Value Chain Dynamics and Evolving Consumer Demographics in the American Television Industry

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Submitted to the Engineering Systems Division in Partial Fulfillment of the Requirements for the Degree of
Master of Science in Technology and Policy at the
Massachusetts Institute of Technology
June 2014

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Abstract
The American television industry has always been one of very fast 'clockspeed,' characterized by the rapid pace of innovation and the emergence of new business models. This has never been truer than now. The entrance of low-cost, viewer-tailored, subscription-based Over the Top (OTT) video-streaming services has shaken up the complex, vertically integrated television distribution industry that has long been dominated by the traditional Multichannel Pay TV (MCPTV) providers - cable, satellite, and telco operators. As a result, industry watchers have become fond of proclaiming the end of the MCPTV industry.

What viewers, in particular the youngest generations (Millennials), want in their television viewing experience has also changed in recent years. The entrance of OTT, along with industry changes - like new net neutrality rules governing ISP behavior - has coincided with a permanent change in television viewing behavior. This raises the question: "What will happen to the distribution of subscribers, and hence value, in the television market as the preferences and demographics of the consumer group evolves?" How the dynamics between OTT and MCPTV, in light of continuous industry change and evolving preferences, will effect the distribution of subscribers in the market, and therefore the success of either the entrant or incumbent, is the focus of this thesis.

This questions has been explored using a system dynamics model of the attributes that affect the relative attractiveness of either OTT or MCPTV, and hence subscriber distribution. The key lessons that emerge for firms include: the attributes that consumers value most have a significant impact on the attractiveness of the product, and should be of primary importance to firms; high consumer price sensitivity does not effect OTT and MCPTV equally; and, should net neutrality be completely done away with, MCPTV providers, in their dual roles as ISPs, have powerful strategic tools, in the form of control over internet price and speed (which directly affects OTT price and speed), at their disposal. Based on the results, and empirical observations of industry dynamics so far, co-existence, in some form, between the incumbent and entrant is the most likely outcome (in the Incumbent’s Dilemma framework).

Thesis supervisor: Professor Charles Fine
Title: Chrysler Leaders for Global Operations Professor of Management and Professor of Operations Management and Engineering Systems
Acknowledgements

I would like to thank the following people for their help in producing this thesis:

- Professor Charlie Fine, for giving me the opportunity to work on something so interesting and to learn so much this past year.
- Chintan Vaishnav and Sergey Naumov, for all of their generosity with their help, tutelage, and patience in building this model.
- Alexandra Kampmann, for all her help and inspiration; Anna Kahn Leavitt, for giving me a place to hit the reset button and helping me keep everything in perspective; and Nina Schuchman, for answering all of my questions.
- Barbara DeLaBarre and all those involved in TPP, for making it such a great program and being constant source of inspiration.
- Natalie Klym and the Communications Futures Program.
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1 Introduction

*Television is the first truly democratic culture - the first culture available to everybody and entirely governed by what the people want. The most terrifying thing is what people do want.*

- Clive Barnes

The typical American watches around 300 minutes of TV a day, with certain age groups and demographics watching far more (Nielsen Holdings, 2013). While this level of TV consumption has remained fairly steady for some time, *how* the typical American consumer watches television and *what* they want from this democratic culture have changed dramatically in recent years.

In 1997 Netflix was founded as a movie rental service, and since launching its streaming service in 2007, it has gone on to finish 2013 with over 44 million American subscribers, a growing international presence, and four Primetime Emmy Awards (Netflix, 2014c). Hulu was founded in 2007 as an ad-supported video streaming service, launched its paid subscription service Hulu Plus in 2010, ended 2013 with over $1 billion in revenue (Hopkins, 2013), and announced in 2014 it had over 6 million paid subscribers with over half watching exclusively on mobile devices (Hopkins, 2014). Amazon launched Prime Instant Video service in 2006, started Amazon Studios in 2010, rolled out its Fire TV streaming media player, and announced that Prime video streams had tripled year over year in 2014 (Amazon, 2014).

With the rapid rise of over-the-top (OTT) video distribution as a profitable, preferred television access methods for a large and growing segment of the population, along with the new characteristics consumers, particularly the

---

Millennial generation, want from their TV consuming experience, the press has become fond of repeatedly ringing the death knells of the ‘traditional TV distribution’ industry. “TV Is Dying And Here Are the Stats To Prove It” (Edwards, 2013), “Internet TV and The Death of Cable TV, really” (Orlin, 2010), and “The Slow, Inevitable Death Of Cable TV” (Singer, 2013), while dramatic titles, are fairly typical sentiments from the TV death-watch crowd.

Netflix, far and away the OTT market leader, has continued to add subscribers hand over fist every quarter since launching its streaming service (Graph 1). And yet, total cable industry revenue has increased every year since 1996, the earliest year data was available (Graph 2). Attempting to reconcile these conflicting narratives only leads to the conclusion that the picture is not as black-and-white as the endless stream of news articles would have one believe.

Graph 1: Netflix Subscribers 2001 - 2011

![Graph of Netflix Subscribers 2001-2013](source: Statista.com, based on Netflix Annual Statement Data (Statista, 2014))
Wading into this murkiness, this thesis is an attempt to understand some of these industry changes, and the circumstances that could arise as the attributes that consumers' value in their television experience evolves. This thesis seeks to look at how the value chain dynamics between the entrants and the incumbents in this industry could play out; or, in the language of the Incumbent's Dilemma model, which of the three broad results – entrant displaces incumbent, incumbent fights off the entrant, or the entrant and the incumbent co-exist – could result and under what circumstances (Vaishnav & Fine, 2014). Specifically, the entrance into the market of OTT subscription video services, coinciding with (and enabling) a permanent change in television viewing behavior, raises the question: "What will happen to the distribution of subscribers, and hence value, in the television market as the preferences and demographics of the consumer group evolves?" In looking at the effects of demographics on viewership (subscriptions), we are really looking at the value flows in this industry, which has significant impact on how the industry actors carry out their corporate strategies going forward.
The television production and distribution industry is one of the more sizeable industries in the USA. The National Cable and Television Association estimates that the gross economic output of the US cable industry was close to $300 billion in 2012, and that the industry accounted for close to $2 million jobs in the same year (NCTA, 2013). Given that this represents just a portion of the entire video distribution value chain, it is easy to conclude that it is a pretty large economic pie, and understanding how the value will be split will have significant consequences going forward (Stone, 2012).

A point of clarification: TV, as the product, is very abstract; assessing its merits would entail value judgments about storytelling and narrative, production values, etc. – very subjective concepts. However, TV-distribution as the product or service is much clearer to analyze, and will be the subject of analysis in this model and thesis. In this sense, types of content (‘premium’ vs. ‘non-premium’ shows) are not the unit of analysis, but rather as just one element or source of ‘competitive differentiation’ for a television distribution service.

While the implications of this work are particularly relevant for corporate policy – strategy, investment, and pricing decisions – going forward (policies that impact a sizable portion of the American economy), government regulation is not altogether absent from this story either. Beyond the obvious ways in which oversight and decision-making by the FCC affect the telecommunications industry, of particular importance is the exceptionally topical (at the time or writing) issue of ‘net neutrality.’ This debate over the control of Internet access networks can, and will, directly impact the bottom line of companies like Netflix, whose product is streamed over the internet and the perception said product in customers’ eyes is a direct function of the quality and speed of the internet connection.

Without a ‘neutral’ Internet, ISPs (Internet Service Providers) could "degrade the performance of competing services" – namely subscription-based OTT video streaming services (which are a direct competitor to the cable or telco services), by
prioritizing HBOGo traffic over Netflix traffic, for instance (Gamero-Garrido, 2014). Or so the argument goes. Clearly, companies like Netflix are strong supporters of a 'neutral' Internet, as a 'degraded' streaming experience hurts their bottom line, either through dissatisfied customers or via the fees ISPs would levy to forgo traffic discrimination (Hastings & Wells, 2014).

Thanks to the popularity of the triple play business model in the not-so-distant past, residential ISPs also happen to mainly be cable and telephone providers (telcos), like Comcast and Verizon – the vertically integrated multinationals that make up 9 out of the 11 largest multichannel pay TV providers (MCPTV) in the USA (eMarketer, 2014). Therefore, if ISPs (and hence MCPTV providers) decide to enact an obvious policy of traffic discrimination, more so than they already do now (Gamero-Garrido, 2014), this will have direct implications on the corporate polices of both OTT and MCPTV video services going forward. The ability of the MCPTV providers to affect either the price (through the cost of internet access) or the quality of service of an OTT customer is one situation, or 'possible futures' the model looks to analyze in a subsequent chapter.

This thesis is laid out as follows: in Chapter 2 we overview the current television industry value chain, the emergence of OTT as a disruptive entrant in the market, and 'Millennials' as a demographically distinct consumer group. In Chapter 3 we provide a brief overview of system dynamics methodology and an outline of the system dynamics model itself. Chapter 4 explores the results of the model under various assumptions and their implications. Chapter 5 discusses the limitations of the model and the future work that would aid in refining it as a decision-making tool. Chapter 6 offers concluding thoughts.
2 Setting the Stage

2.1 Value Chain Overview

The television value chain has become increasingly complex and vertically integrated over the last few decades. Figure 1, below, produced by Natalie Klym of MIT's Communications Futures Program, illustrates this complex space. Before continuing any further, a brief overview of the players in the value chain is in order. For an in-depth look at the American television industry value chain, Waterman, Sherman, & Ji (2012) or Wei-skillern & Marciano (2008), amongst many others, are excellent resources.

![Figure 1: US Television Industry Value Chain](source:klym, 2014)

**Content Generation/Owners:**

This includes both the human capital – the "raw materials used to produce television programs," such as actors, athletes, and organizations like the NBA, NHL
or NCAA (Wei-skillern & Marciano, 2008) – and the production studios – companies like Warner Bros., Disney, and Paramount Television – that are the actual ‘manufacturers’ of content, which they then license the rights to (Wei-skillern & Marciano, 2008).

**Broadcast Networks:**
Companies, or business segments, like ABC, NBC, CBS, etc., that produce their own TV content or license it from content producers. They earn revenues from two sources: traditional advertising and retransmission fees.

**Cable Networks:**
Networks like CNN, ESPN, MTV, HBO, etc., which air television shows, and whose primary revenue sources are affiliate fees charged to the distributors (typically charged on a ‘per-subscriber per-month’ rate) and advertising (PwC, 2012).

**Cable Operators:**
Companies like Comcast, Time Warner Cable, etc., who distribute cable through coaxial cables. They operate on a subscription-based model where the subscriber pays for the service and receives their TV content directly through the cable wire. They also earn revenue from advertising. Given the vertical integration in the value chain, these multinationals often own the cable channels that are most often associated with the word ‘cable.’ As of the 1992 Cable Television Consumer Protection and Competition Act, cable companies are required to negotiate ‘retransmission consent’ from Broadcasters for the right to carry their signals (which usually involves paying fees for this right – the retransmission fees to the Broadcast Networks). They have experienced declining subscriber growth in recent years (Graph 3).

**Direct Broadcast Satellite (DBS):**
Companies like DIRECTV and DISH Network, which distribute digital broadcast signals via orbiting satellites to smaller receiving dishes at the consumer’s location.
Similar to the cable providers, they license content rights and earn revenue from subscriptions and advertising. They have shown small, but steady, growth over the past few years (Graph 3).

**Telecommunication Carriers (Telcos):**
Traditional telephone service companies providing TV service through fiber-optic cables. Verizon's FiOS and AT&T's U-verse are the most prominent telco offering examples. Telcos were the latest additions to the MCPTV content delivery space, using their already sizeable customer base to become viable triple-or-double-play alternatives. Telcos have been the only segment of the MCPTV space to post significant subscriber growth in the last 7 years (Graph 3).

**Over-the-Top (OTT) Distribution Platforms:**
Companies or services like Netflix, Hulu, or Amazon Instant Video, etc., which stream their content exclusively over the Internet (wirelines and wireless). Over-the-top video distribution refers to the delivery of television content without the involvement of the traditional distributors – cable, satellite, or telco operators. OTT services use the ISP's network – piggybacking on top of the services of the ISP – but are not controlled by the operator. While not all identical business models, they earn
their revenues primarily through subscription fees and advertising. See below for further details.

**Viewers:**
The human beings who do the actual watching of television and who develop cult-level devotion to particular television shows; who pay the monthly or annual subscription fees, and whose eyeballs are sold to advertisers. There are over 100 million US households with some sort of pay TV subscription (either MCPTV or OTT, or both). The platforms through which viewers can consume video has expanded in recent years; whereas traditionally people watched their favorite show on a television set, now viewers watch on desktop computers, laptops, tablets, and/or mobile phones. To compare, IDC also reports that in 2011, there were 24.7 million households with a paid subscription OTT video service and 100.2 million households with a MCPTV subscription (Ireland, 2013).

**Device Makers:**
Companies like Google, Apple, and Amazon, who make Chromecast, Apple TV set top boxes, and Fire TV, respectively, in addition to the phones, tablets, laptops, etc. that consumers use to access content from various sources.

**Advertisers:**
All and any companies that pay to have their products or services promoted at any point in this value chain (from product placement in the content production stage, to the traditional ad spots when watching one's favorite primetime TV show).

For the rest of this thesis, and in the accompanying model, the incumbents in this market will be considered the multichannel pay TV services (MCPTV), also referred to as multichannel video programming distributors (MVPDs), or what would be conceptualized as the traditional modes of TV-distribution. This includes cable operators, direct-broadcast satellite providers, and telco operators.
The firms collectively referred to as MCPTV have two traditional sources of revenue: selling subscriptions and advertising. Distinct features of their business models include the triple play and bundling. The triple (or double play) business model offers high-speed Internet, TV, and voice in one package for one fixed price (e.g. Comcast's basic Xfinity triple play package currently starts at $80); the double play is two of these three options (most commonly broadband and video). Double-play packages of broadband and video accounted for 27.5% of all bundles purchased in 2012 across cable and telco providers (Davis, 2013). Bundling refers to a predetermined package of channels that the consumer purchases, rather than the consumer being able to choose on the channels he or she would want to watch (a la carte channel choice). The prices of MCPTV bundles have continued to rise over the last few years, with bundling remaining the dominant way of selling subscriptions.

Table 1 below, from eMarketer.com, highlights the changes in MCPTV subscribers for the leading firms in the most recent quarter for which data is available.

Table 1: Changed in US Pay TV Subscribers, Q3 2013

<table>
<thead>
<tr>
<th>US Pay TV Subscribers and Net Additions, by Provider, Q3 2013</th>
<th>Subscribers</th>
<th>Net additions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Top cable</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comcast</td>
<td>21,647,000</td>
<td>-129,000</td>
</tr>
<tr>
<td>Time Warner Cable</td>
<td>11,607,000</td>
<td>-304,000</td>
</tr>
<tr>
<td>Charter Communications</td>
<td>4,345,000</td>
<td>-25,000</td>
</tr>
<tr>
<td>Cablevision*</td>
<td>2,831,000</td>
<td>-37,000</td>
</tr>
<tr>
<td>Suddenlink Communications</td>
<td>1,186,000</td>
<td>-3,000</td>
</tr>
<tr>
<td>Mediacom</td>
<td>960,000</td>
<td>-23,000</td>
</tr>
<tr>
<td>Cable ONE</td>
<td>561,119</td>
<td>-14,643</td>
</tr>
<tr>
<td>Other major privately held cable companies**</td>
<td>6,745,000</td>
<td>-65,000</td>
</tr>
<tr>
<td><strong>Total top cable</strong></td>
<td>49,882,119</td>
<td>-600,643</td>
</tr>
<tr>
<td><strong>Satellite</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DIRECTV</td>
<td>20,160,000</td>
<td>139,000</td>
</tr>
<tr>
<td>DISH Network</td>
<td>14,049,000</td>
<td>35,000</td>
</tr>
<tr>
<td><strong>Total satellite</strong></td>
<td>34,209,000</td>
<td>174,000</td>
</tr>
<tr>
<td><strong>Telco</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AT&amp;T U-verse</td>
<td>5,256,000</td>
<td>265,000</td>
</tr>
<tr>
<td>Verizon FIOS</td>
<td>5,170,000</td>
<td>135,000</td>
</tr>
<tr>
<td><strong>Total telco</strong></td>
<td>10,436,000</td>
<td>400,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>94,527,119</td>
<td>-26,643</td>
</tr>
</tbody>
</table>

*Includes former Bresnan properties sold to Charter on 7/1/2013; **Includes LRG estimates for Cox and Bright House Networks. Source: Leichtman Research Group Inc. (LRG) with company reports as cited in press release, Nov 18, 2013.
The entrants in this market are over-the-top (OTT) video distribution platforms; more specifically the legal, subscription-based online-TV streaming services. Major market research firms, such as IDC, classify OTT as online subscription video services like Netflix, Hulu Plus, and Amazon Prime Instant Video. They do not include "users of TV Everywhere services in which OTT video is accessed in conjunction with and authenticated via a traditional multichannel pay TV service." (Ireland, 2013) Netflix describes its operations as "licensing and producing exclusive content for our direct-to-consumer business" (Hastings & Wells, 2014).

