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NEW INSIGHTS ON THE LOUIS-SCHMELING PARADOX: DETERMINANTS OF DEMAND FOR SUBSCRIPTION AND PAY-PER-VIEW BOXING

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Abstract

Research question: Studies considering demand for professional boxing are almost completely absent from the Sport Management/Sports Economics literature. Little is known about consumer preferences for a sport which attracts global attention but is unique insofar as it is exempt from standard sporting institutions maintaining competitive balance. We use two new datasets to ask, what are the determinants of main event viewership (Nielsen ratings) and pay-per-views buys? In addressing this question we offer new insights on the outcome uncertainty hypothesis and extend research on direct demand for individual sport.

Research methods: The datasets comprise of 210 *HBO* and *Showtime* broadcasts from 2006 to 2018. We estimate generalised linear models, controlling for economic determinants, bout features, boxer popularity, and scheduling factors.

Results and Findings: For main events, we find conflicting evidence to the outcome uncertainty hypothesis. Fans show a preference for rematches, domestic boxers and heavier divisions. NFL broadcasts and earlier scheduling negatively impact viewership. For pay-per-views, we find a positive price effect. Expectedly, Floyd Mayweather Jr increases buys. Both categories exhibit a negative trend with viewership and PPV buys declining over the sampling frame.

Implications: The results offer new evidence that is contrary to the outcome uncertainty hypothesis for an individual sport. The findings point to differences in consumer preferences between two sources of demand for the same sport. Practically, the findings can inform the strategic decision-making of broadcasters, promoters, advertisers and potential new broadcasting entrants.

Keywords: Boxing, Broadcasting, Demand, Ratings, Pay-Per-View

Word Count: 7,997

DETERMINANTS OF DEMAND FOR SUBSCRIPTION AND PAY-PER-VIEW BOXING

Introduction

Despite professional (pro) boxing's illustrious broadcasting history, viewer demand for the sport has attracted surprisingly little attention.[1] Very little is known about fan preferences for a sport of great historical relevance, and one which attracts global attention, despite its unorthodox governance and competition structures (Gammelsæter, 2020).

In particular, one of the earliest applications of the outcome uncertainty hypothesis to individual sports remains unexplored in the context it was proposed (Neale, 1964). Neale (1964) theorised how a profitable sporting contest required balanced competitors using the famous Joe Louis-Max Schmeling bouts. For Neale (1964), the need for parity was paradoxical as it contrasted typical markets where firms would have a preference for dominance (Humphreys & Zhou, 2015).

In this paper we examine consumer demand for pro-boxing and take advantage of a relatively rare opportunity to investigate two sources of direct demand within the same sport. We model the determinants of subscriber views (Nielsen ratings) for standard main events from 2013 to 2018 and pay-per-view (PPV) buys from 2006 to 2018 broadcast on *HBO/HBO(PPV)* and *Showtime*.

We offer three specific contributions to the sports demand literature. First, we estimate two demand equations using new datasets in an original setting. Second, we focus on the outcome uncertainty-demand relationship using multiple measures of *a priori* balance. This is a concept central to theories of demand for live sport (Pawlowski and Nalbantis (2019) offer a recent

[1] Past research has focussed on the incentive effects related to contracts and rematches (Amegashie & Kutsoati, 2005; Tenorio, 2000). One unpublished study explored attendance and revenue (Balbien et al., 1981).

overview). We innovate on past studies in the domain of combat sports by applying talent–based measures of outcome uncertainty and account for draw probabilities. Third, we construct a new index to measure boxer popularity. This is based on archival data sourced from *The Ring* magazine, and represents a novel and portable measure of popularity.

We find that viewership is negatively correlated with increasing outcome uncertainty for main events. Fans prefer to watch more dominant boxers. As expected, higher quality bouts increase viewership and specific tastes influence demand. Domestic (US) boxers, rematches and heavier weight classes are also preferred. We identify one substitution effect; NFL broadcasts negatively impact demand. A negative trend is apparent with Nielsen ratings declining over time.

For PPV's, we find very limited evidence to support the outcome uncertainty hypothesis. Fans have a preference for welterweight and middleweight PPV's. Floyd Mayweather Jr significantly increases PPV buys. Consistent with past research, we find a positive relationship between demand and price. A negative trend is also apparent for PPV sales.

In general, these findings add to our knowledge of demand for individual sports. Such studies feature relatively infrequently within an established literature modelling attendance and viewership. The results also have implications for the broadcast modelling literature as we show that consumer preferences for the same sport can differ depending on category of the broadcast.

Various parties can make strategic inferences from the results. As *HBO/Showtime* PPV's broadcast between 2017 and 2018 generated a total revenue of approximately $700 million in U.S markets alone, the effects we show are important to promoters and broadcasters who aim to design commercially successful bouts. Also, the findings speak to bodies outside pro-boxing. For example, the results can inform advertisers who select and evaluate the efficiency of

commercial slots based on ratings. Finally, the analysis is timely. As *HBO* recently ceased a 45-year relationship of broadcasting pro-boxing, the results shed light on fan preferences for new broadcasters or those considering market entry and must evaluate the value of broadcasting content.[2]

Theory

Although several recognised works consider why fans consume sport such as Noll (1974) and Horowitz (1978), we appeal to the well-known theoretical insights of Borland and MacDonald (2003). This study distinguishes viewership as one key branch of direct demand for sport. Our econometric analysis focuses on two markets within this category classified by of Borland and MacDonald (2003) – subscription and PPV viewing.

Considering their demand framework in the context of pro-boxing, one would expect causation between viewership/PPV's buys and an interaction of microeconomic factors (e.g. prices, substitutes), consumer preferences (e.g. tastes for weight divisions) and the relative quality of a contest (e.g. outcome uncertainty, bout quality). Similar theoretical accounts to Borland and MacDonald (2003) share features of this approach and imply that sports demand rests on intuitive factors such as quality, outcome uncertainty and features specific to each contest (Szymanski, 2003). Theoretically, these categories are equally legitimate across team and individual sports (Tainsky et al., 2013).

Other factors are expected to affect fan preferences. For example, rivalry (e.g. rematches) is especially important in combat sport (Reams & Eddy, 2017). Organisational factors (e.g. scheduling, programme carriers) also play a role as the broadcasting strategies adopted by carriers can influence the preferences of viewers (Johnsen & Solvoll, 2007). Technological

[2] YouTube began experimenting with live streaming of PPV bouts in September 2017. In September 2018 the sports streaming platform DAZN entered the U.S market.

factors are also relevant. This technological landscape influences how and where content is consumed. On the supply-side, disruption can impact distribution channels and affect what sport content is offered to viewers (Turner, 2007).

