Monopoly Rents and Price Fixing in Betting Markets

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Abstract

Betting markets provide an ideal environment in which to examine monopoly power due to the availability of detailed information on product pricing. In this paper we argue that the pricing strategies of companies in the UK betting industry are likely to be an important source of monopoly rents, particularly in the market for forecast bets. Pricing in these markets are shown to be explicitly coordinated. Further, price information is asymmetrically biased in favor of producers. We find evidence, based on UK data, that pricing of CSF bets is characterized by a significantly higher markup than pricing of single bets. Although this differential can in part be explained by the preferences of bettors, it is reasonable to attribute a significant part of the differential as being due to monopoly power.

Key Words: Pricing, collusion, information, monopoly rents.

JEL Codes: D4, L1, L5.

Monopoly Rents and Price Fixing in Betting Markets*

I. Introduction

In 1998, the UK Monopolies and Mergers Commission (MMC) produced a detailed report on the structure of the UK betting industry in thelight of the bid by Ladbrokes, the largest chain of bookmakers in the UK, to take over Coral, the third largest chain (MMC, 1998). The MMC argued that the take-over would have adverse competitive effects and recommended that Ladbrokes be forced to dispose of the Coral shops. In this paper we argue that, although market structure may be important, the pricing strategies of the betting industry are also a significant source of monopoly rents. In particular, we investigate the hypothesis that the bookmaking industry acts in such a way as to exact monopoly rent from consumers of a specific, popular bet, namely the Computer Straight Forecast.

In Section Two of the paper, the structure of the betting industry in the UK is outlined. In Section Three, price setting behavior for various bets is discussed. In Section Four, we propose formal tests for the presence of monopoly power and present results based on UK betting data. Some concluding remarks are made in Section Five.

II. The UK Betting Market

The UK racetrack betting market consists of three distinct sectors: off-course betting at licensed outlets (the dominant venue for betting), on-course betting, and betting by telephone (through deposit or credit accounts, or via debit cards). There is also an emerging market for betting via the internet. Of overall betting turnover, on-course (of approximately £700 million) and telephone betting (about £500 million) can be compared with total betting turnover of over £7,000 million. Each of these forms of betting can be sub-divided into fixed-odds betting with bookmakers, and pool (parimutuel) betting with the Horserace

Totalisator Board (the Tote). In pool betting, winning bettors share the pool of all winning bets, net of fixed deductions. Within the off-course market, pool betting plays a fairly insignificant role. Current estimates of the proportion of bets placed at Tote odds in the outlets of the two leading bookmakers range between 1.5 and 2 per cent.

About two thirds of all horserace betting office turnover is at Starting Prices (SPs). The SP is what independent assessors at the racetrack determine to be the 'generally available' price at which on-course bookmakers are willing to lay a 'sizeable' bet at the start of a race. In addition, bets may be placed at 'board prices', i.e. prices posted (and which may fluctuate) during the ten minutes or so before the start of a race. Board prices and SPs are relayed by representatives of SIS (Satellite Information Services) to betting offices as representative of what is available at the track. For some races, bookmakers offer their own set of 'early prices' in the hours before the race.

In addition to straight win bets, there are a wide range of other bets available, notably 'each way' bets, allowing the bettor to nominate a horse (or greyhound) either to win or to be placed (usually in the first three), multiple bets on cumulative outcomes and forecast bets such as the Computer Straight Forecast and Tricast, which involve nomination of the first two or three past the post in the correct order. A study of betting shops by Filby and Harvey (1988) indicated that over 20% of all bets in the UK were forecasts.

The off-course fixed odds market is dominated by the large bookmaking chains, namely Ladbrokes, William Hill and Coral. This 'Big 3' accounts for about 60 per cent of turnover in off-course licensed betting offices, whereas a 'Big 4', which includes Tote Credit, makes up 90 per cent of the telephone betting market. Thus, market power is heavily concentrated on the supply side, both in terms of market structure and information. Bruce and Johnson (1996) see this imbalance of power as translating into an inability by

"...demand-side agents to engage in effective negotiation over price" (p.8), and that bookmakers exploit this "control over the profile of odds and promotional material to which bettors are exposed...to influence betting activity into odds zones which profit the bookmakers at the bettors' expense." (p.20)