For the purposes of this paper, OTT will refer to those providers, like Netflix and Hulu, offering subscription TV streaming services, but not the online streaming services of MCPTV providers – like Comcast’s Xfinity TV Go or Time Warner’s HBOGo.

OTT providers license the streaming rights from content providers for the vast majority of their catalogs. These services are also characterized by the ability to timeshift\(^3\), to watch on all types of devices (phones, tablets, laptops, and TVs), to stream simultaneously on multiple screens, their comparatively low prices ($7.99/month for a basic Netflix or Hulu Plus subscription, for instance), and most recently their forays into original (premium) content production. Table 2, below, which compares traditional pay TV (MCPTV) and Netflix (as an example of OTT) across various attributes, provides a quick summary of the similarities and differences between the entrants and incumbents:

### Table 2: Differences Between Pay TV and OTT

<table>
<thead>
<tr>
<th></th>
<th>Pay TV</th>
<th>OTT (e.g. Netflix)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Live</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

---


\(^3\) Timeshifting would have initially meant recording a program to a storage device, like a digital video recorder (DVR) to watch at a later time, but can now be more generally conceptualized as watching a television show at a time other than when it was originally aired, as services like HBOGo, Hulu, Netflix, etc., remove the need to actually record the program as their content is available whenever the consumer chooses to access it.
<table>
<thead>
<tr>
<th></th>
<th>On demand</th>
<th>Bundle</th>
<th>À la carte</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Ownership</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Advertising</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transaction</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Subscription</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-recurring</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Original content</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Deep library</td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

Source: IDC Canada, 2013

The television and video distribution industry has always been one of a very fast 'clockspeed,' or rapid life cycle, based on the exceptionally high rate at which new products or market structures come into being (Fine, 1998). This is visible with even just a cursory look at the some of the more interesting industry developments in the last few years: Aereo, a service that uses mini-antennas to stream over-the-air (OTA) content directly to consumers launched in 2012, and is awaiting a Supreme Court ruling over it’s legality and continued operations; In November 2013, Netflix and Disney’s Marvel TV announced a content production deal slated to develop multiple original series to be streamed exclusively via Netflix (Marvel, 2013); Between November 2013 and January 2014, Verizon announced it was acquiring streaming software company UpLynk, whose technology aids with the effective streaming of “live events, linear television and video on demand” (Verizon, 2014), EdgeCast, one of the industry’s leading CDNs, Intel’s Intel Media, which houses its cloud TV assets (Intel, 2014); In February, Comcast announced plans to acquire Time Warner Cable for USD $45 billion; In April, Amazon announced that it had reached a licensing agreement with HBO, giving its Instant Video Service “exclusive online-only” streaming rights for HBO programming (BusinessWire, 2014).
Similarly, there seems to be a never-ending stream of new innovations in the television ecosystem: Apple TV, Google TV, Roku Boxes, Android TV, Fire TV, Chromecast, to just name a few of the more high-profile ones. This innovation pace does not show any signs of slowing down either: the increasing prominence of 4K televisions has prompted services like Netflix to start offering some of their content in 4K streams; both MCPTV and OTT service providers continue to update and refine their user interfaces across all device types, in particular their mobile ones; and the next big frontier for innovation will be search and navigation of content (and content access options).

### 2.2 Trends

Technology has significantly altered the way consumers watch TV and how they conceive of the TV-viewing experience; this has enabled new habit formation and created a desire for a new set of features in consumers' TV experience. Viewing habits, especially of the Millennial generation (binge watching, the decline of appointment television, time shifting, illegal streaming, etc.), and the attributes valued by viewers (watching over mobile devices, increasing unhappiness with forced bundling prices, etc.) are also evolving at a significant rate. The following paragraphs highlight some of the more notable trends of recent years:

Timeshifting, or watching a show at a time other than when it was originally aired, happens either via recording with a DVR (digital video recorder), to be replayed later, or by using an OTT streaming service, where the content is available whenever the viewer chooses. Timeshifting has helped further the decline of 'appointment television,' or linear programming, where the viewer tunes in at the same scheduled time to watch a particular show. The only exceptions to this are live programming (such as a State of the Union address) or sports⁴. Led primarily by Netflix, which

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⁴ However, as the 2014 Sochi Olympics showed, viewers were willing to watch some, though not all, events the day following their live airing, due to the time difference between the USA and Russia.
releases all the episodes of its original programming simultaneously, the default standard of a one-episode-a-week release schedule is also evolving. Full-season release has been driven by, and continues to fuel, the popularity of 'binge-watching' – watching multiple episodes of a television show in succession (or perhaps even an entire season over the span of a weekend – something this author may or may not be familiar with).

Binge-watching is not just a consumer proclivity, but a pattern of viewing behavior that is impacting business strategies along the value chain. For instance, an OTT provider like Netflix is most interested in acquiring the content licenses to shows with 'concluded storylines' (Barr, 2013), as their viewers, prone to binge watching, are more likely to start series with completed narratives. Whereas reaching syndication eligibility (88 episodes of a series) used to be the primary driver of continued episode production, an OTT licensing deal is now having the same effect – networks, like the CW (which has a content deal with Netflix), are more likely to produce additional seasons or episodes of a show, in order to make them more attractive to Netflix (Barr, 2013).

OTT distributors continue to cater to viewers' desire to binge watch by producing their own 'premium content' – a la House of Cards, on Netflix, or Alpha House on Amazon Instant Video. Serving as alternative sources of premium content (the type of programming classically associated with the cable networks like HBO) – which is available exclusively through the OTT provider – only serves to increase the attractiveness of these options in the eyes of potential consumers. Moreover, the success of ventures like House of Cards (nine nominations and three wins at the 2013 Emmy Awards, enormous critical acclaim and media attention, and high

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What happens when the current sports licensing agreements with cable companies expire and the licenses are up for grabs also remains to be seen (OTT companies, like Amazon or even Google, have the requisite resources to compete for these rights).

5 Similar to Justice Stewart and the obscenity threshold, premium content is also of the 'I-know-it-when-I-see-it'-variety (Lattman, 2007) – typically with more specialized, or niche, storylines, high production values, and often with more nudity or violence than is allowed on broadcast network programming.

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viewer popularity) increases the 'legitimacy' of non-traditional TV production (helping to overcome the mindset that just the big networks can produce quality television). This will have major ramifications in the value chain as more players enter the production space and this non-traditional production only continues to increase.

Pirated (unauthorized) TV watching, while not a new phenomenon (BitTorrent, one of the most popular peer-to-peer file sharing protocols, was launched in 2001; The Pirate Bay, the most popular torrent directory on the Internet, has been around since 2003), has become easier with the advent of online streaming. For the second year in a row, HBO's *Game of Thrones* was the most popular pirated TV show of the year, with its most popular episode garnering nearly 6 million downloads (Torrentfreak.com, 2013). Websites like sidereel.com, which curate different online sources for streaming TV, are amongst the most popular access points for television online, full stop. Sidereel.com was the 10th most popular site for accessing content online in 2013, followed by the Pirate Bay (Graph 4). Industry reaction to the various forms of unauthorized viewing has been mixed. HBO's CEO Richard Plepler is on record as saying password sharing "has no impact on the business" and that it can in fact be a great marketing vehicle (Lynley, 2013), while *Game of Thrones* director David Petrarca has stated that illegal viewing matters less than the 'cultural buzz' that results from more people watching the show (The Sydney Morning Herald, 2013).

Industry analysts report that less than 10% of US Internet users engage in peer-to-peer file sharing (McQuivey, 2010), but that a larger percentage of Internet users do engage in 'casual video piracy' through offshore streaming sites, in tandem to paying for some sort of TV subscription. In fact, in surveys, many viewers express a

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6 Sidereel.com and its ilk don't stream any of the shows, but have links to all the different sites (initially – and still predominantly – illegal, but now also legal) hosting the streams. As a site that started curating only illegal options, their ad-supported website model is an example of direct profiting from illegal TV viewing.
preference for a legal option for online streaming, provided it is easy to use with the catalog size and variety option associated with the illegal alternatives (McQuivey, 2010). It is most likely the emergence of lower cost, convenient, legal online streaming options like Hulu and Netflix that have kept 'casual video piracy' from being a more popular trend than it currently is now. While not overwhelming in terms of total market share, these non-revenue-generating TV access alternatives are most popular with younger viewers. Whether not paying for TV is a trend that becomes an unshakable habit as these viewers age will remain to be seen.

Graph 4: Top Sites Used to Access TV Content Online

![Sites Used to Access TV Content Online by US Internet Users](image)

Source: emarketer.com, data from the September 2013 PricewaterhouseCoopers study "Consumer Intelligence Series: Video Content Consumption." (eMarketer.com, 2013)

Other recent trends in the TV ecosystem include increasing consumer dissatisfaction\(^7\) with the MCPTV status quo (high prices, non-optional bundles, etc.), a desire for total customization of the viewing experience (watching what you want, when you want, on any device), and a migration towards whoever can best meet

\(^7\) In a 2012 study, the highest percentage of consumers who responded being 'very satisfied' with their TV service provider was only 39%, for Verizon. As a comparison, for customers of Comcast and Time Warner – two of the biggest providers – only 11% and 8%, respectively, reported being 'very satisfied' (Change Wave Research, 2012).
these needs. The market entrants *appear* to be more proactive in catering to the changing tastes – providing “consumer-in-control Internet television” (Hastings & Wells, 2014). The result has been notable increases in the number of “cord-cutters,” “cord-shavers” and “cord-nevers.”

Cord-cutting refers to a subscriber cancelling their traditional pay TV subscription, either in favor of an OTT subscription, illegal viewing, or not watching television entirely. Cord-shaving describes the behavior of a consumer cutting back on the amount of money he or she spends on subscriptions. Cord-nevers are those who have never subscribed to a multichannel pay TV services in the first place (and therefore have no cord to cut). There is no consensus amongst industry actors and analysts over the magnitude and impact of cord-cutting, shaving, etc. As Table 1 illustrated, cable providers have been losing subscribers every quarter for the last few years, despite of high industry revenues. However, telco and satellite providers have experienced subscriber growth. Industry survey data does confirm that Millennials, compared to non-Millennials, are more likely to be cord-free (Verizon Digital Media Services, 2014). We turn now to examining Millennials as a consumer group.

### 2.3 Demographics

“Millennials are both the 20th century’s last generation and its first truly digital one. This old century/new technology dichotomy gives pause to marketers attempting to understand and connect with this key demographic (Donnelly & Scaff, 2013).”

Nearly every industry analyst report, not to mention newspaper or magazine article, one reads these days, focuses on how unique the “Millennials” are as a generation and as a consumer group (or “particularly strange,” in the words of one reporter (Thompson, 2012)). All this attention is not without merit. While market researcher estimates vary over the size of the generation gap between the ‘Boomers’ and
Millennials, all agree that it exists (Brooks, 2014). Millennials, or the Millennial Generation, or Gen Y – essentially those born between the early 1980s to early 2000s – have come of age (or are coming of age) in a very different environment than their parents and grandparents (the Boomer generation and older) and are exhibiting very different behaviors as consumers, especially when it comes to their media and entertainment products. This new environment is both technical and economic. The eldest of this generation grew up in the last part of the greatest period of economic growth of the previous century and the bulk of this cohort as reached working age during the worst recession since the Great Depression (Thompson, 2012). According to data from the Pew Research Center, the fraction of those aged 18 to 24 who are employed (56%) is at the lowest level since the government started collecting this data (Pew Research Center, 2012). Millennials are also staying in school longer and living at home longer (36% of Millennials still live with their parents) (Fry, 2013), which is problematic for MCPTV subscribers, as pay-TV growth has traditionally been tied to household growth (Kafka, 2013).

Millennials in North America spend on average 7 hours a day online (Telefonica, 2013) – technology, in all forms, is an integral part of their lives in ways that simply don’t compare to earlier generations. The ability to stream video content over the Internet to your smartphone didn’t even exist 10 years ago; the first iPhone was only introduced in 2007. The ubiquity of technology in Millennials’ lives is reflected in how they consume media and use technology: over 80% watch digital video online (compared to just 47% of Boomers); they spend less time watching live TV; they frequent non-traditional sources, like social networking sites and YouTube, for both content and content-discovery; smartphone penetration is above 50% (it is just 37% for Boomers) and Millennials spend more time on them – as just a smattering of relevant statistics (Dolliver, 2014). Specifically, Millennials are the lowest subscribers of cable and satellite TV and the biggest subscribers of OTT offerings (Table 3).
Coming of age at the same time as the emergence of all these new TV-related technologies and new services (Netflix et al.) which cater directly to what Millennials want in their entertainment means that they are developing viewing habits that are notably different than their parents. The trends described above – binge watching, time-shifting, cord-cutting, etc. – are most prominent amongst this generation. Given that the annual expenditure of US Millennial consumers is projected to more than double by 2020 (Donnelly & Scaff, 2013), and that this generation, with these habits and preferences, will eventually make up the majority of the US market, it is no wonder than understanding how they behave (and how to target them more broadly) is of such interest to firms and analysts.

### 2.4 Problem Definition

The work of this thesis can be situated in the broader context of the Incumbent's Dilemma framework of industry disruption (see Vaishnav & Fine (2014) for a more in depth analysis of the framework). When facing industry disruption – typically
from a new innovation or business model – an incumbent can typically expect one of three broad outcomes to occur: the incumbent is displaced by the entrant, the incumbent defeats the entrant, or they coexist in the market (Vaishnav & Fine, 2014). In this age of constant innovation and an in industries with very fast clockspeeds, entrant firms are faced with constant “threats” to their business models, some of which will fizzle out, being nothing but hype, while on any given day the next Google or Facebook will be born and will be an actual existential disruption to the entrants’ existence. The Incumbent’s Dilemma framework – which analyses aspects of the technology, market, product etc. – attempts to provide a tool to determine how the disruption will actually impact the industry.

This thesis explores the dynamics of a small slice of an industry in the midst of disruption. The advent of online video streaming (the new technology) coupled with a new business model\(^8\) (flat-rate, low price subscription-based streaming service focused on providing a convenient and customizable television viewing experience for the user) has created a classic incumbent’s dilemma for the MCPTV providers. The central question motivating this work – “What will happen to the distribution of subscribers in the television market as the preferences and demographics of the consumer group evolve?” – is an attempt to examine under what conditions consumer preferences and firm behavior will have a meaningful impact on the distribution of consumers in this market, and hence on the success of either the entrants or the incumbents – and therefore, to take a first pass at determining which of the three broad outcomes of the Incumbent’s Dilemma framework is most likely.

\(^8\) Or, as industry analyst Steven Hawley of GigaomPro summarizes: “The primary value proposition for OTT TV is the combination of content availability, price, and convenience. A key selling point is that users can access video through a single subscription and watch it on a PC, tablet, or smartphone as well as on internet-equipped televisions, all at a low cost.” (Hawley, 2012)
3 Methodology and Model Overview

As is typical with theses that incorporate system dynamics modeling, the requisite hat tip to the ‘standard method’ is in order at this point. The standard method, or feedback-based modeling framework, is simply the series of steps used in the modeling process, from the overview of key variables, through the development of causal loop diagrams, through to the building of the actual simulation model and its analysis (Otto & Struben, 2003). There are a plethora of (much more knowledgeable and experienced) resources available that explain system dynamics and the standard method of modeling in depth, to which this author will happily direct the reader. (See Morrison, 1991; Otto & Struben, 2003; and of course the central text in this area, Sterman, 2000)

Broadly, the methodology this thesis will follow includes building a system dynamics model\(^9\) of subscriber behavior and the variables that influence a potential subscriber’s choice to subscribe the MCPTV or OTT, performing sensitivity analysis on the most important parameters, and finally exploring the implications of these results for corporate policy going forward.

The process of system dynamics modeling is ideal for capturing and articulating problems that are evolving and interconnected. System dynamics is a tool most often used to address complex problems that involve many variables, feedbacks processes, delays, and uncertainties, thereby capturing the effect of decisions on other elements in the system, and allowing for the testing of sensitivities. For these reasons, it was chosen as the method of analysis for examining the problem at hand – what will happen to the distribution of subscribers in the legal television distribution market under different preferences, and what will this shift in subscriber distribution mean for the dynamics in the industry. Given that the television space is evolving very quickly with a high amount of uncertainty over

\(^9\) The modeling has been done with Vensim DSSDP modeling software.
what the market and the dominant players will look like in the near future, system
dynamics gives us the opportunity to explore what ‘possible futures’ might look like
under various sets of hypotheses about consumer preferences or different strategic
actions taken by the industry players.