Outcome Uncertainty & Professional Boxing

Of the determinants important to demand, the role of outcome uncertainty has been to the fore of academic interest since Rottenberg's (1956) and Neale's (1964) contributions (Fort & Quirk, 1995). Typically, this is one strand research emerging from these seminal works, the other being evaluations of competitive balance (Fort & Maxcy, 2003).

Neale's (1964) '*Peculiar Economics of Professional Sports*' is most relevant to our empirical analysis as it represented the earliest application of the outcome uncertainty hypothesis to pro-boxing. Neale (1964) appealed to the politically charged bouts in the 1930's between Joe Louis and Max Schmeling to consider the paradoxical structure of sports markets. This served to extend the theory of outcome uncertainty to individual sport.

Neale (1964) begins by considering the strategy of a heavyweight champion and forms the proposition that similar levels of ability were required in order to generate large revenues. Balance created outcome uncertainty – a property which would arouse fan interest. Imbalance or a 'Joe Louis monopoly', would be harmful. This was in contrast to typical markets, where it is anticipated that firms have a preference for dominance to maximise profits. Therein lay the paradox. Competition was required to maximise revenues, or the joint income of both competitors in this bout.

Since Neale's (1964) conjecture, the business model of pro-boxing has changed significantly.[3] Owing to legal developments, in particular the Muhammad Ali Boxing Reform Act, (see Baglio (1999)), the competitive and organisational structure of the sport is vastly different to that theorised by Neale (1964). Presently, the sport exhibits a competitive structure unlike other combat sports and is distinctive as it does not have a clear competition pyramid (Gammelsæter, 2020).

Furthermore, while Neale (1964) theorised a simple profit maximisation framework using two renowned boxers, bout formation is more complex than a bilateral negotiation. Making a bout involves multiple parties entering a bargaining process, and each may have alternative preferences for balance. Closer competition is often in the interest of broadcasters, and at times promoters, but not always favourable for boxers who aim to maximise future earnings by avoiding losses. Unbalanced bouts can be sought out as a series of victories can increase bargaining power in future negotiations. These balance preferences are however contingent on the purse and career stage of the boxer. When the incentives between all stakeholders are not fully aligned, potentially popular bouts are often not formed. Further to this, if bouts are agreed incentives can still go awry as purses are (for the most part) decided prior to a bout. The moral hazard possibilities arising from this has been previously explored (Tenorio, 2000)

At present, intuition suggests that pro-boxing is characterised by particularly low levels of balance. Ironically, modern matchups appear to exhibit the opposite features to those envisioned by Neale (1964). The contractual complexities outlined and the current incentive structure facilitating low levels of competitiveness are abetted by the absence of centralised

[3] Like many elite sports, broadcasting revenue has become increasingly important relative to ticket sales, merchandising or sponsorship. This revenue growth is demonstrated by the increased frequency of PPV's. From 1975 to 1990, we estimate that *HBO* and *Showtime* broadcast just seven PPV events. The popularity of the PPV model grew in the 1990's. Forty-six PPV's took place from 1990 to 2005, increasing to fifty-seven from 2005 to January 2019.

governance in the sport. No consolidated competition design matches equivalent boxers. Four recognised sanctioning bodies (WBA, WBC, WBO, IBF), and many lesser known bodies, can authorise a bout. Under these conditions sophisticated strategic behaviour is commonplace.[4] Sanctioning bodies (who are inclined to approve the bouts of reputable boxers), can reciprocate a promoter's decision to align to their organisation by accommodating uncompetitive bouts. Tenorio (2006) discusses the fragmented governance structure in pro-boxing, highlighting the cyclical logic underlying poor competitiveness in detail.

Related Empirical Literature

Broadcast ratings/viewership research has become a specific branch of a wider empirical literature modelling demand. This line of research was initiated by Hausman and Leonard (1997) and is considered a natural extension of earlier studies concerned with live audiences. The earliest stage of this research modelled broadcasting as a possible negative determinant of live attendance (Baimbridge et al., 1996). This has since progressed into a diverse literature dedicated to modelling broadcasting trends for many team sports. Examples include American football, inclusive of the NFL (Paul & Weinbach, 2007; Sung et al., 2017; Tainsky, 2010; Tainsky & McEvoy, 2012) and NCAA (Brown & Salaga, 2018; Salaga & Tainsky, 2015;), association football (Forrest et al., 2005), basketball (Mongeon & Winfree, 2012) and ice hockey (Paul & Weinbach, 2013). Much of this work has been concerned with tests of the outcome uncertainty hypothesis. In short, the empirical record is mixed insofar as increased balance positively relates to consumer demand. Both Coates et al. (2014) and Budzinski and Pawlowski (2017) demonstrate the absence of widespread empirical support for the outcome uncertainty hypothesis across sports.

[4] An example of this was seen when Floyd Mayweather faced Andre Berto. This was the last of a six-bout deal with *Showtime* and was allegedly Mayweather's final contest prior to retirement. Achieving a comfortable victory was important as Mayweather was then free to negotiate the sale of his 50th bout to beat Rocky Marciano's record of 49 victories.

Demand for combat sport has attracted increasing attention of late (Reams & Shapiro, 2017; Shapiro et al., 2019; Tainsky et al., 2013; Watanabe 2012; Watanabe, 2015). While pro-boxing is notably different, mixed martial arts (MMA) research offers a relevant literature and as is useful given that the sport shares several traits with pro-boxing (e.g. weight classes, undefeated champions etc.).

Tainsky et al. (2013) model the MMA franchise Ultimate Fighting Championship (UFC) PPV purchases for 93 UFC events from 2001 to 2011. They find that consumer tastes are important factors in determining buys and that higher PPV sales are correlated to main events holding higher levels of outcome uncertainty. Fans reveal a preference for specific weight classes, and high-profile bouts. Heavyweight title fights also attract a greater number of PPV purchases. The Tainsky et al. (2013) reduced model shows that scheduling is important to demand for UFC PPV's. Public holiday weekends draw a higher demand.

To date, only one study – Watanabe (2015) – has considered two direct sources of demand for a combat sport. He explores live (gate) attendance and viewership for UFC over a similar sampling frame. Capacity is a key determinant of the live attendance. Turnout at UFC events increased over time but at a diminishing rate. Fan tastes for heavier weight classes and other scheduling factors significantly impact demand. In contrast to increasing attendances, PPV purchases are relatively stable over time.

Reams and Shapiro (2017) study the impact of star power on PPV buys for 102 UFC events from 2007 to 2015. This article focuses on star power in combat sport and moves beyond categorising aspects of stardom dichotomously. A performer's ranking, and champion status, are important factors determining demand. Popularity, measured by metrics such as social media followers or reality TV appearances, fail to affect sales. The use of media publicity similar to the measures of Reams and Shapiro (2017) have become increasingly common over

time to study the relationship between outcomes, such as demand or market value, and popularity (Franck & Nüesch, 2008). This has involved gathering data on a performer's mentions using the *LexisNexis* database (Franck & Nüesch, 2012; Reams & Shapiro, 2017). The advent of social media has also provided further popularity proxies (Watanabe, 2012).

