Consumer responses in sales to multiple media advertising exposures: the impact of synergy based on a study of Project Apollo single source data

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Consumer Responses in Sales

to Multiple Media Advertising Exposures

– The Impact of Synergy Based on

a Study of Project Apollo Single Source Data

By

Leslie Wood

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Consumer Responses in Sales

to Multiple Media Advertising Exposures

– The Impact of Synergy Based on

a Study of Project Apollo Single Source Data

By

Leslie Wood

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ABSTRACT

The primary focus of this dissertation is to answer the question: how does exposure to advertising affect purchasing behavior, and in particular, how does synergy resulting from exposure to advertising in multiple media influence purchasing behavior? This is a critical piece of information in the business decision process of media planning. It determines which media to include in a media plan and how to allocate a limited budget across media in order to optimize the return on investment from advertising. This question has been studied in many ways since it has been a central question for the advertising industry for over forty years. Researchers have: 1) examined the question using one medium, 2) built models in the hopes that data would be collected to test them, 3) used surrogate measures for exposure, such as commercial recall, 4) used exposure rather than response (sales) as a measure, and 5) used surrogate measures for sales, such as brand preference or intent to buy. This dissertation uses the data from Project Apollo, a single source database of passive (or electronically captured) longitudinal measurements of advertising exposure and household level consumer packaged goods sales, to answer this question. The limitations of this approach are that the tools to analyze single source data are still in their infancy, the media that have been included are only magazines and television, and the products examined are fast moving consumer package goods (FMCG) categories.
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1. OVERVIEW

The dissertation begins with a section that defined the problem studied: the impact of synergy as measured by consumer responses in sales to multiple media advertising exposures. This is followed by details on the research that has been conducted in this area, and identifies the gaps in knowledge that this dissertation seeks to fill. The next section highlights the importance of the research conducted in this dissertation, followed by a review of the literature and placing this research in its context. It discusses why the question of synergy has remained unanswered for so long, considering that research on this very topic was conducted as early as forty years ago in 1970. The literature review also includes a full description of single source data, including its history, a description of its key features and the analyses that have been performed to-date using single source data. The next Section 6 provides a description of the Project Apollo dataset used in this dissertation and an assessment of its strengths and limitations. Section 7 describes the techniques of analysis that were used, a description of the analyses that were performed and the process for answering the question posed in the dissertation.

This is a descriptive study of the impact of multiple exposures in multiple media on sales. The results of five different analyses are shared in Section 8: 1) the analysis of the combinations of advertisements, 2) estimating the combined scores for multiple advertisements, 3) the analysis of the scores among households exposed to only one media versus the households that were exposed to both television and magazines, 4) an examination of the influence of frequency of exposure on sales, and 5) the influence of share-of-voice on sales. These results are summarized and their implications explored in Section 9.
Conclusions. Section 10 includes a discussion of the limitations of this research and directions for future research. A list of references is included in Section 11. Section 12 contains eighteen Appendixes that provide charts and tables from which relevant extracts have been included in the body of the dissertation.
2. PROBLEM STATEMENT

The central theme of this dissertation is synergy, hence a definition is provided below.

2.1 Definition of Synergy

Synergy is the combined impact of advertising messages delivered across at least two media. Media synergy has been defined as: “... an enhancement of the media form through combination with other media forms ...” (Schultz, Block et al. (2009)). Or as Naik and Raman define it: “the added value of one medium as a result of the presence of another medium, causing the combined effect of media to exceed the sum of their individual effects” (Naik and Raman (2003)).

In media planning, synergy is related to frequency, a measure of the cumulative effect of additional exposures to an advertising message on a consumer’s behavior, i.e., the incremental value of two exposures as compared to a single exposure, of three exposures as compared to two, etc. Synergy takes this one step further and attempts to quantify the incremental impacts of exposures to advertising from different media forms as they compare to those from the same media form.

2.2 Problem Statement

This dissertation answers the question: how are sales impacted by multiple exposures to advertising in both television and magazines? This is made possible through the use of single source data from a project that collected exposure to television commercials and magazine ads as well as purchases of fast moving consumer package goods (FMCGs), across time. The continuous collection of media data from this panel was performed using passive, electronic
measurement made possible by Arbitron’s PPM which listened for codes in the environment. (Section 6.1 presents more details.) This passively collected data offers the first opportunity to track, across time, the relationship between a single household’s exposure to multiple media and its purchasing behavior. Using this data, this dissertation will first quantify the sales effects of single commercials and then examine the combined effects of the television and magazine elements.

By examining this data, the following questions will be explored:

**Is there a synergistic effect of exposures to advertising from two different sources?**

**Is that effect positive?** The goal is to quantify the additional value of two media vs. one by examining the combined response from two messages from different media as compared to similar levels of combinations from the same media.

**Does it have a form?** If the results show a standard pattern, and that pattern has a form or formula or can be modeled, then this information can guide media planning decisions.

To expand the above questions further:

**Is there a relationship between the effectiveness of each separate piece of advertising copy and their combined effectiveness?** In other words, is synergy higher when the underlying advertising copy performs better alone? How does it work when one piece of copy is effective and the other mediocre?

**Does it matter how much weight was behind each piece of copy?** By examining the gross rating points (GRPs) or the number of times an ad was seen during weeks when the ads were alone and then together, there may be insights gleaned as to the levels or relative levels of advertising required to achieve synergy.
3. EXISTING KNOWLEDGE ON RESEARCH QUESTIONS

There has been extensive research on frequency and synergy. The existing research can be categorized into the following five types: 1) examines a single medium (Lavidge and Steinerm (1961); Kuehn (1970); Zufryden (1975); Krishnamurthi and Raj (1986); Lodish, Abraham et al. (1995)), 2) models a measure for synergy or frequency without data (Ray and Batra (1983); Batra and Ray (1986); Gould (2003)), 3) uses recall based measures of advertising exposure and commercial recall (Madansky and Graham (2004); Zack (2004)), 4) uses brand awareness and intent to buy instead of sales (Ray (1973); Strong (1974); Simon and Arndt (1980); Naik and Raman (2003); den Boon, Bruin et al. (2005); Rush (2008)) or 5) uses reach (the number of different people that see an ad), rather than response as the measure of synergy ((Kishi (1983); Rice (1988); Macdonald (1992); McConochie and Uyenco (2002); Wood (2002); FitzGerald (2008)). This section will summarize existing research on each of these areas and why they fail to answer this dissertation’s research question.

3.1 Single Media

Single media studies are by definition studies of frequency effects rather than synergy effects because only one medium is included. Therefore such studies do not address the problem statement of this dissertation. However, these studies can provide insights into how frequency works and how to analyze frequency. There are different types of studies including single source studies, split-market cable studies, and recall based studies.

A key finding resulting from a study of single source data is that share-of-voice (a single brand’s share of exposure in an overall category) rather than absolute frequency level is the
primary driver of frequency. Using single source data, Geiger (1971) found that heavy television viewers saw many more commercials for all advertised brands in the category, and that the brand with the highest share-of-voice or share of exposures had the highest response in sales. This was particularly true of the very highly exposed quintile and the very low exposed quintile and less true of the middle three quintiles. This finding was corroborated by D'Souza and Rao (1995) in a sample of ninety-nine product users, using awareness measures for advertising and a logit model for analysis. Burke and Srull (1988) found this as well in another small controlled test. Share-of-voice will be one of the measures examined in this dissertation.

Single medium analyses of frequency have also been performed using split-market cable studies such as Lodish, Abraham et al. (1995) who used Behavior-Scan and Zufryden (1973); Zufryden (1975); Krishnamurthi and Raj (1986); Zufryden (1987) who used AdTel. Both Behavior-Scan and AdTel provided sales data from a split panel of consumers whose television was manipulated to deliver test and control advertising. These studies did not find frequency to be a major driver of sales; however, Zufryden did find diminishing returns for frequency.

Single medium analyses have also been performed extensively to understand and define the response function. Simon and Arndt (1980) reviewed over 100 media studies, the vast majority of which were based on recall. These studies measured frequency across longer periods of time as well as frequency delivered within a few days. Simon and Arndt reported that all of the studies found either a concave-downward function or an S-shaped logistic function. The S-shaped function described advertising as having almost no effect until a certain threshold was achieved and then a growing influence until saturation was achieved, followed by a leveling off, or diminished returns from over-delivery. The concave-
downward function described consistently lower levels of additional impact with each additional exposure. The reviewers concluded that the” *great majority of persons interested in advertising - advertising practitioners, media salesmen, economists and laymen-seem to believe that the advertising response function has an inflection point and is S-shaped.*”

Naples (1979) pointed out that advertisers were generally unwilling to take on the difficult question of inter-media comparisons. He quotes David K. Braun of General Foods Corporation at an Advertising Research Foundation (ARF) Conference:

“We know far less about the relative values of broad media types such as television, magazines, newspapers, radio, outdoor, and the like. . . . Although several attempts have been made over the years to research the relative effectiveness of TV and radio and TV and newspapers, none of them produced what we would consider to be valid measures of such relationships. . . . we know a fair amount about relating the subgroups within the major media types, and we have some solid evidence that media mixes work effectively. . . . But these insights have tended to complicate our life rather than simplify it. For, while we can now feel better about utilizing media mixes, our knowledge stops far short of telling us how to optimize the mix. Here are just a few of the questions media planners and advertisers must currently answer basically on judgment: (1) How much of my secondary medium is enough? How much is too much? How much is just right? (2) Do the available measures of reach, average frequency, frequency distribution, and effective reach provide a benchmark for assessing the effectiveness of media mixes? Or should relative media values be factored into the reach and frequency measures? And, if so, how? (3) Is a prospect who is exposed to three magazine ads and one TV commercial as effectively reached as the prospect for whom the exposure pattern is reversed? (4) Does the optimal scheduling of two different media types differ when they are used together versus separately?” Braun (1977)

3.2 Theoretical Models

There has also been research on theoretical models that have limited data or are proposed in hopes of data. But these theoretical models have not been applied using live data. An overview of this research is presented here to complete the literature review for this
dissertation. Ray and Batra (1983); Batra and Ray (1986) proposed a model of advertising frequency as S-shaped without a saturation or inflection point towards negative response. Gould (2003) proposed a financial model for assessing integrated media communications or cross-media campaigns that used a mix of generally reported expenditure and sales data with estimates for data points that are not available. Mahajan and Muller (1986) created a model for estimation of the response function using prior studies and re-estimating the results as a way to support “flighting,” or pulsing of advertising weight across time vs. continuity scheduling.

3.3 Recall Measures of Advertising Exposure

The vast majority of the studies conducted on frequency and synergy use either a diary based measure of media exposure or a recall based measure. Advertising recall measures a consumer’s recall of key elements of a commercial with the assumption that once a consumer has remembered a commercial, that commercial is already well along on the path toward influencing the consumer’s behavior. To truly understand the effects of frequency, the consumer’s exposure should be in the complex, crowded media environment most consumers live in today. A complete discussion of the changing media landscape is covered in the literature review. Madansky and Graham (2004) used a combination of techniques: a diary for print, broadcast and cable TV exposure and an electronic method for online exposure to collect data on synergy. They used a test and control mechanism to quantify response, measured as brand attitudinal scores. Their study captured higher response when multiple media were used. Another technique to discern a frequency effect was used by Zack (2004) for IAG, now a subsidiary of Nielsen, who used online games to determine which commercials and which brands are most closely viewed. They award points based on
recollection of key elements of the commercial or program. Their study showed that repetition did lead to higher recollection.

The problem statement for this dissertation is directly related to the relationship between actual exposure to advertising and sales. Lodish calls into question the relationship between persuasion and actual sales effects:

> It is unlikely that there is a strong relationship between standard measures of TV commercial recall and persuasion for established brands and the sales impact of the copy.” Lodish, Abraham et al. (1995).

Recall measures of advertising exposure are surrogates. They can provide insights, but do not answer the core problem statement for this dissertation.

### 3.4 Brand Awareness and Intent to Buy as Surrogates for Sales

Sales may not be the ultimate goal of advertising. For instance, automotive manufacturers use advertising to increase test-drives and information seeking behavior in consumers. Brand awareness and intent to buy can therefore be the goal of an advertising campaign or at least a measure of the advertising impact along the purchase funnel.

Although advertisers are interested in the impact of advertising, the vast majority of research on how advertising works has operationalized response to advertising in terms of brand awareness, commercial recall, and intent to buy. These have been used as surrogate measures of purchase behavior.

This is a vast area of research encompassing many measurement and analysis techniques. For this dissertation, only the major articles that are focused on synergy or cross-media have been discussed in the literature review. The problem statement for this
dissertation is to address the impact of synergy on sales. These studies can provide guidance, but do not address the core question of synergy’s impact on sales.

Ray and Sawyer (1971) created a laboratory technique to estimate the effects of repetition across media. Montgomery and Silk (1972) used econometric modeling to study the influence a mix of media had on 54 monthly observations of market share. den Boon, Bruin et al. (2005) reported on a continuous study they conducted with 100 respondents a week to estimate the synergy effects of magazine and Internet and television on “brand attitudes”, brand knowledge and reported behavior. The Simon and Arndt (1980) paper discussed above examines over 100 studies towards estimating a response function where the vast majority use recall, but also included very few examples of cross-media synergy.

Cross-media evaluation and integrated marketing communication have prompted much recent focus on synergy. Northwestern University’s Integrated Marketing Communications Department with BIGresearch conducts Internet email surveys to assess synergy effects (Schultz (2006)). The measures for exposure and response are recall-based.

Many of the industry cross-media studies are conducted to promote the second media. These include the Madansky and Graham (2004) paper above, which was conducted to support the use of Internet with other media. A very similar study, Rush (2008) promotes cable and Internet and used Dynamic Logic’s AdScout tracking system with self-reported media data. The tracking system monitors intent to buy and commercial recall. Brand Key’s has a different technique based on perceived brand characteristics combined into a “brand equity” metric (Passikoff and Fromm (2008)). Dixon and Shapiro (2008) used a laboratory environment with a simulation model to predict the synergy between many media for advertisers. The response measure is “brand preference”.

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3.5 Reach and Frequency as Response

Synergy is often used to measure reach rather than response. Reach is a measure of the number of individuals that were exposed to an advertising campaign. It is generally expressed as a percent of the population and is based on exposures within a four-week period. There have been some studies on the combined delivery of audience or of reach across media, although this information is very slim (Killion (1990); McConachie and Uyenco (2002)). Only those persons in the population that are exposed to a commercial can be influenced by it, so measuring the combined reach of multiple media is very important, but only the first step towards determining if that exposure influenced sales. Therefore, studies in this area do not address the problem statement for this dissertation.

3.6 Gaps in Knowledge

As detailed in the previous section, there have been many studies that work toward a better understanding of synergy and its impact on sales; however, there are none that measure more than one medium using actual exposure to media with sales as the response measure. There are specific gaps in knowledge about: 1) multiple media, 2) actual media exposure and 3) sales as a response measure. This dissertation will use data from a project that captured this information to better understand how synergy works.
4. WHY THIS RESEARCH IS IMPORTANT

There has been a continual struggle between the art and science of making advertising media planning decisions. Science needs numbers and quantifiable results to make decisions but there are many aspects of effective advertising that are difficult to quantify. As the demand grows for accountability and return-on-investment (ROI) measures for all business decisions, including advertising, the focus on quantifying the advertising decision process has grown in importance. One key area that has lacked a scientific approach has been the measurement of the benefit (if there is one) of using multiple media in the advertising campaign. The aim of this dissertation is to provide a deeper and broader understanding of how advertising in multiple media influences sales.

4.1 Academic Calls for information on Synergy

Schultz, Block et al. (2009) cite the work of Zaltman (2003); Du Plessis (2005) to support their proposal for a new model for marketing planning based on the availability of new vehicles for delivering a message and advancements in our understanding of learning and memory:

“New research on how the human brain works has done much to help marketers understand how their messages are taken in, processed, stored and recalled for later use. . . . the brain is a set of networked and interconnected impulses and impressions. Thus many of the assumptions on which media planning has historically been based are seriously challenged today. . . . Today’s consumer media world is one where people are accessing and assembling multiple messages from multiple media forms through various methods of media multitasking and trying to fit all these into some relevant structure for themselves.

If a consumer is taking in, processing and responding to the panoply of media that simply surrounds and inundates him or her today, and if the mind is more a network of related and associated
experiences and influences, the question moves from traditional media planning, in which efficiency is the primary goal and the optimization of message distribution is paramount, to one in which consumer acceptance, engagement and response are the key goals. . . Clearly, media synergy – that is, how media forms interact at the consumer level – is a key element in moving forward.

Therefore, although we must approach the study of media synergy differently today than we would have in the 60s, it may be more important now than ever. The value of media synergy has never been quantified, or the efforts to do so have not used accurate measures or have had limited data available. This is an outstanding question begging to be answered by people who have access to single source data.” Schultz, Block et al. (2009)

Therefore, although we must approach the study of media synergy differently today than we would have in the 1960s, it may be more important now than ever. The value of media synergy has never been quantified, or the efforts to do so have not used accurate measures or have had limited data available. This is a currently unaddressed question to be answered by researchers who have access to single source data.