As per the standard method, while there is an almost-endless list of possible
variables that could be included in a model, five key variables have been identified
as having the greatest impact on the attractiveness of either a MCPTV or OTT
service, and hence on the consumers’ inclination to subscribe. These variables are
price, catalog size, quality, effectiveness of advertising, and the effect of word of
mouth (to be defined in greater depth below). As price increases, the attractiveness
of either option decreases; similarly, as the price decreases, the attractiveness of the
offerings increases. For the other four variables, the reverse holds true – as quality,
catalog, advertising effectiveness or word of mouth effectiveness increases, the
attractiveness of the MCPTV or the OTT offering increases; similarly, as the variable
decreases, so does attractiveness.

Within the model (and in reality) there are some important feedback loops that are
worth highlighting. As Figure 2 below highlights, the number of subscribers drives a
reinforcing feedback loops for revenues, for both OTT and MCPTV: all else being
equal, as the number of subscribers increases, revenues (from both subscription
fees and advertising) increases. This in turn raises profits, which leads to an
increase the investment – either in new shows or in quality (the number of HD
shows, for instance). Increased investment leads to an increase in the relative
attractiveness of OTT (or MCPTV), which in turn increases the number of
subscribers, completing the reinforcing loop.

\[\text{10 In Vensim, the dynamics driving OTT and MCPTV subscription have been modeled as symmetrical}
\text{processes. The following descriptions (of loops, variables, etc.) apply to both OTT and MCPTV, and}
\text{are the same for all the age groups.}\]
Other loops in the model are the effectiveness of advertising (balancing) and the effect of word of mouth loop (reinforcing), as illustrated in Figure 3 and Figure 4 below. For advertising, as more households adopt either MCPTV or OTT, there are fewer potential video consuming household, or potential adopters, in the standard Bass Diffusion Model language (Bass, Krishnan, & Jain, 1994; Norton & Bass, 1987; J. Sterman, 2000), left in the market. As potential adopters decrease, or the market saturates, the number of household who adopt due to advertising also decreases (all else being equal), causing the subscription rate (of either OTT or MCPTV) to fall, creating a balancing feedback structure. In the case of word of mouth, as more households adopt either OTT or MCPTV, there are more total adopters, full stop. This means there are more interactions (or potential for interaction) between adopters and potential adopters. This increases the effectiveness of word of mouth, or how likely a potential video consuming household is to subscribe (e.g. if more and more of your friends subscribe to Netflix, and rave about how great House of Cards is, the more opportunity there is for them to sell you on Netflix, and increase your likelihood of subscribing as well). This in turn increases the relative attractiveness of either option, which increases the subscription rate, and hence the total number of subscribers, which increases the total number of interactions between non-
subscribers and subscribers, bring the reinforcing structure of this dynamic full-circle.

Figure 3: Effectiveness of Advertising Feedback Loop

![Advertising Feedback Loop Diagram]

Figure 4: Effectiveness of Word of Mouth (WOM) Feedback Loop

![WOM Feedback Loop Diagram]

Combining all these loops into one causal loop diagram gives a (simplified) description of the dynamics of television video subscription (Figure 5). Figure 5 also highlights another balancing loop in the model, the one involving attrition (abandonment, cord-cutting, etc.). As the number of subscribers increase, the number of people who will end their subscription also increases (even with a fixed attrition rate, the more subscribers there are, the larger the absolute number who will leave). Attrition rates are explored in greater depth below.
As per the standard method, the next step from causal loop diagrams is the building of the actual simulation model\footnote{This has been done with the usual process – adding stock and flow structures, adding additional loops and variables, and estimating the parameters using statistical means, market research data, analogous product histories, expert opinion, other relevant data sources (quantitative or judgmental) (J. Sterman, 2000).}. The simulation model in this thesis attempts to strike a balance between being simplified and user-friendly and still being able to tell the reader (and this author) something useful about the problem it is meant to explore. As with any model, assumptions have been made – in the name of simplification, or due to data availability, etc. One such assumption has to do with the treatment of “non-revenue users” in this market – those of who don’t pay for either a MCPTV or an OTT subscription (and hence watch ‘illegally’) and those that are off-grid entirely. As with other media industries that have been through disruption (the music industry and the newspaper industry, for instance), users’ not paying for content is an issue, either by downloading torrents or streaming through any number of offshore hosting sites. However, it would be a whole other thesis to explore illegal streaming and downloading, and the market and behavioral dynamics driving it. As such, this model currently examines the dynamics of a \textit{legal}, TV subscription market, and assumes that some fixed proportion of illegal viewers exist and are therefore not considering a subscription to either MCPTV or OTT. Given how difficult data on illegal viewing is to find (if it exists at all), as well as the compounding problems of separating subscribers, subscribers who also consume some TV illegally, and those who only consume through non-revenue means, the model uses a fixed percentage of the population under the assumption that when all consumer behavior is averaged across the whole population, the will be a portion of non-revenue-only viewing.
Figure 5: Basic Causal Loop Diagram with Stock and Flow Structures
However, as a thought-experiment, the following figure highlights some of the variables most likely to be driving illegal viewing behavior (Figure 6).

**Figure 6: Illegal Viewing Behavior Drivers (Hypotheses)**

Some hypotheses about the drivers of illegal viewing are as follows: as the price of either MCPTV or OTT increases, those potential video consuming households whose reservation price has been passed are likely to move into the 'non-revenue' market. In particular for OTT, this reservation price will include the cost of Internet access. As Internet has become nearly indispensible in our modern, western society, consumers are far less likely to give up their Internet subscription then their cable or Netflix subscription, for instance. As the price of internet increases, but the reservation price remains unchanged, then a potential consumer is more likely to reach his price ceiling and be prone to use illegal methods. What has been termed 'ease of use' is also bound to impact the rate of 'non-revenue viewing' – how long it takes to find content through illegal channels, how familiar one is with downloading torrents, etc., and how strong the fear of getting caught for downloading or
streaming illegally, will all impact how 'easy' it is to watch through non-revenue means. If it is very easy, the 'subscription rate' is more likely to go up.

The content available through these illegal channels will also impact how many people are likely to access them. Clearly those who watch illegally are willing to accept some decrease in the video quality of a pirated version of the content (the classic example being the shaky-hand recording in a movie theater, popcorn-munching and all). However, the higher the quality of illegal content, or the lower your reservation 'price' for quality, the more likely you are to watch illegally. Similarly, the amount of content available through non-revenue channels and how long it takes for content to become available on these channels will also impact the likelihood of subscribing – as opposed to paying for an OTT or a MCPTV subscription (or paying more for both), nearly the total catalog of both options could be available online. However, there is always a delay in content becoming available illegally after its original provider has aired it. The shorter the time between airings and how quickly it pops up on Pirate Bay or Sidereel.com, the more attractive non-revenue viewing becomes. While this only scratches the surface of illegal viewing, it is as far as this thesis will go in the exploration of non-revenue user behavior and dynamics. Future work could be focused on incorporating the non-revenue users into the model.

There are a few other assumptions that are important to outline before proceeding to a discussion of the actual model variables. This simulation model falls slightly more towards the 'qualitative' end of the "the spectrum of the methods of problem solving available to shed light on complex issues," while still trying to strike the balance between being "sufficiently quantitative to be applicable and rigorous and sufficiently flexible to be relevant, in terms of both audience and method (Wolstenholme, 1999)." The reason for acknowledging the more qualitative nature

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12 As Wolstenholme elaborates, this spectrum ranges from "the extremes of total intuition and speculation at the qualitative end of the spectrum to the use of rigorous mathematical proofs and algorithms at the quantitative end of the spectrum (Wolstenholme, 1999)."
of the model is to highlight the paucity of data available – either quantifiable consumer preference data in the television distribution space or data on industry actor behavior (as most of this data would be proprietary and not available for public consumption) – and to again stress the model’s primary purpose of testing policy implications under different scenarios. Wolstenholme and others acknowledge that lack of data is a problem with quantitative modeling, and hence that models in general are speculative (Wolstenholme, 1999). To reduce speculation as much as possible, where data was available, it has been used; in cases where data was not available, assumptions have been made, based on similar industries, discussions with experts, etc.

The market size has been estimated using data the US Census Bureau, starting in 2011 – the most recent year for which household figures are available (the last full census was in 2010) and also the year that data was available for the aggregate number of OTT and MCPTV subscribers in the USA. ‘Subscribers’ in the model and in its discussion are considered to be households. Traditionally, this is how cable, satellite, and telco operators have counted their subscribers, since the cable fiber typically run to the house and one subscription would serve all those individuals living there. As units must remain consistent, ‘subscribers as households’ are also how OTT subscribers are considered. We can assume parity with using the same units for OTT, given the prevalence of password sharing. Password sharing is a recognized (and accepted) phenomenon between family members and friends, meaning that it is typical that multiple people use the same account, which works out to essentially the same logic as cable companies counting their subscribers in households. Moreover, analysts report the data that has been used to calibrate the model (such as for initial subscriber levels) in number of households. Hence, for both OTT and MCPTV, the model assumes that unit of analysis is the household. Based on the 2011 Census data, there are roughly 121 million households in the USA.

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For instance, the CEO of HBO is on record publically saying he knows people share passwords and that HBO doesn’t really mind: “It’s not that we’re unmindful of it, it just has no impact on the business...[it is a] terrific marketing vehicle for the next generation of viewers (Lynley, 2013).”
The model breaks down potential subscribing households into four age categories, with each group having a distinct set of preferences, or sensitivities, to the factors that make a MCPTV or an OTT subscription more or less attractive. Household 'ages' are considered to be determined by the age of the 'householder', defined by the Census bureau as "The person, or one of the people, in whose name the home is owned, being bought, or rented. If there is no such person present, any household member 15 years old and over can serve as the householder." It is worth noting, of course, that any preference assigned to a particular age group will represent the central tendency of that age group (as represented by the householder), while in reality there will be a distribution of preferences within age groups (and even within households between members).

The age groups are as follows: households 15 to 24 years of age, households 25 to 34 years of age, households 35 to 64 years of age, and households 65 years of age and older. The logic of dividing the population of total households into these groups is as follows: Millennials are widely acknowledged as those ages 15 to 34; however, there is a significant difference between an 18 year old, perhaps in college (or unemployed as it were, in this post-recession economy), and someone who is 30 years old, most likely in the workforce, earning income, and who came of age at a very different time. Similarly, those ages 35 to 64 are considered to be fully in the workforce, most likely married with kids. Finally, those above 65 years of age are most likely retired, and living on a reduced income. The purpose of this anecdotal illustration of the age groups is simply to highlight that these groups are most likely to value different attributes in their television distribution platform, which is a level of detail the model attempts to capture.

The mechanism for household growth has been modeled as the average growth rate of US households for the last 10 years. As this is a uniform growth rate, based on aggregate data from across the USA, and it does not have age attributes, it has been
applied to all age categories in the model. The model has been initialized using 2011 data, as this was the furthest year back for which total MCPTV and OTT subscriber levels were available\textsuperscript{14}. The model also assumes only households above a requisite income level – set to $25,000 in the baseline scenario – are eligible for a video experience, and will thus consider either of the legal TV distribution options. Table 4 breaks down total households and total household above $25,000 in annual income level in 2011 by the age categories used in the model.

Table 4: Initial Subscribers 2011

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Total Households (000s)</th>
<th>HH Above $25,000 (000s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 to 24 years</td>
<td>6,180</td>
<td>3,578</td>
</tr>
<tr>
<td>25 to 34 years</td>
<td>19,846</td>
<td>15,377</td>
</tr>
<tr>
<td>35 to 64 years</td>
<td>68,215</td>
<td>54,927</td>
</tr>
<tr>
<td>65 years and over</td>
<td>26,843</td>
<td>16,864</td>
</tr>
<tr>
<td>Total</td>
<td>121,084</td>
<td>90,746</td>
</tr>
</tbody>
</table>

Source: US Census Bureau 2011

The model also assumes that, because households can subscribe to both OTT and MCPTV, there is a total number of possible ‘subscriptions’ in the market – which has been determined as the product of the total number of households and the fraction of households that subscribe to both and OTT and MCPTV service. As the number of households and number residential subscribers reported by industry analysts never tallies perfectly with the number of households reported by the Census Bureau, the proportion of subscribers reported by analysts was applied to the total number of households reported by the Census Bureau to determine the Initial MCPTV and Initial OTT subscriber levels (e.g. approximately 80% of households subscribe to MCPTV – 100.2 million MCPTV subscriptions out of the total 124.90 million subscriptions. The proportion, 80%, is applied to the Census Bureau figures for the number of households above $25,000 in income, by age group, to determine the

\textsuperscript{14} As the model is not calibrated to historical data, given it wasn’t available beyond two years, it is worth acknowledging at this point that the formulation of the model will drive its outcome.
number of MCPTV subscribers in 2011). These figures are illustrated in Table 5 and Table 6, below.

Table 5: Proportion of OTT and MCPTV Subscribers

<table>
<thead>
<tr>
<th>% With both types of subscriptions</th>
<th>Households (millions)</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>18.2765%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>% Total Households with Paid OTT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19.78%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>% Total households with MCPTV</td>
<td></td>
<td></td>
</tr>
<tr>
<td>80.22%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Percentage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100.00%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Subscriptions (millions)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>MCPTV</td>
<td>(MCPTV Only + Both)</td>
<td>100.20</td>
</tr>
<tr>
<td>OTT</td>
<td>(OTT Only + Both)</td>
<td>24.70</td>
</tr>
<tr>
<td>Total Subscriptions</td>
<td></td>
<td>124.90</td>
</tr>
</tbody>
</table>

Data Source: IDC Research (Ireland, 2013)

Table 6: Initial Subscribers, in Thousands (2011 and 2012)

<table>
<thead>
<tr>
<th>Age Group</th>
<th>OTT Subscribers Over $25,000</th>
<th>MCPTV Subscribers Over $25,000</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2011</td>
<td>2012</td>
</tr>
<tr>
<td>15 to 24</td>
<td>708</td>
<td>901</td>
</tr>
<tr>
<td>25 to 34</td>
<td>3,041</td>
<td>3,834</td>
</tr>
<tr>
<td>35 to 64</td>
<td>10,862</td>
<td>13,560</td>
</tr>
<tr>
<td>65 and over</td>
<td>3,335</td>
<td>4,370</td>
</tr>
<tr>
<td>Total</td>
<td>17,946</td>
<td>22,664</td>
</tr>
<tr>
<td>% Change</td>
<td>26.29%</td>
<td>-4.41%</td>
</tr>
</tbody>
</table>

Given the general setup of the model, the following list overviews the variables in the model, the assumptions underlying them, and the logic behind the parameters in the baseline setup.
3.1 Variables in the Model:

New Household Growth: Using US Census data from the last 10 years, the average household growth rate has been 1.09% (United States Census Bureau, 2011).

Total potential subscriptions: based on 2011 Census data, the number of households in the USA multiplied by the fraction of households that subscribe to both and OTT and MCPTV service (Ireland, 2013), giving the total possible number of subscriptions that could be purchased.

The Fraction of Non-Revenue Users: the percentage of each age group assumed to be not in the legal subscription video market (either off-grid or watching TV through illegal or pirated means). As reported by eMarketer, November 2013 survey results from Verizon Digital Media Services found 13% of Millennials Internet users (those between 16 and 34 years of age) had no pay TV (cable, satellite or fiber optic) services, whereas only 9% of those ages 35 and over had no pay TV service (eMarketer, 2014). Deloitte reports that the percentage of consumers without are paid television service is 11% for those aged 14-24, 10% for those ages 25 to 30, 10% for those 31 to 47, 9% for those 48-66, and 11% for those ages 67 and older (Deloitte, 2014). Based on the similarities of the figures, those from eMarketer have been used for simplicity.

Potential Video Consuming Households: under the assumption that an annual income of at least $25,000 is required to purchase a video subscription, this variable is the function of the proportion of US households with more than $25,000 in income and the total potential subscriptions in the market.

Initial Subscriber Levels: determined using data from IDC Research Services and the US Census Bureau. The proportion of total subscriptions in the market that were either OTT or MCPTV was applied to the number of households in the USA (above
$25,000 in annual income) to determine the number of initial subscribers. These results were summarized in Table 6.

**Total Market:** The sum of MCPTV subscribers, OTT subscribers, and potential video consuming households – those considered for a legal, video service subscription.