Data & Measures

Our dataset consists of main events and PPV's aired on *HBO* and *Showtime*. In total, we consider 210 bouts featuring 173 boxers. This is split between 136 main events from February 2013 to November 2018 and 74 PPV's from January 2006 to December 2018. These time periods are defined by access to data such as Nielsen ratings or betting odds data important to measuring outcome uncertainty.

Although main events and PPV's constitute elite pro-boxing, drawing from the same talent pool, we treat these as two alternative sources of direct demand. There are several disparities between main events and PPV's that merit this separation. First, PPV buys reflect sales for a headline bout inclusive of an undercard. The Nielsen ratings we access only measure the average viewership of the headline bout. Second, PPV's command a variable premium, are targeted at a general audience, and represent a once-off purchase. This contrasts with consuming pro-boxing via subscription which is targeted at a core boxing fan base. Lastly, this distinction is merited due to supply-side factors. The costs of bout formation differ between main events and PPV's. For example, while the costs of main events are borne by the broadcaster, (i.e. distribution, production, advertising, boxer purses), promoters must bear many of these under a PPV model. A PPV therefore represents a riskier product for promoters with the potential for greater outgoings and earnings.[5]

[5] Promoters typically earn the residual once a PPV's fixed costs are covered. Baglio (1999) outlines the complexities of these negotiations. At times, the interests of boxers and their promoters are not compatible in a PPV setting as promotors may incur the costs of a higher purse.

Dependent Variables

The dependent variable for main events – viewership (ratings) – is based on Nielsen Media Research data published in post-bout reports. Viewership is tracked by Nielsen on a minute-by-minute basis and represents an average viewership for the bout. We complied Nielsen ratings data from post-bout reports available online (badlefthook.com, boxingscene.com, boxingnews24.com, ESPN.com, the LA Times, ringtv.com, The Ring Magazine and Yahoo Sports). Nielsen ratings are also relayed via network press releases. The Nielsen ratings are live viewership figures only and we do not include same-day-replay ratings.[6]

The PPV data represents domestic buys from satellite and cable homes. No PPV sales from international broadcasts are included to ensure a well-defined market. All of the PPV sales are reported from the media sources listed above and are disclosed in lieu of viewership. Infrequently events are "double-headers". In these cases the final bout on the card is taken as the main event.

Outcome Uncertainty

As outcome uncertainty results can be sensitive to measurement, we introduce three methods of measuring *a priori* balance. The first is a performance based metric. Performance measures are not reserved to our study and past research on individual sports has applied performance-based metrics of outcome uncertainty (i.e. Larson & Maxcy, 2014; Schreyer & Torgler, 2018). Our measure relies on each boxer's preceding performances and is the absolute difference in ratings points provided by the online boxing database BoxRec.com. Increasing variances suggest a higher probability of success for a given boxer and a lower level of outcome

[6] Although Nielsen ratings are high quality, this data has limitations. We understanding that our Nielsen data did not capture viewership via smart phones, tablets or other digital devices. The data measures private consumption and does not account for viewers in out-of-home settings.

uncertainty. A negative relationship is expected between the rating point's difference and demand.

For the second and third measures, we use outcome probabilities expressed through betting odds. These odds are accessed from oddsportal.com and from fan forums for PPV's taking place in 2006 and 2007[7]. Exploiting betting odds has become a standard practice in the demand literature as these probabilities control for many unobservable features of a contest. In boxing, betting odds capture information such as the effectiveness of a training camp, boxer confidence and any recent information on injuries. For both measures, the odds are adjusted to account for the bookmaker over-round (the vig).

The second measure we adopt is the difference in adjusted betting odds between the boxers (DIBO). A negative relationship is expected between increasing differences in adjusted betting odds and demand. This is the standard measure adopted in previous combat sport research.

Our third measure of outcome uncertainty, incorporates the likelihood of draw outcome. In our dataset the probability of a draw varies from 1.9% to 6.6%. Ignoring this could bias the results. The uncertainty index we adopt is analogous to those applied in team sports (Buraimo & Simmons, 2008; Schreyer et al., 2016).[8] In contrast to our two previous measures, this index is expected to be positively correlated with increasing balance.

Bout Specific Factors

We use data from BoxRec.com to construct a pound-for-pound measure of bout quality. This allows for a comparable assessment of quality, controlling for a boxer's weight and record prior

[7] oddsportal.com is a betting odds monitoring service that importantly provides draw odds for boxing. It has become increasingly used in sports research (Butler, Butler & Eakins, 2020)
[8] This index is based on Theil (1967).

to a bout. This is based on a boxer's rating which is a function of their previous results (i.e. knock out, technical knockout, unanimous decision, draw, etc.).[9] From the Boxrec ratings, we derive a quality scale. In the case of PPV's, this system is used to measure the quality of the headline event and the undercard.

We measure further bout-specific factors including the contracted weight class, title bouts, rematches and whether either boxer is undefeated. These characteristics can regulate suspense. For main events, we consider if a bout features a boxer whose most recent prior bout was at a PPV level. This measure captures any signalling effects associated with recent PPV performances. As boxer ethnicity is a characteristic of fan identification, we control for nationality, categorising boxers as domestic (U.S. nationality) or international. We also take account of the primary (lead) promoter. Finally, if the bout is PPV, we collect data on the real purchase price in U.S dollars for standard definition access from BoxRec.com.

Close substitutes are defined as competing sporting events aired at an overlapping time to a *HBO/Showtime* broadcast. We collect data on competing boxing and UFC broadcasts and other live sport entertainment (NFL, NBA and MLB). Due to scheduling, only UFC events taking place in the U.S are considered and competing boxing broadcasts are relevant for main events only. Just 13 main events (6 per cent) and 5 PPV events (6 per cent) face no competition with other live sport broadcasts.

[9] Points are determined based on the value of the result (v: 0-1), the clarity of the decision (cd: 0-1) and the strength of previous opponents. For example, a knock out or technical knockout leads to the winning boxer earning v=1, cd=1. For a points win, disqualification or unanimous decision, v = 1, cd ≤1. When there is ambiguity (e.g. split decision), the winner earns v=1, cd ≤ 0.5. For a draw v=1, cd=0. Points are awarded proportional to the rounds boxed and are weighted by the ratings difference prior to a bout. Ratings decline if a boxer is inactive, or does not box an opponent within at least 50 percentage points of his points total in the eighteen months previous. The ratings also control for transfers across weight divisions.

