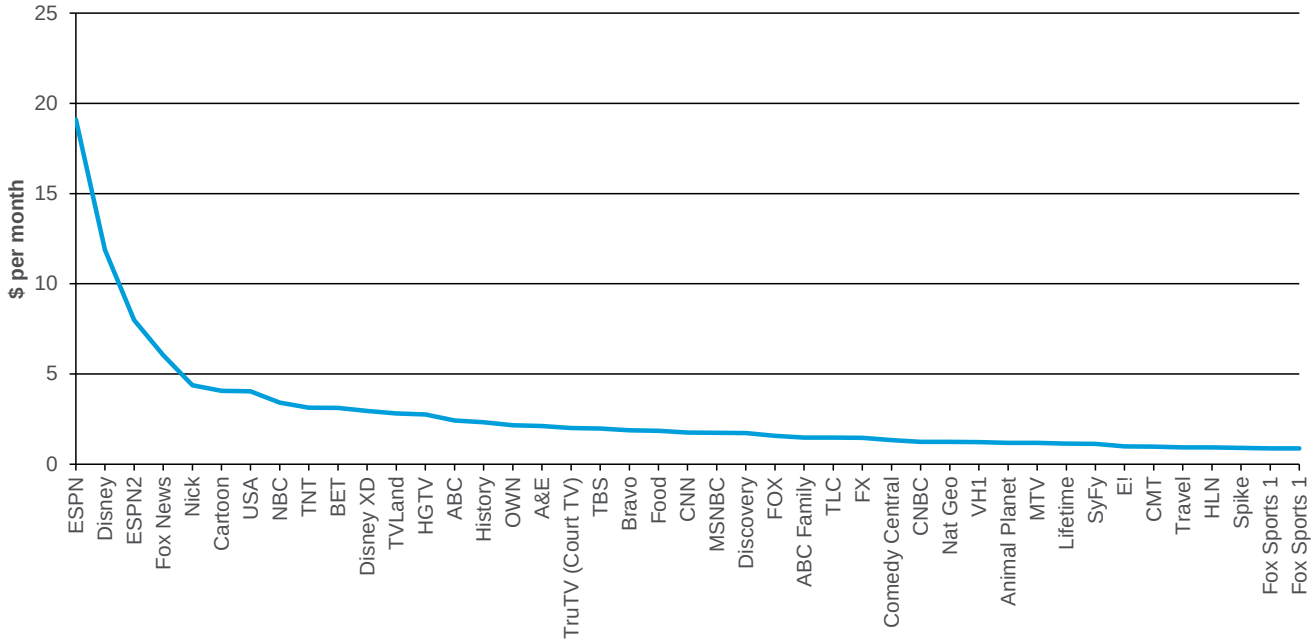


Source: Citi Research

So, with our demand curves in hand, we can now find the profit maximizing retail price (see Figure 19). That's the price that would lead to the maximum area under each channel's demand curve. (Or, P1 and Q1 in Figure 19.) However, for ad-based cable networks, the math is a touch more complex. Why? Since cable networks generate ad revenue, network owners are incented to lower the retail price a bit. This allows a cable network to get more households and generate more advertising revenue (even if subscription revenues aren't maximized). As such, the profit maximizing price is akin to P2 and Q2 in Figure 19.

When we go through profit maximizing math for each cable network, it suggests the following retail prices are profit maximizing:

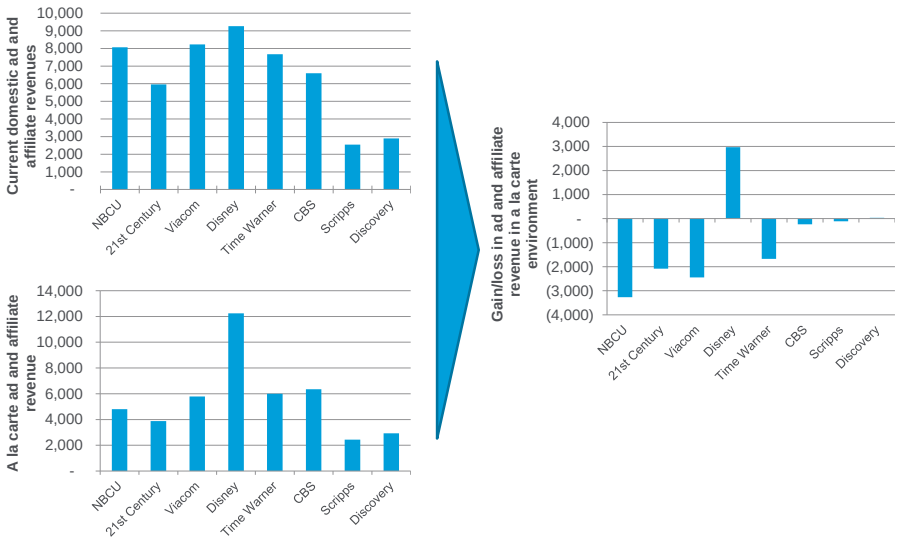
Figure 20. Profit Maximizing Price by Channel



Source: Citi Research

But, how do these a la carte revenues in the United States compare to current revenues in a world where channels are bundled? It turns out that in a pure a la carte world NBCU, 21st Century Fox, Viacom, Time Warner, CBS, Scripps, and Discovery would be worse off. Conversely, our data suggests that Disney could be better off.

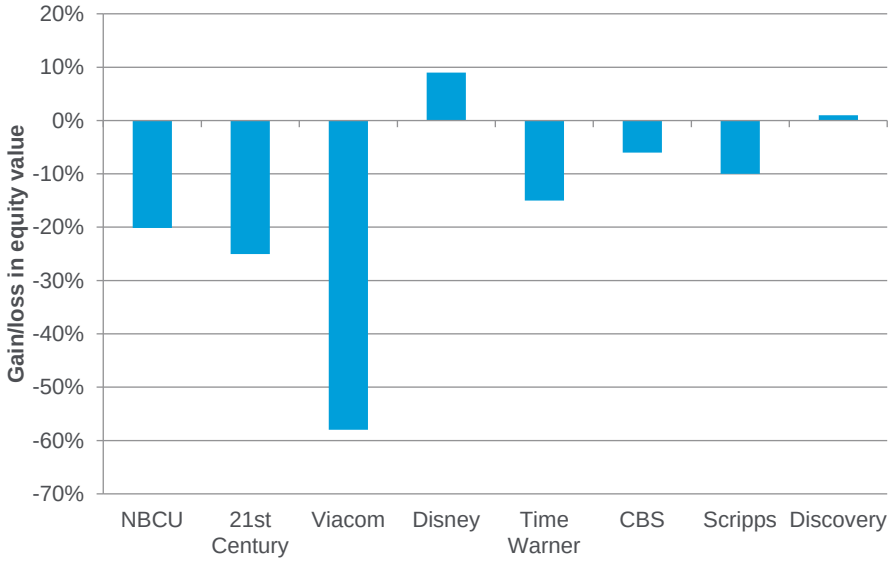
Figure 21. A La Carte Pricing vs. Bundle Pricing



Source: Citi Research

What does this mean for media company stocks? Most media firms would experience 20% to 60% declines in their equity value it we migrated from a bundled content world to an a la carte world. On the flip side, Disney could see 20% upside to their equity value. The impact to Discovery and Scripps would be less pronounced.

Figure 22. Change in Equity Value Based on A La Carte Pricing



Source: Citi Research

So, if Disney would see its equity value rise if it revamped their business to sell their channels directly to consumers (without the pay TV distributor as a middleman) why don't they do it? We think there are several reasons:

First, today all cable networks are increasing the cost of their content by 8-10% per year to the pay TV distributors. But, the pay TV distributors are only passing along 3-4% price increases to consumers. In effect, video gross profit margins for pay TV distributors are shrinking. If a media firm begins to sell directly to consumers, the rate of growth is apt to slow because the media firm will be in the retail business where prices can only rise 3-4% per year. That slower rate of top-line growth would likely lower the multiple the Street would pay for a cable network. As such, the current business model of selling bundled content through distributors is still the most beneficial construct for the media firms.

Second, selling a channel directly to a consumer would pose distribution channel conflicts. That is, how can a firm sell directly to a consumer while simultaneously relying on the pay TV firms for distribution? That's a tricky balancing act.

Third, most media companies don't have the skills and capabilities to handle direct-to-consumer functions like billing, customer service and technical support. Of course, these could be developed. But, it is a different skill set for most media firms.

Fourth, once a channel is sold a la carte, it would likely cause churn to rise. HBO, an existing a la carte channel, has monthly churn rates of 4-5%. As such, content firms probably prefer the steady, predictable revenue streams associated with the existing mode of distribution.

Implications for Pay TV Firms

Want to Buy a Movie Studio?

One of the oldest – and well worn – media clichés is this: Content is king. A number of investors often end a meeting by saying this:

"All I know is I want to own content. That's where the value is."

At some level, of course, it's the right idea. But, it's not precise enough in our view. And, there are two fundamental issues with this investment hypothesis.

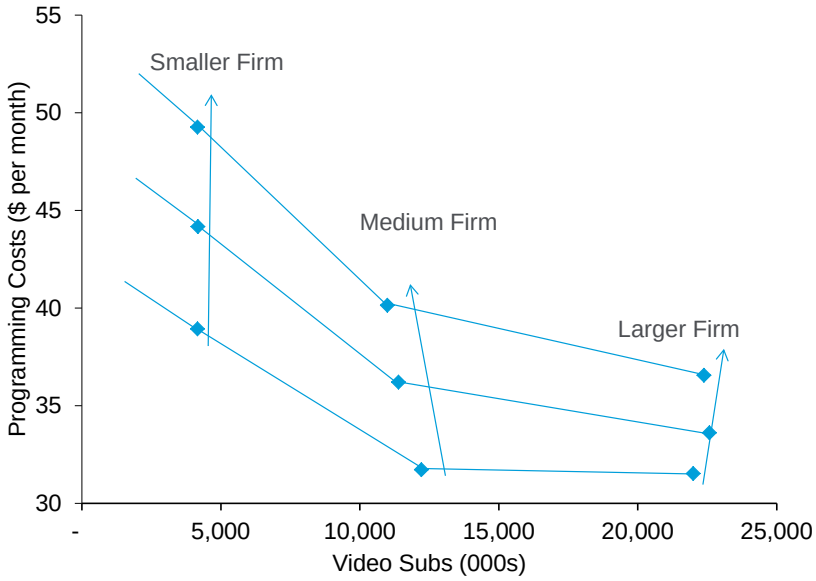
- First, all content isn't king. After all, we have never met an investor that's clamoring to own a movie studio. What makes cable network content valuable isn't the content, per se. Rather, it's what one smart client of ours calls the "monetization engine" supporting the cable network business model. That is, affiliate fees — sold in bundles — roll in even if a show isn't very good. That's hard to beat.

- Second, even if investors narrow their focus to cable network content, there is a danger. The danger is that most cable networks are over-earning. So, if you run out and buy a stock that owns cable network content hoping to benefit from the rise of Netflix and Amazon, be careful. If consumers begin to eliminate their video subscription, there is no amount of SVOD content payments that will make up for the monetary shortfall.

So, content isn't really king. The monetization engine supporting the cable network business is king. But, that monetization engine is also generating super-normal profits. So, have cable networks — cognizant of their excessive profits — been moderating the wholesale prices of their content? Hardly.

It turns out that programming costs have been rapidly increasing for small, medium and large pay TV firms. Indeed, the rate of growth has been a bit more brisk for smaller firms relative to larger firms like Comcast.

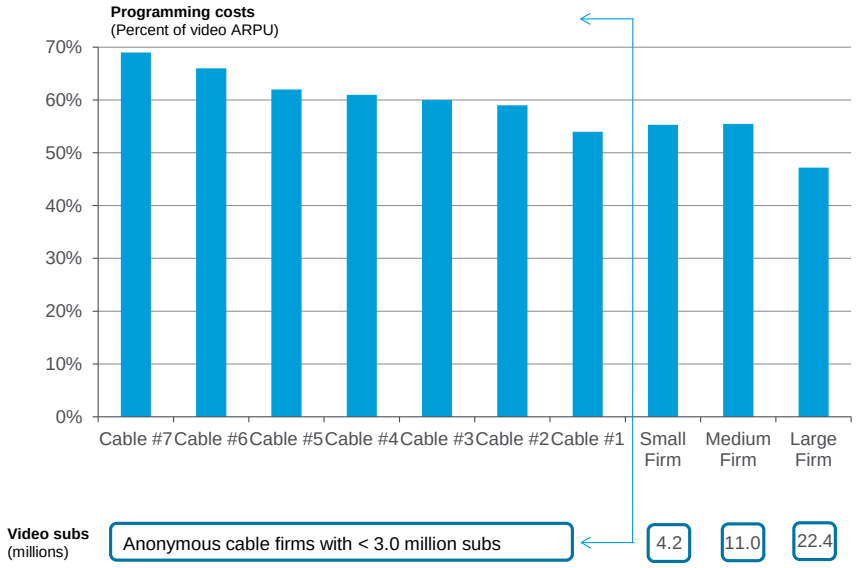
Figure 23. Growth in Programming Costs



Source: ACA, Citi Research

And, this phenomenon isn't isolated to publicly traded cable firms. Recently, the American Cable Association (ACA) — a group that represents over 800 independent US cable operators — submitted data to the FCC that showed that smaller operators — those with fewer than three million video customers — often see video cost of goods that exceed 60% of video average revenues per user (ARPUs). Those are thinner gross profit margins than larger cable firms enjoy. In effect, smaller pay TV firms are getting particularly squeezed by the pricing actions of the media firms. As such, some cable firms are now shifting their strategic focus away from video delivery and pivoting toward broadband.

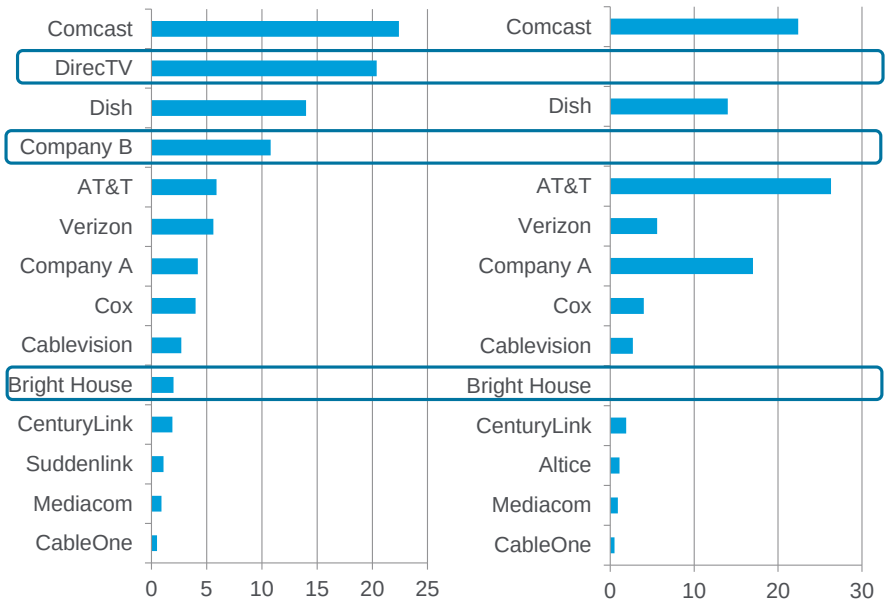
Figure 24. Programming Costs are Large Percent of ARPU for Smaller Players



Source: Citi Research

Other cable firms have responded with a flurry of consolidation. To wit: Comcast tried — and failed — to acquire Time Warner Cable. And, AT&T acquired DirecTV. Collectively, these transactions have radically altered the US pay TV landscape. Below, we show the video subs for each firm prior to – and following – these transactions.

Figure 25. Video Subscribers Before and After Recent M&A



Note: Figure assumes Charters acquires Time Warner Cable and Bright House

Source: Company reports, Citi Research

Media M&A to the Rescue

So far, we've suggested cable networks over-earn due to bundling. In tandem, cable networks keep increasing affiliate fees — about 8-10% per year — on the pay TV distributors. And that has caused the pay TV firms to entertain consolidation (like AT&T and DirecTV).

On the heels of pay TV consolidation, media consolidation is on almost everyone's lips. The motivation for the buy side's M&A narrative goes something like this:

> *"Well, we've seen a fair amount of consolidation among the pay TV firms. So, it's only natural that the content firms will respond with their own wave of consolidation. After all, the content firms need to restore the balance of power."*

Ockham's Razor

William Ockham — a medieval philosopher — suggested that when faced with several competing hypotheses, the best choice is the one that requires the fewest assumptions. In effect, simple is good. And, there's no doubt that the consensus view regarding the motivation for media consolidation is very simple.

But, simple isn't always right. So, while there is undeniable elegance to this narrative, we think media consolidation — if it does occur — is motivated by something that is both more subtle and more profound. If we're right, that subtlety will have significant implications on both the pace of M&A and the likely M&A targets. But, before we get to the punch line, let's summarize our view. It goes something like this:

"Video consumption will change radically over the next 20 years. Video will migrate from linear channels that are pushed to consumers over a closed pay TV network to a pull-based system where individual shows will be consumed via the Internet from subscription VOD services (SVOD). This will cause pay TV penetration rates to fall, cable network ads to decline and Internet penetration rates to rise. The lion's share of pay TV subscriptions in the terminal year will come from sports enthusiasts.

If you own cable networks – and simply acquire content and sell that content in a bundle to a pay TV firm - you're over-earning and are in trouble. These firms need to bulk up TV production assets and sports rights.

If you're a media firm that thrives exclusively on the pay TV ecosystem, you need to complement your assets with free-to-air (FTA) assets. As pay TV penetration drops, more households will rely on the Internet and FTA for content. As such, the FTA assets may increase in value.

If you distribute content — like cable firms — you need to invest in Internet access and ensure you have a means of getting paid more as Internet protocol (IP) video consumption rises. Don't fight the IP wave. Embrace it. This may prompt some pay TV firms to gradually exit the pay TV market to focus exclusively on Internet access.

Finally, investors need to think far more carefully about how a media firm actually creates value. If the value comes from packaging non-sports content that isn't owned, that value is at risk. It is vastly preferable if a media firm creates value from producing shows and is agnostic regarding the mode of consumption."

In effect, any media consolidation wave will probably not be driven by pay TV consolidation. Rather, it's driven by the profound changes stemming from the rise in IP video with Netflix and Amazon leading the charge. This view was informed, in large part, by trends we're seeing in the US video market. And, in recent months, our thesis largely comports to Dr. Malone's recent M&A decisions. Let's see how.

Dr. Malone's New Paradigm

A few decades ago, we suspect Dr. Malone[4] had a very simple idea: capitalize on insights about the US pay TV market by expanding globally.

In the US, about 80% of homes subscribe to pay TV. And, those consumers pay $75 a month for video. But, in the rest of the world, pay TV penetration — and pay TV ARPUs — are far lower. We suspect Dr. Malone thought most of the developed world would eventually comport to the US paradigm: high pay TV penetration rates, high ARPUs.

So, the mandate was simple: consolidate the international cable market — via Liberty Global — and plant the Discovery flag in Europe, Asia and Latin America. Then, just wait for the international markets to mirror the US. But, along that way, the world changed along two critical dimensions.

- First, in the US, Netflix began selling subscription video on demand (SVOD) services. Consumers liked it. And, US TV ratings began to get squishy. In tandem, US pay TV unit growth began to slow (or, in some periods, actually contract). And in Europe, pay TV penetration rates simply aren't growing, even before Netflix enters the market. In effect, it is becoming far less clear if the rest of the world will follow the US path.

- Second, among the US pay TV households, more of the profits are accruing to the owners of sports rights (and, by extension, the cable channels that acquired and resell those rights, like ESPN).

With Dr. Malone's global paradigm in flux, the implication for Discovery was clear. It had the wrong set of assets in our view for two reasons.

- First, for the portion of the market that would ultimately subscribe to pay TV, the lion's share of the profits would not flow to Discovery. That's because Discovery didn't own sports rights.

- Second, Discovery's assets were only relevant for the portion of the market that did subscribe to pay TV. The rest of the market – say 60% of international homes – never touched (and will never touch) Discovery's income statement.

As such, Discovery needed to make some fairly abrupt strategic changes. First, it had to acquire sports rights (like Eurosport and the Olympics). Second, it had to acquire free-to-air channels (like SBS Nordic).

For Liberty Global, the strategic pivot was more subtle. In a world dominated by Netflix, you still need Internet access. But Liberty Global owned Chello Media – it's collection of international channels. In the new world, Chello was the wrong type of asset. After all, Chello didn't own many production assets. In large part, it just packaged content that was produced by third parties. As such, Liberty pursued a

[4] Dr. Malone refers to Dr. John C. Malone, Chairman of the Board of Liberty Media Corporation, Liberty Interactive Corporation, Liberty TripAdvisor Holdings, Inc. and Liberty Global plc.

sale of Chello (to AMC Networks) and invested in ITV (an owner of FTA and production assets).

The bottom line is this: Discovery and Liberty Global are probably on the right track. But, they have only begun to adjust their portfolio. There is still a long way to go.

So, we've tried to show that investors may be misdiagnosing the root cause of media consolidation. It's unlikely to be driven by pay TV consolidation. Rather, it will be driven by Netflix. And, Dr. Malone may be giving hints about the future. But, first, there is one more investor misconception we need to address.

Silicon Valley Meets Traditional Media

In 2013, Ted Sarandos – Chief Content Officer at Netflix - famously quipped:

> *"The goal [for Netflix] is to become HBO faster than HBO can become us".*

What Sarandos likely meant was that Netflix needed to move into original content before HBO untethered its service from the cable network ecosystem. It's a good quote because it neatly encapsulates the twin debates about Netflix. Namely, "Can Netflix create compelling original content?" and "Will HBO successfully untether?"

For its part, Netflix has created compelling content: "House of Cards" or "Orange is the New Black" immediately come to mind. But the success of Netflix isn't about the stories per se. It's about giving Hollywood more flexibility unfettered by the rigid economics of Hollywood. And that flexibility empowers writers, directors and actors.

In 2013, Kevin Spacey — of House of Cards fame — gave a keynote speech at the Guardian Edinburgh International Television Festival. In that speech, Mr. Spacey made some interesting comparisons between the Netflix model and the traditional processes of content creation (via pilots) and content distribution (via windowing):

> *"We were creating a sophisticated multi-layer story with complex characters who would reveal themselves over time, and relationships that would need space to play out. And the obligations, of course, of doing a pilot from the writing perspective is that you need to spend about 45 minutes establishing all the characters and creating arbitrary cliffhangers [to] prove that what you're going to do is going to work."*
>
> *"Clearly the success of the Netflix model, releasing the entire season of House of Cards at once, proved one thing: The audience wants control. They want freedom. And, through this new form of distribution, we have demonstrated that we have learned the lesson the music industry didn't learn: Give people what they want, when they want it, in the form that they want it in, at a reasonable price, and they'll more likely pay for it rather than steal it."*
>
> *"So, I predict in the next decade or two, any differentiation between these platforms will fall away. Is 13 hours watched as one cinematic whole really different from a film? Do we define film as something being two hours or less? Surely, it goes deeper than that. The device and the length are irrelevant; the labels are useless, except perhaps to the agents and managers and lawyers, who use these labels to conduct business deals. But for kids growing up now, there's no difference between watching Avatar on an iPad or watching YouTube on TV or watching Game of Thrones on their computer. It's all content. It's just story."*

Well said. But, why don't the traditional companies respond? The answer brings us back to Janet Yellen. The traditional media companies are over-earning. As such, they can't compete with Netflix's new model without destroying the existing model and its attendant pools of profit. Does anyone remember Clayton Christensen's *The Innovators Dilemma?* It might be worth dusting it off.

So, if the change is real, we need to know if it will be gradual — as investor's hope — or abrupt (as few investors fear)? Let's see.

Media's 'Jenga Moment'

In the 1970s, Leslie Scott created a simple game using children's blocks. He called the game 'Jenga' derived from a Swahili word meaning "to build". In many respects, the pay TV ecosystem can be thought of as a tower of blocks, carefully designed by the content owners to maximize their profits. But, what do we mean by "carefully designed"?

In the pay TV world, it means you needed to hire a few smart economists — like Yellen and Bakos — to explain the economic benefits of windowing (to capture all the area under the demand curve) and the power of bundling (to reduce consumer surplus by reducing heterogeneity).

But, what happens if a large, well-capitalized, company from Silicon Valley acquired a traditional media company? Well, we suspect it would be the 'Jenga Moment' for the media sector. Over time, the traditional ecosystem would collapse.

Why do we say this? We would imagine that this Silicon Valley firm would aggressively move to put more content on the web. This, in turn, would cause more consumers to cut the video cord. And, this would put both affiliate fees and ad revenues under pressure. The non-acquired media companies would find it difficult to adjust to the new model because the legacy ecosystem would still be far more lucrative.

Of course, our scenario isn't realistic because the content rights that are held by media companies are almost always spoken for via long-term contracts. But, if this happened, we suspect the Street would have two immediate reactions:

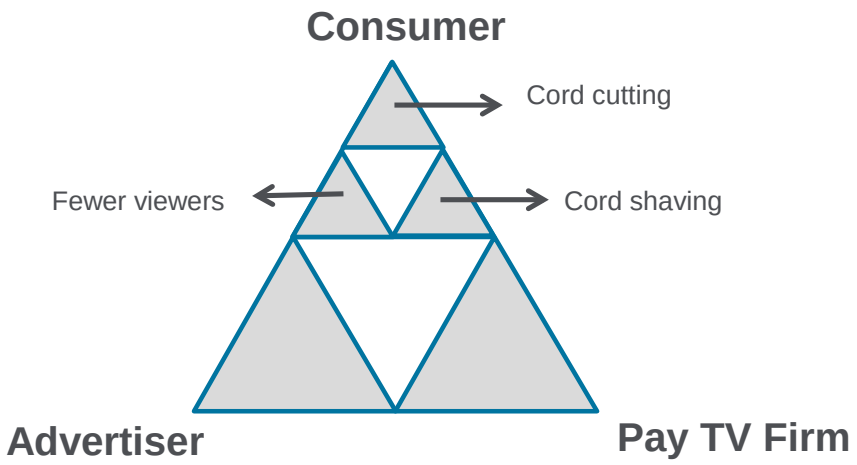
- First, investors would quickly buy other media stocks figuring if one media firm is acquired by Silicon Valley, then other Internet firms would need to follow suit.
- But second, we suspect the Street would soon realize that the implication of such a scenario isn't bullish for media, it's actually quite bearish. The 'Jenga Moment' would be just around the corner. (This is why we wince when an investor says "Content is King." Remember, it's the monetization engine that's king. And, that monetization engine is vulnerable to disrupting firms like those in the Valley.)

The Big Three Threats

So far, we've shown that most of the growth within the US media sector is driven by the cable network business. In part, that's because the cable network business is over-earning via bundling. And, we suggested cable networks are simultaneously squeezing distributor's video gross profit margins. This, in turn, has prompted pay TV consolidation. But, this is unlikely to result in cable network consolidation. Moreover, traditional cable networks are now competing with new web-based entrants. This suggests cable networks face three distinct threats:

- First, at the **consumer** level, households can take advantage of web-based subscription VOD (SVOD) services — like Netflix or Amazon — to reduce consumption of live TV (linear video). Consumers might also trim the size of their traditional video package (cord shaving). Or, they might eliminate their pay TV subscription outright (cord cutting).
- Second, at the **advertiser** level, marketers may shift ad budgets away from TV and spend more on web ads using firms like Facebook.
- Third, at the **pay TV firm** level, there are emerging signs that some pay TV distributors — like Cable One and Suddenlink — are willing to terminate their distribution agreement with some (perhaps less valuable) content providers.

Figure 26. The Big Three Threats



Source: Citi Research

Of course, these three risks — from the consumer, from the advertiser and from the pay TV firms — are related. More SVOD use means lower linear TV consumption. Lower consumption of linear TV means lower TV advertising. And, lower ad revenue means cable networks must rely on affiliate fees for growth. Hefty hikes in affiliate fees mean pay TV firms will have a greater incentive to eliminate content from the bundle.

So, let's take look at each risk. First we'll look at the US. Then, we'll look at Europe.

Three Threats to the US Market

Item #1: The Consumer Threat

The first threat — the Consumer Threat — starts in your living room. Our question is simple: *"How will consumer's viewing habits change with the advent of SVOD platforms like Netflix?*" We can think of three sub-questions related to this threat:

- First, will viewing behavior change?
- Second, will consumers reduce the size of their pay TV bundle (cord shaving)?
- Third, will consumers terminate their pay TV subscription (cord cutting)?

Let's take these in turn.

Consumer Viewing Behavior

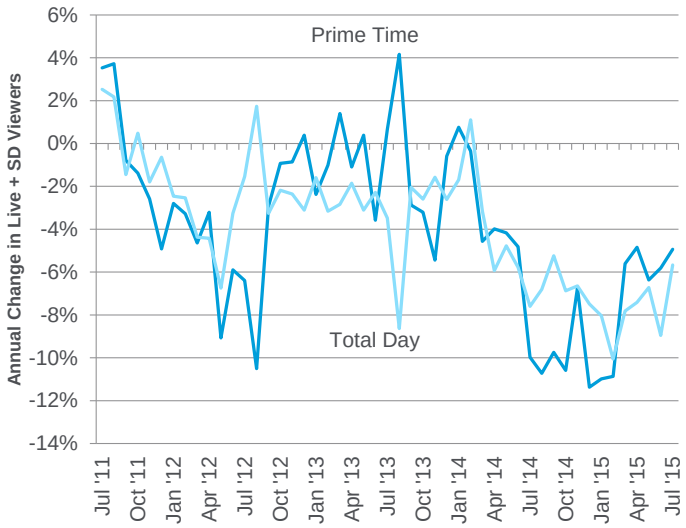
Nielsen is one of the main providers of viewership data for the ad market. However, a growing number of media firms suggest Nielsen's measurement data is error prone. Why?

Nielsen measures three things well: 1) live TV content, VOD and DVR use; 2) TV content on tablets and smartphones if it's consumed within seven days of the original air date; and 3) TV content on PCs. But, until recently there were three areas where Nielsen didn't measure consumption: 1) viewing outside the home including bars, restaurants, gyms and airports; 2) content that's viewed on a connected TV via devices like Roku or AppleTV; and 3) TV content on tablets and smartphones if the content is viewed more than seven days after the original air date. (In May 2015, Nielsen inked a relationship with Roku.)

This suggests Nielsen's historical data isn't perfect. So, we'll review three sets of data. First, we'll present traditional ratings data from Nielsen. Second, we'll delve into Nielsen's Total Audience Report. Third, we'll show data from firms like Netflix and Sandvine. We'll be looking for signs of agreement — or divergence — among these data sets.

But, let's start with Nielsen's ratings data. The Nielsen data suggest US viewers are watching less live TV (including same day DVR playback). The rate of decline is now at a high-single to low-double digit pace. The decline began in 2011, stabilized in 2012 and 2013, and began to fall again in 2014 and 2015.

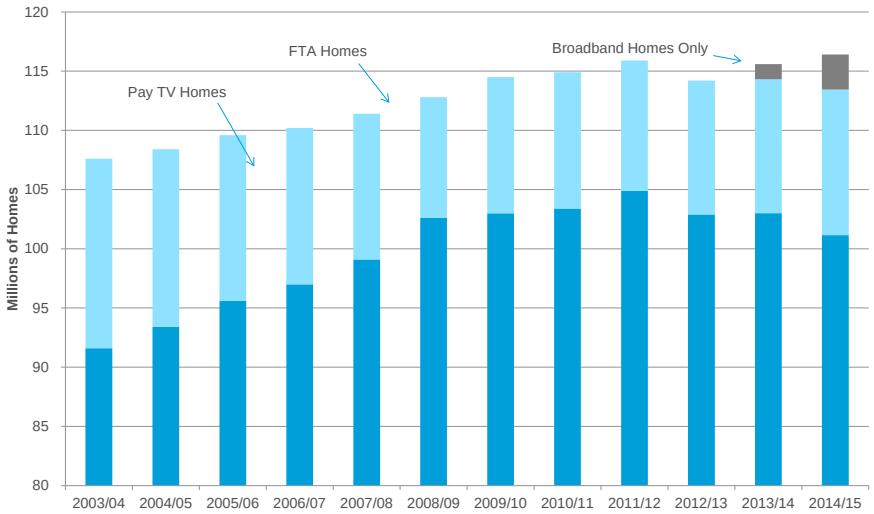
Figure 27. Year-Over-Year Change in Live + Same Day DVR Playback Ratings



Source: Nielsen, Company reports, Citi Research

What's prompting the decline? Part of the answer lies in Nielsen's assumed universe of homes. Until the 2011/2012 TV year, Nielsen had a long history of assuming that TV households were rising. But then, Nielsen reduced the size of traditional TV homes. Nielsen created a new category of "Broadband Only" homes. This figure has risen in two consecutive years. In tandem, Nielsen's assumed universe of pay TV homes fell. So, when Nielsen gathers the data from its sample, it multiplies the sample by a smaller universe of pay TV homes. That puts pressure on ratings trends.

Figure 28. Universe of Media Homes in the US

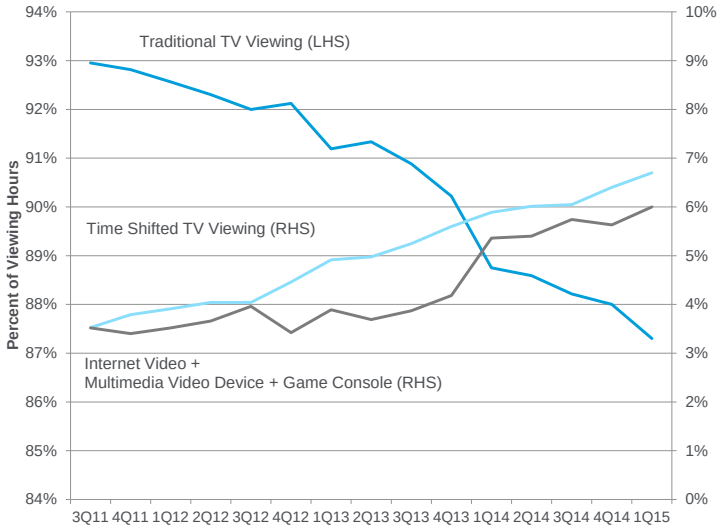


Source: Nielsen, Citi Research

But, other changes lurk beneath the surface. Nielsen's Total Audience Report (TAR) suggests traditional TV viewing made up 93% of video consumption in the third quarter of 2011. By the first quarter of 2015 traditional liner TV viewing fell to 87% of the total. The decline in traditional viewing is due primarily to a rise in DVR use. DVR use increased from 3% of video consumption in 3Q11 to 7% by 1Q15. And, an

increase in Internet viewing (like YouTube), use of Multimedia devices (like Apple TV and Chromecast) and use of Game Consoles for video (Xbox, PS2) increased from 3% of viewing in 3Q11 to 6% of viewing by 1Q15.

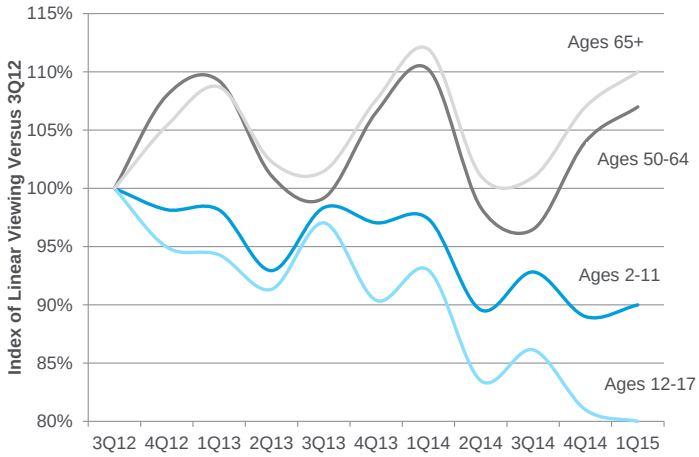
Figure 29. Nielsen Mix of In-Home Video Consumption



Note: Traditional TV = Linear channel, Time Shifted TV = DVR, Internet + Multimedia video = XBox, PS2, Roku, Apple TV
Source: Nielsen

And, the Nielsen TAR data suggests younger viewers are shifting their viewing habits more rapidly than older viewers (particularly viewers between two and 17 years of age). That's an ominous sign. As the population ages, if may portend a structural shift in the way video will be consumed.

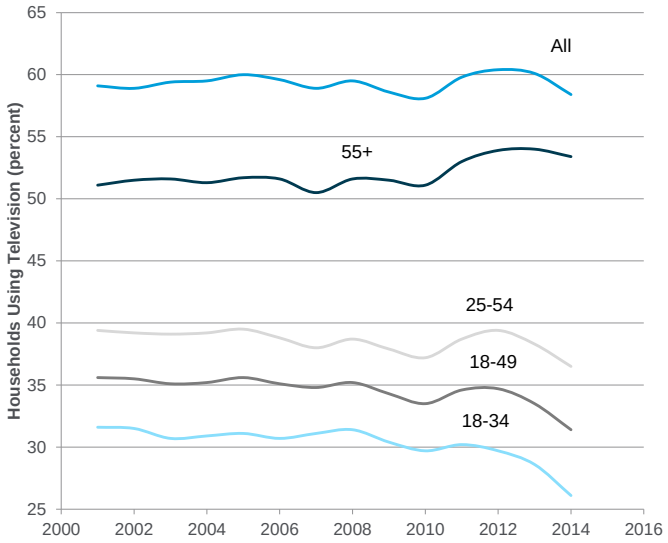
Figure 30. Index of Live TV Viewing to 3Q12 by Age



Source: Nielsen

Or, if we look at the share of households using television — called the HUT — it shows a recent decline among viewers between 18 and 49 years of age. The HUT index has improved, however, for viewers over 55 years of age. Older viewers, it seems, like the DVR. But younger viewers have shifted to the web.

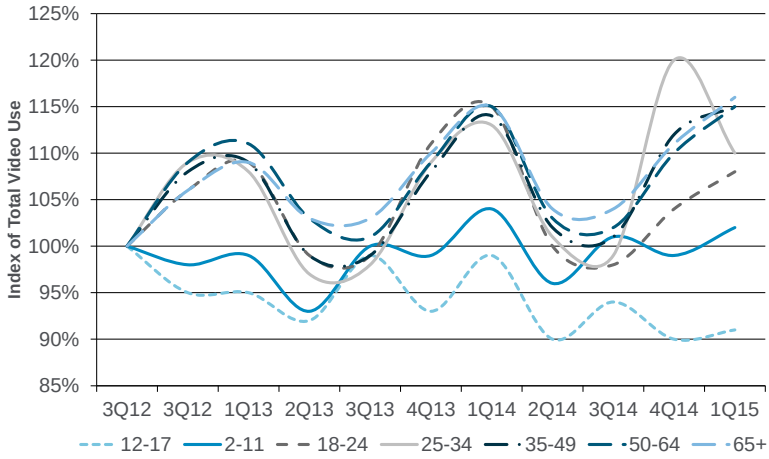
Figure 31. Households Using Television by Age



Source: Nielsen

Some investors suggest, however, that overall consumption of video — including traditional TV and Internet video — is rising. In aggregate, this is true. But, if we index total video consumption to the third quarter of 2012, some age groups are actually watching less video. That's particularly true for those ages 12 to 17. Older cohorts are using these new platforms to increase their overall video consumption.

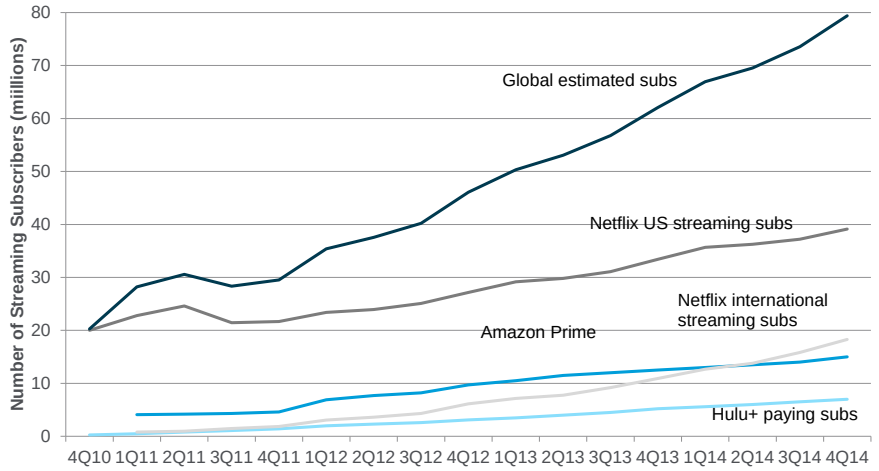
Figure 32. Index of Total Video Consumption by Age



Source: Nielsen

So, that's Nielsen's view. Let's shift to other data sources: Sandvine, Netflix and Hulu. Globally, paying SVOD customers have grown from around 20 million at the end of 2010 to over 80 million in mid-2015. And the bulk of these subscriptions are within the US. And, both within the US — and outside it — Netflix is leading the charge.

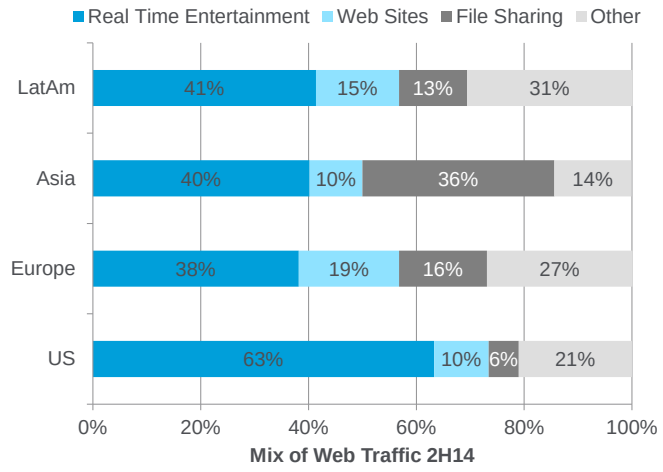
Figure 33. SVOD Subscriptions



Source: Nielsen, Company reports, Citi estimates

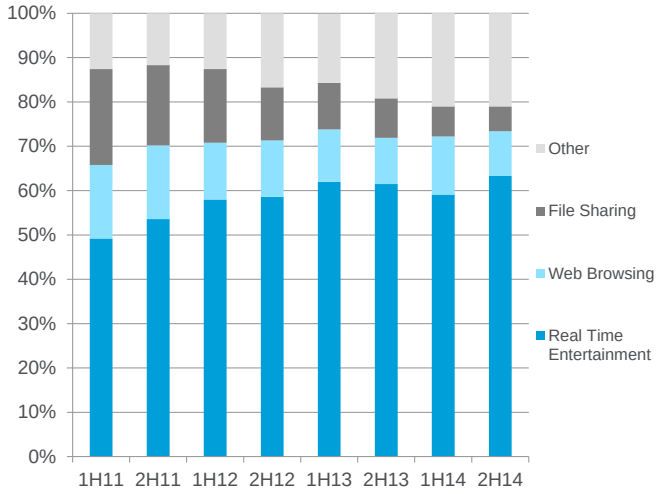
But, are SVOD subscribers actually using these services? To find out, we've used data from Sandvine (a firm that tracks the magnitude and type of bits that traverse the Internet). And, the data show that Real Time Entertainment (RTE) is the largest source of web traffic in every region of the world. RTE comprises 38% of web traffic in Europe and 63% in the US. The only type of traffic that comprises a similarly large portion of traffic is file sharing services in Asia. File sharing sites are proxies for RTE traffic and typically come from sites like Bit Torrent.

Figure 34. Mix of Web Traffic 2H15



Source: Sandvine

Figure 35. Trends in US Web Traffic

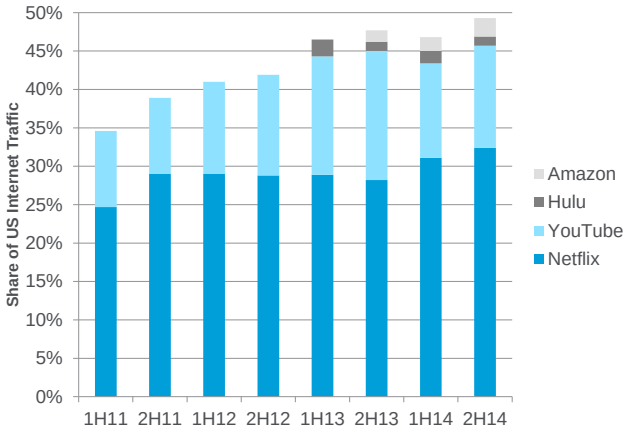


Source: Sandvine

But, not only is RTE traffic the largest contributor of bits on the Internet, we've seen a marked increase in RTE's share of traffic in all regions of the world. In the first half of 2011, less than 50% of all US Internet traffic was RTE. By the second half of 2014, RTE had risen to over 60% of all US Internet traffic.

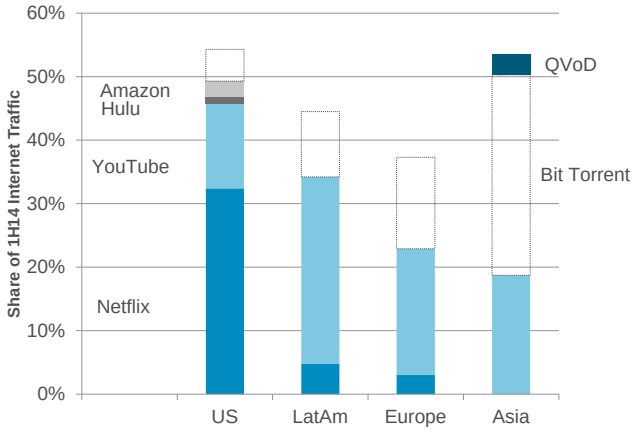
Within the US, the most popular RTE sites include Netflix, YouTube, Hulu and Amazon. While Netflix leads the pack, collectively, just four sites make up nearly 50% of all US Internet traffic. That's up from around 35% four years ago.

Figure 36. Share of US Internet Traffic



Source: Sandvine

Figure 37. Share of Global Internet Traffic, 1H14

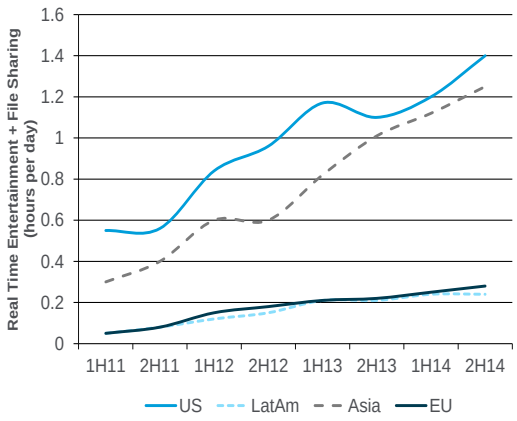


Source: Sandvine, Citi Research

While nearly 50% of US Internet traffic is comprised of these four sites, outside the US, Netflix barely registers (and Amazon and Hulu don't register at all). In the rest of the world, consumers are opting to use YouTube and file sharing sites like Bit Torrent and QVoD (perhaps in lieu of SVOD services like Netflix).

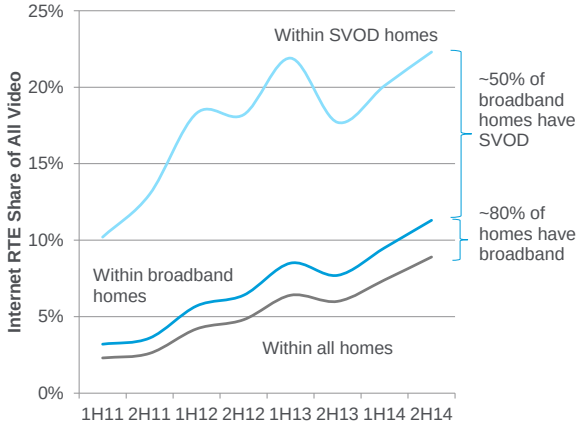
If we widen the aperture to include all RTE and file sharing sites — not just the most popular sites — and assume 0.8 GB per hour of usage, it suggests that US and Asian consumers are spending well over an hour a day on these sites. Europe and Latin America lag behind the US and Asia. We suspect the reason is that Netflix hasn't yet reached critical mass in these regions of the world.

Figure 38. Global Real Time Entertainment + File Sharing



Source: Sandvine, Citi Research

Figure 39. US Internet RTE Share By Household



Source: Sandvine, Citi Research

So, let's take a closer look at the US (where the SVOD market is most developed). Using 0.8 GB per hour of streaming and file sharing, it suggests about 9% of all US video viewing (including DVR use) occurs on the Internet. If we peer inside homes that have a broadband connection, the figure rises to about 11%. And, among homes that have an SVOD and a broadband subscription, about 22% of their video viewing occurs on the Internet. The lowest figure — of about 9% — is about 1.5x to 2x the level Nielsen suggests. We suspect the difference stems from the simple fact that Nielsen's data excludes video consumption on connected devices like Roku and Apple TV.

Consumer Cord Cutting

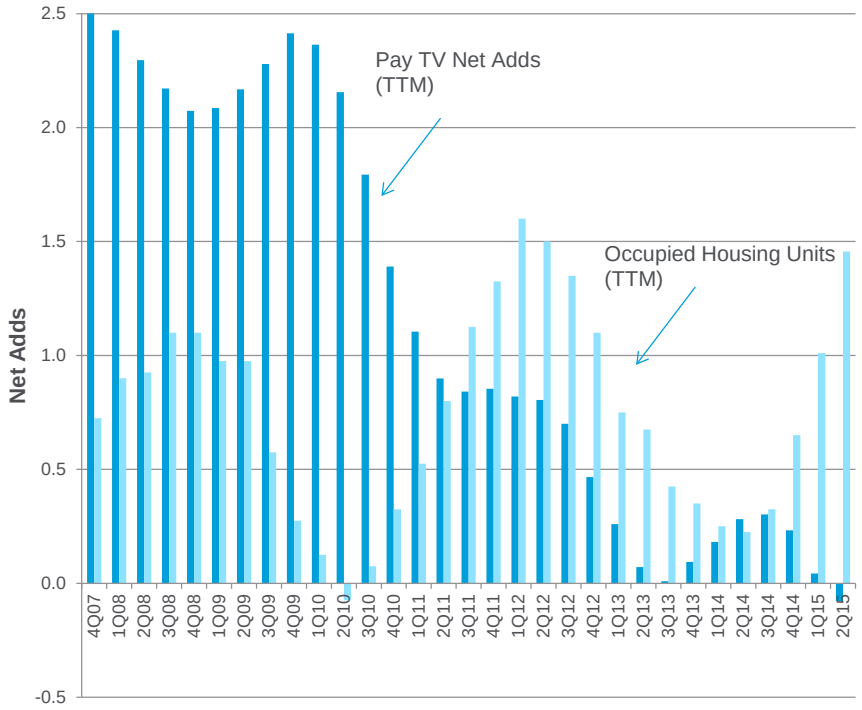
So, the Nielsen data show that live linear viewing is falling because of high DVR usage and the rise of Internet video. And, the Nielsen and Sandvine data both suggest Internet video is rapidly growing.

So, how do consumers feel about paying for linear content when consumption is migrating to the SVOD services? To find out, we looked at sequential changes in occupied housing units and pay TV subscribers in the US. The data show that in 2007 through 2010, pay TV net adds were running about 2.0 to 2.5 million per year. Occupied housing units, however, were only growing about 1.0 million per year. In effect, in the latter part of the last decade, pay TV penetration was rising.

Then, the recession hit. Occupied housing units fell, rebounded, and then slowed again. During the cyclical undulations in the housing market, pay TV net adds began to decelerate. As such, the US is no longer adding many pay TV units even though occupied housing are still growing.

The upshot is some households are terminating their pay TV service (or younger households aren't signing up for pay TV when they move out of their parent's house). But, the magnitude isn't yet sufficient to show an absolute decline in pay TV units. Rather, we're witnessing flattish units that are lagging the growth in occupied housing units.