`Churn rate` or the attrition rate, for both cable and OTT (the “cord-cutting rate” for cable, and the “abandonment rate” for OTT), is the share of subscribers who cancel their subscription in a given month (the time period of the model) and is a function of the total number of subscribers and the average duration of the subscription. When a given subscriber leaves the subscription pool, they return back to the population of potential video consuming households where they choose again whether to subscribe to MCPTV or to cable. The average duration of the subscription is exogenous in the model, and assumed to be constant. In reality, churn rate depends on the promotions on offer (or more accurately, the expiration of the proportional pricing); any switching-costs involved (such as contract termination fees); how satisfied customers are with their experience and customer service interactions; and would also depend on the attractiveness of the alternatives on offer.

Forrester Research, with data from 2007, reports the average churn rate for telcos and cablecos is between 16% and 18% (Cohen, Garon, de Lussanet, & Wilkos, 2009), across all their offerings. This works out to an average duration of subscription of approximately 70 months. However, Forrester also reports that while 50% of customers have had their triple play bundles for over two years, only 13% have had them for more than 4 years. This would suggest that most US households keep their subscriptions between 2 and 4 years, or 24 to 48 months. Moreover, given these results are based on data that is 8 years old, and in the time since OTT options have become more attractive and readily available, that actual churn rates now are most likely higher. As such, the base line model uses three years, or 36 months, as the average churn rate for MCPTV subscribers. Estimates for OTT churn rates are more
difficult to come by. A 2013 Wall Street Journal article, citing financial research firm Sanford C. Bernstein, puts Netflix annual churn between 40% and 50% a year (Gottfried, 2013). This would mean Netflix has an average subscription duration of 24 to 30 months. As Netflix represents the largest share of the OTT market, this figure is assumed to apply to OTT as a whole for attrition rates.

The subscription revenues for both Multichannel Pay TV and for OTT are simply a product of the number of subscribers and the average monthly subscription price (see below).

Advertising Revenues: the reported estimates for advertising revenue for multichannel pay TV vary depending on the source and the year the data was available. Advertising revenue is the product of the number of subscribers and the average advertising revenue per subscriber, for both cable and OTT. Using the most recent and reliable data, average advertising revenue per subscriber was calculated as follows: The 2013 Internet Ad Revenue Report from the Interactive Advertising Bureau and PwC reports cable television advertising revenue at $34.4 billion dollars (PwC, 2013). Dividing by the number of cable subscribers reported in 2013, this gives an average advertising revenue figure of $606.7. As cable is the largest segment of MCPTV providers, this figure has been applied to all MCPTV (and rounded to $600 a year for simplicity).

The average advertising revenue per household for OTT was determined using the total amount of online advertising revenue in 2013 that came from digital video (digital video represented 7% of online advertising revenue in the USA in 2013) – which was reported by PwC at $2.8 billion (PwC, 2013, p. 13). Taking the number of paid OTT subscription households in 2013, 39.4 million (Ireland, 2013), this gives the average advertising revenue per household of approximately $71 per year.

Total Revenue: Is the sum of the advertising revenues and the subscription revenues, on a yearly basis, for either OTT or MCPTV.
**Cost per subscriber:** In the case of companies like Comcast, or Time Warner, which are vertically integrated along the value chain, data has been sourced from their annual reports in the most recent year available; however, only the data for their relevant businesses has been used. For instance, Time Warner Cable reports three businesses segments: Networks, consisting principally of cable television networks, premium pay and basic tier television services and digital media properties; Film and TV Entertainment, consisting principally of feature film, television, home video and videogame production and distribution; and Publishing, consisting principally of magazine publishing and related websites as well as book publishing and marketing businesses (Time Warner, 2012). In this case, only data from the “Networks” segment has been used. In 2012, their total costs (revenues - operating income) were $9,485,000,000. In 2013 (the year for which data was available) there were 11,200,000 video subscribers, working out to an average cost per subscriber of $846.88 annually. Comcast’s Annual Report (Comcast, 2014a) gives the total operating costs for their ‘Cable Communications’ segment as $24,631,000,000 in 2013, with 53,075,000 customers, which gives an average annual cost per subscriber of $464.08. This is clearly only a rough proxy, as these numbers are for the entire cable communication business that includes Internet and voice, but the costs of revenues are not broken down per type of service. DIRECTV provides an average subscriber acquisition cost in their annual report, which was $873 in 2013, for their DIRECTV U.S. business segment. Comparatively, their total operating costs and expenses were $20,232,000,000 in 2013, with 20,253,000 subscribers, giving an average cost per subscriber of $998.96 (DIRECTV, 2014). DISH Network reports their 2013 total costs as $11,568,066,000 and their total subscribers in that year as 14,057,000, giving an average cost per subscriber of $822.94 (DISH Network, 2014). As these four companies represent the significant majority of the MCPTV market (roughly 70% of total subscribers, as per Table 1), we will use an average of their figures as representative of MCPTV. Therefore, the average cost per subscriber (rounded for simplicity) used in the model will be $800.
Looking at the OTT costs per subscriber, Netflix’s 2013 Annual Report breaks out their domestic streaming segment, for which the 2013 cost of revenues was $1,849,154,000 and their 2013 marketing costs were $279,454,000. There were 31,712,000 paid members, giving an average cost per domestic streaming subscriber of $67.12 (Netflix, 2014a). Amazon doesn’t break out the figures for its Instant Video business and data for Hulu, a joint venture between The Walt Disney Company, Fox Entertainment Group, and NBCUniversal, was not available; ideally, the cost per subscriber would reflect the all OTT firms, because Netflix is the largest OTT provider by a significant margin, we can be fairly confident that this number is a good proxy.

**Total Cost:** is a product of the number of subscribers and the average cost per subscriber.

**Total Profit:** total revenues less total costs, for MCPTV and OTT, respectively.

**Investment in New Content:** the product of Total Profits and the fraction of revenues invested in content. Using this formulation allows the model to capture a situation where, if in reality profits are zero or lower, there would be limited or no investment in new content, and therefore no addition to catalog or to the relative attractiveness of the product (MCPTV or OTT). The fraction invested in content initialized in the baseline run was determined using data from company annual reports: In 2012, Time Warner Cable spent $5,129,000,000 on programing costs for its Networks segment (Originals and sports, and Acquired films and syndicated series). Their total revenues for the Networks for the same period were $14,204,000,000 (Time Warner, 2012). Therefore, as a percentage of total revenues, this works out to roughly 36%. Comcast reports programming costs for the Cable Communications segment in 2013 as $9,107,000,000, with revenues (exclusive of high-speed Internet and voice) of $27,845,000,000 (Comcast, 2014a), working out to roughly 33%. DISH Network reports in their annual statements that “Subscriber-related expenses” – which they indicate is primarily programming costs –
represented 56.6% of “Subscriber-related revenue” during the years ended December 31, 2013 (DISH Network, 2014).” DIRECTV reports that “broadcast programing and other” was $10,743,000,000 in 2013, while revenues were $23,235,000,000 in the same year. Therefore, in 2013, programming related expenses were roughly 46% of revenues (DIRECTV, 2014). Therefore, taking a rough average, as these are again the largest proportion of the MCPTV market, we will assume approximately 40% is fraction invested in content in the model. We do note, however, that the figures calculated above as rough proxies, as we do not know if these expenditures are for acquiring or producing new content, or for simply continuing to pay for the rights of existing content.

Netflix reports its 2013 streaming content library at $3,049,758,000, with revenues at $4,374,562,000 (Netflix, 2014a). This works out to be roughly 70% of revenues (note this is the total company revenue, as the additions to content is not broken down by either business or geographic region). Again, as neither the Amazon Instant Video or Hulu information is available, but because Netflix represents such a large proportion of the OTT market, their figures will serve as a proxy for OTT in the model.

**Average Cost Per Show:** In general, data on the costs of producing TV shows is rather hard to come by, and varies based on the type of show (premium cable drama vs. reality TV, etc.). Where data was available, averages were used and applied more broadly to the distribution category as a whole. On average, broadcast network shows cost $3 million an episode, cable network shows cost $2 million an episode, so averaging crudely gives $2.5 million per episode. There are approximately 12 episodes a season in cable network shows and 24 episodes a season in broadcast network shows, for an average of 18 episodes per season. Therefore, at $2.5m an episode for 18 episodes gives a rough estimate of $45 million per season for the cost of a show (Carter, 2010). For OTT, Netflix reports that costs per episode range from $3.8 million to $4.5 million (for House of Cards). The standard run per season on
Netflix is 13 episodes. This gives a rough estimate of $52 million per season (Wallenstein, 2013).

**Base Levels of Content:** Netflix does not disclose how many TV shows or movies they have. Data from the website instantwatcher.com, which catalogs and makes searchable Netflix's inventory, reports 3,698 titles of TV shows, which we will take this as the approximate estimation for Netflix. For Hulu Plus, they have 112 TV show titles available. However, some of these offerings include multiple seasons of the same show, or only a few episodes of one seasons. So, for simplicity, we will assume 112 TV offerings. However, a recent article by Forbes places Hulu's content much higher: “Devitt says, noting that parent companies ABC, NBC and Fox have made huge amounts of their content available on Hulu, which currently boasts a TV catalog of 86,000 episodes from 2,900 TV series” (McGrath, 2014). Amazon Instant Video reports 1,870 TV titles available. They also count individual seasons, which again, is fine. As a rough total of the three, we thus get 8,468 offerings. As these are the major OTT players, this will be the base assumption, and we will scale this up by 10% to represent the rest of the OTT market catalog, giving us 9,315. However, given that many of these platforms offer the same things (e.g. Season 2 of AMC’s The Killing is available on both Netflix and Amazon Instant Video), we will reduce the sum total by 25%, to try to reflect OTT offerings as whole, not just individual company offerings. Therefore, 75% of the total offerings is 6986 shows. Rounding for simplicity, we will use a based OTT catalog figure of 7000 shows.

The availability of traditional cable and broadcast network shows at any given point in time varies: sometimes entire past seasons of a show are available to access (e.g. being able to access all the past seasons of HBO’s *The Sopranos* via HBOGo), sometimes episodes are only available at the time of watching or for a short period of time thereafter (e.g. sports offerings from ESPN or only being able to watch the 5 most recently aired episodes of ABC’s *Scandal* through Comcast’s Xfinity online). Therefore, it is difficult to quantify the 'number' of shows available on traditional television – the nightly news, a daily talk show, or live sports games, while valuable,
are only of value during the time they are aired. No one wants to watch the sports
game tomorrow, or last week's news. Therefore, we will assume that, due to all
these aspects, the base for cable content is larger than for OTT (due to its relative
newness), but that it is on the same order of magnitude (approximately 10,000
shows).

**Total OTT or MCPTV Catalog:** the sum of the base catalog and the number of new
TV shows produced. The number of new shows added is the amount of investment
in new content, divided by the average cost per show (or season).

**Total (Industry) Catalog:** is the sum of the total MCPTC and OTT catalogs (content
inventories).

**Relative Catalog:** the OTT or MCPTV catalog divided by the total catalog.

**Attractiveness:** the attractiveness (of MCPTV or OTT) is a composite variable,
constructed as the weighted sum of the exponents of the effect of price, quality,
relative catalog size, word of mouth, and advertising on attractiveness. Each of the
components has been normalized. Total attractiveness is the sum of the
attractiveness of MCPTV and of OTT. Relative Attractiveness is the exponent of
either OTT or MCPTV, divided by total attractiveness. This is akin to the market
share formulation in the traditional new product diffusion model.

In this way, attractiveness (A) has been determined with the traditional logit choice
model (J. D. Sterman, Henderson, Beinhocker, & Newman, 2007; Vaishnav & Fine,
2014), with the share of attractiveness depending on the five inputs to the
composite variable. The $\beta$'s, or the weights, of each variable represent consumer
preferences or sensitivities, and are modeled uniquely for each age group. With the
exception of price, all of the other variables have a positive impact on attractiveness
(e.g. as the quality increases, the attractiveness increases). As all of the factors
influencing attractiveness have been normalized, by dividing by the reference
values, their sensitivities ($\beta$s) are dimensionless and comparable (J. D. Sterman et al., 2007):

$$A_i = \exp\left(\beta_p \frac{P_i}{P_r}\right) \exp\left(\beta_q \frac{Q_i}{Q_r}\right) \exp\left(\beta_c \frac{C_i}{C_r}\right) \exp\left(\beta_{ads} \frac{Adsi}{Ads_r}\right) \exp\left(\beta_{wom} \frac{WOM_i}{WOM_r}\right)$$

$$A_i = \exp\left[\left(\beta_p \frac{P_i}{P_r}\right) + \left(\beta_q \frac{Q_i}{Q_r}\right) + \left(\beta_c \frac{C_i}{C_r}\right) + \left(\beta_{ads} \frac{Adsi}{Ads_r}\right) + \left(\beta_{wom} \frac{WOM_i}{WOM_r}\right)\right]$$

Relative Attractiveness = \frac{A_i}{\sum_i A_j} = \frac{A_i}{(A_{OTT} + A_{MCPTV})}

**Total Price of MCPTV or OTT:** is a sum of the subscription price and the access price. The subscription price is the price paid by the customer for Netflix or Amazon Instant Video or Comcast Xfinity, etc. The access price is what is paid by the customer to access their TV subscription. In the case of OTT, this would be the price of Internet access. Graph 5 illustrates the trend of increasing price of cable (at the largest share of the MCPTV market) increasing over time. Given the newness of OTT service, prices have remained relatively constant, though Netflix has in recent years introduced different subscription tiers (e.g. $11.99 for 4 simultaneous streams), and announced on May 9, 2014 that they would be increasing their base subscription price from $7.99 to $8.99 (which a two-year grandfathering-in period for existing subscribers).

The subscription price for OTT is set to 7.99 in the baseline model. This is the price for a basic Netflix subscription and for a Hulu Plus subscription. Given that they represent the majority of the OTT market, $7.99 is used at the average OTT subscription price. For MCPTV, the estimates for the average monthly spend per household vary. Market research company The NPD Group reported the 2011 average pay TV subscription as $86 (NPDGroup, 2012), and were recently (February 2014) cited in the New York Times with an average household cable subscription of
$90 per month (Manjoo, 2014). Other industry analysts report similar figures. As it is the most recent, the $90/month figure is used in the baseline model.

Graph 5: Cost of Cable Over Time

![Cost of Cable Over Time](image)

Source: (Schuker, 2011)

The access price for OTT is the price of Internet. The Internet price used in the model is an average of the prices charged by the main wireless providers (after promotional offers expire and standard rates take effect), and is $55 in the initial model setup (based on the average price offered by Comcast and TWC, etc., after promotional offerings end and standard rates apply. As cable is delivered primarily through coaxial cables, DBS through satellites, etc., and Internet is not (strictly) required to watch TV, the price of access for MCPTV can be set to zero.

Effect of Price on Attractiveness: is the total MCPTV or OTT price divided by the reference price, as per the logit model. An increase in price reduces the attractiveness of the product, as the sensitivity of consumers is negative. The reference price ensures that when the value of price falls below the reference price, price affects attractiveness more strongly (Vaishnav & Fine, 2014).
**Effect of Catalog (Content Inventory):** The relative catalog of either OTT or MCPTV, divided by reference relative catalog. This variable is, of course, not intended to capture the addition of any one particular show that might be particularly attractive to any one individual viewer (i.e. a consumer who really wants to watch *House of Cards* or *Game of Thrones* will find Netflix or HBO particularly attractive if the subscription service adds the show of interest to their respective lineups). This variable is meant to capture the relative size of the catalog, not its specific contents. It is also not intended to address the (entirely subjective) value of the shows themselves – i.e. is a catalog full of *The Sopranos*, *The Wire*, *House of Cards*, etc. (the so-called ‘premium content) more ‘valuable’ or attractive than one full of the *Real Housewives of Wherever?* That depends on every individual’s definition of ‘good TV’ and is a kettle of fish that this model (or this thesis) is not even going to attempt to address.

**Effect of quality on attractiveness:** is the quality of MCPTV or OTT, divided by a reference quality (to normalize, as per the logit model). Quality of MCPTV or OTT is a weighted sum of the quality of access and the quality of services.