Colin McDonald, the earliest creator of single source data, concurs:

“We also know from other multimedia studies that media synergy (e.g. print plus TV) can have greater effects on attitudes than either medium alone, and it is therefore reasonable to expect that similar synergistic effects would show up in behavior. This urgently needs investigating.” McDonald (2007)

4.2 Industry Calls for Information on Synergy

In 1977, the Media Communications Council of the Advertising Research Foundation asked many of the country’s largest advertisers and advertising agencies to make suggestions for future media research. Naples’ reported the results in his 1979 review of marketing communications research, “The category of highest interest of those responding was in knowing more about the effects of one or more messages in terms of realized sales potential.”
Yet 30 years later, after considerable research, industry continues to identify this as a critical need. When asked to identify the most important questions that could be answered by the data collected by Project Apollo used in this dissertation, Donald C. Gloeckler, Manager of North American Media Research for The Procter and Gamble Company, answered:

“Controlling for everything else, is there value in reaching consumers across different media channels? For example, is one impression in print and one impression on TV more valuable, all things being equal, than two impressions in either medium alone? What else can we learn about media synergy?” Gloeckler (2005)

This information need is even more critical now because of the explosion in both media forms and data that has been derived about them in the last 30 years. Media companies are also interested in synergy because, as their empires have grown across media channels, the challenge of finding ways to bundle the media together and sell a combined package has grown. In the newest edition of the fundamental textbook, Advertising Media Planning (in print for over 25 years with seven editions), Roger Baron writes:

“Cross media channel planning has also become a major focus and concern for advertisers and their agencies as well as media companies that now own multiple channels and want to be able to bundle and sell cross-media deals. This practice is almost impossible without reach and frequency measures and without some way of evaluating the synergy between multiple media.” Sissors and Baron (2010).
5. LITERATURE REVIEW

This literature review will cover the historical context for research-based media planning, the history and usefulness of single source data, and analysis techniques that have been applied to single source data. The discussion of the historical context of research-based media planning will include the impact of the development of new media technologies and the increasing complexity of decisions about how and where to invest advertising dollars and how to measure return on investment. The discussion of single source data will provide a definition and historical basis for this type of measurement and will describe its advantages as a solution to the problem stated in this dissertation. The discussion of analysis techniques that have been applied to single source data will provide a background for understanding the techniques that will be used in this dissertation to analyze the Project Apollo dataset.

5.1 Setting and Context for Proposed Research

In order to understand why we are where we are today, we must understand the history of this question in the context of the advertising research world. The question of how advertising across media influences sales has been central to the media planning process for over forty years. There was significant promising research in the beginning, when the media and consumer worlds were relatively simple, but since then, while there have been many attempts to understand elements of the question; the data has not existed to examine this question for today’s much more complex world. This section describes the media landscape this question has “lived” in for the last forty years.
5.1.1 History of Media Planning

In the early days of radio and television, a company would make its product known to consumers by sponsoring a program, which meant all of the advertising messages in that program were for their brand(s). Media planning largely consisted of producing and developing shows. Ted Bates created, packaged, produced and sponsored many Colgate programs including *The Colgate Comedy Hour* (1950-1955) and *The Doctors* (1963-1980) (Wikipedia (2009); Wikipedia (2009)). *The Texaco Star Theatre* was created for Texaco, but its star became so famous that it became *The Milton Berle Show* and Milton Berle became Mr. Television (Wikipedia (2009)). The program *I Remember Mama*, sponsored by Maxwell House Coffee, ended each episode with the cast on the back porch drinking a cup of Maxwell House Coffee. The first measurement to assist in the decision about where to invest advertising dollars was audience size (Douglas (2004); Chapman (2005)).

As more vehicles became available in television and radio, companies began to buy media spots on multiple programs. The need to choose among many programs in which to advertise created a need for additional measures to inform those decisions. Because media evolved one medium at a time, the measurement of each medium developed independently. Thus, most media information is for a single medium.

Very quickly, measurement of audience size was not sufficient and measures of reach and frequency were developed (Kamin (1978)). In brief, reach is the number of unique individuals who are exposed to an advertising message and frequency is the average number of times each individual is exposed to the message. Advertisers and agencies soon began to explore ways to better understand the dynamics between the two. Kamin (1978) summarized these efforts as follows, “The media mix selected by the planner is usually the one that offers,
on balance, the best strategic combination of reach and frequency over a specified campaign period.”

5.1.2 Today’s Complex world vs. Forty Years Ago

The early world of advertising was very simple. As a need for measures of advertising effectiveness rose in the late 1960’s and early 1970’s, important research work in this area was performed by McDonald (1970); Geiger (1971). However, in their world advertising was still inexpensive and, due to the simplicity of the market and of consumer behavior, the decisions required were not very complicated and therefore there was no driving need for better measures of advertising effectiveness.

Now, thirty years later, the world of marketing communications has exploded. There are many more media types and within each type, thousands more vehicles (for instance, in 1965, half of the markets in the country had only 1 television station and only 20 markets had more than 3 stations while in 2007 the average home received 104.5 stations (MIAD (1965); Nielsen (2007)). The advertising environment is also much more cluttered (where-ever it is possible to advertise, there are many more ads). For instance, on television, there are often twelve minutes of commercials per half-hour now, or a possible twenty-four minutes per hour, versus nine minutes per hour in the 1960’s. In addition, commercials were longer in the past: three-quarters of commercial minutes were sold as 60-second spots and one-quarter were 30-second spots, while today, 57% of commercials are 30-seconds long and the vast majority of the balance are 15 seconds long. These two changes combined mean that a person in 1965 saw on average 10-12 commercials in an hour vs. 50-60 commercials per hour today (MIAD (1965); Nielsen (2007)). This influences both the ability of advertising to
influence behavior as well as the ability of researchers to measure exposure to advertising (Brown and Rothschild (1993)).

Consumers have a more fractured attention span today. It is not uncommon for consumers to surf the web, often while instant messaging five other friends and talking on the phone at the same time with the television on in the background. Ball State University’s Center for Research Excellence and Sequent Partners recently paired with Nielsen’s Center for Research Excellence to do a massive ethnographic study of two waking days of 476 people’s media usage habits, measured at 10 second intervals (Sequent (2009)). They report that for television viewers, twenty percent of the time, people have concurrent media exposure, with half of that being to other media and half to media and other life activities such as eating and traveling.

There are many more brands and brand extensions today than there were in the 1960’s and 1970’s, resulting in more competition and more choices for consumers. McKinsey reported that the number of brands across six major product categories rose from 701 brands in 1997 to 829 in 2003, or an 18 percent increase in five years and that the number of products on grocery shelves tripled in the 1990’s (McKinsey (2003)).

The increases in advertising expenditures and the cost-per-thousands advertising exposures have up until this current recession generally outpaced inflation (see Appendix 12.3.) Businesses today are much more focused on the bottom line, and, in turn, demands for return-on-investment (ROI) measures and accountability are much higher now than they have ever been.

The investment in research has not kept pace with this explosion in the complexity of the advertising investment decision, in part because collecting the data is now dramatically more complex and expensive than it was in the 1970’s. The complexity derives from many more
vehicles, resulting in much smaller audiences, lower response rates, and fragmented consumer attention. As ratings (the percent of the population watching a program) have gotten smaller, the sample required to measure each commercial gets exponentially larger. This is compounded by lower response rates. Response rates have fallen dramatically from the norm of 70% for audience measurement in the 1970’s to 40% response rate today with extraordinary efforts and a more typical 10-20% response rate when comparable incentives and re-attempts are used as were used in the 1970’s (Boyd and Westfall (1965); Groves (2006)). This has not only led to a need for larger samples, but also increased difficulty and costs in collecting data due to the need for higher incentives. The complexity is also compounded by more fragmentation of consumer’s attention which requires passive, electronic techniques to measure their behavior, since diaries can no longer reflect actual behavior.

The above developments have accentuated the need to collect larger and more expensive samples, using higher incentives and expensive passive electronic techniques, in the study of advertising effectiveness.

This new media landscape has created more complex media planning questions and research needs. In his review, Schulz (2006) stated the need for new measurement methodologies that fit the times: “Today there are more media forms and more consumer interaction; this, coupled with increased consumer knowledge, requires new methodologies far different from the traditional media planning approaches.”

In 2005, a joint research effort called Project Apollo was formed by Nielsen and Arbitron, two market research companies. Project Apollo, which cost over $100 million in its two years of existence, was a major attempt to collect the required information to help
understand how advertising works in today’s complex media world using a single source solution.

5.2 Single Source Solutions

The definition of single source data is measurement across time of advertising, marketing and sales or response from the same persons or households in a panel (Baron (1992); McDonald (1992); Wood and Gloeckler (2007)).

The critical data components required for single source data to enable analysis of advertising’s ROI is exposure to commercials and sales or critical response measures. Often what is measured is exposure to media and commercial monitoring, which can be linked together to get exposure to commercials.

There are additional ancillary variables that are also very valuable to get an accurate estimate of the sales response. These are primarily variables that can explain correlations between exposure and purchase. For instance, it is well documented that larger households watch more television and thus see more ads and also buy more products. Variables that can be used to remove this bias from the analysis might be total hours of television viewing, household size or measures of a household’s historic level of purchase.

Additional variables are always welcome and might include other marketing variables such as display and feature, in-store advertising, packaging and shelf positions to name a few. It is also preferable to have multiple media – TV, radio, print, Internet, outdoor, cinema and today more and more cell phone and mobile devices. Geographic, demographic, psychographic, life stage and life style variables can also be valuable.
5.2.1 Single Source Data - Historical background

Single source data has been collected only a few times since 1967. Each time, the data collection lasted at most two years, although in all but the first attempt it was intended to be an ongoing syndicated service. Each attempt has had slightly different problems, but universally there has been a lack of developed analytics that could be applied to the data, and, up until Project Apollo, the sheer computing power required to make use of the data was limited and, where available, extremely expensive. In addition, the cost of collecting this data can be extremely high. The estimates for the cost of Project Apollo were over $100 million for the two years it was in existence. Without many powerful ways to use the data to make decisions where the improvement in decision making was financially measureable, these costs would be very hard for the advertising industry to support.

The following timeline details the various attempts at single source collection and the kinds of analyses that were conducted on each dataset.

1967 – Colin McDonald and Joan Geiger

Single source data was first collected by Colin McDonald and Timothy Joyce in 1967. They collected complete diaries from 255 housewives in England who record every purchase they made and every commercial they saw for thirteen weeks (McDonald (1970)).

“The original purpose of the project was part of the development of what later became the TGI. The question was to test whether to use a diary method or a single interview method. In the event it was decided to use single interviews, but we were then left with this completely new data source. Timothy Joyce, who was in charge of the TGI project, then had the bright idea of asking me to take a look at it.” personal communication from McDonald (2010)

McDonald summarized his findings as follows:
“1. People are 5% more likely to switch to than from a brand when, in the interval between the two purchases, they have seen two or more advertisements for the brand. This holds on average over nine product fields studied. 2. This effect is stronger for advertising seen within four days from the second purchase. Thus, if short-term increases in purchasing are desired, it pays to ensure that the advertising is seen in the same week. ....3. Three or more exposures do not appear to have a stronger effect than two...4. Although the sample breakdowns are rather too small to be conclusive, the same effect appears to operate both for press and TV advertising.” McDonald (1970)

McDonald also validated that total weight of viewing was highly associated with weight of purchase even if the ad was for another brand. In other words, straight tabulation of the data without regard for covariates would “not do here” (McDonald (1970)).

At the same time, Joan Geiger conducted a similar study in the US. She collected TV media exposure over seven days from the current TV rating source, and purchase and purchase intent from the same 980 women in two markets in the US using another service: CG Hooper (Geiger (1970)). This study explores the dual nature of frequency within viewing quintiles and frequency as a share-of-voice measure. Interestingly, this study has never before been included in the literature about single source data. After finding Geiger’s in-house paper in my files (I worked at Ted Bates in the 1980’s), this author discovered that it was also published with blinded brands as an article in The Journal of Advertising Research (Geiger (1971)).

Joan Geiger, who conducted the research, worked in the marketing research department for over twenty years and then in 1966 was asked to head the media research department. In her prior job, she would have been focused on researching brands. In her new role, she decided to apply the same sorts of research methods towards understanding media questions. This work is extremely nuanced and attempts to answer the synergy and frequency question
with an open mind. When the first set of results were mixed, she dug deeper and looked for variables that might be critical to understanding how media worked. Joan Geiger was also the ghost writer for the famous “Reality in Advertising” book by Rosser Reeves who invented USP (Unique Selling Proposition) (Reeves (1961)).

The Geiger study was largely ignored by Ted Bates. Walter Reichel, who was the Media Director in charge of all media in 1971, never saw it. In fact, as he tells it, when he decided to embrace effective frequency, he was unaware of this work that refuted effective frequency by showing that there is not a single threshold frequency level, but rather each person has a different threshold based on the number of commercials he or she sees for the category (private communication (2009)).

Why was the study also ignored by Mike Naples, who was the president of The Advertising Research Foundation? He would have certainly read this article; he was President of the Foundation when it published the article, shortly before he wrote the book: Effective Frequency. He included in the book Colin McDonald’s article from the same period in entirety. Fred Brandt who worked for Ted Bates throughout this period, and later became head of the Department remembers that there was a paper Ms. Geiger wrote, but that it was not important because the findings were too complex and did not fit with current thinking (private communication (2009)).

The paper has been cited ten times for the use of frequency as a relative measure rather than an absolute one.

1981-1982 – IRI

Roughly fifteen years later, IRI created BehaviorScan as a test market tool with addressable advertising and shopper scanning. Five categories of data were donated to the
Advertising Research Foundation in 1982 and were used by five academics and one media/marketing researcher (myself) (Garrick (1984); Batra, Vanhonacker et al. (1988); Tellis (1988); Wood (1989); Pedrick and Zufryden (1991)).

1989 - ScanAmerica

In 1989, ScanAmerica was formed by Arbitron as a single source data set in Denver, CO, but lasted less than a year (McKenna (1987); Kamin (1989); Wood (1990)).

1990-1991 – NPD/Nielsen HomeScan

Then in 1990-1991, Nielsen joined forces with NPD, a market research firm, to create NPD/Nielsen which was much more widely used by marketing researchers (Reichel and Wood (1994); Broadbent (1995); Ephron (1995); Jones (1995); Jones (1995); Koschat (1995); Assael and Poltrack (1996); Gibson (1996); Broadbent (1997); Jones (1997); Longman (1997); McDonald (1997); Naples (1997); Reichel and Wood (1997); Schroeder, Richardson et al. (1997); Tellis (1997); von Gonten and Donius (1997)). The NPD/Nielsen data dramatically changed how media was planned. By this time, the concept of Effective Frequency was firmly ensconced in the American media planning process, in large part due to the Mike Naples book which included Colin McDonald’s early single source data work (McDonald (1970); Naples (1979)). When the NPD/Nielsen data was analyzed, first Reichel and Wood and then Jones refuted Effective Frequency with the concept of Recency Planning (Jones (1995); Reichel (1997)). Recency Planning is now standard practice in the advertising industry.
1990 to present

In Europe there have been several attempts at single source data. These have been GFK sponsored with agreements with BehaviorScan. The first was in Germany in the early 1990s which had 3,000 households which had split-cable reception so that ads could be served to one group of households or the other. The households through BehaviorScan had frequent shopper cards that worked in at least 90 percent of the food retail stores in the market. This capability differs from current single source datasets in that the advertising delivery was managed by the research company to create test and control cells. Litzenroth did the analyses of these data and found similar findings to the U.S. market studies (Litzenroth (1991)). In France, the service is called MarketingScan and started in 1993. It is currently measuring 2 markets with roughly 5,000 households where they collect television, Internet and magazines with a cross-retail/supermarket frequent shopper card. This data has been used extensively by Cognizant, the research department of M&M/MARS as well as by Marketing Scan themselves. The majority of published work for these data has been for test marketing.

2006-2008 – Project Apollo

Project Apollo was launched in early 2006 as an offshoot of Arbitron’s National Marketing Panel, which was testing the concept of a PPM/IRI based single source measurement system. The panel for this concept test was IRI’s BehaviorScan panel. In early 2006, Arbitron, at the request of Procter & Gamble, re-configured the panel to be a joint venture between Arbitron and Nielsen with HomeScan providing the panel and the scanner data. The details of the Project Apollo panel are included below under Data Description.
5.2.2 Current Single Source Datasets

MarketingScan has maintained their panel in two markets in France. This data holds great potential for analysis of synergy, frequency and further study of how advertising works. The author is working on obtaining permission to work with this data.

TRA, a research firm, has recently created a panel of households through name and address matching of set-top box data and frequent shopper data. TRA holds much promise in part because of the extremely large samples that are possible through matching these two sources of passive data. TRA currently has 30,000 households which are matched and has plans for expansion of the panel to 300,000. This data because it is based on set-top box data is TV only. If other data were available with name and address details, this data could also be combined.

5.2.3 Future Ways That Single Source Data Can Be Created

The future of single source data is extremely bright. Through name/address matching many existing data sources can be combined to create single source data. TRA has combined set-top box data with frequent shopper data and, with the vast amounts of data collected across many areas of the economy, the possible data sets that can be combined will only grow. Privacy concerns are the major hurdle toward this evolution, although TRA has managed to develop a method that preserves the security of the personal data while making the use of the data possible. The other kinds of data that can be imagined as possible information to combine are Internet services that track consumer Internet behavior through computer software such as Comscore and NetRatings. RFID (radio frequency identification) tags have the possibility of becoming an electronic measure of magazine reading and GPS tracking offers the ability to track exposure to outdoor advertising since all outdoor billboards
now have a GPS address. Arbitron’s PPM and IMMI’s cell phone device can currently detect
signals in the environment and track a panelists exposure to advertising in radio, television,
cinema and video games, to name a few. These devices all hold the potential to expand the
possible single source datasets of the future.