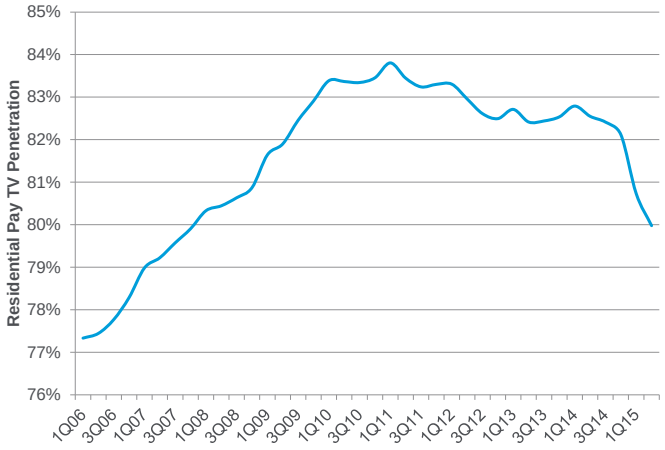
Figure 40. Pay TV Net Adds Versus Occupied Housing Units



Source: Company reports, Citi Research

If we take the same data and express it differently, it shows that US pay TV penetration peaked in the first quarter of 2011, just below 84%. Since then, pay TV penetration has fallen to 80%.

Figure 41. US Pay TV Penetration Rates



Source: US Census, Company reports, Citi Research

Going forward, we expect pay TV penetration rates to continue to fall. Indeed, we expect more consumers to cut the cord entirely. Over the long-run, we expect the pay TV penetration in the US to mirror Europe: only sports enthusiasts will subscribe to pay TV. That's because sports isn't available on SVOD platforms.

Figure 42. Pay TV Penetration Rates in the US

	2014	2015E	2016E	2017E	2018E	2019E	2020E	2021E	2022E	2023E	2024E	2025E	2026E	2027E	2028E	2029E	2030E
US households	116.6	117.8	118.9	119.5	120.1	121.3	122.6	123.8	125.0	126.3	127.5	128.8	130.1	131.4	132.7	134.0	135.4
x Percent with TV	100%	99.5%	99.5%	99.5%	99.5%	99.5%	99.5%	99.5%	99.5%	99.5%	99.5%	99.5%	99.5%	99.5%	99.5%	99.5%	99.5%
= TV households	116.1	117.2	118.3	118.9	119.5	120.7	121.9	123.2	124.4	125.6	126.9	128.2	129.4	130.7	132.0	133.4	134.7
x Pay TV	80.4%	79.0%	77.4%	76.2%	74.5%	72.8%	71.0%	69.5%	68.0%	66.0%	64.0%	62.0%	60.0%	58.0%	56.0%	54.0%	52.0%
= Pay TV households Public	93.3	92.6	91.6	90.6	89.1	87.8	86.6	85.6	84.6	82.9	81.2	79.5	77.7	75.8	73.9	72.0	70.0
memo: US household growth	1.4%	1.0%	1.0%	0.5%	0.5%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%
memo: Pay TV household growth	0.0%	-0.8%	-1.0%	-1.1%	-1.7%	-1.4%	-1.4%	-1.1%	-1.2%	-2.0%	-2.1%	-2.2%	-2.3%	-2.4%	-2.5%	-2.6%	-2.7%

Source: Citi Research

Consumer Cord Shaving

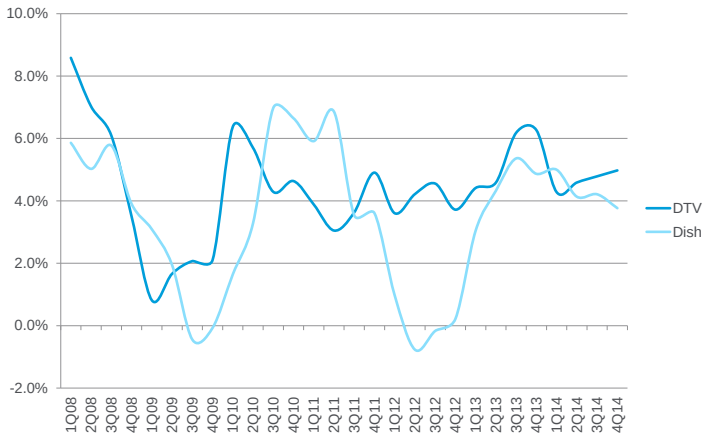
So, we've reviewed the linear viewership data: it's down. And, we've reviewed the pay TV penetration rates: they're falling. The last consumer threat is cord shaving. The idea is simple: with more SVOD services available, will consumers elect to spin-down to a less expensive video package?

In the US, the list of SVOD services seems to grow each week: Netflix, Hulu and Amazon have been in the market a while. But recently, CBS launched CBS All Access and Showtime Anytime. Time Warner launched HBO Now. Viacom announced Noggin. Dish launched a web-based service with thinner packages called Sling TV. Each of these offers would seem to heighten the risk of cord shaving.

But, assessing the cord shaving risk is difficult. Cable and telco firms bundle video, data and voice services into packages. And, while these companies disclose a video ARPU figure, it's of little use. The bundling discounts can be applied to any service — video, data or voice — at the discretion of the cable firm. As such, for firms that bundle, it's hard to prove if cord shaving is happening.

So, we've turned to the disclosures from two US direct broadcast satellite (DBS) firms because they only sell video. And, the data doesn't show much (if any) cord shaving. While it's true that both firms moderated price increases in 2009 and Dish elected to not raise prices again in 2012, we don't see any systemic downward pressure on video ARPUs. As such, we don't think there's ample evidence to suggest cord shaving is significant phenomenon (yet).

Figure 43. Annual Price Change for Satellite Video Services (Percent)



Source: Company reports, Citi Research

But, make no mistake. As HBO Now, Showtime Anytime, CBS All Access, Sling TV, Apple and Noggin take share, it is reasonable to assume that some of these subscribers will come from the existing pay TV universe. And, that will mean cord shaving is well underway even if the DBS firms report steady ARPU gains.

With the first US threat — the Consumer Threat — behind us, let's shift to the second item: The Advertiser Threat.

Item #2: The Advertiser Threat

Back in 1874, John Wanamaker opened the first department store in Philadelphia. Wanamaker was the first retailer to place a half-page ad in a newspaper. The costs troubled him. Somewhat famously, he quipped: *"Half the money I spend on advertising is wasted; the trouble is I don't know which half."*

What Wanamaker hit upon was a deep structural flaw with traditional ads: there isn't a feedback loop. All that changed with the Internet. For the first time, marketers could tailor their ads to reach specific groups and measure the ads' effectiveness.

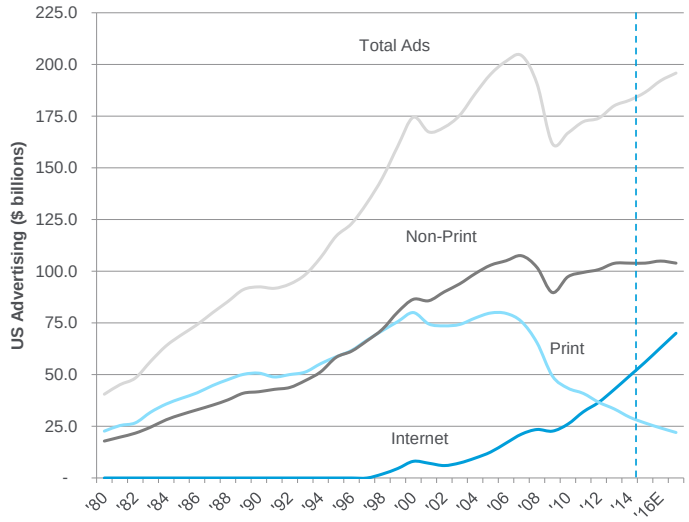
Internet Steals from Print

But, it took 125 years to find a solution to Wanamaker's conundrum. And, it is perhaps fitting — or ironic — that the Internet's first victim was print advertising. Indeed, virtually all of the growth in Internet ad spending has come at the expense of print.

US print ads — including directories, newspapers and magazines 3 peaked at ~$75 billion in 1999. Then, the print category spent about 10 years with relatively muted growth. Then, beginning in 2009, print advertising began to contract. And, it's unlikely to ever grow again.

If you look at the non-print, non-Internet ad categories — encompassing broadcast TV, cable TV, radio, outdoor, and direct mail — an eerily similar pattern may be unfolding. The level of non-print, non-Internet ad spending has been flattish for about 10 years at the $100 billion level. Could this stability foreshadow a future era of steep declines similar to print?

Figure 44. Total US Advertising Spend by Medium



Source: Magna, Citi Research

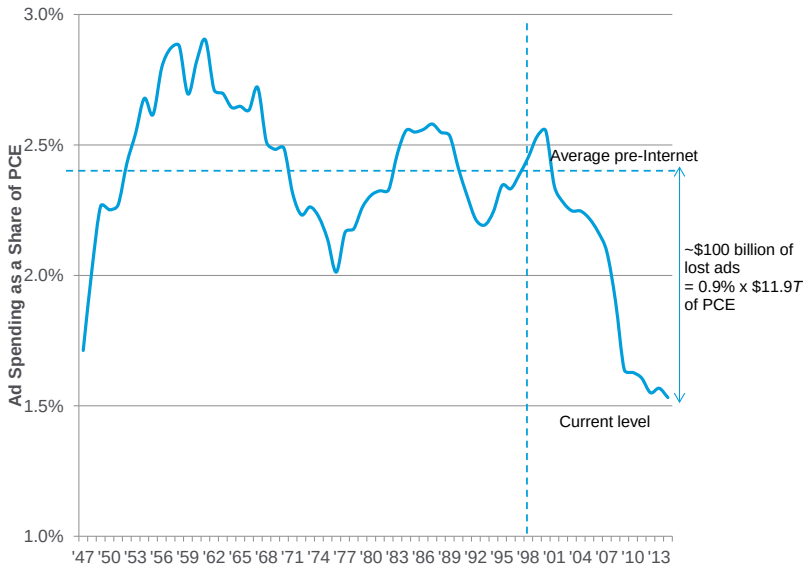
Internet Pressures Overall Ad Outlays

We think the answer is 'yes'. But, why?

First, the Internet is a more affordable way to advertise. We say this because in the US between 1947 and 1998, ad outlays across all mediums averaged 2.4% of Personal Consumption Expenditures (PCE). But, since the inception of Internet ads, total ad outlays have represented a smaller portion of PCE. Indeed, by 2014, overall ad outlays represented just 1.5% of PCE.

Said another way, something — most likely the Internet — has eliminated ~$100 billion of advertising over the last 15 years (or 0.9% x $11.9 trillion of PCE). That is, if the Internet was never invented, it's quite possible that 2014 advertising outlays would be $285 billion (~ 2.4%. of PCE) rather than $183 billion (~ 1.5%. of PCE).

Figure 45. Total Advertising Spend as Percent of Personal Consumption Expenditures



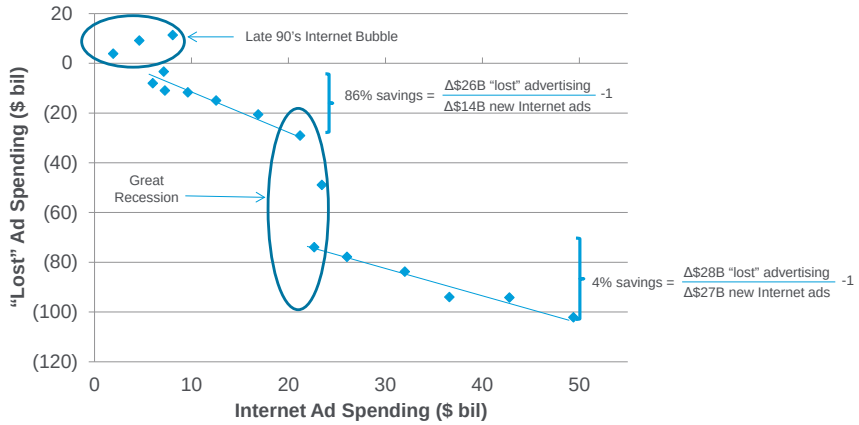
Source: Magna, US Department of Commerce, Citi Research

To get a more granular sense of how the Internet is affecting ad spending, we plotted annual changes in Internet ad spending on the x-axis against the implied annual reduction in total ad spending (based on PCE) on the y-axis. There are four distinct periods in the US:

- From 1998 to 2000, the Internet was additive to overall ad spending. That's when the first wave of dotcoms were spending venture capital (VC) money to build brands. (Remember the Pets.com Super Bowl ad in 2000?)
- From 2001 to 2007, the Internet was growing briskly and advertising's share of PCE began to fall. During this era, every $1 of incremental Internet ad spending reduced the size of total ads by almost $2, a savings of 86%.
- From 2008 to 2009, the Great Recession hit. Internet ad spending didn't change much, but overall ad spending shrank by about $50 billion. That is, when it was time to cut ad budgets, marketers left Internet ad spending unscathed.
- From 2010 to 2014, Internet ad growth resumed. And, advertising's share of PCE began to fall again. During this era, every $1 of incremental Internet ad spending reduced the size of total ads by about $1, a savings of 4%.

In 2014, the Internet is still wringing out material inefficiencies across the ad ecosystem. And, that doesn't bode well for traditional media.

Figure 46. "Lost" Ad Spending Due to Advent of Digital Advertising

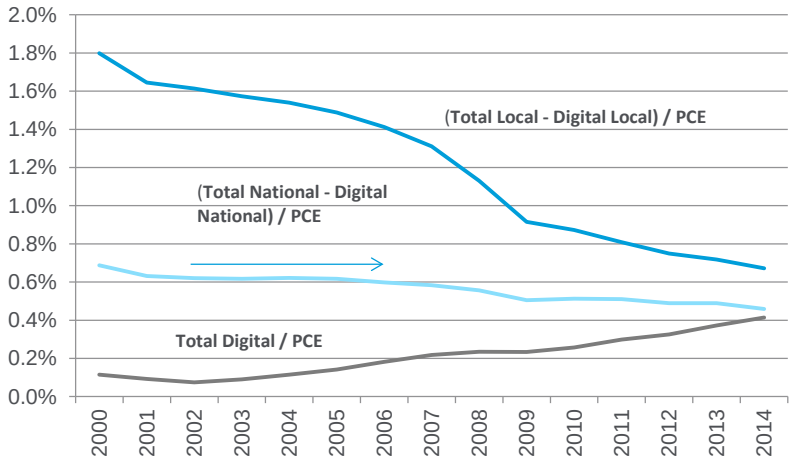


Source: Magna, Citi Research

Local Ads Feel Most of the Internet Pain

But, what forms of traditional media advertising have felt the most pain? The first wave of inefficiencies was taken out of the local ad market. Indeed, non-digital local and direct advertising fell from 1.80% of PCE in 2001 to 0.67% of PCE in 2014. Non-digital national advertising declined at a far more muted pace: about 0.70% of PCE in 2000 to 0.46% of PCE in 2014. But, we expect national to feel more of the pain going forward since Internet video is now beginning to show signs of strength.

Figure 47. Internet Impact on Local vs. National Advertising Spend



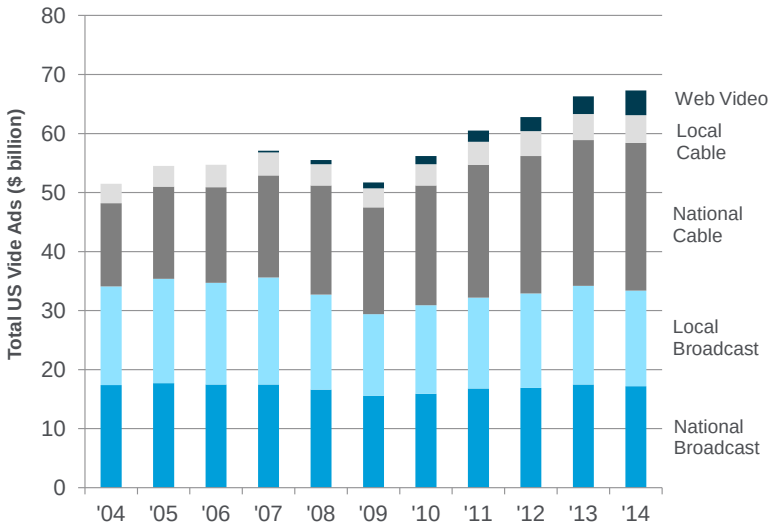
Source: Magna, Citi Research

A Closer Look at Video Ad Spending

But, what if we zoom in and focus on just video ads (versus total ads)? In the US, 2014 total video ad outlays were around $67 billion. The outlays can be divided into five categories: national broadcast, local broadcast, national cable, local cable and web-based video. There are three key observations over the last 10 years:

- First, national and local broadcast ad spending has remained flattish at about $32 billion.
- Second, national and local cable ad spending grew significantly over the last 10 years from about $31 billion in 2004 to $41 billion in 2014.
- Third, web-based video is relatively new. It didn't exist in 2004. But, by 2014 it generated over $4 billion in revenues.

Figure 48. Share of US Digital Advertising by Medium

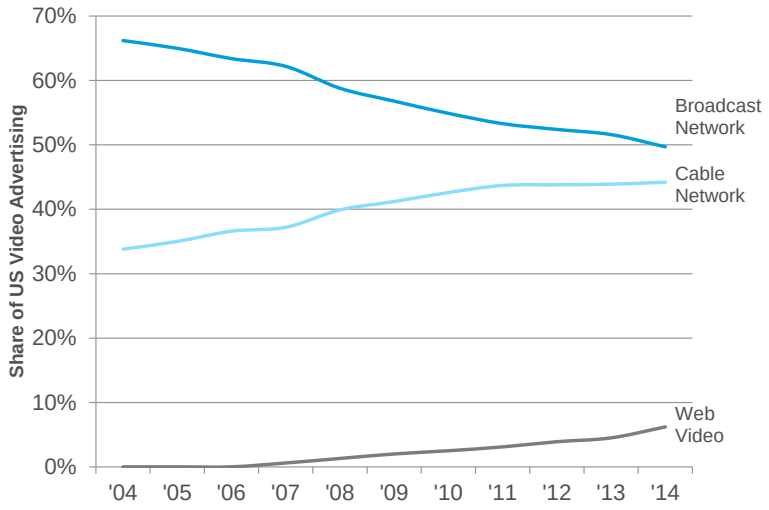


Source: Magna, Citi Research

We can simplify the five video ad categories by grouping the data into three buckets: Cable network ads (national and local), broadcast network ads (national and local) and web-based video ads. And, three trends emerge:

- First, broadcast's share of total video spending fell from 66% in 2004 to 50% in 2014.
- Second, cable's share of total video spending increased from 34% in 2004 to 44% in 2014.
- Third, web-based video has grown from 0% share in 2004 to 6% share in 2014.

Figure 49. Share of US Video Advertising by Medium

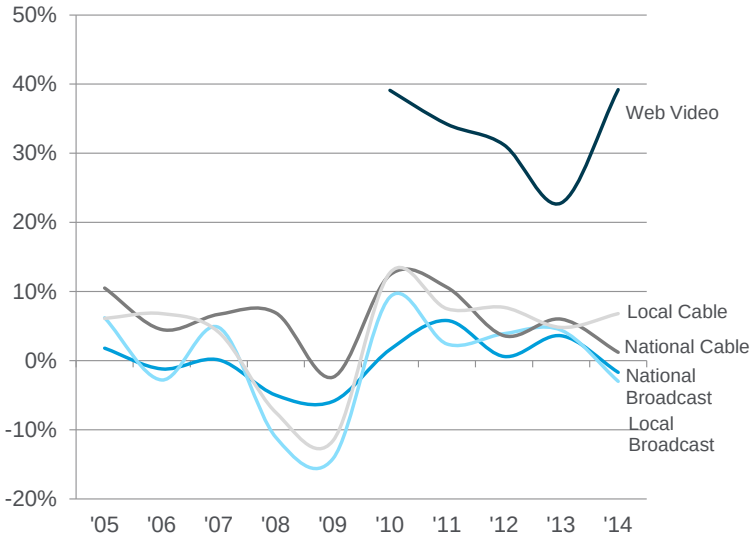


Source: Magna, Citi Research

If we look at the year-over-year growth rates of each medium, there are two important observations.

- First, the growth in web-based video advertising decelerated in 2011, 2012 and 2013. But, in 2014 web-based video reaccelerated. That's important because 2013 wasn't an easy comp (driven by a recession).
- Second, as web-based video growth reaccelerated in 2014, all traditional forms of video advertising — except local cable — decelerated in 2014. (And, local cable didn't decelerate due to political spending.) This suggests that web-based video is indeed a substitute for traditional TV advertising.

Figure 50. US Video Advertising Growth Rates by Medium

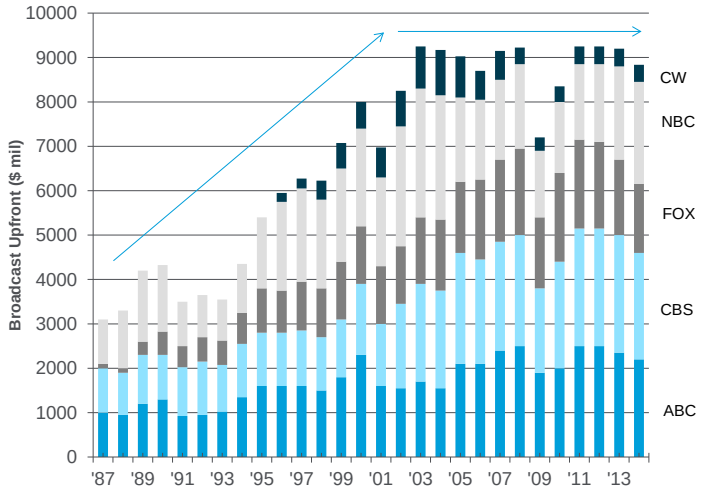


Source: Magna, Citi Research

A Closer Look at Broadcast TV Trends

We can see the ability of cable networks and the Internet to put pressure on broadcast TV ad spending in other ways, too. Across the major broadcast networks, the upfront commitments peaked for the 2003/2004 TV season at $9.25 billion. Since then, the dollar commitments have been relatively flat. The unwillingness of advertisers to commit to more broadcast ad spending speaks volumes about the emergence of viable substitutes: the rise of cable network and Internet video ads (at the expense of broadcast).

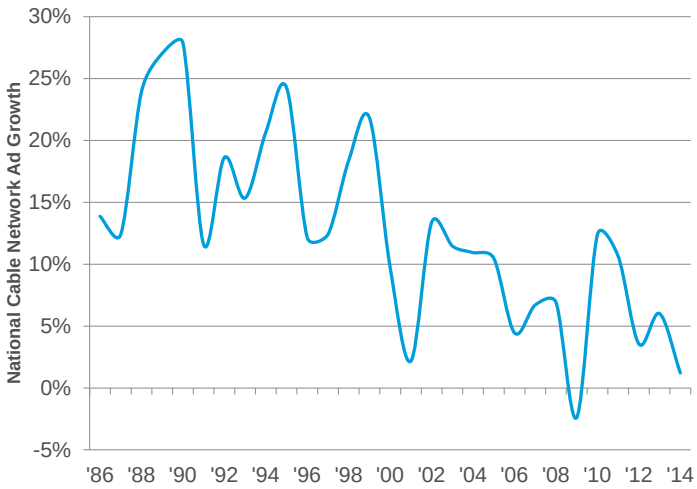
Figure 51. US Broadcast Upfront Total Advertising Commitments



Source: Press reports, Citi Research

So, what about cable network advertising trends? While it used to grow in the double digit range, in the last decade growth has slowed to the mid-single digit range.

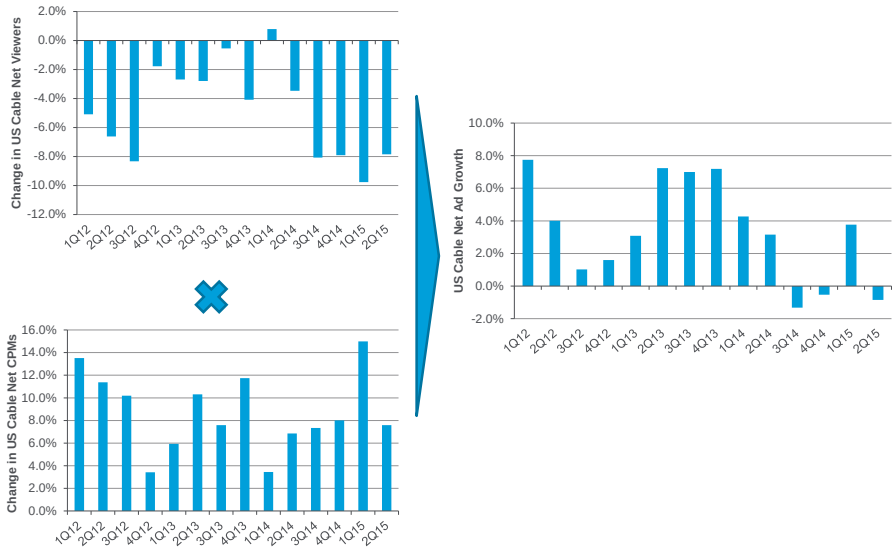
Figure 52. US National Cable Network Ad Growth



Source: Magna, Company reports, Citi Research

Why has this deceleration in cable network advertising growth occurred? Driven by players like Netflix, viewership among US cable networks has been declining for the past three years (Figure 53, upper left). But, cable network pricing has been rising at a high-single digit pace (Figure 53, lower left). Until recently, the price increases were able to offset the ratings declines. That is, cable network advertising was still growing. But, in several recent periods, cable network ads actually contracted in the US (Figure 53, right).

Figure 53. Components of US Cable Ad Growth



Source: Company reports, Citi Research

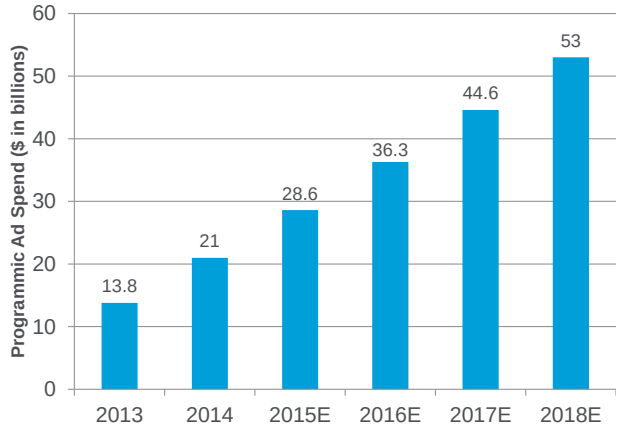
The ability of cable network ads to continue to grow in spite of ratings declines seems to be driven by robust growth in pricing. But, since we showed that marketers view Internet ads as a viable substitute for TV ads, this strategy is unlikely to prove sustainable. The more cable networks raise price, the more compelling marketers will find web-based video alternatives.

US Internet: Who Benefits and Why

We see the next leg of growth for Internet advertising being driven more by national brand advertisers than the local and direct response advertisers that have driven the bulk of growth to date. We believe four key factors are at work and will be the key drivers:

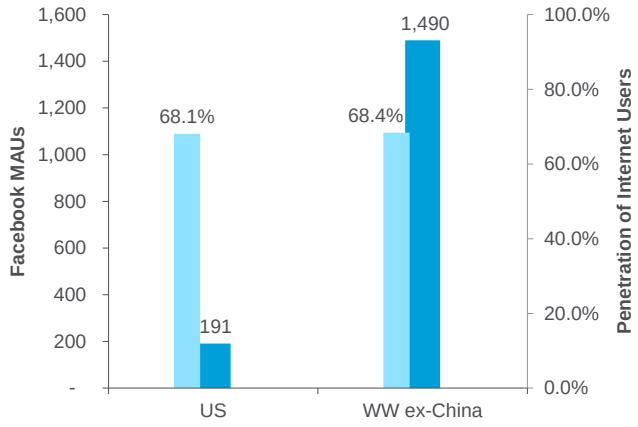
- **Time Spent** – The continued shift in media and information consumption to Internet-based publishers and away from traditional media.
- **Audience Targeting** – Recent advancements in audience targeting (e.g., persistent social profiles, programmatic real-time ad exchange platforms) that provide superior targeting capabilities not only over traditional media but also the Internet's legacy/incumbent cookie-based approach.

Figure 54. Programmatic Ad Spending Projected to Grow at 26% CAGR Through 2018



Source: Magna, Citi Research

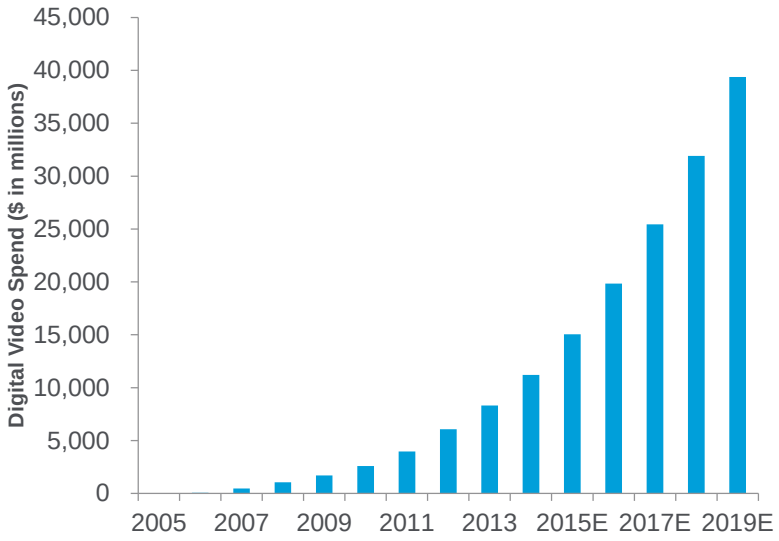
Figure 55. Facebook Monthly Active Users



Source: Company reports, Citi Research

- **Reach** – The emergence of platforms like Facebook that enable mass reach while also enabling fine targeting.
- **Digital Video** – The recent rise in production, distribution and consumption of professional and semi-professional video content online (e.g., YouTube, Vice, Hulu, Vessel, Facebook, BuzzFeed, Twitter).

Figure 56. Global Digital Video Spend is Projected to Grow at 29% CAGR Through 2019



Source: Magna, Citi Research

As the next wave of advertising shifts, we see pure-play cable networks most at risk, followed by magazines and then broadcast networks and other incumbent channels. Internet media companies will be the primary beneficiaries. More specifically, Internet media companies with audience targeting capabilities at scale should benefit disproportionately (e.g., Facebook, Google).

The bottom line is this: Internet advertising has taken a large bite out of total US advertising. The first victim was print. But, recent data suggest TV advertising is apt to be the next victim. Historical data suggest that over the last decade cable networks advertising has captured material share of broadcast TV advertising. And now, Internet video ads will likely put further downward pressure on traditional forms of TV advertising. So, what do we expect going forward? Let's take a multi-step approach to developing a US ad forecast.

Step 1: Total US Ad Forecast

First, we expect the US ad outlays to continue falling as a share of PCE. When we lay this ad-to-PCE ratio against Citi's PCE forecast, it suggests total ad spending will likely slow to 2% growth in 2015 and 1% growth thereafter.

Figure 57. Total US Ad as a Percent of PCE

	2012	2013	2014	2015E	2016E	2017E	2018E
Total PCE	11,223	11,484	11,929	12,310	12,692	13,060	13,439
x Ads as % PCE	1.56%	1.58%	1.55%	1.52%	1.50%	1.47%	1.45%
= Total Ads	175.5	181.3	184.3	187.6	190.4	192.0	194.9
memo: ad growth		3%	2%	2%	1%	1%	1%

Source: US Department of Commerce, Citi Research

Step 2: Local/National/Digital Forecast

Next, we decompose US ad spending into three buckets: non-digital Local, non-digital National and Digital.

Figure 58. Local/National/Digital Advertising as Percent of PCE

	2012	2013	2014	2015E	2016E	2017E	2018E
Non-Digital Local / PCE	0.75%	0.72%	0.67%	0.63%	0.59%	0.56%	0.54%
+ Non-Digital National / PCE	0.49%	0.49%	0.46%	0.43%	0.41%	0.39%	0.36%
+ Digital / PCE	0.33%	0.37%	0.41%	0.47%	0.50%	0.52%	0.54%
= Total Ads / PCE	1.56%	1.58%	1.55%	1.53%	1.50%	1.47%	1.45%
Non-Digital Local ($bn)	84	83	80	77	75	73	72
+ Non-Digital National ($bn)	55	56	55	53	52	50	49
+ Digital ($bn)	37	43	49	58	63	68	73
= Total Ads ($bn)	176	181	184	188	190	191	194

Source: Magna, Citi Research

Step 3: Non-Digital Local Detailed Forecast

Next, we break out non-digital Local advertising into its various segments. While we continue to expect declines in local advertising for those industries already heavily impacted (newspapers, directories) we see Local Cable and Local Broadcast as having relatively benign declines (~1% declines).

Figure 59. Non-Digital Local Advertising Forecast

	2012	2013	2014	2015E	2016E	2017E	2018E
Local Broadcast TV	16	16.7	16.2	16.0	15.9	15.8	15.7
+ Local Cable TV	4.4	4.5	4.7	4.7	4.6	4.5	4.5
+ Local Radio	14.2	14.1	13.6	13.351	13.259	13.167	13.075
+ Local Newspapers	18.9	17.5	15.4	13.5	12.4	11.16	10.4
+ Local Outdoor	6.7	6.9	7.0	7.05	7.15	7.25	7.4
+ Direct Mail	19.5	19.6	20.6	20.5	20.4	20.0	20.3
+ Directories	4.2	3.2	2.457	1.84	1.5	1.2	0.95
= Total Local	84.0	82.5	80.2	77.2	74.9	73.1	72.3
+ Political	2.6	0.3	1.9	0.3	3.5	0.3	2.6
= Total Local w/ Political	86.7	82.8	82.1	77.5	78.4	73.5	74.9

	2012	2013	2014	2015E	2016E	2017E	2018E
Local Broadcast TV		4%	-3%	-1%	-1%	-1%	-1%
+ Local Cable TV		2%	4%	-1%	-2%	-1%	-1%
+ Local Radio		-1%	-3%	-2%	-1%	-1%	-1%
+ Local Newspapers		-8%	-12%	-12%	-8%	-10%	-7%
+ Local Outdoor		4%	1%	1%	1%	1%	2%
+ Direct Mail		1%	5%	0%	0%	-2%	2%
+ Directories		-24%	-24%	-25%	-18%	-20%	-21%
= Total Local		-2%	-3%	-4%	-3%	-2%	-1%
+ Political							
= Total Local w/ Political		-5%	-1%	-6%	1%	-6%	2%

Source: Magna, Citi Research

Step 4: Non-Digital National Detailed Forecast

On the National advertising front we expect TV, especially cable networks, to see declines. For cable networks, we forecast 3% to 4% declines versus 1% declines among TV Broadcasters.

Figure 60. Non-Digital National Advertising Forecast

	2012	2013	2014	2015E	2016E	2017E	2018E
National Broadcast TV	16.9	17.5	17.2	17.0	16.9	16.8	16.7
+ National Cable TV	23.3	24.7	25.0	24.3	23.6	22.7	21.8
+ National Radio	1.2	1.2	1.2	1.150	1.141	1.130	1.125
+ National Newspapers	0.8	0.7	0.7	0.6	0.6	0.5	0.5
+ Magazine	12.6	12.0	10.6	10.1	9.5	9.05	8.4
= Total National	54.9	56.1	54.7	52.9	52.0	50.4	49.0
+ Olympics	0.6	0.0	0.5	0.0	0.7	0.0	0.5
= Total National w/ Olympics	55.6	56.1	55.2	52.9	52.7	50.4	49.5

	2012	2013	2014	2015E	2016E	2017E	2018E
National Broadcast TV		4%	-2%	-1%	-1%	-1%	-1%
+ National Cable TV		6%	1%	-3%	-3%	-4%	-4%
+ National Radio		-3%	-3%	-2%	-1%	-1%	0%
+ National Newspapers		-8%	-6%	-8%	-6%	-8%	-9%
+ Magazine		-5%	-11%	-5%	-6%	-5%	-7%
= Total National		2%	-3%	-3%	-2%	-3%	-3%
+ Olympics							
= Total National w/ Olympics		1%	-2%	-4%	0%	-4%	-2%

Source: Magna, Citi Research

Step 5: Digital Detailed Forecast

Finally, our Digital advertising forecast. Most importantly, we see digital video spending increasing at a ~24% per year rate to ~$10 billion from $4 billion in 2014.

Figure 61. Digital Advertising Forecast

	2012	2013	2014	2015E	2016E	2017E	2018E
Search	19.3	22.9	25.0	26.4	27.8	29.0	30.2
+ Video	2.4	3.0	4.4	5.7	7.0	8.6	10.5
+ Display	10.5	12.3	15.1	21.1	23.4	25.3	26.7
+ Other	4.3	4.6	4.9	4.7	4.9	4.9	5.6
= Total Digital	36.6	42.8	49.5	57.9	63.1	67.8	73.0

	2012	2013	2014	2015E	2016E	2017E	2018E
Search		18%	10%	6%	5%	4%	4%
+ Video		23%	49%	29%	23%	23%	22%
+ Display		18%	23%	40%	11%	8%	6%
+ Other		6%	6%	-5%	5%	1%	13%
= Total Digital		17%	16%	17%	9%	8%	8%

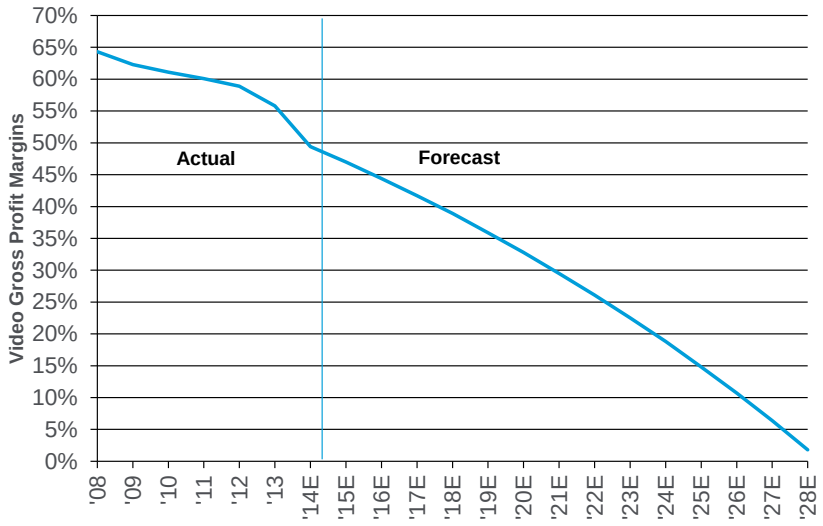
Source: Magna, Citi Research

Item #3: Pay TV Provider Threat

So, far, we've reviewed the US Consumer Threat and the US Advertiser Threat. In the Consumer Threat section, we suggested ratings are weak and cord cutting is ongoing. In the Advertiser Threat section we suggested that web-based video ads are a viable substitute for TV ads. Let's look at the third threat to cable networks: The US Pay TV Threat. Our aim is to see which firm's content might get dropped by a pay TV distributor.

The reason we think pay TV firms will drop content is based on pure economics. To wit: Pay TV firm's video gross profit margins have been compressing for a long time. And, if affiliate fees keep rising at 8% per year while video ARPUs rise 3% per year, video gross profit margins will reach zero by the end of the next decade.

Figure 62. Pay TV Distributor Video Gross Profit Margins (%)

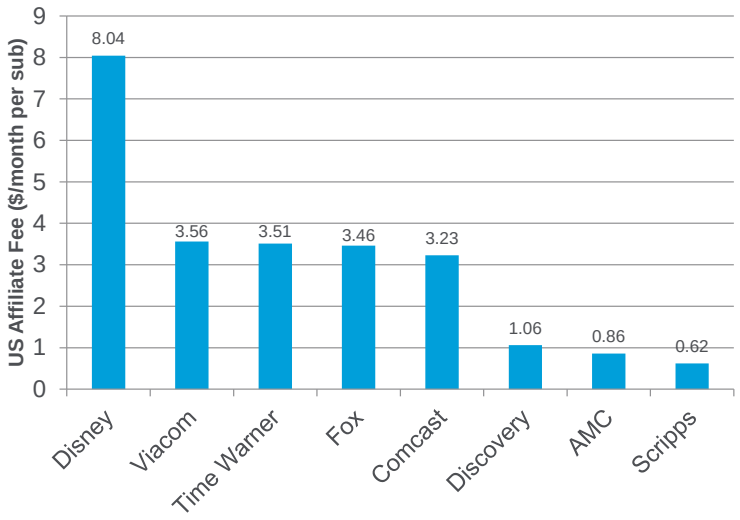


Source: Company reports, Citi Research

As pay TV firm's watch video gross profits fall, it's natural to ask a simple question: "Which cable network is the culprit?" Well, virtually all cable networks are raising affiliate fees at a high-single digit pace.

But, even if we exclude the Regional Sports Networks, there's a wide variance in the cost of cable programming. Indeed, Disney's affiliate fees are about $8.00 per sub per month. But, Scripps costs only $0.62 per sub per month. That's quite a difference. What causes the divergence?

Figure 63. US Cable Network Affiliate Fees Excluding RSNs

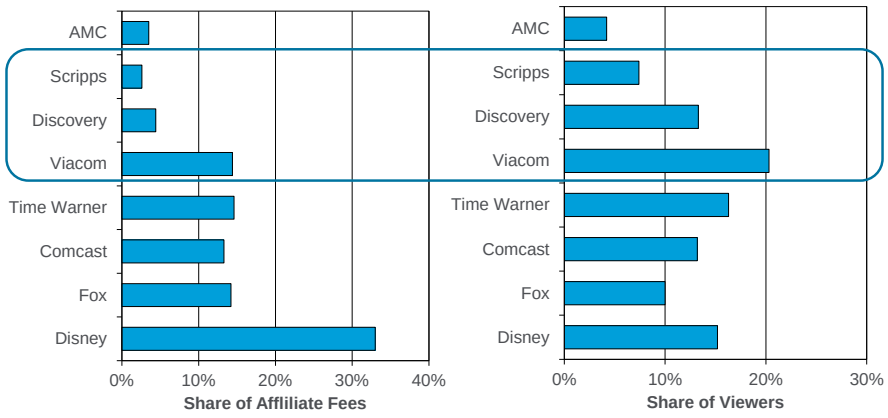


Source: Nielsen, Company reports, Citi Research

The Affiliate Fee Market is Efficient: Variance Not Driven by Viewers

Many investors believe the variance in affiliate fees stems from the variance in viewership. Some investors have taken this construct a step further. They argue that viewership levels can be used to show the market for affiliate fees is inefficient. They argue, for example, that Discovery in under-earning because the firm captures 13% of viewership but only 4% of affiliate fees.

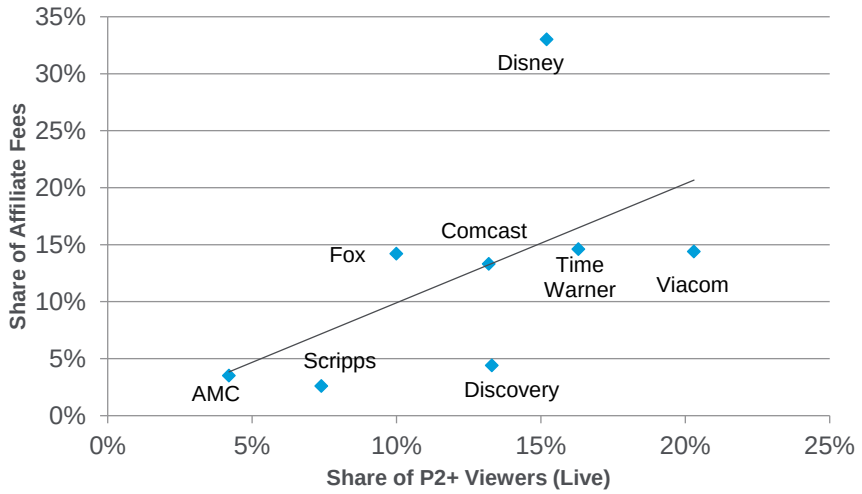
Figure 64. Share of Viewers vs. Affiliate Fees



Source: Nielsen, Company reports, Citi Research

By plotting the data in a scatter plot, firms below the trend-line would be under earning. Is this true? We don't think so. In simple terms, this analysis ignores sports costs. Let's see why sports matter.

Figure 65. Share of Viewers vs. Share of Affiliate Fees (%)

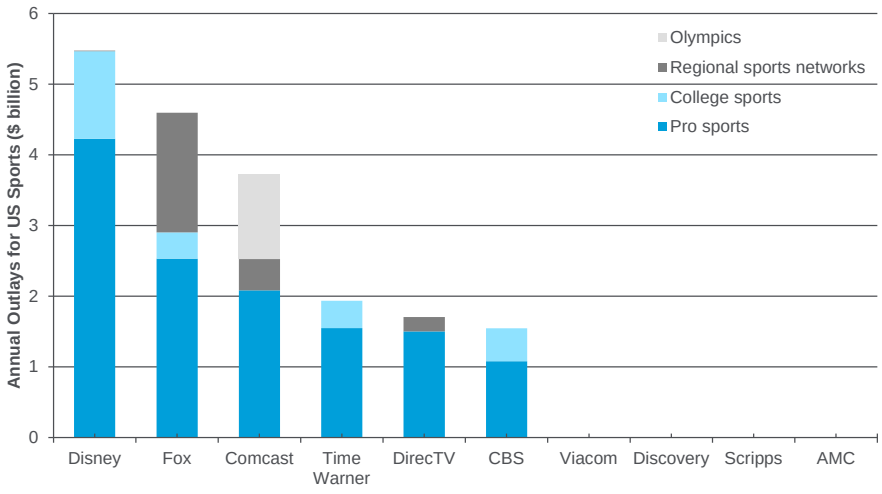


Source: Nielsen, Company reports, Citi Research

Sports Costs Drive Affiliate Fees

If we exclude Regional Sports Networks (because RSN's are not captured in Nielsen's ratings data), Disney spends over $5.4 billion a year on sports. Fox spends $2.9 billion a year. Other firms — like Viacom, Discovery and Scripps — do not spend on US sports.

Figure 66. Annual Sports Outlays by Media Firm

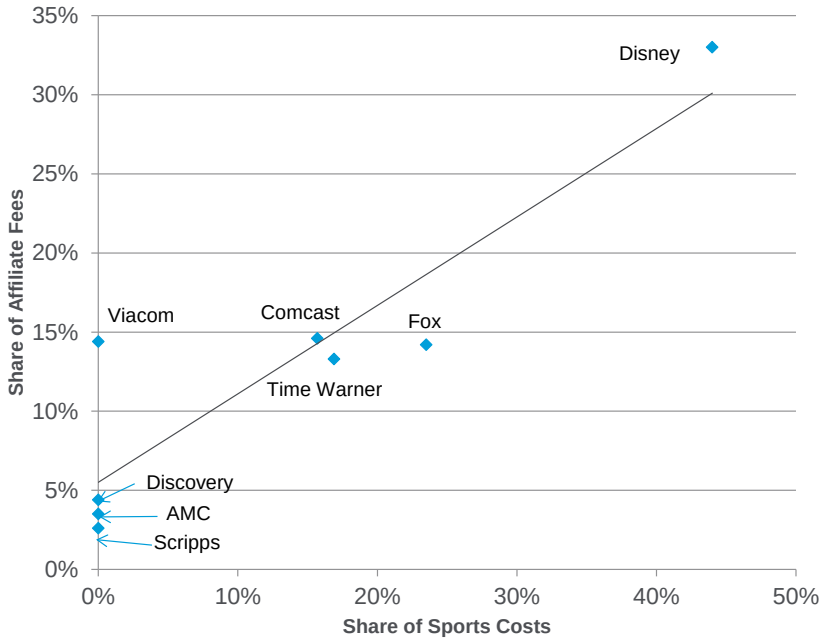


Source: Company reports and Press reports

And, you'll notice (in Figure 67) that the firms that are above the trend line — like Disney and Fox — are both large buyers of sports rights. This suggests that if we plot each firm's share of non-RSN sports costs against the share of non-RSN affiliate fees, a clear picture might emerge. It shows:

- A very strong correlation between sports costs and affiliate fees.
- Among firms that don't spend on sports rights, Viacom is actually capturing far more in affiliate fees than rivals (due to robust viewership).

Figure 67. Share of Sports Costs vs. Share of Affiliate Fees (%)



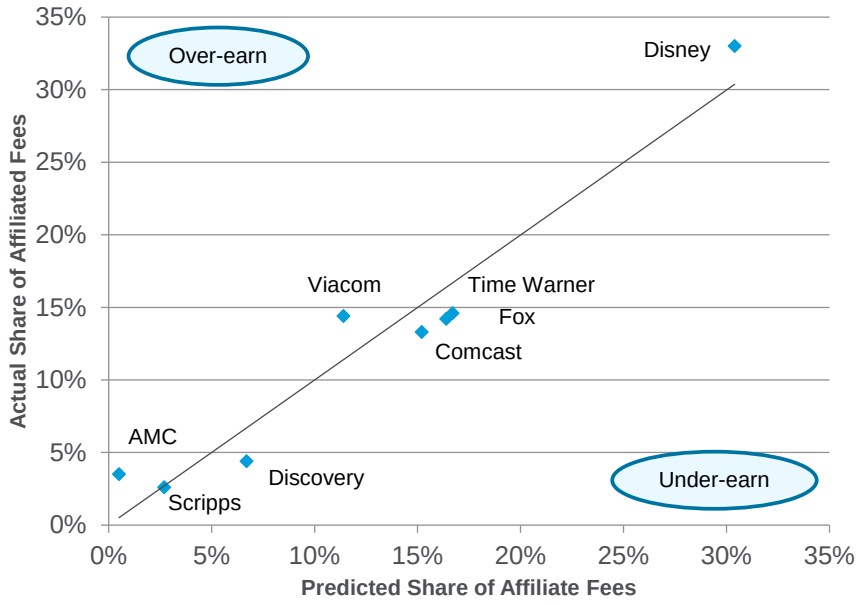
Source: Company reports, Citi Research

A Holistic Picture: Sports Costs + Viewers

So, it seems sports costs and viewership levels are partial drivers of affiliate fees. Let's bring the two pieces together. That is, we'll see if sports costs plus audience delivery can be used to explain the dispersion in affiliate fees among the cable networks.

And, it turns out that these two variables explain over 90% of the variance in affiliate fees. The data suggests Disney, Viacom and AMC are over-earning. Conversely, other firms are under-earning. But, the variance is very, very small. Indeed, the market for US affiliate fees is remarkably efficient. This insight strongly suggests it isn't obvious which piece of content a pay TV firm might drop. All firms seem to be 'fairly' priced.

Figure 68. Predicted Affiliate Fees Using Sports and Viewership vs. Actual Fees (%)



Source: Company reports, Press reports, Citi Research

The BDR: A Risk Assessment

With falling video gross profit margins, someone's content will likely fall by the wayside. But, which content should be dropped if all the content is 'fairly' priced? We need an analytic way to balance the affiliate fee savings against the lost video gross profit margins from defecting pay TV subs.

We start by adding RSN fees to our non-RSN affiliate fees and then divide by average video gross profit margins (of 46%) for the average pay TV firm. The resulting percentage is what we call the 'Breakeven Defection Rate' or BDR.

The BDR suggests that if a pay TV firm thought it would lose fewer subs than the BDR, it should drop the cable network content. Some cable networks have very low BDRs of around 1% to 2% — including Discovery, Scripps and AMC. Other cable networks have high BDRs in the mid-to-high teens — including Disney and Fox.