**The Quality of Access:** is determined by the speed required to stream video and the average Internet speed in the USA (because “access” for MCPTV comes through the fibers or the dish, and is not dependent on internet speeds, or affected by network congestion, etc., the weight assigned to quality of access for MCPTV is set to zero). Netflix recommends 5 Megabits per second for HD quality video streaming, and 25 Mbps to stream 4K quality; Hulu Plus recommends "a downstream bandwidth of at least 3 Mbps for a smooth playback experience"; and Amazon Instant Video recommends "3.5Mbits/sec or higher." Given, as these firms represent the majority of the OTT market, the median recommended download speed range (3 to 25 Mbps) is 11Mbps. However, this would be under ‘ideal circumstances’; if accounting for congestion (which can happen anywhere along the streaming path), OTT servers potentially getting overloaded at peak times, and transmitting errors, etc., the internet speed required for streaming has been scaled up by a factor of 2.5
Networks are typically considered congested at 80% capacity, and peak times, server overload, transmitting errors, etc., easily add double the delay \((2 \times (1/0.8))\), to 27.5 Mbps. The average Internet speed in the USA, which was 23.9 Mbps as of April 2014 (Net Index from Ookla, 2014), is then divided by the required download speed to determine the ‘quality of access.’

**Quality of Service**: a weighted sum of the picture clarity and the mobility of watching either service (a function of the number of devices upon which subscriber can access his or her subscription). The picture clarity is set as a constant between zero and 1. For MCPTV companies, this value should close to 1, as MCPTV traditionally has been the best picture clarity with which (most) consumers are familiar (and thus able to make comparisons with). Given that for Comcast and TWC, as well as other MCPTV providers, not all of their channels are available in HD, the value assigned is less than 1, at 0.9 in the baseline model. Not all of the titles available on OTT are available in HD either. However, Netflix’s platform can handle HD video and 5.1 audio streaming, has introduced 4K streaming in some titles, and has been very well reviewed by consumer reporting websites (Archer, 2014). Amazon Instant Video also streams in full HD upon video launch. Both Amazon Instant Video and Netflix stream in a minimum of 480p, or lines of pixel, with the majority of the recent TV shows streaming in typical HD 1080p (Honorof, 2014). Aggregating the reviews of the products online, as well as the stated capabilities of the big three OTT subscription online streaming services, picture clarity for OTT is set to 0.8, given that most of the content is available in HD or and 4K services are beginning to be rolled out.

Given that over a third of the population now owns the trio of smartphone, tablet and laptop (Deloitte, 2014), the number of devices variable is intended to reflect the value consumers place on being able to access content on multiple devices. The number of devices is a linear function \((y = mx + b)\), where \(b\) is equal to zero (In the extreme case, if you can’t watch on any devices, this adds nothing to quality), \(x\) is the average number of devices for OTT or MCPTV upon which the subscription can be
accessed, and the slope $m$ is the maximum number of devices for either OTT or MCPTV upon which the subscription can be accessed. Where data was available, the average number of devices for MCPTV was set to 3 (Comcast, 2014b). In the case of OTT, per the Netflix Terms of Use ("You may watch on up to six unique authorized Netflix ready devices and the number of devices on which you may simultaneously watch is limited"), customers may watch on up to 6 devices (Netflix, 2014b). Amazon Instant Video allows for streaming of two titles at the same time, but you can stream the same title to no more than 1 device at a time. For Hulu Plus, customers can activate their subscriptions on as many devices as they would like, but can only stream simultaneously to one at a time (Hulu, 2014). Therefore, the average number of devices for OTT was set to 6 (as Netflix is the largest, by a significant margin, or the of OTT providers).

**Effect of Word of Mouth (WOM):** The effect of WOM on attractiveness is based on the standard formulation in the Bass Diffusion Model (J. Sterman, 2000), to capture one of the mechanisms through which potential video consuming households become (more) aware of MCPTV or OTT options. In the model, positive WOM adds to the attractiveness of either service, and hence increases the likelihood a potential video consuming household will subscribe (e.g. if your neighbors are talking about how convenient Netflix is, or how great the latest season of *House of Cards* is, this adds to Netflix's attractiveness in the eyes of someone looking to purchase a video service). As in the Bass Model, the effect of WOM is a function of the adoption fraction and the contact of existing customers with potential customers. Based 2013 data, Deloitte reports that the buying decisions in the media, technology, and telecom space of 86% of USA households are influenced from a medium to high degree by recommendations from friends and family, and 68% were influenced by "online review or recommendation from someone within your social media circle" (Deloitte, 2014). Taking the range gives an average of 77% of US households influenced to a medium to high degree by 'word of mouth' (or at least what will serve as a proxy).
Effect of Advertising: The effect of advertising on attractiveness of MCPTV or OTT is also based on the standard Bass Model (J. Sterman, 2000), and is a function of the ‘effectiveness’ of advertising and the potential video consuming households. Advertising effectiveness is a constant in the model, meant to encapsulate how successful either the advertising of OTT or MCPTV companies is at reaching potential customers and increasing the attractiveness of either option. Data for the effectiveness of advertising by industry is difficult to come by. Using general USA data from 2012, across three screens (mobile, online, and TV) general recall averages around 50%; the impact on purchase intent is only around 10%. As the effect of advertising constant is meant to capture the effect of advertising by OTT or MCPTV companies on increasing attractiveness, it entails elements of brand recall, message recall, favorability, and purchase intent (Business Insider, 2013). Based 2013 data, Deloitte reports that the buying decisions in the media, technology, and telecom space of 23 to 71% of USA households are influenced from a medium to high degree by advertising across TV, newspapers, magazines, mobile, text and tweet (Deloitte, 2014). Therefore, using these values as the range – both OTT and MCPTV are soundly in the ‘media, technology, and telecom’ space as defined by Deloitte, and these figures will be marginally more accurate estimates than general US advertising data – gives a mean of 47%, which is the advertising effectiveness used in the model.

MCPTV or OTT Subscribers: is a function of the subscription rate and the attrition rate. The subscription rate is the product of relative attractiveness of either OTT or MCPTV and the potential video-consuming households. As this is a rate, when the number of potential video consuming households decreases (and they become either MCPTV or OTT subscribers), the subscription rate itself decreases.

As Graph 1 illustrated in Chapter 1, Netflix, the largest OTT provider, subscriptions have been increasing every year since it’s founding. The trend is the same with other OTT services, as Graph 6 of Hulu Plus Subscriptions also highlights. We expect to
see a similar increase, at least initially, in the model. As Graph 3 and Table 1, in Chapter 2, illustrated, MCPTV Subscriptions have been either remaining fairly constant (satellite and telco) or decreasing over time (cable). Given that cable represents the largest share of MCPTV, we expect to see a continuation of this decrease, at least initially, in the model.

**Graph 6: Hulu Plus Quarterly Subscriber Growth, 2010-2012**

![Hulu Plus Quarterly Subscriber Growth, 2010-2012](image)

**Source:** (Kilar, 2012)

**Total MCPTV Subscribers:** the sum of all MCPTV subscribers for all age categories.

**Total OTT Subscribers:** the sum of all OTT subscribers for all age categories.

**Total Non-Revenue Users (NRU):** the sum of all NRUs for all age categories.

**Total MCPTV Market Share:** the Total MCPTV Subscribers as a percentage of the total number of ‘subscriptions’ (or the sum of Total MCPTV Subscribers, Total OTT Subscribers, and Total NRU).
**Total OTT Market Share**: the Total OTT Subscribers as a percentage of the total number of ‘subscriptions’ (or the sum of Total MCPTV Subscribers, Total OTT Subscribers, and Total NRUs).

**Total RNU Market Share**: the Total NRUs as a percentage of the total number of ‘subscriptions’ (or the sum of Total MCPTV Subscribers, Total OTT Subscribers, and Total NRUs).

**Total MCPTV Revenue**: the sum of total MCPTV revenues for all age categories.

**Total OTT Revenue**: the sum of total OTT revenues for all age categories.

**Total Industry Revenue**: the sum of Total MCPTV Revenue and Total OTT Revenue.

**Total MCPTV Profits**: the sum of total MCPTV profits for all age categories.

**Total OTT Profits**: the sum of total OTT profits for all age categories.

**Total Industry Profit**: the sum of Total MCPTV Profit and Total OTT Profit.

The Figure 7 below illustrates the completed simulation model structure for one age group (with identical structures for all four groups), expanding on the causal loop diagram with stock and flow (Figure 5) structures to include the variables described above.
Figure 7: Completed Simulation Model Structure for One Age Category
In this chapter we will examine the results of model analysis and their policy implications. Graph 7 shows the distribution of subscribers between OTT and MCPTV over the 20-year time-horizon of the model, in the most basic baseline scenario - all 5 attributes of OTT or MCPTV attractiveness are weighted equally, for all age groups. Clearly, as non-revenue users are a fixed proportion of the population in the model, it remains constant over time. OTT subscribers increase over time before plateauing at steady state; conversely, the MCPTV subscribers increase for a few time periods before decreasing to steady state.

While this would seem to correspond roughly with subscription trends in recent years (OTT subscriptions increasing, telco subscriptions increasing but cable...
subscriptions decreasing), we knows that consumers place different emphasis on different attributes when making their subscription decision. As such, varying the weights, or sensitivities, to price, quality, catalog, word of mouth, and advertising will help make the model more reflective of behavior in real life. Baseline 1 will simply be useful from an illustrative point of view – emphasizing the changes with the addition of preferences.

Unfortunately, there is no encyclopedia (or Wikipedia page, as it were) with the weights consumers attribute to different aspects of an OTT or MCPTV service. As such, we have to hunt for data and insights from many different sources, possibly making assumptions and using proxies along the way. Consequently, the preferences used in the model should be considered only the best estimates we have with the data available. As these are estimates, we cannot say for certain whether the outcomes generated by the model are entirely accurate; therefore, in order to make the best use of the model we can perform sensitivity analysis – looking at how the results differ if consumers place more or less emphasis than the assumed preference value on a particular attribute, and what that would mean for the distribution of subscribers in the market (and thus how firms should tailor their actions in order to leverage those insights).

To begin, we establish some insights into the preferences of consumers with respect to price, quality, catalog, word of mouth, and advertising. Intuitively, and based on the trends of late (cord-cutting, etc.), it would seem that price is the most important factor in the attractiveness of either product. Reporting from Quirk's Marketing Research Review confirms these assumptions: "Millennials and Boomers have a similar set of concerns that drive purchases. Both groups tend to focus primarily on quality, price and value, depending on the category. Millennials as a group are relatively more price-conscious than Boomers" (Brooks, 2014).
Other industry reports and surveys would also support this: eMarketer reports, “47% of 18- to 24-year-olds and 40% of 25- to 34-year-olds said they spend less on cable due to the availability of digital video” (Dolliver et al., 2014). This would indicate a higher preference for the attributes that services like Netflix differentiates itself upon (lower price, ease of use, depth of catalog), with specific emphasis on spending less (i.e. price). A 2013 study by Belkin & Harris, asking consumers how strongly they agreed with the following statement: “I would consider replacing my cable/satellite subscription with a streaming media subscription (e.g., Netflix, Hulu Plus) in 2013” (Verna, Chadwick, & Mckay, 2013), found the following (Table 7):

Table 7: Consumers Who Would Consider Replacing MCPTV with OTT

<table>
<thead>
<tr>
<th>% of respondents</th>
<th>Strongly agree</th>
<th>Somewhat agree</th>
<th>Somewhat disagree</th>
<th>Strongly disagree</th>
<th>Not applicable</th>
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<td>21%</td>
<td>22%</td>
<td>36%</td>
<td>10%</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-34</td>
<td>17%</td>
<td>23%</td>
<td>20%</td>
<td>27%</td>
<td>14%</td>
</tr>
<tr>
<td>35-44</td>
<td>15%</td>
<td>17%</td>
<td>25%</td>
<td>30%</td>
<td>12%</td>
</tr>
<tr>
<td>45-54</td>
<td>12%</td>
<td>19%</td>
<td>21%</td>
<td>39%</td>
<td>9%</td>
</tr>
<tr>
<td>55+</td>
<td>7%</td>
<td>13%</td>
<td>21%</td>
<td>49%</td>
<td>10%</td>
</tr>
<tr>
<td>Total</td>
<td>12%</td>
<td>18%</td>
<td>21%</td>
<td>37%</td>
<td>11%</td>
</tr>
</tbody>
</table>

Looking at just the ‘strongly agree’ and ‘somewhat agree’ categories, we can see that Millennials value the offerings of the streaming services the most. While this is an imperfect measure, intuitively it makes sense that younger generations (in college, recently in the work force, possibly unemployed), who have suffered significantly due to the recession, and are most likely to be comfortable with technology, would be the most sensitive to price and ease of use – the attributes of product attractiveness typified by OTT.
Attempting to narrow this down a bit more, a February 2013 Cowen and Company survey found that 67.5% of respondents would NOT continue their Netflix subscription if there was a price increase (Verna et al., 2013). Whether this is in fact true (consumers often over-report frugality), it would indicate that consumers are exceptionally price sensitive, and hence put a very high weight on price. PwC also reports that a significant portion of consumer would tolerate more adds in order to save money on subscription fees (PwC Consumer Intelligence Series, 2013). This again reinforces the assumption that consumers are very price sensitive. That survey found that those ages 18-24 report being willing to watch the most adds, but concludes specifically: “For the older crowd (35-49) especially, watching ads is mostly not worth what they’d save in fees” (PwC Consumer Intelligence Series, 2013). Therefore we can conclude that between age groups, if younger consumers are willing to watch more advertising in lieu of paying fees or are more inclined to cut the cord, younger age groups are more sensitive to price than older ones.

Consumers of all ages also seem to value new original programming (Dolliver et al., 2014; PwC Consumer Intelligence Series, 2013), in particular since both OTT and MCPTV have deep back catalogs. While investment by both MCPTV and OTT includes acquisition of the rights to existing programming, the biggest push and the most notable differentiator is in original content production (which is captured by the “investment in content” variable, which affect the size of the catalog). Therefore, we can infer that consumer place a high weight on the catalog. A 2012 TVGuide.com study about why viewers were watching more streaming content found “the biggest draw was the ability to catch up on missed episodes, which 73% of respondents cited. A majority also noted being able to catch up on shows discovered mid-season or between seasons” (Verna et al., 2013). This would also confirm the consumers place a high value on the ability to time shift and the content available. Responding to the following question: “How important is original programming in influencing your interest in subscribing to a particular service,” 66% of those 18-24 report original programming (a proxy for investment in content) important; 72% of those 25 to 34 consider it important; 62% of those 35 to 49 years of age report it as
important; but only 48% of those 50-59 report it as important. Therefore, the first three age categories seem to value content roughly the same amount, while those who are older seem to put slightly less emphasis on it.

Quality is the most difficult attribute for which to find data on the level of importance consumers ascribe to it, relative to other attractiveness attributes. A 2003 paper in the SA Journal of Industrial Psychology found that consumers ranked price and quality of nearly identical importance – however, the ranking of attributes is highly dependent on the type of product in question (Brijball, 2003). Other analyst reports find that, “Product features emerged as the second most prominent reason for customer churn, behind price, as the reason users switch service providers” (Market Wired, 2013). Given that product features can be a proxy for what is captured by the ‘quality’ attribute in attractiveness, we will assume that quality ranks as high, or almost as high as catalog (though still behind price), in terms of the relative weights in the attractiveness decision. Given that quality in the model is comprised of picture quality, the number of devices upon which content can be accessed, and the quality of access, which are all rather age-agnostic features, we will assume that all four age groups place the same weight on quality.

The PWC Consumer Intelligence Series reports that consumers, when asked in the absence of a traditional TV subscription how they would learn about new content options, only 6% of consumers reported they would ask a friend/rely on traditional WOM (PwC Consumer Intelligence Series, 2013). Using how consumers go about content discovery as a rough proxy for the effect of WOM in general when choosing how to access content, we can assume that WOM is not something potential subscribers put much weight on. Intuitively, this makes sense – it is so easy these days to go online and research all the options for TV access, read articles about the pros and cons of each, and browse the infinite number of customer reviews. General data from McKinsey also seems to confirm the relatively low importance of word of mouth. Figure 8, below, highlights their key findings:
Figure 8: Top 3 Factors That Influence Whether A Product is Considered at Each Stage of the Consumer Journey

Word of mouth

While these particular results are for a mobile-phone example, the report found that the trends held overall. Given the paucity of data and that mobile phones are in the general telecommunication and media space, we can assume that similar lack of importance of word of mouth at the moment of purchase for TV (as well as in the other stages), as compared to the other attributes in attractiveness, which reconciles with the PWC Consumer Intelligence Series findings. Finally, we will assume that while consumers are not that sensitive to word of mouth overall, Millennials are likely to place marginally more value on it than older age groups. Millennials, across a range of product categories, are more influenced by word of mouth than older generations (Brooks, 2014). Therefore, the model will be calibrated with the Millennial age categories having a slightly higher weight on word of mouth than the other two age groups.
Finally, how much weight do consumers place on advertising? As was previously mentioned, the impact on purchase intent from advertising is only around 10% (general USA data). While advertising might raise awareness, and a really catchy advertisement could make a product seem particularly in touch with consumers, given the low conversion rate from ad to purchase intent, we can assume that consumers do not place a high weight on advertising and that advertising does not contribute that much to attractiveness. However, most reports note that while Millennials are more influenced by word of mouth, 'Boomers,' or the older age categories, are more influenced by traditional advertising. Therefore, the model will be calibrated with the older age categories (35 to 64 and 65+) having a slightly higher weight on advertising than the Millennial-age groups.