Popularity Index

Rankings available from back issues of *The Ring* magazine offer a basis to consider bout popularity. *The Ring* is the premier fan magazine for the sport and publishes yearly boxer rankings at a pound-for-pound and divisional level. Similar to past studies the premise of our popularity measure is based on media content (e.g. Reams & Shapiro, 2017). Unlike Reams and Shapiro (2017), our popularity measure does not 'transcend the ring' and we do not distinguish talent-based popularity from other residual sources of fame, such as celebrity accrued to media performances.[10]

The Ring ranking is based on the judgments of an expert ratings panel. Using this data, we create an index using a two-step approach. First, we determine each boxers rank *within* their specific division. Second, we weight this by the proportion of boxers within that division that appear in the pound-for-pound rankings. This adjustment is made to control for quality differences between weight categories over time. Each bout is assigned a score representing the sum of the annual ratings. The advantage of this measure is that it offers a consistent metric over the sampling frame that controls for variations in the intensity of divisional popularity across time.

Qualitative Factors

Finally, qualitative variables affecting viewership are considered. We include a time trend, control for broadcasts near a public holiday (+/- one day) and identify the carrier. We also

[10] Popularity proxies such as social media supporters (e.g. Twitter followers) either did not exist at the time of the PPV or, in many cases, were only used by a limited number of boxers. At best, social media metrics would be unbalanced across boxers and likely crude given the years of the sampling frame. Other measures of popularity such as internet search volume tools also had limitations. For example, more recent boxers and bouts were disproportionally popular when we accessed search volume data. Furthermore, search volume tools often provided ambiguous data, based on average monthly searches or relative search volume.

consider the location of the event as this can impact scheduling. Five distinctive locations account for over 70 per cent of the bouts with the remaining events located in a range of places predominantly within the U.S. Table 1 provides an overview and further details of the variables within the empirical framework.

[Table 1 near here]

Model Specification & Approach

This section specifies the empirical models and addresses econometric problems relating to the specification. Following this, we provide descriptive statistics.

As PPV is a de facto measure of bout quality, we do not include this measure when estimating the determinants of buys. The mean bout quality for PPV's is 0.95 (SD = 0.1) and it is omitted from the model due to collinearity problems.[11] Several bout variables, substitutes and qualitative factors are not applicable to PPV's and are excluded. Undercard quality and price variables are relevant to the PPV model only.

One further control is included in the PPV model to account for a specific star effect. The criteria applied to determine a star is if a boxer was exclusive to PPV from 2006 to 2018. One boxer is included in the final specification - Floyd Mayweather Jr. We believe this inclusion is justified. At the time of writing, Mayweather Jr was the highest pound-for-pound ranked boxer of all time according to BoxRec.com and was consistently ranked as one of the highest-paid athletes in the world.[12]

[11] This is the case when bout quality is included in the PPV model; the measure reports a VIF of 74.15. (11.34 for the complete model). This raises collinearity concerns.

[12] Mayweather Jn was ranked as the highest-paid athlete in the world by Forbes in 2012, 2014, 2015 and 2018. Other exclusive PPV boxers over the sampling frame were experimented with but were not included in the final specification such as Oscar De La Hoya and Shane Mosley.

The viewership and PPV models estimated are of the form:

$$Viewership = \beta_0 + \beta_1 OU + \beta_2 BoutQuality + \beta_3 Title + \beta_4 Rematch + \beta_5 Undefeated + \beta_6 Domestic + \beta_7 PrevPPV + \beta_{8-11} WeightDiv + \beta_{12-17} Promoter + \beta_{18-22} Subs + \beta_{23} Pop + \beta_{24} Hol + \beta_{25} Trend + \beta_{26} HBO + \beta_{27-31} Location + \varepsilon \quad \text{(Equation 1)}$$

$$PPV\ Buys = \beta_0 + \beta_1 OU + \beta_2 Price + \beta_3 UnderQual + \beta_4 Title + \beta_5 Rematch + \beta_6 Undefeated + \beta_7 Domestic + \beta_{8-10} WeightDiv + \beta_{11-13} Promoter + \beta_{14} Mayweather\ Jr + \beta_{15-18} Subs + \beta_{19} Pop + \beta_{20} Hol + \beta_{21} Trend + \beta_{22} HBO + \beta_{23-25} Location + \varepsilon \quad \text{(Equation 2)}$$

Our empirical strategy follows a similar approach to Tainsky et al (2013). We adopt New York as a base dummy for main events as it approximates a mid-point between both ends of the geographic spectrum (California to Europe). For continuity, it is maintained as the base for the PPV estimations. Five variations of an augmented Dickey Fuller (ADF) test report significant test statistics (see appendix 1), indicating stationarity in the dependent variable for both the Nielsen ratings and PPV buys. We also conduct a skewness test and a Shapiro-Wilks test to inspect the distribution of each dependent variable (see appendix 2). The normality hypothesis is rejected for both dependent variables. These normality violations imply that the most basic linear regression techniques would produce biased estimates.

A modelling concern arising from equation 2 is the potential for price endogeneity. We treat price as exogenous but it is conceivable that prior knowledge of demand could influence price. The price point selected for a PPV could be higher when demand forecasts are higher and vice-versa. To address potential price endogeneity concerns we conduct a series of augmented regression tests (Durbin–Wu–Hausman - Davidson & MacKinnon (1993)). No significant relationship is found when price residuals are included in the PPV model, or variations of the

model. These checks mitigate price endogeneity concerns and we assume it is valid to include a price variable.[13]

We estimate a generalised linear model (GLM) using maximum likelihood and adopt a standard Gaussian-identify link function using robust standard errors. AIC criteria is used to refine the model. It is of note that only minor differences in the model quality, as judged by AIC criteria, exist when we estimate variations of the general equations specified.

Descriptive Statistics

Table 2 provides descriptive statistics for the continuous variables. Main events attracted an average of 816,875 viewers per bout over a six-year period. A relatively high bout quality is reported. However, given the wider distribution of talent that competes outside of PPV, quality differences are apparent. The main event with the highest viewership is Canelo Álvarez vs. James Kirkland (2,146,000). The lowest Nielsen ratings are for Anthony Joshua vs Dominic Breazeale (227,000).

The average PPV buys (per bout) from January 2006 to December 2018 were 723,162. A mean revenue of ~$41m dollars was earned from domestic sales. This average masks the heterogeneity in the PPV data however. The median PPV number of buys (~400,000) returns a lower average of ~$23m from a PPV sale.

Low levels of outcome uncertainty are frequently observed. Although a mechanism to establish parity between opponents exists – the partitioning of boxers into weight divisions – significant disparities arise within these classes. Sixteen main events with the join minimum value for measure 3 are reported (OU = 0.03). On average, these bouts lasted six rounds and only three

[13] Past research has included PPV price as exogenous but noted the limitations (Reams & Shapiro, 2017; Tainsky et al., 2013; Watanabe 2015).

ended with a judge's (unanimous decision) verdict. No unanticipated victories occurred in what are deemed mismatches. In contrast, the main event with the relatively highest level of outcome uncertainty (OU = 0.61) – Adrien Broner vs. Jessie Vargas (April 2018) – lasted twelve rounds and concluded with a majority draw verdict.