Figure 69. Breakeven Defection Rates by Cable Network

	Disney	Fox	Comcast	Time Warner	Viacom	Discovery	Scripps	AMC	Total
RSN affiliate fees	6	706	184	0	0	0	0	0	896
/ Pay TV homes (mil)	100	100	100	100	100	100	100	100	100
= RSN Affiliate fee per home per quarter	0.06	7.06	1.84	0.00	0.00	0.00	0.00	0.00	8.96
/ Months per quarter	3	3	3	3	3	3	3	3	3
= RSN affiliate fee per month	0.02	2.35	0.61	-	-	-	-	-	2.99
+ Non-RSN affiliate fee per month	8.04	3.46	3.23	3.56	3.51	1.06	0.62	0.86	24.35
= Affiliate fee per month	8.06	5.82	3.84	3.56	3.51	1.06	0.62	0.86	27.33
/ Video gross profit (avg)	40.59	40.59	40.59	40.59	40.59	40.59	40.59	40.59	nm
= Breakeven Defection Rate (BDR)	19.9%	14.3%	9.5%	8.8%	8.6%	2.6%	1.5%	2.1%	nm

Source: Company reports, Press reports, Citi Research

But, how can an investor (or a pay TV firm) decide the likely defection rate? We think history provides some clues. Let's look.

Looking to History for Clues

Over the past few years, there were four notable carriage disputes:

- On August 2, 2013, Time Warner Cable dropped CBS in some systems for 30 days and lost ~190K subs.
- On December 21, 2014, Dish dropped Fox News for 26 days and lost ~ 90K subs.
- On April 1, 2014, Cable One dropped Viacom and lost ~18K subs.
- On October 1st, 2014 Suddenlink dropped Viacom and lost ~29K subs

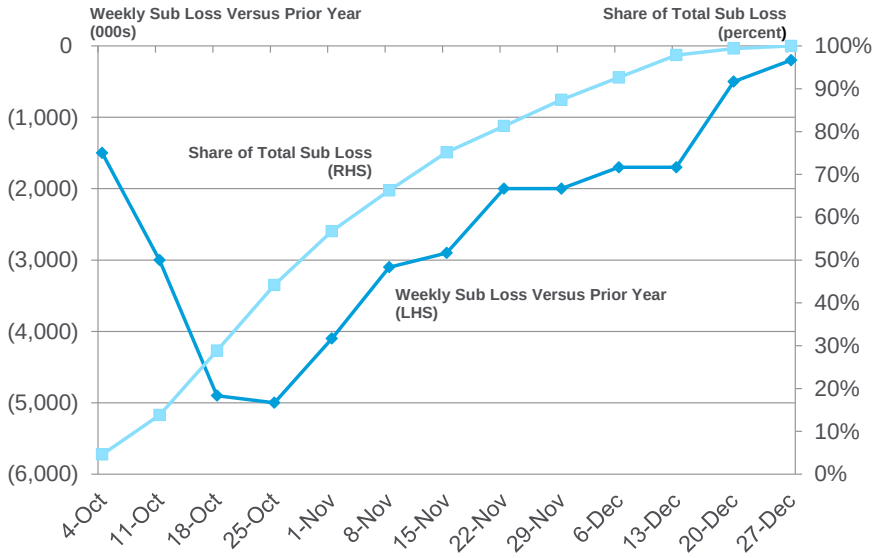
Figure 70. Sub Losses from Prior Programming Disputes

Content	Fox News	CBS	Viacom	Viacom
Dropped by	Dish Network	Time Warner Cable	Cable One	Suddenlink
Start date	21-Dec-15	2-Aug-13	1-Apr-14	1-Oct-14
End date	15-Jan-15	2-Sep-13	N/A	N/A
Length of blackout (days)	26	30	90	90
Lost video subs	90	190	18	29

Source: Press reports, Citi Research

Since the duration of each dispute isn't uniform, we need to normalize the data. Suddenlink's fourth quarter 2014 disclosures suggest following a blackout, 65% of subs will defect within the first month and virtually all sub defections occur within 90 days.

Figure 71. Example of Cable Company Incremental Subscriber Loss vs. Prior Year



Source: Company reports

So, we assume 150K Dish losses and 292K Time Warner losses. These adjusted data are akin to a *permanent* black-out for all four disputes (even though the Dish and Time Warner Cable disputes were transitory).

Figure 72. Normalized Subscriber Losses from Prior Blackouts

Content	Fox News	CBS	Viacom	Viacom
Dropped by	Dish Network	Time Warner Cable	Cable One	Suddenlink
Pay TV subs attributable to blackout	90	190	18	29
/ Portion of quarter dropped	60%	65%	100%	100%
= Pro rata sub losses	150	292	18	29

Source: Press reports, Citi Research

What's Your Passion?

To make sense of the variance in sub defections among the disputes, we need to ask this:

> *"Which households are so passionate about a network (or show) that they will actually switch pay TV firms if the content is missing?"*

To answer this question, we need to take a few steps:

- First, we begin with each pay TV firm's total subs. Then, we adjust this figure for the subs that were affected by the blackout. The adjustment is large for CBS (due to the overlap of CBS' owned TV stations) and for Dish (due to the Hispanic video tier).
- Second, we multiply by each content group's cume score (or the number of viewers that tune into the content in a given week). For Fox News and CBS, we use the network's cume. And, for Viacom' we used the aggregate cume across all networks (consistent with the nature of the blackout).
- Third, the Passion Score is the plug between the actual number of subs defecting and the number of homes that tune into the channel (cume). The Passion Score is 3-4% for Viacom, 5% for Fox News and 14% for CBS.

Figure 73. Estimate of Content Passion Index

	Dish Fox News	TWC CBS	Cable One Viacom	Suddenlink Viacom
Subs lost	90	190	18	29
/ Normalizing for permanent blackout	60%	65%	100%	100%
= Pro forma sub losses with permanent loss	150	292	18	29
Total pay TV homes	14,050	11,720	525	1,171
x Impacted by content blackout	82%	27%	100%	100%
= Pay TV homes w/o content	11,500	3,200	525	1,171
x Cume of network(s)	27%	65%	82%	82%
= Homes that could miss content in a blackout	3,105	2,080	432	964
x Passion score	4.8%	14.1%	4.1%	3.0%
= Defecting homes	150	292	18	29
/ Pay TV homes w/o content	11,500	3,200	525	1,171
= Defection rate among affected homes	1.3%	9.1%	3.4%	2.5%
memo: Defection rate among all homes	1.1%	2.5%	3.4%	2.5%

Source: Nielsen, Company reports, Citi Research

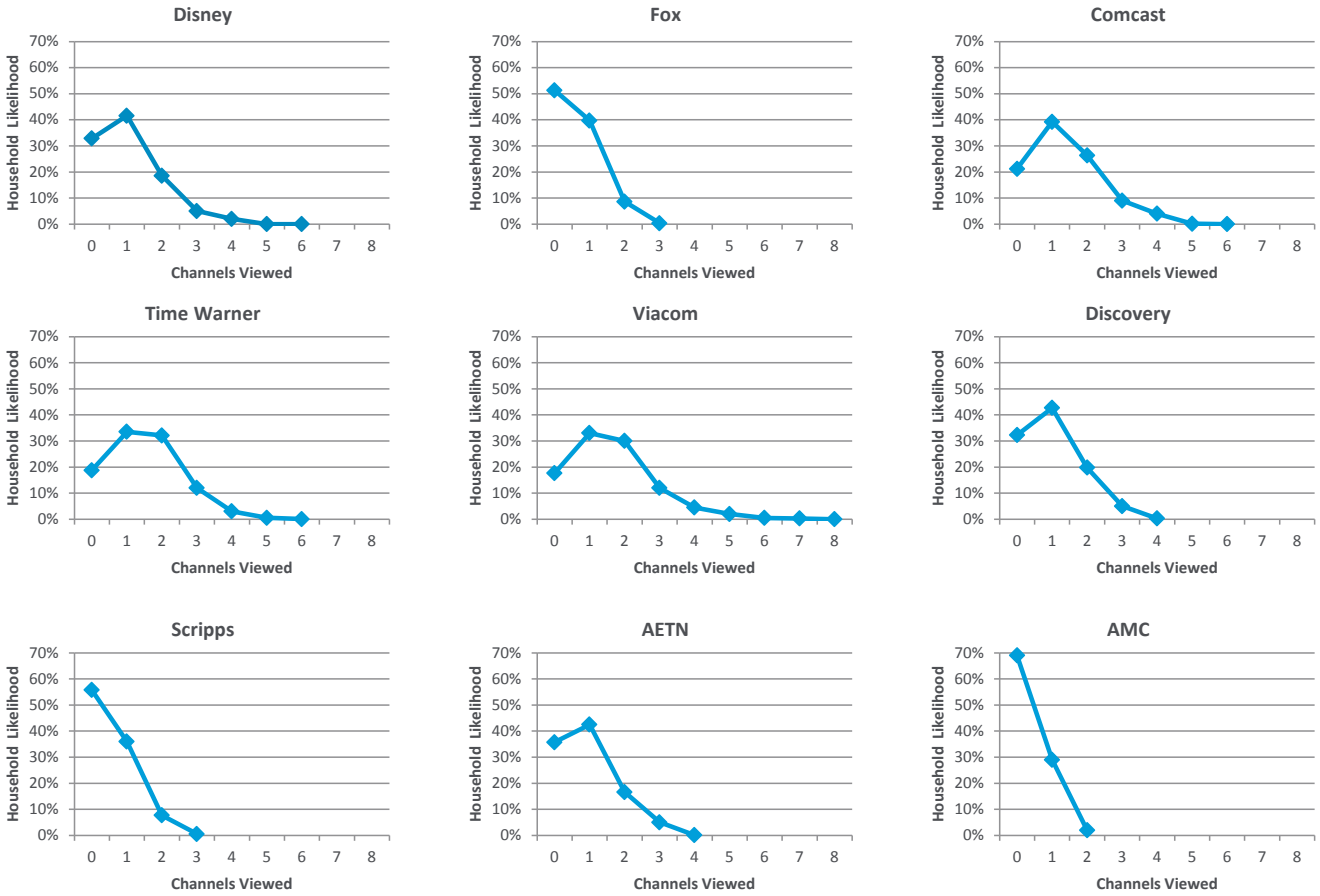
But, how can we broaden this analysis beyond the four disputes we've reviewed? We need to take two steps: 1) quantify the network cume for each cable network group; and 2) define the Passion Score for every cable network group.

Focusing on Network Cume

According to Nielsen, each firm will typically have a popular channel with a cume in the 20%-30% range and a handful of niche networks with a cume in the low-single digit range. But, cable network groups with many channels — like Viacom — have a distinct advantage over rivals. The likelihood of a home not tuning into any of the channels falls as the number of channels rises.

If we go through the (independent) conditional probabilities for each cable network group, some firms — like Viacom and Time Warner — have an 80% chance that someone in the household will tune into one (or more) of the firm's channels. AMC, on the other hand, only has a 30% chance that a home will tune into one (or more) of the firm's channels. The gap has less to do with the popularity of a single channel. It has more to do with how many channels are in the portfolio.

Figure 74. Likelihood of Watching a Network Group's Channels



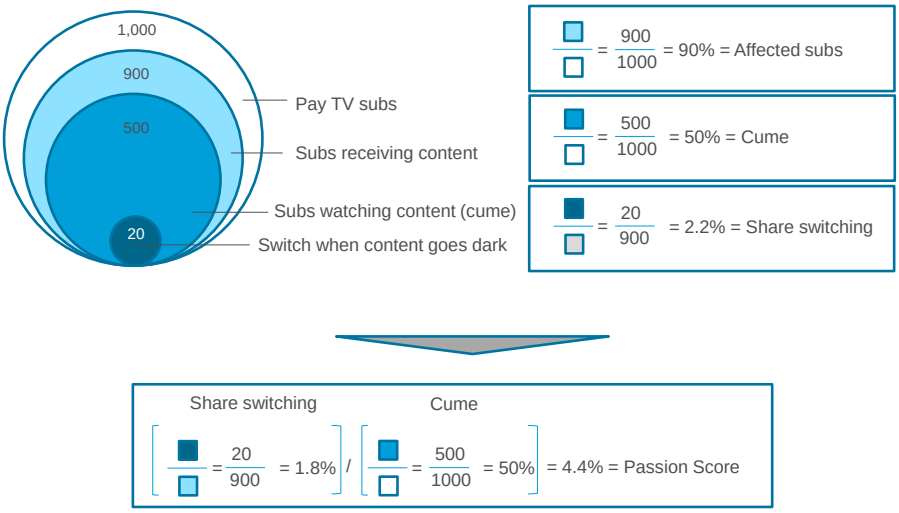
Source: Nielsen, Citi Research

Defining the 'Passion Score'

So, with our cume scores in hand, the only missing figure — the plug if you will — is the Passion Score. What is a Passion Score? And, how can we calculate it?

Let's use a simple example. Imagine the pay TV firm has 1,000 subs, 900 of which receive the content and 500 of which actually watch the content. And, assume that 20 subs defect when the content is missing. The Passion Score is simply the fraction of subs that switch pay TV firms (2.2%) divided by the network cume (50%). Or, a Passion Score of 4.4%. You will notice that the Passion Score rises if more subs defect. And the Passion Score rises if the network cume falls. This makes sense.

Figure 75. Defining the Passion Score



Source: Citi Research

So, now that we have an intuitive understanding of how to define the Passion Score, we need a way to predict the Passion Score for each firm. Recall, using actual blackouts, we showed that the Passion Score is 3-4% for Viacom, 5% for Fox News and 14% for CBS. Why are the Passion Scores so different? We think it has to do with the peakiness of the viewership profile.

Let's see why.

Peaky Viewers Are Passionate Viewers

The best way to quantify the Passion Score is to look at two variables: 1) the average viewers during the day; and 2) the peakiness of the viewership during the most popular hour of programming across all the firm's networks.

When we collected these data for Fox News, CBS and Viacom, it suggests that CBS and Fox News get big bumps in viewers during the most popular hour. However, Viacom's most popular hour of programming on a single network generates fewer viewers than average viewership across all its networks.

So, let's regress the Passion Score (y-axis) against the two (x-axis) inputs: 1) the average viewers during the day; and 2) the ratio of peak hour viewing to average viewing.

Figure 76. Average Viewers and Viewer Peakiness to Estimate Passion Score

	Dish Fox News	TWC CBS	Cable One Viacom	Suddenlink Viacom
Average viewers (4Q14)	1,095	2,609	4,069	4,069
x Ratio of average to peak	356%	952%	69%	69%
= Max viewers	3893	24824	2820	2820
Passion Index	4.8%	14.1%	4.1%	3.0%

	Y-Axis	X-Axis	
	Passion	Avg Viewers	Avg to Peak Viewers
Dish and Fox News	4.8%	1,095	356%
Time Warner Cable and CBS	14.1%	2,609	952%
Cable One and Viacom	4.1%	4,069	69%
Suddenlink and Viacom	3.0%	4,069	69%

Source: Nielsen, Citi Research

The regression suggests that about 98% of the Passion Score can be predicted by viewers and viewer peakiness. Moreover, the P-values are quite low for both coefficients suggesting the likelihood of statistical significance is high.

Figure 77. Drivers of Passion Score Multivariate Regression

Regression Statistics	
Multiple R	1.00
R Square	0.99
Adjusted R Square	0.98
Standard Error	0.01
Observations	4

ANOVA

	df	SS	MS	F	Sig F
Regression	2	0.01	0.00	68.82	0.08
Residual	1	0.00	0.00		
Total	3	0.01			

	Coef	Std Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	-0.834%	1.34%	(0.62)	64%	-17.8%	16.1%
Coef: Avg viewers	0.001%	0.00%	2.47	24%	-0.004%	0.005%
Coef: Peakiness	1.330%	0.12%	11.26	6%	-0.2%	2.8%

Source: Nielsen, Citi Research

If we take the two coefficients from the regression and multiply by our two inputs, it suggests we can mirror the Passion Score for Fox News (4.8%), CBS (14.1%) and Viacom (3.6%) quite well. In effect, the regression works.

Figure 78. Predicted and Actual Passion Scores

	Dish Fox News	TWC CBS	CableOne Viacom	Suddenlink Viacom
Average total day viewers	1,095	2,609	4,069	4,069
x Regression coefficient	0.001%	0.001%	0.001%	0.001%
= Passion Score from viewers	0.9%	2.2%	3.5%	3.5%
Ratio of Top show to Prime Time	356%	952%	69%	69%
x Regression coefficient	1.33%	1.33%	1.33%	1.33%
= Passion Score from ratio of Top Show to Prime time	4.7%	12.7%	0.9%	0.9%
Passion Score from ratio of Prime to Total Day	0.9%	2.2%	3.5%	3.5%
+ Passion Score from ratio of Top Show to Prime time	4.7%	12.7%	0.9%	0.9%
= Y-intercept	-0.8%	-0.8%	-0.8%	-0.8%
= Predicted Passion Score	4.8%	14.1%	3.6%	3.6%
Actual Passion Score	4.8%	14.1%	4.1%	3.0%
- Predicted Passion Score	4.8%	14.1%	3.6%	3.6%
= Regression Error	0.0%	0.0%	0.5%	-0.5%

Source: Nielsen, Citi Research

The Predicted Defection Rate (PDR)

So far, we've suggested: 1) if the status quo endures, pay TV gross profit will disappear in 15 years; 2) it isn't clear that any cable network group is materially over-earning based on its affiliate fees; 3) each cable network group has a unique Breakeven Defection Rate; 4) during prior blackouts, the sub defection rate is a function of the cume and Passion Score; and 5) the Passion Score is best approximated by the peakiness of the viewership profile.

With that foundation in place, we're in a position to assess the Predicted Defection Rate for cable networks and broadcast networks. Let's start with cable networks.

Cable network Predicted Defection Rates

Based on: 1) average total day viewers; 2) the most popular hour of programming in the month; 3) the regression coefficient; and 4) the network's cume, we can predict the defection rate for each cable network group. The lowest PDR is Scripps at 1.3%. Disney has the highest PDR at 9.5%.

Figure 79. Cable Network Predicted Defection Rates

	Disney	Fox	Comcast	Time Warner	Viacom	Discovery	Scripps	AETN	AMC
Average viewers (4Q14)	3,792	2,361	2,558	3,519	4,069	2,666	1,591	2,324	1,017
x Ratio top shows to average viewers	881%	165%	182%	106%	69%	176%	187%	195%	1539%
= Max viewers	33,395	3,893	4,657	3,735	2,820	4,694	2,970	4,531	15,643
Average viewers	3,792	2,361	2,558	3,519	4,069	2,666	1,591	2,324	1,017
x Regression coefficient	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%
= Passion Score from average viewers	3.2%	2.0%	2.2%	3.0%	3.5%	2.3%	1.4%	2.0%	0.9%
Ratio of Top Show to Prime Time	881%	165%	182%	106%	69%	176%	187%	195%	1539%
x Regression coefficient	1.33%	1.33%	1.33%	1.33%	1.33%	1.33%	1.33%	1.33%	1.33%
= Passion Score from ratio of Top Show to avg viewers	11.7%	2.2%	2.4%	1.4%	0.9%	2.3%	2.5%	2.6%	20.5%
Passion Score from avg viewers	3.2%	2.0%	2.2%	3.0%	3.5%	2.3%	1.4%	2.0%	0.9%
+ Passion Score from ratio of Top Show to average viewers	11.7%	2.2%	2.4%	1.4%	0.9%	2.3%	2.5%	2.6%	20.5%
+ Y-intercept	-0.8%	-0.8%	-0.8%	-0.8%	-0.8%	-0.8%	-0.8%	-0.8%	-0.8%
= Predicted Passion Score	14.1%	3.4%	3.8%	3.6%	3.6%	3.8%	3.0%	3.7%	20.5%
x Network cume	67.2%	48.7%	78.8%	81.2%	82.4%	67.7%	44.2%	64.3%	31.0%
= Predicted Defection Rate (PDR)	9.5%	1.6%	3.0%	2.9%	2.9%	2.6%	1.3%	2.4%	6.4%

Source: Citi Research

Broadcast Network Predicted Defection Rates

Using the same inputs, we can estimate the PDR for ABC (Disney), FOX (21st Century Fox), NBC (Comcast) and CBS. The Predicted Defection Rates are 9% to 10% for CBS and NBC and 5% for FOX and ABC.

Figure 80. Broadcast Network Predicted Defection Rates

	Disney	Fox	Comcast	Time Warner	Viacom	Discovery	Scripps	AETN	AMC	CBS
Average viewers (4Q14)	1,854	1,374	2,360							2,609
x Ratio Top Shows to average viewers	565%	835%	1090%							952%
= Max viewers	10,476	11,471	25,724							24,824
Average viewers	1,854	1,374	2,360							2,609
x Regression coefficient	0.001%	0.001%	0.001%							0.001%
= Passion Score from average viewers	1.6%	1.2%	2.0%							2.2%
Ratio of Top show to Prime Time	565%	835%	1090%							952%
x Regression coefficient	1.33%	1.33%	1.33%							1.33%
= Passion Score from ratio of Top Show to avg viewers	7.5%	11.1%	14.5%							12.7%
Passion Score from avg viewers	1.6%	1.2%	2.0%							2.2%
+ Passion Score from ratio of Top Show to average viewers	7.5%	11.1%	14.5%							12.7%
+ Y-intercept	-0.8%	-0.8%	-0.8%							-0.8%
= Predicted Passion Score	8.3%	11.4%	15.7%							14.1%
x Network cume	66.0%	47.0%	67.0%							65.0%
= Predicted Defection Rate (PDR)	5.5%	5.4%	10.5%							9.1%

Source: Citi Research

Since predicted defection rates are additive across cable networks and broadcast networks (once we adjust for TV station ownership among the media firms), the total Predicted Defection Rate is highest for Disney (15%) and lowest for Scripps (1%).

Figure 81. Composite Defection Rates

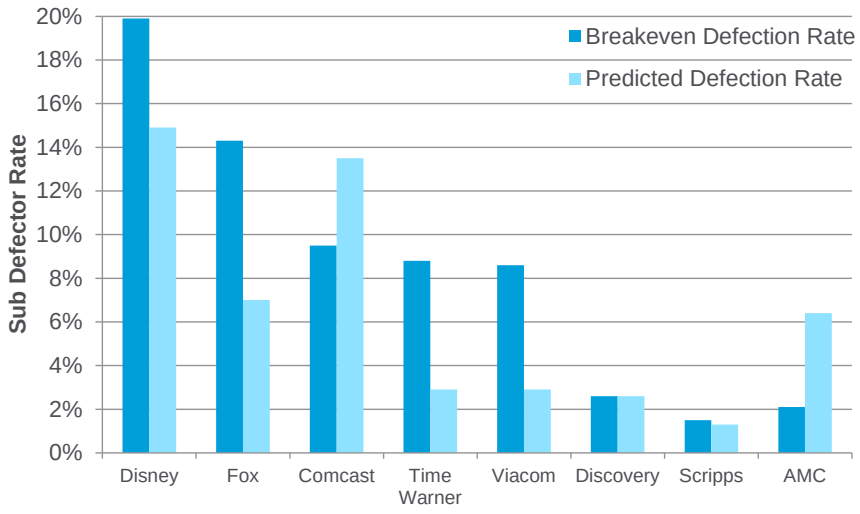
	Disney	Fox	Comcast	Time Warner	Viacom	Discovery	Scripps	AETN	AMC	CBS
Broadcast Predicted Defection Rate	5.5%	5.4%	10.5%							9.1%
x O&O ownership	23.0%	37.5%	27.0%							40.0%
= PDR x O&O ownership	1.3%	2.0%	2.8%							3.7%
+ Cable Network Predicted Defection Rate	9.5%	1.6%	3.0%	2.9%	2.9%	2.6%	1.3%	2.4%	6.4%	0.0%
= Composite Predicted Defection Rate	14.9%	7.0%	13.5%	2.9%	2.9%	2.6%	1.3%	2.4%	6.4%	9.1%
Breakeven Defection Rate	19.9%	14.3%	9.5%	8.8%	8.6%	2.6%	1.5%	nm	2.1%	nm
- Predicted Defection Rate	14.9%	7.0%	13.5%	2.9%	2.9%	2.6%	1.3%	2.4%	6.4%	9.1%
= Gap	4.9%	7.3%	-4.0%	5.9%	5.7%	0.0%	0.2%	nm	-4.2%	nm

Source: Citi Research

If we compare the pay TV firm's Breakeven Defection Rate (BDR) from to the Predicted Defection Rates (PDR) from, a clear picture emerges. It shows:

- First, two firms may be at greatest risk of being dropped by a pay TV firm: Viacom and Time Warner. These firms are at greater risk because the PDR is less than the BDR. Moreover, the Predicted Defection Rates are quite low.
- Second, Disney and Fox face the next greatest risk. Here, too, the PDR is below the BDR. But, the sheer magnitude of likely defections — between 7% and 15% of the sub base — is very large. As such, it may dissuade a pay TV firm from dropping the content due to negative operating leverage and programming scale benefits that would erode with large subscriber defections.
- Third, four firms are relatively safe. These include Comcast, AMC, Discovery, and Scripps. Comcast and AMC have a PDR that exceeds the BDR. And Discovery and Scripps have a PDR and BDR that are near-parity (suggesting pay TV firms will not generate extra profits without this content).

Figure 82. Predicted and Breakeven Defection Rates



Source: Citi Research

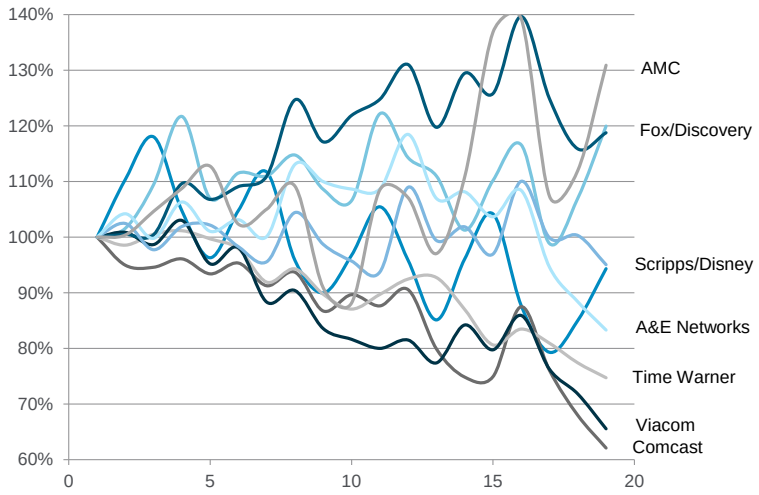
Other X-Factors to Think About

Of course, beyond the BDR and PDR, there are many other factors that could influence a pay TV firm's decision to keep or drop a network. These include: 1) ratings trends; 2) premium channel ownership; 3) RSN ownership; 4) other free-to-air networks; and 5) over-the-top offerings. Let's look at each.

X-Factor #1: Ratings Trends

Typical agreements between pay TV firms and content owners last between three and seven years. As such, multi-year ratings changes could have a bearing on the renewal decision of a pay TV firm. We examined live ratings trends for nine cable network groups and indexed the ratings to the second quarter of 2010. The data suggest four firms have seen material ratings erosion: Comcast, Viacom, Time Warner and AETN. These firms may be at greater risk relative to peers.

Figure 83. Index of P2+ Live Ratings to 2Q10



Source: Nielsen, Citi Research

X-Factor #2: Premium Ownership

In addition, ownership of premium channels may also influence a pay TV firm's decision to drop (or keep) content. Time Warner owns HBO/Cinemax (with 1.2 million average viewers). CBS owns Showtime (300,000 average viewers). And Viacom is a partial owner of Epix (with viewership too small to be captured by Nielsen). Since we have not included the impact of premium channels in our analysis, this is mitigating factor. Ownership of a premium channel may lower a content owner's risk.

X-Factor #3: RSN Ownership

When we estimated the BDR, we included regional sports networks (because the pay TV firms incur costs and generate gross profits from these networks). But, in our assessment of the PDRs, we excluded RSNs (because we don't have RSN ratings from Nielsen). As such, we need to lower the risk profile for firms with heavy RSN ownership. Fox, in particular, could see lower risks than our BDR/PDR assessment suggests is likely.

Figure 84. Regional Sports Network Exposure

	Affiliate Fee ($ per Sub)	Reach (mil)	Affiliate Fee ($ mil per yr)	Sports Costs ($ mil per year)
Fox	2.80	83.9	2,823	1,694
+ Comcast	3.37	18.2	735	441
+ DirecTV	3.33	8.5	340	204
+ MSG	2.92	16.2	568	341
+ Disney	0.30	6.7	24	9
+ Other	2.51	51.1	1,536	922
= Total	2.78	184.6	6,040	3,624

Source: SNL Kagan, Citi Research

X-Factor #5: Over-the-Top (OTT) Offerings

The final X-Factor to consider is whether a firm has an OTT offer. CBS recently launched CBS All Access. Viacom recently launched Noggin. And Time Warner just rolled-out HBO Now. An OTT offer could make it more likely that a pay TV firm drops a network's content.

Bringing It All Together

So, if we brought all the data together, we would rank the blackout risks by firm in the following steps:

- First, we would compare the BDR to the PDR. Firms with a negative score are safest. Firms with large positive score are most at risk. Through this screen, AMC is the safest and Fox is the most at risk.
- Second, we would lower the risk profile for firms with a high PDR. That's because a high PDR would result in significant negative operating leverage if many subs defected (including amortization of fixed costs and lower programming scale benefits). This lowers Fox's risk two notches (because Fox has a PDR or 7.0% while Time Warner and Viacom have a lower PDR of 2.9%). Comcast also moves down one notch in risk.
- Third, we would look at recent ratings trends. Since Viacom's ratings have been quite poor (even relative to peers), this moves the firm up one spot. AMC's robust ratings move the firm down one notch.
- Fourth, we lower Time Warner's risk profile by one level due to the importance of HBO.
- Fifth, we lower Fox's risk profile by one level given the firm's RSN portfolio.

We have not made any other adjustments for ownership of other free-to-air assets (like Telemundo) or new OTT offers (like Noggin and HBO) because the assets are too small or the services are too nascent.

The final rank — from safest to most risky — is as follows: AMC, Comcast, Discovery, Scripps, Disney, Fox, Time Warner and Viacom. In aggregate, our initial screen — based on PDRs and BDRs — is largely similar to our final ranking (which incorporates the X-Factors). The only notable change is that Fox's position swapped with Viacom. The other firm's rankings were unchanged by the X-Factors.

Figure 85. Ranking Firms for Blackout Risks Using All Factors

	Safest							Riskiest
BDR versus PDR	AMC	Comcast	Discovery	Scripps	Disney	Viacom	Time Warner	Fox
memo: BDR less PDR	-4.2%	-4.0%	0.0%	0.2%	4.9%	5.7%	5.9%	7.3%
Prior rank	AMC	Comcast	Discovery	Scripps	Disney	Viacom	Time Warner	Fox
Adjust for high PDR	Comcast	AMC	Discovery	Scripps	Disney	Fox	Viacom	Time Warner
memo: PDR	13.5%	6.4%	2.6%	1.3%	14.9%	7.0%	2.9%	2.9%
Prior rank	Comcast	AMC	Discovery	Scripps	Disney	Fox	Viacom	Time Warner
Ratings Trends (X-Factor #1)	AMC	Comcast	Discovery	Scripps	Disney	Fox	Time Warner	Viacom
memo: index 2Q10	131%	62%	119%	95%	94%	120%	75%	66%
Prior Rank	AMC	Comcast	Discovery	Scripps	Disney	Fox	Time Warner	Viacom
Premium ownership (X-Factor #2)	AMC	Comcast	Discovery	Scripps	Disney	Time Warner	Fox	Viacom
memo: avg viewers (000)	nm	nm	nm	nm	nm	1,200	nm	nil
Prior Rank	AMC	Comcast	Discovery	Scripps	Disney	Time Warner	Fox	Viacom
RSN Ownership (X-Factor #3)	AMC	Comcast	Discovery	Scripps	Disney	Fox	Time Warner	Viacom
memo: coverage of households	nm	18.2	nm	nm	6.7	83.9	nm	nm
Prior Rank	AMC	Comcast	Discovery	Scripps	Disney	Fox	Time Warner	Viacom
Other FTA Ownership (X-Factor #4)	AMC	Comcast	Discovery	Scripps	Disney	Fox	Time Warner	Viacom
memo: avg viewers	nm	1,200	nm	nm	nm	nm	nm	nil
Prior Rank	AMC	Comcast	Discovery	Scripps	Disney	Fox	Time Warner	Viacom
OTT Offer (X-Factor #5)	AMC	Comcast	Discovery	Scripps	Disney	Fox	Time Warner	Viacom
memo: SVOD content	nm	nm	nm	nm	nm	nm	HBO	Noggin

Source: Citi Research

The bottom line is this: currently the price of content is based on average viewership plus sports costs. But, in the future, the value of content will likely be driven by hit shows with peaky viewership profiles. As such, if you're a content firm with large audience delivery but few (or no) hit shows — like Viacom — you may be at risk of having your content dropped by a pay TV firm.

Aggregate US Risks

So, far, we've reviewed the Consumer Threat. We suggested ratings are weak and cord cutting is occurring. In the Advertiser Threat section we showed that the Internet is put downward pressure on ads spending relatively to PCE. And, so far most of the pain has been felt by print ads. But, recent data supports the view that the Internet's next victim may be TV. And, in the Pay TV Threat section we showed that a cable network is at greatest risk when the Predicted Defection Rate is less than the Breakeven Defection Rate especially when the PDR is small. That occurs when the price of the content is high today but you have few hit shows.

Now, our aim is to bring all of these pieces of analysis together to give investors a sense of the composite risk for each media firm with cable network exposure.

For the Consumer Threat, we think the best way for a firm to insulate itself from ratings erosion, cord cutting and cord shaving is to produce high quality content. This is notoriously difficult to predict. So, as a proxy, we think the Street will look to outlays on sports as the best insurance against shifting consumer behavior. On this metric, Disney fares best. And a number of firms — from AMC to Viacom — fare worst because these firms do not spend on sports. (This metric is a US metric and does not give credit for Discovery's recent sports investments or Fox's significant international sports rights.)

For the Advertiser Threat, we think it will be difficult for any firm to insulate itself from losses to the Internet. As such, perhaps the best way to assess this risk is to measure cable network advertising relative to total revenues. The lower the figure, the better off a firm is. On this metric, Scripps fares worst. Disney fares best.

Regarding the Pay TV threat, we've used the BDR and the PDR augmented by several X-factors (including the magnitude of the PDR, ratings trends, ownership of premium channels and RSN ownership). On this metric, Viacom fares worst and AMC fares best.

Figure 86. Aggregate US Risks

	Consumer Threat			Advertiser Threat			Pay TV Threat		
Description	Cord cutting Cord shaving Fewer viewers			Web ads steal from TV ads			Pay TV firm drops content		
Citi Framework	Outlays on sports rights			Cable TV ads / total revenue			PDR > BDR with 5 X-factors		
		Sports Outlays ($ bil)	Rank		Cable Ads to Total Revenue (pct)	Rank		PDR less BDR	Rank
Risk (high)	AMC	0	5	Scripps	0.67	8	Viacom	5.7	8
	Discovery	0	5	Discovery	0.49	7	Time Warner	5.9	7
	Scripps	0	5	AMC	0.44	6	Fox	7.3	6
	Viacom	0	5	Viacom	0.36	5	Disney	4.9	5
	Time Warner	1.936	4	Time Warner	0.17	4	Scripps	0.2	4
	Comcast	3.727	3	Comcast	0.14	3	Discovery	0	3
	Fox	4.597	2	Fox	0.12	2	Comcast	-4	2
Risk (low)	Disney	5.445	1	Disney	0.08	1	AMC	-4.2	1

Source: Press reports, Company reports, Citi Research

If we ascribe equal weights to each threat (33%), it suggests that in aggregate Viacom is at greatest risk. Conversely, Disney faces the lowest composite risk.

Figure 87. Composite Risk Scores

	Consumer Threat					Advertiser Threat					Pay TV Threat					Composite
	Rank	x	Weight	=	Score	Rank	x	Weight	=	Score	Rank	x	Weight	=	Score	Score
Viacom	5.0		33%		1.65	5		33%		1.65	8		33%		2.64	5.9
Scripps	5		33%		1.65	8		33%		2.64	4		33%		1.32	5.6
Discovery	5		33%		1.65	7		33%		2.31	3		33%		0.99	5.0
Time Warner	4		33%		1.32	4		33%		1.32	7		33%		2.31	5.0
AMC	5		33%		1.65	6		33%		1.98	1		33%		0.33	4.0
Fox	2		33%		0.66	2		33%		0.66	6		33%		1.98	3.3
Comcast	3		33%		0.99	3		33%		0.99	2		33%		0.66	2.6
Disney	1		33%		0.33	1		33%		0.33	5		33%		1.65	2.3

Source: Citi Research

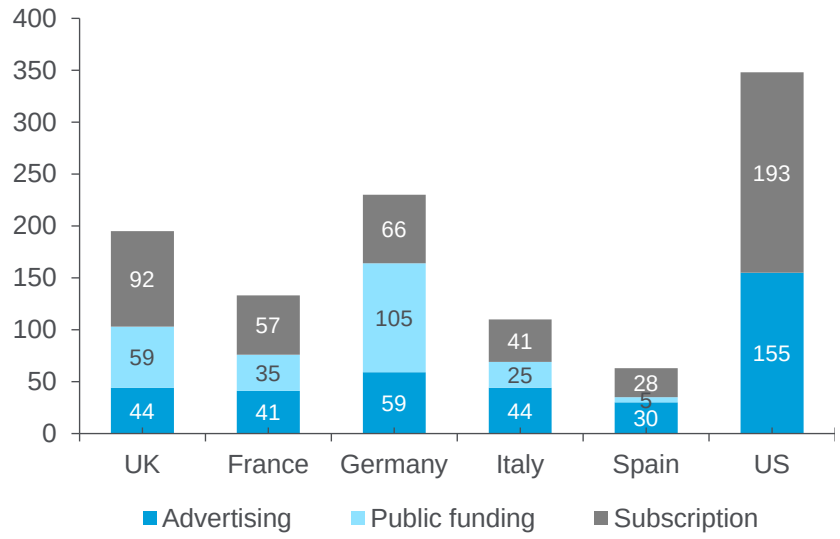
Three Threats in the European Market

So, what does all this mean for Europe? To answer that question, we'll use the same framework: the Consumer Threat, the Advertiser Threat and the Pay TV Threat. It is worth highlighting, however, that the European TV market is very different from the US. And, even within Europe, there are differences across the five main markets: UK, France, Germany, Italy and Spain.

How Europe Differs from the US

The European TV market is dominated by free-to-air while the US is dominated by pay TV. Indeed, total TV spend per head — including subscription fees and advertising — is at least 1.5x higher in the US relative to the main European markets. While public funding of TV closes some of the gap, several factors explain the spending gap. First, ad loads are higher in the US (15 to 20 minutes per hour versus maximum of 12 minutes per hour in Europe). Second, pay TV penetration is higher in the US. Pay TV penetration in the US is close to 80%. In Europe the highest level of pay TV penetration is in France at 56%. Germany has the lowest level at 19%.

Figure 88. TV Revenue per Head (2013, £)



Source: Ofcom, IHS, Industry data

Arguably, markets with high pay TV, Internet and 4G penetration are most likely to experience more rapid changes in consumer viewing habits, as consumers take the opportunity to 'unbundle' their pay TV subscription or make use of OTT services via their connected TVs or other devices. Within Europe, this makes the UK and France appear most vulnerable. Even so, in the long run, it's hard to see how this transition in consumer behavior is going to be avoided in developed markets around the world, including Europe. The change in the level of 4G mobile penetration highlights the speed at which technology is enabling changing consumer habits. At the end of 2013, 4G penetration in the UK was around 5%. Within a year it had reached 20%.

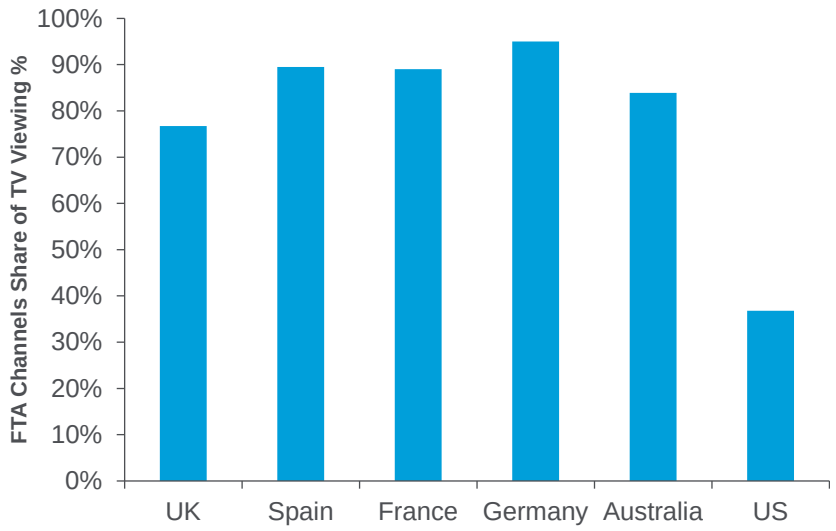
Figure 89. Penetration Rates by Market (2013)

	Pay TV penetration	Internet penetration	4G penetration of mobile 2014
US	86%	78%	42%
UK	51%	84%	20%
France	56%	80%	14%
Germany	19%	83%	8%
Italy	25%	58%	3%*
Spain	28%	67%	18%
Australia	30%	75%	20%

*Note: this relates to 2013
Source: IHS, Ovum, Citi Research

The other main difference between the US and Europe, driven by the pay TV/channel landscape, is that TV viewing time in Europe is concentrated on the FTA channels. FTA's share of viewership varies from 77% to 95% (versus ~37% in the US). The implication is clear: any change in consumer viewing habits is likely to have more bearing on FTA TV in Europe, than it does on pay TV. In Europe, it's less about cord cutting, and more about technology enabling consumers to view the content they want to see, when they want to see it.

Figure 90. Share of Viewing on Free (Ad Funded) Channels



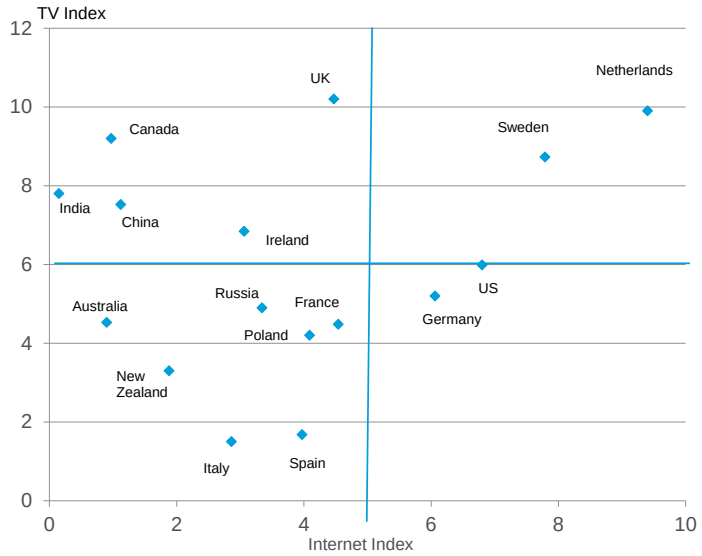
Source: BARB, Mediametrie, Kantar, Statista.com, Nielsen, Citi Research

To assess the risk of OTT globally, we created two indices.

- First, the Internet index looks at broadband penetration rates, broadband speeds and data caps. Countries with high penetration rates, high speeds and no data caps receive higher rankings.
- Second, the TV index looks at pay TV penetration rates and free-to-air alternatives. Countries with high pay TV penetration rates and many free-to-air options receive higher rankings.

As such, markets in the upper-right quadrant face the greatest OTT risk while markets in the lower-left face the smallest risk. The UK may face the highest risk among the main European markets, followed by France, Germany, Italy and Spain.

Figure 91. Internet – TV Threat Matrix By Country



Source: Citi Research

While the structure and starting point is different in Europe versus the US, there are common threads and we therefore use the same framework to think about the potential threats.

Item #1: The Consumer Threat

Like the US, the main providers of audience measurement data have faced scrutiny from the industry participants. It's worth noting that the measurement by market does vary in Europe. In the UK and France, for example, the data incorporates time shifted viewing seven days after air date. But, in France this change just occurred in late 2014. And, in Germany, it captures only three days of time shifting.

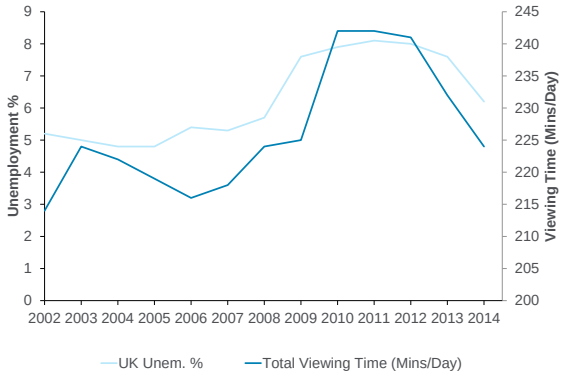
In Germany the audience ratings body (AGF) announced that it will include YouTube and other digital platform viewing in their audience reports this year. Last year, Norway started to include all video viewing across all devices/locations, resulting in a reported 15% lift in viewing times. Sweden recently announced that online and linear video viewing will be consolidated into a single metric.

We could see adjustments to viewing time as panels are adapted to include online measurement. And, this may mean we see an increase in overall viewing time in the near term. But, there are three reasons we don't necessarily think this will be positive for the traditional TV operators:

- First, consumers have a finite amount of time. So, after an initial potential increase in video consumption, this is likely to plateau and cannibalize linear viewing in the long-run.
- Second, from the perspective of the broadcasters, time shifted viewing is already being monetized via online ads.
- Third, additional detail on audiences of non-linear 'channels' may actually provide consistent (and legitimate) data for the challengers to use as currency for taking advertising share.

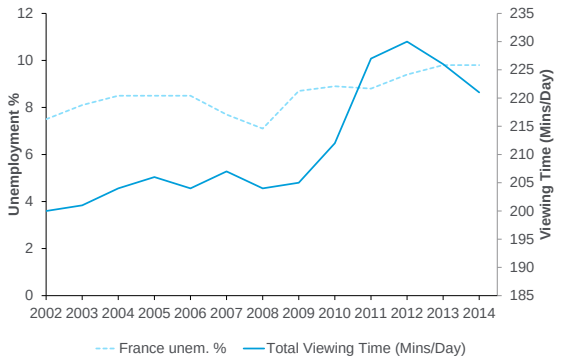
The other consideration is whether there are cyclical drivers in the change in linear viewing time. Our analysis shows that there is an 80%+ correlation between unemployment and linear viewing trends (except in Germany). The UK, in fact, has seen linear viewing decline in the past three years, and France and Spain for the past two years. In 2014, viewing declined 3.4% in the UK and 2% in France and Spain. Italy is the only market where viewing has continued to grow. Germany was fairly stable over the past couple of years.

Figure 92. UK Viewing Time vs. Unemployment



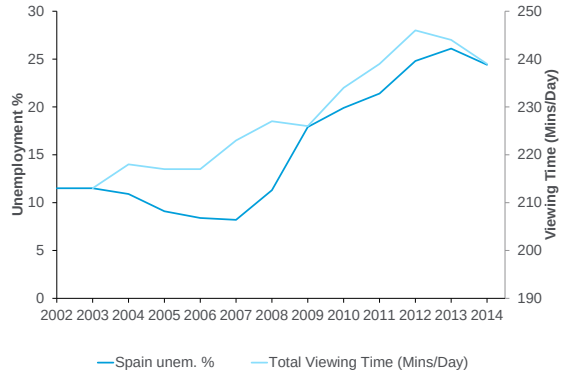
Source: Citi Research

Figure 93. France Viewing Time vs. Unemployment



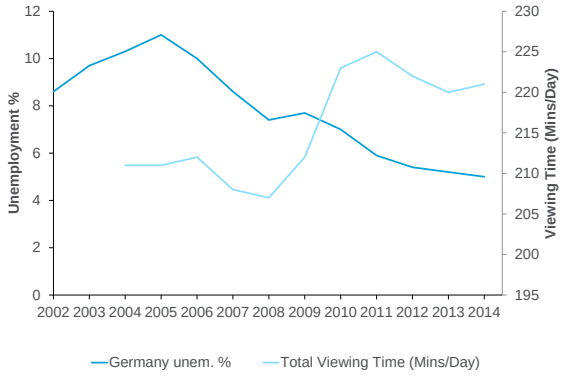
Source: Citi Research

Figure 94. Spain Viewing Time vs. Unemployment



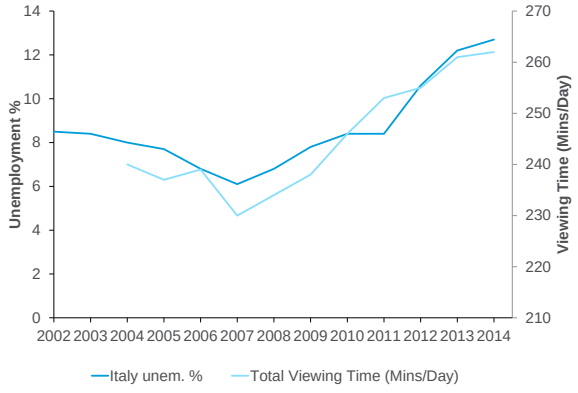
Source: Citi Research

Figure 95. Germany Viewing Time vs. Unemployment



Source: Citi Research

Figure 96. Italy Viewing Time vs. Unemployment

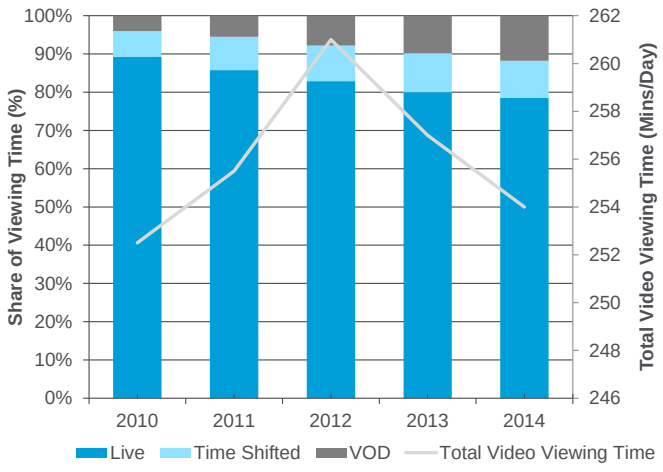


Source: Citi Research

While macro factors (like employment) may influence the magnitude of TV consumption, it's hard to deny that there are structural shifts. Within Europe, the UK market has the most available data, so we will often use that as the reference point.

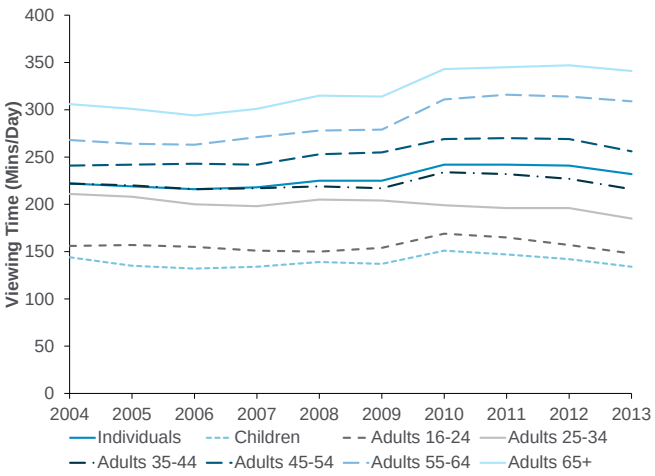
Our analysis highlights the structural shift in how video is consumed. Firstly, in the UK, 2013 was the first year in which all age groups saw viewing time fall. The decline was more pronounced in the younger categories where unemployment is less relevant. Secondly, in the UK real time TV viewing fell from 89% of overall video viewing in 2010 to 78.5% by 2014. In tandem, time shifted viewing — including DVR and 7 day catch up — and VOD took share.

Figure 97. UK Share of Total Video Viewing Time



Source: BARB, Ofcom, Citi Research

Figure 98. UK Linear TV Viewing Time by Age



Source: BARB, Ofcom, Citi Research

While live TV viewing is still the largest contributor to overall video viewing, the Sandvine data presented earlier highlights that in Europe, Real Time Entertainment represents 38% of web traffic. In the UK, Netflix is the second largest source of downstream traffic during peak evening hours accounting for 17.8% of traffic (YouTube 19.9%). Clearly VOD is gaining traction. As we noted earlier, the increase of broadband and 4G penetration is likely to help drive that higher.