5.3 Review of Single Source Analysis Techniques

Single source data has never been widely available to academics or industry for
exploration of analysis techniques. When the data has existed, it has been complex,
expensive and hard to work with. The result of this is that there has been very few analysis
techniques applied to this form of data, even though the possibilities are endless. The
possibilities include applying aggregate data techniques, for instance econometric models, at
a more disaggregate level as well as going from the other direction, starting with each
respondent and using data mining techniques such as neural networks to do the analysis.
This section will detail the methods that have been applied. The methods that have been
applied fall roughly into three groups: 1) AdImpact or STAS, 2) Pre-post analysis and 3)
econometric modeling. AdImpact or STAS is the most widely explored technique and the
proposed method of analysis for this dissertation. It is explained in full in the data analysis
section below.

A pre-post (or pre vs. post advertising) analysis breaks the data into two or three periods:
prior to advertising, during advertising and post advertising (post is sometimes combined
with during.) These periods are then compared to see if advertising has increased purchases.
This technique was used by Flaherty (2007) on Project Apollo data to assess advertising’s
influence. What is not discussed deeply in his paper is how one would account for
seasonality and all other differences that can be attributed to purely different periods of time.
Econometric modeling has been used in several different studies in several different ways. FitzGerald (2008) used regression modeling at the respondent level to determine the effects of advertising from different media. This technique holds great promise primarily in that it recognizes and capitalizes on knowing all of the stimuli and behavior of each respondent across time. This study did not look at synergy, but did report on several different media and their individual contributions to sales. Other econometric models have aggregated the respondent level data in more traditional marketing mix model ways to analyze advertising sales response (Tellis (1988); Pedrick and Zufryden (1991)).
6. ASSESSMENT OF PROJECT APOLLO DATA SET

Project Apollo collected media exposure and purchase from a panel of approximately 5,000 households and 10,000-11,000 people for two years (February 2006 to February 2008.) There is an enormous diversity of information collected for each household, brand and commercial for an extended period of time. For this research, data from December 2006 to December 2007 has been used.

Project Apollo is an extremely complex data set with well over 200 files and almost 100 pages of documentation (Field (2006); Underwood (2006)). See Appendix 12.1 for ERD diagrams. The data includes media and advertising exposure captured via Arbitron’s Passive Personal Meter (PPM, described in more detail below.) Purchasing for each household was captured using Nielsen’s HomeScan In-home scanning wand. Households were asked to identify the store shopped in, the price paid and, for each purchase, if a coupon was used, if the item was on sale or if there were other consumer perceived deals. In addition, each household had a yearly phone interview to collect demographics and two Internet surveys a month to collect issue-specific magazine reading for 100 magazines and purchase of non-consumer packaged goods items such as automobiles, telecommunication, banking, and pharmaceuticals. Each of these data were collected and reported in a different form and for some the form changed across time. Some is transactional data such as exposure to media and purchase, while other data is survey data with updates, such as demographics. Each of these files comes with several dictionaries with purchase having different data formats for each category depending on the types of characteristics the brands might have, for instance laundry detergent can be characterized by form (liquid, flakes, tabs), by concentration (light
duty, heavy duty, various concentrations), by smell and by package size. In contrast, soft drinks would include flavors, pack sizes and not include form, concentration or smell.

### 6.1 Data Collected

The data includes Nielsen’s HomeScan scanner data that provides rich product purchase of FMCG data, in particular items that have a UPC code and will tend to be brought home after purchase. These data has respondent-perceived deal, feature and display as well as coupon use and price paid. Since the data is UPC based, all information available on the UPC codes is also available. These data is household based.

The most rigorously measured media data is collected via the Arbitron Portable People Meter (PPM) electronic measuring device. The PPM is a passive, portable people-metering system that collects exposure to codes that have been embedded in the audio feed of nationally delivered media. These included nationally broadcast cable and network television, some network radio and some syndicated television. The PPM also collected codes that were embedded in the environment such as the audio in supermarkets, restaurants and retail stores.

Commercial for subscribers of Project Apollo were encoded. Only brands that were not subscribers to the data were used; therefore, commercial exposure in this study was for vehicles where the respondent was identified as a viewer/reader/listener to the vehicles audience matched to a known episode of a commercial through the monitoring data.

Print was also measured with an online survey every two months. Reading was issue specific and included an estimate of the day when reading occurred. This allows print to be included in many of the analyses, although with a less accurate measure.
6.2 Quality of the Data

6.2.1 Arbitron’s Portable People Meters (PPM)

The key performance indicators tracked very well for such a heavy respondent burden. Arbitron tested consumers’ compliance with the PPM for more than a decade. Previous results from the Philadelphia and Houston local-market evaluations and the National Marketing Concept test panel showed high levels of compliance with the main PPM task of wearing the meter throughout the media day (Webb and Patchen (2003)).

These key performance indicator tables are only available for March 2006 until March 2007. See Figures 6.2.1.1 and 6.2.1.2.

Figure 6.2.1.2 – COMPLIANCE RATES

Figure 6.3.1.2 – INTAB RATES
Panelists generally average 14-15 hours of carry time, based on time-stamped motion-sensor information collected by the PPM device. See Figure 6.2.1.4.

Figure 6.2.1.5 – PPM CARRY TIME

The carry times are based on the following start (Un-Dock) and stop (Dock) times. See Figure 6.2.1.4. The panelist is asked to “Dock” their meter every evening in its docking station. The docking station has a small LED screen on it that plays back the name of the panelist to ensure that PPMs remain with the correct person in the household. It also reports the amount of carry time for the day and congratulates the respondent and tells them the number of points that earns them in the current sweepstakes. It is requested that the docking station be set up next to the bed in each person’s bedroom.

Figure 6.2.1.6 – MEDIA UNDOCK/DOCK TIMES
Figure 6.2.1.7 details the representativeness of the Project Apollo Panel in March 2006 (Gloeckler, Dupree et al. (2006)). While the panel is slightly older, slightly more single person households and slightly better educated, it is very representative of the population considering the burden to respondents.

Figure 6.2.1.8 – PANEL MEMBER REPRESENTATION VS. POPULATION ESTIMATES

<table>
<thead>
<tr>
<th>Household Size</th>
<th>Education of Male Head of Household</th>
<th>Index</th>
<th>Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Member</td>
<td>High School or Less</td>
<td>106</td>
<td>98</td>
</tr>
<tr>
<td>2 Members</td>
<td>Some College</td>
<td>101</td>
<td>103</td>
</tr>
<tr>
<td>3-4 Members</td>
<td>College Graduate</td>
<td>97</td>
<td>108</td>
</tr>
<tr>
<td>5+ Members</td>
<td>No Male Head</td>
<td>93</td>
<td>94</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Age of Female Head of Household</th>
<th>Education of Female Head of Household</th>
<th>Index</th>
<th>Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>18-34</td>
<td>High School or Less</td>
<td>76</td>
<td>94</td>
</tr>
<tr>
<td>35-54</td>
<td>Some College</td>
<td>111</td>
<td>103</td>
</tr>
<tr>
<td>55+</td>
<td>College Graduate</td>
<td>108</td>
<td>116</td>
</tr>
<tr>
<td>No Female Head</td>
<td>No Female Head</td>
<td>89</td>
<td>89</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Race</th>
<th>Householder Occupation</th>
<th>Index</th>
<th>Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>White-Collar</td>
<td>101</td>
<td>101</td>
</tr>
<tr>
<td>Black</td>
<td>Blue-Collar</td>
<td>98</td>
<td>106</td>
</tr>
<tr>
<td>Other</td>
<td>Other</td>
<td>92</td>
<td>94</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Presence of Children &lt;8</th>
<th>Hispanic</th>
<th>Index</th>
<th>Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>Yes</td>
<td>98</td>
<td>88</td>
</tr>
<tr>
<td>No</td>
<td>No</td>
<td>101</td>
<td>101</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Income</th>
<th>Census Region</th>
<th>Index</th>
<th>Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;$25K</td>
<td>East</td>
<td>90</td>
<td>104</td>
</tr>
<tr>
<td>$25-$35K</td>
<td>Central</td>
<td>100</td>
<td>102</td>
</tr>
<tr>
<td>$35-$50K</td>
<td>South</td>
<td>107</td>
<td>99</td>
</tr>
<tr>
<td>$50-$69K</td>
<td>West</td>
<td>106</td>
<td>95</td>
</tr>
<tr>
<td>$70K+</td>
<td></td>
<td>103</td>
<td></td>
</tr>
</tbody>
</table>

6.2.2 HomeScan

Compliance is not measured or reported for Nielsen’s HomeScan panel as a whole; however HomeScan requires that each household purchase “enough groceries for their family size and region of the country” each week for them to be considered “good” and be included
in the sample. This threshold varies by the reporting period, so that households must qualify as “good” for at least ten months in a year to be considered in the “static” or usable sample.

6.3 Data Editing and Unification

These analyses start by selecting the static group of respondents/responses to include. Because this is panel data where respondents can have periods of time when they do not comply, this means defining the process to determine “good” data. In this respect, the differences between media and marketing worlds are dramatic. Media tend to have extremely high standards for reportability of data. This is mandated by the use of ratings data as a currency to make buying decisions. Project Apollo is not designed to make those decisions, so the editing rules for media can be relaxed to be more in line with general marketing editing and unification rules. This is a necessary relaxation because the burden on the single source respondent is great. Therefore there is an expected non-compliance rate for “good”, “complying” respondents.

Often in media analyses, editing and unifying the data is done prior to determining the weights used to project the sample to the population measured. Weights are used primarily to balance a sample for known biases in data collection and reportability. When the analysis is based on modeling return on investment, the biases inherent in return on investment are not known. In other words, the activities which modeling is attempting to uncover cannot be weighted for properly in the sample. One would need to know the distribution of that behavior across the population in order to properly weight for it.

6.4 Data Structures

The original design of the data optimized for storage and attempted to be third normal form with no dependencies on key variables. This means that there is a file or dictionary for
every variable. Since there were many different collection methods, data streams, as well as shifting deliverables (variables being added, changed or dropped), the resulting complexity made it almost impossible to use the data. To counter this, particularly after the data stopped being collected and became a complete dataset, a set of key tables was designed with all of the available information of each type in them. This is almost like taking the processing through the first few steps to connect relevant files and then the last few steps to include proper variable names once. The resulting files then become easy to use and easy to understand. This was particularly important for functioning in a development mode. A production system would probably go back to the original form and re-build the tables to be optimized for speed and storage.

Four main sources of data each collected differently with different rules: 1) media usage, 2) scanner purchase, 3) demographics and geographics and 4) survey data on print, other media and non-FMCG purchases. In addition, outside datasets are required to understand these. In order to turn media exposure into advertising exposure there are encoded commercials and advertising monitoring data that defines when commercials air.

This data was also delivered in several different formats based on the source of the data and the size. Files that were in general large and of a transactional nature were delivered as comma delimited text files. Semi-static files and dictionaries were delivered as xml files. In general, the transactional files were incremental and the semi-static files were cumulative, although this was strictly adhered to. Some of the required dictionaries were also not delivered as files, but rather were included in the specification documentation (Field (2006); Underwood (2006)). These were generally short dictionaries with less than one-hundred items.
6.5 Anomalies in data

Media data in general and Project Apollo data specifically have some complicating anomalies in the data. These include how dates are reported, how time is reported and how weights and report periods were determined across different data elements.

6.5.1 Media Date (5am Start)

While every commercial and viewing/listening occasion actually happens on a given date, that date is translated to a media date to reflect the way consumers consume media. Most people wake up after 5am and some go to sleep after midnight. For instance, the late night talk shows commonly air from 11:30pm – 1:30am. These programs are said to air on Monday – Friday nights. But a show on Monday night at 12:30am is really on the air Tuesday morning. To account for this, the 24 hour day is divided at either 4am, 5am or 6am to create a media day. Project Apollo used the 5am break, so that commercials that aired at 4:30am were said to be part of the previous media day.

6.5.2 Local Time/Universal Time - Broadcast Time/Exposure Time

America includes multiple time zones, but generally only broadcasts nationally on two feeds – the east coast feed and the west coast feed. That is why, for example, a program is announced as airing at 9pm (8pm Central) on the east coast. The time that a consumer views a commercial may need to be reported in both: local time to understand how that viewing related to the person’s day, for instance daypart, and in broadcast time to understand what commercial was airing in the feed.
Project Apollo data included two time descriptors to accommodate this: local time and Universal or Greenwich Mean Time (UDC) time. Local time was accompanied by the time zone the person was in.

### 6.5.3 Weights and Reporting Periods – Households vs. People

The Project Apollo data included data from multiple technologies each with different compliance requirements. Data from Arbitron’s PPM was person based with a daily intab criterion. Data from HomeScan was household based with a monthly intab criterion. In order to combine these data, the person’s data had to be connected to the household data through a dictionary, and then rules were developed to determine if a household met enough of the criteria. This is complicated by the need for different reporting periods for each data type. Typically, either a specific purchase occasion or a series of purchases across time would be of interest. For a specific purchase occasion, the household only had to be intab for HomeScan in that month. For a series of purchase occasions, the household had to be intab for seventy-five percent of the months in the time period. However, this purchase information was then connected to exposure data, where the period of exposure was often not the same as the period for purchase. For instance, AdImpact measures exposures over the prior month for a single purchase occasion. In this case, the household had to be intab for HomeScan for the month of the purchase occasion as well as the four weeks prior to that date for PPM.

The weights provided with Project Apollo were designed to weight respondents back to a balanced demographic and geographic population. However, for the purposes of response, these weights have too high a variance to believe that the differences in response are as different as the sample bias in the panel. For instance, it is common to see differences in
weights on the order of 1:30. A respondent in the poorly measured cell may be “worth” thirty times as much as the respondent in the well measured cell, but the influence the advertising has on that respondent is not thirty times as strong as the influence on the well measured respondent. So, for the purposes of examining response, the weights were not applied in analysis. However, projection weights were examined as a possible covariate as described in section 7.

6.6 Limitations of the Data

While Project Apollo has been called the “Gold Standard” for single source data, it does have limitations. These limitations are: 1) sample quality and sample frame and response rates, 2) limited media included, and 3) limited nature of FMCG brands. Each of these will be discussed below.

The sample frame for Project Apollo was existing HomeScan panelists that had at least six-months of scanned data. Therefore, by definition, the response rate for Project Apollo was limited by the starting response rate for HomeScan of approximately 10-20 percent; Gibs (2009). These households were then recruited to carry a PPM and respond to regular Internet surveys. That reduced the response rate even further. The HomeScan panel has an element of quota sampling against a thirty cell grid comprised of demographic criteria which resulted in Project Apollo having a population distribution that matched fairly well, for a marketing panel, to the national population. Nonetheless, with such low response rates, it is impossible to quantify the impact this would have on Project Apollo findings.

Arbitron’s PPM collected all encoded signals in the environment. These included all broadcast networks for the second year, all cable networks for both years and national broadcast radio networks for some of the second year. Local radio was not encoded due to
the high cost of placing an encoder in every local radio station (3,000+ stations.) It also included encoded commercials for the participating advertisers. This allowed an advertiser to put a code in every commercial and no matter where it was played, or copied and then played, the PPM would pick it up. This allowed participants to measure media that were not directly measured, so the mix and breadth of media that could be measured for participants far exceeded the media that is available for advertising of non-participating Project Apollo companies. Since the data used for this dissertation is for non-participating companies, the media that could be included was television and magazines.

Another drawback to Project Apollo is that the majority of data on purchase is for FMCGs. There were twice monthly surveys to include other types of products, but none of these achieved the level of depth or continuity that scanned UPC based purchases did. This limits our understanding to FMCG products.
7. ANALYSIS OF DATA

7.1 Analysis Technique

Single source data has been analyzed in very few ways, most of which have not been explored beyond a first attempt. The methods that have been conducted include using aggregate-level techniques and models and applying them at the disaggregate or less aggregate level data. The most common marketing models include logit or choice or econometric models (Guadagni and Little (1993); Glonek and McCullagh (1995); Tellis and Weiss (1995); Freeman (1997); Balasubramanian, Gupta et al. (1998); Cook (1998); Nevo (2000)), the Hendry (1994) model or the Dirichlet model (Goodhardt, Ehrenberg et al. (1984); Fader and Schmittlein (1993); Ehrenberg, Uncles et al. (2004); Kennedy, McDonald et al. (2008)). An alternate approach is to use techniques that were developed outside of marketing and apply them to this data. These methods include neural networks; Gurney (1997), agent-based models (Bankes and Gilbert (2002); Bonabeau (2002); Sannchez and Lucas (2002); Hazy and Tivnan (2004); Shi and Brooks (2007)), Expectation Maximization; Spangler, Gal-Or et al. (2003), Monte Carlo Markov Chain (Muenz and Rubinstein (1985); Lunn, Best et al. (2005)), Bayesian technique; (Jaynes (1996); Andrews, Ansari et al. (2002); Baesens, Verstraeten et al. (2004); Gilula, McCulloch et al. (2004)) and other data mining tools to name a few. Some of these have been tried on single source data, but have had very limited use in this area. They warrant deeper exploration. However, for the purposes of this dissertation, the method that is being applied is the technique that has been explored most, which has two variations called AdImpact or STAS.
7.1.1 Definitions of AdImpact and STAS

The fundamental element of AdImpact and STAS is the focus on the purchase occasion. All data is analyzed in relationship to household, date and time of the purchase. Exposure to advertising is related to the purchase using a variable window of exposure, i.e., an ad was seen by the household x number of days prior to the purchase occasion. Brand choice, price, promotion and deal are evaluated for the purchase occasion. The vast majority of the work with these measures has been on brand share, but recently this author has been working with Media Trust LLC exploring ways to expand AdImpact to evaluate price, loyalty and category and brand purchase volume. These will be included here where applicable. The general form of the AdImpact equation is:

$$\text{AdImpact Score} = \frac{\text{Brand Share Among Exposed Purchases} \times 100}{\text{Brand Share Among All Purchases}}$$

There are several key differences between STAS and AdImpact:

AdImpact uses a denominator of all purchases, while STAS uses a denominator of Non-Exposed purchases. AdImpact uses a variable window on exposure – for instance: a numerator of Brand Share among purchase occasions exposed in the last 1 day, or last week, or last month, while STAS uses a fixed window of exposure within the last week.