III. Price Setting in Off-course Betting Markets

Each on-course bookmaker has the right to set prices about which bets may be placed on different outcomes. These prices are usually reported in the form of odds. Odds of 5 to 1 laid against an outcome, for example, imply a return to a successful bet of five times the initial stake, plus the stake returned. An unsuccessful bet loses the entire stake. Odds made available by each bookmaker are normally single bets to win or each way bets. The large off-course bookmakers have the power to intervene in the on-course market so as to manipulate (legally) the on-course prices, and most importantly the Starting Price. However, the MMC found "no substantiated evidence that [this practice] was being abused." (p.17)

The most important form of price competition is on the terms of betting rather than the prices themselves. For example, "offering a percentage addition to winnings on certain categories of bet; offering to pay out on both results in a horse race in the event that a result is changed following a Stewards Enquiry; offering to pay on the SP if a punter takes an early price but the SP turns out to be better; and various permutations on the theme of 'tax-free' or 'tax-reduced' betting." (MMC, p. 26). Nevertheless, the MMC found that such options were "...limited in both availability and appeal." (MMC, p.27)

An important issue in the setting of on-course prices arises if some consumers possess superior information to the bookmakers. The implications of such 'inside information' in betting markets are well documented in the literature (see, for example, Shin, 1993; Vaughan

Williams and Paton, 1997). Specifically, the equilibrium odds will reflect a premium in favor of the bookmakers, designed to protect against the potential informational advantages of a subset of bettors. However, there is no clear reason to attribute the consequent resource redistribution and misallocation to monopolistic behavior by bookmakers.

The situation in the market for forecast bets is somewhat more complex. Firstly, these bets are usually restricted to the off-course betting market. Secondly, prices for these bets are derived from the prices of single bets. For example, the payout to the Computer Straight Forecast (CSF), in which bettors are required to nominate the first two home in the correct order, is calculated using a nationally applied computerized formula which includes SPs as one component. The likelihood of insider information being exploited in this market is extremely low for several reasons. In the first place the CSF payouts are derived from the SPs and are uncertain at the time of placing a bet. Win bets, however, can be placed at a certain price at any point in the market. It is also well established that the SPs of winners are, on average, shorter than at any other point during the course of the market (Crafts, 1985, 1994). This makes it highly unlikely that insiders would find it more profitable to place a CSF bet with an uncertain return rather than to take a price on a win bet at some stage in the market. A further feature of the UK market which makes insider trading in the CSF market even less likely is that CSF bets, which can only be placed off-course, are normally subject to a deduction of 9 per cent, whereas SP bets can be placed tax-free on-course.

As with win bets at SP, all off-course bookmakers pay out the same odds for a given successful CSF bet. The difference from single bets is that there is no competitive process in arriving at these odds. Although bookmakers are at liberty to set odds on forecast bets, in practice the payout is almost always determined in accordance with the national formula, which is determined and circulated by the industry. In other words, bookmakers in the UK explicitly co-ordinate the prices of CSF bets. The potential implications of this pricing strategy are clear. Even if the prices for single bets are close to competitive prices, the industry may build an extra markup into its derivative pricing formula for CSFs.

Thus, there is prima facie evidence of price fixing in the setting of odds. Despite this, it is possible that the presence of close substitutes to CSF bets may provide effective competition and so limit the markup that can be achieved in practice. There are likely to be two sources of competition. The first is the single (win and place) bets offered by bookmakers. A second, and perhaps closer, substitute is the Dual Forecast (DF) offered by the Tote which requires consumers to select the first two horses past the post. However, unlike the CSF, the DF does not require the correct finishing order to be specified. Thus, it is difficult for consumers to compare returns directly. Further, the DF is promoted in far fewer off-course outlets than the CSF. The MMC Report suggests that a significant degree of product differentiation exists between various types of bet, with many consumers displaying considerable loyalty to their favored product. There is also one other aspect of the bookmakers' pricing strategy in the UK that reduces the ability of substitute products to provide effective competition for CSF bets. The pricing formula used to calculate the CSF returns is not publicized and is difficult to obtain, although technically it is not withheld. Further, unlike win bets and the Tote Dual Forecast, the likely payout to each CSF combination is not made available to consumers during the course of betting. Indeed, the only information to which consumers have ready access is the actual CSF payout to the winning selection. In other words, when consumers purchase CSF bets, all price information is effectively withheld from them *ex-ante* whilst all price information except that on the winning product is withheld *ex-post*. Consequently, it is extremely difficult to compare prices across the different types of bet. It would still be possible (though not without cost) for consumers to estimate the expected price of a CSF bet by using historic data on winning payouts. However, suppliers hinder even this by changing the pricing formula every so often. This is not to say that CSF returns might not be lower than other comparable bets, for reasons such as consumer preferences for risky or skewed rewards. Indeed, even where, as in defined US betting arenas, such formulae are widely available, the expected return can still be relatively poor. Rather, the non-disclosure of the formula in the UK should be regarded as a potential contributory factor in the process.