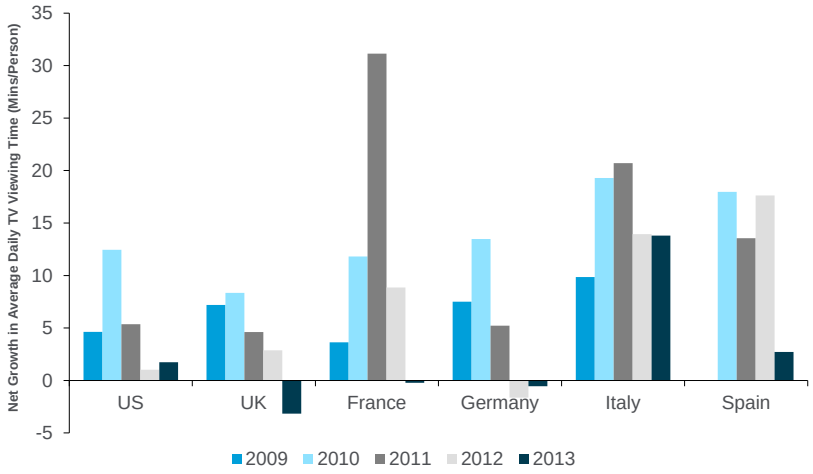
VOD: Additive or Cannibalistic?

Our next consideration is whether VOD is additive to linear viewing, or cannibalistic. There will be some cyclical factors and some structural factors driving this. It is clear from Figure 100 that, in general, the net change in video viewing has been positive between 2009 and 2013. This trend is driven by growth in non-traditional viewing. As we noted earlier, 2009 to 2012 saw traditional viewing increase driven by heightened unemployment, so it is not necessarily conclusive that an increase in non-traditional viewing will expand overall video viewing time.

In most markets the expansion of overall viewing time appeared to slow in 2011/12. In 2013, half of the markets saw a small contraction in overall video viewing time. On average, viewing time across all markets (except Italy) increased by only one minute per day per person. Taking into account only those markets where unemployment had started to normalize — like the US, UK and Germany — viewing times contracted about two minutes per day per person in 2013.

With limited data (coupled with various influencing factors), we're cautious about placing too much emphasis on the data. What we do know is that given our economists forecast unemployment rates continuing to come down in Europe, linear viewing is likely to continue to fall.

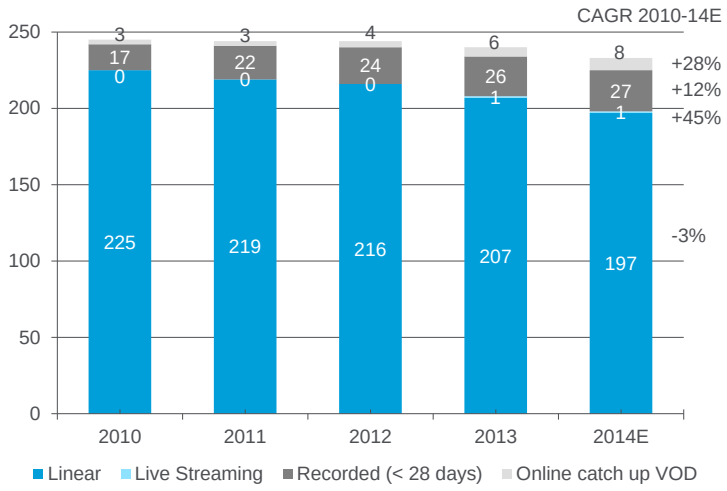
Figure 99. Net Growth in Video Viewing (Change in Traditional + Change in Non-Traditional Viewing), 2009-13



Source: HIS, Company Reports, Kantar, Citi Research

Looking more closely at the UK is a bit more conclusive. While linear viewing has been falling an average of 3% per year (from 2010 to 2014), time shifted viewing has taken share. Recorded (or PVR) viewing remains the most popular means to time shift, but live streaming and online catch-up are growing the fastest. This growth hasn't yet been sufficient to offset linear viewing declines. Overall broadcast viewing has declined about 1% from 2010-14E.

Figure 100. UK: Daily Viewing of Broadcaster Content (linear & non-linear)



Note, CAGR = compound annual growth rate.
Source: OC&C

While the European market structure differs to the US, the common thread is that there are clearly changes afoot in how consumers view video. Our analysis suggests that over the top video viewing may not be entirely additive to TV viewing in Europe. For the European broadcasters, if they can recapture the same share of eyeballs online as they do offline, the risk to advertising revenue may well be limited. Next, we consider if the broadcasters are successfully recapturing viewing online or not.

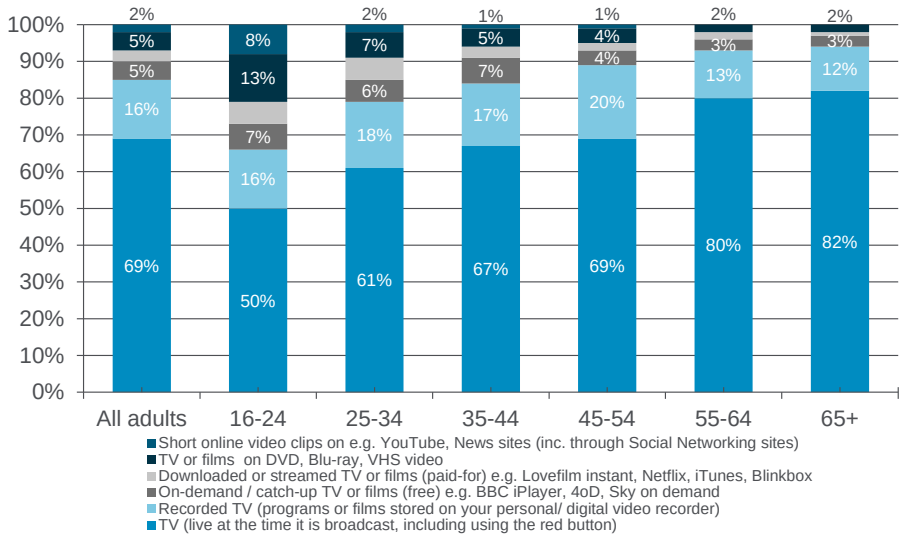
Where the Eyeballs are Going

The rise of personal video recorders (PVRs) was the first red flag for the FTA broadcasters as it has led to a decline in impacts. PVR penetration appears to have plateaued in the past couple of years in the UK at ~75% penetration. This may be because OTT platforms and catch up services now offer an alternative. The challenge for the FTA broadcasters is that with PVRs the viewer at least remains within the same ecosystem of channels (and TV advertising budgets haven't really seen a negative impact of PVR usage). The danger with viewing shifting to OTT platforms is it presents the next phase of channel fragmentation for the broadcasters.

Now we delve even further into this to look at where viewing is going to, and how 'audience share' looks in an online video world.

The reality is that viewing habits vary by age group. In the UK, Ofcom found that only 50% of video viewing time is spent watching live TV amongst 16-24 year olds versus 69% for all adults. What may be more surprising is that 13% of video consumption is via DVDs for 16-24 year olds, compared to only 5% of time for all adults.

Figure 101. UK Video Consumption Share by Type



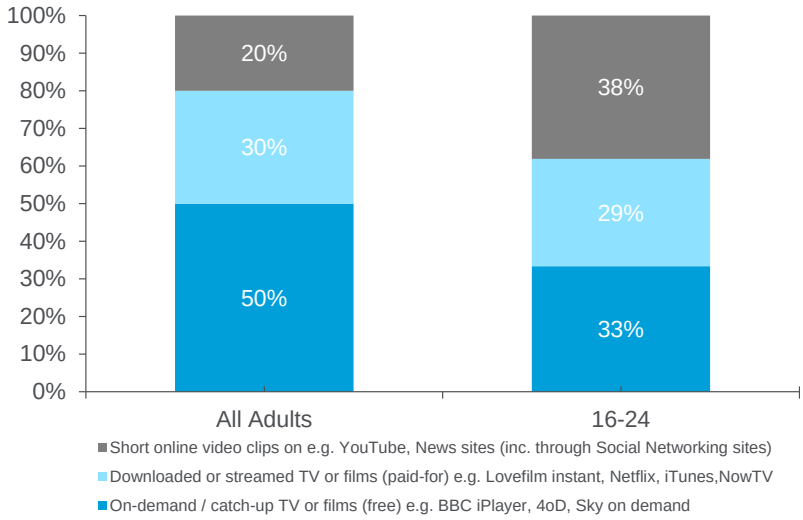
Source: Ofcom

Looking at online only video viewing, we make the following observations:

- Short form video is the most dominant amongst 18-24 year-olds at 38% of online video viewing time versus 20% for all adults.
- Interestingly, for both groups, paid for VOD (no ads) makes up close to a third of video viewing time.
- Ad funded/free VOD makes up 50% of online video viewing time for all adults versus 33% for 16-24 year olds.

Even assuming short form viewing time doesn't impact linear/long form video viewing time, then catch-up/Ad-funded VOD would still only take ~63% share of all adults viewing time online versus >75% share in a linear world. For the younger age group it rises to ~40% of share. The big question is whether viewing habits of 16-24 year-olds will sustain or evolve as they age.

Figure 102. Online Video Viewing – All Adults & 16-24 Year Olds



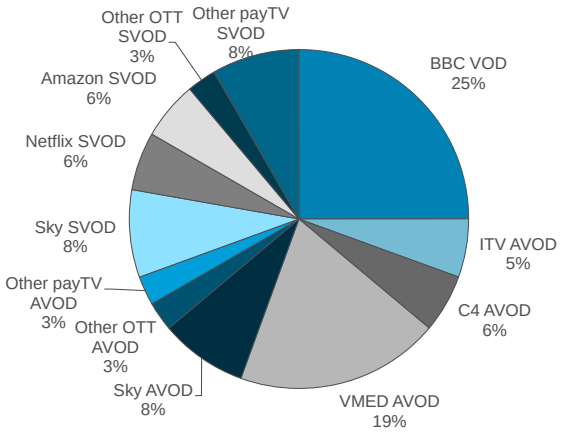
Source: Ofcom, Citi Research

Taking it a step further and looking at the long form video viewing split by platform (ignoring transaction VOD), ad-funded VOD (within this we include the BBC as it's free, although it doesn't carry advertising) takes ~70% share of the long form VOD market versus subscription VOD ~30%. This broadly tallies with the data above. We have included a pie chart of share of linear viewing by main channel operators to compare share by channel group. The interesting observations from the chart by platform are:

- The FTA broadcasters only take ~35% of VOD share directly via their own sites. This compares to >70% share of audience in a linear viewing world. Arguably the VOD share will be higher as VMED (Virgin Media) and Sky AVOD will also include catch up content from the FTA broadcasters. Even if we assumed that VMED and Sky AVOD was entirely driven by the FTA broadcaster's content, then there would still be ~6ppt deficit versus linear viewing share.

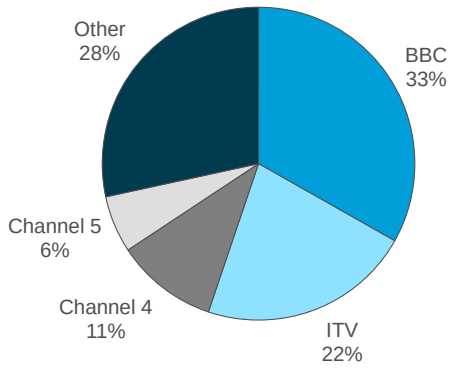
- The linear versus VOD viewing gap varies drastically by broadcaster. The BBC takes 25% long form VOD share versus 33% linear viewing share. ITV, however, takes only ~6% VOD share directly versus 22% linear viewing share. Channel 4 fares better, as it has a similar share of VOD directly as ITV but the gap versus linear viewing share is only ~5ppts. We see two main reasons to explain these differences: 1) Channel 4 has a younger audience demographic of the channel groups, and therefore is more likely to attract eyeballs online; 2) the BBC doesn't carry advertising, while ITV and Channel 4 does, and this may highlight the dislike of advertising around VOD; and 3) there is a high proportion of children's content on the BBC iplayer, and users can download (to view offline) on the iPlayer (Channel 4 has recently introduced this option on some content).
- Due to the high share of viewing time on BBC online, and the SVOD share of time, >50% of long form VOD viewing in the UK is on platforms that carry no advertising.

Figure 103. UK Long Form VOD Viewing by Platform (Based on Time)



Note: Sky's Now TV site within other OTT SVOD
Source: Citi Research

Figure 104. Linear Viewing Share by Channel Group



Source: BARB

Looking at the top 10 video and TV sites by market (based on traffic) also paints a very different picture to that of linear TV. YouTube tops the list across all five European markets. There are also several illegal video sites that feature in the top 10. Germany is the only market where neither of the listed FTA broadcasters rank in the top 10. While the ranking is just a snapshot in time, we believe it illustrates two things: 1) broadcasters face a fragmented on-line market; and 2) piracy remains on issue online. For broadcasters this isn't such bad news, as it presents a greater problem for SVOD services than ad funded services. However, for owners of content it puts pressure on the value in the industry.

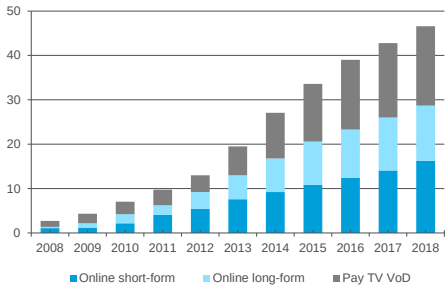
Figure 105. Top 10 TV & Video Sites by Market (as of October 2015)

	UK	France	Germany	Spain	Italy
1	Youtube	Youtube	Youtube	Youtube	Youtube
2	Netflix	**TF1.fr**	Bs.to	Mega-apps.es	**Mediaset**
3	**Sky**	Programme-TV.net	Netflix	**Telecinco.es**	**Sky**
4	ITV	Dailymotion	**Sky**	Plus.es	Nowvideo
5	Vimeo.com	Maxiwebtv	**Nowtv**	**Mitele.es**	**Rai**
6	Dailymotion	Papystreaming	Giga	Newpct1.com	Staseraintv.com
7	**Channel4**	Bfmtv	**Zdf**	**Atresplayer**	**Mediasetpremium**
8	Watchseries.li	Netflix	Dailymotion	Miravideos.net	Dailymotion
9	Filmon.com	**Mycanal.fr**	Livetv.sx	**Antena3.com**	Eurostreaming.tv
10	Vodlocker.com	**6play.fr**	Myvideo.de	Filmon	Vidto.me

Source: SimilarWeb (20 October 2015), Citi Research. Bold = broadcast/pay TV online platform

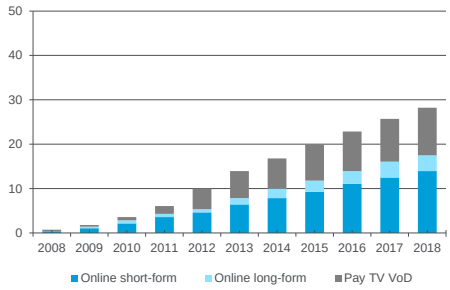
While we have used a lot of UK data to highlight the consumer threat, we noted earlier that those markets with higher internet/4G penetration rates are likely to see the shift in consumer viewing habits. The VOD viewing time forecasts from IHS also demonstrate this. We make two observations: 1) by 2018E VOD consumption in Germany will average less than 15 minutes per day, the lowest of all markets; 2) The UK is the highest at 40 minutes per day in 2018E.

Figure 106. UK VOD Avg Viewing (Min/Day)



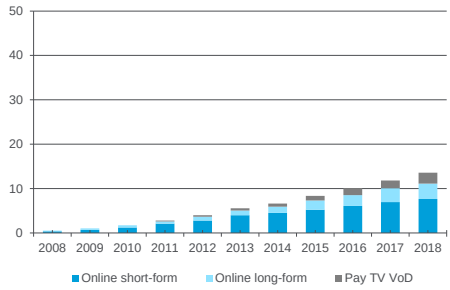
Source: IHS

Figure 107. France VOD Avg Viewing (Min/Day)



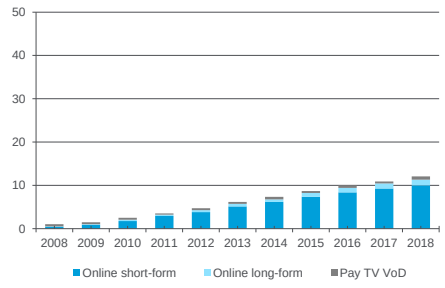
Source: IHS

Figure 108. Germany VOD Avg Viewing (Min/Day)



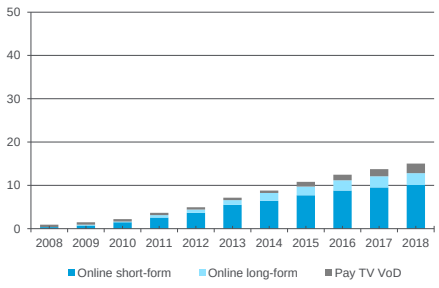
Source: IHS

Figure 109. Italy VOD Avg Viewing (Min/Day)



Source: IHS

Figure 110. Spain VOD Avg Viewing (Min/Day)

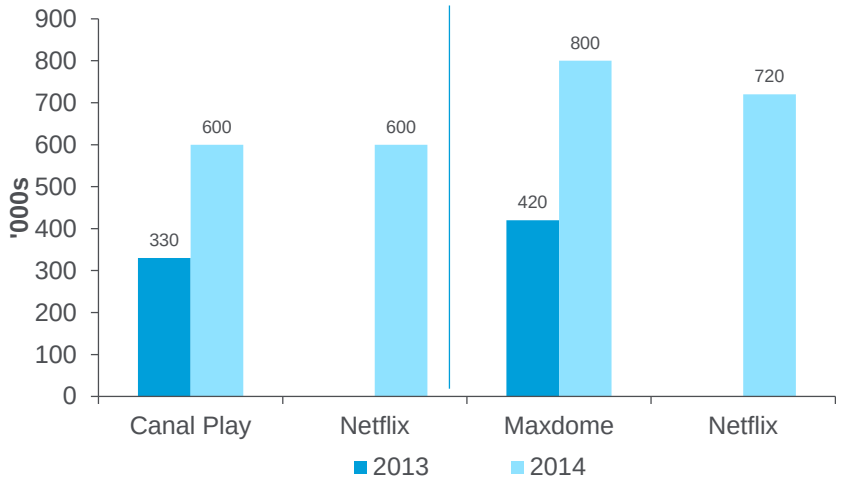


Source: IHS

The ramp up in VOD consumption appears steady for each market, but these trends are often difficult to predict. Germany is an interesting example. It is cited as the market that is least likely to be challenged by VOD as consumers aren't willing to pay for content, there's a significant range of channels available in FTA, ad minutes are lower than the US and local content is important. However, the sub numbers that Netflix managed to attract within a quarter of launching are not insignificant, and are not far off the level of subs of Maxdome (P7S1's VOD platform that has been in existence for some time).

We make two interesting observations: 1) it is notable how quickly the sub gap closed versus Vivendi's CanalPlay in France and P7S1's Maxdome in Germany, despite Netflix carrying limited local content. The increase in competition could push out the break-even point for the local OTT operators (recently confirmed by P7S1 as it amended guidance for breakeven at Maxdome to 1.5m subs, from 1m subs due to rising competition); and 2) Netflix's penetration of the German population (at 1% within 3 months) has been no slower than that of France (also at 1%), despite a more supportive internet infrastructure in France. Germany may be less protected from the structural shift in viewing than we think and, more broadly, the IHS forecasts could be extremely conservative, especially since Netflix has recently launched in Spain and Italy.

Figure 111. Netflix Sub Base vs. Largest SVOD Competitors in France & Germany ('000)



Source: SNL Kagan, Company Reports, Citi Research

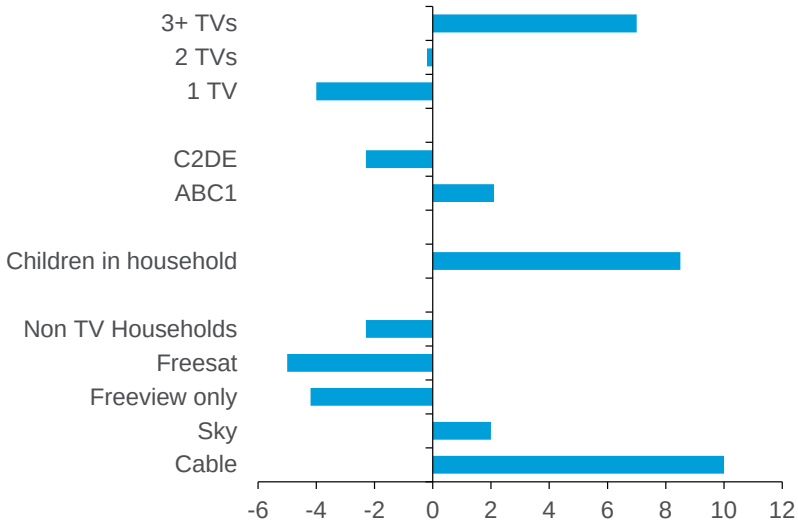
We have established that consumers are likely to view more video over the top, which in turn drives further channel fragmentation, raising the risk that incumbent broadcasters can't recapture all of the linear audience leakage via online services. Now we consider the risk of pay VOD stealing eyeballs, and the propensity amongst consumers to pay.

Are Consumers Prepared to Pay for Video?

Netflix features in the top 10 video in Germany and the UK, and SVOD sites take up ~30% share of video viewing time. This suggests that we are beyond the early adopter phase and there is impetus to pay.

Courtesy of BARB, we can get a better view of the demographics of the average Netflix sub in the UK. What this shows is that they tend to be heavy TV viewers (3+ TVs in the house), more likely to have a pay TV subscription (cable is probably high due to VMED offering it via its platform) and more likely to be ABC1.

Figure 112. UK Netflix Subscriber Profile (4Q14)



Source: BARB Establishment Survey

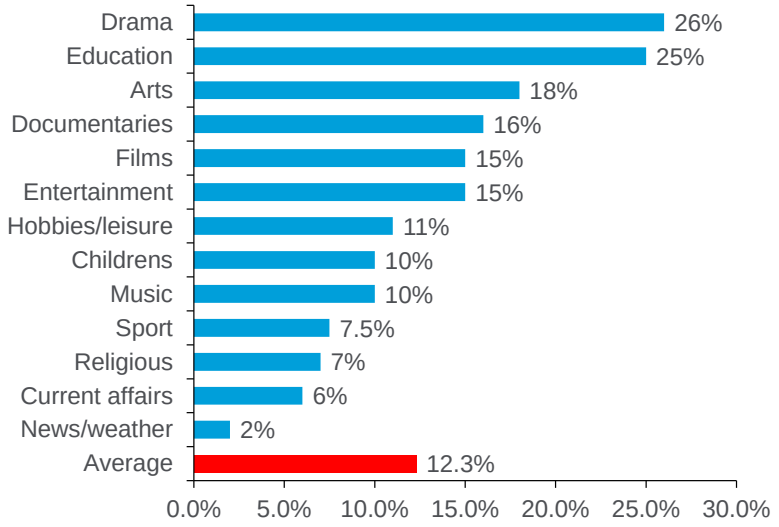
TV light homes and homes with only FTA are less likely to have a Netflix subscription. This makes sense as these are also the homes where TV viewing has less value, and where there may never be willingness to pay for video. It may also be homes where Internet connections are slow/poor, and an SVOD service isn't an option. This at least offers some comfort for FTA broadcasters that the change in viewing habits of the broader population may happen at a manageable pace. It also means that as the 'reluctant payers' increase viewing online, the FTA broadcasters with the AVOD platforms are likely to be the main beneficiaries, which may help narrow the offline and online audience share gap.

Genres Vulnerable to Time Shifting

Next we consider the genres most at risk of time shifted viewing. Like the sports argument for pay TV, exposure to popular live content is important for FTA broadcasters in order to maintain scale in audience delivery, which is the main support for TV advertising.

When we look at the genres that consumers are most likely to view on a time shifted basis it's no surprise that drama is at the top and sports and news is towards the lower end. Netflix's genre profile reflects this, with the appeal being driven by exclusive dramas and the means to 'binge-watch'.

Figure 113. UK: % of Time Shifted Viewing by Genre



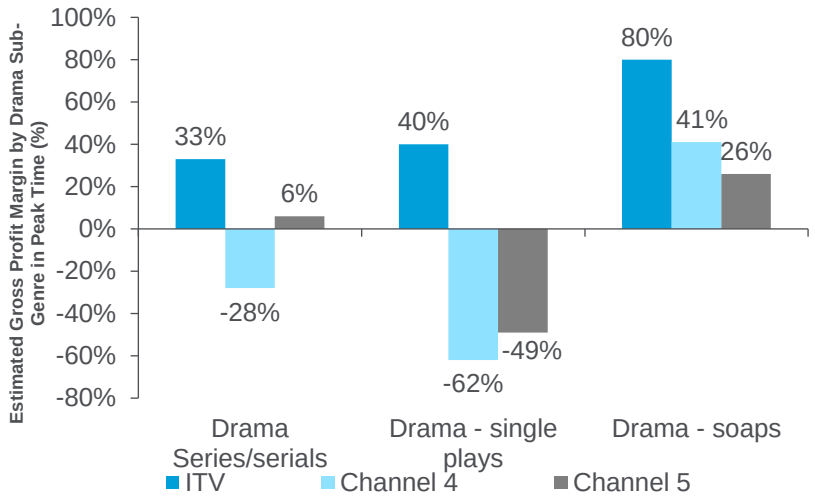
Source: BARB

What is interesting, however, is a comment we heard recently from management of one of our broadcasters. It was that the channel businesses (in the US especially) are extremely focused on increasing the level of scripted dramas. With broadcast budgets only growing at ~5%, something else has to give, and that has meant reality and entertainment formats are facing the pressure. What's interesting about this is that drama feels like the genre that consumers want, as the growth in Netflix may have highlighted, but it's also the genre that increases the vulnerability of channels to linear viewing declines given the level of time shifting. While some of the benefit can be captured online (through the back catalogue as well as driving VOD usage), it increases the risk of the core business.

In the UK, we have seen the opposite trend through the recession as the public service broadcaster spend on content overall was down 20% in 2014 versus 2008, but drama spend was down 39% and spend on entertainment and comedy was flat as the broadcasters cut costly drama, to drive down the programming cost.

Drama tends to also be more costly than reality and entertainment, and as Figure 115 below highlights, scale is important for it to be a profitable investment (ITV's gross margin is positive across all drama types versus mixed outcome for Channel 4 and 5, both of which have much lower audience share).

Figure 114. Estimated Gross Profit Margins By Drama Sub-Genre

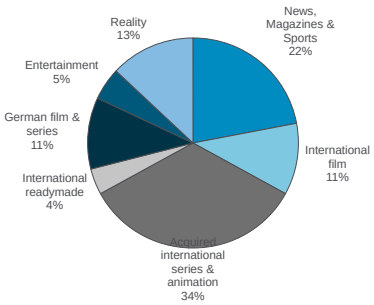


Source: Citi Research

O&O make an interesting point in a recent report on content creation (August 2014) that one of the reasons that broadcasters increasingly turn to international formats — now making up 20%-30% of peak time broadcast across Europe — is to limit the high risks of trying out a new program idea. Adapting a format that has worked elsewhere is seen as far less risky. According to O&O, about half of new programs fail on the first airing, with only 1 in 8 becoming longer term successes. As long as rights continue to be sold into Europe on a market by market basis, those acquiring rights to international shows and formats for a particular market should remain relatively shielded from a dramatic change in the competitive landscape. The contracts, with the US studios in particular, tend to be long term so any disruption is unlikely to come in the near term, although they won't be immune to content cost inflation.

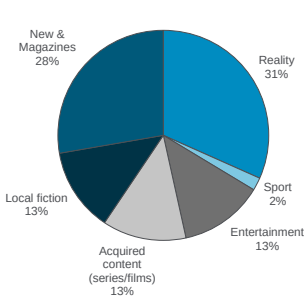
Figures 116, 117 and 118 show programming exposure for three of the European broadcasters. Based on the genres vulnerable to time shifting, ProSiebenSat.1 appears at most risk of broadcast content being time shifted (60% of programming hours is film/series, and >50% is US acquired content), and RTL the least vulnerable (23% of programming hours being series/films).

Figure 115. P7S1 Programming Exposure



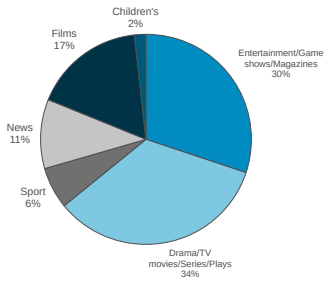
Source: Company Reports (2013, split by hours)

Figure 116. RTL (Germany) Programming Exposure



Source: Company Reports (2012, split by hours)

Figure 117. TF1 Programming Exposure



Source: Company Reports (2014, ex one off sports, split by cost)

So, to recap, linear viewing may still dominate video viewing time in Europe, but it is declining (albeit slowly). Technology developments will only accelerate the shift to online viewing further. Quite bluntly, the data suggests that not only is online viewing not necessarily additive to linear viewing time, the FTA broadcasters face the risk of share moving from >70% in a linear world, to only 50% of viewing time in an OTT world. Competition for rights will increase and FTA broadcasters may increasingly be priced out of sports rights in Europe (bar the rights for one off events that are often required to be on FTA TV). Those reliant on drama and/or US acquired content may be most at risk of content cost inflation and time shifted viewing.

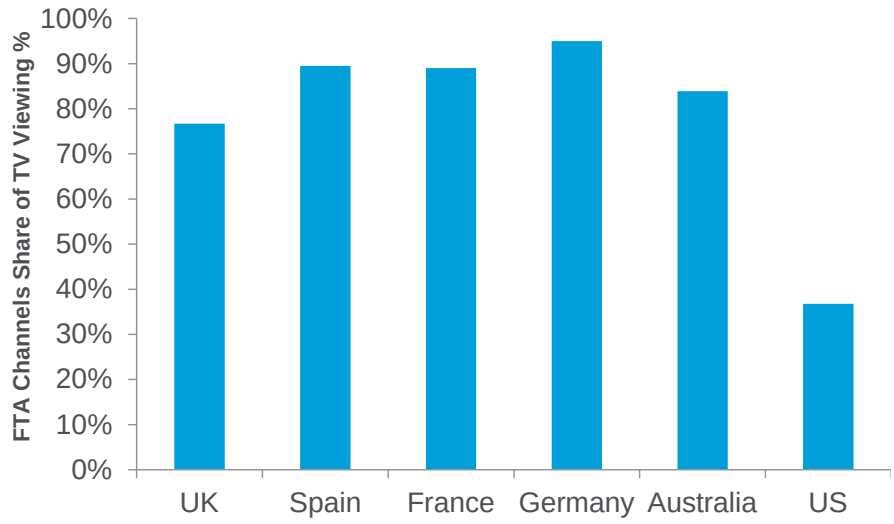
One saving grace may be the reluctance of non-pay TV customers to pay for video content, which could help to limit the pace of the shift online, and could also mean the FTA broadcasters see some online viewing share shift back in their favor as the laggards prefer 'free' VOD.

We consider the impact of pay TV in due course. For now, let's look at how these changes in usage could impact the advertising ecosystem.

Item #2: The Advertiser Threat

What is clear from our analysis is that despite market structure differences between Europe and the US, the European consumer habits aren't that dissimilar to those of the US consumer when it comes to video consumption i.e. there is an increase in time spent on online video. Viewing in the European TV market is dominated by the free to air ad funded channels, as opposed to cable networks which are funded wholly or partially by affiliate fees. While cord cutting and cord shaving may be less relevant in Europe, understanding the implications for TV advertising from changing consumer habits is vital as this is the main source of revenue for the European broadcasters.

Figure 118. Share of Viewing on Free (Ad Funded) Channels

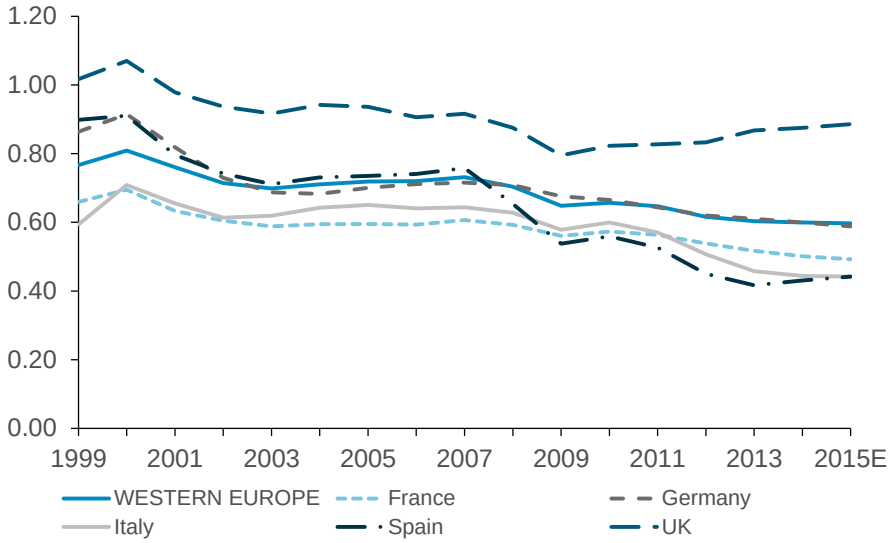


Source: BARB, Mediametrie, Kantar, Statista.com, Nielsen, Citi Research

The Relationship between Advertising and GDP

Taking a step back from TV advertising, it appears that the overarching ad trends in Europe have been similar to the US. Looking at the longer term relationship between advertising and GDP, the average nominal GDP multiplier has come down from just over 1x in the 1960s-1990s, to closer to 0.8x in the 2000s. In 2015E, global ad spend as a percentage of GDP is expected to be ~10bps lower than the 16 year average. There has been one major shift during this period: an increase in online ad spend (from 1.8% share in 1999 to close to 30% by 2015E). This has dragged on overall ad spending as an almost infinite supply of inventory has put pressure on pricing, and greater targetability drives more efficiency of spend.

Figure 119. Europe: Advertising Share of GDP

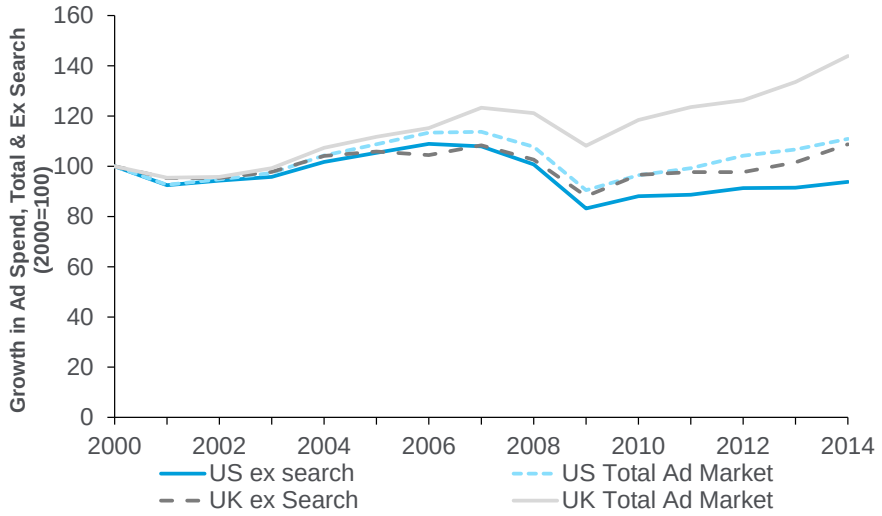


Source: GroupM, Citi Research

Within Europe, advertising as a share of GDP has increased in only one market since 2009: the UK. On closer examination even this may be definitional. That's because search is included in to the advertising spend total in the UK, whereas the limited available information in other European markets means search is likely to be underestimated.

In the UK, search makes up ~50% of online ad spend and 25% of overall media spend. And, it's clear that the bulk of growth in the UK ad market over the past 15 years has been driven by search. The overall UK ad market is up 44% since 2000 and up 21% since 2007. However, when you exclude search, the ad market is up only 9% since 2000 and is flat since 2007. When you take into account that nominal GDP is up ~20% in the UK since 2007, the implication is that the underlying trend in UK (brand) advertising spend as a percent of GDP is not dissimilar to other markets. If anything, the relationship with GDP has weakened more so.

Figure 120. Growth in Ad Spend in US and UK With and Without Search



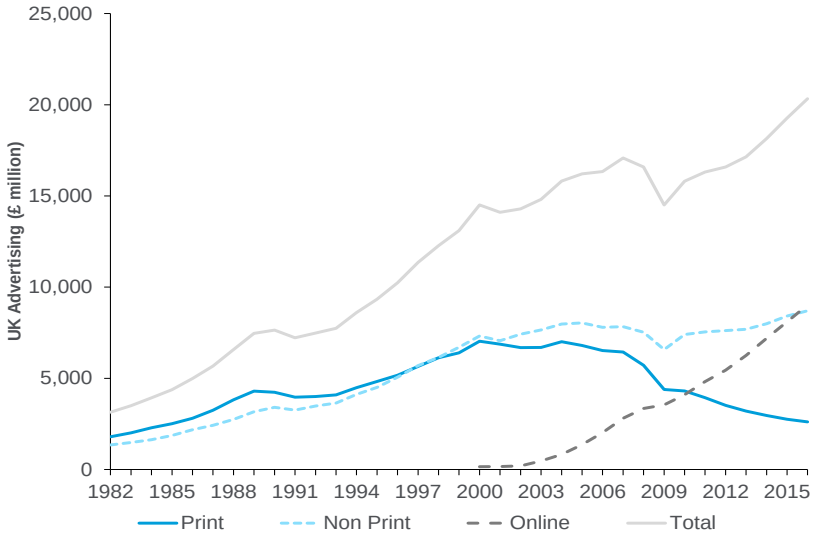
Source: Magna, Citi Research

UK History is Similar to the US

There are a few important long-term ad trends in the UK:

- The print category peaked in 2000 at about £7 billion ($10.8bn), and was broadly stable until 2007, then print ad spend began to contract fairly heavily.
- Online spend overtook print in 2010, and online has seen a very steady (and steep) increase since the early 2000s.
- The non-print, non-Internet ad spend has been flat for ~10 years. Clearly the recession had an impact in 2008/09, but the UK ad market bounced back fairly quickly. Unlike the US, this portion of ad spend is still expected to see mild growth over the next couple of years. We wonder how sustainable this is, and whether structural challenges suggest this may be optimistic.
- The difference versus the US is that online is much closer to overtaking non-print ads. We expect this to occur in 2016. If online is going to continue to take share then it seems inevitable that non-print ad spend will also suffer alongside print from here.

Figure 121. Total UK Advertising Spend by Medium



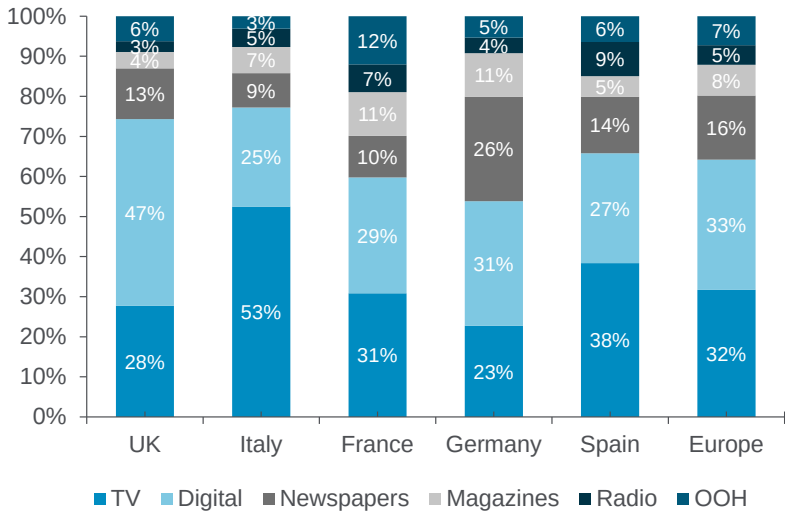
Source: WARC, Citi Research Note: Includes direct mail.

Level of Risk for TV Advertising

What is clear from the data is that Google has been the main beneficiary of ad market growth in the past 15 years (and print has been the main victim.) Consumer time will continue to shift online, and this suggests that the deflationary impact on advertising will continue. The question now is who will be the main beneficiary of ad market growth over the next 15 years? More importantly, could TV be the next victim in Europe?

Naturally we conclude that the market where TV advertising is most at risk is the market that appears to be overearning versus the average (and the US would fall into this with TV ~40% share of ad spend). This suggests TV in Italy may face the most risk. The market that appears least at risk, on this basis, is Germany. There may still be more spend to come out of print, since it still represents 26% of ad spending. Although it's interesting to note that more recently we have seen Sir Martin Sorrell (WPP CEO) come out in support of print, and our recent discussion with the UK Chairman of the IAB highlighted that he believes that localness is important, and regional press will continue to play a role in media, which is a significant portion of the German market.

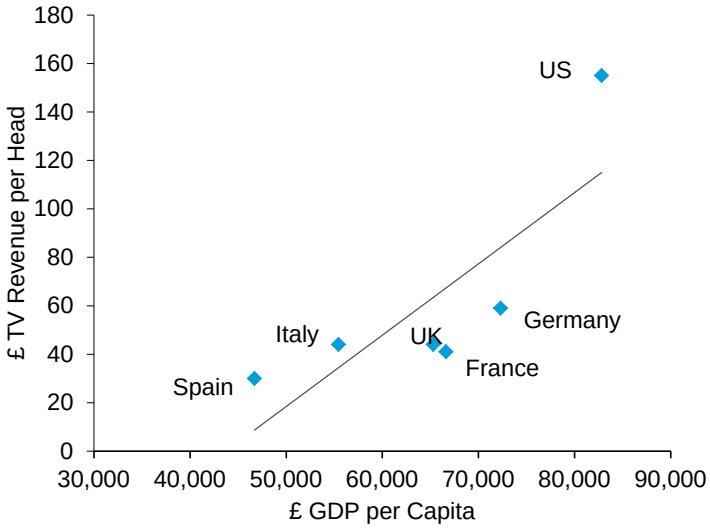
Figure 122. European Mix of Ad Spending by Media



Source: Magna, Citi Research

When we look at ad spending on a per capita basis, TV still appears to be over-earning in Italy but it doesn't look as extreme as the share level (of 53%) suggests. Spain is also over-earning, but the US is over-earning the most. France appears to be under-earning the most. In fact, Germany TV ad revenue per head doesn't seem to be out of kilter with the UK and France.

Figure 123. TV Ad Revenue per Capita vs. GDP per Capita in 2013



Source: Ofcom, Worldbank, Citi Research

With that in mind, the risks to TV are likely rising, but print could still remain a source of funds for online advertising as print still stands at ~21% of spend on Europe (~15% in the US) versus TV at 32% (~40% in the US). This makes sense when you think about the fact the TV minutage in the US is much higher (and more disruptive) than the level of minutage in Europe, and therefore TV ad spend share is naturally higher.

However, share of online spend in Europe is also more advanced than in the US, and print is clearly a finite source of funding. If linear TV viewing continues to fall as consumer habits change (and CPMs in digital media fall), then the implied CPM (cost per thousand) will get to the point where TV is no longer efficient/cheap.

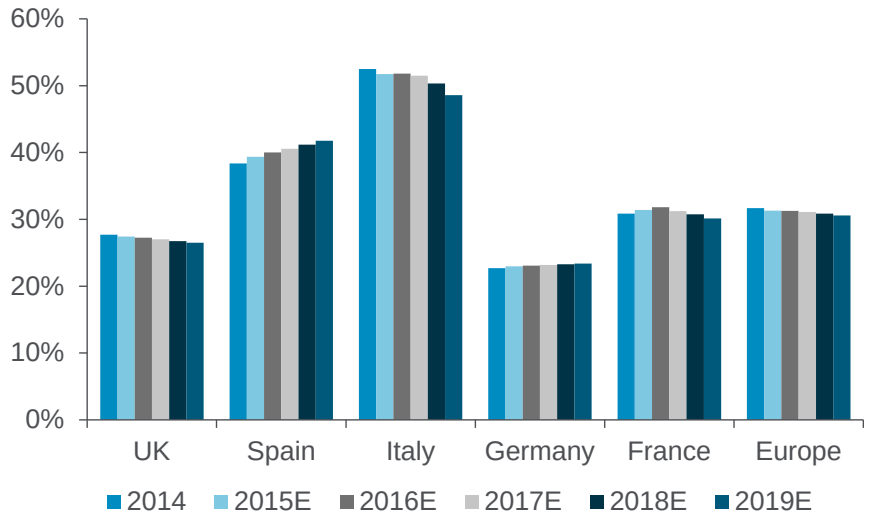
Closer Look at Video Ad Spend

When we look at growth rates by medium, we can see that 2011 was the year when video ad spend in Europe accelerated, and across 2011-13 broadcast TV channels saw negative growth. In 2014, broadcast TV saw growth but that likely reflects the better macro environment rather than a sign of growth reaccelerating.

Looking more closely at the key markets in Europe, we observe that:

- TV share of ad spend is expected to continue to come down in Europe by ~1ppt 2014-19E.
- UK TV share is expected to fall, despite online spend already exceeding TV.
- TV ad share in Spain is forecast to increase from its already elevated level of ~50%. To us, this suggests the cycle is important. For Spain, the TV ad market remains ~45% below the peak, and while TV share appears high it is deemed to be extremely cheap on a CPM basis vs. history and other media (including online).

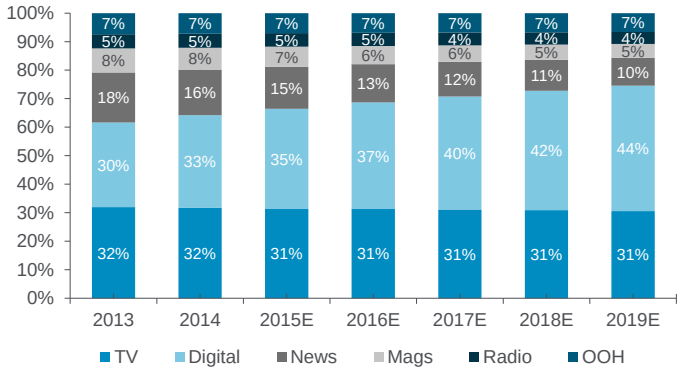
Figure 124. TV Share of Ad Spending in Europe



Source: Magna, Citi Research

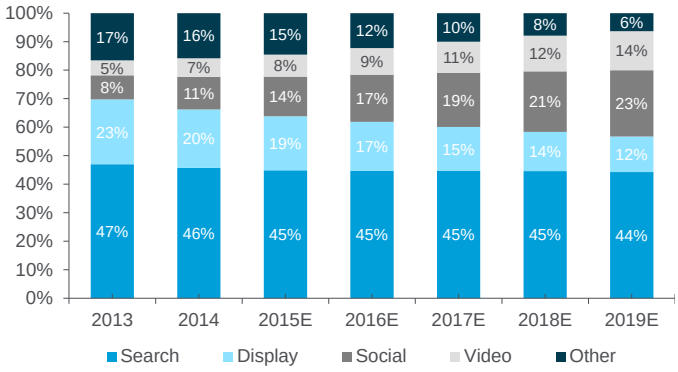
Magna forecasts digital spend to increase share by close to 10 percentage points in the next four years in Europe. Print will continue to be main source of share gain, but TV will not be immune. Looking closer at share of digital ad spend, traditional media isn't necessarily going to be the only source of funds for online video. There is likely to be some share shift within digital from Display advertising to Video and Social.

Figure 125. Mix of Ad Spending in Europe 2013 to 2019E



Source: Magna, Citi Research

Figure 126. Europe: Digital Media Spend by Category



Source: Magna, Citi Research

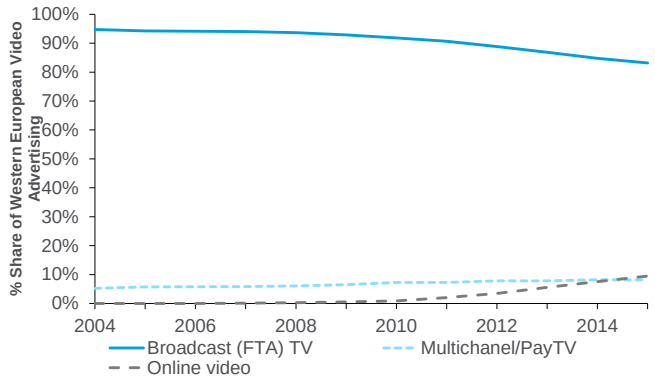
Capturing Share of Online Video Advertising

So, we've argued that viewing is increasingly shifting online and established that TV ad revenue could come under pressure. In fact, if Magna is right that TV advertising share leakage is only 0.3 percentage points a year, in a European ad market expected to grow ~2.5% from 2014 to 2019, then the outlook for TV advertising is still broadly positive (more so than for the US), implying ~2% growth for TV advertising annually. However, the danger is that the market underestimates the timing and/or pace of structural shifts.

Later we look at what the overall video advertising growth rate may look like for the European broadcasters if the TV ad market growth reflects linear viewing trends. Having established that incumbent FTA broadcasters may struggle to recapture all of the linear audience leakage, we firstly assess whether the broadcasters can recapture advertising leakage, or accelerate overall growth via their AVOD sites.

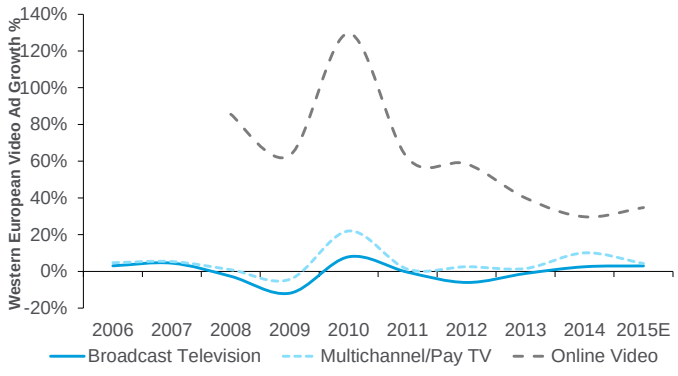
If we look at video ad spend overall in Western Europe we can see that over five years online video advertising has gone from ~1% share of video ad spend, to 8%. While it will overtake multichannel/pay TV channel share of video advertising, it is broadcast TV channels (incumbent channels) that are losing share (with an ~8ppts of share erosion during 2010-15E). Unlike the US where the cable networks may be most vulnerable to advertising pressures, European broadcasters don't have that line of defense.

Figure 127. Share of Western Europe Video Advertising



Source: Magna, Citi Research

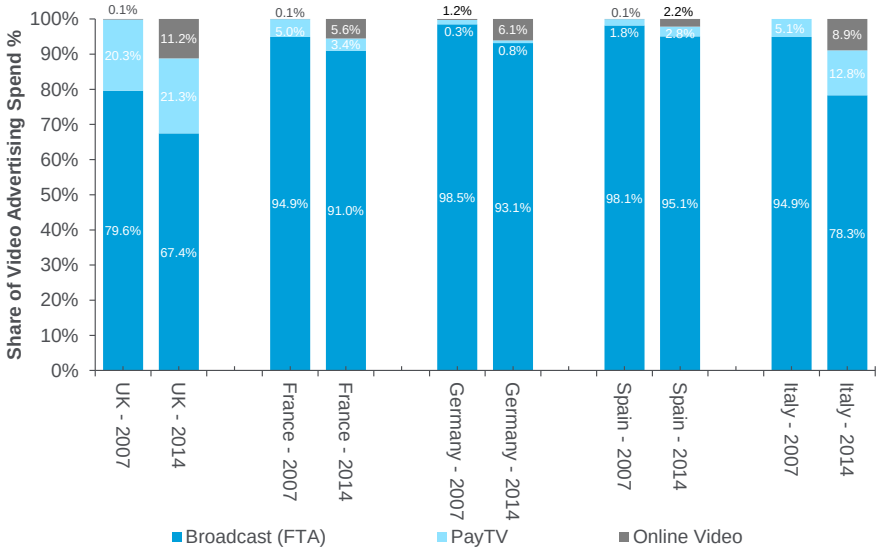
Figure 128. Western Europe Video Ad Growth Rates by Medium



Source: Magna, Citi Research

FTA share of video advertising is lower across all European markets than it was seven years ago. Both Pay TV and online video have been beneficiaries (especially in Italy and the UK).