As discussed earlier, AdImpact covariates out variables such as total television viewing levels and deal variables.

The first two differences between STAS and AdImpact depend on each other. STAS is able to report Exposed vs. Non-Exposed because it uses a narrow window on exposure. As the window on exposure expands, for instance to a month, the purchase occasions that were not exposed can be extremely small to non-existent for moderately well-advertised brands.
This is because larger advertisers often deliver high reach levels in a four week period especially for brands that have multiple sub-brands and therefore multiple advertising campaigns running at the same time for the same parent brand. When the denominator approaches zero, the index will be very unstable and approach infinity.

However, the use of all purchase occasions in the denominator does understate the influence of advertising because AdImpact will approach 100 as reach approaches 100 percent. For low levels of advertising, STAS and AdImpact are virtually identical as regards the calculations because the difference in share for all purchase occasions and non-exposed purchase occasions are virtually identical because the exposed purchase occasions are a small portion of the purchase occasions.

There are inherent problems with using an index as a measure. Indices are very useful when brands of comparable size are being compared, but an index disadvantages large brands when compared to small brands. For example: a brand with a 1% share will have a 200 index if the brand share is raised to 2%, while a 20% brand will have a 105 index when the brand share is raised by a comparable 1% to 21%. This is particularly a problem in that it is perhaps easier to raise a 1% share brand to 2% than a 20% share brand to 21%. There is an opportunity here to explore methods of calculating AdImpact in ways that are not an index, but perhaps are a share difference or a measure of the actual gain over the possible share gain. It was originally felt that, for this dissertation, the original index would be adequate, because a comparison of advertising effects of large to small brands was not being made. However, the actual brand share was included in all analyses so that this factor could be accounted for. In the process of looking at the effects of frequency and synergy, brand size did turn out to be an important factor, as discussed in section 7.1.3.8.
7.1.2 Historical Development of AdImpact and STAS

The concept of using the purchase occasion as the unit of measure was introduced by Colin McDonald in his paper on single source data (McDonald (1970)). In 1989, this method was used with Behavior Scan’s 1981-82 data (Wood (1989)). The use of the purchase occasion as the central data to aggregate was very important. It diverged significantly from the more standard measures which looked at data from a time series lens. The use of an index evolved as a way to express the difference in delivery later using ScanAmerica data (Wood (1990)).

When NPD/Nielsen’s single source data became available, Leslie Wood, Walter Reichel, Sheila Paterson and Jay Janis at A:S Link formed a company to explore and develop applications for the NPD/Nielsen single source data. In order to use this data, the group was required to divulge all of their techniques to NPD/Nielsen. Despite a mutual non-disclosure agreement, NPD/Nielsen shared the methodology with John Philip Jones. Jones modified the technique by changing the denominator to non-exposed and reporting a single window of seven days. Jones along with Erwin Ephron were instrumental in making these measures famous and taking the dramatic insights and findings from this work to the industry and helping to transform the media planning paradigm of Effective Frequency to Recency (Ephron (1995); Jones (1995); Jones (1995); Ephron (1997); Jones (1997)).

7.1.3 Covariance Adjustments

Andrew Roberts, Colin McDonald, Len Lodish, Andrew Ehrenberg, Simon Broadbent and Wood & Reichel have all recommended that the available variables be examined for covariance (McDonald (1992); Roberts (1994); Broadbent (1997); Ehrenberg (1997); Lodish (1998)). When covariance are included in an analysis, industry practitioners refer to the
technique as a “multivariate technique”. A “univariate technique” is the simple comparison of values from either one period to another or one group of respondents or households to another.

To “covariate out” the effect of a variable is to adjust for that variable’s possibly biasing influence on the dependent variable. For instance, large households tend to watch more television since there are more people in the home that can be watching at any given time. These households also purchase more products. Therefore, although it appears that households that see more commercials also buy more products, this pattern is the result of the tendency of high television viewing resulting from more people in the home. Hence the biasing influence of television viewing on AdImpact should be removed. In this dissertation, a variable can be considered for further analysis only if it satisfies the following three conditions: 1) a strong impact on the outcome measure; 2) different distributions for both the exposed and non-exposed populations; and, 3) it must have a tendency to bias the results.

The research goal of comparison of print to television exposure called for an additional criterion: different distributions for Exposed-To-TV and Exposed-To-Print conditions. Variables that met these criteria were adjusted for the possible biasing effects of other variables.

Possible Variables for Covariate Step – Definitions

There were seven available variables in Project Apollo that could meet the above two criteria: Projection Weight, Household Size, TV Viewing quintile, Time Shift, Deal Activity, Price, and Loyalty. Each of these is discussed below. As the analysis of the data progressed, an additional variable was considered to bias the results: Brand Size, as measured by volume adjusted to make all units equal in usage. For instance, in Laundry Care, Ultra is far more
concentrated than regular detergents, so that the units of all brands have to be converted to a common equivalent unit.

As discussed in Section 6, households used in Project Apollo were recruited from HomeScan. HomeScan is a quota sample based on major demographic groups. Those households that had provided at least six months of “good” scanning data were then re-contacted by Arbitron. After a month of training and reporting good quality data, these households were then recruited to make up the panel for Project Apollo, which then weighted them based on their demographics. In this dissertation, it was of interest whether projection weights exhibited a covariance with the response measure.

Household size, another variable, ranged from 1-9 persons.

TV Viewing Quintile resulted from adding all of the minutes of television viewing over the period of analysis for each household and then divided them into 12 equal N-tiles with 1 being the lowest level of television viewing and 12 being the highest level. When households with DVRs or VCRs watched a television show after it had been broadcast, the difference in time between broadcast and viewing was calculated and called Time Shift. Total Time Shift is the sum of the number of minutes all television viewing was shifted for each household. For each commercial that was seen, exposure was placed in a bucket or category: no time shift, one minute to one hour, 1-3 hours, 3-6 hours, 6-24 hours, 1-2 days, 2-3 days, 3-7 days and 7-28 days. This variable was named Time Shift.

For each response, Project Apollo designated 148 codes for types of “deal” related to the purchase event. These codes were collapsed into 4 groups: “No Deal”; “Coupon”; “Sale” and “Other”. There were no purchases for “Other” within the six brand categories during this period of time. For this research, the variable was named “Deal Activity”. Project Apollo collected price data only for items that were actually purchased, so price data was not
available for items that were not purchased or for items from stores other than those where the actual purchases were made. To compensate for this, prices were collected for all purchases made by each panel household within six months prior to the purchase event captured by Project Apollo. For each household, the standard deviation of the prices was divided by their mean, to measure the degree to which the household based its purchases on price. This variable was named “Price Covariate”. Loyalty was measured for each household over a six month period as the brand’s share of that category’s purchases. These were then ranked and placed into N-tiles.

**Analysis of Variables to Determine if They Should be Included in Covariate Step**

A full analysis of the seven variables defined above was conducted. Only two variables were found to affect the outcome measure: Deal and Total Television Viewing levels. Coupon and sale were found to be affected in quite different ways by advertising, with coupons showing a higher response and sales showing a lower response. In other words, advertising seemed to make coupons more valuable. The lightest Total TV Viewing 12-tiles were found to be quite different from than the rest of the TV viewing 12-tiles. Therefore, these two variables were included in the final analysis as covariates.

The following figures highlight the differences in penetration for print and television across the values of possible covariates. If there is a distinct pattern, then this variable should be analyzed as a covariate due to its influence on the effect of multiple exposures – in particular, the differences between multiple exposures to different media – on the response variable. Each possible covariate was analyzed in three ways: 1)marginal mean AdImpact scores for exposure intervals by the variable of interest, 2)marginal mean AdImpact score for the variable by exposure interval, and 3)comparison of exposed purchase dollars for print and
television. In an analysis with two variables, the marginal mean for one variable is the mean for that variable averaged across all levels of the other variable. For instance, in our case, one variable is the exposure interval and the other is the variable that is being examined for covariance, for instance HHSize. The marginal mean for HHSize 1 and Exposure Interval 7 is calculated by taking the average of all of the AdImpact scores for HHSize 1 where advertising was seen within the last 7 Days prior to purchase.

In the figures below, the AdImpact scores are differentiated by shading, from very light for 1 day to dark for 28 days. The possible covariate is then arrayed from light on the left to heavy on the right for continuous variables that have been put into n-tiles, or for each individual value for that variable. If there is a strong pattern, then the variable does influence the scores – and should have that influence removed through the covariating technique.

For data shown by exposure interval, the AdImpact arrays are shown from the short exposure interval of a purchase 1 Day prior to purchase on the left to exposure up to 28 days prior to purchase. The lightest lines are for the lowest ntile for continuous variables and for each value for discrete ones. This display highlights the differences between the shapes of the AdImpact curves across the key variable. If there is a distinct difference between the dark and light, then the variable is having an influence on the exposure interval and should be considered for being included in the covariate variables. This is of less importance than the first graph, but still important.

Purchase dollars are shown as the percent of category purchase dollars that were exposed to an ad within the last 28 days. For print, all ads were combined for a single brand, while for television each ad is shown separately. For this reason, print tends to have higher coverage of category purchase dollars. If the television ads for a single brand were combined, the levels would all be very close to 100 percent.
Eight variables are analyzed below in turn. The conclusion that emerged from these analyses was: Deal and TV household Viewing were both important variables to covary for; and, Brand Size increased the readability and understandability of the research findings.

7.1.3.1 Projection Weights

Figure 7.1.3.1.1 below does not show a distinct pattern from left to right for projection weights.

Figure 7.1.3.1.1 - MARGINAL MEAN ADIMPACT SCORE BY PROJECTION WEIGHT

Figure 7.1.3.1.2 also shows dark lines at both the top and the bottom – without great variation in the slopes of the lines.
Figure 7.1.3.1.3 changes the axes from the previous graph with the x-axis being Exposure Interval and each line being a different n-tile. The heaviest n-tile is darkest and has the highest values for the variable. This figure illustrates the variance for television and print when Exposure levels are examined. For all of the graphs of exposure levels by media, the print will show higher “reach” because the print data is per Sub-Brand while the television data is per commercial, and thus has lower weight. In this case there does not appear to be a consistent bias across Projection Weight N-tiles.
Figure 7.1.3.1.3 - COMPARISON OF EXPOSED PURCHASE DOLLARS BY PROJECTION WEIGHT

7.1.3.2 Purchase on Deal

Figure 7.1.3.2.1 suggests that coupons have a distinctly higher response to advertising, particularly within 2 days of exposure to advertising, as compared to either No Deal or Sale. Deal was therefore included as a covariate variable.
When Deal Type is examined by Exposure Interval, coupons have consistently higher scores, and the 1 day score is particularly high as seen in Figure 7.1.3.2.2.
Figure 7.1.3.2.3 illustrates an examination of Exposure Levels across Deal Type for Print and TV and shows a minor bias of lower exposure levels for both deal types.

**Figure 7.1.3.2.3 - COMPARISON OF EXPOSED PURCHASE DOLLARS BY DEAL TYPE**

7.1.3.3 Household Size

Household Size is another variable that demonstrates a bias. In Figure 7.1.3.3.1, AdImpact scores across HHSize N-tiles indicate that single person homes are more responsive than 2 and 3 person homes but this finding is reversed with household in which there are large numbers of persons (7) in a home.
A linear trend line has been added to Figure 7.1.3.3.1 to create Figure 7.1.3.3.2 which shows that there isn’t an overall bias, but as can be seen, the r^2 is .004 – very low.
Figure 7.1.3.3.3 show that higher household size n-tiles (darker lines) have higher scores. This may, in large part, be due to larger homes purchasing more products and tending to watch more television in total.

Interestingly in Figure 7.1.3.3.4, Print has a declining pattern of exposure as the household size increases, while television has an increasing pattern. The increasing pattern for television is due to the television being a household level measure rather than a persons level measure. The more people there are to watch, the longer the television is on in the household.
Household size was not selected as a covariate.

**7.1.3.4 Price**

Figure 7.1.3.4.1 shows that Price does not appear to have a consistent bias across n-tiles, but does show a consistently higher response for prices just below the average (the 3-5 n-tiles) and for the 12th n-tile, or household that paid the highest prices.
While some n-tiles do exhibit stronger patterns than others, Figure 7.1.3.4.2 does not indicate a consistent bias. The top two lines are the 3\textsuperscript{rd} and 4\textsuperscript{th} n-tiles the next two are 5\textsuperscript{th} and 12\textsuperscript{th} n-tiles.
Figure 7.1.3.4.3 is a comparison of exposure to advertising for print and TV by price n-tiles, and also does not display any bias.

**Figure 7.1.3.4.3 - COMPARISON OF EXPOSED PURCHASE DOLLARS BY PRICE N-TILES**

![Comparison of Exposed Purchased Dollars](image)

**7.1.3.5 Loyalty**

Loyalty has a built in bias as shown in Figure 7.1.3.5.1. However, households that purchase only one brand will not always have a 100 AdImpact score, as we see in the 12\textsuperscript{th} n-tile below. The 10\textsuperscript{th} and 11\textsuperscript{th} n-tiles are extremely loyal purchasers but appear to show consistently high responsiveness to advertising. This could be characterized as advertising that reinforces loyalty.
In Figure 7.1.3.5.2, the top two lines are the 10th and 11th ntiles are very loyal to advertised brand. The 12th n-tile is the group that includes almost all 100 percent loyal households. The 100 percent loyal households have a brand share of 100 percent, so no amount of advertising can increase their brand share. The differences between a marginal mean AdImpact scores of 100 and the actual values for the 12th n-tile are made by the few households that are almost 100 percent loyal.
Figure 7.1.3.5.3 below suggests a distinct pattern of exposure across the loyalty segments. The moderately loyal tend to have far less exposure to television advertising than either the non-loyal or the extremely loyal.
Loyalty was not chosen as a covariate, even though it does appear that advertising has a bias towards impacting the most loyal households more than the less loyal. The reason for not including loyalty is that it isn’t a confounding variable. The differences are due to real responsiveness by these homes, not to an artificially higher buying rate.

7.1.3.6 TV Viewing

Total household television viewing shows a very decided bias toward larger viewing levels being connected to higher scores. Larger households have higher viewing patterns because there are more people in these households to watch television. Larger households also purchase more products. Thus households with higher viewing levels purchase more products which is not a product of being responsive to advertising. Thus Total TV Viewing is a biasing variable and is included as a covariate.
A linear trend line for 7 Days has been added to Figure 7.1.3.6.1 in Figure 7.1.3.6.2 to show the general bias.

Figure 7.1.3.6.2 - MARGINAL MEAN ADIMPACT SCORE FOR TOTAL TV VIEWING N-TILES WITH SLOPE
Figure 7.1.3.6.3 corroborates the choice of Total TV Viewing as a covariate. The darkest, 12th n-tile is consistently on the top while lighter, lower n-tiles are below.

Television viewing would not be expected to be a major influence on print readership, but is directly related to total television viewing.
7.1.3.7 Time-Shifted Viewing

The advertising that was seen with the highest levels of time-shift had the highest levels of response. Thus, while they may see less advertising, the longer the delay from recording to playback, the higher the short-term effect of the advertising. Perhaps this indicates that those programs that are viewed farthest from the time they were recorded are the programs the viewers are most engaged with. It may also be that they have the fewest commercial seen and so have the lowest levels of clutter.
The bias for the heaviest quintile of length of time from record to playback is extreme and continues out to at least 14 days as seen above. The differences are most remarkable within a period of 3 days, as seen below.
Time-shift behavior is only performed during television viewing, so can only be reported for television commercials. Since it is a variable that indicates exposure to television, it makes sense that the advertising with even moderate levels of time-shift are exposed to the television advertising.
This variable was also not chosen as a covariate for the same reason loyalty was not chosen. The commercials seen after the longest delay from broadcast do have higher response. This again is not a confounding variable.

### 7.1.3.8 Brand Size

Brand Size was an additional variable considered for covariating. In Figure 7.1.3.8.1, there is a distinct pattern of darkest on the bottom to lightest on the top. There are also much higher AdImpact scores for small brands than for larger, higher n-tile brands.
When we examine the slope for the 7 Day scores we also see a distinct bias towards higher scores for the smallest brands. See Figure 7.1.3.8.2.
There does not appear to be a difference between exposed purchase dollars based on brand size. See Figure 7.1.3.8.3.

Figure 7.1.3.8.3 - COMPARISON OF EXPOSED BRAND PURCHASE DOLLARS

Brand Size did turn out to be a critical variable to include in the covariate procedure. When Brand Size was included, the results became much more clear and understandable. Since results are shown with and without accounting for Brand Size, the instances where brand share are removed are called: “AdImpact Modified by Brand Size”.

7.2 Scope of Analysis

Project Apollo data was used for six brands across different categories to assess the synergistic effects of television and magazine advertising on purchase of those brands. The potential for analysis of this form of data is tremendous for the question of synergy as well as many other questions on how advertising works. The exploration of this form of data has captured the imaginations of several researchers for their entire careers including McDonald,
Roberts, and myself and there are still many areas that have not been explored. This dissertation project used the most evolved and explored analysis technique against the current state of the art single source database, Project Apollo.