In summary, the market for CSF bets exhibits key features that distinguish it from that for single bets. Firstly, the prices of CSF bets are fixed explicitly by an organized group of producers. Further, there exists a significant degree of product differentiation between various types of bets that may inhibit effective competition from different market sectors. This feature is reinforced by the fact that price information is asymmetrically weighted against consumers. In these circumstances, we hypothesize that producers will be more able to exact monopoly rent from consumer of CSF bets than from consumers of single bets. It is to tests of this hypothesis that we now turn.

IV. Tests of Monopoly Rents

1. Methodology

The empirical identification of monopoly rents is notoriously complex. Both rates of return above an estimated ‘normal’ level and price cost margins have been used as measures of monopoly power. However, it is difficult to disentangle the monopoly power component of such measures from other factors such as rents to more efficient firms or risk premia. Further, the question of what constitutes the ‘normal’ rate of return is itself not easy to answer (see Martin, 1993, pp. 486-98 for an overview of these debates).

Fortunately, the case we are looking at provides us with a ready solution to many of these problems. As the cost conditions and market structure are identical for both off-course win bets and CSF bets, any differential markup between the implicit price of win bets and CSF bets can be attributed to the presence of monopoly power. Since SPs may also contain some element of monopoly pricing, arising, for example, from the operation of off-course bookmakers in the on-course market, this differential markup may well underestimate the total extent of monopoly rents. However, it will provide us with an estimate of the monopoly power associated with the CSF pricing strategies as opposed to that associated with the market structure of the industry.

Our measure of monopoly rents is the price cost margin or Lerner Index of monopoly power. Although this is commonly used in studies of market power, the difficulty of obtaining detailed price and/or marginal cost data means that most authors are forced to approximate its value using some measure of profitability. This problem is not present in the case in question. Firstly, the price of a bet is equivalent to the implied probability of the payout or odds to a winning bet. In general if the payout to a winning outcome is R, the implied probability (or price) of a bet on that outcome, P, is equal to 1/R. As the win odds are published for every horse in a race, the price of all single fixed odds bets can be easily calculated. For CSF bets, the limited information provided by suppliers means that it is only for the winning combination that prices can be calculated. Secondly, as cost conditions are equivalent in the markets for CSF and off-course single bets, marginal cost data is not necessary to calculate the differential markup.

The methodology is to calculate the price of the winning CSF bet which is implied by the SPs and to compare this with the actual price of the CSF bet. Formally, denote the actual price by P_c and the price implied by the SPs as P_s, the differential markup, M_d, is :

$$M_d = \frac{(P_c - m_c) - (P_s - m_c)}{P_c} \qquad (1)$$

where m_c is marginal cost. This reduces to:

The test of the hypothesis that producers extract greater monopoly rents from CSF bets is of the null that $M_d = 0$ against the alternative that $M_d > 0$.

$$M_d = \frac{(P_c - P_s)}{P_c} \qquad (2)$$

P_c is given directly by *1/CSF* where *CSF* is the winning payout including the original stake. P_s can be calculated as the product of two elements: the objective probability of horse A winning and horse B coming second (π_{AB}) and one plus the markup in this probability implied by the win odds prices. The latter can be estimated by the bookmakers' 'overround' (or excess of the probabilities implied by the SPs of all horses in a race over unity). Noting that SPs are reported excluding the original stake, the probability which the SP of horse *i* implies (π'_i) is equal to $1/(SP_i + 1)$. The overround for race j is calculated as $OR_j = \sum_{i=1}^{n} \pi_{i'} - 1$ where n is the number of horses in the race.