In summary, to determine the effect of preferences on the distribution of subscribers, we will assume that all age groups place the greatest emphasis on price (with the younger age groups placing a greater weight than the older ones), followed by catalog (with Millennials, again, placing slightly greater weight on quality than the older generations), then quality, followed by word of mouth and advertising – Millennials place more weight on word of mouth and the older generations place more emphasis on advertising. The weights – which are relative, comparing the value placed on one attribute to another – will be the same for each age group for both OTT and MCPTV. They are summarized in Table 8:

### Table 8: Preference Parameters

<table>
<thead>
<tr>
<th>Variable</th>
<th>Age Group</th>
<th>Baseline</th>
<th>High (x1.5)</th>
<th>Low (x.5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight of Effect of Price on Attractiveness</td>
<td>15 to 24</td>
<td>-13</td>
<td>-19.5</td>
<td>-6.5</td>
</tr>
<tr>
<td></td>
<td>25 to 34</td>
<td>-12</td>
<td>-18</td>
<td>-6</td>
</tr>
<tr>
<td></td>
<td>35 to 64</td>
<td>-10</td>
<td>-15</td>
<td>-5</td>
</tr>
<tr>
<td></td>
<td>65 and over</td>
<td>-10</td>
<td>-15</td>
<td>-5</td>
</tr>
<tr>
<td>Weight of Relative Size of Content Inventory</td>
<td>15 to 24</td>
<td>8</td>
<td>12</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>25 to 34</td>
<td>8</td>
<td>12</td>
<td>4</td>
</tr>
<tr>
<td>Age Group</td>
<td>Attribute Weights</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>-------------------</td>
<td>-------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>35 to 64</td>
<td>7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>65 and over</td>
<td>7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight of Effect of Quality on Attractiveness</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15 to 24</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>25 to 34</td>
<td>5</td>
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<tr>
<td>35 to 64</td>
<td>5</td>
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<td></td>
<td></td>
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<tr>
<td>65 and over</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight of Effect of WOM on Attractiveness of Cable</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15 to 24</td>
<td>2</td>
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<td></td>
<td></td>
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<tr>
<td>25 to 34</td>
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<tr>
<td>35 to 64</td>
<td>1</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>65 and over</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight of Effect of Cable Adoption from Advertising</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15 to 24</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25 to 34</td>
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<td></td>
</tr>
<tr>
<td>35 to 64</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>65 and over</td>
<td>2</td>
<td></td>
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</tbody>
</table>

The results for the distribution of subscribers in the baseline run with preferences ("Attribute Weights 1"), by age group, are illustrated in the following graphs:

Graph 8: Subscriber Distribution - Ages 15 to 24

The graphs show the subscriber distribution over time for different age groups with varying attribute weights. The x-axis represents time in months, and the y-axis represents the number of subscribers. Different lines indicate different age groups and attribute weight configurations.
As the above graphs show, how consumers value the attributes of attractiveness has a significant impact on the distribution of OTT and MCPTV subscribers. For all four age groups, the decline of MCPTV is more pronounced, as is the increase in OTT subscribers. Looking at the aggregate distribution of subscribers, in Graph 12 below, we can see the impact on the industry on the whole. Including consumer weights for price, quality, catalog, word of mouth, and advertising has a significant impact on the steady state reached by the model (and thus its implications). MCPTV reaches equilibrium at roughly 34% of the market, while OTT reaches equilibrium at roughly 62% of the market, after approximately 10 years.
Using this initial simulation run with preferences, we can now perform sensitivity analysis on each of the weights, to determine what the effect on subscriber distribution, if in fact consumers do place more or less weight on an attribute. The range for sensitivities will range from 0.5 times the baseline value on the low end (consumers place less weight on that attribute) to 1.5 times the baseline value on the high end (consumers place more weight on that attribute). See Table 8 for a full summary of the values.

### 4.1 Attribute Sensitivity Analysis: Price

[Graph 13: Subscriber Distribution, Range of Price Weights]
At higher values for the weight consumers give to price, we can see the declining MCPTV subscriber trend is exacerbated – MCPTV subscribers decrease more quickly and reach steady state at a lower level. OTT subscribers increase more sharply and reach steady state at a much higher price. The reverse is true with a smaller value for the weight of price. We can thus conclude from these results that the greater the weight consumers place on price, the more attractive the more inexpensive option (OTT) becomes; similarly, the less emphasis consumers place on price, the more subscribers MCPTV retains.

4.2 Attribute Sensitivity Analysis: Catalog

If consumers place an even greater weight on catalog, MCPTV subscribers actually increase before reaching steady state; OTT subscribers increase slightly but plateau at a much lower level of subscribers. If consumers place less weight on catalog than the initial run with preferences assumes, then OTT captures the majority of the market. This would imply that if consumers place a high weight on catalog, then the size of the catalog does have a significant effect on the distribution of subscribers. These effects could be due to the model formulation – MCPTV has more revenue per subscriber due to higher prices, and thus has more to invest in content, and has a
higher content base level to begin with – but we also know that MCPTV has a significant number of offerings not available on OTT (such as sports, or many premium cable channels' content), which would be one explanation accounting for this dynamic occurring in reality.

4.3 Attribute Sensitivity Analysis: Quality

Looking at a high and low range of consumers' weight given to quality, the results indicate that the greater the sensitivity of consumers to quality, the more amplified the trends of the initial preference run. At higher valuation of quality, we see OTT capture more of the market share, and at lower valuations of quality we MCPTV retain most of its subscriber base and market share. This result is most likely due to the formulation of quality in the model – an aggregation of the number of devices a consumer can stream on, picture clarity, and (in the case of OTT) speed of internet access. The number of possible streaming devices is set greater for OTT than for MCPTV, which drives the effects of quality – when more weight is placed on quality, subscriber distribution shifts in favor of OTT; when less emphasis is placed on quality, MCPTV retains most of their market share. In reality however, quality is
firstly a much more subjective concept, but secondly, would also include factors like ease of use (how user-friendly is the user interface) and how strong the recommendation algorithms are for new content, as well as things like customer service. Considering all these factors, and making quality driven by more variables than just the ones chosen due to data availability and time constraints, would most likely make composite value of quality much more similar for MCPTV and OTT, and we wouldn't see such extremes in subscriber distribution.

4.4 Attribute Sensitivity Analysis: WOM

A both the high and low range of weight placed on word of mouth, there is next to no impact on the distribution of subscribers. Therefore, we can conclude that, comparatively, word of mouth does not have a very large impact on attractiveness.
4.5 Attribute Sensitivity Analysis: Advertising Effectiveness

These results show that there is actually no impact on subscriber distribution, whether consumers place a higher or lower weight on advertising as an attribute of product attractiveness. This corresponds to what we know intuitively and what industry analysts report – that in addition to valuing other preferences more greatly, online research and discovery, followed by word of mouth, have a greater impact on consumers’ product discovery.

This sensitivity analysis on the size of the weights assigned to the attributes of attractiveness confirms what industry reports (and general intuition) indicate – that the attractiveness of either option, and therefore the distribution of subscribers, is most sensitive to price, then catalog and quality. We can now turn to analyzing the impact on subscriber distribution and revenues of possible strategic policies firms could enact – namely altering price or altering the amount invested in content.
4.6 Effect of Price Changes on Subscriber Distribution

Both the entrants and incumbents have two options – to increase the subscription price, or to lower it. We can examine the outcome of each option, as compared to the baseline run with preferences (“Attribute Weights 1”). For this set of scenario analyses we will assume a range of a 20% increase or decrease for both OTT and MCPTV (as a comparison, the recent Netflix price increase from $7.99 to $8.99 for new customers represents a 12.5% increase), as the bounds of the price changes. These are summarized in Table 9.

<table>
<thead>
<tr>
<th>Table 9: Price Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline MCPTV Price</td>
</tr>
<tr>
<td>---------------</td>
</tr>
<tr>
<td>Baseline OTT Price</td>
</tr>
<tr>
<td>Increase OTT Price</td>
</tr>
<tr>
<td>Decrease OTT Price</td>
</tr>
</tbody>
</table>

4.6.1 MCPTV Price Changes

Graph 18: Effect of Increased MCPTV Price on MCPTV Subscribers, by Age Group
These results of Graph 18 and Graph 19 indicate that an increase in MCPTV price alone has a significant impact on subscriber distribution, across all age groups. Obviously, because price has a negative weight, an increase in MCPTV price makes MCPTV less attractive, resulting in a migration of consumers to OTT. However, as

Graph 20 and Graph 21 below indicate, a decrease in the price of MCPTV results in an increase in the number of MCPTV subscribers, as MCPTV becomes more attractive. Similarly, OTT is able to gain a few more subscribers initially, but eventually decreases to a slower steady state level of subscribers upon an MCPTV price increase. This would make sense, as an increase in the number of MCPTV subscribers means increased MCPTV revenue, increased investment in content, and increased attractiveness – activating the reinforcing loop described in the earlier chapter.
Graph 20: Effect of Decreased MCPTV Price on MCPTV Subscribers, by Age Group

Graph 21: Effect of Decreased MCPTV Price on OTT Subscribers, by Age Group
4.6.2 OTT Price Changes

Turning now to changes in the OTT subscription price, Graph 22 illustrates the effect of an increase in the price of OTT on MCPTV subscribers, while Graph 23 illustrates the impact on OTT subscribers:

At each age group the decrease in MCPTV subscribers is dampened slightly, but the overall trend is not impacted. This makes sense – an increase in the price of an OTT subscription, like the recent one announced by Netflix, is nominal – the purchasing decision isn’t comparing Netflix for $7.99 to Netflix for $8.99 (or a 20% increase, as
it were in this simulation), but rather comparing Netflix for less than $10 a month to the price of MCPTV.

Similarly, while an increase in the price of OTT makes this option slightly less attractive, it does not change the overall trend of continued OTT growth until steady state. Comparatively, looking at a decrease in OTT subscription price (Graph 24 and Graph 25), we see that a lower OTT price means the relative attractiveness of OTT increases and thus that MCPTV subscribers decrease at a faster rate, while OTT subscribers increase at a faster rate.
Graph 24: Effect of Decreased OTT Price on MCPTV Subscribers, by Age Group

Graph 25: Effect of Decreased OTT Price on OTT Subscribers, by Age Group
Based on these results, the model tells us that consumers are sensitive to changes in price and that this has a large impact on the relative market share in steady state, based on the magnitude of the change and whether it is the entrant or incumbent changing their prices. The higher consumer price sensitivity to MCPTV price changes as compared to OTT price changes would seem to suggest a more elastic demand curve for MCPTV, with changes in price having a significant effect on subscription demand. However, this doesn’t entirely reconcile with the relatively small loses in MCPTV subscribers seen in recent years (as shown in Graph 3), despite rising price increases. Minimal MCPTV subscriber loses with price increases would suggest an inelastic demand curve (or more likely confirm the strength of the MCPTV triple or double play pricing strategy and the presence of monopolistic or oligopolistic conditions in the internet service provision market – leaving customers with limited options for internet access and without alternatives to the triple play – and thus remaining cable subscribers, whether they watch or not).
Now, we turn to examining the impact of both OTT and MPCTV increases prices on subscriber distribution, which is the most realistic scenario given the trend of increasing cable prices in recent years and the recent actions by Netflix. As

Graph 26 illustrates, an increase in both prices results in OTT with the majority of the market share – the increase in OTT price is rather insignificant when compared to the increase of the already much larger MCPTV price. The attractiveness of MCPTV falls significantly, leaving the entrant, OTT, to take most of the market.

Graph 26: Effect of Increased MCPTV and OTT Price on Subscribers
4.7 Effect of Price Changes on Revenues

We can also evaluate the impact price changes have on the revenues of both MCPTV and OTT. Graph 27 and Graph 28 highlight the changes to revenues over time with the price changes outlined above. MCPTV revenues are inversely related to MCPTV price – as price increases, MCPTV becomes less attractive, loses subscribers, and thus revenues; and as MCPTV price decreases, revenue increases. When OTT price increases, there is negligible impact on the revenues of MCPTV, as there is little impact on the attractiveness of OTT and therefore on subscriber distribution.

An increase in the price of OTT does increase total OTT revenues, as, even though there are slightly fewer subscribers, there are more revenues per subscriber and thus more total revenue. The reverse is also true – that a decrease in price of OTT decreases OTT revenues. Changes in the price of MCPTV have a significant impact on OTT revenues, however – an increase in the price of MCPTV drives up OTT revenues, as MCPTV becomes less attractive, and the distribution of subscribers alters in OTT's favor. Conversely, a decrease in the price of MCPTV significantly
decreases OTT revenues – MCPTV is more attractive at a lower price, reaches steady state with a greater proportion of total subscribers, thus taking subscribers and revenues from OTT.

Graph 27: Total MCPTV Revenues, with Price Changes

Graph 28: Total OTT Revenues, with Price Changes

The most interesting case is the increase in both MCPTV and OTT price. In this scenario, OTT ends up with the highest revenues of all the price change scenarios,
and MCPTV with some of the lowest. As MCPTV price increases, it loses subscribers, and thus revenue, to OTT. This dynamic is far greater than the decrease in attractiveness (and potential subscriber loss) from an increase in OTT price. Therefore, as MCPTV loses subscribers and OTT gains them, they actually earn more subscription revenue per household at this higher price, resulting in significantly larger total revenue. This would mean more absolute resources available to invest in content (or features, etc.), furthering the reinforcing loop of attractiveness.

4.8 Net neutrality-Based Strategic Policy

As discussed in Chapter 1, the recent decision by the DC Circuit Court (Verizon v FCC, 2014) to strike down the FCC rules enforcing ‘net neutrality’ mean that ISPs, which happen to be the MCPTV of this model (for the most part), could, if they chose, impact either the quality or the price of internet access, and thus of OTT. We can examine what the effect of a decrease in quality of access (e.g. designating Netflix or Hulu Plus traffic to a ‘slow’ lane) or an increase in the price of access (e.g. ISPs increasing the price of Internet access for consumers; they could alternative charge OTT providers a fee for ‘fast lane’ access, which would most likely be passed on to consumers; the end result would be the same – an increase in the total price of OTT). Americans already experience oligopoly-like conditions in the provision of broadband – one or two ISPs at most for the majority of Americans, a lack of competition the FCC says leads to the high prices characteristic of the American market (Manjoo, 2014). This means that significant price increases are not infeasible for the ISPs (MCPTV providers) to carry out. We will examine two scenarios – one where the price of access (internet) is increased for OTT subscribers, the other where the quality of access is significantly decreased for OTT subscribers – assuming both are the result of deliberate actions by MCPTV providers in their capacity as ISPs.
Assuming the price of Internet increases 20%, the results on subscriber distribution and revenues are as follows in Graph 29.

Graph 29: Effect of Increase in the Price of Internet Access on Subscriber Distribution

Increasing the price of Internet increases the total price of OTT, and thus we see similar dynamics unfold as when the OTT subscription alone was increased in the previous section. However, a 20% increase in the price of Internet (which may or may not be realistic, but is modeled for consistency) is significantly greater than Netflix increasing the price of its basic subscription by a dollar, for instance. This has a significant impact on the attractiveness of OTT, shifting the distribution of subscribers towards MCPTV, compared to the baseline run with preference weights ("Attribute Weight 1" in Graph 29 and Graph 30). Similarly, OTT revenues are also negatively impacted by an increase in Internet price. As OTT loses subscribers due to the price increase, they also lose revenues; MCPTV gains subscribers as a result of the decreased OTT attractiveness, resulting in higher MCPTV revenues – by a
significant proportion. Therefore, we can conclude that a significant increase in the price of access to the Internet will have a severe impact on the success of OTT, but that from the incumbent's point of view, this is a particularly effectual strategy to repel the entrants.

Turning now to a decrease in the quality of access of OTT, meant to simulate traffic discrimination on the parts of the ISPs, we see the results on subscribers and revenues as illustrated by Graph 31 and Graph 32. In the baseline setup with preferences, the average Internet speed is 23.5 Mbps; we can examine two scenarios - one where the quality decreases by 25% and the other where quality decreases by 50% - both of which would be noticeable differences to an Internet user, but in particular the halving of perceived 'quality'.