One year of data was analyzed using AdImpact expanded to focus on frequency across media. AdImpact was applied in a multivariate approach and frequency was examined as absolute levels and as the relative measure of share-of-voice.

### 7.2.1 Brands and Categories Covered by Analysis

Analysis of a complete dataset required Project Apollo data, monitoring data for print and for TV, and UPC dictionaries. From Project Apollo, crude UPC dictionaries were available for a very large number of product categories, while refined UPC dictionaries were available for only twenty six categories. The rough dictionaries were manually turned into refined dictionaries for another category, bath tissue. Many of these groups of products were related, e.g. shampoo, hair spray, styling gel. Where this occurred, the category for which the most data were available was selected. Thus, shampoo was selected over hair spray and styling gel. This resulted in nine product categories: soft drinks, snacks, shampoo, skin care, laundry detergent, bath tissue, cosmetics, deodorants, and air care. Because the analysis required data on not only purchase or exposure, but on exposure followed by purchase on multiple occasions, the final selection of product categories for analysis had to be based on data quantity. These categories had to have substantial magazine and television exposures, thus providing a sample large enough to make observations on synergy. Thus, the categories chosen were reduced further to those for which the largest amount of data was available: soft drinks, snacks, shampoo, skin care, laundry detergent and bath tissue. An added advantage
to this selection was that it covered a variety of packaged goods of consumer interest: food, self-care, and home-care.

The original plan was to examine one brand per category, however as a key component of the analysis is share-of-voice, all data was pulled for all of the brands in these categories. While this would appear to yield an overwhelmingly large amount of data, the project focus is on print data compared to television data. Print data was collected in Apollo for only 12 weeks, so for the purposes of this dissertation, analysis was reduced from 2 years to 12 weeks. The net was cast much wider to capture anything that went on in that period of time.

The brands are blinded, as required by Arbitron and Nielsen in their agreements for using this data.

The analysis involved 67 brands altogether. Of these, 11 brands had only television advertising, 23 had only print advertising, and 32 had advertising in both media. The 11 brands that had television advertising only were labeled with a first letter “T”, while the print only brands were labeled with a “P”. The brands with both print and television were labeled with a first letter “B” (for both.) The analysis was conducted with the TV-only and print-only brands to investigate the effect of different commercials in a single media, but only the 32 brands with advertising in both media were used to examine cross media synergy.

7.2.2 Analysis Based on Purchase Occasion

The method of analysis was based on purchase occasion, building on the work done with AdImpact and STAS. Neither AdImpact or STAS has explored fully the question of frequency or the enhanced question of synergy; however, AdImpact and STAS have now been used by a wide number of researchers to define the short-term effects of advertising (Reichel and Wood (1994); Jones (1995); Jones (1995); Broadbent (1996); Roberts (1996);
Reichel and Wood (1997); Schroeder, Richardson et al. (1997); Jones (1998); Lodish (1998);
Du Plessis (2000); McDonald (2007); Wood and Gloeckler (2007); Wood (2008)) so they are
tools that have been explored extensively.

7.2.3 Measures of Frequency

The measures of exposure frequency were both absolute and relative, in other words,
using both actual exposure frequency as well as share-of-voice within each category. Share-
of-voice is a measure of a household’s share of exposures for a single brand within the
category. For instance, if a household’s exposure to Brand A in Category 1 is 4 exposures
out of 12 exposures to any brand in category 1, then that household has a 25% share-of-voice.
All advertising within a category is only known for a few categories, so the share-of-voice
analysis will be for a smaller list of brands. The share-of-voice is also known much more
completely for television than for magazines since there were only one-hundred magazines
included in Project Apollo.

7.2.4 Data Time Period

Project Apollo data for the period of December 2006 to December 2007 was used for
this dissertation. The data prior to December 2006 does not include encoding of the
broadcast networks. This is important because monitoring data was used to connect the
media exposure data to produce advertising exposure. Since share-of-voice is an integral part
of this analysis, it is necessary that the broadcast networks be included. After December
2007 the quality of the sample begins to erode. The sample size diminishes because new
sample was not added as panel attrition happened (see Appendix 12.4.)
7.2.5 Comparisons of Measures

Synergy was examined in several ways using AdImpact scores and AdImpact modified for brand size across all brands: 1) the net effect of combined television and magazine advertising on purchasing, 2) effects across frequency levels, 3) effects across share-of-voice levels, and 4) effects decomposed for people who saw ads in both media vs. those that saw either. These analyses were developed by selecting periods of time when advertising appeared in both media and periods when it appeared in only one. To differentiate the effect of synergy from the effects of overall advertising weight, strength and impression levels, where possible, periods of time were selected to match on these variables.

While the first analysis examined advertising’s net effect on purchases for all participants, the second analysis examined the impact of 1+, 2+, 3+ exposures to advertising in combined and single media.

The third, share-of-voice analysis was conducted for these two conditions as well, but divided the households into groups based on the household’s share of category exposures. The number of n-tiles was chosen based on the sample available. Two forms of this analysis will be examined: 1) holding the share n-tiles constant and 2) allowing the n-tiles to be defined by each schedule.

The fourth analysis separated households into those that saw both TV & print and those that saw only one or the other. Because of the possible influence the kinds of people who exist in each cell might have on this analysis (e.g., TV viewers can be very different from print readers and in particular from print readers who don’t watch television), the net effects analysis was conducted to examine overall impacts as well.
The final step was to combine all of the data from these analyses and statistically compare the results to determine if there were any empirical generalizations that could be drawn.
8. RESULTS

8.1 Analysis of the Combinations of Ads

Synergy is the combined influence of advertising across media. The first analysis was conducted to understand how ads combine into campaigns within, as well as across, media. To do this, 1) the combinations of print ads were analyzed with the Total Print scores, 2) the combinations of television ads were analyzed with the Total Television scores, 3) Total Print plus Total Television were analyzed with Total Brand and 4) all ads for a brand were shown with the media and brand totals. For the combinations of print ads, only brands with multiple substantial print ads were examined. All combinations are available in Appendices 12.6-12.9.

The fourteen print ads for Skin Care brand BS, when combined, produced the heavily dashed line across the middle in Figure 8.1.1, which appears to represent something closer to an averaged effect than an effect greater than the sum of its parts.
Similarly, the combined effect of the seventeen print ads for Skin Care brand BAB, represented by the heavily dashed line across the middle in Figure 8.1.2, does not suggest a synergistic effect.

Figure 8.1.2 - PRINT ADS COMBINED: SKIN CARE BRAND BAB
Combinations of television ads produced the same pattern. The combined effect of the seventeen television ads for Carbonated Beverage brand BA is represented by the solid heavy blue line across the middle in Figure 8.1.3.

Snacks brand BAE had many fewer commercials, but each had much heavier weight. Yet when combined, their effect exhibited the same pattern, as shown by the solid medium blue across the middle of Figure 8.1.4.
Cross media combinations demonstrated the same pattern. The combined effect of Total Print and Total Television, represented by Brand Total lies between the two.

Figure 8.1.5 illustrates this for Carbonated Beverage brand BA with the black line, Total Brand BA being roughly in the middle of the red, Total Print, and blue, Total Television, lines.
All of the examples exhibit this pattern.

The expectation was that the combined effect of these commercials would be more than each one’s individual effect, i.e., that the black line would be above the red and blue lines. What was observed, however, was that the combined effect looks more like an average.

8.2 Estimating the Combined AdImpact Score of Multiple Commercials

This section describes an attempt to use a weighted average to estimate the combined influence of several ads. The hypothesis was that if it is possible to estimate the combined impact of multiple commercials either across or within media, then the influence of synergy must be minimal, or might be a function of that average. Five possible weights were explored to create weighted averages to estimate combined influence on purchase: 1) impressions delivered for each ad, 2) reach of each ad, 3) the number of exposed category
purchase occasions (PO), 4) the category dollars for purchase occasions and 5) the category dollars for exposed purchase occasions.

Three exposure intervals were analyzed: 1, 7 and 28 days prior to purchase. These were chosen to reflect the two extremes as well as the most common planning interval – 7 days.

In the Figure 8.2.1 below, the actual AdImpact score is shown in the first column, followed by five highlighted estimates of that score for all five weights in each exposure interval. Of these five, the first estimate combines All Print and All TV scores for Brand BA into an estimate of Total Brand BA impact, weighted by Reach. The weights themselves are shown in Figure 8.2.2.

Figure 8.2.1 shows these for the first brand. The complete display is in Appendices 12.10-12.12. For Brand BA, the actual AdImpact score from advertising seen one day before purchase for the total brand was 108.0. The estimate based on weighting using reach or impressions was 108.1, the estimate for exposed category purchase occasions (PO) was 107.8, for category dollars it was 107.3, and for exposed category dollars it was 107.8.
Figure 8.2.1 - WEIGHTED AVERAGE ADIMPACT SCORES - ACTUAL AND ESTIMATES

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<th>1 AdImp - Weighted</th>
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Figure 8.2.2 - ESTIMATION WEIGHTS

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The values for all brands were then compared, excluding combinations where exposure was to only one media or where a media had only one ad. Only those combinations where all of the component parts were reported were compared. Figure 8.2.3 shows the sum of the errors squared for each estimating method.

The method that used Exposed Category Dollars for the same exposure interval produced the closest results for 1 Day and 7 Day Dollars and was very close to the ideal for the 28 Day AdImpact estimates.

![Figure 8.2.3 - ANALYSIS OF ERRORS FOR ESTIMATING ADIMPACT SCORES](attachment:image)

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<td>137.813</td>
<td>131.807</td>
<td>471.776</td>
<td>61,401</td>
</tr>
<tr>
<td>7 Day AdImpact Dollars</td>
<td>3.138</td>
<td>3.138</td>
<td>961</td>
<td>19.367</td>
<td>502</td>
</tr>
<tr>
<td>28 Day AdImpact Dollars</td>
<td>3.653</td>
<td>3.653</td>
<td>796</td>
<td>5.503</td>
<td>831</td>
</tr>
</tbody>
</table>

Therefore, in continued analyses, estimates were used for what the AdImpact Score would be if the total were weighted by Exposed Category Dollars.

This was not as fruitful as hoped. While there appear to be quite a few combinations that deliver more than would be estimated – and thus perhaps demonstrate synergy - there also appear to be a number that are below. See Figure 8.2.4 below.
A key question to ask is whether these estimates were influenced by the size of the AdImpact score. Figure 8.2.5 below shows no relationship between the size of AdImpact score and the difference between estimated and actual scores.
However, when AdImpact size was examined, the measure appeared to be very sensitive to brand size, and with every examined brand and category having dramatically different brand sizes, this could confound the estimates (See section 7.1.3.8.) A second analysis was therefore undertaken, removing brand size as a variable. When this was done, there did appear to be synergy for the vast majority of the combinations, although the effect was very small in comparison to what was expected. See Figure 8.2.6.

Figure 8.2.6 - SCORE DIFFERENCE - ADIMPACT MODIFIED FOR BRAND SIZE

8.3 Analysis of Scores Among Households Exposed To Either Both Media or Only One of Them

This section compares the results from analyzing two different cases: 1) households that were exposed to advertising for the brand through both print and television within the analysis period, 2) households that were exposed only to print and 3) households that were exposed only to television.
The three brands with substantial data in all three groups of households are shown here, while all brands with advertising in both media are shown in Appendix 12.13.

Figure 8.3.1 shows the results for Carbonated Beverage brand BA. The light red and light blue lines are for households that were exposed to only one of the media. These are both higher than the other lines on the chart which are for households that were exposed to both media. One would expect that exposure to two media would have an increased influence rather than the other way around. Perhaps the real value of multiple channels of communication is in providing more modes of delivering information so that the consumer has access to the information in the mode that they are most responsive to. This may be more important than delivering multiple messages from different media to the same individual. This is certainly an area worth much more exploration.

The dark lines in Figure 8.3.1 indicate the response within the homes exposed to both media. Again, the total – the black line - is between the red and the blue lines.

Figure 8.3.1 - ANALYSIS OF EXPOSURE TO BOTH MEDIA OR ONLY ONE: CARBONATED BEVERAGE BRAND BA
Figure 8.3.2 shows the results for Snack brand BAF. Interestingly, television’s influence on television-only households was much lower in influence on households that also saw magazines, while the influence of print on print-only households was substantially higher than its influence on households that were exposed to both.

Figure 8.3.2 - ANALYSIS OF EXPOSURE TO BOTH MEDIA OR ONLY ONE: SNACK BRAND BAF

Hair Care brand BL shows a similar pattern for print in Figure 8.3.3. Its influence on print-only households is much higher than its influence on households exposed to both media. However, in this brand’s case, television also had a higher influence on television-only households than on those households exposed to both media. The black line, the combined influence from print and television, lies between the dark red lines of print and the dark blue of television. Again, this represents a combination effect that is more of an average than an additive effect.
Figure 8.3.3 - ANALYSIS OF EXPOSURE TO BOTH MEDIA OR ONLY ONE: HAIR CARE BRAND BL

8.4 Examination of Frequency of Exposure

Synergy is an extension of frequency. Frequency measures the additional impact of multiple exposures, while synergy measures the additional impact of multiple exposures across media. It should be noted, that frequency here is being tabulated for each household and then the sales response of that household is being measured. In media planning, frequency is often reported for an entire schedule or campaign across all households.

AdImpact Scores were analyzed for the measurement of a frequency effect and brand size again produced too much noise. When brand size is added as a covariate, the impact of frequency becomes much clearer and stronger. All of the analyses shown for frequency include brand size as a covariate (see 7.1.3.8.)

There are four analyses undertaken here: 1) frequency of exposure by media, 2) frequency of exposure for combined media, 3) a test of the diminishing returns of frequency by media, and 4) a test of the diminishing returns of frequency for combined media.
8.4.1 Frequency of Exposure by Media

Frequency of exposure is quite different for each media. This is true even when the brand had substantial use of print, because print was measured for only 100 magazines and was measured only twice during this period, rather than continuously as it was for television. In the figures below, frequency is shown within each media. Results are shown here for three brands that had advertising in both print and television. For all brands in this analysis, results are shown in Appendices 14-15.

Carbonated Beverage brand BA has a positive frequency influence – all three trend lines have a positive slope. The 7 day influence was the highest (slope of .0329.), as shown in Figure 8.4.1.1.

Figure 8.4.1.1- FREQUENCY OF EXPOSURE: CARBONATED BEVERAGE BRAND BA: ALL TV
The influence of frequency from print was also substantial, although with far fewer data points the slope may not be as accurate. Nonetheless, there is a substantial positive slope for exposures within 1 and 7 Days, but negative for 28 Days. See Figure 8.4.1.2.

Figure 8.4.1.2 - FREQUENCY OF EXPOSURE: CARBONATED BEVERAGE BRAND BA: ALL PRINT

For Detergent brand BE, television also exhibits a positive effect of frequency with a slope of .0134 for 7 Days. See Figure 8.4.1.3.
Figure 8.4.1.3 - FREQUENCY OF EXPOSURE: DETERGENTS BRAND BE: ALL TV

Figure 8.4.1.4 indicates that print exhibits a tremendous influence with a slope of .4622. Again, there are far fewer data points, but clearly frequency does have an influence.

Figure 10 - FREQUENCY OF EXPOSURE: DETERGENTS BRAND BE: ALL PRINT
Television for Hair Care brand BG has a 28 Day slope of .0075, as shown in Figure 8.4.1.5.

Figure 8.4.1.5 - FREQUENCY OF EXPOSURE: HAIR CARE BRAND BG: ALL TV

In Figure 8.4.1.6, Print for Hair Care Brand BG, has numerous data points which produce a slope for 28 Days of .018, more than twice as large as the TV slope was.
Hair Care brand BJ has a negative slope for 1 and 7 Days for television. The advertising is still positive, except each additional exposure does not increase the impact on sales.
Figure 8.4.1.8 shows that, for print, Brand BJ also has a negative slope for 7 Day, but a positive slope for 28 Days.

8.4.2 Frequency of Exposure by Brand for Combined Media

The findings illustrated in the following figures suggest a clear influence of frequency for many brands. Several examples are discussed here, while all brands with exposures above one frequency are included in Appendix 12.16.

These graphs are plots for each frequency, not cumulative frequency, i.e., a frequency of 10 exposures is for households that were exposed exactly ten times to the brands advertising within the exposure interval. Each exposure interval is depicted in a different color, with longer intervals depicted as darker red. The size of the data point is an indication of the amount of data that supports each point. Larger dots include 30+ exposed brand purchase occasions for that point. Linear trend lines have been added for the 1 Day, 7 Day and 28 Day
points to indicate the general trend of the data. If the lines are higher on the right, then exposures with a higher frequency tend to deliver more sales than those with lower. These three data points were selected to represent the closest in period (1 Day), the longest period (28 Days) and the most common measurement period (7 Days.)

In Figure 8.4.2.1, we see that Brand BB has a strong lift from left to right indicating that the higher the frequency the higher the increase in delivered sales. The 1 Day scores show a negative frequency effect, with a slope of -.0086, than the 7 Day, with a slope of .0516. The 7 Day is also substantially higher, roughly twice as high as the 28 Day scores of .0242.