The calculation of π_{AB} is somewhat more difficult. One approach is to use variants of a formula first suggested by Harville (1973). Harville argued that the probability of the two horses coming first and second can be given by:

$$\pi_{AB} = \frac{\pi_A \pi_B}{1 - \pi_A} \qquad (3)$$

where π_A *and* π_B are the objective probabilities that horse A and B win respectively.

One problem with this formula is that, in cases when the reward for being placed is insignificant relative to that for winning, some horses may tend either to win or finish outside of the money (see Hausch, Ziemba and Rubinstein, 1981). In these cases, the Harville formula, which assumes running times are independently and exponentially distributed, and inversely related to the probability of winning, will produce an over-estimate of the probability that a horse will finish second or third for favorites and an underestimate for longshots (see Hausch, Lo and Ziemba, 1994). Consequently both Henery (1981) and Stern (1990) propose modifications to the formula which Lo, Bacon-Shone and Busche (1995) show can be approximated as follows:

$$\pi^*_{AB} = \pi_A \frac{\pi_B^\lambda}{\sum_{i \neq A}^{n} \pi_i^\lambda} \tag{4}$$

where λ is a depreciation factor between 0 and 1. Lo et al. suggest a range of possible values of λ from 1 (which corresponds to the Harville formula) to 0.76. Although we calculate our estimates using both extremes, we find that, in practice, the value of λ makes no difference to our conclusions and for expositional ease, we report results based only on $\lambda = 0.88$, the mid-point suggested by Lo et al.

Estimation of these types of formulae depends on knowing the objective win probabilities of each horse. These might be estimated by normalising the probabilities implied by the starting prices so that they sum to unity in any race. It is a well-known result, however, that this will tend to underestimate the true probabilities of favorites and overestimate them for longshots (for discussions of this 'favorite-longshot' bias see Sauer, 1998; Vaughan Williams, 1999). Consequently, we propose a two-stage procedure to allow for this bias. In the first stage, we run a probit model on an indicator variable (win_{ij}) which is equal to 1 if horse i wins race j and 0 otherwise. In the second stage, we use the predicted probabilities from this model and normalize them so that they sum to unity for each race. The normalized predicted probabilities are then used as proxies for the objective probabilities in equation (4) above. P_s is now calculated as:

$$P_s = \pi^*_{AB} . (1 + OR_j) \tag{5}$$

An alternative specification is to use the individual markup implied by one or other of the first two places instead of the OR. As the markup tends to be lower for horses which have greater probability of winning (as implied in the odds), equation (5) will tend to overestimate P_s and underestimate the differential markup, M_d. Thus, the estimates below should be seen as a lower bound on the impact of any differential monopoly power in the CSF market.

2. Data

Our sample is 1080 horse races taken from the first half of the 1996 UK flat racing season. Starting Prices and other race data were supplied by from Racedata Modeling Ltd. CSF, Tote Win Pool and Tote DF pool winning payouts are taken from the Raceform Flat Annual for 1997. To allow for comparisons across the different bets, we only consider off-course bets where a betting 'tax' of 9% is payable. As CSF payouts are reported net of tax, this requires some adjustment to the reported payouts. For ease of comparison, we calculate all returns based on a £1.09 bet. In other words, a £1 stake plus 'tax' of nine pence. A further adjustment needs to be made as CSF and Tote returns are published including the original stake, whilst SPs are published net of the stake.

3. Results

As noted above, CSF payouts are only available for the winning outcome. Hence, it is impossible to compare the mean value of the overround for SP and CSF bets. However, in both cases it is possible to calculate the mean return that a consumer who places a unit bet on each possible outcome can expect to get. This is reported in Table 1. The mean return to CSF bets is -0.551, whereas it is -0.381 for SP bets. For comparison purposes we also report the equivalent figure for Tote Win Pool bets and Tote DF bets. Simple t-tests confirm that the mean return to CSF bets is significantly lower than that to each of the other types of bet[1]. This is indicative of greater monopoly rents from CSF bets. However, if the book for any race is not balanced, the actual rents gained by suppliers will be dependent on the relative amount of money bet on each outcome. We can get around this problem by comparing the differential price cost margin for equivalent outcomes using the approach described above.