[Table 2 near here]

Table 3 shows descriptive statistics for the dummy variables. The percentage of observations for which this condition is true is shown in brackets.

[Table 3 near here]

Results

Table 4 reports the results for main events. We find that preferences for outcome uncertainty are contrary to the theoretical prediction for all three OU measures. Fans favour relatively unbalanced bouts. As expected, a preference for higher quality matchups is also present across all three models - *Bout Quality* is the largest positive coefficient. Additional bout specific factors impact viewership, many of which are also anticipated. A *Rematch* increases viewership and there is a preference for *Domestic* boxers and heavier weight classes. One substitute statistically influences viewership levels across models 1 to 3; competing *NFL* broadcasts reduce viewership. Bouts broadcast on *HBO* attracted greater audiences compared to *Showtime* and main events taking place in *Europe* attract less viewers. All three models report a negative *Trend* coefficient. We find no evidence that *Popularity* impacts viewership.

[Table 4 near here]

Table 5 displays the results for the PPV category. We find partial evidence in support of the outcome uncertainty hypothesis. Although the estimates across models 4 to 6 show the

theoretically expected signs, only model 6 reports a significant relationship between OU and PPV buys.

We find a positive *Price* effect across models 4 to 6, a finding we return to in the discussion. *Rematches* and *Undefeated* boxers negatively impact PPV buys. For the latter effect, this could be interpreted as fans preferring seasoned boxers, who are more likely to have suffered career defeats. As we show next however, this *Undefeated* effect is not robust once two outliers are treated. Sales are negatively related to *Domestic* boxers across models 4 to 6. This is a reasonable finding given the presence of highly talented international boxers in this sample.

Welterweight and *Middleweight* divisions attract significantly more PPV buys. It is notable that the models show a strong positive effect for the welterweight division. This result is likely due to a golden era of boxers competing at welterweight since 2006. Significant promoter variables illustrate that PPV buys are higher for bouts promoted by *Top Rank* and *Main Events*. *Mayweather Jr* significantly increases PPV buys, an effect that is anticipated given the boxer's dominance. Limited evidence exists to that popularity increase sales. Consistent with main events, there is a negative *Trend* coefficient, with PPV buys decreasing from 2006 to 2018. A location effect for *Other* is found across models 4 to 6 indicating that hosting events outside of the standard venues attracts fewer PPV buys. This effect is not replicated when two outliers are controlled for.

[Table 5 near here]

We investigate the robustness of the PPV results seen in models 4 to 6 in light of two outliers in the data – *The Fight of the Century*" (Floyd Mayweather Jr. vs. Manny Pacquiao) and "T*he Money Fight – The Biggest Fight in Combat Sports History*" (Floyd Mayweather Jr. vs. Conor McGregor). The former reached 4.6 million buys and the latter 4.3 million. These PPV's are the highest selling in the history of U.S boxing. Two approaches are followed and these

comparisons are presented in Table 6. We estimate model 7 using the log of PPV buys as the dependent variable and estimate model 8, omitting the two observations. Many of the results shown in table 6 are robust. The partial evidence found in support for the outcome uncertainty hypothesis does not hold however. Neither the *Popularity* or *Undefeated* effects are substantiated.

[Table 6 near here]

Although comparisons between these results and others studies within combat sport are limited, several of our findings are consistent with the MMA literature. Our evidence suggests that tastes cluster around specific weight divisions across both sources of demand. Fan preferences for specific weights in combat sport are consistent with Tainsky et al. (2013) and Watanabe (2015). The results contrast with Tainsky et al. (2013) however as we do not find evidence in support of the outcome uncertainty hypothesis in a combat sport. Likewise, our talent-based popularity (measure) produces generally contrasting results to past studies (Reams & Shapiro, 2017).

Only Watanabe (2015) has considered the differences between two sources of demand (UFC live attendances and PPV buys). The variations include time trends, holiday effects and fan tastes (e.g. preferences for weight categories). A similar comparison between two sources of demand can be made here. Interesting variations arise between both sources. First, there is a preference for dominance for main events that does not extend to PPV's. Second, preferences for certain characteristics differ between both sources. Viewers favour domestic boxers and rematches for main events. However, a negative effect is reported for the same features at a PPV level. These variances illustrate differences in the consumer tastes for the same sport across two different sources of demand and speak to differences in the preferences of alternative segments of the market.

Discussion

Preferences for Dominance

It is not unusual to find that viewers do not value outcome uncertainty, or at least place a lower value on it relative to other quality dimensions. That said, is worthwhile to consider why fans would prefer less balanced bouts.

One interpretation of this finding is that progressing boxers attract viewers. These boxers usually have gained exposure and are in the process of building their career but have not yet advanced to PPV boxing. If the full extent of a boxer's potential remains uncertain, a career momentum hypothesis may explain fan preferences to view relatively more unbalanced bouts. Several examples stand out in our data. Gennady Golovkin boxed in main events in 2016 (vs. Dominic Wade). At this stage of his career Golovkin already held both a prestigious record, having boxed in many main events previously. Despite the lack of balance, this bout drew 1,325,000 viewers. It is as if fans anticipated his ascent to a fully-fledged PPV performer. Golovkin later boxed in prominent PPV's against Canelo Álvarez. The career of heavyweight boxer Deontay Wilder provides a similar example. Having established a reputable status, Wilder boxed Luis Ortiz in 2018 and Bermane Stiverne in 2017. Betting odds showed that Wilder held a 76 per cent and 96 per cent probability of success respectively yet both bouts attracted over 1,000,000 viewers. An opportunity to view an improving performer, who is at or transitioning toward the PPV threshold, could attract for fans.

Further behavioural explanations are also appealing. For example, fans may have a preference to view a salient 'talent gap' to appreciate elite boxers even more, relative to what is already a highly talented competitor. Also, it is plausible that fans have a preference for upsets. This could be considered a variant of the "David versus Goliath" effect (Buraimo & Simmons,

2008). Rare shock outcomes tend to live on in the memory of viewers and can become watershed moments in the sport (e.g. Buster Douglas defeating Mike Tyson).

Scheduling & Substitutes

While the prohibitive factors associated with European bouts are largely anticipated (afternoon broadcasting times), the results broadly demonstrate and quantify this effect. As we cannot measure ring-walks, this result can only be interpreted generally. That said, the negative *Europe* coefficient shows that bouts scheduled at evening/night European times reduce demand by over a quarter of a million viewers. The sensitivity of viewership to start times has been shown recently (Brown & Salaga, 2018) and, expectedly, pro-boxing is no different to other live sport broadcasts.