Figure 8.4.2.1 - FREQUENCY OF EXPOSURE: CARBONATED BEVERAGE BRAND BB: COMBINED TV & PRINT

Figure 8.4.2.2 for Snack Brand BAE, while having larger dots and more exposures, does not have as high slopes for 1 Day (.0052) and 7 Day (.0033), but does have a high slope for 28 Day (.0465).
Paper products Brand BQ, shown in Figure 8.4.2.3, has less advertising (smaller size data points), but again, there is some lift as frequency increases for the 7 and 28 Day scores.
8.4.3 Incremental Effects Per Frequency Level of Exposure for Individual Media

The frequency question that pertains to synergy is: “Are there incremental gains with each additional frequency level?” In other words, if one exposure delivers x, do 2 exposures deliver 2x, or something consistently larger or smaller? These next figures illustrate the analysis that was conducted in an attempt to answer that question. Each value has been divided by its frequency of exposure, i.e., the AdImpact score associated with the second exposure is divided by two, the score associated with three exposures by three, etc.

The slope of this line is an indication of synergy. If the slope is positive, then additional frequency has a synergistic effect, i.e. the effect is higher than the multiple of frequency.

The next key question addressed was, "Is the synergy between magazines and television larger than the synergy within each media?” The following figures display the data for 1 Day, 7 Day and 28 Day scores divided by frequency for television alone, magazines alone and then in the next section, the combination of television and magazines together.
Figure 8.4.3.1 for Television only Carbonated Beverage brand BB does have a positive trend line indicating that additional frequency increases the influence more than the previous frequency for 7 Day and 28 Day scores. This is quite amazing since the general consensus has been that frequency provides diminishing returns.

Figure 8.4.3.2 for print advertising for Carbonated Beverage brand BAE also has a substantial positive incremental influence from frequency for both 1 Day and 28 Days and roughly no incremental increase for 7 Days.
8.4.4 Incremental Effects Per Frequency Level of Exposure for Combined Media

If we look at the same brands, we see that for Carbonated Beverage BB, the scale is much smaller, going from a high of 1.0 for the full effect and .15 for the incremental effect. Nonetheless, the 7 Day and 28 Day linear trend lines show positive slopes of .0023 for 7 Day and .0005 for 28 Day. The 1 Day slope is negative, -.0119 indicating that incremental frequency within one day of purchase does not provide incremental gains in sales commensurate with exposure.
8.4.5 Analysis of the Trend Lines for Frequency and Effect Per Frequency

(Score/Frequency)

All of the trend lines were gathered for both analyses by media and combined media and for Frequency and Effect per Frequency. For Frequency, a positive slope indicated that frequency had a positive effect. If the Effect per Frequency slope was also positive, then the combined effect was greater than the sum of the parts, suggesting synergy between the exposures. Results are tabulated below. For the 7 Day scores analyzed by media, 84 percent were positive and 63 percent were positive enough to classify as synergy. For the 7 Day scores across media, 85 percent were positive and 52 percent were positive enough to classify as synergy. Thus, frequency had a positive effect for 84% of the advertising studied, with the effect being larger than the sum of the parts to a greater degree for within media combinations than across media combinations.
The intercept gives the starting point of the trend line. When a trend line has an extreme upward slope, the intercept might be negative. The table below shows that, for the most part, this was the case for Frequency for Combined Media. The decline in the percent of cases that were positive is a direct result of this.

![Figure 8.4.5.1 - PERCENT OF TREND LINES WITH POSITIVE VALUES](image)

<table>
<thead>
<tr>
<th>Percent Positive Values</th>
<th>1 Day</th>
<th>7 Day</th>
<th>28 Day</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Slope</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>By Media</td>
<td>75.5%</td>
<td>83.7%</td>
<td>94.8%</td>
</tr>
<tr>
<td>Combined Media</td>
<td>68.4%</td>
<td>84.6%</td>
<td>100.0%</td>
</tr>
<tr>
<td><strong>Effect Per Frequency</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>By Media</td>
<td>50.0%</td>
<td>63.3%</td>
<td>74.5%</td>
</tr>
<tr>
<td>Combined Media</td>
<td>40.0%</td>
<td>51.9%</td>
<td>60.7%</td>
</tr>
<tr>
<td><strong>Intercept</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>By Media</td>
<td>61.8%</td>
<td>42.9%</td>
<td>25.9%</td>
</tr>
<tr>
<td>Combined Media</td>
<td>68.4%</td>
<td>50.0%</td>
<td>22.2%</td>
</tr>
<tr>
<td><strong>Effect Per Frequency</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>By Media</td>
<td>79.4%</td>
<td>79.6%</td>
<td>84.3%</td>
</tr>
<tr>
<td>Combined Media</td>
<td>84.2%</td>
<td>92.3%</td>
<td>92.6%</td>
</tr>
</tbody>
</table>

8.5 Analysis of Share-of-Voice

It has long been theorized that of the several brands in a product category, people respond most to the brand whose advertising they are most often exposed to, the brand with the largest “share-of-voice.” This theory encourages advertisers to match the spending, where possible, of their brand’s primary competitors, which has been the fundamental budget-setting strategy for many brands, and, if not the fundamental strategy, it is always a component of budget-setting.

Share-of-voice is defined in this analysis as the share of a household’s impressions to the designated brand out of all of the impressions the household received for the product.
category within seven days prior to purchase. For this analysis, all purchase occasions were divided into n-tiles. N-tile 12 includes households for whom all impressions of a product category were received from advertising for a single brand, i.e., that brand had 100 percent share-of-voice. The other 11 n-tiles include households for whom that brand’s share-of-voice was less than 100 percent, i.e., the household saw ads from the brand’s competitors as well. AdImpact scores were modified for brand size.

Included in the analysis were all brands that had enough sample for comparison across more than three n-tiles. All findings are included in Appendix 12.18. Several examples are detailed here. Share-of-voice is depicted in shaded lines in the figures below. The darker the line, the higher the share-of-voice. The darkest line is for the 12th n-tile of purchase occasions. These were purchases made by households who, 7 days prior to the purchase occasion, were exposed to advertising for the designated brand only. The 7 Day scores are highlighted with a red box since this is the period within which the share-of-voice was determined. The scores for the other days are shown for the purchase occasions where the 7 Day share of exposure was within the identified n-tile.

In Figure 8.5.1, Carbonated Beverage brand BA, as share-of-voice diminished, so did the influence of the advertising on purchase.
Hair Care brand BL had scores that were higher and closer to the top 12\textsuperscript{th} n-tile for the more highly concentrated n-tiles, as shown in Figure 8.5.2. This suggests that share-of-voice had less influence on the purchase of Brand BL because the brand was able to perform even in the presence of competitor’s advertising.
On the other hand, Figure 8.5.3 shows that Hair Care brand BJ did not perform as well when households received advertising from competitors.
A share-of-voice analysis appears to place a brand’s advertising within the context of the rest of its category’s advertising. This could provide valuable insights for budget-setting and for determining if the commercials a brand is airing are performing as well on their own as when exposed with other advertising.
9. CONCLUSIONS

This dissertation tackled the question of frequency and synergy in 5 different ways. Each analysis informed the next, as is explicated below. The first analysis used AdImpact scores to graph the effects of the parts of an advertising campaign for an indication of whether the whole effect was larger than the sum of those parts. This involved analyzing the effect of 1) individual ads within television compared to an overall television effect, 2) individual ads within print compared to an overall print effect, and 3) print and TV advertising compared to a total brand effect. The results did not reveal, in any of these conditions, that a combination produced a higher AdImpact curve than the parts. In fact, upon closer examination, the combined effect appeared to approximate an average of the individual effects.

A second analysis was then undertaken to discover the ideal way to calculate that average. It was found that the best estimator of the actual combined effect was a weighted average based on exposed category dollars, i.e., the amount of dollars spent on items in the category during purchase occasions that were exposed to parts of the advertising campaign within the exposure interval. This made perfect sense, since AdImpact measures the influence of advertising on dollars spent. If a weighted average exactly predicted the combined effect, then this would refute the existence of synergy. However, when the combined effects were examined to see how accurate the estimates were, results showed otherwise. The actual combined effect was consistently slightly higher than the estimate in the vast majority of the cases. This suggested that a comparison of the estimate to the actual combined effect might be a measure of the degree of synergy.

A third analysis examined whether the effect of combined print and television ads was substantially different if the analysis included only people who had been exposed to both
media. In other words, when the sample included only those who had actual exposure to both media, what kind of response was there to print, what kind of response to television, and what was the combined response? Again, the combined effect was not higher than the effect of either of the parts in any particular situation.

In looking at these estimates of combined effects, it became evident that AdImpact might be overly sensitive to brand size, because AdImpact, being an index measure, is driven by the size of the brand. Removing the influence of brand size was explored. The results of this analysis showed that the estimates became more accurate using an AdImpact score modified by brand size. This modified AdImpact score was used in continued analyses relating to combined effects across media and within media in measuring the effect of synergy. As a measure, it turned out to be extremely powerful, revealing very distinct patterns demonstrating the effects of frequency and synergy, as described below.

The fourth analysis focused on the effects of frequency. Was there a predictable difference in response by people who had been exposed exactly three times or exactly four times, and how did that response differ from one or 20 such exposures? For all of the frequencies available in the data, the frequency curve was examined for actual exposure at each of the levels for a given campaign, the slope of the frequency trend line was analyzed, and the slope was compared for print and television and for both combined. This led to the observation, in many cases, of a distinct effect of frequency that seemed to continue from the first exposure on. The next step in this analysis was to determine whether the second exposure was of equal value, or were there diminishing returns - indicating that it was of lesser value, or was it, in fact more valuable? The premise was that, if there is synergy, the second exposure would be more valuable than the simple combination of two exposures. This was examined by graphing effectiveness divided by frequency, i.e., if exposed three
times, effectiveness was divided by three, resulting in effectiveness per exposure.

Diminishing returns should result in a negatively sloped curve, no effect should result in a flat line, and a synergistic effect should result in a positive slope. What resulted, for most of these analyses, was a positive slope to effectiveness per exposure. Where it was measurable, in 40-50% of the cases this was true at the 1 day level, in 52-64% of the cases at the 7 day level, and in 60-75% of the cases at the 28 day level, suggesting synergy. In by far the majority of the cases, the shape of the trend and slope of the curve was positive. These data could be and should be analyzed more deeply, because for this project only the overall slope of the trend line was examined. The shape of the curve was not modeled and could lead to a much better understanding of the response function.

The fifth analysis focused on share-of-voice, with the premise that if frequency did not affect purchase response, then share-of-voice would, because share-of-voice is a measure of the percentage of exposures to advertising for the brand within all of that category’s exposures. There are very few instances in the literature in which share-of-voice has been addressed directly as potentially influencing sales results. The analysis of share-of-voice data on n-tiles (12-tiles) in this study resulted in a striking pattern indicating that the higher the share-of-voice, the more impact on purchase. In addition, some brands exhibit a pattern for high share-of-voice n-tiles, (for instance, n-tiles with 70-90% of the exposures were for the identified brand) that is very similar to those with 100% share-of-voice. Other brands exhibit a pattern for these same high share-of-voice n-tiles where the impact on purchases is much lower. We could conjecture in the first case that the brand’s advertising is extremely strong, even in the face of competition, while in the second case, the brand’s advertising is strong only when it’s the only advertising that was seen but does not do well in the context of ads for competitors. This finding suggests that the value of a brand’s advertising must be
considered within the context of all of a category’s advertising at the same time. The effectiveness of advertising cannot, hence, be measured in a vacuum. The finding also seems to refute a common conjecture that share-of-voice does not produce results. The fact that this research showed that AdImpact modified by brand size reveals this influence may be an indication of the robust power of AdImpact modified by brand size.

This dissertation set out to answer the following key questions: Does synergy exist? Can it be measured? How does it work? How does it differ from frequency, or how does it enhance frequency? Several analyses were conducted resulting in the development of a measure of frequency and synergy that revealed the influence of frequency in a way that had not previously been done within Project Apollo. The new measure was also able to discern an effect of share-of-voice, which hasn’t been demonstrated so far in the literature.

In demonstrating that the whole is greater than the sum of the parts for frequency and share-of-voice in well over half the cases analyzed, a door has been opened toward answering several more complex questions that have faced marketers and advertisers. These questions include: How much is enough? Flighting versus continuity, Reach versus frequency, and What is the response function to advertising? The creation of these analytics holds the potential to allow researchers and business people to more fully understand the answers to these questions. The question of how much is enough can be translated to how much advertising is enough advertising to deliver on an advertiser’s specified goals: To produce a brand share of x, how much advertising is needed? To keep the same brand share, one might ask, how much advertising is needed to encourage consumers to continue to buy my brand at the rate that they have been. The analysis of share-of-voice provides a great deal of understanding into whether spending on a brand’s advertising should match the spending of the brand’s competitors in the marketplace for that product category or whether lower levels
of spending are enough. If share-of-voice graphs show that even a low share-of-voice is producing substantial sales, then advertising appears to be strong and perhaps further investment in advertising is unnecessary. If, even when it does have a higher share-of-voice, a brand’s advertising doesn’t seem to do the job that would be expected, then, in the competitive arena, advertising dollars are being lost. How much is enough can be answered by how the advertising’s creative performs in comparison to all other advertising in the category.

The question of flighting (placing ads so that there are bursts of high level of activity) versus continuity (continuous lower levels of activity) could be restated as well. If a company has have enough money to buy 5,200 GRPs, should it be allocated as 100 a week, 200 every other week and then nothing in the intervening weeks, or 300 every third week? If the advertiser has only half the number of GRPs should they be in only half the year? How long should the hiatus be? Should one make sure that one has enough weight? These are very common questions for advertising and media planning and there has not been clear information available to guide these decisions. What is known comes from recency theory, which was also built on AdImpact scores. Recency theory says that advertising in close proximity to purchase exerts a powerful influence on sales. This dissertation adds to this knowledge with the finding that frequency matters. For many commercials, frequency performs better over longer periods of time. If we understood more about how a particular advertising campaign was working, advertisers could understand whether low or medium or high levels of frequency are needed in a campaign. Most research using market mixed modeling or tracking studies are unable to report impact for very low levels of advertising. This has led to a belief that there is a minimum threshold level of advertising needed in order to produce any impact. In this dissertation research, there were brands whose advertising
exposures were smaller than any previous minimum threshold levels in terms of GRPs. We were able to measure advertising’s influence on these brands with very low advertising levels, which is contrary to the belief that a minimum advertising level is required to produce impact. It must be noted that this finding is based on data and an analysis technique focused on the impacts at the level of each household, which are then aggregated to yield the impact of advertising for that brand. Very low levels of advertising can produce an influence in the household’s exposures to those commercials. The additional analysis in the dissertation of share-of-voice data showed that unless the commercials were extremely powerful in terms of creative, a small number of exposures could be drowned out by competitors.

The third question is reach versus frequency. Reach times frequency equals GRPs. Reach is more expensive than frequency: the dayparts that deliver lots of reach tend to be a lot more expensive because they involve higher rated programs. Is it important to spend that money to deliver reach, or can frequency do a solid job? Our conjecture in the past was that increased frequency had diminishing returns, but this was not demonstrated in the current analyses. While the closer an exposure is to the purchase occasion, the more powerful the influence is on sales, it also appears that additional frequency does deliver a powerful influence, if the advertising is working strongly. Further in depth analysis of this data could provide more information on the degree of reach versus the degree of frequency that would be ideal.

The analytic technique introduced here could also further the understanding of the advertising response function. There has been wide study of the response function, but never has there been so much information about so many brands in so many categories available as there is from Project Apollo. With single source data becoming more and more available, these patterns will be able to be understood far more deeply and modeled. At the moment,
we just used the trend line to get a sense of positive or negative slope, but we do believe that there is probably a shape to these points and look forward to further analysis of these points to better understand what the shape of that function is.

Synergy has been discussed in this dissertation primarily as a function of cross media, of print with television. This author had presupposed that there would be more synergy across media based on findings from the learning theory area of research. But in working with the data, it appears that there is more synergy within media than across media. Some ads were synergistic with other ads in the same campaign and others weren’t, and some print and television campaigns were more synergistic than other print and television campaigns. That doesn’t suggest that multiple messages don’t increase sales, but that the more different ways the message is sent the greater the impact on sales. It doesn’t appear that cross media always is better than within media for any particular individual, and it seems that the amount of synergy may relate to the pieces of the creative and how they work together. The fact that the synergistic effect can be measured means that one can plan and schedule and buy for it and look at the cost differential of delivering a message in one form or another.
10. LIMITATIONS AND DIRECTIONS FOR FUTURE RESEARCH

10.1 Limitations

There are a number of limitations to the research presented in this dissertation: 1) analysis was restricted to limited media; 2) analysis was restricted to a limited number of brands, and 3) only one analysis technique was applied to the data.

In addition to television and magazines, Project Apollo was designed to measure radio, Internet and mobile media exposure via embedded advertising code. However, only the television and magazine data were collected as media exposure rather than commercial exposures. Therefore, these are the only media that could be included in our analysis because of Project Apollo restrictions on the use of data for advertisers who were Project Apollo clients.

Advertising is used for many kinds of brands with many different purchase cycles, consideration sets, and purchase funnels. Data analysis for this study was confined to FMCG brands since these could be scanned with a UPC wand. Further, only six brands across six categories were included for analysis. While the brands were chosen to cover food, home care and body care, they do not reflect the full spectrum of different types of brands. Data on different product types and categories may yield different results.

There are many potential analysis techniques that have not yet been developed or explored for this form of data. As these techniques evolve, they may provide deeper and more elaborate understanding of how frequency and synergy work. The analysis technique chosen is the only one that provides a sound comprehensive measure from the published literature.
10.2 Directions for Future Research

This work suggests several areas for future research: cross media reach and frequency, different analysis techniques and other forms of data to address questions such as fusion vs. single source. Fusion is a data integration technique that connects multiple data sources at the respondent level based on matching variables such as respondents having a similar age, gender, etc…. It also suggests an in-depth analysis of the response function and the cross-over effects of frequency, combined with an understanding of share-of-voice. In addition, an exploration of how share-of-voice analyses could influence advertising budget decisions would be valuable for the advertising industry.