The first step is to estimate the probit model on the indicator variable, win_{ij}. The model we estimate is:

$$win_{ij} = \alpha_0 + \alpha_1 . \ln(\pi_{i'}) + \alpha_2 . \ln(\pi_{i'}) . n_j + u_{ij} \qquad (6)$$

where n_j is the number of horses running in race j and π_i is the probability implied by the SP of each horse, normalized to sum to unity for each race.

The logarithmic form for the probabilities is used as this leads to an error term that satisfies assumptions of normality and homoskedasticity. The motivation for the inclusion of the interaction of n_j with $ln(\pi_i)$ comes from evidence that the bias implicit in the SPs against longshots is dependent on the number of runners in a race (see Shin, 1993). Although there are an enormous number of other variables (e.g. form of horse, jockey, trainer) that might affect the probability of winning, they are generally publicly available and, as such, the information they contain is likely to be incorporated into the bookmakers' odds. This is confirmed statistically as none of a wide range of possible variables improve the explanatory power of our model (full details are available from the author on request). The estimates of equation (6) on all horses running in the 1080 races are as follows:

$$win_{ij} = \underset{(0.057)}{0.423^{**}} + \underset{(0.038)}{0.773^{**}} \ln(\pi'_i) - \underset{(0.001)}{0.0043^{**}} \ln(\pi'_i).n_j$$

*Log Likelihood = -3032.18; standard errors (in brackets) are adjusted to allow for dependence within races; ** indicates significance at the 1% level.*

First, we confirm that the predicted probabilities from this equation and normalized as described above do not display the standard favorite-longshot bias. We group the 11,351 horses according to the predicted probabilities, and then calculate the objective probabilities of winning as given by the win frequency for each group. The null hypothesis of no bias is equivalent to the null hypothesis that the constant term is zero in a regression of the predicted on the objective probabilities (see Busche and Hall, 1988, pp. 609-11). Our predicted probabilities fit the objective probabilities extremely well. For example, using 30 equal sized groups of horses we obtain an R^2 of 0.9843. Our constant term is 0.0011 (standard error = 0.0032) which is not significantly different to zero at all conventional levels. Using different groupings of horses makes no different to our conclusion that the predicted probabilities estimated by equation (6) are unbiased.

We take the predicted probabilities of winning and calculate P_s for each race using equation (5). We then calculate the differential markup of CSF bets using equation (2). The results are reported in Table 2. The first column gives the mean price of CSF bets as implied by the SPs, whilst column 2 gives the actual price. The mean differential markup (M_d) is reported in column 3. The mean differential markup is 14.3% for CSF bets, a figure that is significantly greater than zero at all conventional levels.

4. Alternative Explanations

Although this is indicative of differential monopoly rents, we cannot exclude other explanations for the higher markup. One plausible alternative explanation arises from the fact that CSF bets are characterized by a relatively low probability of winning and a relatively large winning payout compared to the relevant SP bets. The differential markup may reflect a preference amongst bettors for either variance or skewness. For example, Ali (1977) and Quandt (1986) identify bettors as displaying local risk preference, as evidenced by the overbetting of longshots relative to favorites. However, Bird, McCrae and Beggs (1987), using Australian data, and Golec and Tamarkin (1998), using US data, argue that in fact bettors in the US are averse to risk but display a strong preference for skew. In either case, if UK bettors mirror these preferences, the higher markup may be explained by higher demand for CSF bets. An initial examination of the data provides some support for these alternatives. The lower part of Table 2 reports the mean prices and differential markup for various groups of races excluding the larger CSF payouts. When the higher CSF payouts are excluded there is a gradual reduction in the value of the differential markup. However, even for the lowest 10% of payouts, the differential markup (2.45%) is still significantly greater than zero at the 1% level.