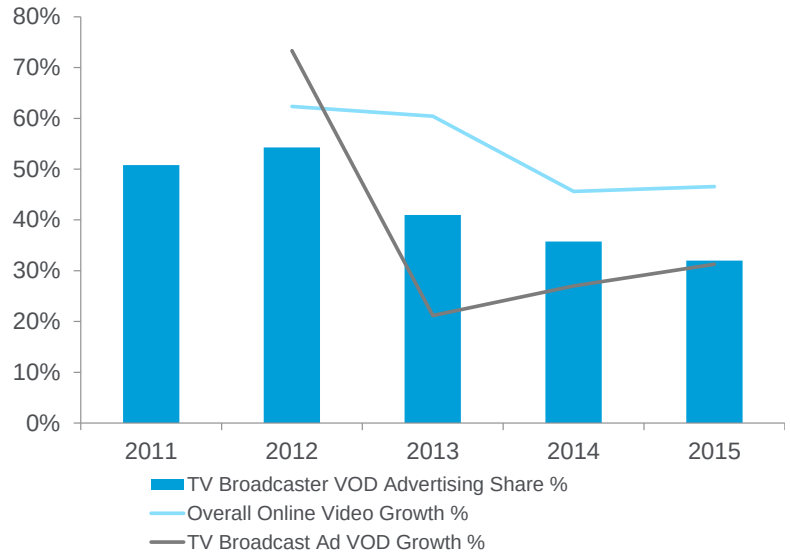
Figure 129. Share of Video Advertising 2007-2014



Source: Magna, Citi Research

Using the UK as our guide, Advertising Association/WARC data show broadcasters' online video advertising growth at ~30% in 2014/2015, compared to overall online video advertising growth of closer to 50%. In fact, ITV's recent first half 2015 results saw VOD revenue growth at 20% (versus growth in long form video views of 29%). This gap in the growth rates has led to broadcasters' share of online video ads to fall from 50% in 2011/12 to 33% by 2015.

Figure 130. UK Broadcasters Share of VOD Advertising and Growth Rates



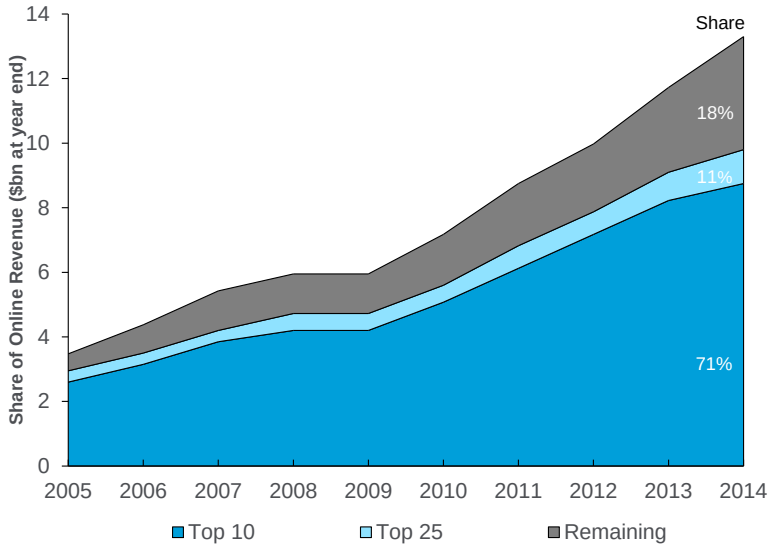
Source: AA/WARC, Citi Research Note: Broadcaster VOD advertising includes Sky Go

What we are yet to see is if the falling share of online video for the TV broadcasters is reflective of the demographic that is consuming video online (predominately the younger generation). And, we know that this demographic allocates a greater share of video viewing time to short form video. As the broader population increases its online video consumption, could the TV broadcasters regain some online share? Or could more viewing shift to non-ad funded platforms, bypassing the broadcasters?

What will be interesting is to see whether it is a blessing or a curse that non-ad funded SVOD services are taking a decent chunk of share of long form video viewing. On one side it means substitutability of traditional TV advertising is low (as there's limited alternatives). But, conversely if time spent with ad funded media declines then it poses the risk that overall ad spend could fall.

Data from the US shows that online advertising revenue is concentrated amongst few companies. The share of the top 10 publishers/ad selling companies was at 71% in 2014, and has been fairly steady oscillating between 69% and 74% between 2005 and 2015. Those outside of the top 25 only take 18% share. Given Facebook's push into video, and YouTube's presence, there is a risk that online video advertising will increasingly accrue to these two operators.

Figure 131. Concentration of US Online Advertising Among Ad Selling Firms



Source: IAB/PwC Internet Ad Revenue Report (2014), Citi Research

Utilization of data to increase the targetability of TV advertising could help the FTA broadcasters to defend their position. Not only will this help maximize CPMs online via more targeted advertising, but it also helps better inform the broadcasters in developing and adapting content it commissions and airs.

FTA Broadcasters Risk Going Ex-Growth

Using the UK (as the market with the most data available) we attempt to calculate how a change in linear share of video viewing time could impact overall advertising revenue for FTA broadcasters (traditional TV advertising + online video advertising).

For viewing trends we assume that the 2014 growth rate continues for live and online video viewing (i.e., -3% and +18.6% respectively). For advertising we assume: 1) FTA TV advertising growth will be in line with the shift in linear viewing, net of inflation (per Citi economics forecasts); 2) pay TV advertising growth continues at the rate of 2007-14 average, helped by targetability; and 3) the overall video advertising market continues to grow as Europe is in recovery mode, and assume 4% growth. Finally we assume that FTA broadcasters lose 2 percentage points of share of the online video advertising a year, consistent with the past couple of years.

The outcome is that overall video advertising for the FTA broadcasters (TV plus on-line video) could go ex-growth if the viewing declines continue at this pace. The big caveat is this: we assume the overall video advertising market continues to grow. If you remember back to earlier in the report, we have seen ads as a share of GDP decline, as the shift to online spend has been deflationary, and so our assumption could prove optimistic over the longer term.

Figure 132. UK FTA Broadcaster Ad Revenue if Ad Trends Follow Viewer Trends

UK Video Spend						Citi estimates from 2015				Assumption
Spend (£m)	2010	2011	2012	2013	2014	2015	2016	2017	2018	
FTA TV	2833.0	2914.0	2879.0	3032.0	3156.3	3098.9	3081.6	3063.5	3053.8	
Pay TV	817.8	810.0	855.0	909.0	999.0	1048.9	1101.4	1156.5	1214.3	
Online Video	45.9	92.7	155.0	317.9	524.7	719.4	878.9	1044.4	1206.8	
Total	3696.7	3816.7	3889.0	4258.9	4680.0	4867.2	5061.9	5264.4	5475.0	
Growth %										
Broadcast TV	16.1%	2.9%	-1.2%	5.3%	4.1%	-1.8%	-0.6%	-0.6%	-0.3%	Based on total change in live+time shifted viewing + inflation
Pay TV	14.2%	-1.0%	5.6%	6.3%	9.9%	5.0%	5.0%	5.0%	5.0%	Average growth 2007-14 of 5%, assume it continues
Online Video	92.9%	101.9%	67.3%	105.1%	65.0%	37.1%	22.2%	18.8%	15.6%	
Total Growth %	16.3%	3.2%	1.9%	9.5%	9.9%	4%	4%	4%	4%	Total video market has outgrown viewing growth in the past. Assume it continues, hence 4% growth overall
Share %										
Broadcast TV	76.6%	76.3%	74.0%	71.2%	67.4%	63.7%	60.9%	58.2%	55.8%	
Pay TV	22.1%	21.2%	22.0%	21.3%	21.3%	21.6%	21.8%	22.0%	22.2%	
Online Video	1.2%	2.4%	4.0%	7.5%	11.2%	14.8%	17.4%	19.8%	22.0%	

UK Viewing Time (mins/day)	2010	2011	2012	2013	2014	2015	2016	2017	2018	
Live	224.9	219.2	216.4	205.6	199.4	193.4	187.6	182.0	176.5	
% change		-2.5%	-1.3%	-5.0%	-3.0%	-3%	-3%	-3%	-3%	Assume decline continues at same pace as 2014
Time Shifted	17.2	22.2	24.2	26.2	24.6	25.9	27.2	28.5	30.0	
% change		29.1%	9.0%	8.3%	-6.0%	5%	5%	5%	5%	Assume growth continues in time shifting (PVRs)
VOD	10	14.2	20.5	25.3	30	35.6	42.2	50.0	59.3	
% change		42.0%	44.4%	23.4%	18.6%	18.6%	18.6%	18.6%	18.6%	Assume growth at same pace as 2014
Total	252.1	255.6	261.1	257.1	254.0	254.8	256.9	260.5	265.8	
% Change		1.4%	2.2%	-1.5%	-1.2%	0.3%	0.8%	1.4%	2.0%	
Share of viewing %										
Live	89.2%	85.8%	82.9%	80.0%	78.5%	75.9%	73.0%	69.8%	66.4%	
Time Shifted	6.8%	8.7%	9.3%	10.2%	9.7%	10.2%	10.6%	11.0%	11.3%	
VOD	4.0%	5.6%	7.9%	9.8%	11.8%	14.0%	16.4%	19.2%	22.3%	
Change in FTA ad rev						-57.4	-17.2	-18.1	-9.7	
+ online VOD revenue				104.3	149.9	184.2	207.4	225.6	236.5	
Share of VOD market				32.8%	28.6%	25.6%	23.6%	21.6%	19.6%	Adjust for pay TV share (at 20%) and assume broadcasters share of VOD market is 2% lower each year
Total FTA + VOD (£m)				3136.3	3306.2	3283.0	3289.1	3289.1	3290.4	
Growth % (linear + VOD)					5.4%	-0.7%	0.2%	0.0%	0.0%	

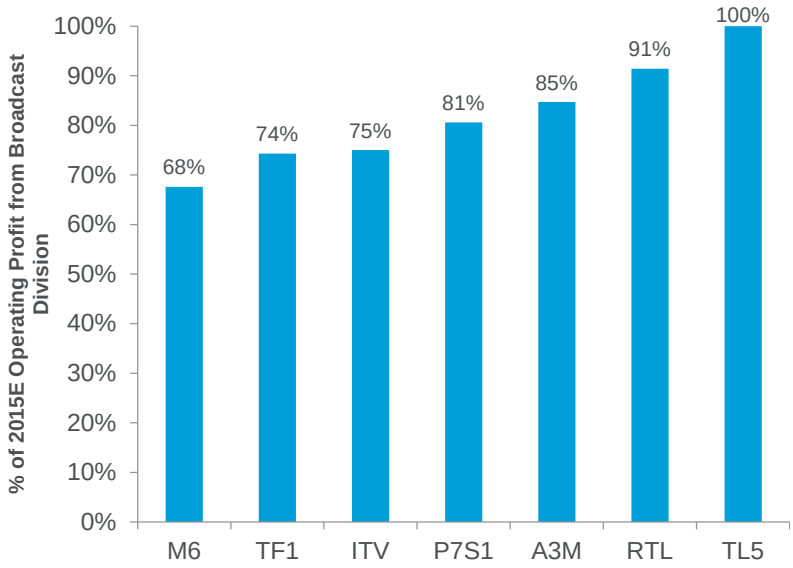
Source: Citi Research

This scenario is clearly not playing out yet. The UK TV ad market is likely to be up >5% this year (from 15% above the 2007 peak). Given linear viewing trends are declining we look at why the TV ad markets in Europe appear to be more resilient to the structural challenges than in the US.

TV in Europe More Resilient than the US (Short Term)

It is worth recalling that for all of the European FTA firms, the contribution to operating profit from the broadcast business ranges from 68% to 100%. Those that are deemed most diversified — like ITV, P7S1 and RTL — actually aren't the lowest in the range, reflecting the high margins these groups make in the broadcast business. The point here is that any shift in overall advertising will have a significant impact for all firms.

Figure 133. Broadcast Contribution to Overall Operating Profit, 2015E

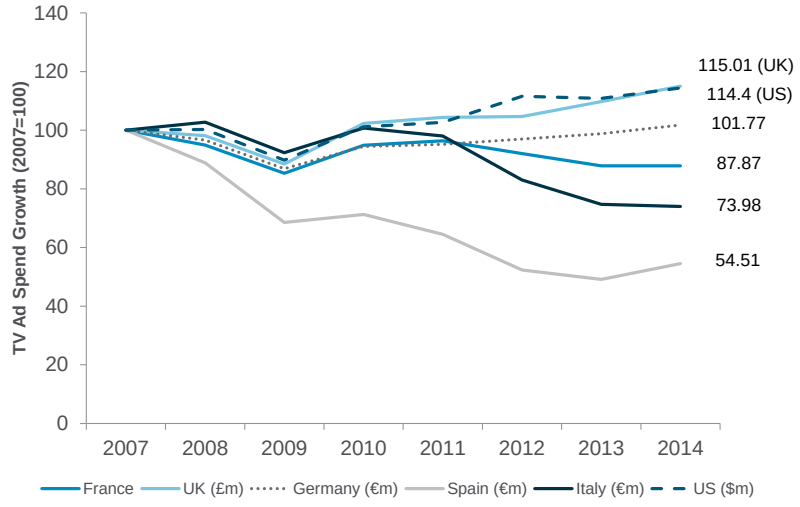


Source: Company reports, Citi Research

We believe there are three key reasons that TV advertising in Europe has been more resilient than the US:

1. **Macro Factors** – Europe is behind the US in the economic cycle, and in many markets TV remains well below previous peaks. During a macro recovery, TV tends to be the first to benefit from brand building campaigns as it provides high reach, and at the trough of the cycle the pricing has fallen. In the US TV only saw declines in 2009, and the recovery in 2010 saw the TV ad market rise above the previous peak. Additionally, as we noted earlier, the balance between print and TV within the share of ad spend in the US is much more heavily skewed to TV, than it is in Europe.

Figure 134. TV Ad Spend Index vs. 2007

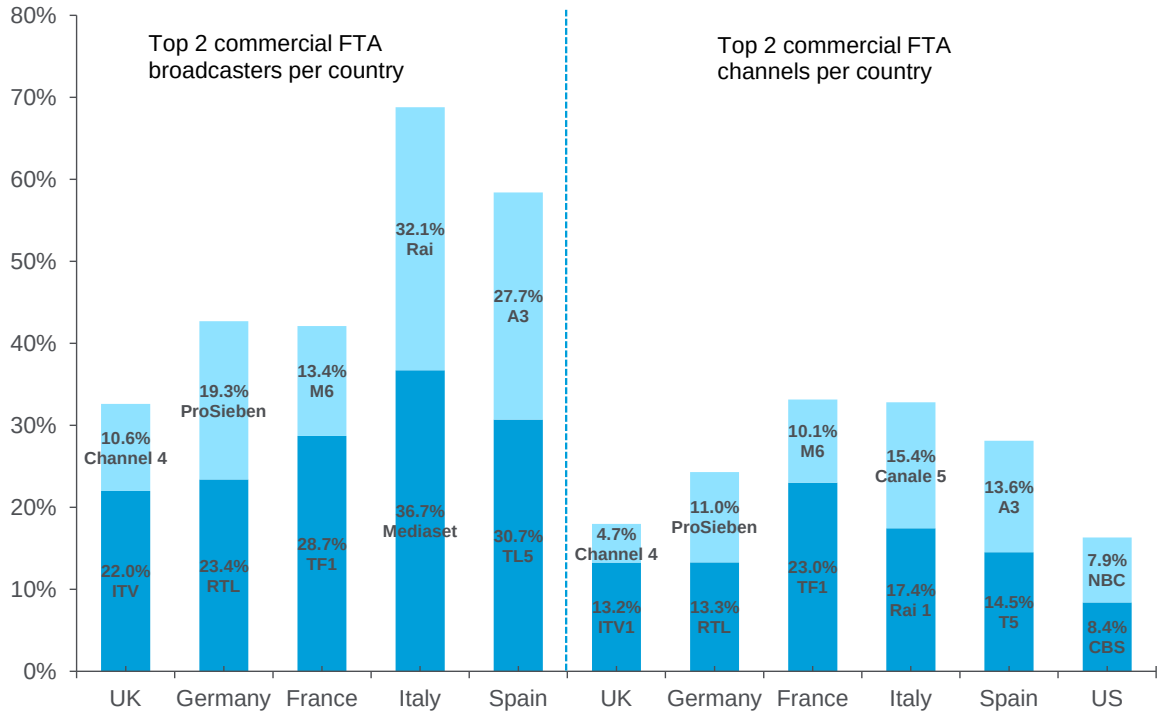


Source: Magna, Citi Research

2. **Audience Share Concentration and Scale** – The starting point is different with the audience share concentration in the US already low, as the highest audience share on a single channel stands at ~8% and as we noted earlier, the TV minutage is also much higher than in Europe. When we look across Europe we can see the concentration of audiences is higher, and FTA share of TV viewing is high. In Italy, close to 70% of audience share is across two broadcasters (one of which is Mediaset), and in the UK, it's ~33% (although if you included the BBC, this rises to above 50%). In most markets (bar the UK), FTA channels make up 90%+ of TV viewing time. It may be no coincidence that TV advertising share is highest in those markets where audience share concentration is also highest, and lowest in markets where audience concentration is lower.

   At the channel level (excluding Channel 4 as a non-public entity in the UK) none of the top two channels have less than 10% audience share. The point we are making here is that TV in Europe, in general, has the highest reach of all media, and can still deliver large audiences, which is very difficult to substitute. The more scarce the large shows, the more of a premium can be commanded. TF1 has the highest audience share across the broadcasters, in any one channel, and based on this argument, should be the best protected near term.

Figure 135. 2014 Audience Share Concentration by Market



Source: Mediametrie, BARB, GfK, Nielsen, Company reports, Citi Research

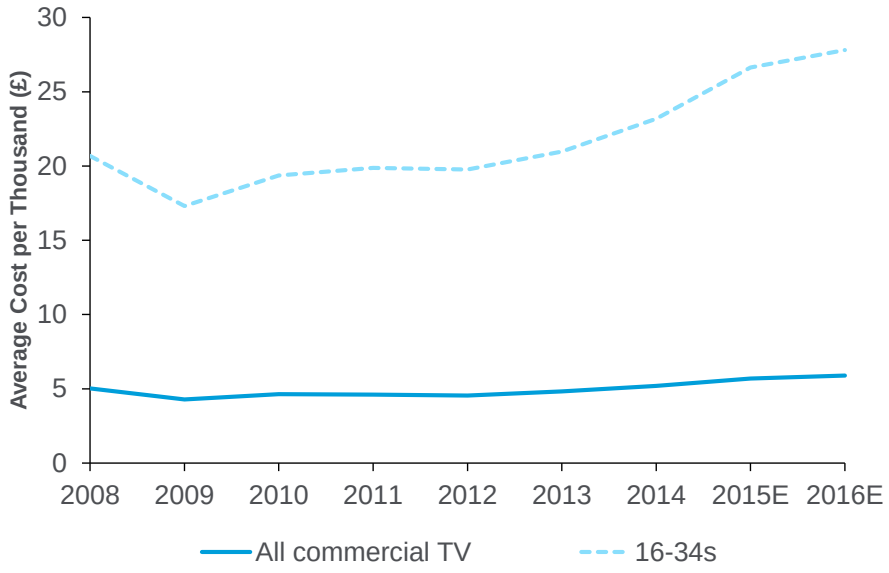
3. **Online Video Issues** – Online video is still in its infancy, in our view, and especially premium online video. It may take time before online video advertising provides a full substitute for TV. We say this for a few reasons:

   — There is a scarcity of premium online video inventory, so currently demand is outstripping supply, and the broadcasters can benefit from that through their

own OTT offerings. This is particularly relevant in Europe where some of the most popular free VOD platforms don't have advertising (like BBC in the UK and TVE in Spain). There is a greater choice of online video advertising options in the US. This argument is unlikely to hold 0066or long as we have seen the likes of YouTube start to see an acceleration in online video growth.

— Linked to this is that pricing of online video still exceeds that of linear TV, typically by a ratio of 4:1. In fact, the CPM argument is increasingly weak as we have seen TV CPMs rise, and when you drill down into TV CPMs by demographic, the 16-34 year old TV CPM is more than 4x the average overall CPM for linear TV. Online video is most likely to offer exposure to the younger demographic, and if online CPMs are 4x linear TV CPMs, then it doesn't look any more expensive than trying to reach 16-34s via linear TV.

Figure 136. UK TV Average Cost per Thousand



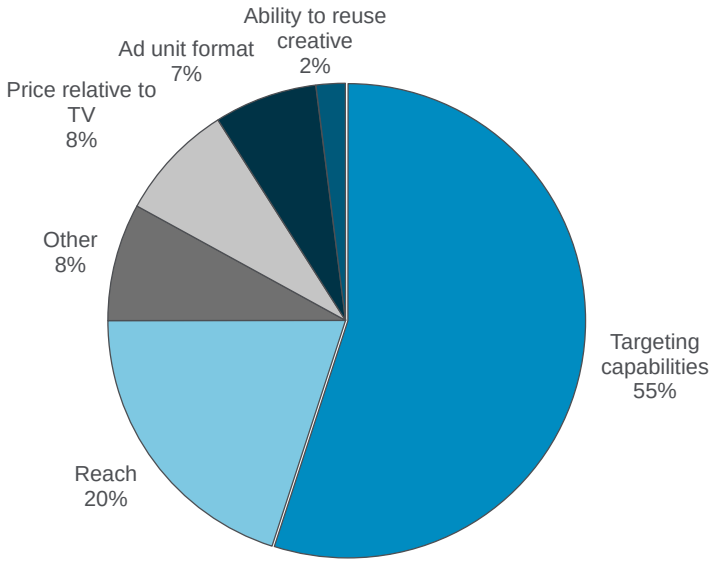
Source: GroupM, Citi Research

— Questions remain around online viewability, online ad fraud and the rising risk of ad blocking technology. According to Innovoid, the viewability of online pre-roll video ads ranges from 77% on broadcasters' sites to 39% through platforms and aggregators.

When Does Scale No Longer Matter?

So, scale is linear TV's defense. But when does the need for scale disappear? Currently the buying of TV advertising slots is still a 'manual' process. As viewing shifts online, this could increasingly become automated via programmatic trading platforms. Audience scale and key shows will become less important as it becomes easier to target very specific demographics. In fact advertisers see targeting capabilities as the most valued aspect of digital video.

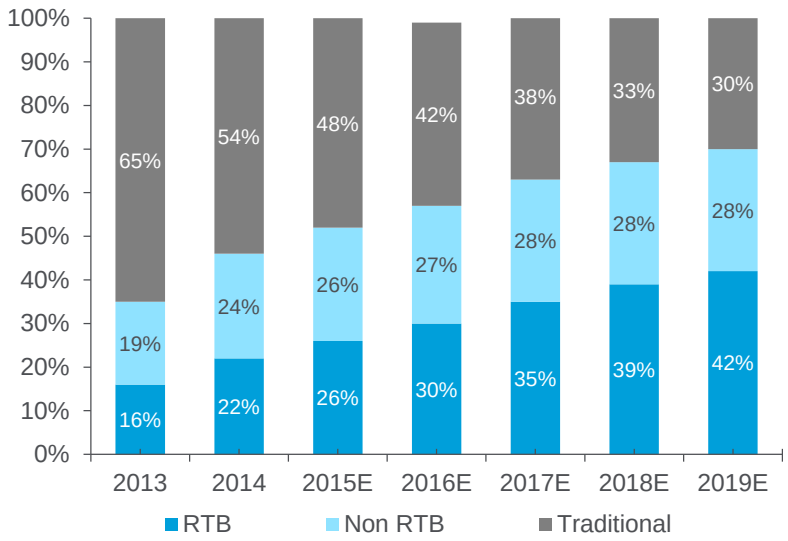
Figure 137. Agencies: Aspect of Digital Video Ads Valued Most by Clients



Source: Brightroll, Citi Research

According to Magna forecasts, traditional buying of online inventory (including video) will make up only 30% of transactions in 2019, down from ~50% currently, driven by growth in real time bidding. Magna expects non-standard (native) formats and premium video inventory to remain outside of programmatic buying but there is a risk that the pricing premiums for large audiences may come under pressure, as programmatic buying could have the impact of flattening pricing across video advertising.

Figure 138. Global: Display, Social and Video Ad Buying Method



Source: Magna, Citi Research

Diversification Opportunities

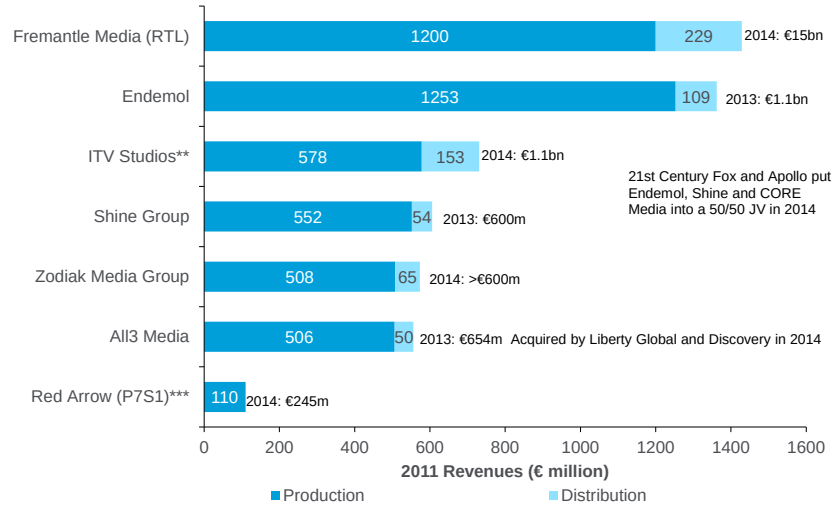
The conclusion from our analysis appears comparatively bearish for the broadcasters.

- First, we concluded that changes in TV viewing are pushing advertising money online.
- Second, we noted that traditional broadcasters competitive position online is not as strong as in the traditional linear world, suggesting a real risk that the broadcasters not only go ex-growth but start to see active revenue decline in due course.
- Third, we noted that overall exposure to broadcast/advertising remains high.

At the same time, we are also aware that the broadcasters have been diversifying, and additional/new revenue streams could provide prospects for future growth. It is worth briefly considering the revenue opportunities and whether incumbents are in a position to benefit.

Content Production – RTL, ITV and P7S1 all have exposure to international content production (although margins are mid-teens at best), which should benefit from growing competition for content exclusivity. However, the European content production ecosystem is less developed versus the US. This is not so much of a comment on the underlying rights owners. There are clearly quite a few football clubs and competitions – like F1 – which operate as commercial enterprises. Rather, it reflects the fact that true content production businesses - with global scale - are relatively scarce.

Figure 139. European TV Production Businesses by Revenue (Year-end December 2011, € Mil)

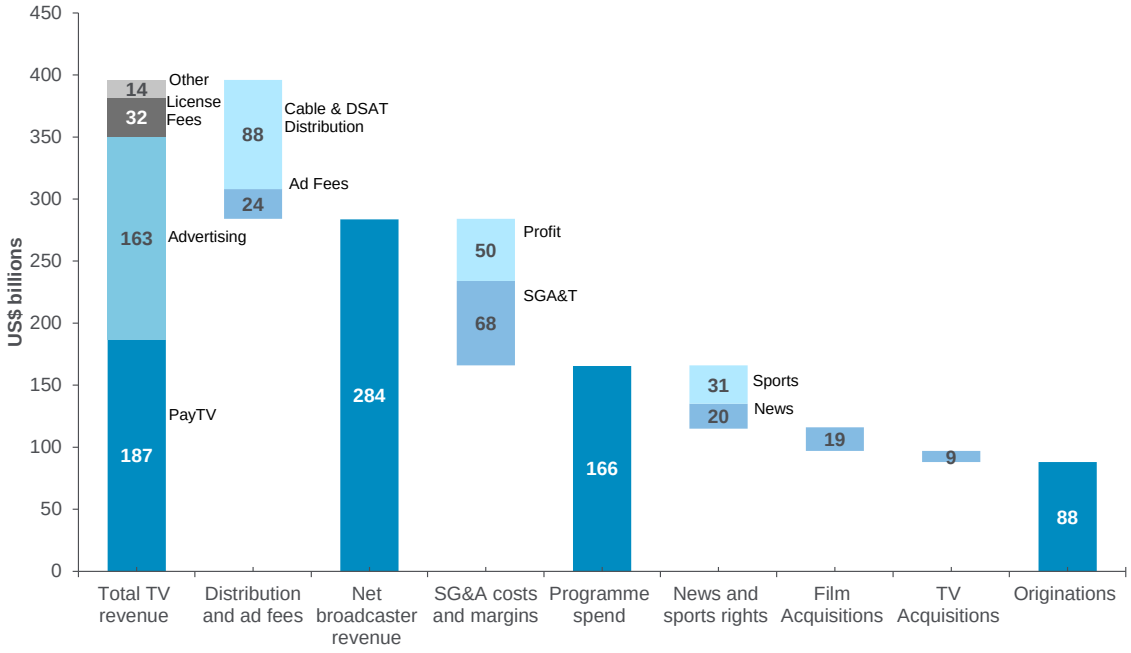


Source: Company reports, Guardian.com, Citi Research

This, in turn, means that FTA broadcaster's reliance on acquired content is relatively high. Even where domestic broadcasters do commission or self-produce local programming, this is often skewed to lower value formats (like game shows and chat shows). P7S1 is a good example. It may own a content production asset but it is the broadcaster with the highest content exposure to US acquired content (at ~53%) within the European listed FTA broadcasters.

The global spend on commissioned TV content equates to $88 billion, and is growing at 3-4% annually. Growth in acquisition of ready-made TV content is growing at 5-6%.

Figure 140. Global TV Sector – Flow of Funds (2012)



Source: PWC, O&O Analysis

We are also seeing the internationalization of the TV sector. Netflix has led the charge with existing operators in the TV ecosystem looking to shore up their own positions on the distribution side. The following are a list of transactions in the past 2-3 years, and this list is by no means exhaustive:

- Discovery's acquisition of Eurosport from TF1 (Pan-Europe) – it seems like this is driven by the twin imperative to both gain scale within cable networks but also to get access to a broad range of sports rights.
- Discovery's acquisition of SBS from ProSiebenSat.1 (Scandinavia) – SBS is a pan-Scandinavian FTA/Pay broadcast business and the deal appeared to be motivated by the desire to build scale in cable networks as well as secure better economics on distributing proprietary content in Scandinavia.
- Liberty Global's acquisition of 9.9% of ITV from (6.4% from BSkyB (UK)) – ITV is a UK channel business (with four major national channel brands) as well as a significant content production business. Although only a stake, this is widely seen as a potential precursor to a full takeover in due course. The logic for the deal, according to Mr. Fries was that it will "enhance our relationship with ITV and its management. They have a very large production studio whose output could be very interesting with respect to program needs in other jurisdictions."

- Liberty Global and Discovery's joint acquisition of All3Media (UK/Global) – All3Media is a UK-based content production company, largely (but not solely) focused on scripted content – both drama and scripted reality. (Midsomer Murders is a key brand as is The Only Way is Essex). As per the "Malone Doctrine", like ITV, All3Media gives the groups access to content formats that can be monetized across the geographic footprint of the group as well as across platforms (including OTT).

- Viacom's acquisition of Channel 5 from Northern & Shell (UK) – Channel 5 is a UK based FTA channel business with three major national channel brands. Channel 5 offers Viacom an opportunity to distribute existing content more effectively as well as gain critical mass in areas like advertising sales.

- Disney's acquisition of Das Vierte (Germany) – Das Vierte was a FTA channel in Germany which has been effectively closed down and the spectrum/EPG positioning reallocated to a new Disney-branded channel.

- Sky's acquisition of Sky Deutschland and Sky Italia (Germany & Italy) – Sky (formerly BskyB) created Sky Europe, a pan European pay TV business present in the UK, Ireland, Italy, Germany and Austria in 2014.

- 21st Century Fox formed JV between Shine and Endemol (Global) – 21st Century Fox owns Shine, and Apollo owns Endemol and the two formed a JV to put the two content production assets together

The growth in the content production sector appears more attractive than the TV advertising space longer term, and therefore owning content production assets seems sensible. It's even more sensible if this content is also used as the main driver of the core broadcast business.

The acquisitions highlight that on the content production side, scale is important. As noted earlier, the issue is that the scale sits mainly in the US. The chart of the European production businesses highlights that there has been some consolidation amongst these names in the past couple of years, led by the US names. Also, one of the reasons ITV Studios and P7S1's Studio business has seen notable revenue expansion in the past 3 years is due to acquisitions. Increasing internationalization of TV may present those European broadcasters that have some exposure here (ITV, P7S1, RTL and Sky) as interesting M&A opportunities, as the US media companies (which seem to be facing more pressure than those in Europe) look to secure direct access to content and a bigger footprint over which to spread the cost i.e. channels in more markets. In some cases the current valuations appear to be factoring that potential in.

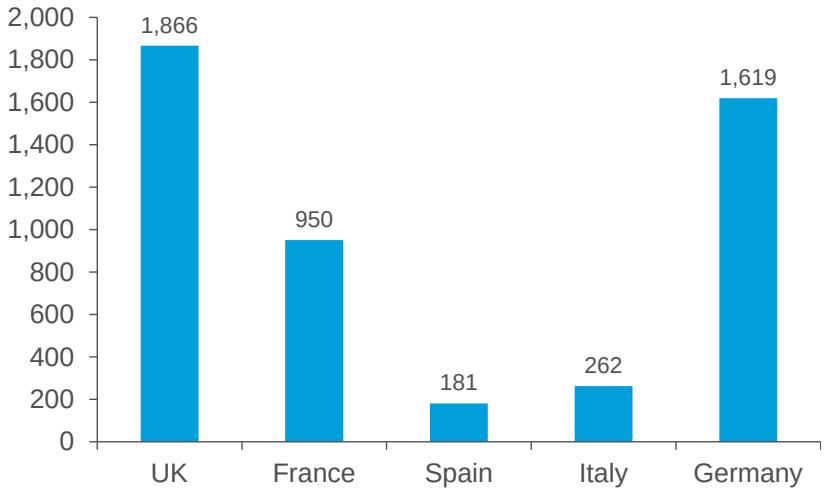
Platform/operator fragmentation offers a healthy level of competition for content. However, longer term, there is a sense that operators have to be careful what they wish for. The platform fragmentation is happening on the global, rather than local stage, which not only presents risks for the legacy platform models, but also means the end market is becoming more concentrated. Netflix and Amazon spend ~ $4 billion on content, which is only ~5% of the global TV content market. This means that the majority of the end markets are the traditional domestic TV operators. Our analysis so far in this note has highlighted the risks to their core revenues (especially in the US). If the net broadcaster revenue is squeezed, it is hard to see how global SVOD platforms will more than cover the shortfall.

It is worth briefly mentioning the value of territorial exclusivity in the sale of rights in Europe. This creates competitive tension in each market, thereby maximizing the potential value of the rights. The Digital Single Market proposals by the EC may threaten this.

All of this builds to a conclusion that the current boom in content production could be temporary, as the various platforms vie for the best content on an exclusive basis, and attempt to build out back catalogues as quickly as possible. The risk is that this status quo is unsustainable.

- **New channels** – Several broadcasters have been launching new channels (across FTA, pay TV and new markets) e.g. Atresmedia in LatAm, RTL in Asia.
- **MCNs & Technology** – This is a catch-all category that covers various forays into online and technology by the broadcasters. To highlight a few:
  - **Online Investment** - P7S1 pioneered the idea of media for equity, exchanging inventory for stakes in online start-ups, and TL5, TF1 and A3M have followed suit. P7S1 has built on this by increasing ownership in specific verticals, the largest one being travel sites.
  - **MCNs** - The rise of MCNs (Multichannel networks, or MCPs as they are often called), which involves channels initially launched on YouTube focused on specific interests e.g. music, gaming, beauty. These have seen interest from broadcasters. RTL bought majority stakes in Broadband TV and StyleHaul, P7S1 owns CDS, Disney acquired Maker in 2014 and Warner Bros acquired Machinima in 2014. This provides them with access to the younger audience (that linear TV is losing), exposure to online video advertising, e-commerce and licensing opportunities, a window to showcase new/linear content, and an interchange for talent between linear and online. This is a very interesting area but there is also a revenue share with YouTube, and to generate additional revenue streams the channel/network needs to have a strong presence.
  - **Programmatic technology** - RTL was the first broadcaster to acquire a programmatic technology platform (SpotX) which will give it some control over it how it manages its own video inventory as the market moves that way. It also means it has a position in more than one part of the online video value chain, which should reduce the level of revenue leakage.
  - **TVOD and SVOD** – NowTV (Sky), CanalPlay (Vivendi) and Maxdome (P7S1) are all examples of SVOD players that have been launched by broadcasters. All of which compete with Netflix for subs. TVOD provides another new source of revenue, with the physical DVD and Blu-ray market the most likely source of market share. In the UK this remains an almost €1.9 billion ($2.15bn) opportunity.

Figure 141. Physical DVD & Blue-Ray Market (€, 2013)



Source: ivf-video.org

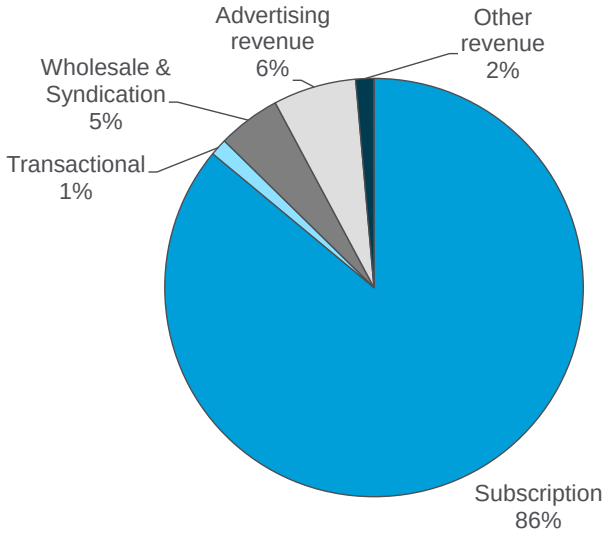
So to recap, our review of the Consumer Threat suggests that Europe is seeing the same fundamental trends in media consumption as the US, and that this potentially signals risks for the large incumbent FTA broadcasters in Europe. Our review of the Advertiser Threat also indicates risks but suggests these may be less imminent as European broadcasters enjoy the benefits of a delayed economic recovery and exploit their (short term) scale advantages.

To complete the picture, let's review the Pay TV Provider theat.

Item #3: Europe Pay TV Provider Threat

The focus of the Pay TV Threat in the US relates to cable networks, and whether they are at risk of being removed from pay TV platforms. In Europe, the truth is this source of revenue is less important. For example, Sky in the UK only makes 5% of revenue from the equivalent of affiliate fees.

Figure 142. Sky UK Revenue Split (2014)



Source: Citi Research

We highlight the three factors driving this:

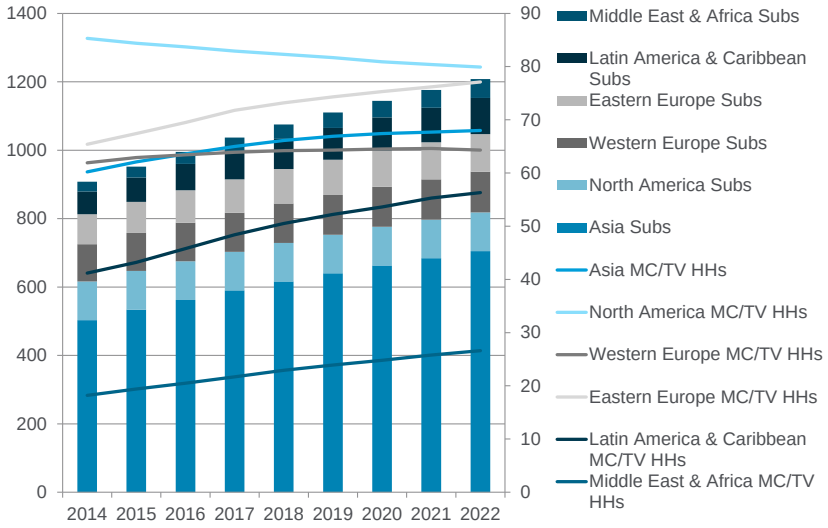
- Firstly, as we noted earlier, penetration levels are much lower in Europe than in the US, and the subscription revenue per head is lower. This means European consumers appear less willing to pay for content, or the content freely available is of a fairly high standard.

- Secondly, there is less separation between the pay channel owners and pay platforms in Europe than there is in the US. For example, Sky owns channels as well as distribution, and the same for Vivendi in France. Sky's revenue is mainly from subscription fees, as it has a direct relationship with the consumer due to owning platforms and channels. Many of the other pay TV channels offered in Europe are those of the US networks, or smaller non-publicly owned operators.

  Pulling channels off platforms feels highly unlikely in Europe, at this stage, as the platforms are building still out their offerings and pay TV penetration is low. Sky's relationship with Discovery and Viacom is a good example of how differently it works to the US. Sky has the contract to sell advertising on behalf of Discovery and Viacom in the UK, and also carries the channels on its platform. It is a more intertwined mutually beneficial relationship.

- Finally, we believe that the economics of the European pay TV landscape is likely to face less disruption than in the US if we are right that the US will start to look more like Europe. SNL Kagan forecasts also support this view, as it forecasts pay TV in Europe to stay fairly static over the next two years, and pay TV penetration in the US to fall closer to 80%.

Figure 143. Global Pay TV Subs and Penetration by Region (Subs, Millions & % Penetration)



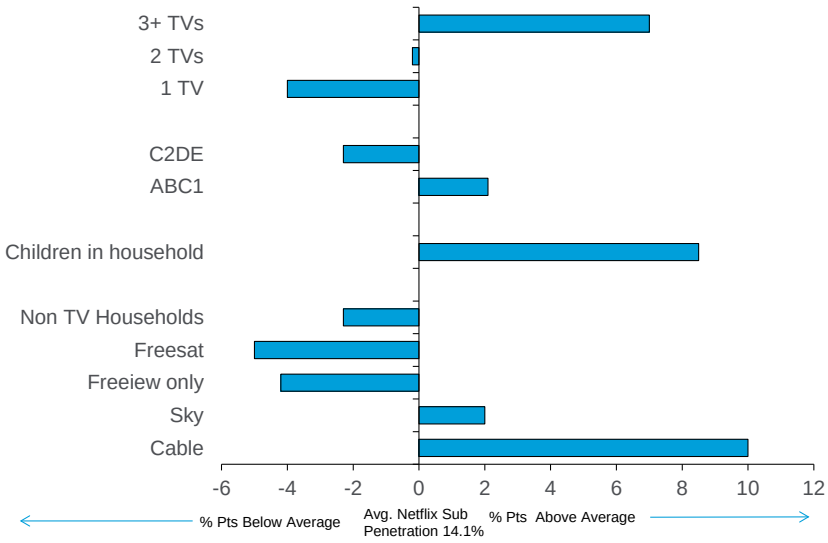
Source: SNL Kagan

Even in a market like the UK, where arguably it is as close as Europe gets to looking like the US, we have seen no signs of cord cutting. In fact, churn has been coming down on average.

Segmenting the Market

Overlaying the relatively secure pay TV sub base with what we know about the profile of Netflix subs (it's skewed to pay TV subs), highlights that the likes of Netflix has been additive to — rather than cannibalistic — to the pay TV ecosystem. Whether this will change or not, we don't know, and it is likely to depend on OTT offers broadening out the content offering, as they are some way off replicating that of a pay TV provider.

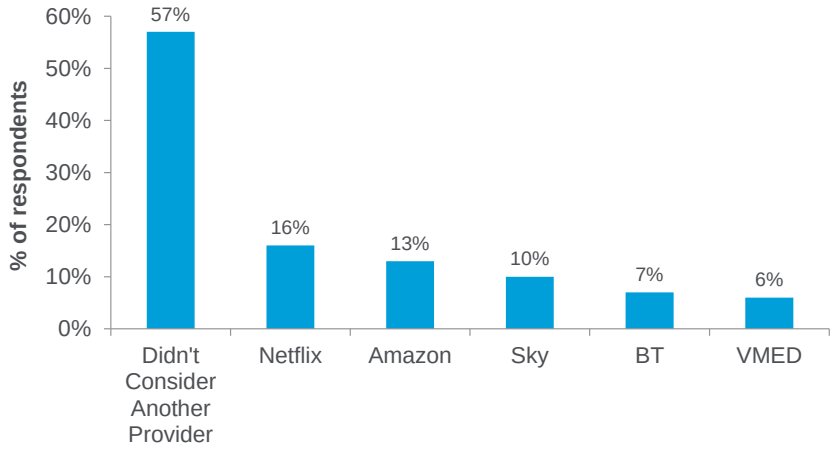
Figure 144. UK Netflix Sub Profile (4Q14)



Source: BARB Establishment Survey

With European consumers far less used to paying for TV content than in the US, it makes it much easier to segment the market. Sky's launch of Now TV is a good example of this. The vast majority of people taking its Now TV branded OTT service either haven't considered Sky as a competitor product or, in the case of 57% of users, any competitor product at all. The main motivation for taking NowTV is to access content not on Freeview (68% of users).

Figure 145. Which Provider Did Now TV Users Consider Before Selecting Now TV



Source: Sky

Despite what looks like a less vulnerable position in Europe for pay TV, we acknowledge that the Internet has lowered barriers to video entry (providing a capital light means to launch a content offer), and provides consumers with more flexibility to consume video when and where they want. With that in mind, we are not advocating that the pay TV operators sit back and relax. To limit the value that might accrue to others, pay TV operators and telcos need to ensure that they diversify away from providing just content distribution or basic connectivity. Triple play and quad play offers are increasingly common in Europe, with both pay TV and telco operators creeping into each other's territory.

Figure 146. European Operators

UK	France	Germany	Italy	Spain
BT TV	Bouygues	DT/T-Home	Mediaset Premium	Ono
Sky	Canalsat	Kabel Deutschland	Sky Italia	Telefonica
Smallworld Cable	Numericable-SFR	Sky Deutschland	Telecom Italia	
Talk Talk Plus TV	Orange	Unity Media KBW		
Virgin Media	TNT			

Source: DigitalResearch.com, Wikipedia

While there are significant differences between the US and the European pay TV markets, the same factors will help reduce risk of disintermediation: 1) sports rights, as a means to maintain a core base; 2) production assets to retain some control, and exclusivity over content, and increase the stickiness of the customer base; 3) Low reliance on advertising; 4) ownership of internet infrastructure to benefit from streaming growth (and ability to raise price) and 5) standalone OTT channel/offer, broadening the TAM. We would argue there is a 6th risk reducing factor, and that is to operate on a pan-European (or multi-market) basis, providing leverage to compete with the global SVOD players. We have seen moves by both pay TV and telco operators along these lines. To highlight a few:

- Sky forming Sky Europe, launching NowTV (OTT offer), announcing a mobile virtual network operator (MVNO) with O2 and acquiring content production assets.
- BT acquiring sports rights in the UK.
- Telefonica acquiring Digital+ in Spain, and acquiring the Spanish football rights.
- Vivendi's launch of CanalPlay and Watchever, and acquisition of content production assets.
- Vodafone's acquisition of ONO and KDG, and reported interest in Sky last year.
- EE launching an OTT offer in the UK.

Below we include details by operator of how they screen on the six points of defense we note above.

Figure 147. Scorecard for European Operators Defense Characteristics

	Sky	Virgin Media	BT	TalkTalk	Vodafone	Telefonica	Vivendi (Canal+)	Mediaset Premium
Sports Content	●	◐	●	◐	◐	●	●	●
Production Assets	●	◐					●	
Low Reliance on Advertising	◐	●	●	●	●	●	◐	◐
Ownership of Internet infrastructure	◐	●	●	◐	●	●		
Standalone OTT offer	●						●	
Pan-European	●	◐						

Source: Citi Research

Sky is the only one that ticks each of those boxes in some way, followed by Vivendi (Canal+) and Virgin Media (Liberty Global). What is clear from this is that access to sports rights and access to the infrastructure has been addressed. This explains why we have seen inflation in premium sports rights (see below) as new entrants have entered the bidding process, and why we have seen pricing competition in broadband. Pay TV operator entry into broadband consequently led to telcos entering the pay TV space (via acquisition of sports rights usually), in order to limit churn on the core broadband base.

The areas which have not been broadly addressed are:

- Ownership of production assets, which arguably is less easy to address given lack of sizable M&A opportunities.
- Standalone OTT offers are only possible if there is a sufficient catalogue of premium content. This would mean moving beyond bidding for sports rights, and like sports rights, the contracts are long.
- One could argue that in an internet-centric, capital light, world launching into new markets with a pay TV offer is much easier than it used to be. However, lack of content makes that difficult. To address the territorial gaps, the question is whether we see further cross country consolidation in the pay TV market.

While we think the risk to pay TV itself in Europe is lower than in the US, increased competition raises two main questions: 1) What happens to programming cost inflation?; 2) What will happen to ARPU?

What Happens to Programming Costs?

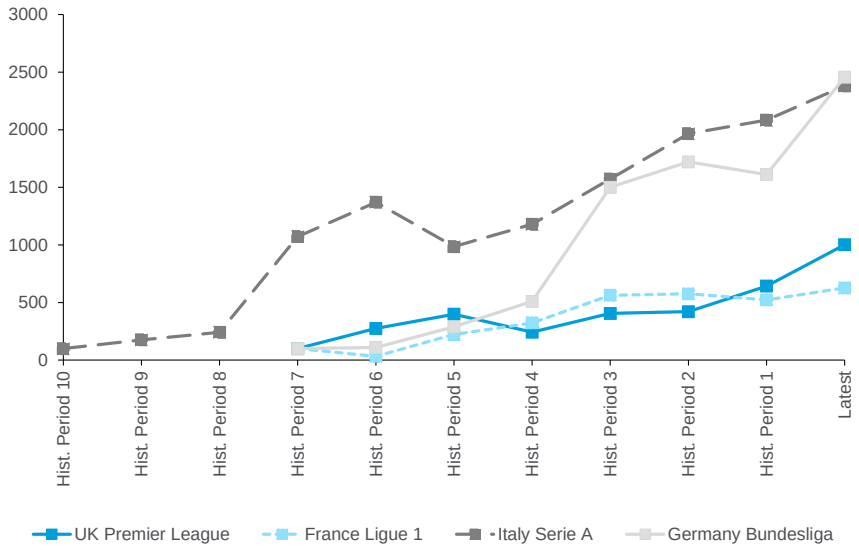
First let's look at what happens to programming cost inflation.

In sports rights, which are disclosed separately, we have seen significant cost inflation for premium rights, and that is unlikely to change, especially if sports rights remain the cornerstone of pay TV. James Murdoch, CEO of 21st Century Fox recently said:

"*Some sports are just incredibly valuable and you'll see continued escalation but there are breaking points. It depends on the business you can make out of it….. As we see a proliferation of competition and innovation downstream, in terms of people trying to provide content to customers, sport is going to continue to be a real driver of that. [But] it doesn't mean that any price is the right price*"

We would agree with that, and this highlights why it is also important to diversify reliance away from one set of rights.

Figure 148. European Football Rights Inflation (per Match in the Home Market, Indexed to 100)



Source: Company reports, Ofcom, DigitalTV Europe

It is harder to isolate the inflation levels across other content, although PWC/O&O analysis suggests that film acquisitions and originations in the global TV sector saw 3%-4% compound annual growth between 2007 and 2012. Rising competition implies that this level is likely to rise, and highlights the importance of controlling as much content as possible, hence Sky's shift into content production, and Vivendi's focus in this area.

Sports and movie rights remain the cornerstone of pay TV, and in each market there is one main player that carries the majority of these rights, and these contracts tend to be for a minimum of three years.