10.2.1 Cross-media Reach & Frequency

There has been little research on the estimation of reach across multiple media due to the lack of data. Single source data, as well as other cross media data that do not also measure purchase behavior, can be used for this. This is an area ripe for extensive research (Kishi (1983); Rice (1988); McConochie and Uyenco (2002)).

The media that are included in this dissertation are limited to television and print. As more data become available, for instance, data from MarketingScan in France, a similar analysis across more media will expand our understanding of how synergy works.

10.2.2 Fusion vs. single source

Fusion combines data from multiple data sets at the respondent level into a quasi single source data set. These data have been shown to produce valuable insights for targeting, but are suspected to be unable to discern the response to advertising (Santini (1988); Baker, Harris et al. (1989); Cannon and Seamons (1995); Roberts (1996); Maiville (2002); Wood (2002); Wood (2002); Doe and Kugel (2005)). However, these data are much less expensive and may hold promise.
10.2.3 Analysis Methods

There are many analysis techniques that have been developed to mine data. Very few of these have been applied to single source data. These should be explored and developed in order to fully recognize the potential of this rich data in better understanding how advertising works.

The response function has been widely studied. However, these new data and analysis techniques provide rich, deep data for building a model. In this dissertation there are multiple levels of data reported for 67 brands, and single source data promises to provide many more on-going cases.

Frequency as a function was always thought to be at odds with a share-of-voice function; however these data indicate that both can exist from the same data. How do they work together? What are the implications for the media planning decisions on where and how to deploy media dollars to deliver the most impact for a given budget?

Share-of-voice and frequency analysis are also windows onto a path towards better tools to use to set budgets. With a more accurate and richer understanding of the return on investment for advertising, advertisers will be able to determine the advertising budget to meet the specified goals of the advertisers and defend its spending based on measurable results.
11. REFERENCES


Gibs, J. (2009) "An Interview with: Jon Gibbs Senior Vice President -Media Analytics, Nielsen Online." eMarketer - Digital Intelligence Volume, DOI:


Gloeckler, D., L. Dupree, et al. (2006). Project Apollo's Spotlight on Consumers and ROI; Results Preview from USA Pilot ESOMAR. Shanghai, China.


Wikipedia (2009) "The Colgate Comedy Hour." Volume, DOI:

Wikipedia (2009) "The Doctors (1963 TV series)." Volume, DOI:

Wikipedia (2009) "Milton Berle." Volume, DOI:


12. APPENDICES

12.1 Appendix ERD Diagram for Delivered Project Apollo Data

Figure 12.1.1 Fundamental Tables
Figure 12.1.2 PURCHASE DETAIL.
Figure 02.1.3 Viewing Detail
Figure 12.1.4 Dayparts

Sample Viewing query:
```
SELECT AQHViewing.OutletID, RefDayparts.lengthOH
FROM AQHViewing, daypartViewing, RefDayparts
WHERE AQHViewing.AQHId = daypartViewing.AQHViewingId
and daypartViewing.daypartId = RefDayparts.daypartId
and viewingDaypartsId = 25
```
Figure 12.1.5 Demographics and Geographics

This table is going to be lag:
One row for each respondent x the number of demos that fit the excel

Select all records from A/SH where Demold = 4

SELECT A/SHViewing.*
FROM A/SHViewing, respDemos
WHERE respDemos.respID = A/SHViewing.resp and
    respDemos.Demoid = 4

In this case the demoID is known as it has been selected for example from a list on a form or from a previous query.
Figure 12.1.6 Further Demographic and Geographic Detail
Figure 12.1.7 Weights and Intab Status
Figure 12.1.8 Viewing Tables – General Viewing
Figure 12.1.9 Average Quarter Hour Viewing

AQHViewing
And related Tables
Figure 12.1.10 Encoded Commercial Viewing
Figure 12.1.11 Outlets
Figure 12.1.12 Commercial Monitoring
12.2 Appendix: Clutter

Figure 12.2.1 Prime-Time Clutter

Mindshare Clutter Watch Reports (2001-2007)
<table>
<thead>
<tr>
<th>Broadcast Primetime</th>
<th>Cable Primetime</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Network Commercial Minutes</strong></td>
<td><strong>Total Commercial Minutes</strong></td>
</tr>
<tr>
<td>NBC</td>
<td>12:45</td>
</tr>
<tr>
<td>CBS</td>
<td>12:01</td>
</tr>
<tr>
<td>MTY*</td>
<td>-</td>
</tr>
<tr>
<td><strong>Total Commercial Minutes</strong></td>
<td></td>
</tr>
<tr>
<td>ABC</td>
<td>13:04</td>
</tr>
<tr>
<td>NBC</td>
<td>12:45</td>
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<tr>
<td>CBS</td>
<td>12:01</td>
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<td>FOX</td>
<td>12:15</td>
</tr>
<tr>
<td>CW</td>
<td>12:18</td>
</tr>
<tr>
<td>TEL</td>
<td>11:27</td>
</tr>
<tr>
<td>FUT</td>
<td>7:18</td>
</tr>
<tr>
<td>UNI</td>
<td>7:16</td>
</tr>
<tr>
<td>MTY*</td>
<td>-</td>
</tr>
<tr>
<td><strong>Total Non-Program Minutes</strong></td>
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<tr>
<td>ABC</td>
<td>15:33</td>
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<tr>
<td>NBC</td>
<td>14:58</td>
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<tr>
<td>CBS</td>
<td>13:51</td>
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<tr>
<td>FOX</td>
<td>14:40</td>
</tr>
<tr>
<td>CW</td>
<td>14:55</td>
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<tr>
<td>TEL</td>
<td>16:00</td>
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<tr>
<td>FUT</td>
<td>11:10</td>
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<td>UNI</td>
<td>12:15</td>
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<tr>
<td>MTY*</td>
<td>-</td>
</tr>
</tbody>
</table>

**Note:** Not included in last year.

**Footnote:** Changed name to TNT in October 2007. The time represents the combined data from both networks.

Mindshare Clutter Watch Reports (2001-2007)
12.3 Appendix: Advertising Expenditures

Figure 12.3.1 Advertising Expenditures in Relationship to GDP

### Figure 12-2: Advertising Expenditure Data

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Media Advertising</th>
<th>National TV</th>
<th>Magazine (Alt)</th>
<th>Network and Satellite Radio</th>
<th>National Newspaper (Alt)</th>
<th>National Digital/On-Line Media</th>
<th>Outdoor</th>
<th>Direct Media Advertising</th>
<th>Local TV</th>
<th>Local Broadcast Radio</th>
<th>Local Periodicals (Alt)</th>
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<tbody>
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<td>2000</td>
<td>28,142</td>
<td>13,602</td>
<td>2,500</td>
<td>19,130</td>
<td>2,120</td>
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<td>5,220</td>
<td>2,120</td>
<td>8,120</td>
<td>6,220</td>
<td>1,800</td>
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<td>2001</td>
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<td>13,602</td>
<td>2,500</td>
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<td>2,120</td>
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<tr>
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<td>13,602</td>
<td>2,500</td>
<td>19,130</td>
<td>2,120</td>
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<td>8,120</td>
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<td>13,602</td>
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<td>56,142</td>
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<td>2,120</td>
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<td>2,120</td>
<td>8,120</td>
<td>6,220</td>
<td>1,800</td>
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</table>

### Global Economic Product (GDP) vs Consumer Confidence Index

<table>
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<tr>
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<th>GDP (trillion)</th>
<th>Consumer Confidence Index</th>
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<tr>
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<td>15,230</td>
<td>120</td>
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<tr>
<td>2001</td>
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<td>2002</td>
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<td>2003</td>
<td>16,730</td>
<td>135</td>
</tr>
<tr>
<td>2004</td>
<td>17,230</td>
<td>140</td>
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<tr>
<td>2005</td>
<td>17,730</td>
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<tr>
<td>2006</td>
<td>18,230</td>
<td>150</td>
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<tr>
<td>2007</td>
<td>18,730</td>
<td>155</td>
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</table>

### Advertising Expenditure Data

<table>
<thead>
<tr>
<th>Year</th>
<th>Advertising Expenditure (billion)</th>
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</thead>
<tbody>
<tr>
<td>2000</td>
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<td>2006</td>
<td>24,000</td>
</tr>
<tr>
<td>2007</td>
<td>26,000</td>
</tr>
</tbody>
</table>

### Sources

- "Worldwide Media & Global Media Forecasts Report, September 2013".
- "Government Printing Office, Department of Commerce, December 2009".

---

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### Figure 12.3.3 Media Cost-Per-Thousand Indexes: 1980-2008

<table>
<thead>
<tr>
<th>Newspapers</th>
<th>Magazines</th>
<th>Network TV</th>
<th>Cable TV</th>
<th>Network Spot TV</th>
<th>Radio Spot</th>
<th>Radio Direct</th>
<th>Mail CPI</th>
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<td>115</td>
<td>87</td>
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<td>126</td>
<td>135</td>
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<td>126</td>
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<td>140</td>
<td>134</td>
<td>144</td>
<td>102</td>
<td>132</td>
<td>115</td>
<td>126</td>
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<td>1989</td>
<td>148</td>
<td>141</td>
<td>151</td>
<td>107</td>
<td>135</td>
<td>127</td>
<td>131</td>
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</table>

| 1990       | 153.9      | 150.2      | 160.8   | 109.1          | 146.6      | 128.9        | 127.3    |
| 1991       | 157.8      | 151.4      | 154.4   | 113.4          | 140.7      | 132.1        | 129.5    |
| 1992       | 160.1      | 156.3      | 152.1   | 114.7          | 147.8      | 118.9        | 119.2    |
| 1993       | 162.5      | 173.8      | 157.4   | 117.6          | 151.5      | 124.8        | 116.9    |
| 1994       | 168.4      | 182.9      | 164.5   | 119.3          | 161.8      | 123.9        | 134.8    |
| 1995       | 177.3      | 189.4      | 182.9   | 124.1          | 169.7      | 131.4        | 139.4    |
| 1996       | 185.6      | 204.0      | 202.0   | 135.9          | 188.0      | 159.4        | 148.2    |
| 1997       | 192.2      | 211.4      | 218.4   | 148.1          | 200.2      | 145.0        | 139.4    |
| 1998       | 201.8      | 224.1      | 235.1   | 157.4          | 215.4      | 155.7        | 172.8    |
| 1999       | 210.9      | 235.3      | 255.8   | 178.2          | 226.2      | 166.6        | 183.8    |

| 2000       | 219.3      | 244.7      | 282.9   | 195.5          | 253.3      | 189.9        | 205.1    |
| 2001       | 212.7      | 248.4      | 288.2   | 198.5          | 241.4      | 178.5        | 189.4    |
| 2002       | 220.0      | 262.9      | 308.1   | 199.8          | 266.2      | 183.3        | 193.2    |
| 2003       | 224.6      | 274.1      | 322.8   | 201.9          | 266.5      | 185.1        | 198.1    |
| 2004       | 231.0      | 280.4      | 346.8   | 220.7          | 300.5      | 190.6        | 195.1    |
| 2005       | 244.8      | 291.6      | 342.3   | 231.7          | 275.0      | 194.4        | 201.0    |
| 2006       | 259.1      | 300.4      | 345.0   | 230.5          | 260.2      | 195.1        | 208.0    |
| 2007       | 271.0      | 315.4      | 352.2   | 225.9          | 270.8      | 193.8        | 219.5    |
| 2008 est.  | 282.1      | 328.0      | 372.3   | 221.4          | 285.0      | 205.4        | 193.5    |

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Figure 12.3.4 Cost-Per-Thousand Indexes - Graph
12.4 Appendix: Project Apollo Intab Household Sample Sizes

Figure 12.4.1 Project Apollo Intab HH Sample Sizes
12.5 Appendix: Concurrent Media Exposure: Sequent (2009)

Figure 12.5.1 Share of Concurrent Media Exposure

![Share of Concurrent Media Exposure For Screen and Other Major Media](image1)

The following chart shows which specific media were disproportionately used concurrently.

Figure 12.5.2 Indices for Screen and Other Media

![Concurrent Media Exposure Indices for Screen and Other Major Media](image2)

Measures shown in grey when not statistically significant.
Figure 12.5.3 Share of Total Minutes

Share of Total Minutes, Core Sample, N=752, Spring '06 & Fall '08

TV tended to be the medium with or without other files.
Audio tended to be a sole medium while another file activity took place.

Figure 32: 6 Degrees of Concurrency For Major Media

Computing time was spread fairly evenly across 6 Degrees of Concurrency.
12.6 Appendix: AdImpact Scores – Large Combined Ads within Media - Print

Figure 12.6.1 Skin Care Preparations: Brand BS

![Graph](image1.png)

Figure 12.6.2 Skin Care Preparations: Brand BAB

![Graph](image2.png)
12.7 Appendix: AdImpact Scores – Large Combined Ads within Media – Television

Figure 12.7.1 Carbonated Beverage: Brand BA

Figure 12.7.2 Hair Care: Brand BL
Figure 12.7.3 Skin Care Preparation: Brand BAB

Figure 12.7.4 Snacks: Brand BAF
Figure 12.7.5 Skin Care Preparations: Brand BS

Figure 12.7.6 Snacks: Brand BAE
12.8 Appendix: AdImpact Scores – Print Total + Television Total = Grand Total

Figure 12.8.1 Carbonated Beverage: Brand BA

Figure 12.8.2 Detergents: Brand BE
Figure 12.8.3 Hair Care: Brand BL

Figure 12.8.4 Paper Products: Brand BQ
Figure 12.8.5 Snacks: Brand BAE

![Graph](image1)

Figure 12.8.6 Snacks: Brand BAF

![Graph](image2)
12.9 Appendix: AdImpact Scores – Combined Ads by Media and Total

Figure 12.9.1 Carbonated Beverages: Brand BA

Figure 12.9.2 Carbonated Beverages: Brand BB
Figure 12.9.3 Carbonated Beverage: Brand BC

Figure 12.9.4 Carbonated Beverage: Brand PA
Figure 12.9.5 Detergents: Brand BD

![Graph of Ads Combined By Media and Total for Detergents: Brand BD](image)

Figure 12.9.6 Detergents: Brand BE

![Graph of Ads Combined By Media and Total for Detergents: Brand BE](image)
Figure 12.9.7 Hair Care Brand BF

![Graph of Ads Combined By Media and Total for HAIR CARE: Brand BF](image1)

Figure 12.9.8 Hair Care Brand BG

![Graph of Ads Combined By Media and Total for HAIR CARE: Brand BG](image2)
Figure 12.9.9 Hair Care Brand BH

Figure 12.9.10 Hair Care Brand BI
Figure 12.9.11 Hair Care: Brand BJ

Figure 12.9.12 Hair Care: Brand BK
Figure 12.9.13 Hair Care: Brand BL

Figure 12.9.14 Hair Care: Brand BM
Figure 12.9.15 Hair Care: Brand BN

Figure 12.9.16 Paper Products: Brand BO
Figure 12.9.17 Paper Products: Brand BP

Figure 12.9.18 Paper Products: Brand BQ
Figure 12.9.19 Paper Products: Brand BR

Figure 12.9.20 Skin Care Preparations: Brand BAA
Figure 12.9.21 Skin Care Preparations: Brand BAB

Figure 12.9.22 Skin Care Preparations: Brand BAC
Figure 12.9.23 Skin Care Preparations: Brand BAD

![Graph showing Adimpact Score vs Exposure Interval for Brand BAD.](image1)

Figure 12.9.24 Skin Care Preparations: Brand BK

![Graph showing Adimpact Score vs Exposure Interval for Brand BK.](image2)
Figure 12.9.25 Skin Care Preparations: Brand BF

Figure 12.9.26 Skin Care Preparations: Brand BI
Figure 12.9.27 Skin Care Preparations: Brand BS

Figure 12.9.28 Skin Care Preparations: Brand BU
Figure 12.9.29 Skin Care Preparations: Brand BV

Figure 12.9.30 Skin Care Preparations: Brand BZ
Figure 12.9.31 Snacks: Brand BAE

Figure 12.9.32 Snacks: Brand BAF
12.10 Appendix: Weighted Combinations of Ads
Figure 12.10.1 Weighted Combinations of Ads

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## Appendix: Estimates of Weighted Combinations for AdImpact Scores with Complete Information on the Parts

**Figure 12.11.1 Estimates of Weighted Combinations**

<table>
<thead>
<tr>
<th>Part</th>
<th>Estimate 1</th>
<th>Estimate 2</th>
<th>Estimate 3</th>
<th>Estimate 4</th>
<th>Estimate 5</th>
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</thead>
<tbody>
<tr>
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<td>0.234</td>
<td>0.345</td>
<td>0.456</td>
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<tr>
<td>Part B</td>
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<td>0.234</td>
<td>0.345</td>
<td>0.456</td>
<td>0.567</td>
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<td>0.456</td>
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</table>

Notes:
- Each estimate is based on the weighted combination of factors affecting AdImpact scores.
- The complete information on the parts is crucial for accurate estimation.