Graph 31: Effect of Decrease in the Quality of Internet Access on Subscriber Distribution
As per the formulation of the model, a decrease in the quality of Internet access affects the overall quality of OTT, which makes OTT less attractive. This propagates
through the model: OTT doesn't gain subscribers, compared to the baseline "Attribute Weight 1" run, with the impact increasing at lower quality levels. A 25% quality decrease still results in OTT gaining subscribers and MPCTV losing subscribers, simply to a lessened degree. However, at 50% decrease in quality of access has such a significant effect on OTT attractiveness that MCPTV actually reaches steady state with the vast portion of the market as compared to OTT (the results of Graph 29 vs. Graph 31). These results are mirrored in the revenues of MCPTV and OTT over time in this scenario, with subscriber levels dictating revenue. The model shows that MCPTV actually gains marginally more subscribers (and revenue) with the 50% decrease in quality than with the 20% increase in price in the steady state, given the magnitude of the change (when propagated through the formulation of the model) is so much greater. That ISPs could sustain a 50% quality decrease without severe reputation loss is unlikely.

4.9 Effect of Increased Investment in Content on Subscriber Distribution

Another policy action available to both OTT and MCPTV is to increase the proportion of revenues, and thus of profits, invested in content. If firms invest more content, this increases the attractiveness of the subscription service, which will affect the distribution of subscribers. We can examine the results of this type of policy by OTT and MCPTV in three scenarios – MCPTV increasing the amount of investment in content, OTT increasing its increasing its investment, and the scenario where both increase investment.

Graph 33: Effect of Increased MCPTV Content Investment on Subscriber Distribution

88
Graph 34: Effect of Increased OTT Content Investment on Subscriber Distribution

The increases in investment in content have negligible effect on the distribution of subscribers, with OTT investment having even less of an effect that MCPTV. This is most likely due to the formulation in the model. Total inventory is a function of the base inventory and the additions to content due to investment, which is then
converted into the relative size of OTT or MCPTV inventory. Given that the base catalogs are large in both cases, to simulate the relatively deep back catalogs, simply from a numerical standpoint, additions to content would need to be significant in order to affect the relative size of the OTT or MCPTV inventory. Therefore, due to the way catalog has been modeled, the translations to changes in attractiveness are much smaller than they would be in reality (where the exclusivity of content – e.g. Netflix-produced *House of Cards*, only available on Netflix, is enough to cause people to subscribe – in addition to just size, has an impact on the attractiveness of catalog). Consequently we see a much smaller increase in the number of subscribers than we would expect as a result of an increased-investment policy. This is not entirely misrepresentative of reality, however – given both OTT and MCPTV have huge back catalogs (more than any consumer could ever watch), adding one more drop to the bucket, so to speak, is unlikely to significantly alter the attraction to a particular consumer. In the scenario where both OTT and MCPTV firms increase their investment in content, we see the same, minimal, impact (Graph 35). However, despite the small magnitude of the change in subscribers (which change revenues), we can see that increased investment does add to the attractiveness marginally more for MCPTV than for OTT. This is because MCPTV has more revenue per subscriber, and therefore more total revenue, to invest (they also would have some sort of economies of scale in reality as well).

Graph 35: Effect of Increased OTT and MCPTV Content Investment on Subscribers

15 It is more likely specific additions (i.e. original content people want to watch) to catalog – a formulation the model does not capture – that will alter attractiveness enough to significantly effect subscriber distribution.
4.10 Policy Lessons

What consumer’s value matters: if consumers place a lot of weight on a particular attribute (like quality or content), firms should be particularly careful of their treatment of this aspect of their product.

Consumers are very price sensitive - act accordingly: increases in price, especially for MCPTV firms, can have a significant impact on market share and revenue; alternatively, OTT can gain revenues without losing many subscribers by increasing price. MCPTV firms would do well to carefully consider price increases, especially at a time when OTT is increasing prices. A MCPTV price increase significantly harms the attractiveness of MCPTV, regardless of an OTT price change, due to the difference in magnitude, but it does leave OTT with more subscribers generating more revenue per subscriber, and thus in a much stronger competitive position.
Catalog matters too: the more revenue earned, the more investment in content is possible. Despite the formulation of the model, we can still assume catalog matters, though what is added will probably have more of an impact as how much is added. Firms should keep up a strategy of competitive differentiation based on their catalog size and specific contents (focusing on content that raises the services profile, like *House of Cards* has for Netflix, and is exclusive to that service).

Controlling Internet speed and/or price are powerful weapons in the incumbent arsenal (though there might be reputational risks to using them). OTT firms will be watching whether the FCC’s recently (May 15, 2014) proposed rules addressing net neutrality are ratified, and whether ISPs begin charging content providers for ‘fast’ lane access in earnest. MCPTV providers, as ISPs, have the potential to extract a lot of revenue from content providers like OTT services through fast lane fees (like the deal Netflix struck with Comcast earlier this year) and make OTT less attractive to consumers by increased prices (these fees will most likely be passed on to consumers).

Age matters – to a certain extent: Millennials are broke, unemployed, indebted, and optimistic (to generalize) – their preferences are the logical followings of their circumstances; if their circumstances change, hard grained habits might not. Therefore, low price, customizable, individual-centric TV provision is probably here to stay. Millennials do value different things than their parents, but they don’t yet make up the whole market. They are particularly sensitive to price, and preference the subscription option that is most attractive economically. Understanding each customer segment is good business practice, remembering that the Boomer generation and older still have significant market power.
5 Limitations and Future Work

5.1 Model Limitations

As with any model, there are caveats and limitations that are worth spending a few moment acknowledging. While the model is not of a finite market, in the sense that household growth has been modeled, the data for household growth was an average across all U.S. households; intuitively we know that the household group likely to be growing the most are those of the younger age groups, as Millennials represent a growth proportion of the population, while the growth rate of the oldest households are likely to be decreasing (as older people expire).

Clearly reality is not a ‘one or the other’ world – the same household can subscribe to both Netflix and Comcast, for instance. While the model has tried to capture this in modeling the total number of subscriptions, this is an imperfect characterization of how people consume television. A consumer could purchase a triple-play package, and have Amazon Instant Video access as part of their Amazon Student Prime membership, and still watch illegally sometimes (i.e. torrenting HBO content, which until recently, was only available through HBO). However, to model that accurately would require something along the lines of being able to account for the hours per day or month a consumer spends watching any of the options, and modeling the allocation of attention to each option, which is rather infeasible. As such, the model has been built with assumptions and generalizations for the sake of simplicity and function, but recognizing the far more complicated nature of television watching (and paying) is important\footnote{One could also consider the resulting market shares of OTT and MPCTV to be the fraction of television consumption an adopter does using one or the other service (Vaishnav, 2009).}.

In a similar vein, using households as the unit of analysis does not fully capture the nuances of preferences amongst the members. Applying preferences to the entire

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\footnote{One could also consider the resulting market shares of OTT and MPCTV to be the fraction of television consumption an adopter does using one or the other service (Vaishnav, 2009).}
household based on the age of the 'householder' – the only member of the household for whom data is available – is also a generalization that does not perfectly reflect household makeup and behavior in reality. For instance, a householder in his mid-50s might be more inclined to listen to his teenage children when making the MCPTV vs. OTT decision, which is not a nuance captured by the model.

The $25,000 minimum income used as the threshold for being 'eligible' for a video experience applies to both MCPTV and OTT, as it is used to determine the Potential Video Consuming Households pool. However, leaving the cost of access aside, if you have internet connection (public library, college campus, café, etc.) then a $7.99 to $11.99 OTT subscription requires significantly less income than would be necessary to afford a MCPTV subscription. As such, there have probably been a (small) proportion of households that have been excluded from consideration (falling below $25,000 in annual income) that might in fact have an OTT subscription (or a MCPTV subscription, but that is far less likely). Again, the income level is a generalization that has been applied to the total population of households that is not a perfect representation of reality. Similarly, there is a technically a small percentage of people who are entirely off grid – no subscription or non-revenue viewing television at all. As this is such a small percentage of the population, for the sake of simplicity, and because extracting them from the general population doesn't provided any additional insights into the dynamics of the legal, paying market, this group has not been explicitly built into the model.

Finally, the model has been built as a discrete time dynamic system – viewing the variables as occurring in a series of time steps, or "a succession of time points and time intervals (Ossimitz & Mrotzek, 2008)." The time units of the model are in months, with the time step = 0.0625. The alternative method for dealing with time would be to model in continuous time – where the differential equation is solved at every infinitely small time step. That is, the equation is solved for every single point in time. This is only possible analytically and impossible with a computer. Therefore,
we approximate the "correct" differential equation with a difference equation that is solved for some time step of a finite size\textsuperscript{17}. This is discrete time, i.e. the time has been divided up into discrete chunks (Kampmann, 2014). While there are disadvantages of using discrete time – namely that we might not take a correctly sized time step and miss out on important dynamics – we have tried to minimize these effects with a sufficiently small time step.

### 5.2 Future Work

Keeping in mind the caveats of the model in its existing state, much of the future work that could be completed to improve its accuracy and usefulness in exploring future industry scenarios involves correcting some of the existing limitations.

In an ideal world, a survey on consumer preferences with respect to their TV consumption choices would be carried out, in order to calibrate the model with primary data and generate more accurate outcomes. We would then also want to break down the population into smaller age groupings in order to look for more nuanced differences in behavior. Dividing the population by gender or region would also lead to new consumer insights, which could then drive more tailored corporate policy. Actual consumer preference data would also allow for the construction of a demand function based on the elasticities gleaned from the consumer surveys, as a way to transition households between the general population into potential video consuming households, thereby eliminating the crude income cutoff measure. This demand function would be based on the minimum price available, which would determine the number of people who will become potential adopters of a television video subscription service (either OTT or MCPTV) (Vaishnav, 2009). Ideally we would want this demand function to capture the ‘adjustment dynamics’ of consumers in response to increases or decreases in price; this would necessitate determining if the demand function can be specified linearly – whether the

\textsuperscript{17} Well, Vensim does.
“magnitude of the marginal demand responses resulting from marginal price changes is...constant over the whole range of possible prices” (Abada, Briat, & Massol, 2013), or whether a non-linear specification would be required.

In a similarly ideal situation, data would be found for multiple years for both OTT and MCPTV subscribers, which would allow for calibration of the model to historical data. Currently, only data for 2011 and 2012 is available for total OTT and total MCPTV subscribers, and two data points is insufficient to calibrate accurately. The best case would be to calibrate the model to historical data starting in the year OTT was introduced in the market (perhaps 2007, as this was the year the largest OTT firm – Netflix – introduced their video streaming service and the year Hulu was founded).

Similarly, adapting the model with aging chain, where the outflow from a stock depends on the age itself – would add an additional dimension to the model. This is very common when modeling populations in system dynamics, and capturing chronological aging – consumers getting older (and expiring) and preferences evolving – and would add an additional shade of reality to the model. Without the aging chain, the system runs until steady state and these results are analyzed. An aging chain would make it possible to evaluate how the dynamics of consumer behavior and preferences evolve over real time. It should be noted that an aging chain might potentially introduce unstable fixed points - i.e. the results will continue to change and never reach a steady state (which is what happens in real life) (Kampmann, 2014).

The model's analysis could also be expanded beyond the American context – agents in the television value chain in other countries are also facing similar, if not more complex, entrant and incumbent issues. This would also lead to examining the nature of 'Millennials' in different contexts, and whether 'Millennials' as we conceptualize them in North America are a universal concept, or if there are distinct
demographic behaviors in different countries, or some other regional/cultural etc. differentiators.

Another next step would be to endogenize the price and quality attributes that make up attractiveness, completing more dynamics loops, and to capture the reality of investment in features (or innovation) and the price set by the providers are a function of their performance (number of subscribers, revenues, etc.). This would, again, help to capture actual firm behavior and the dynamic nature of these variables. Similarly, adding a formulation to capture the time value of content would also improve the model’s depiction of reality. Currently, catalog is simply a function of the number of shows, and its impact on attractiveness is dependent on the size of the catalog. However, the ‘value’ of content, and thus of the overall catalog, is time-dependent. The ‘value’ of certain types of content (such as sports, or other live events) to the consumer, in terms of how eager they are to consume content as close to its original airing as possible (and thus pay for the subscription that will enable them to do so), depreciates over time. In the case of the Super Bowl or the nightly news, the ‘value’ to the consumer depreciates very quickly – there is little point in watching Monday’s news on Tuesday, and no one really wants to watch the Super Bowl the day after it has already been dissected at the water cooler. Other types of content depreciate more slowly (and one could argue that some content even appreciates – think of a cancelled show, like Arrested Development, which developed such a passionate fan cult following that Netflix actually produced another season many years after it went off-air). Therefore, adding the time value of content to the model would go some way in capturing the more dynamic nature of its value and the impact it has on consumer choices.

In a similar vein, delays would also be built into the model, specifically around the content production. It takes many months from the point of the investment decision for the finish product (the TV show) to be available to consumers – and thus to potentially impact their view of the catalog’s attractiveness. This delay should be incorporated into the model. Likewise, there is also a delay between when one
might consider ending the MCPTV subscription and actually cutting the cord and subscribing to something else. Currently, based on the attrition rate, when a consumer leaves either the OTT or MCPTV subscriber pool, they return to the Potential Video Consuming Households pool and are immediately redistributed to either OTT or MCPTV again based on the attractiveness. This process takes more time in reality (and potentially involves switching costs, which would also ideally be included). Incorporating delays like these will affect how quickly the steady state is reached in the model – currently peaks in subscribers and revenues are happening within the first 12 months – this is faster than these dynamics would play out in reality.

Finally, including firm dynamics and interactions would be another appropriate piece of future developments that would increase the accuracy of the model’s reflection of reality. Building out the how content investment and production decisions and processes occur, including the delays and the other actors involved would be one step. Capturing the dynamics between firms, such as the incentives and ability to execute mergers and acquisitions, would go some way in capturing how the incumbent firms interact amongst themselves and with entrant firms. For instance, this would allow actions – such as the proposed Comcast/Time Warner merger, or other industry consolidation – to be modeled, and its impacts evaluated.
6 Conclusion

Harkening back to the original question posed by the Incumbent’s Dilemma framework – which of the three possible outcomes is most likely for the TV distribution space? Both the simulation scenarios explored in chapter 4 and empirical observations of subscriber and firm behavior would indicate quite strongly its co-existence between the incumbent and entrant. The OTT entrants will continue investing in content and features, only furthering their attractiveness to consumers; the incumbents will continue leveraging their advantages: large capital resources and their dual roles as ISPs. While OTT services continue to add subscribers hand-over-fist, some MCPTV providers, like the telcos, aren’t losing subscribers either. Even at the time of writing, industry activity continues at the frantic clockspeed that has become the norm: The FCC voted to move forward on a new net neutrality framework, which might have major implications for traffic-discrimination by ISPs, and AT&T announced its plans to acquire DIRECTV.

Industry integration and collaboration, like the types that were outlined in Chapter 2, will continue.

All of this would indicate co-existence, but it will most likely be at a ‘steady state’ of much lower levels of MCPTV subscribers and much higher levels of OTT subscribers than are seen now. As is the naming trend, this co-existence might even have a name that catches on: “cord-stacking,” or consumers having one or more TV subscription service (stacking the subscriptions, as it were, to create their ideal TV service). In a state of coexistence – especially one that favors entrant growth – incumbents aside, OTT’s success represents opportunity for others in the value chain: another source of demand for the products of studios and content generators and another audience for advertisers to market to.

However, it is important to note that much of the much of the discussion about the decline of MCPTV is (or isn’t, as it were) prefaced on the assumption of no dramatic
increase in the price of Internet. Right now, OTT is particularly attractive because it is a low cost alternative compared to the incumbents’ offerings. However, the Comcast’s, Time Warner’s and Verizon’s of the world cannot and should not sit idly by while new firms and new business models try to ‘steal their lunch.’ In addition to adapting to how they cater to consumer desires in their video experiences (TV Everywhere being the obvious example), there is little stopping these firms from eventually increasing the price of the Internet that they provide (“The cable giants will simply become even-more-inescapable Internet giants” (Manjoo, 2014)). In which case, OTT will become less attractive financially, and less feasible as a substitute product (and is much more likely to stay a compliment, which we already see). As long as the triple or double play stays more economical than internet alone, then people will subscribe to get internet, and cable will retain subscribers.