One substitution effect is present. Competing *NFL* decreases viewership for main events. This finding points to pro-boxing having a greater shared fan base with the *NFL*. *NFL* broadcasts have been shown to cause significantly lower ratings, but this is reserved to broadcasts that are in competition with local teams playing the same sport (Tainsky & McEvoy, 2012). Except for this one negative *NFL* effect, the peripheral nature of substitutes is largely consistent with Tainsky et al. (2013) who show that no rival entertainment options influence PPV buys for mixed martial arts. Neither model offers supporting evidence that UFC broadcasts influence boxing viewership or PPV buys. UFC broadcasts are not cannibalising the pro-boxing fan base.

Price Effect

Consistent with past research on demand for PPV's we identify a positive PPV price effect (Reams & Shapiro, 2017; Tainsky et al., 2013). We advocate a cautious interpretation of this finding. First, the positive relationship between price and PPV buys can be regulated by a

restricted range of prices (Reams & Shapiro, 2017). Although the price range for PPV boxing is more varied compared to other combat sports, it is still constrained. Second, the price-quantity demanded relationship may reflect attempts to build habits. As the supply of a PPV is unlimited once its fixed costs are covered, providers may sell an event below the profit-maximizing price point to encourage future demand (Tainsky et al., 2013). Third, latent characteristics of each PPV can result in a heterogeneous "product". While it is possible to control for many variables affecting sales, it is challenging to quantify hidden traits that vary across PPV's such as hype created between camps or media attention. PPV's could be viewed as differentiated products that are not perfect substitutes (Noll, 2007).

Viewership Trends

A negative viewership trend is apparent for both main events and PPV's. The popularity of viewing pro-boxing via traditional subscription channels and PPV is in decline. It would be naive however to solely attribute this decay to a decline in the popularity of pro-boxing, particularly given the recent shifts in the broadcasting landscape. Although the evidence is consistent with the view that the sports status is waning, the trend could reflect wider cord-cutting practices and a switch to viewing content on a range of digital devices. The decline may also be a result on the increased number of televised bouts broadcast on networks such as NBC and FOX (e.g. Haymon Boxing's Premier Boxing Champions series). Free-to-air broadcasts may serve the needs of casual viewers, deterring consumers from purchasing premium content.

Conclusion

We contribute to the literature on demand for live sport by modelling the determinants of two sources of direct demand for pro-boxing broadcasts. This context is one of the few mainstream sports which it is yet to receive attention from researchers. While we focus on the outcome-

uncertainty demand relationship, our modelling offers insight to a suite of demand determinants for the sport. The results present evidence that are, in part, contrary to the outcome uncertainty hypothesis and show variations between two sources of demand for the same sport. In general, these results add to the understanding of broadcasting demand for individual sports.

Various management implications can be derived from the findings and our results are of commercial relevance. Specifically, the findings can inform strategic decision making of those organising and broadcasting events. First, the results are a reminder of the importance of quality in determining viewership outside of PPV's. This is relevant to broadcasters considering entry. For main events, staging rematches and bouts featuring domestic boxers achieves higher viewership. The opposite of this implication is applicable to PPV organisers. Avoiding competition with NFL broadcasts is another clear implication for broadcasters scheduling main events. From a policy perspective, as we find that undercard quality does not affect PPV buys, organisers could continue to use a share of the card to promote diversity within the sport at the most elite level without impacting revenues. An example would be greater promotion of women's pro-boxing.

There are several limitations to this paper which can form the basis of future research. First, our data does not capture viewership on digital devices. The sampling frame covers a period of technological advance which saw consumers no longer limited to television viewership. Second, we cannot access data on all determinants theoretically important to demand. For example, information on advertising budgets is private. Marketing efforts, especially those attempting to promote a boxer as a 'face/heel' (protagonist/antagonist), could impact demand. Considering publicity effects of advertising or other behavioural responses to the face/heel dynamic in the context of combat sports is a viable avenue for future demand research. Fans could be more willing to purchase premium content in the hope to see an antagonist lose.

Finally, we offer conjecture to explain the declining trend. Further research should distinguish the causal effects of this deterioration. Exploring data from streaming services or basic cable broadcasts would help determine if the trends reflect a decline in the appeal of the sport.

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Table 1. Variable Overview

Variable	Explanation
Viewership	Nielsen Media Research ratings
PPV Buys	Domestic purchases from satellite and cable homes
OU	Outcome uncertainty measures: (i) BoxRec Difference (ii) DIBO (iii) Theil index
Bout Quality	BoxRec pound-for-pound rating
UnderQual	BoxRec undercard quality measure (if PPV)
Price	Reported price in U.S dollars (if PPV)
Title Bout	Dummy variable to indicate a title bout
Rematch	Dummy variable to indicate a rematch
Undefeated	Dummy variable to indicate if either boxer is undefeated
Domestic	Dummy variable to indicate a U.S boxer
PrevPPV	Dummy variable to indicate a bout with a boxer with a PPV matchup previously
Weights	Dummy variables to indicate weight divisions: Heavyweight (>200lbs), Light Heavyweight (~175lbs), Middleweight (~160lbs) Welterweight (~147lbs) or Superfly/Feather/Light/Bantam (<147lbs)
Promoters	Dummy variables to indicate promoters: DiBella Entertainment, Golden Boy Promotions, K2 Promotions, Main Event Promotions, Matchroom Sports, Top Rank or Independent Promoters
Substitutes	Dummy variables to indicate substitute broadcasts: Boxing, NFL, NBA, MLB, UFC
Popularity	A pound-for-pound index measuring boxer reputation
Holiday	Dummy variable to indicate if a bout coincides with a major U.S or international holiday
Trend	Time Trend
Broadcaster	Dummy variables to indicate a *HBO* or *Showtime* broadcast
Locations	Dummy variables to indicate a venue: California, Nevada, New York, Canada, Europe or Other

Table 2. Descriptive Statistics – Main Events & PPV Buys

Variable	Mean	SD	Max	Min
		Main Events		
Viewership	816,875	337,259	2,146,000	227,000
BoxRec (OU)	385.42	299.83	1335.2	15.8
DIBO (OU)	0.56	0.25	0.89	0.00
Theil (OU)	0.25	0.18	0.61	0.03
Fight Quality	0.83	0.16	1	0.40
Popularity	26.64	18.01	90.00	2.00
Trend	6.55	3.15	12	1
		PPV		
PPV Buys	723,162	798,224	4,600,000	50,000
Price	$57.69	$9.40	$89.95	$44.95
BoxRec (OU)	624.99	479.22	2410.00	1.20
DIBO (OU)	0.44	0.20	0.87	0.04
Theil (OU)	0.35	0.16	0.66	0.03
Bout Quality	0.95	0.10	1	0.60
UnderQual	12.39	2.60	8.00	21.00
Popularity	48.55	26.74	110.00	6.00
Trend	37.50	21.00	1	74