More formally, we use regression analysis to test whether the significance of the markup is robust to the preferences of bettors. Our basic model is that the markup in each race j, M_{dj}, is a function of the (constant) degree of monopoly power, α_0, and the differential expected utility arising from a CSF bet and the relevant SP bets:

$$M_{dj} = \alpha_0 + a.(EU \textit{ from the CSF bets - } EU \textit{ from SP bets})_j + \mu_j \tag{7}$$

where μ_j is a normally distributed error term.

The expected utility (EU) for each bet is given as follows:

$$EU(CSF_j) = p_{csf}.v(CSF_j) + (1\text{-}p_{csfj}).v(0)$$

(8a)

$$EU(SP\ bets) = mean[EU(SP_{1j})\ and\ EU(SP_{2j})]$$

$$EU(SP\ bets) = 0.5[(p_{1j}.v(SP_{1j}) + (1\text{-}p_{1j}).v(0) + p_{2j}.v(SP_{2j}) + (1\text{-}p_{2j}).v(0)] \quad (8b)$$

where p represent probability, v(.) is a utility function and subscripts 1 and 2 indicate bets on the winning and second placed horse respectively.

In order to estimate this model, we need to impose a functional form on the utility function, v(.). Golec and Tamarkin (1998) suggest using the following polynomial function and show that it fits existing betting data very well:

$$v(R) = b_0 + b_1 R + b_2.R^2 + b_3.R^3 + u \quad (9)$$

where R is the payout and u is an error term implied by the truncation of the polynomial.

This is an extremely general functional form and allows for different preferences for return (R), risk (R^2) and skewness (R^3). Using this form, the expected utility of a CSF bet becomes:

$$EU(CSF_j) = p_{csfj}.(b_0 + b_1.CSF_j + b_2.CSF_j^2 + b_3.CSF_j^3 + u_j) + (1\text{-}p_{csfj}).b_0$$

or

$$EU(CSF_j) = p_{csf}.(b_1\ CSF_j + b_2.CSF_j^2 + b_3.CSF_j^3 + u_j) + b_0 \quad (10)$$

The expected utility for SP bets on the winning and second placed horse are defined similarly with errors, v_j and w_j.

Equation (7) above now becomes:

$$M_{dj} = \alpha_0 + a.\{p_{csfj}.(b_1.CSF_j + b_2.CSF_j^2 + b_3.CSF_j^3 + u_j) + b_0 - 0.5.[p_{1j}.(b_1.SP_{1j} + b_2.SP_{1j}^2 + b_3.SP_{1j}^3 + v_j) + b_0 + p_{1j}.(b_1.SP_{2j} + b_2.SP_{2j}^2 + b_3.SP_{2j}^3 + w_j) + b_0]\}+\mu_j$$

which reduces to:

$$M_{dj} = \alpha_0 + \alpha_1.X_{1j} + \alpha_2.X_{2j} + \alpha_3.X_{3j} + \varepsilon_j \qquad (11)$$

where $X_1 = p_{csfj}.CSF_j + p_{1j}.SP_{1j} + p_{2j}.SP_{2j}$

$X_2 = p_{csfj}.CSF_j^2 + p_{1j}.SP_{1j}^2 + p_{2j}.SP_{2j}^2$

and $X_3 = p_{csfj}.CSF_j^3 + p_{1j}.SP_{1j}^3 + p_{2j}.SP_{2j}^3$

and $\varepsilon_j = p_{csfj}.u_j + p_{1j}.v_j + p_{2j}.w_j + \mu_j$

As the error term, ε_i, in equation (11) will be heteroskedastic with respect to the relative probabilities, we report robust standard errors. A further issue is the appropriate values of p_{csf}, p_1 and p_2 to use in the expectations. As we are interested in the subjective probabilities of bettors, we use the values implicit in the respective win odds, adjusted for overround. OLS estimation of equation (11) gives the following result:

$$M_{dj} = \underset{(0.834)}{5.05^{**}} - \underset{(3.26)}{12.07^{**}}\, X_{1j} + \underset{(0.014)}{0.35^{**}}.X_{2j} + \underset{(2.50e\text{-}5)}{3.32\text{ e-}4^{**}}.X_{3j}$$

$R^2 = 0.266$; standard errors robust to heteroskedasticity are in brackets; ** indicates significance at the 1% level.