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### 12.12 Appendix: Combinations of Weighted AdImpact Scores Where All Scores for Parts Was Not Known

#### Figure 12.12.1 Combinations of Weighted Scores – Not Complete Parts

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<thead>
<tr>
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<th>Weighted Score</th>
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<td>4.0</td>
<td>4.0</td>
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... (continued table)
12.13 Appendix: AdImpact Scores HHs Exposed to Both Media vs. Exposed to One

Figure 12.13.1 Carbonated Beverage: Brand BA

![Graph showing AdImpact Scores for HHs exposed to both media vs. exposed to one, comparing Brand BA.](image)

Figure 12.13.2 Carbonated Beverage: Brand BB

![Graph showing AdImpact Scores for HHs exposed to both media vs. exposed to one, comparing Brand BB.](image)
Figure 12.13.3 Carbonated Beverage: Brand BC

Figure 12.13.4 Detergents: Brand BD
Figure 12.13.5 Detergents: Brand BE

Figure 12.13.6 Hair Care: Brand BF
Figure 12.13.7 Hair Care: Brand BG

Figure 12.13.8 Hair Care: Brand BI
Figure 12.13.11 Hair Care: Brand BL

Figure 12.13.12 Paper Products: Brand BO
Figure 12.13.13 Paper Products: Brand BQ

Figure 12.13.14 Skin Care Preparation: Brand BAB
Figure 12.13.15 Skin Care Preparation: Brand BAC

Figure 12.13.16 Skin Care Preparation: Brand BF
Figure 12.13.17 Skin Care Preparation: Brand BI

Figure 12.13.18 Skin Care Preparation: Brand BS
Figure 12.13.19 Skin Care Preparation: Brand BU

Figure 12.13.20 Skin Care Preparation: Brand BV
Figure 12.13.21 Skin Care Preparation: Brand BZ

Figure 12.13.22 Snacks: Brand BAE
12.14 Appendix: Combined TV & Print Scores by Frequency of Exposure

Figure 12.14.1 Carbonated Beverage: Brand BA

Figure 12.14.2 Carbonated Beverage: Brand
Figure 12.14.3 Carbonated Beverage: Brand BC

Figure 12.14.4 Detergents: Brand BD
Figure 12.14.5 Detergents: Brand B5

Figure 12.14.6 Hair Care: Brand BF
Figure 12.14.7 Hair Care: Brand BG

Figure 12.14.8 Hair Care: Brand BH
Figure 12.14.9 Hair Care: Brand BI

Figure 12.14.10 Hair Care: Brand BJ
Figure 12.14.11 Hair Care: Brand BK

Figure 12.14.12 Hair Care: Brand BL
Figure 12.14.13 Hair Care: Brand BM

Figure 12.14.14 Hair Care: Brand BN
Figure 12.14.15 Paper Products: Brand BO

Adimpact Score Modified for Brand Size Combined TV & Print
By Frequency of Exposure
PAPER PRODUCTS: Brand BO

Figure 12.14.16 Paper Products: Brand BP

Adimpact Score Modified for Brand Size Combined TV & Print
By Frequency of Exposure
PAPER PRODUCTS: Brand BP
Figure 12.14.19 Skin Care Preparation: Brand BAA

Figure 12.14.20 Skin Care Preparation: Brand BAB
Figure 12.14.21 Skin Care Preparation: Brand BAC

Figure 12.14.22 Skin Care Preparation: Brand BAD
Figure 12.14.23 Skin Care Preparation: Brand BF

![Graph for Ad Impact Score Modified for Brand Size Combined TV & Print by Frequency of Exposure for Skin Care Preparations: Brand BF]

Figure 12.14.24 Skin Care Preparation: Brand BI

![Graph for Ad Impact Score Modified for Brand Size Combined TV & Print by Frequency of Exposure for Skin Care Preparations: Brand BI]
Figure 12.14.25 Skin Care Preparation: Brand BJ

Figure 12.14.26 Skin Care Preparation: Brand BK
Figure 12.14.27 Skin Care Preparation: Brand BS

Figure 12.14.28 Skin Care Preparation: Brand BU
Figure 12.14.29 Skin Care Preparation: Brand BV

Figure 12.14.30 Skin Care Preparation: Brand BZ
Figure 12.14.31 Snacks: Brand BAE

Figure 12.14.32 Snacks: Brand BAF
12.15 Appendix: Individual TV & Print Scores by Frequency of Exposure

Figure 12.15.1 Carbonated Beverage: Brand BA – All TV

Figure 12.15.2 Carbonated Beverage: Brand BA - All Print
Figure 12.15.3 Carbonated Beverage: Brand TD – All TV

Figure 12.15.4 Detergents: Brand TE – All TV
Figure 12.15.5 Detergents: Brand PB – All Print

Figure 12.15.6 Detergents: Brand BD – All TV
Figure 12.15.7 Detergents: Brand TF – All TV

Figure 12.15.8 Detergents: Brand BE – All Print
Figure 12.15.9 Detergents: Brand BE – All TV

![Graph showing Adimpact Score Modified for Brand Size by Frequency of Exposure for Brand BE - All TV with linear best fit lines and regression equations.]

Figure 12.15.10 Hair Care: Brand BF – All TV

![Graph showing Adimpact Score Modified for Brand Size by Frequency of Exposure for Hair Care - Brand BF - All TV with linear best fit lines and regression equations.]

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Figure 12.15.11 Hair Care: Brand PI – All Print

Figure 12.15.12 Hair Care: Brand BG – All Print
Figure 12.15.15 Hair Care: Brand BI – All TV

![Graph showing Adimpacl Score Modified for Brand Size By Frequency of Exposure for HAIR CARE: Brand BI - All TV.](image)

Figure 12.15.16 Hair Care: Brand BJ – All Print

![Graph showing Adimpacl Score Modified for Brand Size By Frequency of Exposure for HAIR CARE: Brand BJ - All Print.](image)
Figure 12.15.17 Hair Care: Brand BJ – All TV

Figure 12.15.18 Hair Care: Brand BK – All Print
Figure 12.15.19 Hair Care: Brand BK – All TV

Figure 12.15.20 Hair Care: Brand BL – All Print
Figure 12.15.21 Hair Care: Brand BL – All TV

Figure 12.15.22 Hair Care: Brand PN – All Print
Figure 12.15.23 Hair Care: Brand BM – All TV

Figure 12.15.24 Hair Care: Brand BN – All TV
Figure 12.15.25 Paper Products: Brand BO – All TV

Figure 12.15.26 Paper Products: Brand TG – All TV
Figure 12.15.27 Paper Products: Brand BQ – All Print

Figure 12.15.28 Paper Products: Brand BQ – All TV
Figure 12.15.29 Paper Products: Brand BR – All TV

Figure 12.15.30 Skin Care Preparations: Brand BS – All Print
Figure 12.15.31 Skin Care Preparations: Brand BS – All TV

![Graph showing Ad Impact Score Modified for Brand Size By Frequency of Exposure for Brand BS.](image1)

Figure 12.15.32 Skin Care Preparations: Brand BF – All TV

![Graph showing Ad Impact Score Modified for Brand Size By Frequency of Exposure for Brand BF.](image2)
Figure 12.15.33 Skin Care Preparations: Brand BU – All TV

Figure 12.15.34 Skin Care Preparations: Brand TH – All TV
Figure 12.15.35 Skin Care Preparations: Brand BV – All TV

Figure 12.15.36 Skin Care Preparations: Brand BI – All TV
Figure 12.15.37 Skin Care Preparations: Brand BK – All TV

Figure 12.15.38 Skin Care Preparations: Brand BAA – All TV
Figure 12.15.39 Skin Care Preparations: Brand BAB – All Print

Figure 12.15.40 Skin Care Preparations: Brand BAB – All TV
Figure 12.15.41 Skin Care Preparations: Brand BAC – All TV

Figure 12.15.42 Skin Care Preparations: Brand PN – All Print
Figure 12.15.43 Skin Care Preparations: Brand BZ – All TV

Figure 12.15.44 Snacks: Brand TI – All TV
Figure 12.15.45 Snacks: Brand TJ – All TV

Figure 12.15.46 Snacks: Brand BAE – All Print
Figure 12.15.47 Snacks: Brand BAE – All TV

![Graph showing Adimpact Score Modified for Brand Size By Frequency of Exposure for Snacks: Brand BAE - All TV](image1)

Figure 12.15.48 Snacks: Brand TK – All TV

![Graph showing Adimpact Score Modified for Brand Size By Frequency of Exposure for Snacks: Brand TK - All TV](image2)
Figure 12.15.49 Snacks: Brand BAF – All Print

Figure 12.15.50 Snacks: Brand BAF – All TV
12.16 Appendix: Combined TV & Print Scores/Frequency by Frequency of Exposure

Figure 12.16.1 Carbonated Beverages: Brand BA

Figure 12.16.2 Carbonated Beverages: Brand BC
Figure 12.16.3 Detergents: Brand BD

![Graph showing Score/Frequency by Exposure Interval Combined TV & Print for Detergents: Brand BD]

Figure 12.16.4 Detergents: Brand BE

![Graph showing Score/Frequency by Exposure Interval Combined TV & Print for Detergents: Brand BE]
Figure 12.16.5 Hair Care: Brand BF

Figure 12.16.6 Hair Care: Brand BG

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Figure 12.16.7 Hair Care: Brand BH

Figure 12.16.8 Hair Care: Brand BI
Figure 12.16.9 Hair Care: Brand BJ

Figure 12.16.10 Hair Care: Brand BK
Figure 12.16.11 Hair Care: Brand BL

Figure 12.16.12 Hair Care: Brand BM
Figure 12.16.13 Hair Care: Brand BN

Figure 12.16.14 Paper Products: Brand BO
Figure 12.16.15 Paper Products: Brand BP

Figure 12.16.16 Paper Products: Brand BQ
Figure 12.16.17 Paper Products: Brand BR

Figure 12.16.18 Skin Care Preparations: Brand BAA
Figure 12.16.19 Skin Care Preparations: Brand BAB

Figure 12.16.20 Skin Care Preparations: Brand BAC
Figure 12.16.21 Skin Care Preparations: Brand BF

Figure 12.16.22 Skin Care Preparations: Brand BI
Figure 12.16.23 Skin Care Preparations: Brand BK

Figure 12.16.24 Skin Care Preparations: Brand BS
Figure 12.16.25 Skin Care Preparations: Brand BU

Figure 12.16.26 Skin Care Preparations: Brand BV
Figure 12.16.27 Skin Care Preparations: Brand BZ

![Figure 12.16.27 Skin Care Preparations: Brand BZ](image1)

Figure 12.16.28 Snacks: Brand BAE

![Figure 12.16.28 Snacks: Brand BAE](image2)
Figure 12.16.29 Snacks: Brand BAF
12.17 Appendix: Individual TV & Print Scores/Frequency by Frequency of Exposure

Figure 12.17.1 Carbonated Beverage: Brand BA - All TV

![Graph showing score/frequency by exposure interval for Brand BA - All TV](image1)

Figure 12.17.2 Carbonated Beverage: Brand BA – All Print

![Graph showing score/frequency by exposure interval for Brand BA - All Print](image2)
Figure 12.17.3 Carbonated Beverage: Brand TA - All TV

Figure 12.17.4 Carbonated Beverage: Brand TB - All TV
Figure 12.17.5 Carbonated Beverage: Brand BB - All TV

Figure 12.17.6 Carbonated Beverage: Brand TC - All TV
Figure 12.17.7 Carbonated Beverage: Brand BC - All Print

Figure 12.17.8 Carbonated Beverage: Brand BC - All TV
Figure 12.17.9 Carbonated Beverage: Brand TD - All TV

Figure 12.17.10 Detergents: Brand TE - All TV
Figure 12.17.11 Detergents: Brand BD - All TV

Figure 12.17.12 Detergents: Brand TF - All TV
Figure 12.17.13 Detergents: Brand BE - All Print

![Graph showing the relationship between Ad Impact Score Modified and Frequency of Exposure for Brand BE - All Print.](image)

Figure 12.17.14 Detergents: Brand BE - All TV

![Graph showing the relationship between Ad Impact Score Modified and Frequency of Exposure for Brand BE - All TV.](image)
Figure 12.17.15 Hair Care: Brand BF – All TV

Figure 12.17.16 Hair Care: Brand PI – All Print
Figure 12.17.17 Hair Care: Brand BG – All Print

Figure 12.17.18 Hair Care: Brand BG – All TV
Figure 12.17.19 Hair Care: Brand BH – All TV

Figure 12.17.20 Hair Care: Brand BI – All TV
Figure 12.17.21 Hair Care: Brand BJ – All Print

![Graph showing Score/Frequency by Exposure Interval for Hair Care: Brand BJ - All Print. The graph includes a trend line with the equation y = -0.003x + 0.0076.]

Figure 12.17.22 Hair Care: Brand BJ – All TV

![Graph showing Score/Frequency by Exposure Interval for Hair Care: Brand BJ - All TV. The graph includes a trend line with the equation y = -0.0021x - 0.0006.]

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Figure 12.17.23 Hair Care: Brand BK – All Print

Figure 12.17.24 Hair Care: Brand BK – All TV
Figure 12.17.25 Hair Care: Brand BL – All Print

Figure 12.17.26 Hair Care: Brand BL – All TV
Figure 12.17.27 Hair Care: Brand PN – All Print

![Graph showing Score/Frequency By Exposure Interval for Hair Care: Brand PN - All Print](image1)

Figure 12.17.28 Hair Care: Brand BM – All TV

![Graph showing Score/Frequency By Exposure Interval for Hair Care: Brand BM - All TV](image2)
Figure 12.17.29 Hair Care: Brand BN – All TV

Figure 12.17.30 Paper Products: Brand BO – All TV
Figure 12.17.31 Paper Products: Brand TG – All TV

![Graph showing Score/Frequency by Exposure Interval for Brand TG - All TV]

Figure 12.17.32 Paper Products: Brand BQ – All Print

![Graph showing Score/Frequency by Exposure Interval for Brand BQ - All Print]
Figure 12.17.33 Paper Products: Brand BQ – All TV

Figure 12.17.34 Paper Products: Brand BR – All TV
Figure 12.17.35 Skin Care Preparations: Brand BS – All Print

Figure 12.17.36 Skin Care Preparations: Brand BS – All TV
Figure 12.17.37 Skin Care Preparations: Brand BF – All TV

Figure 12.17.38 Skin Care Preparations: Brand BU – All TV

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Figure 12.17.39 Skin Care Preparations: Brand TH – All TV

Figure 12.17.40 Skin Care Preparations: Brand BV – All TV
Figure 12.17.41 Skin Care Preparations: Brand BI – All TV

Figure 12.17.42 Skin Care Preparations: Brand BK – All TV
Figure 12.17.43 Skin Care Preparations: Brand BAA – All TV

Figure 12.17.44 Skin Care Preparations: Brand BAB – All Print
Figure 12.17.45 Skin Care Preparations: Brand BAB – All TV

Figure 12.17.46 Skin Care Preparations: Brand BAC – All TV
Figure 12.17.47 Skin Care Preparations: Brand PN – All Print

Figure 12.17.48 Skin Care Preparations: Brand BZ – All TV
Figure 12.17.49 Skin Care Preparations: Brand TI – All TV

Figure 12.17.50 Snacks: Brand TJ – All TV
Figure 12.17.51 Snacks: Brand BAE – All Print

Figure 12.17.52 Snacks: Brand BAE – All TV
Figure 12.17.53 Snacks: Brand TK – All TV

Figure 12.17.54 Snacks: Brand BAF – All Print
Figure 12.17.55 Snacks: Brand BAF – All TV
12.18 Appendix: Share-of-Voice

Figure 12.18.1 Carbonated Beverage: Brand BA

Figure 12.18.2 Carbonated Beverage: Brand TA
Figure 12.18.3 Carbonated Beverage: Brand TB

Figure 12.18.4 Carbonated Beverage: Brand BB
Figure 12.18.5 Carbonated Beverage: Brand BC

Figure 12.18.6 Detergents: Brand TE
Figure 12.18.7 Detergents: Brand PB

Figure 12.18.8 Detergents: Brand BD
Figure 12.18.9 Detergents: Brand TF

![Graph showing Brand Advertising By Category 7 Day Share-of-Voice N-tile for DETERGENTS: Brand TF.]

Figure 12.18.10 Detergents: Brand BE

![Graph showing Brand Advertising By Category 7 Day Share-of-Voice N-tile for DETERGENTS: Brand BE.]

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Figure 12.18.11 Detergents: Brand BE

Figure 12.18.12 Hair Care: Brand BF
Figure 12.18.13 Hair Care: Brand PI

Figure 12.18.14 Hair Care: Brand BG
Figure 12.18.17 Hair Care: Brand BJ

Figure 12.18.18 Hair Care: Brand BK
Figure 12.18.19 Hair Care: Brand BL

Figure 12.18.20 Hair Care: Brand BN
Figure 12.18.21 Hair Care: Brand BO

Figure 12.18.22 Hair Care: Brand TG
Figure 12.18.23 Paper Products: Brand BQ

Figure 12.18.24 Paper Products: Brand BR
Figure 12.18.25 Skin Care Preparations: Brand BS

Figure 12.18.26 Skin Care Preparations: Brand BF
Figure 12.18.27 Skin Care Preparations: Brand BU

![Graph of Brand Advertising By Category 7 Day Share-of-Voice N-tile](image1)

Figure 12.18.28 Skin Care Preparations: Brand TH

![Graph of Brand Advertising By Category 7 Day Share-of-Voice N-tile](image2)
Figure 12.18.31 Skin Care Preparations: Brand BK

Figure 12.18.32 Skin Care Preparations: Brand BAA
Figure 12.18.33 Skin Care Preparations: Brand BAB

Figure 12.18.34 Skin Care Preparations: Brand BAC
Figure 12.18.35 Skin Care Preparations: Brand BZ

Figure 12.18.36 Snacks: Brand TI
Figure 12.18.37 Snacks: Brand BAE

Figure 12.18.38 Snacks: Brand TK
Figure 12.18.39 Snacks: Brand BAF