Table 3. Dummy Variable Frequency

Variable	Main Event	PPV
Title Bout	118 (86%)	61 (82%)
Rematch	14 (10%)	16 (22%)
Undefeated	85 (62%)	37 (50%)
Domestic	79 (58%)	51 (68%)
PrevPPV	11 (8%)	-
Heavyweight	17 (13%)	10 (14%)
Light Heavyweight	22 (16%)	-
Middleweight	35 (26%)	23 (31%)
Welterweight	36 (26%)	33(44%)
Lightweights	26 (19%)	8 (11%)
Matchroom Sports	19 (14%)	-
Goldenboy	29 (21%)	33 (45%)
K2 Promotions	8 (5%)	-
Top Rank	27 (20%)	30 (40%)
DiBella Ent	9 (6%)	-
Mainevent	6 (5%)	3 (5%)
Independent Promoter	40 (29%)	8 (10%)
Boxing	37 (27%)	-
NFL	14 (10%)	2 (2%)
NBA	38 (28%)	30 (40%)
MBL	74 (54%)	43 (58%)
UFC	69 (51%)	-
Holiday	6 (4%)	8 (10%)
HBO	87 (64%)	65 (87%)
Showtime	49 (36%)	9 (13%)
California	25 (19%)	3 (4%)
Nevada	14 (10%)	55 (74%)
New York	38 (27%)	9 (13%)
Canada	10 (8%)	-
Europe	17 (13%)	-
Other	32 (23%)	7 (9%)

Table 4. GLM Results – Main Events

	Model 1: BoxRec			Model 2: DIBO			Model 3: Theil		
Dep Var: Viewership	**Coefficient**	**RSE**	**Z-stat**	**Coefficient**	**RSE**	**Z-stat**	**Coefficient**	**RSE**	**Z-stat**
OU	74,561***	(21,128)	3.53	141,960*	(78,825)	1.80	-219,409**	(105,925)	-2.07
Bout Quality	597,824***	(146,145)	4.09	552,415***	(154,990)	3.56	571,268***	(153,899)	3.71
Title	-102,986	(76,563)	-1.35	-97,313	(85,167)	-1.14	-96,094	(84,864)	-1.13
Rematch	185,991**	(71,773)	2.59	176,465**	(76,382)	2.31	182,803**	(76,442)	2.39
Undefeated	2,084	(37,151)	0.06	-3,051	(40,705)	-0.07	-6,262	(40,718)	-0.15
Domestic	110,000**	(45,531)	2.42	117,452**	(47,653)	2.46	116,680**	(47,459)	2.46
PrevPPV	87,139	(82,918)	1.05	135,469*	(81,058)	1.67	135,979*	(79,916)	1.70
Heavyweight	221,144**	(107,270)	2.06	225,775*	(120,664)	1.87	223,442*	(119,552)	1.87
Light Heavyweight	65,916	(74,443)	0.89	110,545	(73,793)	1.50	109,978	(73,706)	1.49
Middleweight	106,405	(66,991)	1.59	137,055**	(69,233)	1.98	137,007**	(68,749)	1.99
Welterweight	172,154***	(47,690)	3.61	188,417***	(50,213)	3.75	187,894***	(50,002)	3.76
Matchroom Sports	-79,711	(71,649)	-1.11	-83,424	(74,558)	-1.12	-79,966	(73,932)	-1.08
Golden Boy	80,558	(60,048)	1.34	84,112	(61,111)	1.38	88,047	(61,193)	1.44
K2 Promotions	87,711	(101,177)	0.87	84,074	(108,483)	0.77	83,972	(107,481)	0.78
Top Rank	-91,709	(80,557)	-1.14	-67,256	(84,510)	-0.80	-67,226	(83,828)	-0.80
DiBella Ent	51,762	(102,268)	0.51	49,216	(104,264)	0.47	49,598	(103,551)	0.48
Main Event	17,183	(85,142)	0.20	30,900	(83,697)	0.37	31,746	(83,386)	0.38
Boxing	-22,936	(43,983)	-0.52	-24,006	(45,959)	-0.52	-21,825	(45,734)	-0.48
NFL	-188,269**	(84,437)	-2.23	-201,888***	(85,200)	-2.37	-198,568**	(85,310)	-2.33
NBA	-82,361	(54,259)	-1.52	-62,118	(55,706)	-1.12	-62,910	(55,731)	-1.13
MLB	-33,003	(55,122)	-0.60	-13,684	(59,713)	-0.23	-12,916	(59,642)	-0.22
UFC	29,253	(40,112)	0.73	9,942	(45,522)	0.22	11,042	(45,323)	0.24
Popularity	1,841	(1,161)	1.59	959.25	(1,166)	0.82	1,012	(1,165)	0.87
Holiday	-9,522	(73,788)	-0.13	-55,271	(71,971)	-0.77	-54,088	(71,316)	-0.76
Trend	-2,788***	(501)	-5.56	-2,988***	(503)	-5.94	-3,009***	(501)	-6.01
HBO	321,898***	(59,551)	5.41	302,202***	(63,717)	4.74	299,754***	(62,820)	4.77
California	19,908	(49,838)	0.40	-5,587	(51,829)	-0.11	-4,443	(51,582)	-0.09
Nevada	-50,821	(59,300)	-0.86	-68,711	(56,933)	-1.21	-69,919	(56,317)	-1.24
Canada	40,201	(89,892)	0.45	889	(89,821)	0.01	-8,143	(89,203)	-0.09
Europe	-270,282***	(93,768)	-2.88	-257,772***	(94,215)	-2.74	-259,729***	(93,980)	-2.76
Other	118,418**	(118,418)	2.12	64,138	(56,414)	1.14	61,400	(56,325)	1.09
Constant	-126,103	(182,280)	0.69	233,008	(142,710)	1.63	358,205***	(115,699)	3.10
N		136			136			136	
VIF		4.87			4.16			4.29	