Figure 149. Sports and Movie Rights for European Operators

	UK	France	Germany	Spain	Italy
Top Domestic football league	Sky/BT (2018/19)	Canal+/BeIN Sport (2019/20)	Sky D (2017)	Telefonica – Canal+	Mediaset/Sky Italia (2017/18)
Champions League	BT (2017/18)	Canal+/BeIN Sport (2017/18)	Sky D (2018)	beIN Sports (2018)	Mediaset (2017/18)
Formula One	BBC/Sky (2018)	Canal+ (2015)	Sky D (2015)	Telefonica (multi-year)	Rai/Sky Italia (from 2013)
HBO	Sky (2020)	OCS (agreed 2013)	Sky D (2020)	Telefonica - Canal +	Sky Italia (agreed 2014)
Warner Bros	Sky (agreed 2012 for 5 yrs)	Canal+ (from Sept 2013)	Sky D (agreed 2014)	Telefonica - Canal +	Mediaset Premium (agreed 2015)
Fox	Sky	NA	P7S1 (Basic pay-TV licenses) (agreed 2013)	Telefonica - Canal +	NA
Paramount	Sky (agreed 2014)	Canal+ (agreed 2013)	Sky D (agreed 2014)	Telefonica - Canal +	Sky Italia
Universal	Sky (agreed 2012)	NA	Sky D (agreed 2013)	Telefonica - Canal +	Mediaset Premium (agreed 2015)
Disney	Sky (agreed 2015)	Canal+	Sky D (agreed 2013)	Telefonica - Canal +	Sky Italia
Sony	Sky (agreed 2013)	OCS (agreed March 2015)	Sky D (agreed 2012)	Telefonica - Canal +	Sky Italia

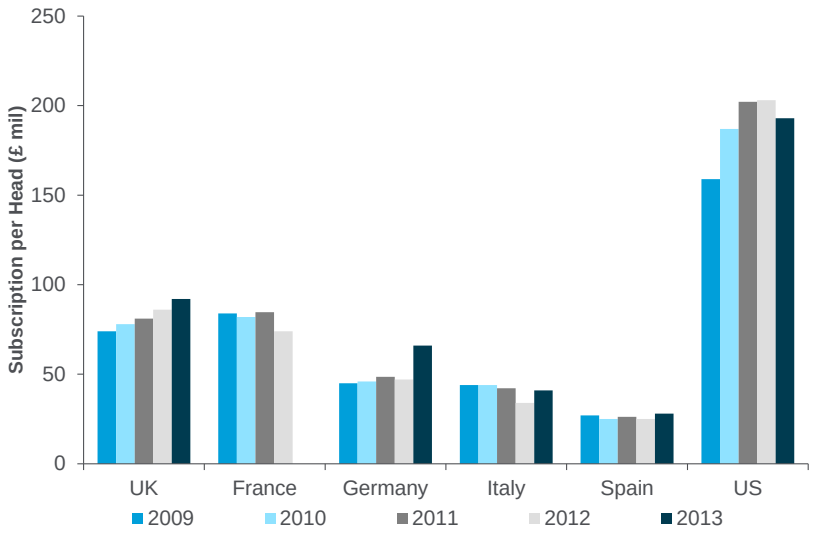
Source: Press releases, Citi Research

Outlook for ARPU

Second, we consider the outlook for average revenue per user (ARPU).

As you'd expect the subscription per head cost in the US is the highest as penetration is the highest. Across markets in Europe the level has remained fairly static from 2009 through 2013, although in the UK it has continued to grow.

Figure 150. TV Subscription Revenue per Head (£ Millions)

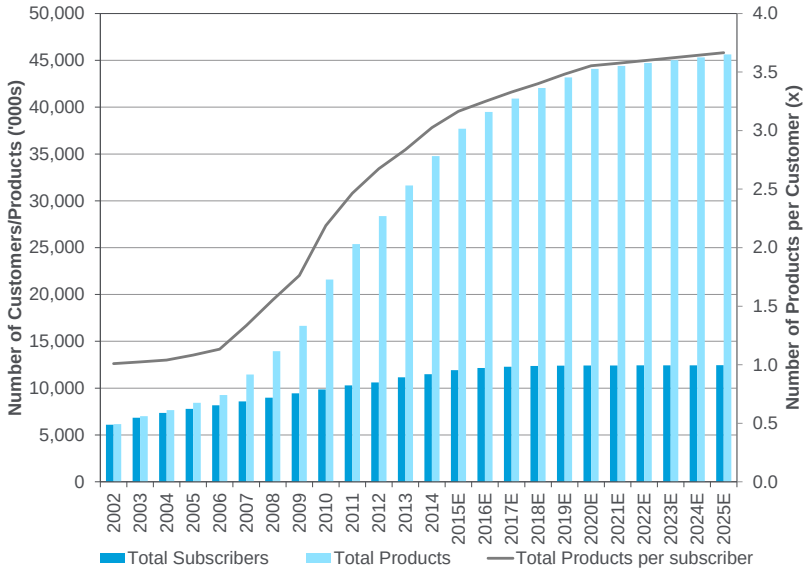


Source: Ofcom

This is based on TV subscription revenue per head only, and doesn't factor in the ancillary revenues that are generated, or the additional services that are bundled into the fees. On one level there is a danger that increased competition between platforms and cross-subsidization between services/offerings continues to put pressure on TV ARPUs. Even if we don't see this, growth in OTT services could also dilute the headline ARPU numbers, albeit this would mean lower ARPUs across a higher sub base.

This having been said, for the main TV providers there is a lot more than simple TV ARPU to think about. Many of the main providers have been broadening their product offerings (e.g. high definition, triple- and quad-play services) and deepening of product penetration across the base. The chart below highlights that this has been a key driver of growth in the UK for Sky, with the number of products per customer rising from just over 1 in 2004 to ~3 last year.

Figure 151. Sky Product Penetration in the UK

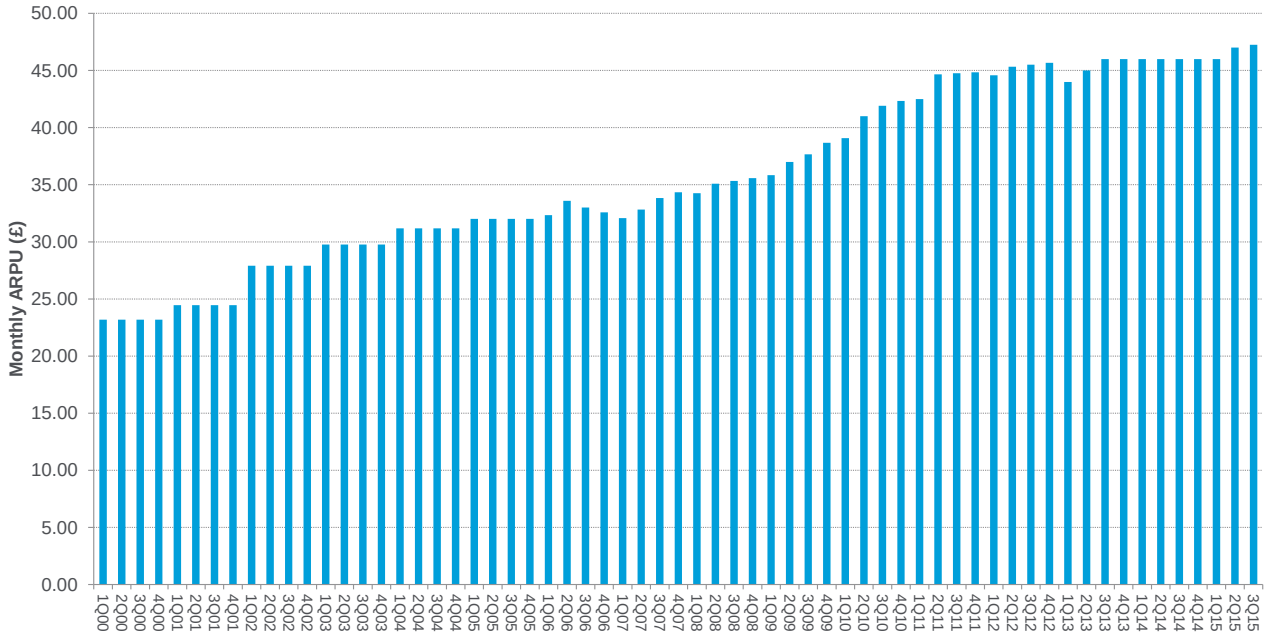


Source: Sky, Citi Research

Looking at the impact of this on yield, overall ARPU has continued to rise but there are a number of moving parts:

- Over the period the percentage of the base taking a premium product (sports/movies) has actually diminished, from around 90% in the early 2000s to 50%-60% today. More recently, NowTV ARPUs have been included in the calculation. These effects have been dilutive to overall ARPU and may well continue to be so as OTT services proliferate.
- Against this, as per the chart above, the number of products the group typically sells to an average customer has gone up. This incremental yield has been almost wholly additive and potentially has a long way further to go.
- Finally, we should consider price which has been a relatively consistent lever not only for Sky but for most established pay TV operators not only in the UK but across Europe.

Figure 152. Sky Monthly ARPU, 2000-2015 (£ per month)



Source: Sky, Citi Research

Aggregate European Risks

In summary we have reached a number of conclusions with respect to European TV:

- First, we argued that Europe is fundamentally different from the US, with lower overall TV revenue per head. One of the reasons for this (we believe) is that European markets tend to enjoy a higher level of quality local content provision free-to-air funded either by the state or via a license fee. This has been one of the factors that constrained pay TV penetration.

- Second, TV viewing in Europe is much more concentrated on free-to-air channels. While there is no doubt that new technologies are changing the way that consumers watch TV, the implications are more for free-to-air than for pay TV, in our view.

- Third, pay TV services in Europe have been much more reliant on sports and US movies as the primary drivers of customer acquisition. In markets where sports and US movies have been the preserve of the free-to-air channels (e.g. Germany, Spain), pay TV penetration has been stunted, although this may be changing. While in markets where the pay TV players have managed to wrestle a degree of control over sports and premium movies (including US acquired content), pay TV penetration has done better.

- Fourth, hitherto OTT services in a European context appear to be more additive than cannibalistic. For the free-to-air businesses some of the incremental viewing can be monetized separately via catch up services, while for the pay TV businesses careful segmentation seems to be facilitating further penetration of the market, satiating demand for content while not cannibalizing existing premium pay TV subscribers.

- Fifth, although video viewing has not come at the expense of free-to-air yet, this could change in time. In various European markets there appears to be a viewing gap between linear and VOD, driven, at least in part, by changing preferences for different forms of content as well as demographic factors. This poses a risk to free-to-air TV advertising in our view. Indeed we see a real risk that once macro recovery has worked its way through, the free-to-air broadcasters potentially go ex-growth.

- Sixth, we think pay TV in Europe does not necessarily suffer from the risk of cord cutting in the same way as the US, but that there are still a number of hurdles to long-term success. The main preconditions for longer-term viability are, in our view: comfort on a group's control of sports rights, ownership of content production, a low reliance on advertising, guaranteed access to/ownership of internet infrastructure and a clear, ideally segmented, approach to OTT.

- Seventh, as in the US we see content production as being relatively shielded from some of the major headwinds facing the industry over the next few years. Indeed there is a strong argument that content production companies should be able to 'make hay while the sun shines' by continuing to provide content to free-to-air broadcasters short-term while also catering for new OTT providers looking to differentiate their platforms by investing in proprietary content.

With these seven points in mind we think there are a number of general considerations for investors in the European Media space:

- First, even where free-to-air businesses have done a good job of diversifying their businesses, more often than not this has not resulted in a material dilution of the importance of the free-to-air business within the mix. It is possible that exciting diversification activities may make the investment debate more interesting at the margin, but it is important not to let the tail wag the dog.

- Second, with this in mind, while we argue there is scope for ad markets to recover from cyclically depressed lows and for companies with strong market positions and low margins/multiples there is potentially very strong gearing to this, the uneven pace of recovery means investors should be especially wary of where each company/market is in its own cycle. We would be more wary of companies with recovered margins/multiples and focus on companies that have depressed revenues vs. peak, depressed margin vs. mid-cycle levels, depressed multiples vs. peers and ideally all three.

- Third, we think investors can afford to take a more constructive stance on pay TV. The challenge is finding assets that meet the criteria we highlight above but that are standalone businesses. Most companies exist within the context of larger, converged telco-media groupings.

- Fourth, we think assets with exposure to content production will likely continue to enjoy a strategic premium, albeit potentially ahead of what might be deserved in light of scale.

Below we include a net scores table of the areas we have explored in the note for the FTA European broadcasters, taking into account near term cyclical support and the longer term structural risks.

Figure 153. Net Score on Cyclical & Structural Screens Explored

	ITV	M6	TF1	P7S1	RTL	TL5	A3M	MS
Cyclical Screens								
Low point in cycle	N	Y	Y	N	N	Y	Y	Y
TV pricing < average	N	Y	Y	N	N	Y	Y	Y
Structural Screens								
Linear viewing trend positive	N	N	N	=	=	N	N	Y
Present in top 5 online video sites	Y	N	Y	N	N	Y	N	Y
Duopolistic broadcast market	N	N	N	Y	Y	Y	Y	N
Programming vulnerable to time shifting	N	N	N	Y	N	N	N	N
Audience scale	Y	Y	Y	Y	Y	Y	Y	Y
International content production exposure	Y	N	N	N	Y	N	N	N
Cyclical (Y)	-2	2	2	-2	-2	2	2	2
Structural (Y)	0	-4	-2	1	1	0	-2	0
Overall Net Score (Y minus N)	-2	-2	0	-1	-1	2	0	0

Source: Citi Research

The Third Pipe

So, due to bundling, US cable networks over-earn. That's suggests they may find it difficult to succeed in the Internet-centric video world. And, without adjustments, the cable network divisions of the media firms face three risks: from the Consumer, from the Advertiser and from Pay TV firms.

In tandem, virtually every investor we speak with has the same conceptual framework for the broader media ecosystem:

- Most investors like the content stocks. But in the last year, the Street has become far more selective. Media stocks that have sports rights (low Consumer Threat), low ad exposure (low Advertising Threat) and many hit shows (low Pay TV Threat) are clearly favored over firms with no sports rights, heavy ad exposure and few hit shows.

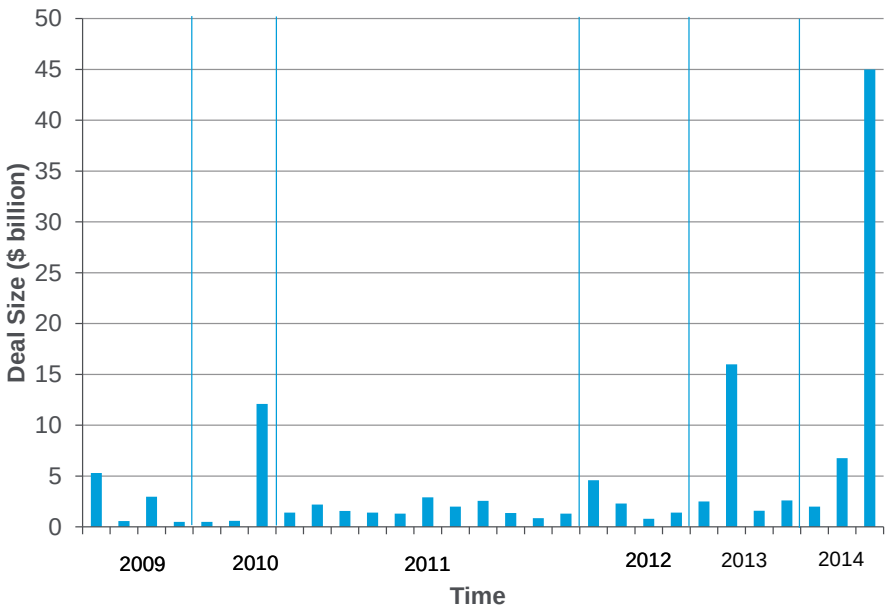
- Some investors like distribution stocks (if they have last-mile infrastructure). While these firms are experiencing falling video gross profit margins (as content costs rise faster than video ARPUs), the cable and telco firms can at least raise pricing for broadband. And broadband penetration and consumption keeps growing.

- And, few investors like the direct broadcast satellite (DBS) stocks. That's because these firms are exposed to rising content costs and don't have last-mile infrastructure. Most investors believe these assets will have difficulty in a broadband-centric world (particularly as pay TV penetration rates begin to fall).

This framework suggests two things: First, investors recognize that content firms have ample negotiating power over all forms of distribution (including cable, telco and DBS). Second, as distribution of video migrates from closed systems — like cable and DBS — to open systems — like the Internet — the last-mile infrastructure will become more valuable.

CEOs seem to agree. If you took a look and recent last-mile M&A — going back to 2009 — there has been a fair amount of activity. And, the pace of the last-mile M&A has picked up significantly in recent years. While there aren't necessarily more deals, the magnitude of capital CEOs are willing to invest in last-mile infrastructure is clearly rising.

Figure 154. M&A Deal Size is Increasing

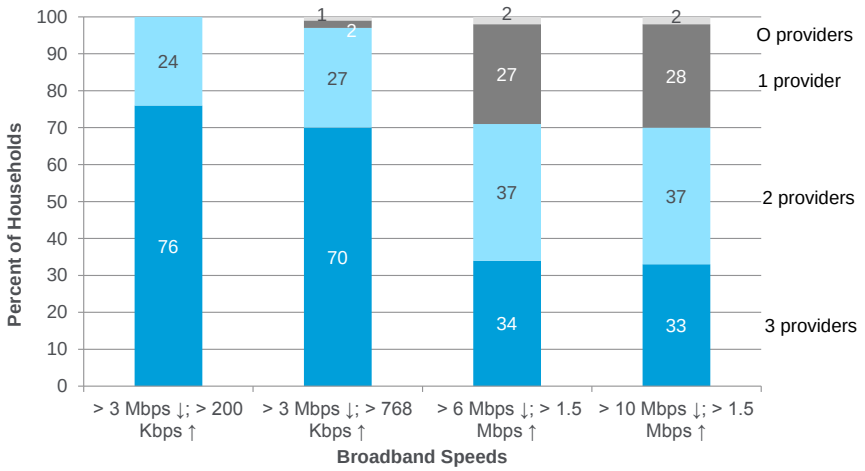


Source: SNL Kagan, Citi Research

Most investors suspect that this wave of distribution M&A is induced by escalating programming costs. That is, scale can be a potent — if transitory — antidote when negotiating content deals. But, we suspect there is something else going on: CEOs may be coming to the conclusion that the most durable portion of the media value chain may be the last-mile infrastructure. Why might that be true?

In late 2013, the FCC suggested that about 27% of US households only have one provider that can deliver 6 Mbps download speeds. And, 37% of households only have two providers that can deliver similar speeds. In effect, in almost 2/3rds of US homes, a broadband provider enjoys has a monopoly or a duopoly structure.

Figure 155. Number of Providers at Different Speeds per Household



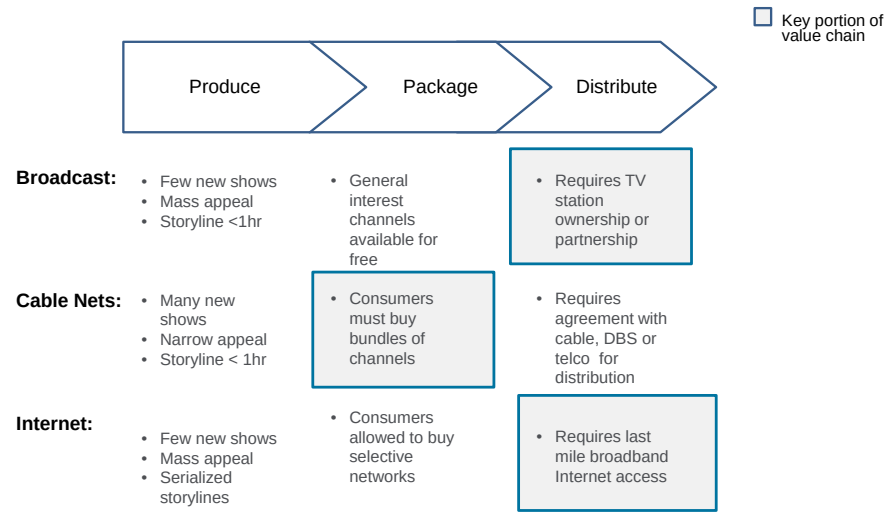
Source: Citi Research

And, while the FCC data also suggests about 1/3rd of homes have three or more broadband providers that can deliver 6 Mbps, we suspect this data is heavily skewed by current generation wireless services (which often have data caps). As such, if you exclude wireless data, we suspect the market is even more concentrated than the FCC data suggest.

Multiple Options to Break the Duopoly/Monopoly Structure

So, if we're right, CEOs are increasingly willing to invest large sums to secure their place in the broadband infrastructure market because this may emerge as the most durable portion of the media value chain.

Figure 156. Value May Shift to Last-Mile Internet Access



Source: Citi Research

That notion, however, depends on new technologies not upsetting the status quo. And, there are quite a few new technologies to consider:

- First, **fiber-to-the-home (FTTH)** from players like Google.
- Second, **satellite broadband** from players like EchoStar and ViaSat.
- Third, **mobile wireless** firms are rolling out 4G services that, in theory, could replace wireline data services. This last option could come from players like Sprint, Verizon and AT&T.
- Fourth, **fixed wireless** strategies that may be deployed by players like the Dish Networks.

Let's take a closer look at each potential broadband substitute.

Third Pipe Option #1: FTTH

To assess FTTH's economics, investors need to examine three key variables: 1) household densities; 2) capital costs; and 3) subscriber economics (including take-rates). Let's look at each.

Step 1: Household Densities

The Census decomposes the US landmass into Metro Statistical Areas and Micro Statistical Areas. Collectively, these two groupings account for 94% of the US population, but only 47% of the land mass. As such, Census data provides sufficient granularity to assess the attractiveness of FTTH investments for all but 6% of the US population. But, what magnitude of investment is required for FTTH deployments?

Figure 157. US Census Classification

Census Area	Number of Areas	Counties	Population per Area	Share of US Population	Population (mil)	H'holds (mil)	Area (mil of sq mi)	Population Density (Pop/sq mi)	Household Density (HH/sq mi)
Metro Statistical	381	1,167	50K+	85%	258.3	99.4	0.91	282.9	108.8
+ Micro Statistical	536	641	10K to 50K	9%	30.9	11.9	0.74	42.0	16.1
+ Other (rural)	nm	1,335	< 10K	6%	19.5	7.5	1.88	10.4	4.0
= Total US	nm	3,143	nm	100%	308.7	118.7	3.53	87.4	33.6

Source: US Census, Citi Research

Step 2: Costs to Pass/Connect/Maintain a FTTH Network

The cost of a FTTH network can be decomposed into three buckets:

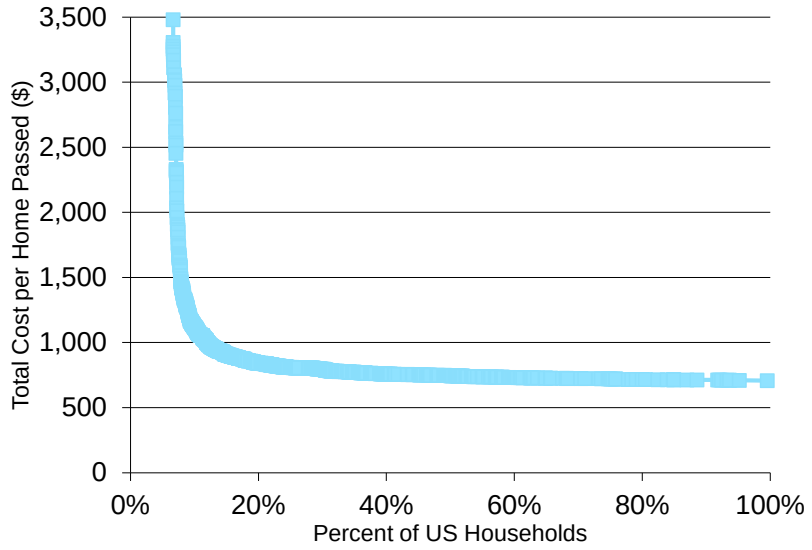
- First, there is the **cost to pass a home**. The FCC's OBI Technical Paper (Chapter 4) suggests the cost to pass a home can be approximated by this formula: [$702 x $exp^{(8.19/\text{Household Density})}$]. Higher household densities require lower attach rates. Conversely, lower household densities require higher attach rates to justify the upfront investment.

- Second, there is the upfront cost to **connect the home** to the network. This includes success-based capex that is fully variable. The same FCC paper estimates these costs at $1,100 per home and includes $650 in initial costs to attach the network to the home (labor, line drop and network interface device) and $450 in labor and CPE (in-home wiring and WiFi router).

- Third, there are the on-going costs to **maintain the customer's connection** to the network. This cost is sensitive to the churn rate. We assume a five year customer life which is akin to a monthly churn rate of 1.7%. This translates into annual outlay of about $90 per year (or $450 every five years).

By applying the FCC's formula and sorting US households by density, suggests the upfront cost per home passed drops dramatically as densities improve but then quickly levels off. The cost to pass a home drops below $1,000 for about 88% of US households.

Figure 158. FTTH Capex per Home Passed Ranked by US Home Density



Source: US Census, FCC, Citi Research

Step 3: Subscriber Economics

If we shift to recurring revenues and costs, we've made the following assumptions for a data-only FTTH service:

- First, we assume a data ARPU of $70 per month. This is consistent with recent pricing for Google's 1 Gbps data service in Kansas City, KS. We also assume 3% price inflation.
- Second, we also assume 90% gross profit margins. The marginal costs are quite limited and include items like bad debt, billing and transport.
- Third, we assume a depreciable life of 30 years for the network and 5 year life for the customer premises equipment (CPE). This translates into $166 of depreciation per customer per year.
- Fourth, we assume the firm uses 3x debt-to-EBITDA with interest costs of 6%.
- Fifth, we apply a 10% weighted average cost of capital (WACC).

These assumptions suggest over 20 years the service provider would generate $3,371 of after-tax cash flows.

Figure 159. Recurring Revenue and Costs of FTTH Data

		Year 1	Year 5	Year 10	Year 15	Year 20
	ARPU (3% inflation)	70	79	91	106	123
	x Months	12	12	12	12	12
	= Annual revenue	840	945	1096	1271	1473
	- Cost to serve (90% margins)	84	95	110	127	147
	= Annual EBITDA	756	851	986	1144	1326
	- Depreciation	166	166	166	166	166
	- Interest (3x leverage; 6% debt)	136	153	178	206	239
	= EBT	453	531	642	771	921
	- Tax (38%)	172	202	244	293	350
	= Cash from operations	281	329	398	478	571
	/ Cost of capital (WACC = 10%)	1.1	1.6	2.6	4.2	6.7
(A)	= NPV of inflows	256	205	154	114	85
	memo: NPV sum of outlays	3,371				

Source: FCC, Google, US Census, Citi Research

On the cost side, our aim is to match the $3,371 of inflows by adjusting our capital investments. But, some of the capital investments do not change based on household density or attach rates. For example, the CPE and maintenance investments of $450 every five years do not change. And, the $1,100 of upfront costs to connect the network to the home and put in the network interface device (NID) and customer premise equipment (CPE) do not change. However, what does change is the cost per home passed per subscriber. Deductively, this figure is $1,643. And, this implies a take rate (or attach rate) of 48% for all homes that are passed with FTTH.

Figure 160. Investments Required for FTTH Data

		Year 0	Year 5	Year 10	Year 15	Year 20
	Cost per home passed	791				
	/ Take rate	48%				
	= Cost per home passed per sub	1,643				
(D)	+ Connection costs	650				
(D)	+ CPE (including churn)	450	450	450	450	450
	= Total capex per sub	2,743	450	450	450	450
	/ Cost of capital (WACC = 10%)	1.0	1.6	2.6	4.2	6.7
(B)	= NPV of outlays	2,743	279	173	108	67
	memo: NPV sum of outlays	3,371				

Source: FCC, US Census, Citi Research

So, now, we are in a position to see how the breakeven attach rate varies in markets that are urban and rural. In Figure 162, we begin with the net present value (NPV) of the inflows and remove the CPE capex every five years. And, we remove the $1,100 of success-based capex. What remains is the cost per home passed. Then we see what attach rate is required to achieve breakeven economics.

For rural households (left side of Figure 162) the breakeven attach rate exceeds 100%. That is, it's uneconomic even under optimistic scenarios. For more less rural households (right side of Figure 162), the breakeven attach rate is 48%. This suggests for 30% of households, FTTH is likely uneconomic. For the remaining 70% of households, FTTH may be economic because the breakeven attach rates are below 50%.

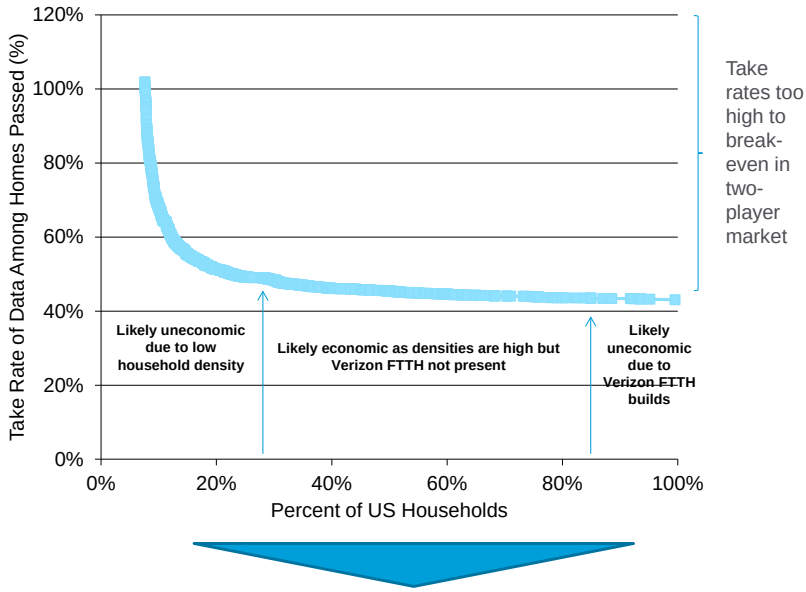
Figure 161. Implied Take Rate for Breakeven FTTH Economics

	More Rural			Less Rural
	Attach Rates for Breakeven FTTH			
(A) NPV of inflows (Year 1 to 20)	3,371	3,371	3,371	3,371
(B) - Churn capex year 20	67	67	67	67
(B) - Churn capex year 15	108	108	108	108
(B) - Churn capex year 10	173	173	173	173
(B) - Churn capex year 5	279	279	279	279
(D) - Upfront capex year 0	1,100	1,100	1,100	1,100
= Cost per home passed	1,643	1,643	1,643	1,643
x Breakeven take rate	154.1%	102.4%	79.4%	48.1%
= Cost per home passed	2,532	1,682	1,304	791
memo: percent of homes	7%	8%	9%	30%

Source: FCC, US Census, Citi Research

We show the breakeven attach rate graphically in Figure 163. The data suggest that in about 30% of homes, the household densities are too low to justify investment. And, in another 15% the densities are high enough but the minimum attach rates are too high since Verizon FiOS has already created a robust duopoly. (Of course, we've depicted Verizon's FiOS build within the most urban markets for graphical simplicity. In reality, the existing FiOS markets likely skew urban, but are not *exclusively* urban.)

Figure 162. Take Rate of Data for FTTN to Break-Even at Various Household Densities



FTTH overbuild can achieve break-even economics in 55% of US. 25% of US requires take rates that are too high in two player markets (cable + DSL). 15% of US has FiOS suggesting take rates unlikely to exceed 33%.

Source: FCC, US Census, Google, Citi Research

As such, we think Google's FTTH investments are likely a threat to about 55% of the US. That is, 100% less 15% with FTTH less 30% where footprint densities are too low.

But, Does Our Framework Work?

So far, we've suggested that the markets that will likely attract FTTH investment will have two key characteristics:

- First, the markets **can't be too rural** because the fixed costs required to pass a home with fiber would require attach rates that are unreasonably high.
- Second, in the semi-urban markets, **a FTTH firm would probably avoid FiOS** markets because attach rates are unlikely to reach the key 40-50% range. While that's plausible (even likely) in a two player market (cable and FTTH) it's unlikely in a three player market (cable, FiOS and FTTH).

So, let's look at some early Google FTTH cities and see if they comport to our framework. In Figure 164, we summarize the three markets where Google fiber has been deployed and nine markets where Google fiber may be deployed. The interesting aspect of these markets is that not one is a Verizon FiOS market.[5] As such, one of our screens seems to work.

Figure 163. Current and Proposed Google FTTH Markets

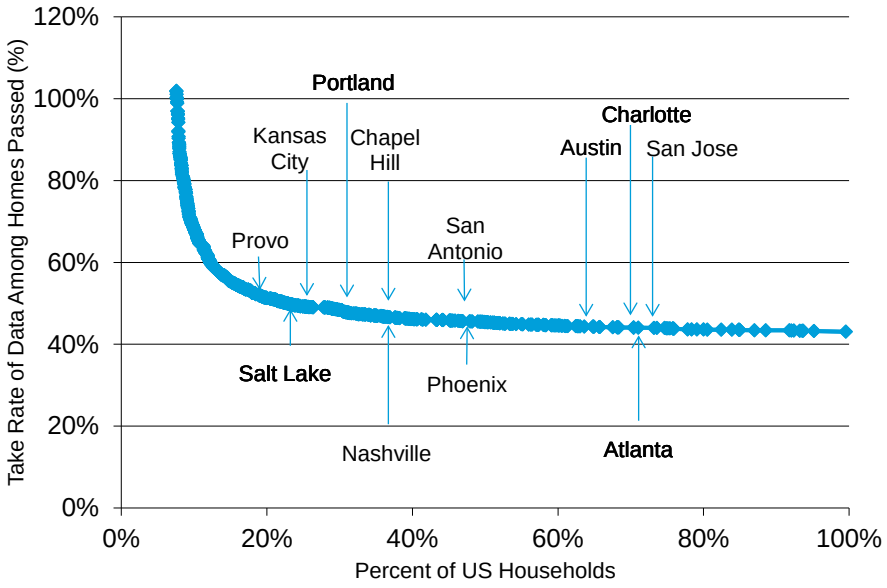
Market	Population	Google Status	FIOS Market	H'holds (mil)	Household Density (HH/sq mi)	FTTH Breakeven Take Rate
Austin	1.7	Current	No	0.66	156.4	45%
Kansas City	2.0	Current	No	0.78	100.0	46%
Provo	0.5	Current	No	0.20	37.6	53%
Atlanta	5.3	Potential	No	2.03	243.0	44%
Charlotte	1.8	Potential	No	0.68	219.2	44%
Nashville	1.6	Potential	No	0.61	107.5	46%
Phoenix	4.2	Potential	No	1.61	110.7	46%
Portland	2.2	Potential	No	0.86	128.1	46%
Raleigh-Durham	0.5	Potential	No	0.19	110.3	46%
Salt Lake City	1.1	Potential	No	0.43	45.3	51%
San Antonio	2.1	Potential	No	0.82	112.7	46%
San Jose	1.8	Potential	No	0.71	263.7	44%
Total	24.9			9.6		

Source: US Census, Google reports, Verizon reports, Citi Research

For the second screen, we'd like to see that each of the markets Google has selected has a reasonably high household density (thereby lowering the breakeven attach rate). And, as we show in Figure 165 all 12 of the Google markets have footprint densities that suggest a breakeven take rate that varies from 44% to 53%. As such, we think it's reasonable to assume that our framework comports to the algorithm Google is using to select markets for new FTTH builds.

[5] Verizon FIOS markets include: NYC (NY), Philadelphia (PA), Washington (DC), Hagerstown (PA), Los Angeles (CA), Tampa (FL), St. Petersburg (FL), Sarasota (FL), Manchester (MA), Ft. Worth (TX), Pittsburgh (PA), Providence (RI), New Bedford (MA), Richmond (VA), Petersburg (VA), Norfolk (VA).

Figure 164. Take Rate of Data for FTTN to Break-Even for Google FTTH Markets (%)



Source: Company reports, Citi Research

Implications for Google

Investors have struggled with what to make of Google's fiber initiative. Some believe the company is serious about a robust roll-out. Others believe the company is simply attempting to spur greater innovation and investment by incumbent broadband providers.

We lean toward the latter camp. We say this for a few reasons: 1) Google's history with the wireless spectrum auctions; 2) the way Google has addressed its Fiber plans (or lack thereof) from a public relations standpoint; and 3) the potential expense involved. As such, we believe that the most likely outcome is minimal investment by Google but a competitive response that would ultimately help Google's core ad business via greater speeds and Internet usage. Indeed, AT&T recently announced the possibility of expanding its Gigapower service to up to 100 cities and 21 new major markets. Others may follow AT&T's (err, Google's) lead.

But, if we're wrong — and Google is serious about a broad-based US FTTH expansion — we estimate it would cost Google about $52 billion in upfront capex to pass 65 million US households. In addition, if Google achieved 33% attach rates on these 65 million homes, it would take another $37 billion in variable capex. All told, that's nearly $90 billion of investment, or about 3.5 years' worth of Google free cash flow. Of course, these costs would be offset by the gross profits from the monthly service fees (that range between $70 and $120 per month) plus any incremental revenue streams that might develop (like advertising).

All told, we think few companies — including Google — will spend the capital to overbuild the incumbent last-mile broadband providers. But, beyond FTTH, there are other Third Pipe technologies we need to explore, including Satellite Broadband. Let's take a look.

Third Pipe Option #2: Satellite Broadband

Satellite broadband has been around for several decades. But, the current generation of satellite broadband service was launched in 2012 (ViaSat's Excede and EchoStar's Hughes). These satellites deliver 14x more capacity the prior generation of service launched in 1998.

Figure 165. Evolution of Satellite Broadband Technology

Year	Capacity (Mbps)	Capex ($ mil)	Firm	Design Details
1974	144	NA	Westar-1	
1982	288	NA	Westar-4	24 Transponders
1993	1,000	NA	NA	Ku-Band
1998	10,000	300	Wild Blue, SPACEWAY 3	Ka-Band w/ spot beams
2011	140,000	450	ViaSat-1; Jupiter (Echo XVII)	Ka-Band w/ many spot beams
2016	60% more vs. ViaSat-1?	625	ViaSat-2; Echo XIX	Dynamic adj of spot beam capacity?

Source: ViaSat, Citi Research

In terms of offerings, both platforms allow consumers to choose from four packages. Typically, the offered download speeds are 10 Mbps but they can be as low as 5 Mbps or as much as 15 Mbps. Crucially, however, each package has a restriction on the amount of data that can be consumed. Low-end packages — priced at $50 to $65 per month — limit data consumption to 5 GB per month. High-end packages — priced at $130 a month — limit data consumption to 20-25 GB per month.

Figure 166. Satellite Broadband, Pricing, Speeds and Data Limits ($ per Month, Mbps, GB/mo)

	Excede				Hughes			
	Evolution	Classic 10	Classic 15	Classic 25	Connect	Power	Power Pro	Power Max
ARPU	64.99	49.99	74.99	129.99	49.99	59.99	79.99	129.99
Dnload	12 Mbps	12 Mbps	12 Mbps	12 Mbps	5 Mbps	10 Mbps	10 Mbps	15 Mbps
Upload	3 Mbps	3 Mbps	3 Mbps	3 Mbps	1 Mbps	1 Mbps	1 Mbps	2 Mbps
Data: Email; web	Unlimited	nm	nm	nm	nm	nm	nm	nm
Data: All apps	5GB video	10 GB	15 GB	25 GB	5 GB	10 GB	15 GB	20 GB

Source: Citi Research

The combination of relatively high retail prices — coupled with meaningful restrictions on data usage — means that satellite broadband isn't faring particularly well relative to the wireline alternatives. That is, only about 2 million US consumers subscribed to satellite broadband at the end of 2013. That pegs the platform's market share at just 2%. And while the next generation of satellites — with faster speeds — allowed satellite to gain about 12% of the net adds in 2013, most consumers still perceive satellite broadband as service that is tailored to markets without wireline broadband alternatives.

But, why is that? And, could it change?

Figure 167. US Broadband Penetration Rates (Million, Percent)

	2008	2009	2010	2011	2012	2013	2014
Cable modem	40.3	42.4	45.3	48.3	51.6	54.4	57.0
+ DSL	30.4	31.2	31.6	31.5	31.1	30.7	30.1
+ FTTP	2.9	4.0	5.0	5.9	6.7	7.5	8.4
+ Satellite	0.9	1.1	1.2	1.2	1.5	1.9	2.0
+ Other Wireline	0.7	0.7	0.8	0.8	0.8	0.8	0.8
+ Fixed Wireless	0.5	0.5	0.6	0.7	0.8	0.9	1.0
= Total Fixed Subs	75.7	79.9	84.5	88.3	92.6	96.2	99.3
- Non-residential	6.7	6.6	7.6	7.6	8.1	8.3	8.5
= Residential Fixed Subs	69.04	73.3	76.9	80.69	84.46	87.9	90.85
/ Occupied Housing Units	111.9	111.7	112.5	114.1	114.7	115.0	115.6
= Broadband Penetration	61.7%	65.6%	68.4%	70.7%	73.6%	76.4%	78.6%
memo: sequential change		4.0%	2.7%	2.4%	2.9%	2.8%	2.2%
memo: cable share		53%	54%	55%	56%	57%	57%
Cable modem	nm	2.19	2.9	2.93	3.39	2.75	2.61
+ DSL	nm	0.77	0.43	(0.15)	(0.35)	(0.44)	(0.60)
+ FTTP	nm	1.1	1.01	0.9	0.83	0.72	0.88
+ Satellite	nm	0.18	0.06	0.01	0.26	0.45	0.09
+ Other Wireline	nm	0.01	0.08	-	0.03	(0.02)	-
+ Fixed Wireless	nm	0.04	0.06	0.11	0.08	0.13	0.10
= Total Fixed Net Adds	nm	4.29	4.53	3.81	4.24	3.58	3.08
- Non-Residential	nm	(0.06)	1.01	0.01	0.53	0.11	0.22
= Residential Fixed Net Adds	nm	4.23	3.52	3.80	3.71	3.48	2.86
Satellite Net Adds	nm	0.18	0.06	0.01	0.26	0.45	0.09
/ Total Fixed Net Adds	nm	4.29	4.53	3.81	4.24	3.58	3.08
= Satellite Share of Net Adds	nm	4%	1%	0%	6%	12%	3%

Source: FCC. Citi Research

The current generation of satellites has 140 Gbps of capacity. About 60% of the capacity is allocated to the downlink (from web to the user). And there is a 10% efficiency loss. As such, about 75 Gbps of capacity is available downstream. If every user actually received (the advertised) 12 Mbps in speed, the current generation of satellites could only service 6,300 customers at the same time. (The older generation of satellites can only serve 1,200 subs.) But, the management teams of ViaSat and EchoStar suggest each of the current generation of satellites can serve 2 million customers. So, what's going on?

Figure 168. Simultaneous Users at Advertising Bandwidth

	WildBlue	ViaSat-1	Comments
Total capacity (Gbps)	10	140	Design capacity
x Allocated to downlink	60%	60%	
= Downlink capacity	6	84	Allocated from web to user
x Efficiency loss	100%	90%	
= Usable downlink capacity (Gbps)	6	76	From web to user with losses
x Mbps per Gbps	1,000	1,000	
+ Usable downlink capacity (Mbps	6,000	75,600	
x Kbps per Mbps	1,000	1,000	
= Usable downlink capacity (kbps)	6,000,000	75,600,000	
/ BHOL (kbps)	33	33	From prior figure
= Simultaneous users in busy hour	180,000	2,268,000	

Source: US Census, Citi Research

Like terrestrial wireless, satellite broadband is a shared service. As such, data consumption must be constrained. Let's illustrate with some simple math. If a consumer downloaded 3 GB per month in a steady, low-level stream of bits 24 hours a day, the consumer would only need 9 Kbps of bandwidth (1/7th of a dial-up connection). But, since about 15% of total usage occurs during the busiest hour of the day, a satellite broadband firm can design the system to deliver just 33 Kbps. This is sometimes called the Busy Hour Offered Load (BHOL).

Figure 169. Data Usage per Month Versus Busy Hour Offered Load (BHOL)

	Average	x	Share of Use in Busy Hr	=	Busy Hour Offered Load (BHOL)
Usage per month (GBytes)	3		15%		0.45
/ Days per month	30				30
= Usage per day (Gbytes)	0.1				0
/ Hours per day	24				1
= Usage per hour (GBytes)	0.004				0.15
/ Minutes per hour	60				60
= Usage per minute (GBytes)	0.0001				0.003
/ Seconds per minute	60				60
= Usage per second (GBytes)	0.000001				0.000004
x MB per GB	1,000				1000
= Usage per second (MBytes)	0.001				0.004
x KB per MB	1,000				1000
= Usage per second (KBytes per second)	1.2				4.2
x Bits per byte	8				8
= Offered bandwidth (kbps)	9				33

Source: Citi Research

As such, if a user only gets 3 GB of data during a month, then the older satellites (like WildBlue's offering of 5 Mbps service) can serve 180K subs. And, the current satellites (like ViaSat-1's offering of 12 Mbps service) can serve 2.2 million customers in the busy hour. Put simply, the number of customers satellite broadband can service is inversely proportional to the total amount of GB the household consumes. This is why the satellite firms restrict data consumption…it takes a lot of customers to pay for a $400 million satellite.

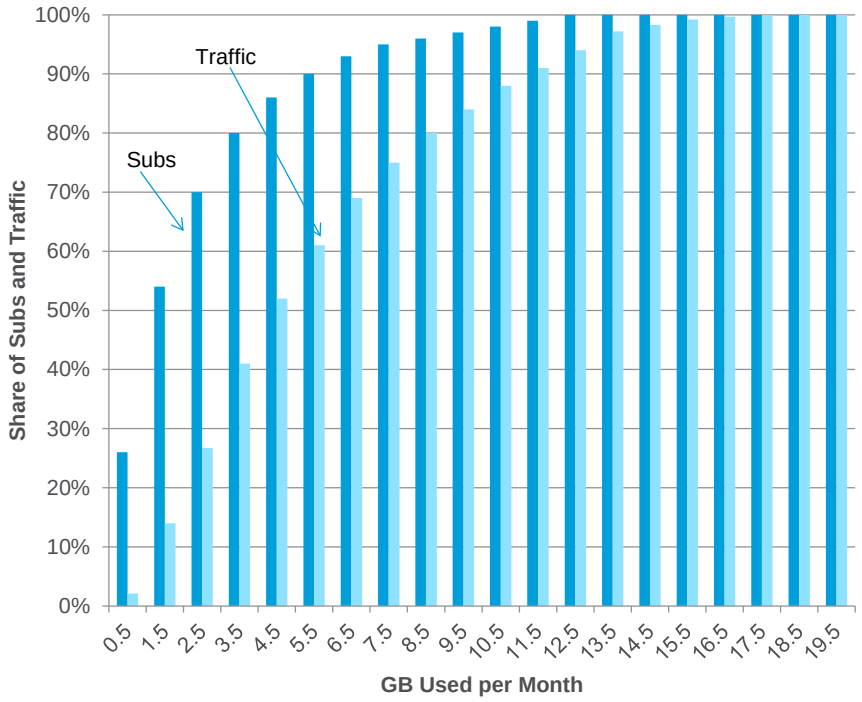
Figure 170. Maximum Customers per Satellite

	WildBlue	ViaSat-1	Comments
Total capacity (Gbps)	10	140	Design capacity
x Allocated to downlink	60%	60%	
= Downlink capacity	6	84	Allocated from web to user
x Efficiency loss	100%	90%	
= Usable downlink capacity (Gbps)	6	94	From web to user with losses
x Mbps per Gbps	1,000	1,000	
+ Usable downlink capacity (Mbps)	6,000	75,600	Maximum speed offered
/ Downlink bandwidth offered (Mbps)	5	12	
= Simultaneous users	1,200	6,300	

Source: Citi Research

So, the next logical question is this: "How much data do consumers actually use each month?" Wyoming's Public Service Commission posted an interesting presentation from ViaSat from June, 2012. The data suggests a typical satellite broadband customer gets about 2.7 GB per month (not far from our 3 GB example from above).

Figure 171. Share of Subs and Data Usage by ViaSat Customer (%,GB per Month)

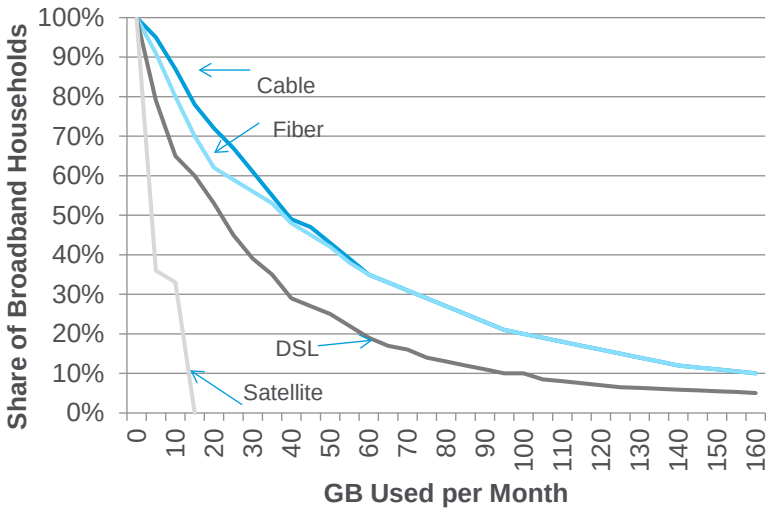


Source: Citi Research, Wyoming PSC

So, how do these data usage patterns compare to terrestrial platforms?

In Figure 173, we've used data from the FCC's 2013 broadband survey (Measuring Broadband America) to show the comparison in data usage by platform. The data shows that satellite broadband users consume far fewer GB per month versus terrestrial rivals. This, of course, severely restricts the addressable market for satellite services if wireline alternatives are available. After all, the utility consumers derive from their broadband connection can be thought of as the area under each curve.

Figure 172. Cumulative Distribution of User Traffic by Technology (%, GB per month)



Note: Data from September 2012 panel of 6,635 panelists
Source: Citi Research, FCC

So, let's recut the math from to show how many customers a satellite could serve as the data usage increases. The analysis suggests if users were allowed to use 24 GB per month — equivalent to the highest priced Excede service at $130 per month — ViaSat-1 could only serve 280,000 customers. Moreover, as we showed in Figure 173, a usage limitation of 24 GB per month would satisfy only 50% of DSL users and 25% cable/FTTH users.

Figure 173. Ability to Serve Satellite Broadband Subs Falls with Rising Data Usage (GB, %, Mil)

	Usage per Month							
	Low							High
Usage per month (Gbytes)	3	6	9	12	15	18	21	24
x Portion in busy hour	15%	15%	15%	15%	15%	15%	15%	15%
= Busy hour usage per month (Gbytes)	0.45	0.90	1.35	1.80	2.25	2.70	3.15	3.60
x Conversion of GB to Kbps in busy hr	74	74	74	74	74	74	74	74
= Busy Hour Offered Load	33	67	100	133	167	200	233	267
Usable downlink capacity (Gbps)	76	76	76	76	76	76	76	76
/ Busy Hour Offered Load (BHOL)	33	67	100	133	167	200	233	267
= Simultaneous users in busy hr (mil)	2.27	1.13	0.76	0.57	0.45	0.38	0.32	0.28

Source: Citi Research

But, in addition to facing competition from terrestrial platforms that don't have such restrictive data caps, satellite broadband faces two other challenges: growing data demand and shifting usage patterns. Let's look at each item.

First, Cisco reports that North American consumer's fixed line data traffic is growing 23% per year. As such, traffic is expected to nearly double every four years (Figure 175). Absent technological improvements — and new satellite launches — satellite broadband will see its customer base fall by 50% every four years (Figure 174). Of course, there will likely be new satellite launches, but these new launches may be required to maintain — rather than grow — satellite's existing market share.