However, how new entrants in the internet provision space (like Google Fiber) – which aim to provide lower cost, faster, alternatives to the traditional ISPs like Verizon and Comcast – will affect the feasibility of this type strategy (increasing the price of internet to de facto increase the price of your competitor) remains to be seen. Therefore, all things considered, we can say OTT and MCPTV are imperfect substitutes, if, as in reality, the comparison is between an OTT subscription and the triple or double play, which includes Internet access. All of the activity in this space does bode well for consumers in the long run (perhaps after some price increases), who are the most likely beneficiaries of heightened competition, and the resulting innovation, in the market.
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Appendix: Model Equations

Note: equations re for baseline run, for one age group. Formulations are identical for all other age groups

Attractiveness of MCPTV = 
\[
(\exp(Weight of Effect of MCPTV Adoption from Advertising \times Effect of MCPTV Adoption from Advertising)) \times (\exp(Weight of Effect of MCPTV Quality on Attractiveness \times Effect of MCPTV Quality on Attractiveness)) \times (\exp(Weight of Effect of MCPTV Price on Attractiveness \times Effect of MCPTV Price on Attractiveness)) \times (\exp(Weight of Effect of WOM on Attractiveness of MCPTV \times Effect of WOM on Attractiveness of MCPTV)) \times (\exp(Weight of Relative Size of MCPTV Content Inventory \times Effect of Relative Size of MCPTV Content Inventory on Attractiveness))
\]
Units: Dmnl

Attractiveness of OTT = 
\[
(\exp(Weight of Effect of OTT Adoption from Advertising \times Effect of OTT Adoption from Advertising)) \times (\exp(Weight of Effect of OTT Price on Attractiveness \times Effect of OTT Price on Attractiveness)) \times (\exp(Weight of Effect of OTT Quality on Attractiveness \times Effect of OTT Quality on Attractiveness)) \times (\exp(Weight of Effect of WOM on Attractiveness of OTT \times Effect of WOM on Attractiveness of OTT)) \times (\exp(Weight of Relative Size of OTT Content Inventory \times Effect of Relative Size of OTT Content Inventory on Attractiveness))
\]
Units: Dmnl

Average Cost Per MCPTV Show = 4.5e+07
Units: Dollars/Show/Year

Average Cost per OTT Show = 5.2e+07
Units: Dollars/Show/Year

Average Duration of MCPTV Subscription Ages 15 to 24 = 36
Units: Months

Average Duration of OTT Subscription Ages 15 to 24 = 30
Units: Months

Average Speed of Internet = 23.5
Units: Mbps

Base MCPTV Content Inventory = 10000
Units: Shows

Base OTT Content Inventory = 7000
Units: Shows

MCPTV Ad Effectiveness = 0.47
Units: Dmnl

MCPTV Adoption Fraction = 0.77
Units: Dmnl

MCPTV Contact Frequency = IF THEN ELSE (Total Market > 0, MCPTV Subscribers Ages 15 to 24 / Total Market, 0)
Units: Dmnl

MCPTV Contact with Potential Customers = MCPTV Contact Frequency * IF THEN ELSE (Total Market > 0, Potential Video Consuming Households Ages 15 to 24 / Total Market, 0)
Units: Dmnl
MCPTV Investment in Content =
Fraction of MCPTV Revenue Invested in Content \times MCPTV Total Profit Ages 15 to 24
Units: Dollars/Year

MCPTV Picture Quality =
0.9
Units: Dmnl

MCPTV Subscription Rate =
Relative Attractiveness of MCPTV \times (Potential Video Consuming Households Ages 15 to 24)/Time Constant
Units: Subscribers/Month

"Cord-Cutting Rate" =
MCPTV Subscribers Ages 15 to 24/ Average Duration of MCPTV Subscription Ages 15 to 24
Units: Subscribers/Month

Effect of MCPTV Adoption from Advertising =
MCPTV Ad Effectiveness \times (IF THEN ELSE(Total Market > 0, Potential Video Consuming Households Ages 15 to 24/ Total Market, 0))
Units: Dmnl

Effect of MCPTV Price on Attractiveness =
Total MCPTV Price/Reference MCPTV Price
Units: Dmnl

Effect of MCPTV Quality on Attractiveness =
Quality of MCPTV/Reference Quality of MCPTV
Units: Dmnl

Effect of Devices on Mobility of MCPTV =
1/7
Units: 1/Device

Effect of Devices on Mobility of OTT =
1/7
Units: 1/Device

Effect of OTT Adoption from Advertising =
(OTT Ad Effectiveness \times (IF THEN ELSE(Total Market > 0, Potential Video Consuming Households Ages 15 to 24/Total Market, 0)))
Units: Dmnl

Effect of OTT Price on Attractiveness =
Total OTT Price/Reference OTT Price
Units: Dmnl

Effect of OTT Quality on Attractiveness =
Quality of OTT/Reference Quality of OTT
Units: Dmnl

Effect of Relative Size of MCPTV Content Inventory on Attractiveness =
Relative Size of MCPTV Content Inventory/Reference Relative Size of MCPTV Catalog
Units: Dmnl

Effect of Relative Size of OTT Content Inventory on Attractiveness =
Relative Size of OTT Content Inventory/Reference Relative Size of OTT Catalog
Units: Dmnl

Effect of WOM on Attractiveness of MCPTV =
MCPTV Adoption Fraction \times MCPTV Contact with Potential Customers
Units: Dmnl

Effect of WOM on Attractiveness of OTT =
OTT Adoption Fraction \times OTT Contact with Potential Customers
Units: Dmnl

Fraction =
3.578e+06/6.18e+06
Units: Dmnl
Fraction New Households Ages 15 to 24 =
\( \frac{1}{12} \times (0.00109 + \text{RAMP}(1e-05, 0, 240)) \)
Units: 1/Month

Fraction of MCPTV Revenue Invested in Content = 0.4
Units: Dmnl

Fraction of OTT Revenue Invested in Content = 0.7
Units: Dmnl

Fraction Subscribing to Both MCPTV and OTT = 0.182765
Units: Dmnl

Initial MCPTV Subscribers = 2.87e+06
Units: Subscribers

Initial non subscriber Households Ages 15 to 24 = 6.18e+06
Units: Subscribers

Initial OTT Subscribers = 708000
Units: Subscribers

Initial Total Subscriptions Ages 15 to 24 =
Initial non subscriber Households Ages 15 to 24 * (1 + Fraction Subscribing to Both MCPTV and OTT)
Units: Subscribers

MCPTV Access Price = 0
Units: Dollars/Month/Subscriber

MCPTV Advertising Revenue per viewer = 600
Units: Dollars/Subscriber/Year

MCPTV Advertising Revenues =
MCPTV Advertising Revenue per viewer * MCPTV Subscribers Ages 15 to 24
Units: Dollars/Years

MCPTV Cost per Subscriber = 800
Units: Dollars/Subscriber/Year

MCPTV Subscribers Ages 15 to 24 = \text{INTEG} (\text{MCPTV Subscription Rate - "Cord-Cutting Rate"},
Initial Cable Subscribers)
Units: Subscribers

MCPTV Subscription Price = 90
Units: Dollars/Month/Subscriber

MCPTV Subscription Revenues =
MCPTV Subscribers Ages 15 to 24 * MCPTV Subscription Price
Units: Dollars/Month

MCPTV Total Cost =
MCPTV Cost per Subscriber * MCPTV Subscribers Ages 15 to 24
Units: Dollars/Year

MCPTV Total Profit Ages 15 to 24 =
MCPTV Total Revenue Ages 15 to 24 - MCPTV Total Cost
Units: Dollars/Year
MCPTV Total Revenue Ages 15 to 24 =
MCPTV Advertising Revenues + (MCPTV Subscription Revenues * Months per year)
Units: Dollars/Year

Mobility of Watching MCPTV =
Effect of Devices on Mobility of MCPTV * Number of Devices MCPTV User Can Watch On
Units: Dmnl

Mobility of Watching OTT =
Effect of Devices on Mobility of OTT * Number of Devices OTT User Can Watch On
Units: Dmnl

Months per year =
12
Units: Months/Year

New Household Growth Ages 15 to 24 =
(((Initial Total Subscriptions Ages 15 to 24 - Initial Cable Subscribers - Initial OTT Subscribers) * (1 - Non Revenue Fraction Ages 15 to 24)) * Fraction New Households Ages 15 to 24) * (1 - Non Revenue Fraction Ages 15 to 24)
Units: Subscribers/Month

Non Revenue Fraction Ages 15 to 24 =
0.13
Units: Dmnl

Non Revenue Users Ages 15 to 24 = INTEG (
NRU Flow Ages 15 to 24,
(Initial Total Subscriptions Ages 15 to 24 - Initial MCPTV Subscribers - Initial OTT Subscribers) * (Non Revenue Fraction Ages 15 to 24))
Units: Subscribers

NRU Flow Ages 15 to 24 =
(((Initial Total Subscriptions Ages 15 to 24 - Initial Cable Subscribers - Initial OTT Subscribers) * (1 - Non Revenue Fraction Ages 15 to 24)) * Fraction New Households Ages 15 to 24) * (Non Revenue Fraction Ages 15 to 24)
Units: Subscribers/Month

Number of Devices MCPTV User Can Watch On =
3
Units: Device

Number of Devices OTT User Can Watch On =
6
Units: Device

OTT Abandonment Rate =
OTT Subscribers Ages 15 to 24 / Average Duration of OTT Subscription Ages 15 to 24
Units: Subscribers/Month

OTT Access Price =
55
Units: Dollars/Month/Subscriber

OTT Ad Effectiveness =
0.47
Units: Dmnl

OTT Ad Revenue per Viewer =
71
Units: Dollars/Subscriber/Year

OTT Adoption Fraction =
0.77
Units: Dmnl

OTT Advertising Revenues =
OTT Ad Revenue per Viewer * OTT Subscribers Ages 15 to 24
Units: Dollars/Year
OTT Contact Frequency = IF THEN ELSE (Total Market > 0, OTT Subscribers Ages 15 to 24 / Total Market, 0) Units: Dmnl

OTT Contact with Potential Customers = OTT Contact Frequency * IF THEN ELSE (Total Market > 0, Potential Video Consuming Households Ages 15 to 24 / Total Market, 0) Units: Dmnl

OTT Cost Per Subscriber = 67.12 Units: Dollars/Subscriber/Year

OTT Investment in Content = Fraction of OTT Revenue Invested in Content * OTT Total Profits Ages 15 to 24 Units: Dollars/Year

OTT Picture Quality = 0.8 Units: Dmnl

OTT Subscribers Ages 15 to 24 = INTEG (OTT Subscription Rate - OTT Abandonment Rate, Initial OTT Subscribers) Units: Subscribers

OTT Subscription Price = 7.99 Units: Dollars/Month/Subscriber

OTT Subscription Rate = Relative attractiveness of OTT * (Potential Video Consuming Households Ages 15 to 24) / Time Constant Units: Subscribers/Month

OTT Subscription Revenues = OTT Subscribers Ages 15 to 24 * OTT Subscription Price Units: Dollars/Month

OTT Total Costs = OTT Cost Per Subscriber * OTT Subscribers Ages 15 to 24 Units: Dollars/Year

OTT Total Profits Ages 15 to 24 = OTT Total Revenue Ages 15 to 24 - OTT Total Costs Units: Dollars/Year

OTT Total Revenue Ages 15 to 24 = OTT Advertising Revenues + (OTT Subscription Revenues * Months per year) Units: Dollars/Year

Potential Video Consuming Fraction = Fraction * Total non subscriber Households Age Group 1 / Time Constant 2 Units: Subscribers/Month

Potential Video Consuming Households Ages 15 to 24 = INTEG (-MCPTV Subscription Rate + "Cord-Cutting Rate" + OTT Abandonment Rate - OTT Subscription Rate + Potential Video Consuming Fraction, 0) Units: Subscribers

Quality of MCPTV = [Quality of MCPTV Access * Weight of Cable Access] + (Quality of MCPTV Services * Weight of MCPTV Offerings) Units: Dmnl

Quality of MCPTV Access = IF THEN ELSE (Average Speed of Internet / Recommended Streaming Speed < 1, Average Speed of Internet / Recommended Streaming Speed, 1) Units: Dmnl

Quality of MCPTV Services =
(Mobility of Watching MCPTV * Weight of Mobility of Watching MCPTV) + (MCPTV Picture Quality * Weight of MCPTV Picture Quality)
Units: Domnl

Quality of OTT =
(Quality of OTT Access * Weight of OTT Access) + (Quality of OTT Service * Weight of OTT Offerings)
Units: Domnl

Quality of OTT Access =
IF THEN ELSE(Average Speed of Internet / Recommended Streaming Speed < 1, Average Speed of Internet / Recommended Streaming Speed, 1)  
Units: Domnl

Quality of OTT Service =
(Mobility of Watching OTT * Weight of Mobility of Watching OTT) + (OTT Picture Quality * Weight of OTT Picture Quality)
Units: Domnl

Recommended Streaming Speed =
27.5  
Units: Mbps

Reference MCPTV Price =
75  
Units: (Dollars/Month/Subscriber)

Reference OTT Price =
60  
Units: (Dollars/Month/Subscriber)

Reference Quality of Cable =
0.5  
Units: Domnl

Reference Quality of OTT =
0.5  
Units: Domnl

Reference Relative Size of MCPTV Catalog =
0.4  
Units: Domnl

Reference Relative Size of OTT Catalog =
0.4  
Units: Domnl

Relative Attractiveness of MCPTV =
Attractiveness of MCPTV / Total Attractiveness of All Products  
Units: Domnl

Relative attractiveness of OTT =
Attractiveness of OTT / Total Attractiveness of All Products  
Units: Domnl

Relative Size of MCPTV Content Inventory =
IF THEN ELSE(Total Catalog > 0 , Total MCPTV Content Inventory / Total Catalog, 0 )  
Units: Domnl

Relative Size of OTT Content Inventory =
IF THEN ELSE(Total Catalog > 0 , Total OTT Content Inventory / Total Catalog, 0 )  
Units: Domnl

Time Constant =
1  
Units: Months

Time Constant 2 =
1  
Units: Month

112
Time to produce content = 12
Units: Month

Total Attractiveness of All Products = (Attractiveness of MCPTV) + (Attractiveness of OTT)
Units: Dmnl

Total MCPTV Price = MCPTV Subscription Price + MCPTV Access Price
Units: Dollars/Month/Subscriber

Total Catalog = Total MCPTV Content Inventory + Total OTT Content Inventory
Units: Shows

Total Market = Potential Video Consuming Households Ages 15 to 24 + OTT Subscribers Ages 15 to 24 + MCPTV Subscribers Ages 15 to 24
Units: Subscribers

Total MCPTV Content Inventory = (MCPTV Investment in Content/Average Cost Per MCPTV Show) + Base MCPTV Content Inventory
Units: Shows

Total non subscriber Households Age Group 1 = INTET (New Household Growth Ages 15 to 24 - Potential Video Consuming Fraction, (Initial Total Subscriptions Ages 15 to 24 - Initial Cable Subscribers - Initial OTT Subscribers) * (1 - Non Revenue Fraction Ages 15 to 24))
Units: Subscribers

Total OTT Content Inventory = (OTT Investment in Content/Average Cost per OTT Show) + Base OTT Content Inventory
Units: Shows

Total OTT Price = OTT Access Price + OTT Subscription Price
Units: Dollars/Month/Subscriber

Total Potential People in Market Ages 15 to 24 = MCPTV Subscribers Ages 15 to 24 + Non Revenue Users Ages 15 to 24 + OTT Subscribers Ages 15 to 24 + Total non subscriber Households Age Group 1
Units: Subscribers

Weight of MCPTV Access = 0
Units: Dmnl

Weight of MCPTV Offerings = 1 - Weight of Cable Access
Units: Dmnl

Weight of MCPTV Picture Quality = 0.4
Units: Dmnl

Weight of Effect of MCPTV Adoption from Advertising = 1
Units: Dmnl

Weight of Effect of MCPTV Price on Attractiveness = -13
Units: Dmnl

Weight of Effect of MCPTV Quality on Attractiveness = 5
Units: Dmnl

Weight of Effect of OTT Adoption from Advertising = 113
Weight of Effect of OTT Price on Attractiveness = -13
Units: Dmnl

Weight of Effect of OTT Quality on Attractiveness = 5
Units: Dmnl

Weight of Effect of WOM on Attractiveness of MCPTV = 2
Units: Dmnl

Weight of Effect of WOM on Attractiveness of OTT = 2
Units: Dmnl

Weight of Mobility of Watching MCPTV = 1 - Weight of MCPTV Picture Quality
Units: Dmnl

Weight of Mobility of Watching OTT = 1 - Weight of OTT Picture Quality
Units: Dmnl

Weight of OTT Access = 0.7
Units: Dmnl

Weight of OTT Offerings = 1 - Weight of OTT Access
Units: Dmnl

Weight of OTT Picture Quality = 0.4
Units: Dmnl

Weight of Relative Size of MCPTV Content Inventory = 8
Units: Dmnl

Weight of Relative Size of OTT Content Inventory = 8
Units: Dmnl