Table 5. GLM Results – PPV

	Model 4: BoxRec			Model 5: DIBO			Model 6: Theil		
Dep Var: PPV Buys	**Coefficient**	**RSE**	**Z-stat**	**Coefficient**	**RSE**	**Z-stat**	**Coefficient**	**RSE**	**Z-stat**
OU	-1,068	(154)	-0.69	-472,405	(304,517)	-1.55	743,960*	(387,734)	1.92
Price	65,085***	(12,381)	5.26	63,061***	(11,696)	5.39	61,660***	(11,266)	5.47
UnderQual	13,752	(30,426)	0.45	8,899	(31,175)	0.29	5,939	(30,915)	0.19
Title Bout	-200,982	(140,382)	-1.43	-203,350	(143,815)	-1.41	-200,170	(143,484)	-1.40
Rematch	-257,206**	(124,545)	-2.07	-258,012**	(126,801)	-2.03	-263,456**	(126,833)	-2.08
Undefeated	-205,343*	(112,822)	-1.82	-239,555**	(116,608)	-2.05	-247,184**	(116,428)	-2.12
Domestic	-232,125*	(127,345)	-1.82	-211,440*	(125,515)	-1.68	-210,782*	(121,609)	-1.73
Heavyweight	314,194	(267,137)	1.18	201,511	(275,745)	0.73	158,906	(273,025)	0.58
Middleweight	496,979**	(235,432)	2.11	447,517*	(229,115)	1.95	403,784*	(228,311)	1.77
Welterweight	613,626***	(222,025)	2.76	578,177**	(223,082)	2.59	561,653**	(216,903)	2.59
Golden Boy	192,286	(167,128)	1.15	200,911	(171,314)	1.17	192,314	(169,582)	1.13
Top Rank	598,608***	(182,708)	3.28	601,528***	(179,175)	3.36	576,598***	(178,433)	3.23
Main Event	563,983***	(226,408)	2.49	595,933***	(222,949)	2.67	604,151***	(226,262)	2.67
Mayweather Jr	1,219,215***	(230,688)	5.29	1,263,042***	(239,954)	5.26	1,267,167***	(231,429)	5.48
NFL	-86,610	(246,847)	-0.35	-146,699	(221,966)	-0.66	-161,155	(216,108)	-0.75
NBA	-58.198	(99,748)	-0.58	-44,584	(96,798)	-0.46	-41,909	(94,965)	-0.44
MLB	-96,838	(126,693)	-0.76	-109,875	(126,523)	-0.87	-109,800	(126,388)	-0.87
UFC	-87,562	(177,400)	-0.49	-92,380	(182,034)	-0.51	-70,073	(177,749)	-0.39
Popularity	5,325*	(2,810)	1.90	4,870	(2,998)	1.62	5,027*	(2,939)	1.71
Holiday	91,658	(240,058)	0.38	81,695	(241,924)	0.34	63,230	(237,898)	0.27
Trend	-15,440***	(4,357)	-3.54	-13,605**	(4,452)	-3.06	-12,415**	(4,445)	-2.79
HBO	252,589	(229,961)	1.10	248,756	(213,478)	1.17	222,012	(203,806)	1.09
California	-308,537	(273,346)	-1.13	-402,333	(288,672)	-1.39	-437,513	(282,193)	-1.55
Nevada	-183,182	(144,087)	1-.27	-257,715	(158,611)	-1.62	-271,830	(157,679)	-1.52
Other	-459,464**	(226,534)	-2.03	-456,663**	(203,525)	-2.24	-434,057**	(201,679)	-2.15
Constant	-2,826,456***	(748,650)	-3.78	-2,492,655***	(690,495)	-3.61	-2,817,686***	(668,732)	-4.21
N	74			74			74		
VIF	9.45			9.67			9.98		

Table 6. GLM Results – Log Specification & Omission of Outliers

	Model 7: Log Specification			Model 8: Outliers Omitted		
	Coefficient	**RSE**	**Z-stat**	**Coefficient**	**RSE**	**Z-stat**
OU (Theil)	0.535	(0.531)	1.01	272,815	(344,635)	0.79
Price	0.555***	(0.008)	6.57	30,714***	(6,629)	4.63
UnderQual	0.005	(0.036)	0.15	8,439	(24,449)	0.35
Title Bout	-0.147	(0.192)	-0.77	-43,077	(119,106)	-0.29
Rematch	-0.339**	(0.172)	-1.97	-196,623**	(89,939)	-2.19
Undefeated	-0.091	(0.189)	-0.48	-145,245	(96,748)	-1.50
Domestic	-0.629***	(0.190)	-3.32	-267,639**	(112,252)	-2.38
Heavyweight	0.537	(0.474)	1.13	443,355*	(226,958)	1.95
Middleweight	1.090***	(0.301)	3.61	697,845***	(196,363)	3.55
Welterweight	1.216***	(0.292)	4.16	631,233***	(164,712)	3.83
Golden Boy	0.142	(0.222)	0.64	143,563	(167,853)	0.86
Top Rank	0.641**	(0.300)	2.14	506,305**	(179,202)	2.83
Main Event	0.964**	(0.414)	2.33	569,563**	(190,895)	2.98
Mayweather Jr	1.125***	(0.312)	3.60	900,753***	(223,273)	4.03
NFL	-0.217	(0.234)	-0.93	-181,572	(151,008)	-1.20
NBA	-0.119	(0.171)	-0.70	-51,757	(88,472)	-0.59
MLB	-0.190	(0.205)	-0.93	-50,244	(110,106)	-0.46
UFC	-0.301	(0.213)	-1.41	-49,087	(130,072)	-0.38
Popularity	-0.005	(0.003)	-1.61	-2,399	(2,306)	-1.04
Holiday	0.127	(0.293)	0.59	205,761	(207,407)	0.99
Trend	-0.019**	(0.006)	-2.93	-10,561***	(3,232)	-3.27
HBO	-0.323	(0.284)	-1.14	68,745	(171,876)	0.40
California	-0.868	(0.401)	-1.16	-168,902	(196,827)	-0.86
Nevada	-0.880	(0.242)	-0.36	-36,626	(135,809)	-0.27
Other	-0.190	0.357)	-0.53	-259,389	(181,654)	-1.43
Constant	10.226***	(0.066)	15.45	-1,526,399	(555,048)	-2.75
N		74			72	

Appendix

1. Augmented Dickey-Fuller Test Results

Model – Main Event	Test Statistic	1% Critical Value	Lags	Result
Intercept	-7.257***	-3.498	0	Stationary
Intercept and trend	-8.846***	-4.028	0	Stationary
Intercept	-5.354***	-3.499	1	Stationary
Intercept and trend	-6.869***	-4.029	1	Stationary
Suppressed Constant	-2.611***	-2.595	0	Stationary
Model – PPV	**Test Statistic**	**1% Critical Value**	**Lags**	**Result**
Intercept	-8.778***	-3.548	0	Stationary
Intercept and trend	-9.177***	-4.099	0	Stationary
Intercept	-5.803 ***	-3.541	1	Stationary
Intercept and trend	-6.201***	-4.102	1	Stationary
Suppressed Constant	-5.341***	-2.611	0	Stationary

2. Dependent Variable Normality Test Results

SK Test	Pr	$\chi 2$	Pr > $\chi 2$
Main Event - Skewness	0.00	12.02	0.00
Main Event - Kurtosis	0.09		
PPV - Skewness	0.00	49.95	0.00
PPV - Kurtosis	0.00		
Shapiro-Wilks Test	**W**	**Z**	**P > Z**
Main Event	0.96	3.23	0.00
PPV	0.67	6.62	0.00