Figure 174. North American IP Traffic Forecast (GB per Month, %)

	2010	2011	2012	2013	2014E	2015E	CAGR '07 to '10	CAGR '11 to '15E
North America web, email and data	883	1,021	1,272	1,541	1,781	2,443	nm	24%
+ North America file-sharing	674	785	919	1,081	1,280	1,522	nm	18%
+ North America gaming	18	24	32	43	53	82	nm	36%
+ North America VoIP	21	22	23	23	23	23	nm	2%
+ North America video calling, webcam	80	108	154	198	254	333	nm	33%
+ North America video	1,625	3,039	4,179	5,419	6,619	8,130	nm	28%
+ North America managed IP	2,422	3,403	4,566	5,665	6,324	6,880	nm	19%
= Total North American consumer traffic	5,723	8,402	11,145	13,970	13,334	19,415	63%	23%
- Managed IP	2,422	3,403	4,566	5,665	6,324	6,880	66%	19%
- Mobile	61	145	303	549	882	1,367	185%	75%
= Fixed North American public Internet	3,240	4,854	6,276	7,756	9,128	11,169	60%	23%
memo: growth	51%	50%	29%	24%	18%	22%		

Source: Citi Research, Cisco Virtual Networking Index Report

Second, while email and web page traffic occurs throughout the day, video consumption tends to cause busy-hour traffic to increase more rapidly than overall traffic. Cisco explains this dynamic clearly in a recent report (The Zettabyte Era):

> *"Video is the underlying reason for accelerated busy-hour traffic growth. Unlike other forms of traffic that are spread evenly throughout the day (such as web browsing and file sharing), video tends to have a "prime time". Because of video consumption patterns, the Internet now has a much busier busy hour. Because video has a higher peak-to-average ratio than data or file sharing, and because video is gaining traffic share, peak Internet traffic will grow faster than average traffic. The growing gap between peak and average traffic is amplified further by the changing composition of Internet video. Real-time video such as live video, ambient video, and video calling has a peak-to-average ratio that is higher than on-demand video."*

Of course, as the portion of traffic that occurs in the busy-hour rises, the BHOL increases. This, in turn, lowers the number of simultaneous users that can be served on any given satellite (Figure 174).

Bottom Lines

To examine the durability of the broadband monopoly/duopoly we've examined one potential rival platform: Satellite Broadband. Our analysis suggests these services are higher priced versus terrestrial alternatives. And, these services have severe data limitations making the service unsuitable for 50% of DSL customers and 75% of existing cable/FTTH users. Moreover, as data usage grows — particularly video usage — the ability of satellite broadband to serve its existing customers will fall unless there are new satellite launches. Although we do expect satellite technology to continue to improve, these improvements will likely be required to keep up with rising IP traffic demands. As such, we think it's very unlikely that Satellite challenges the incumbent terrestrial platforms like FTTH, cable modem and DSL.

But, there is another technology we need to examine: Wireless Broadband.

Third Pipe Option #3: Wireless Broadband

Wireless networks stitch together a large number of cell sites to create ubiquitous and reliable coverage for mobile voice and broadband services. Commercial cellular service effectively began in the United States in 1983 as an analog service. Digital mobile service (or 2G services) began in the 1990s. Spectrum availability was increased substantially with the auction of PCS licenses in 1994. Sprint spectrum launched the first PCS system in the US in Washington D.C. in 1995.

Unlike Europe, the carriers in the US employed competing digital technology standards (TDMA, CDMA, GSM, and iDEN) on a variety of spectrum bands. This paved the way for meaningful differences in quality and handset selection. In the last few years, however, device selection has become more homogenous among the carriers. All four national carriers (and some regionals) are deploying long-term evolution (LTE) as a common 4G solution. Chipset advances have reduced the costs of incorporating different technologies and frequency bands into the same device form factors.

Regarding spectrum, there are two key observations:

- First, the US has ample amounts of spectrum. The real issue is that the spectrum is in the wrong hands. While larger carriers (AT&T and Verizon) may not have sufficient spectrum, smaller carriers (Sprint, T-Mobile and Dish) have excess spectrum. As such, **spectrum ownership - rather than availability - is the real constraint.**

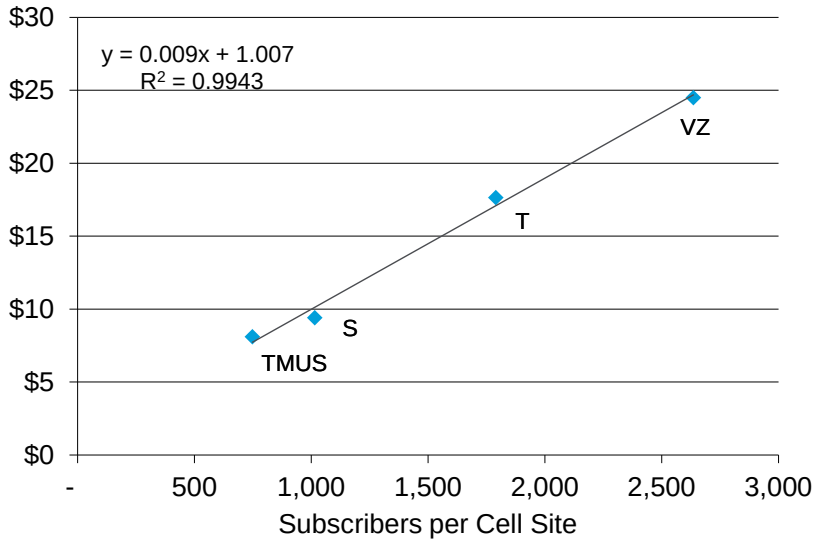
- Second, **downlink spectrum is more valuable than uplink spectrum.** This is driven by the shift in traffic patterns due to the rise of mobile data. As symmetric voice traffic is overtaken by asymmetric data traffic, wireless networks will see far more bits sent from the network to the user (versus bits from the user to the network).

So, if a carrier has ample downlink spectrum (and is using the latest 4G technology), can a wireless service provider economically offer a data service that is a viable substitute for fixed broadband services?

Scale Economics of Mobile Wireless

To answer that question, we need to understand the economics of a wireless network. And, on this front, we turn to the scale and returns of the four largest US wireless carriers. It turns out that the best predictor of a wireless carrier's operating income before depreciation and amortization (OIBDA) margin and OIBDA per sub is governed by the number of subscribers served per cell site. Using first quarter 2014 results, we found a 99% correlation between subscribers per cell site and OIBDA per sub.

Figure 175. Normalized Monthly OIBDA per Subscriber vs. Subscriber per Cell Site



Note: OIBDA margin normalized for estimated impacts of EIP and other transitory items. The r-squared correlations are slightly lower on a trailing 12-month basis, but still well above 0.90.
Source: Company reports, Citi Research

Why does this correlation exist? We suspect it's due to the fixed cost nature of the wireless business. If we simplified the economics of the mobile business on a per site basis, if would include three major cost items (using the national average of roughly 1,500 subscribers per cell site):

- **Network costs** are driven by the number of cell sites operated for both coverage and capacity. It includes tower rent, backhaul costs, engineering costs, marginal costs of traffic, and network maintenance. We estimate $12K per site per month.
- **Subscriber operating costs** are tied to the number of customers. These costs include customer care, systems, overhead, and administrative expenses to maintain the customer base. We believe each of national carriers likely has minimum efficient scale with respect to their operations. We estimate $13.5K per site per month.
- **Acquisition and retention costs** are tied to advertising outlays and the number of device sales. We estimate these costs run $19K per site per month.

Below, we summarize these costs.

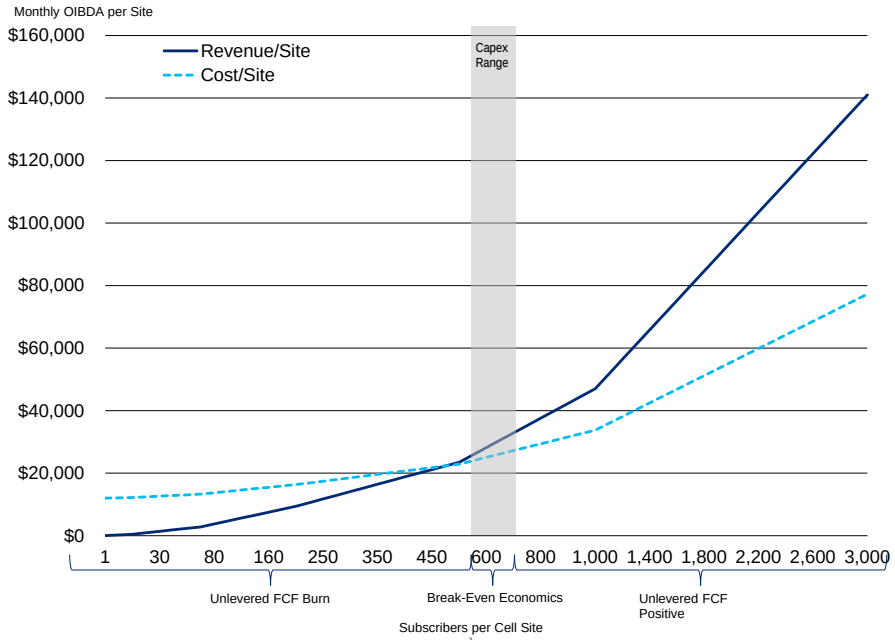
Figure 176. Simplified Economic Analysis for the Mobile Wireless Sector

	Average
Users/Site	1,500
x ARPU	$47.00
= Revenue per Cell Site	$70,500
Site-based costs	
Operating Costs per Site (Average)	$12,000
Subscriber-based costs	
Other operating costs per subscribers/month	$9.00
x subscribers	1,500
= Subscriber-Based Costs	$13,500
Site-Based Costs	$12,000
+ Subscriber-Based Costs	$13,500
Annual Operating Expenses	$25,500
Note: Monthly Costs/Customer	$17.00
Cash Flow before Marketing & Device Costs	$45,000
Note: % Margin	64%
Marketing & Device Cost per Device Sale	$370
/ Replacement Life	29
= Average Monthly Cost	$13
x Subscribers	1,500
= Marketing & Device Cost/Month	$19,138
Total Cost per Site	$44,638
Note: Cost per Subscriber	$29.76
OIBDA/Site	$25,862
Note: % Margin	*37%*

Source: Company reports, Citi Research

Armed with this data, we can show how a wireless carrier's revenues and costs change as the carrier serves more customers per site. The data suggests carriers need to capture over 600 subscribers per cell site to reach break-even economics (at a 10% OIBDA margin) and achieve over 750 subscribers per cell site (to generate a 20%-plus OIBDA margin). At this point, the company would generate EBITDA that matches the high-end of the capital intensity range for the carriers.

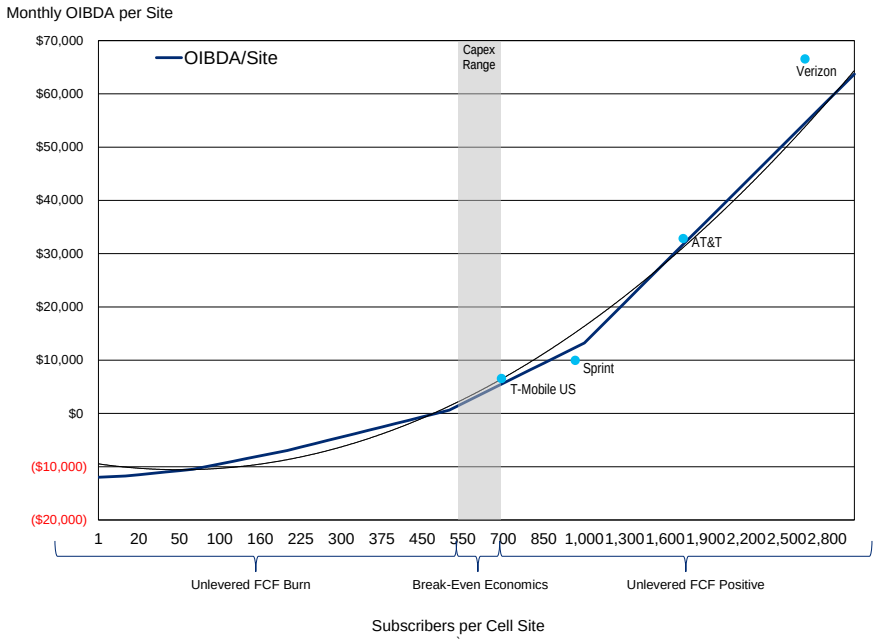
Figure 177. Subscriber Cell Site Scale Fuels Profitability for Wireless Carriers Site



Source: Company reports, Citi Research

We can simplify this analysis further by subtracting revenue from cost to arrive at OIBDA per site. And, to confirm the reasonableness of our simplified economic model (from above), we've superimposed the actual data for each of the four national carriers. (We note that the data is adjusted for installment billing, which is why T-Mobile is generating a lower OIBDA per site than the amount which can be calculated from the income statement.) Since each of the four national carriers lies very close to the line we created using our simplified economic model, we believe the data is a reasonably good proxy for the economics of the wireless business.

Figure 178. Subscribers Drive OIBDA Scale on a Per Site Basis

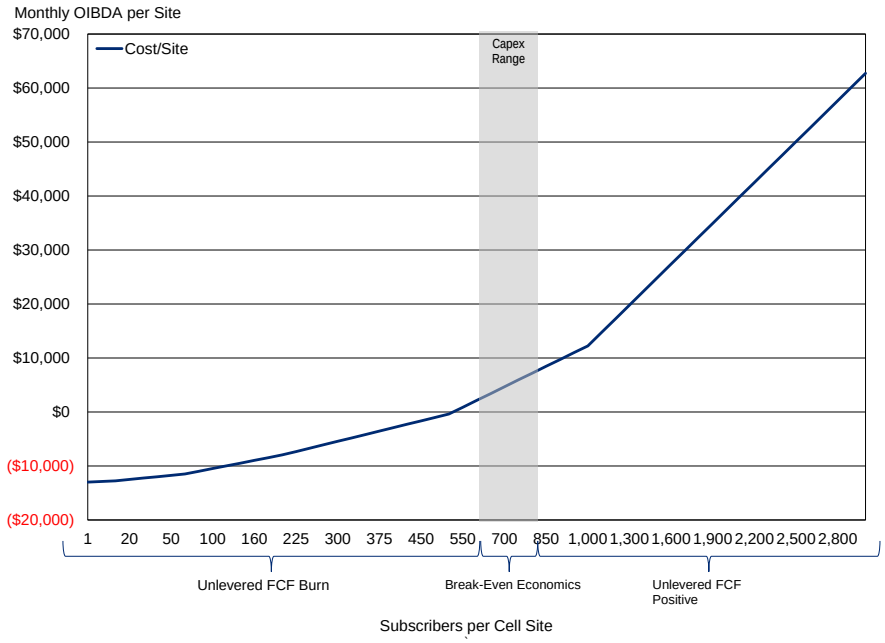


Source: Company reports, Citi Research

But, there is one adjustment we need to make. AT&T, Verizon, and T-Mobile are using, on average, less than 40 MHz of downlink spectrum in their networks. And, all three carriers have plans to deploy additional spectrum resources for capacity. Verizon is deploying AWS spectrum nationally, AT&T is deploying WCS spectrum nationally, and T-Mobile is re-farming spectrum from MetroPCS and adding 700 MHz spectrum in a variety of its markets.

As such, we are adjusting the cost curve to reflect an incremental cost relating to tower amendments and backhaul for this additional spectrum. We added $1,000 in monthly network costs of which we believe 50-60% will come from tower amendments and the balance from a rapid increase in backhaul capacity. The revised cost structure from using additional spectrum resources moves the break-even economics from a range of 600-750 to 650-850 customers per site.

Figure 179. Subscribers Drive OBIDA Scale on a Per Site Basis with Incremental Costs for Added Spectrum



Source: Company reports, Citi Research

The Trade-Off: Economics versus Bandwidth

So far, we've shown that the wireless business is a scale business. And, we've suggested that a carrier must serve more than 750 customers per cell site to generate free cash flow.

Our next question is this: "*What sort of wireless offer – in terms of speed and data usage - can a carrier offer if they need to serve at least 750 customers per site?"* In effect, carriers can serve few customers per site with a fantastic offer. But, they won't make money. Or, carriers can serve many customers per site with a lackluster offer and make tons of money. Our aim is to understand the trade-off.

To assess the trade-off requires at least six key inputs. So, our aim is to describe each of the key inputs and then show how the outputs fit onto the industry's cost structure (from the prior section). Let's see if we can do it.

The Six Critical Variables

#1 Downlink Spectrum Available

Our first key variable is the magnitude of downlink spectrum that can be used for wireless data services. The FCC just updated its estimate of spectrum that is available for mobile broadband from 452 MHz to 581 MHz (before considering another 40 MHz of paired AWS-3 to auctioned in 2015).

On a downlink basis, we estimate that 374 MHz of spectrum could be allocated to the downlink. If we exclude Sprint (that enjoys significantly excess downlink spectrum), our understanding of spectrum holdings by carrier suggests that a typical carrier — like AT&T, Verizon, T-Mobile or Dish — **could each deploy an average of about 50 MHz of downlink spectrum.** Hence, we use 50 MHz as a base case.

Figure 180. Estimated Spectrum and Downlink Spectrum in US (MHz)

Frequency Band	Band	Estimated FCC Screen	Estimated Downlink
EBS/BRS	2.5 GHz	157 MHz	133 MHz
PCS	1.9 GHz	140 MHz	70 MHz
AWS-1	1.7/2.1 GHz	90 MHz	45 MHz
700 MHz	700 MHz	70 MHz	41 MHz
ASW-3	1.8 GHz	65 MHz	20 MHz
Cellular	850 MHz	50 MHz	25 MHz
AWS-4	2.0/2.2 GHz	40 MHz	40 MHz
WCS	2.3 GHz	20 MHz	10 MHz
Nextel/SMR	800/900 MHz	14 MHz	7 MHz
Total		646 MHz	391 MHz

Source: FCC, Bingham, Citi Research

#2: Minimum Data Speed per Month

Wireless capacity needs to balance the number of users against performance, as measured by speed or consumption. To provide for greater over-subscription, we believe all four mobile carriers are offering consumption-based pricing for shared wireless broadband services (i.e. MiFi, personal hotspots) to limit intensive video usage, especially during the peak busy hour.

We believe delivering a minimum speed during the peak busy hour is the most important capacity constraint wireless companies need to manage (versus the aggregate amount of monthly data consumption). Mainstream fixed high-speed Internet products are currently advertising downstream speeds of 12-25 Mbps from most cable firms, wireline telco firms and satellite broadband companies. **We have chosen 12 Mbps as the minimum speed wireless needs to offer to provide a competitive service to fixed broadband alternatives.**

Verizon, for example, already advertises speeds capable of competing with entry-level broadband services. And, based on a June 2013 survey from PC Magazine, the typical speed offered by the carriers using LTE is about 11 Mbps. (We suspect the average speed of the mobile broadband LTE networks may have slowed since the PC Magazine survey in June, 2013, as the number of LTE smartphone customers has risen substantially over the last two years).

Figure 181. Advertised and Average Mobile Broadband Speed US National Mobile Carriers

	Average Downlink		Average Uplink	
Carrier	LTE	HSPA/3G	LTE	HSPA/3G
AT&T	16.02	4.52	6.64	1.08
Sprint	5.11	0.74	2.49	0.62
T-Mobile	13.11	7.66	7.43	1.18
Verizon	10.25	1.08	4.55	0.74
Average	11.1225	3.5	5.2775	0.905

Source: Company reports, PC Magazine (June 2013), Citi Research

#3: Share of Use in Busy Hour

Since all networks – including wireless networks – must be built to serve customers in the busy hour, the next key variable is the portion of all traffic that occurs during the busiest hour of the day.

Our analysis of FCC data in its OBI Technical Paper as well as our study of some recent data from Sandvine and historical video consumption patterns suggest peak-busy hour usage ranging between 10% and 15%. **We have assumed ~15% of traffic occurs in the busy hour.** (This is similar to the rate we used to analyze Broadband Satellite capacity.)

And, since there is a trade-off between data speed per month and the portion of data consumed in the busy-hour, this translates into consumption of up **to 54 GB per user per month at 12 Mbps.** The figure also shows the direct relationship between speed and data consumption, as the capacity in a cell is shared between fewer users.

The trade-off between speed and data consumption reinforces our belief that the constraint carriers are solving for during the peak busy hour is speed (versus consumption). If too many users access the network at the same time - or use data intensive applications like streaming media - then customers may become unhappy with the average service speeds. As such, carriers have imposed limits on data consumption to preserve speeds.

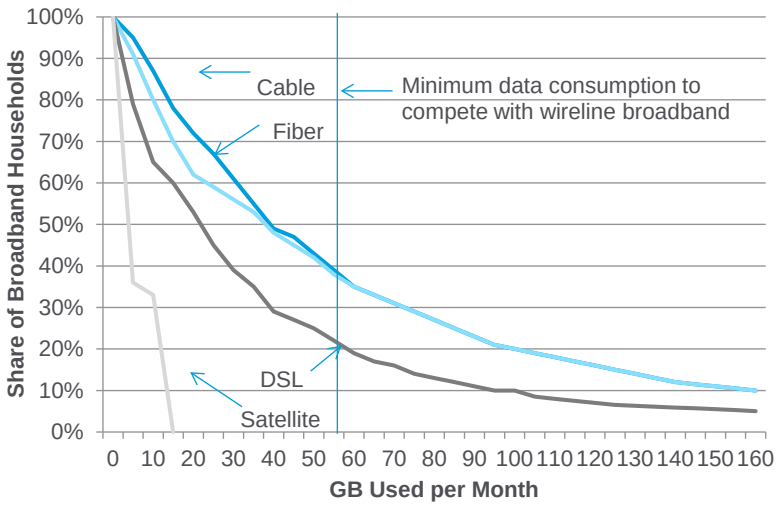
Figure 182. Monthly Consumption Available Based on Busy Hour Usage, Downstream Speed

% of Peak	Monthly Downstream Speed (Mbps)						
Busy Hour Usage	4	8	10	12	15	20	25
5%	54.0	108.0	135.0	162.0	202.5	270.0	337.5
10%	27.0	54.0	67.5	81.0	101.3	135.0	168.8
15%	18.0	36.0	45.0	54.0	67.5	90.0	112.5
20%	13.5	27.0	33.8	40.5	50.6	67.5	84.4
25%	10.8	21.6	27.0	32.4	40.5	54.0	67.5
30%	9.0	18.0	22.5	27.0	33.8	45.0	56.3
35%	7.7	15.4	19.3	23.1	28.9	38.6	48.2
40%	6.8	13.5	16.9	20.3	25.3	33.8	42.2
45%	6.0	12.0	15.0	18.0	22.5	30.0	37.5
50%	5.4	10.8	13.5	16.2	20.3	27.0	33.8

Source: Citi Research

So, is 54 GB a month a sufficient amount of data consumption? Data usage differs significantly among wireline users. About 10% of users consume less than 10 GB per month. But, 10% of fiber users use 160 GB per month. For our purposes, mobile carriers at a speed of 12 Mbps and 54 GB per month can meet the needs of 60% of cable modem users, 60% of fiber users and 75% of DSL users. As such, we think it's a reasonable starting point for wireline data substitution.

Figure 183. Cumulative Distribution of Wireline Traffic by Technology (%, GB/month)



Note: Data from September 2012 panel of 6,635 users
Source: FCC. Citi Research

#4: Spectral Efficiency

The spectral efficiency has significantly improved since the introduction of digital wireless service as carriers have upgraded their networks from 2.5G (EDGE technology) through the introduction of 4G (LTE) services. The efficiency of the network is described as the bits that can travel over a unit of spectrum (Hz) per second. The efficiency is also expressed as a peak speed, or what is theoretically possible with the technology, as well as an average speed, which is the predicted experience on a loaded network.

According to an FCC Technical paper, 4G LTE data is over 7x more efficient than the 2.5G EDGE alternative on a peak basis, but only 2.5x more efficient for the average usage experience. Unfortunately, the user experience is not homogenous for mobile service, as the more users that share the resources of a single cell, the speed at which the user is moving, and the location of the user within the cell can greatly impact the specific user performance.

For example, a user can achieve a better data experience if she is closer to the center of the cell, moving at a speed under 15 kilometers per hour, and is sharing capacity with fewer simultaneous users within the cell. Hence, the average experience only captures about 15% to 43% of the possible peak speeds, with the more advanced technologies achieving a much lower average experience relative to peak advertised capability.

Figure 184. Summary of Spectral Efficiency by Technology

Technology	EDGE	EV-DO	HSPA	LTE	LTE
Peak Performance					
Data Rate per cell site (Mbps)	0.7	9.3	43.2	258	516
/ Sectors per cell	3	3	3	3	3
= Data rate per cell site sector (Mbps)	0.2	3.1	14.4	86.0	172.0
/ spectrum used (MHz)	0.2	1.25	5	10	20
= bits/Hz efficiency	1.2	2.5	2.9	8.6	8.6
Note: Multiple of EDGE		2.1x	2.5x	7.4x	7.4x
Average Cell Data Rates					
Data Rate per cell site (Mbps)	0.3	2.6	15	37.5	75
/ Sectors per cell	3	3	3	3	3
= Data rate per cell site sector (Mbps)	0.1	0.9	5.0	12.5	25.0
/ spectrum used (MHz)	0.2	1.25	5	10	20
= bits/Hz efficiency	0.5	0.7	1.0	1.3	1.3
Note: % of Peak Performance	43%	28%	35%	15%	15%
Note: Multiple of EDGE		1.4x	2.0x	2.5x	2.5x

Source: FCC, Citi Research

Based on our conversations with industry contacts and several companies, the average experience for the LTE standard may be outperforming the FCC's reference of average data rates of 1.3 bits per Hz. Our anecdotal live speed tests of LTE networks at their infancy and in their current form also support this assertion.

Also, since the FCC published the OBI Technical Paper, the LTE-Advanced standard has evolved and is now targeting peak 15 bits per Hz and a future average target of 3.7 bits per Hz efficiency (using 4x4 MIMO), representing 25% of peak performance (according to Agilent Technologies). As such, we will use 3.7 bits per Hz for our model.

Based on LTE advanced, we highlight the potential capacity of an individual cell site at peak and at average performance under a few scenarios. While greater spectrum depth on LTE-Advanced could produce better average efficiency - as the overhead is shared across a larger amount of spectrum - the FCC did not show any efficiency improvement between its 10 MHz LTE and 20 MHz LTE scenarios, which has led us to keep the average efficiency constant in our scenarios.

Figure 185. Cell Site Capacity Under Peak and Average Scenarios for Varying Spectrum Depth

	10 MHz Downlink		20 MHz Downlink		40 MHz Downlink	
Item	Peak	Average	Peak	Average	Peak	Average
MHz	10	10	20	20	40	40
x bits/Hz	15.0	3.7	15.0	3.7	15.0	3.7
= Data capacity per sector (Mbps)	150	37	300	74	600	148
x sectors/cell	3	3	3	3	3	3
= Data capacity per cell (Mbps)	450	111	900	222	1,800	444

Source: FCC, Agilent Technologies, Citi Research

We estimate that a cell site can offer average capacity of 111 Mbps in a 10 MHz downlink channel, which is similar to the LTE service Verizon has launched nationally on its 700 MHz spectrum. T-Mobile and other national carriers have been working towards launching LTE services on a paired 20x20 MHz channel, which could boost downlink capacity per cell site to roughly 222 Mbps on average.

If Dish Networks were to use its spectrum for Mobile LTE advanced service with 40 MHz of downlink AWS-4 spectrum, the company could offer average capacity of 444 Mbps. On average the national carriers have between 40-65 MHz of downlink spectrum currently with some still waiting to be deployed and other bands still relying on older, less efficient, technologies. Hence, Dish's broadband spectrum remains highly disruptive to the current mobile competitive landscape.

#5: Traffic Concentration per Site

All of our work thus far has been focused on the economics and technical capabilities of a specific site. But, of course, not all sites are utilized equally. Some sites — those used for coverage — have lower utilization rates. Other sites — those built to address capacity issues — have higher utilization rates. As such, we need to adjust our calculations to migrate from the average site to the most heavily utilized sites.

In recent conversations, we learned that one national carrier is capturing around 60% of wireless traffic on about 40% of the cell sites. Another national carrier suggested 80% of the traffic is on roughly 58% of their cell sites. It seems data usage is spreading out more quickly and causing the level of concentration to fall from historical levels (which used to be closer to 80% of traffic on 20% of sites). **So, for our analysis, we assume 60% of traffic is concentrated on 40% of sites.**

#6: Oversubscription Rate

Wireless companies sell bandwidth on an over-subscribed basis under the assumption that not everyone in the cell will access the network at the same time. Our review of the FCC Technical Paper infers an over-subscription range of 16-25x to convert the dedicated capacity in a cell site to the speed a specific customer can achieve during the peak busy hour with 80-90% probability. **We chose an oversubscription rate of 20x,** which is above the fixed wireless levels of 16-18.5x.

Pulling It Together

With our six key variables in place, we're now in a position to bring all the data together. We should highlight, however, that we are making a few simplifying assumptions in our model:

- First, we assume all 50 MHz of the downlink spectrum per carrier is **completely dedicated for home replacement** service instead of shared for mobile users and mobile broadband for home users.
- Second, we assume all downlink spectrum uses the **latest LTE-Advanced standard.**
- Third, we assume carriers consistently **achieve average performance** targeted by the standard.

With those assumptions in mind, let's look at the three analytic steps:

#1: Peak Speed Available

Using 50 MHz of downlink spectrum and spectral efficiency of 3.7 bits per Hz, we can infer that a specific cell site can offer dedicated capacity of 555 Mbps. Applying an oversubscription rate of 20x and dividing by target speed of 12 Mbps, we can infer a cell site can handle up to 925 users in the peak-busy hour. The analysis also infers a Busy Hour Offered Load (BHOL) of 600 Kbps.

#2: Adjusting for Sites with Heaviest Usage

Our calculations in Step #2 are for a specific site. But, since some sites — the coverage sites — are underutilized while other sites — the capacity sites — are more fully utilized, we need to make an adjustment. We are assuming that 60% of the traffic occurs on 40% of the sites. We can infer that an average site at the network level can serve about 617 users, which recognizes that 40% of the sites will have a greater number of users (albeit at or below 925 customers per site in order to maintain 12 Mbps of speed on the busiest sites).

#3: Busy Hour Offered Load

Based on a busy hour offered load of 600 Kbps per user, we can infer that each customer could consume up to 54 GB per month, assuming 15% of traffic occurs in the peak busy hour.

Figure 186. Estimating Average Users per Site for Mobile Broadband Substitution

Step 1. Calculate Users per Site

	Average
Downlink Spectrum per sector (MHz)	50
x bits/Hz	3.7
= Data capacity per sector (Mbps)	185
x Sectors/Site	3
= Data capacity per site (Mbps)	555
x Oversubscription rate	20
= Effective data capacity per site (Mbps)	11,100
/ Minimum data speed per user (Mbps)	12
= Maximum users per site	925
Data capacity per site (Mbps)	555
x KB/MB	1,000
= Data capacity per site (kbps)	555,000
/ Maximum users/site	925
= BHOL (kbps)	600

Step 2. Adjust for Capacity Sites

	Average
Usage concentration	60%
/ Site concentration	40%
= User concentration in capacity sites	1.5x
Maximum Users/site	925
/ concentration ratio	1.5x
= Effective Users/site	617

Step 3. Consider Consumption Capacity per Month

	Average	Share of Use in Busy Hour	Peak (BHOL)
Downlink Usage per month (GB)	54.0	15%	8.1
/ Days per month	30		30
=Usage per day (GB)	1.80		0.27
/ Hours per day	24		1
= Usage per hour (GB)	0.08		0.27
/Minutes per hour	60		0
= Usage per minute (GB)	0.00		0.00
/ Seconds per minute	60		60
= Usage per second (GB)	0.00		0.00
x MB per GB	1,000		1,000
= usage per second (Mbps)	0.02		0.08
x KB per MB	1,000		1,000
= Usage per second (Kbps)	20.83		75.00
x Bits per byte	8		8
= Offered bandwidth (kbps)	167		600

Source: FCC, Sprint, Company reports, Citi Research

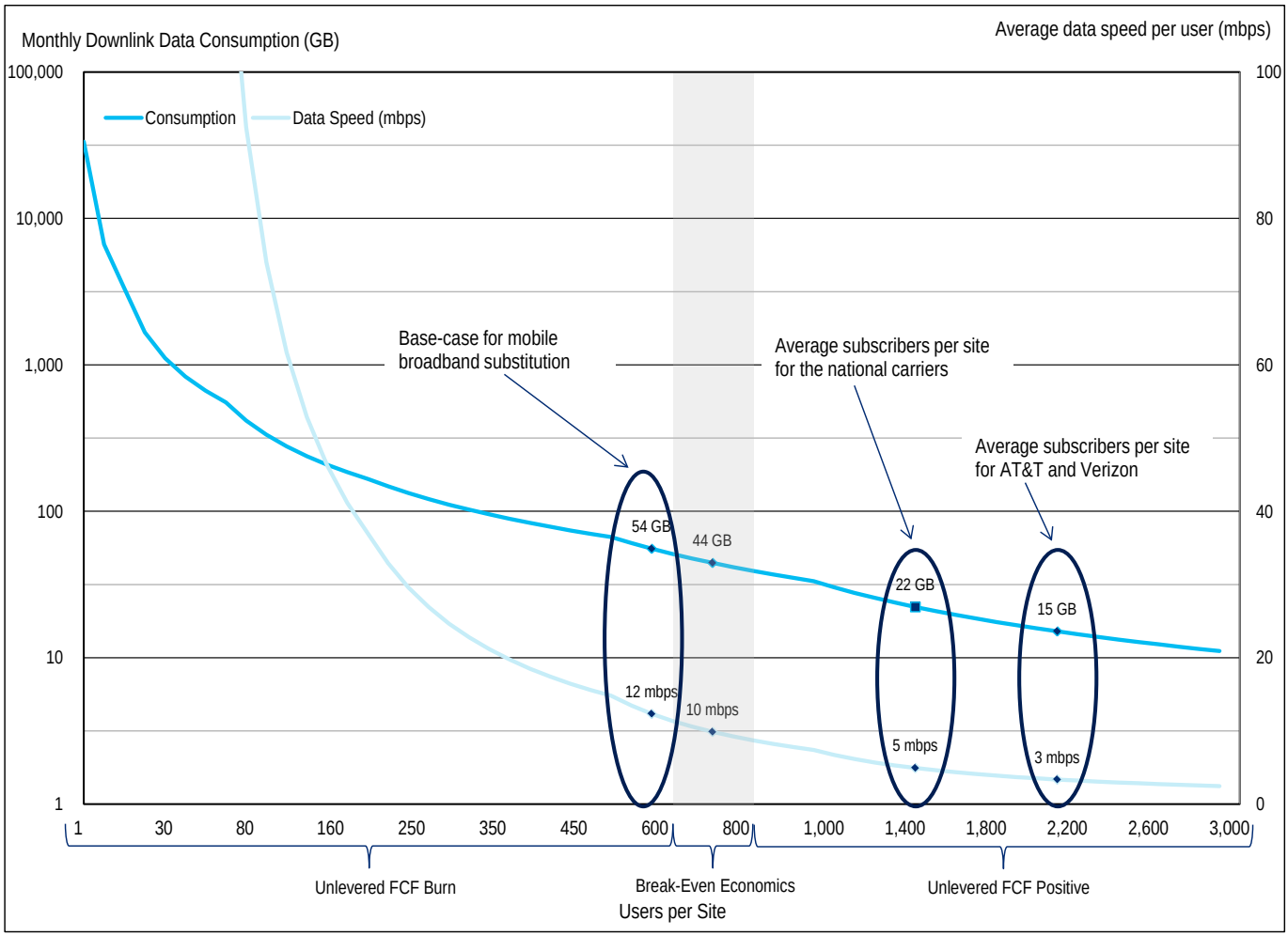
Map Cell Site Performance to Industry Costs

So far, we've shown two things. First, we showed that the wireless industry is a scale driven business. And, we created a simplified industry cost model to show that wireless carriers must serve around 750 customers per site to generate break-even unlevered FCF. Second, we showed that an individual cell sites performance is governed by six key variables. But, at higher levels of performance, carriers can only serve a limited number of customers per site.

In this section, our aim is to bring the two pieces of analysis together. That is, we hope to show what level of performance a wireless carrier can offer consumers — measured in speed (Mbps) and data usage (GB per month) — at different cell densities. This will allow is to see if these service offerings can compete with wireline alternatives while simultaneously generating free cash flow.

With targeted usage of at least 12 Mbps, we estimate the network can serve an average of 617 customers per cell site, while providing for monthly consumption of up to 54 GB. This is below the bottom-end of the break-even range of 650 subscribers per cell site. To move toward 850 customers per cell site, the wireless carrier could only offer speeds of around 9 Mbps in the peak busy hour with monthly consumption of up to 39 GB. And, if the carrier wants to improve profitability further, the offering will diminish further. Indeed, to match the cash flows of AT&T and Verizon, carriers can only offer 3 Mbps and 15 GB of data a month. **As such, wireless carriers are unlikely to compete with wireline broadband alternatives.**

Figure 187. Mobile Carriers Trade Broadband Performance for Profitability



Source: Company reports, Citi Research

And since our model assumes all of the 50 MHz of downlink spectrum employed by the carrier is dedicated to the home replacement opportunity, it becomes even more difficult for large wireless incumbents to challenge the broadband duopoly since the incumbents have a significant installed base of existing customers.

Verizon Provides Some Insight into LTE Capacity

Verizon's early deployment of LTE broadband provides some reference points for capacity since the company deployed the band nationally on its 700 MHz spectrum (paired 10 MHz x 10 MHz) and only began to add commercial service onto additional spectrum resources for its 4G LTE service in the fourth quarter of 2013. At the time, the company announced plans to add LTE onto its AWS spectrum, Verizon had about 36 million LTE devices on about 41,500 LTE cell sites, or about 867 LTE customers on LTE-enabled sites.

The company acknowledged capacity problems in some of its markets with a focus on New York City and San Francisco and then began to offer capacity on its AWS spectrum. The company has just recently launched its XLTE service to brand the new spectrum depth on its LTE service. We estimate that Verizon could have targeted a minimum speed of 2.6 Mbps on its 700 MHz LTE network, using a 20x oversubscription rate.

Figure 188. Implied Peak Minimum Data Speeds on Verizon's 700 MHz LTE Network

Item	Amount
Downlink Spectrum per sector (MHz)	10
x bits/Hz	3.7
= Data capacity per sector (Mbps)	37
x Sectors/Site	3
= Data capacity per site (Mbps)	111
x Oversubscription rate	20
= Effective data capacity per site (Mbps)	2,220
LTE Devices	36,000,000
/ LTE Sites	41,450
= LTE Subscribers per Site	869
Effective data capacity per site (Mbps)	2,220
/ LTE Subscribers per Site	869
= Minimum data speed per user (Mbps)	2.6

Source: Company reports, Citi Research

Verizon is targeting an average speed of 5-12 Mbps, but a "minimum" under our analysis could be lower than the 5 Mbps. If the engineering "minimum" was indeed 5 Mbps, then Verizon would be using a higher oversubscription rate than our 20x (all else being equal). We believe a mobile service could have a higher oversubscription rate than a fixed broadband replacement product given that fixed broadband would likely absorb heavier use of streaming media, especially video.

An oversubscription of greater than 20x as a mobile broadband replacement could infer upside to our analysis of wireless capabilities described above. We also recognize increasing use of streaming media may put downward pressure on the mobile over-subscription rate over time. As we think about the implications for our economic analysis of mobile broadband, the oversubscription rate would need to be at or above 28x to push the subscribers per cell site into the positive unlevered free cash flow range (holding other variables constant).

Wireless a Complement to, Not a Substitute for, Fixed Broadband

Mobile could become an effective competitor against fixed line services if the amount of downlink spectrum were substantially increased and/or if fewer carriers were to capture a much deeper concentration of downlink spectrum. This brings us to Sprint's Spark service using the 2.5 GHz spectrum acquired from Clearwire.

Sprint Spark Should Ignite Competition to Fixed Broadband

While higher frequencies suffer from more limited signal propagation, they are able to accommodate greater use of antenna technology referred to as MIMO. Sprint has announced plans to utilize 8x8 MIMO technology with its 2.5 GHz spectrum, which can push the target peak spectral efficiency to 30 bits per Hz, according to the LTE standards. However, Sprint's disclosures suggest the company is targeting bits per Hz of 22-23. (We'll use 22.5 bits per Hz in our analysis). The average performance, unfortunately, has been difficult to find. Using the same level of efficiency as LTE advanced between average and peak targeted speeds, we estimate an average performance of 5.6 bits per Hz efficiency.

Sprint has 120 MHz planned for LTE deployment at the 2.5 GHz frequency and we estimate 75% (or 90 MHz), can be used for downlink purposes based on our conversations with Sprint. We estimate a peak speed per cell site over 6 Gbps, which is consistent with the company's target of 2 GB per cell (we believe they are describing capacity at the sector level) and average performance of around 1.5 Gbps. On a per user basis, the latest Qualcomm chipsets will be able to access only 60 MHz at a time (3x20 MHz aggregation), implying 45 MHz of downlink on a per user basis.

Figure 189. Calculating Simultaneous Dedicated User Capacity Under Sprint's Spark Service

	90 MHz Downlink		
Item	5 Mbps	10 Mbps	25 Mbps
MHz	90	90	90
x bits/Hz	5.6	5.6	5.6
= Data capacity per sector (Mbps)	504	504	504
x sectors/cell	3	3	3
= Data capacity per cell (Mbps)	1,512	1,512	1,512
/ dedicated user speed target (Mbps)	5	10	25
= Simultaneous Users	302	151	60

Source: Company reports, Citi Research

Below, we've re-run the analysis for Sprint's Spark. Specifically, we have changed the following variables: First, we've increased downlink spectrum from 50 MHz to 90 MHz. Second, we increase the spectral efficiency from 3.7 bits/Hz to 5.6 bits/Hz. These two changes increase the maximum users per site from 925 to 2,520. Also, the network's average users per site improve from 617 to 1,680.

Figure 190. Average Users per Site for Mobile Broadband Substitution for Sprint Spark

Step 1. Calculate Users per Site

	Average
Downlink Spectrum per sector (MHz)	90
x bits/Hz	5.6
= Data capacity per sector (Mbps)	504
x Sectors/Site	3
= Data capacity per site (Mbps)	1,512
x Oversubscription rate	20
= Effective data capacity per site (Mbps)	30,240
/ Minimum data speed per user (Mbps)	12
= Maximum users per site	2,520
Data capacity per site (Mbps)	1,512
x KB/MB	1,000
= Data capacity per site (kbps)	1,512,000
/ Maximum users/site	2,520
= BHOL (kbps)	600

Step 2. Adjust for Capacity Sites

	Average
Usage concentration	60%
/ Site concentration	40%
= User concentration in capacity sites	1.5x
Maximum Users/site	2,520
/ concentration ratio	1.5x
= Effective Users/site	1,680

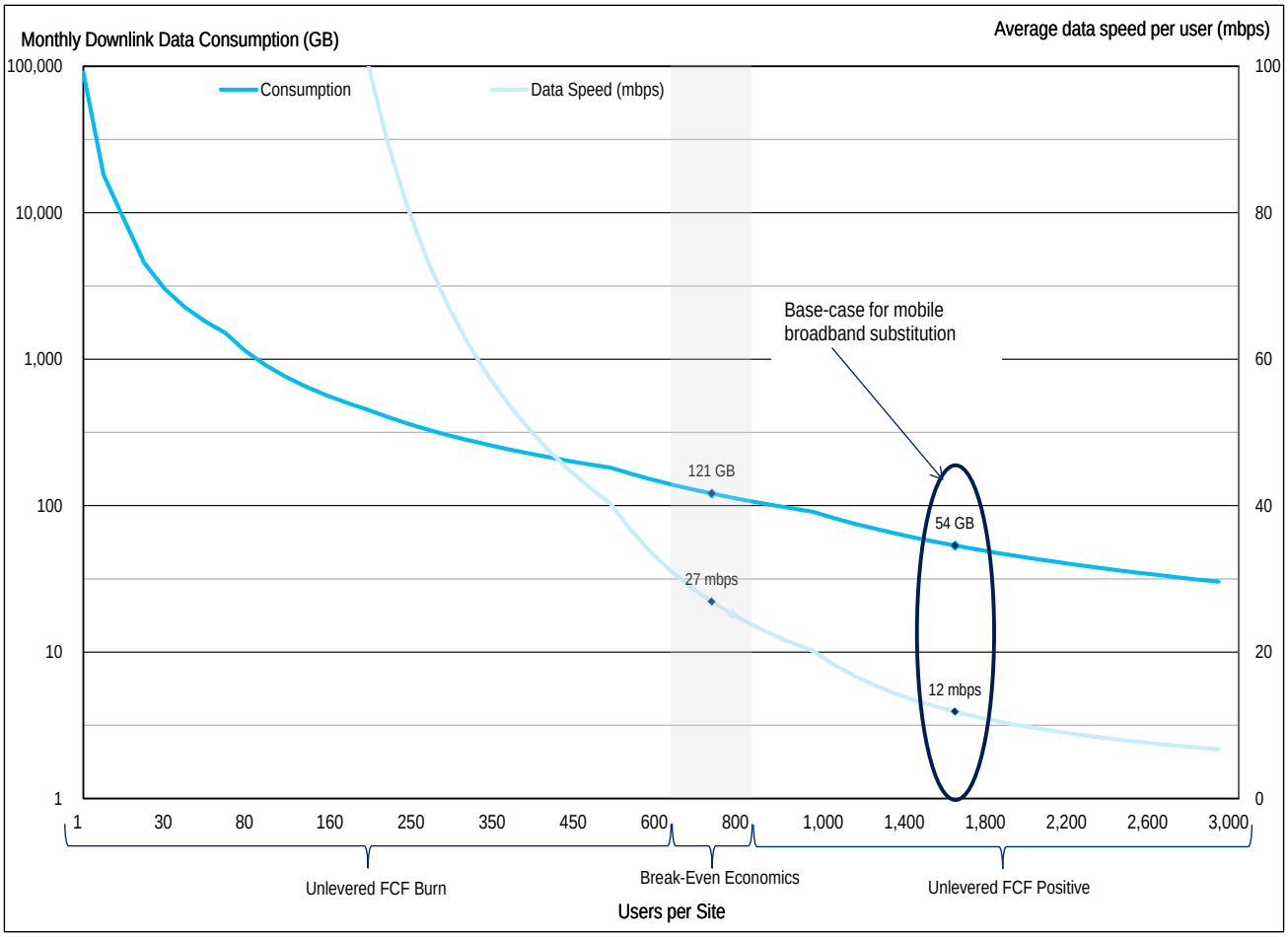
Step 3. Consider Consumption Capacity per Month

	Average	Share of Use in Busy Hour	Peak (BHOL)
Downlink Usage per month (GB)	54.0	15%	8.1
/ Days per month	30		30
=Usage per day (GB)	1.80		0.27
/ Hours per day	24		1
= Usage per hour (GB)	0.08		0.27
/Minutes per hour	60		60
= Usage per minute (GB)	0.00		0.00
/ Seconds per minute	60		60
= Usage per second (GB)	0.00		0.00
x MB per GB	1,000		1,000
= usage per second (Mbps)	0.02		0.08
x KB per MB	1,000		1,000
= Usage per second (Kbps)	20.83		75.00
x Bits per byte	8		8
= Offered bandwidth (kbps)	167		600

Source: FCC, Sprint, Company reports, Citi Research

The combination of nearly 2x the downlink spectrum and nearly 2x the spectral efficiency from the advanced 8x8 MIMO antennas could provide Spark with enough capacity to offer a mid-range broadband replacement product. The challenge, however, is the propagation of the cell site given the more limited reach and lower level of in-building penetration associated with the 2.5 GHz spectrum. These coverage limitations could cause Sprint to respond with greater site density. But, of course, this would reduce the number of subs per cell site threatening Sprint's ability to generate positive unlevered free cash flow. As the graph below shows, the company can offer peak busy hour speeds of 27 Mbps and monthly capacity of up to 121 GB at 750 customers per cell site. Since our base-case for landline data substitution is 12 Mbps and 54 GB per month, there is an envelope of opportunity for Sprint to generate cash flow and offer consumers a service that replaces terrestrial data services.

Figure 191. Sprint Spark Service Could Ignite Mobile Broadband Competition with a Mid-Range Broadband Service (Coverage Permitting)



Source: Company reports, Citi Research

Bottom Lines

To examine the durability of the broadband monopoly/duopoly we examined Next Generation wireless services. Our analysis suggests a few important things.

- First, the economics of the wireless business suggest carriers must serve at least **750 customers per cell site** to reach free cash flow breakeven (where EBITDA matches capex).
- Second, even if incumbent carriers use 50 MHz for LTE, **they cannot offer wireless data speeds that will rival wireline alternatives during peak busy hours.** We believe the speeds are simply too low if carriers want to earn a return on their capital and generate meaningfully positive unlevered free cash flow.
- Third, the **only potential wireless platform that may be able to challenge the wireline broadband providers is Sprint's Spark service.** Since Spark can use 90MHz of spectrum for downstream services (120 MHz in all) and will likely have improved spectral efficiency, they can offer speeds of 27 Mbps and data usage levels of 121 GB per month at break-even free cash flow. Whether this level of performance is sufficient to compete with wireline broadband alternatives will depend on whether wireline data usage patterns continue to increase.

Third Pipe Option #4: Fixed Wireless

So, far we've reviewed three platforms that could upset the broadband duopoly: Fiber, Satellite Broadband, Wireless Broadband. Now, we turn our attention to the last platform: Fixed Wireless.

With the US launch of 3G in 2000 and 4G in 2010, data has become an ever-increasing portion of network traffic and driver of service revenue growth for wireless carriers. The thirst for data has required carriers to acquire more spectrum simply to meet the needs of their existing customers. Both outsiders and industry participants have continuously sought ways to use spectrum to compete in the fixed broadband business but, thus far, an economically viable model has not been found.

As mobile industry revenue has slowed — and postpaid competition remains elevated — we believe mobile carriers will look to expand the addressable market for mobile broadband revenue. Connected devices and over-the-top apps are obvious adjacencies, but these emerging opportunities may take many years to become meaningful contributors to the industry's top-line. As such, entering into the fixed wireless broadband market could be of interest.

Previously, we've highlighted four key concepts regarding spectrum:

- First, the US has ample amounts of spectrum. The real issue is that the spectrum is in the wrong hands. While larger carriers (AT&T and Verizon) may not have sufficient spectrum, smaller carriers (Sprint, T-Mobile and Dish) have excess spectrum. As such, **spectrum ownership - rather than availability - is the real constraint.**
- Second, **downlink spectrum is more valuable than uplink spectrum.** This is driven by the shift in traffic patterns due to the rise of mobile data. As symmetric voice traffic is overtaken by asymmetric data traffic, wireless networks will see far more bits move from the network to the user (rather than the user to the network).
- Third, **wireless is a scale business.** As such, carriers face a trade-off between network performance and profitability. Hence, the U.S. mobile networks will have a tough time generating positive unlevered free cash flow, while simultaneously offering entry-level terrestrial broadband performance. Instead, we see mobile carriers migrating to 100% LTE and delivering peak data rates of around 3-5 Mbps.
- Fourth, **mobile broadband capacity can be created in multiple ways.** Carriers can create capacity by using more efficient technology, acquiring additional spectrum, or adding more network infrastructure.

So, if a carrier has ample downlink spectrum using 4G LTE and can leverage existing mobile infrastructure on the latest technology, can a wireless service provider economically offer a data service that is a viable substitute for fixed broadband services? Surprisingly, we believe the answer is, yes.

Fixed Wireless is Different from Mobile

To begin, we need to construct a model that identifies the capacity and coverage requirements of a fixed wireless broadband network. Once we complete this step, we can estimate the costs of capacity and the cost of coverage to determine whether the network will produce a positive gross profit. Importantly, we see five key differences between fixed and mobile wireless networks:

- First, homes are stationary while mobile users are not. This is an obvious but important difference when designing a cellular network.
- Second, homes can have a dedicated and directed wireless transceiver on the structure, improving the network capacity and efficiency.
- Third, fixed wireless usage (and the intensity of that usage) is likely to be higher than a mobile experience. This is due, in part, to a greater amount of streaming video. This lower the amount of over-subscription the network can handle.
- Fourth, unlike mobile, fixed wireless carriers have the luxury of selecting a sub-set of attractive markets to deploy the service.
- Fifth, a fixed wireless network can piggy-back on existing mobile infrastructure lowering the on-going costs of coverage and capacity.

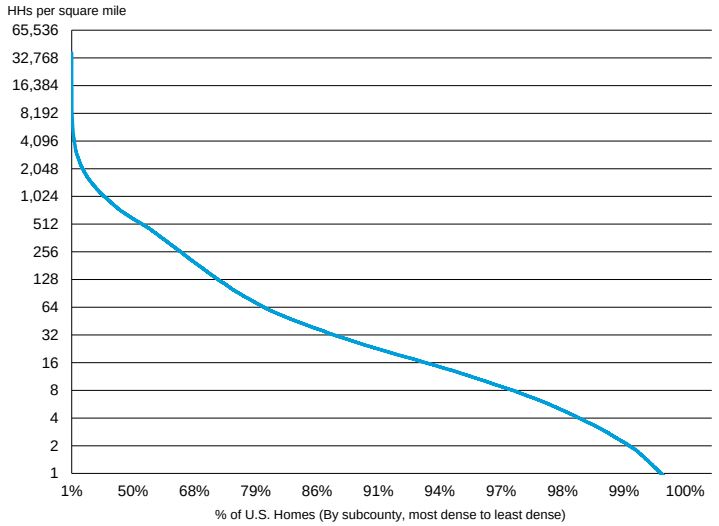
The Fixed Wireless Economic Model

With the differences between fixed and mobile networks behind us, we now need to identify an economic model for a fixed wireless broadband service. While this has some things in common with our previous analysis regarding scale and capacity, there are some new nuances. We break this model down into four steps.

Step 1: Identify Addressable Markets

The U.S. is large with significant variation in household densities. Since a fixed wireless strategy can target specific markets, we segmented the U.S. at a very granular level using sub-counties (versus counties or states). This gives us details on ~37,000 cities and towns across the U.S.

Figure 192. US Household Density (% , Homes per Square Mile)



Source: US Census, Citi Research

Step 2A: Calculate Coverage Requirements

Next, we estimate the amount of bandwidth - and infrastructure – that's required to serve each micro-market. There are six key variables:

#1: Spectral Efficiency

Spectral efficiency is simply the number of bits per Hz that wireless spectrum can transmit. According to the FCC, LTE has a peak efficiency of 8.6 bits per Hz but an average of just 1.3 bits per Hz. This is just 2.5x better than the average 2.5G EDGE experience but further improvements are expected. The LTE-Advanced standard has a goal of 3.7 bits per Hz using 4x4 MIMO. This is the starting point for our model.

Figure 193. Wireless Spectral Efficiency by Technology

Technology	EDGE	EV-DO	HSPA	LTE	LTE
Peak Performance					
Data Rate per cell site (Mbps)	0.7	9.3	43.2	258	516
/ Sectors per cell	3	3	3	3	3
= Data rate per cell site sector (Mbps)	0.2	3.1	14.4	86.0	172.0
/ spectrum used (MHz)	0.2	1.25	5	10	20
= bits/Hz efficiency	1.2	2.5	2.9	8.6	8.6
Note: Multiple of EDGE		2.1x	2.5x	7.4x	7.4x
Average Cell Data Rates					
Data Rate per cell site (Mbps)	0.3	2.6	15	37.5	75
/ Sectors per cell	3	3	3	3	3
= Data rate per cell site sector (Mbps)	0.1	0.9	5.0	12.5	25.0
/ spectrum used (MHz)	0.2	1.25	5	10	20
= bits/Hz efficiency	0.5	0.7	1.0	1.3	1.3
Note: % of Peak Performance	43%	28%	35%	15%	15%
Note: Multiple of EDGE		1.4x	2.0x	2.5x	2.5x

Source: FCC, Citi Research

Fixed wireless uses better antennas that can increase power and improve signal reception. Since the antennas are stationary, they can also be directed to improve on signal reception. Based on commentary from one manufacturer (BandLuxe), a household device can get an RF gain of 20 to 40 db. We translate this to a ~35% improvement in bits per Hz, getting a **roughly 5 bits per Hz efficiency** for fixed wireless broadband.

Figure 194. Downlink Bandwidth Utilized

	Downlink Spectrum Utilized					
Downlink Bandwidth	5 MHz	10 MHz	15 MHz	20 MHz	40 MHz	60 MHz
x bits/Hz	5.0	5.0	5.0	5.0	5.0	5.0
= Data capacity per sector	25	50	75	100	200	300
x sectors per site	3	3	3	3	3	3
= Dedicated data capacity per site	75	150	225	300	559	899

Source: Citi Research

#2: Traffic Concentration

Traditional mobile networks are built for both coverage (low utilization) and capacity (high utilization). Since we are examining the market for homes with a mixed location, **we apply a traffic concentration ratio of 1:1.** The absolute level of traffic is subject to penetration rates and we explore this a bit later.

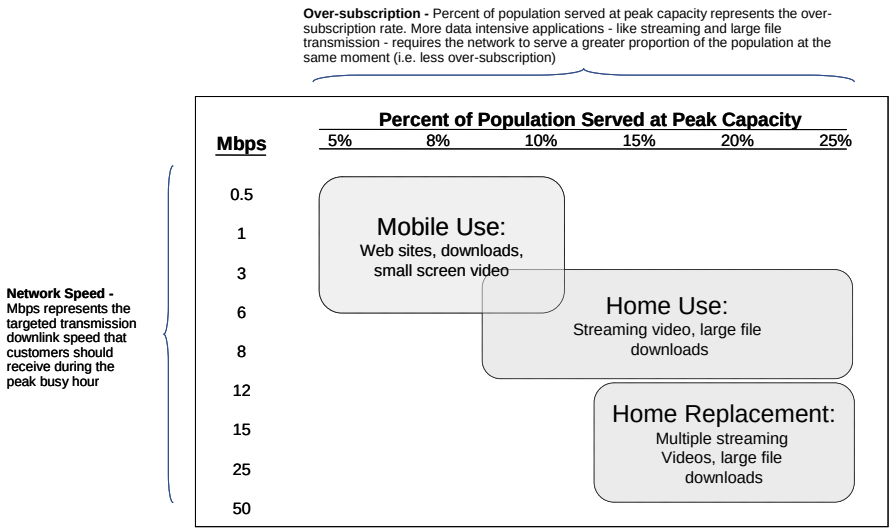
#3: Data Speeds

We estimate a competing entry-level broadband service would **need to offer at least 12 Mbps** of data speed for the end-user. This speed level is similar to recent fixed broadband trials by Dish with nTelos and Sprint which offers at least 10 Mbps and 15 Mbps, respectively, using 2.5 GHz spectrum.

#4: Over-Subscription

Wireless companies sell bandwidth on an over-subscribed basis under the assumption that not everyone in the cell's coverage area will access the network at the same time. After reviewing the FCC's technical papers, we estimate mobile carriers use a relatively high over-subscription rate of 20x (which means 5% of customers are served in the peak hour while a 10x over-subscription rate would mean 10% of customers are served in the peak hour). A fixed broadband service is more likely to serve streaming video and other traffic-intensive applications. This means a carrier needs a lower oversubscription rate. Based on our prior work and conversations with industry contacts, we chose **an oversubscription rate of 5x.**

Figure 195. Network Speed vs. Oversubscription



Source: Citi Research

#5: Busy Hour Usage

Since all networks — including wireless networks — must be built to serve customers in the busy hour, our second key variable is the portion of all traffic that occurs during the busiest hour of the day. Our analysis of FCC data in its OBI Technical Paper as well as recent data from Sandvine and historical video consumption patterns suggest peak-busy hour usage ranging between 10% and 15%. **We have assumed ~15% of traffic occurs in the busy hour,** which is similar to the rate we used to analyze Broadband Satellite capacity.

Figure 196. Calculating the Busy Hour Offered Load

Step 1. Calculate busy hour offered load (BHOL)

	Average
Downlink Spectrum per sector (MHz)	10
x bits/Hz	5.0
= Data capacity per sector (Mbps)	50
x Sectors/Site	3
= Data capacity per site (Mbps)	150
x Oversubscription rate	5.0
= Effective data capacity per site (Mbps)	749
/ Minimum data speed per user Mbps)	12.0
= Maximum users per site	62
Data capacity per site (Mbps)	150
x KB/MB	1,000
= Data capacity per site (kbps)	149,850
/ Maximum users/site	62
= BHOL (kbps)	2,400

Estimating average downlink usage month does not depend on spectrum per cell site, as more spectrum simply adds more users.

Step 2. Adjust for Capacity Sites

	Average
Usage concentration	60%
/ Site concentration	40%
= User concentration in capacity sites	1.0x
Maximum Users/site	62
/ concentration ratio	1.0x
= Effective Users/site	62

Step 3. Consider Consumption Capacity per Month

	Average	Share of Use in Busy Hour	Peak (BHOL)
Downlink Usage per month (GB)	216.0	15%	32.4
/ Days per month	30		30
=Usage per day (GB)	7.20		1.08
/ Hours per day	24		1
= Usage per hour (GB)	0.30		1.08
/Minutes per hour	60		60
= Usage per minute (GB)	0.01		0.02
/ Seconds per minute	60		60
= Usage per second (GB)	0.00		0.00
x MB per GB	1,000		1,000
= usage per second (Mbps)	0.08		0.30
x KB per MB	1,000		1,000
= Usage per second (Kbps)	83.33		300.00
x Bits per byte	8		8
= Offered bandwidth (kbps)	667		2,400

Source: FCC, Citi Research

And, since there is a trade-off between data speeds and the portion of data consumed in the busy-hour, **this translates into consumption of up to 216 GB per user per month at 12 Mbps.** The figure also shows the direct relationship between speed and data consumption, as the capacity in a cell is shared between fewer users in a fixed wireless scenario versus a mobile scenario.

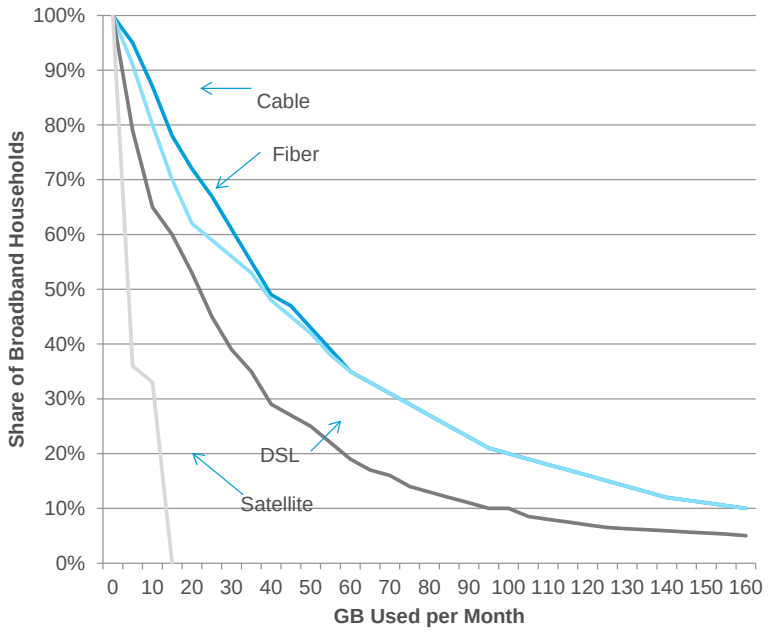
Figure 197. Data Consumption is Combination of Busy Hour Traffic and Over-Subscription Rate

% Busy Hour Traffic	Over-Subscription Rate					
	1.0x	4.0x	5.0x	7.5x	10.0x	20.0x
5%	3,240 GB	810 GB	648 GB	432 GB	324 GB	162 GB
10%	1,620 GB	405 GB	324 GB	216 GB	162 GB	81 GB
15%	1,080 GB	270 GB	216 GB	144 GB	108 GB	54 GB
20%	810 GB	203 GB	162 GB	108 GB	81 GB	41 GB
25%	648 GB	162 GB	130 GB	86 GB	65 GB	32 GB

Source: FCC, Citi Research

Based on the FCC's distribution of broadband usage by technology, the fixed wireless broadband network should be able to address the needs of most US consumers. Indeed, very few households use over 160 GB per month (even for households that use FTTH and cable modem platforms).

Figure 198. Data Usage by Connection Technology



Source: FCC, Citi Research

#6: Cell Site Coverage Area

The area a single cell site can serve is based on the distance the signal can propagate. And, the propagation varies based on the frequency of the spectrum. Spectrum at lower frequencies travels farther distances than higher frequency spectrum (holding other variables — power, antenna height — equal). As such, low-band spectrum provides significant cost advantages since fewer sites are required.

Figure 199. Cell Site Radius by Spectrum Frequency

Band	Frequency	Avg. Radius
Low	700 MHz	4.0
	800 MHz (Cellular and iDEN)	4.0
Mid	1900 MHz (PCS)	2.0
	2100 MHz (AWS)	2.0
High	2300 MHz (WCS)	1.6
	2500 MHz (BRS & EBS)	1.6

Source: Citi Research

We can use the four major carrier's current networks to show the power of low-band spectrum (Figure 200). Verizon has the fewest cell sites covering nearly 2.3 million square miles within the US, with an average cell site radius of 3.9 miles. T-Mobile (using almost entirely mid-band spectrum) operated with an average cell site radius of 1.9 miles. With low-band introduced, T-Mobile expects its average radius to increase to roughly 3.0 miles by the end of 2015.

We assume carriers begin deploying fixed wireless on cell sites with low-band spectrum. Over time, we add coverage and capacity sites using mid- and high-band spectrum. The incremental sites will come with higher costs within our economic model.

Figure 200. Cell Site Radius by Carrier

Carrier	Frequencies (MHz)	Coverage Area	Sites	Area per Site	Average Radius
AT&T	700/800/1900/2100	2,250	70	32	3.2
Sprint	850/1900/2500	850	40	21	2.6
T-Mobile US	700/1900/2100	1,600	57	28	3.0
Verizon	700/800/1900/2100	2,250	48	47	3.9
T-Mobile US (Mostly Mid-Band)	1900/2100	600	53	11	1.9

Note: Coverage area in square miles and radius in miles.
Source: Company data, Citi Research

Step 2B: Calculate Capacity Requirements

Coverage sites are unlikely to sufficiently meet demand, particularly in dense areas. As such, we must determine how much spectrum — and what type of spectrum — a carrier has available for fixed wireless. Only then can we calculate how many homes can be served by a single cell site. This, coupled with coverage area, allows us to determine how many sites are required to serve a single market.

Most carriers don't have excess nationwide spectrum. But, some carriers suggest they have excess capacity in rural areas. Below we show how much excess spectrum is currently available by carrier. AT&T is repurposing 10-15 MHz of downlink 700 MHz spectrum for fixed wireless in rural markets and has 20 MHz of WCS spectrum (2.3 GHz) than can be repurposed for broadband. Dish owns 40 MHz of AWS-4 that can be paired with its PCS and AWS-3 holdings to provide a robust service. And, Sprint could allocate 20-60 MHz of its ERS/BRS (2.5 GHz) spectrum band for fixed wireless.

Figure 201. Available Spectrum by Band and Carrier

Commercially Available Spectrum	Band	Total Spectrum	Unpaired Spectrum	Paired Spectrum	Possible Downlink	Possible Uplink
700 MHz	700 MHz	80 MHz	12 MHz	68 MHz	46 MHz	34 MHz
Cellular	850 MHz	50 MHz	0 MHz	50 MHz	25 MHz	25 MHz
Nextel/SMR	800/900 MHz	14 MHz	0 MHz	14 MHz	7 MHz	7 MHz
PCS	1.9 GHz	140 MHz	0 MHz	140 MHz	70 MHz	70 MHz
AWS-1	1.7/2.1 GHz	90 MHz	0 MHz	90 MHz	45 MHz	45 MHz
AWS-3	1.8 GHz	65 MHz	15 MHz	50 MHz	25 MHz	25 MHz
AWS-4	2.0/2.2 GHz	40 MHz	0 MHz	40 MHz	40 MHz	0 MHz
WCS	2.3 GHz	20 MHz	0 MHz	20 MHz	10 MHz	10 MHz
ERS/BRS	2.5 GHz	157 MHz	157 MHz	0 MHz	133 MHz	23 MHz
Total		656 MHz	184 MHz	473 MHz	401 MHz	240 MHz

Carrier	Total	Possible Downlink	Possible Uplink
Verizon Wireless	115 MHz	58 MHz	58 MHz
AT&T	141 MHz	74 MHz	67 MHz
Sprint Corp	194 MHz	139 MHz	55 MHz
T-Mobile US	77 MHz	38 MHz	38 MHz
US Cellular	8 MHz	4 MHz	4 MHz
Dish	79 MHz	55 MHz	24 MHz
Public Safety	10 MHz	5 MHz	5 MHz
Other	32 MHz	16 MHz	16 MHz
Total	656 MHz	389 MHz	267 MHz

Spectrum Goal by 2015	Band	MHz	Probability for Commercial Use	Probability Wtd. MHz Contribution
MSS L-Band (SkyTerra, Inmarsat)	1.5/1.7GHz	40 MHz	50%	20 MHz
Big Leo (Globalstar, Iridum)	1.6/2.5GHz	10 MHz	75%	8 MHz
Broadcast TV	650 MHz	120 MHz	75%	90 MHz
Total		170 MHz		118 MHz

Source: FCC, Company data, Citi Research

Assuming different amounts of downlink spectrum, we can calculate the number of homes that each cell site can address. We use the key model inputs - 5 bits per Hz, 5x oversubscription, and 12 Mbps service - while also assuming 3 sectors per cell site. As an example, **10 MHz of low-band spectrum could serve 63 households; 20 MHz doubles this to 125 households.** There is a linear relationship between spectrum and households served all else being equal.

We couple the households served analysis with the cell site radius to estimate the addressable homes per square mile. Low-band frequency could serve 50 square miles assuming a 4 mile radius, implying it could serve 1 home per square mile. High-band spectrum, at a 1.6 mile radius could serve 8 square miles or 8 homes per square mile. **We assume a 20% market penetration rate,** meaning addressable homes are 5x the number of homes that the network can serve.

Figure 202. Calculating Addressable Homes

Item	Downlink Spectrum Scenario					
Spectrum (MHz)	5	10	15	20	40	50
x bits/Hz	5.0	5.0	5.0	5.0	5.0	5.0
x Sectors/site	3	3	3	3	3	3
= Dedicated downlink data capacity per site (Mbps)	75	150	225	300	600	750
x Over-subscription rate	5.0x	5.0x	5.0x	5.0x	5.0x	5.0x
= Available downlink data capacity per site	375	750	1,125	1,500	3,000	3,750
/Minimum data speed per household served (Mbps)	12	12	12	12	12	12
= Homes served per cell site	31	63	94	125	250	313
Low-Band Scenario						
Homes served per cell site	31	63	94	125	250	313
/ Area at average radius of 4.0 miles	50	50	50	50	50	50
= Average Homes Served per Square Mile	1	1	2	2	5	6
/ Target penetration	20%	20%	20%	20%	20%	20%
= Average Addressable Homes per Square Mile	3	6	9	12	25	31
% of homes addressed in markets with equal or lower density	1%	2%	4%	5%	10%	12%
Mid-Band Scenario						
Homes served per cell site	31	63	94	125	250	313
/ Area at average radius of 2.0 miles	13	13	13	13	13	13
= Average Homes per Square Mile	2	5	7	10	20	25
/ Target penetration	20%	20%	20%	20%	20%	20%
= Average Addressable Homes per Square Mile	12	25	37	50	99	124
% of homes addressed in markets with equal or lower density	5%	10%	14%	16%	24%	26%
High-Band Scenario						
Homes served per cell site	31	63	94	125	250	313
/ Area at average radius of 1.6 miles	8	8	8	8	8	8
= Average Homes per Square Mile	4	8	12	16	31	39
/ Target penetration	20%	20%	20%	20%	20%	20%
= Average Addressable Homes per Square Mile	19	39	58	78	155	194
% of homes addressed in markets with equal or lower density	8%	14%	18%	21%	29%	32%

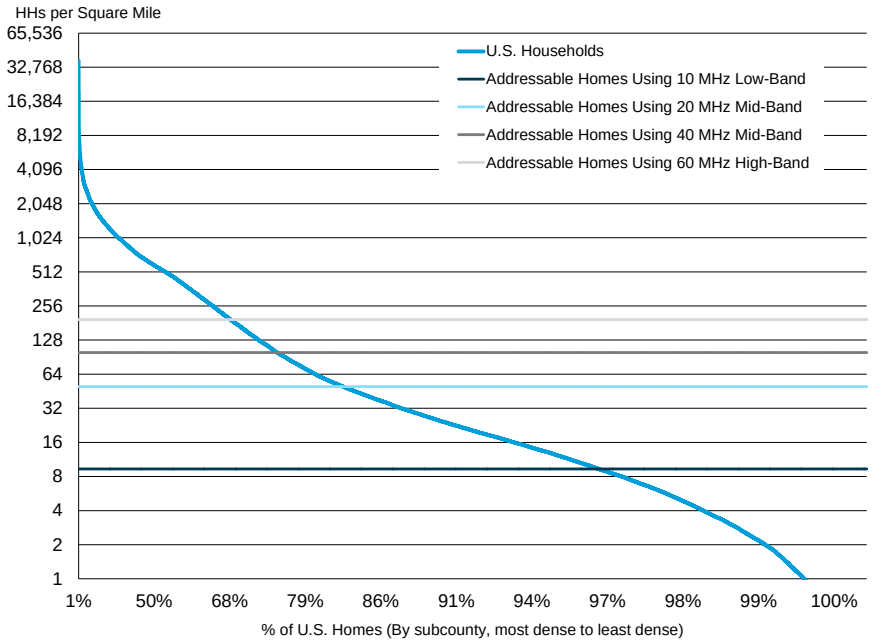
Source: FCC, Citi Research

This analysis shows the trade-off in inherent in the selection of spectrum frequencies. While low-band frequencies travel farther, a cell site can serve a market with far lower household densities. With 10 MHz of low-band spectrum, only 2% of households can be served without the need for some additional capacity sites. Using mid-to-high band spectrum covers more households but required 3.5x to 6x more sites, adding significant up-front capital and ongoing operating costs.

Example: Capacity Model for Salt Lake City

To see steps 2A and 2B come into focus, we use Salt Lake City, Utah as an example. Our objective is to map the city's population density (the curved line) against the number of customers than can be served with low and high-band spectrum (the horizontal lines). What's clear is with 10 MHz of low-band spectrum, a carrier could only serve ~68% of the population of Salt Lake City. But, with 60 MHz of high-band spectrum, a carrier could serve ~97% of the population.

Figure 203. Addressable Home Reach by Available Spectrum



Source: US Census, Citi Research

But, how many cell sites will be required to serve these customers? With low-band sites covering 50 square miles each, only 6.5 cell sites are needed for baseline coverage. Mid-band spectrum will require an incremental 19.4 coverage sites. And, high-band spectrum requires an additional 33.9 sites. (We do use fractional sites in our analysis since coverage between markets is likely to be contiguous in a national or regional strategy.)

Considering both total coverage sites and addressable households from Step 2B, we can calculate households served. With 15 MHz of low-band spectrum, AT&T can serve 605 households with 6.5 coverage sites. Meanwhile, with Sprint's 60 MHz of high-band spectrum, the firm needs 40.4 cell sites and can serve 15,000 households. These households served, however, range from 0% to 5% of the addressable market, which is well below our 20% market penetration goal.

Figure 204. Sites Needed by Carrier in Salt Lake City

Salt Lake City CCD Example	AT&T		DISH		Sprint	
Downlink Spectrum	10 MHz	15 MHz	20 MHz	40 MHz	20 MHz	60 MHz
Frequency	Low-Band	Low-Band	Mid-Band	Mid-Band	High-Band	High-Band
Population	932,320	932,320	932,320	932,320	932,320	932,320
Homes passed	333,475	333,475	333,475	333,475	333,475	333,475
Total Area	326	326	326	326	326	326
Water Area	1	1	1	1	1	1
x HHs passed per sq mi	1,027	1,027	1,027	1,027	1,027	1,027
= Land area	325	325	325	325	325	325
/ Coverage per site	50	50	50	50	50	50
= Baseline coverage sites needed	6.5	6.5	6.5	6.5	6.5	6.5
Land Area	325	325	325	325	325	325
/ Coverage per site	50	50	13	13	8	8
= Band-Adjusted Coverage Sites	6.5	6.5	25.9	25.9	40.4	40.4
- Baseline coverage sites	-6.5	-6.5	-6.5	-6.5	-6.5	-6.5
= Incremental Coverage Sites	0.0	0.0	19.4	19.4	33.9	33.9
Band-Adjusted Coverage Sites	6.5	6.5	25.9	25.9	40.4	40.4
x HHs per site	62	94	125	250	125	375
= HHs Served	404	605	3,228	6,456	5,044	15,132
/ Homes in Market	333,475	333,475	333,475	333,475	333,475	333,475
= % Addressable	0%	0%	1%	2%	2%	5%
% Commercial Share	20%	20%	20%	20%	20%	20%
Incremental Share Needed	20%	20%	19%	18%	18%	15%
x Homes	333,475	333,475	333,475	333,475	333,475	333,475
= Homes to Serve	66,291	66,090	63,467	60,239	61,651	51,563
/ Users per site	62	94	125	250	125	375
= Additional capacity sites needed	1,062	706	508	241	494	138
+ Coverage sites	6	6	26	26	40	40
= Total sites needed	1,068	712	534	267	534	178

Source: US Census, FCC, Citi Research

Step 3: Estimating the Cost of Capacity

Having established a methodology to estimate the total number of sites needed to cover and serve a market at 20% penetration, we can estimate the costs to build and operate that network. We make some simplifying assumptions about capital costs and monthly operating costs to come up with the estimated totals.

Capital Costs

We assume baseline coverage using low-band spectrum will re-use existing sites resulting in $50K to $100K in new equipment costs per site. **We assume $50K for upgrades**, consistent with our prior economic analyses. For incremental coverage sites with high-band spectrum and new capacity sites, we estimate the marginal cost of new construction is $100-200k. **We assume $100K for new sites**, consistent with prior estimates.

Monthly Operating Costs

With baseline coverage sites in place (for mobile use), we estimate monthly costs are the rent amendment (to the tower owner) and incremental backhaul costs of $1,000 to $2,000 per site. **We use $1,000 for upgraded sites.** Based on our bottoms-up study of input costs including third-party site rental, backhaul, and engineering, **we estimate a new site costs $5,000 per month.** Including incremental costs related to the core network and maintenance costs, we believe this cost can be as low as $4,000 per month and as high as $6,000 per month

An Example: Salt Lake City

Building on the prior work estimating the number of sites required to serve Salt Lake City at 20% penetration, we calculate the capital and operating costs of the network (Figure 205). In the AT&T example with 15 MHz of downlink low-band spectrum, there is $71 million of capital costs and $3.5 million in monthly operating costs. That's akin to $213 per home passed in capital and $53 per home served in monthly expense. For Sprint's 60 MHz of high-band spectrum, the same figures are $52 per home passed in capital and $13 per month in operating costs. Once again, this shows the importance of spectrum depth, regardless of the frequency band.

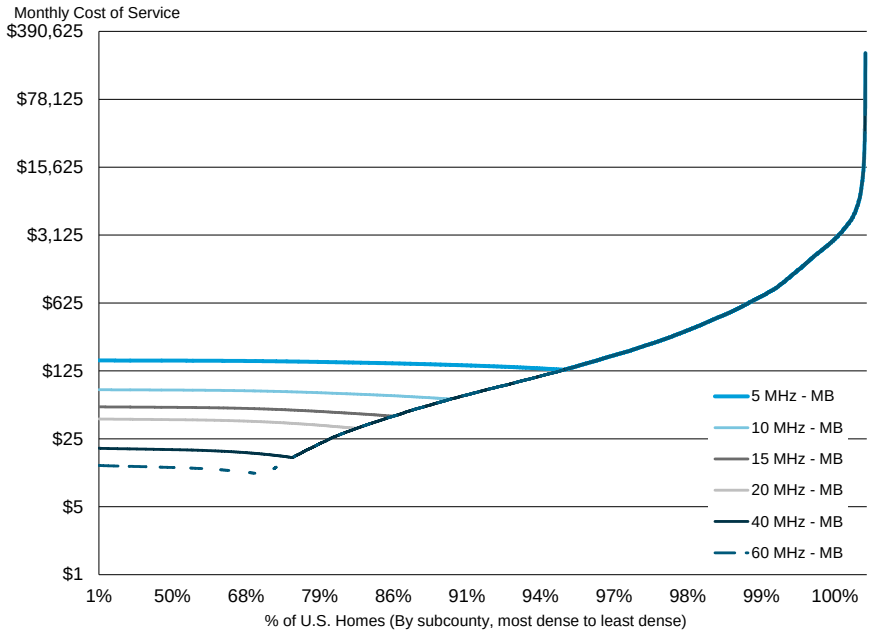
Figure 205. Capital and Operating Costs by Carrier in Salt Lake City

Salt Lake City CCD Example	AT&T		DISH		Sprint	
Downlink Spectrum	10 MHz	15 MHz	20 MHz	40 MHz	20 MHz	60 MHz
Frequency	Low-Band	Low-Band	Mid-Band	Mid-Band	High-Band	High-Band
Population	932,320	932,320	932,320	932,320	932,320	932,320
Homes passed	333,475	333,475	333,475	333,475	333,475	333,475
Baseline Coverage sites	6	6	6	6	6	6
x Monthly operating cost/site	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000
= Monthly operating cost for baseline coverage	$6,463	$6,463	$6,463	$6,463	$6,463	$6,463
+Capacity Sites & Incremental Coverage	1,062	706	528	261	528	172
x Monthly operating cost/site	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000
= Monthly operating cost for capacity sites	$5,308,628	$3,528,314	$2,638,157	$1,302,922	$2,638,157	$857,843
Total Monthly Cost	$5,315,090	$3,534,777	$2,644,620	$1,309,384	$2,644,620	$864,306
/ Homes served	66,695	66,695	66,695	66,695	66,695	66,695
= Monthly cost per home	$79.69	$53.00	$39.65	$19.63	$39.65	$12.96
Note: Average monthly cost per site	$4,976	$4,964	$4,952	$4,903	$4,952	$4,855
Baseline Coverage sites	6	6	6	6	6	6
x Capital cost/site	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000
= Capital cost for baseline coverage	$323,134	$323,134	$323,134	$323,134	$323,134	$323,134
+Capacity Sites & Incremental Coverage	1,062	706	528	261	528	172
x Capital cost/site	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000
= Capital cost for capacity sites	$106,172,550	$70,566,277	$52,763,141	$26,058,436	$52,763,141	$17,156,868
Total Capital Cost	$106,495,685	$70,889,412	$53,086,275	$26,381,570	$53,086,275	$17,480,002
/ Homes served	66,695	66,695	66,695	66,695	66,695	66,695
= Capital cost per home served	$1,596.76	$1,062.89	$795.96	$395.56	$795.96	$262.09
x Target penetration	20%	20%	20%	20%	20%	20%
= Capital cost per home passed	$319	$213	$159	$79	$159	$52

Source: US Census, FCC, Citi Research

So, let's map the cost to serve relative to population density but keep an eye on spectrum depth. There are two important conclusions from the chart. First, for the horizontal lines we can see that the cost to serve falls as spectrum depth improves (from 5 MHz at the low end to 60 MHz at the high end). Second, you'll notice that toward the right-hand portion of the chart, the cost to serve is the same regardless of spectrum depth. That's because toward the right-hand side of the chart, the carriers are serving rural markets. And in the rural markets the costs of coverage sites overwhelms the cost of capacity sites. As such, in rural markets, spectrum depth confers no cost advantage to the carrier. You can also see that the cost to serve in much of the land mass in well in excess of $40 a month. That suggests fixed wireless is uneconomic in these areas. But, fortunately, most households are located in more urban areas. As such, the cost of fixed wireless is well below $40 a month for ~80% of all households if the carrier has 40 MHz or 60 MHz of spectrum. The costs are much higher if a carrier only has 5 MHz or 10 MHz of spectrum.

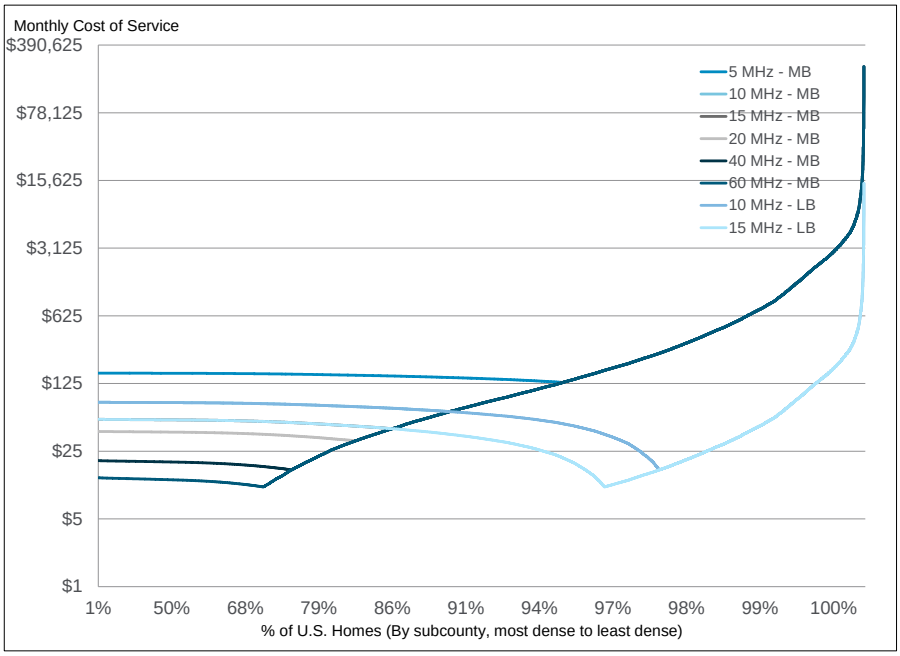
Figure 206. Monthly Operating Costs by Available Spectrum



Source: US Census, FCC, Citi Research

Now, the prior chart used mid-band spectrum exclusively. What if we shift to low-band spectrum? How much will costs fall? In the chart below, we copied the analysis from the last slide and depicted the mid-band spectrum cost curves with solid lines. But, the low-band spectrum is in dashed lines. What's clear is that low-band spectrum significantly lowers a carrier's costs even with only 10 MHz or 15 MHz of spectrum.

Figure 207. Monthly Operating Costs by Available Spectrum including Low-Band Spectrum



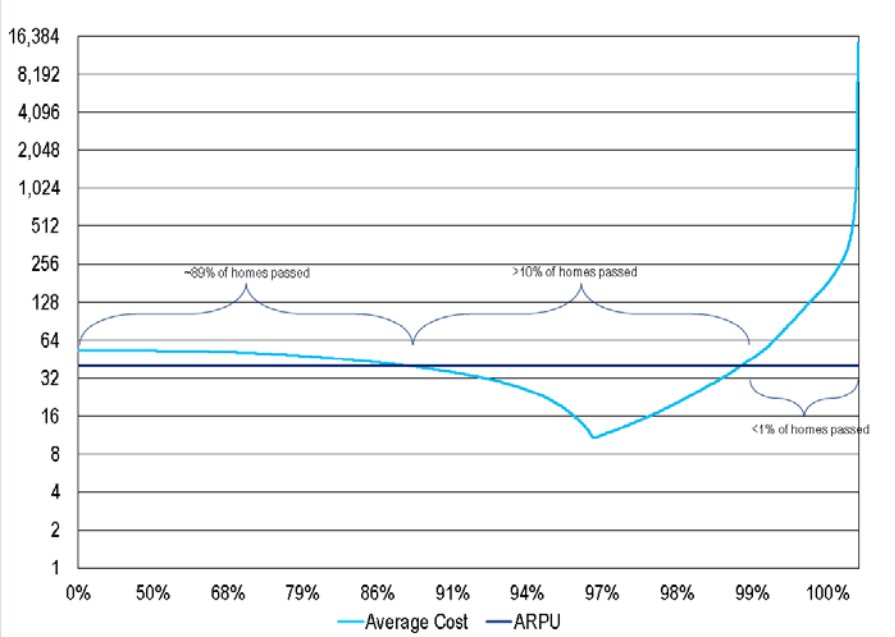
Source: US Census, FCC, Citi Research

Step 4: Determine Gross Profit for Each Market

We now have the framework to analyze the fixed wireless broadband service potential for all ~37,000 sub-counties. As such, the next few charts are for the entire US, (not our sample market in Salt Lake City). **We estimate a $40 monthly ARPU**, similar to that of current entry-level wireline broadband offerings. With the potential for carriers to use a fixed wireless broadband service as a bundle to support existing gross profit and improve retention, we view the gross profit contribution and payback as a reasonable starting point for the economic analysis. Further, our analysis doesn't include the time value of money or incremental costs of marketing.

Assuming AT&T dedicates 15 MHz of low-band nationwide spectrum to offer a 12 Mbps fixed wireless service; we estimate 14 million households could be served using 36K total sites. Total capital spending is $2.3 billion, but we estimate AT&T could generate $440 million in gross profit and break even in 5.3 years. This seems reasonable as AT&T has committed to offering fixed wireless broadband to 13 million households as part of its pending DirecTV acquisition. This assumes the company reaches 20% market penetration, or 2.8 million potential subscribers.

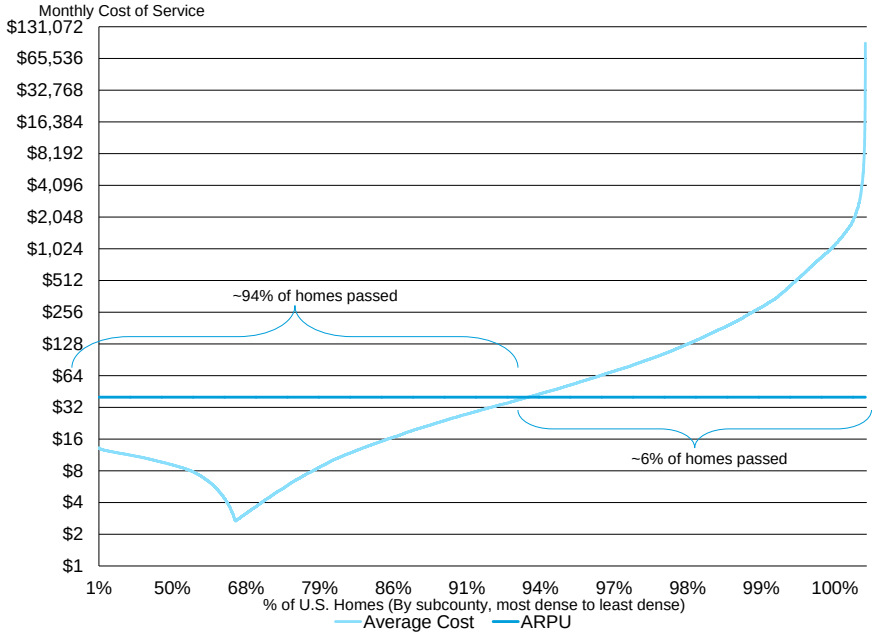
Figure 208. Revenue and Cost Curves for AT&T



Source: US Census, FCC, Citi Research

Companies that have greater spectrum depth but at mid- and high-band frequencies have greater addressable markets due the capacity created. But, the capital and operating costs are also greater. For example, with 60 MHz Sprint could reach 125 million households – about 94% of homes passed - with positive gross profit. But, the capital costs would run about $8.6 billion.

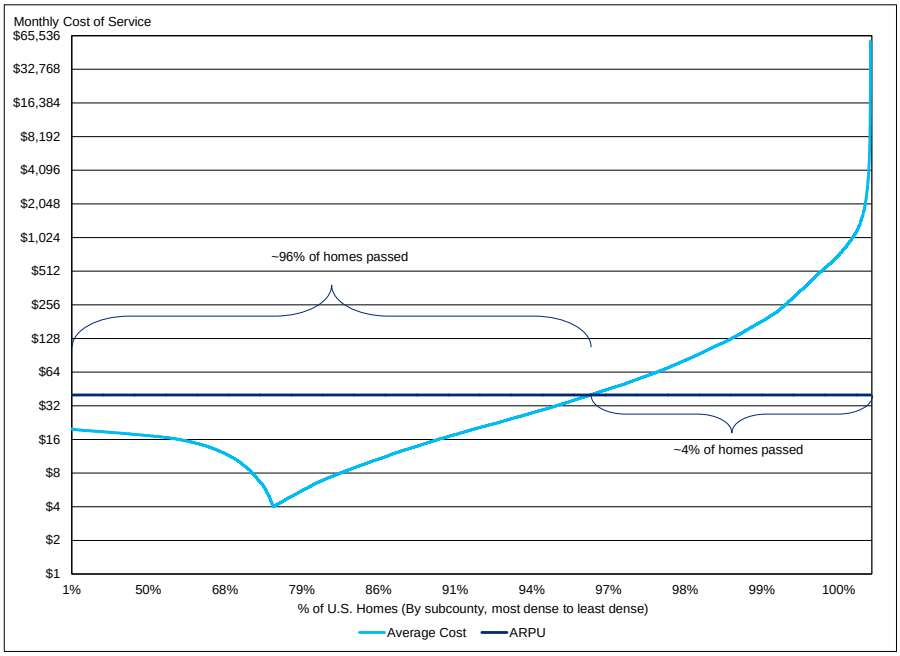
Figure 209. Revenue and Cost Curves for Sprint



Source: US Census, FCC, Citi Research

Dish, with 40 MHz of mid-band spectrum (assuming they can leverage an existing network), can address 128 million households. That's about 96% of US homes. But, it will require $10.9 billion in capital.

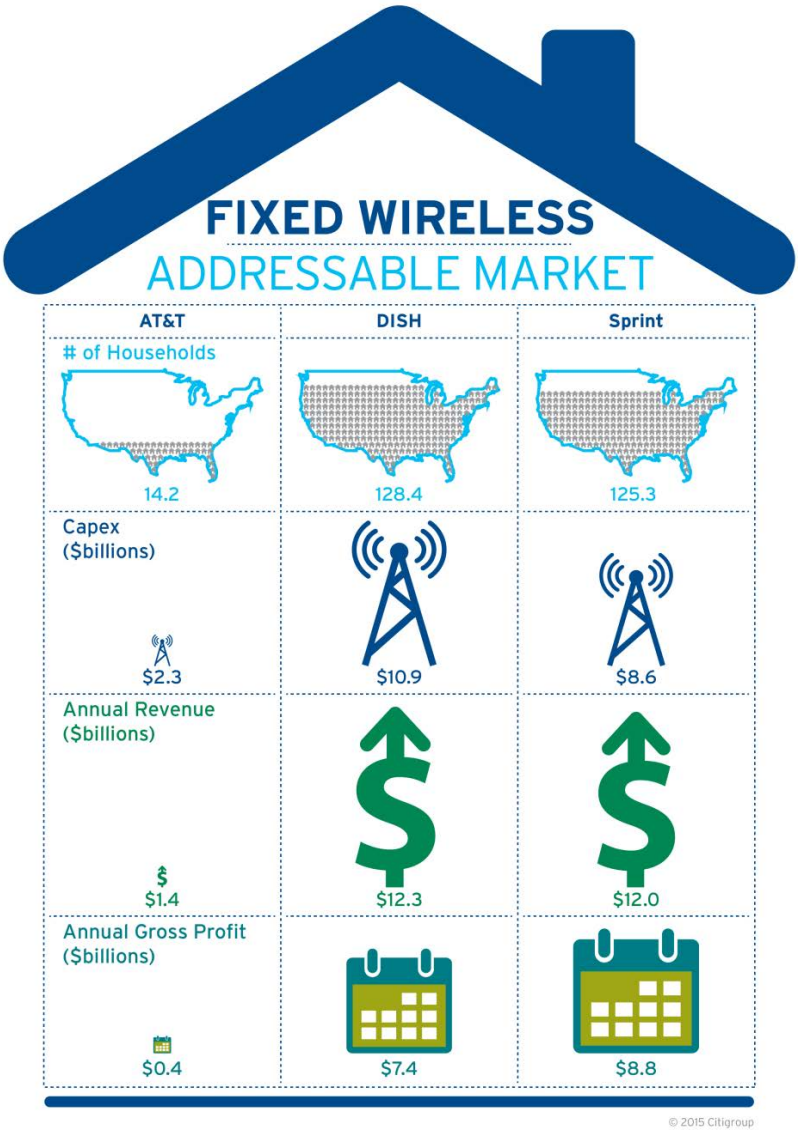
Figure 210. Revenue and Cost Curves for DISH



Source: US Census, FCC, Citi Research

If we summarized the analysis for AT&T, Dish and Sprint, it suggests that both Dish and Sprint could serve the vast majority of US households with 12 Mbps data service profitably. While the capital outlays are large – around $10 billion for each carrier – the profit potential may also be large. As such, we see Fixed Wireless as a viable technical solution to break the broadband duopoly in the US market.

Figure 211. Fixed Wireless: The Best Hope to Break the Broadband Duopoly



Source: Citi Research

Fixed Wireless Summary

So, pulling all the analysis together leads to the following conclusions:

- First, spectrum depth, spectrum frequency, and the re-use of existing mobile infrastructure are the most critical variables to construct a competitive broadband alternative. The potential to use high-band frequencies likely increases up-front investment, but also improves capacity. Low-band spectrum can improve the competitiveness of fixed wireless broadband services in smaller markets and less-dense rural areas.

- Second, having the right mix of spectrum and existing infrastructure can create an **economically viable entry-level broadband service at 12 Mbps.** Our economic analysis shows that AT&T with its 15 MHz of 700 MHz spectrum could offer a fixed wireless solution to roughly 14 million homes. Assuming 20% market penetration, cumulative capital spending required for coverage and capacity is $2.3 billion for an annual revenue opportunity of $1.4 billion, or around 1% of our forecasted pro forma 2016 revenue for AT&T. Sprint, using 60 MHz of 2.5 GHz spectrum, could serve 125 million households, but at a capital cost of $8.6 billion for annual revenue of $12 billion or 36% of our forecasted 2016 revenue.

- Third, the **potential for Dish to pursue a fixed wireless broadband service seems more significant** after this analysis, and could explain the company's repeated interest in partnering with or purchasing a national wireless carrier. With 40 MHz of mid-band downlink spectrum, Dish could provide broadband services to 128 million households for $10.9 billion in capital spending for an annual revenue opportunity of $12 billion. Key to this analysis, again, is the leveraging of existing mobile broadband infrastructure to reduce the monthly operating costs.

- Fourth, **the need for greater cell density and fiber backhaul would be a potential positive for tower companies and competitive fiber providers.** This includes American Tower, Crown Castle, SBA Communications, Level 3, and Zayo. Meanwhile, existing DSL providers with lower speed offerings are most at risk, particularly in rural areas, including Frontier and CenturyLink.

- Fifth, our fixed wireless analysis shows that **Sprint can employ its 2.5 GHz spectrum to economically offer an entry-level broadband alternative**, even though the high-band frequency requires substantially greater cell density than mid- and lower-spectrum band alternatives. The analysis supports our previously published assertion that Sprint could leverage its deep 2.5 GHz spectrum holdings and compete with current entry-level wireline broadband alternatives.

In the Third Pipe chapter, we explored four distinct broadband technologies: Fiber-to-the-home (FTTH), Satellite Broadband, Wireless Broadband and Fixed Wireless. While each of the third pipe technologies we have explored has its limitations relative to cost or performance, we believe Fixed Wireless has emerged as the most likely of the technologies to be used to create a Third Pipe.

Bottom Lines

In this report, we've suggested a few things:

- First, we showed that across the US media landscape, **cable networks are the most important source of growth** among all the divisions. Indeed, between 2007 and 2014, cable networks comprised 81% of the revenue growth and 73% of the industry's EBITDA growth.

- Second, we suggested via the work of third party economists (and our own work) that **cable networks over earn.** The key enabler is the propensity of cable networks to bundle popular and unpopular networks together when they are sold to pay TV firms.

- Third, we posited that the **delivery of video services is undergoing a profound change** from push-based delivery via one-to-many networks (cable, DBS) sold in bundles to the Internet-based delivery sold in smaller sized packages (Netflix, HBO Now, Amazon).

- Fourth, we suggested this shift to the **Internet poses three distinct threats to cable networks:** 1) Shifting consumer behavior is causing TV ratings to decline and resulting in lower pay TV penetration, 2) Shifting advertiser behavior as marketers shift away from TV ads toward web-based ads and 3) Shifting pay TV provider behavior as firms begin to drop content from their bundled channel line-up to preserve (or expand) margins. While every firm faces some risks from these threats, firms that have 1) Significant sports rights (Consumer threat), 2) Low ad exposure (Advertiser threat) and 3) Hit shows (pay TV provider threat) are apt to be more insulated.

- Fifth, we suggested the consensus view regarding media consolidation is wrong. Yes, it may happen, but the root cause is not consolidation among the pay TV distributors. Rather, **media mergers will be driven by the rise of Netflix and other SVOD players** like it. Indeed, the flurry of M&A emanating from Dr. Malone may be in response to the rise in SVOD providers and the secular flow of value towards sports content.

- Sixth, we hypothesized that value may migrate from cable networks to the edges of the video value chain. That is, historically most of the value was captured by cable networks. Going forward, **most of the value is apt to be captured by owners of production rights and last-mile Internet access** providers.

- Seventh, we showed most US markets have one or two broadband Internet providers. But, **there are four potential broadband technologies** that could upset the industry structure: 1) FTTH (from Google), 2) Satellite Broadband (EchoStar, ViaSat), 3) Wireless Broadband (Verizon, AT&T) and 4) Fixed Wireless (Dish Networks).

- Eighth, we suggested 1) **FTTH is economically feasible for about 50% of the US**, but that the capital required to deploy this infrastructure may be prohibitive, 2) **Satellite Broadband is a niche service** only applicable to unserved markets, 3) **Wireless Broadband will likely complement rather than supplant fixed line** Internet access unless Internet traffic slows dramatically and 4) **Fixed Wireless may offer the best hope to break the broadband duopoly** in the US. With $10B in capital investments, both Dish and Sprint have the ability to serve the majority of US households with 12 Mbps speeds.

- Ninth, we see multiple threats to the Cable Network ecosystem and few technical rivals to the last-mile infrastructure. As such, we believe value is apt to flow from content packagers — like cable networks — to last-mile distributors. This shift in value, however, assumes that the regulators don't impose pricing restrictions on Internet access providers.

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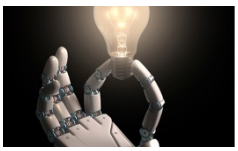

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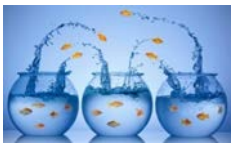

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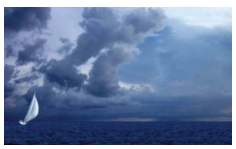

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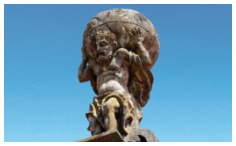

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NOW / NEXT

Key Insights regarding the future of the Media Ecosystem

TECHNOLOGY

Cable companies changed the broadcasting value proposition by shifting consumers from free-over-the-air broadcasting to lucrative bundled package services. / The advent of the Internet for the distribution of video has disintermediated the cable delivery model forcing cable companies further down the value chain toward distribution to continue to grow profits.

INFRASTRUCTURE

In late 2013, the FCC suggested that about 27% of US households only had one provider that could deliver 6Mbps download speeds. And, 37% of households only had two providers that could deliver similar speeds. / Given the threats that cable networks are seeing from consumers, advertisers and pay TV firms, the value has shifted to last-mile broadband Internet access and new technologies like fiber-to-the-home, satellite broadband, mobile wireless and fixed wireless.

SOCIAL CONSTRUCTS

Historically, viewers were happy with turning on their television and searching for a show to watch as the television business that was born in the 1940s delivered free content to consumers over to their homes but with no flexibility on scheduling. / Technology has now changed the way viewers consume video, moving preferences to on-demand and the ability to watch video anywhere and on a choice of devices.