The constant term is positive and strongly significant. Its value suggests that there is a residual average markup of just over 5% that cannot be explained by preferences of bettors for the low-probability high-payout CSF bets. Reassuringly, a link test (see Pregibon, 1980) cannot reject the null hypothesis that the functional form is correctly specified. As the truncation of the polynomial in equation (9) to the third power of R is somewhat arbitrary (see Golec and Tamarkin, 1998, p.210), we test the sensitivity of the estimate to the inclusion of higher powers of R. Inclusion of the fourth and fifth powers of R in equation (9) lead to very similar estimates of monopoly power of 10.07% and 5.72% respectively.

An alternative measure of the probabilities in the expected utility functions would be to use those predicted from equation (6) above. Although these values are estimated and would introduce a measurement error problem into equation (11), the high value of the R^2 in the regressions of predicted probabilities on winning frequencies is suggestive that the problem may not be too serious. Using this method gives a much higher estimate of monopoly power of 10.3%. We explore the issue of measurement error by using errors-in-variables regression. Experiments with reliability levels as low as 90% for variables individually and jointly, lead to a range of estimates for the constant term from 10.7% down to 5.4%, the latter figure being very close to our earlier estimate. In every case the estimates are significantly greater than zero.

A higher markup in the CSF than SP bets may, in principle, reflect an efficient market response to the activity of bettors with inside information. However, as argued in Section 3, the institutional features of the UK market, such as the ability to take a price, and tax considerations, make it highly unlikely that such bettors will find it optimal, in the UK at least, to exploit their information through the CSF.

In summary, we find that the price of CSF bets involves an extra markup of at least around 5% over the markup involved in win bets, even allowing for the impact of consumer preferences on the different bet types. The institutional characteristics of this market strongly suggest that this aspect of the total differential, at least, can be attributed to monopoly power in the market.

V. Policy Implications

The UK betting industry exhibits a high degree of market concentration and the consequences of this have recently been examined by the MMC. This paper has argued that the market for forecast bets exhibits additional characteristics that can be associated with the extraction of monopoly rents from consumers. Prices are coordinated perfectly across the whole industry, the product is highly differentiated and information to consumers is restricted. The empirical evidence presented in this paper strongly supports the hypothesis that bookmakers extract significantly greater monopoly rents from CSF bets than from other bets. The mean return to a unit bet on each CSF combination is significantly lower than those to fixed odds win bets or the Tote Dual Forecast. Further, the price markup implied by CSF payouts to winning selections is significantly higher than that implied in the SPs. Although part of this difference can be attributed to the preferences of consumers, there remains a significant residual markup for which the most likely explanation is monopoly power.

Our findings have several policy implications. Given that the monopoly power is likely to be the result, at least in part, of the restricted information available to consumers, one suggestion is that bookmakers should be forced to publicize the pricing formulae by which forecast payouts are calculated. Further, they might also be required to display the expected return to each CSF selection in the same way as the Dual Forecast displays that are provided by the Tote. Although the industry is likely to strongly resist such proposals, the evidence presented in this paper suggests that they would have a significant impact on this clear case of resource misallocation. As Dowie, Coton and Miers (1991) state, "Neither the argument that [the formulae] are too complicated to understand, nor the argument that they are business secrets, are acceptable in the light of the consumer's right to know the terms on which he is transacting." (p.440)

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Table 1: Mean Returns to Off-course Bets

	SP	Tote Pool	DF Pool	CSF
Number of Possible Bets	11,362	11,362	57,358	114,716
Mean Return	-0.381	-0.369	-0.309	-0.551

Notes:

a. Mean return is calculated to a 1.09 off-course bet (£1 stake plus £0.09 tax) on each possible horse or combination of horses.

Table 2: Differential Markup for CSF Bets

	P_s (CSF Price Implied by SP)	P_c (Actual CSF Price)	M_d Differential Markup (%)	Number of Races
All Races	5.630	5.956	14.29**	1080
	(0.215)	(0.215)	(0.589)	
Lowest 90% CSF Payouts	6.220	6.556	10.71**	972
	(0.231)	(0.231)	(0.518)	
Lowest 75% CSF Payouts	7.293	7.642	7.61**	810
	(0.261)	(0.261)	(0.505)	
Lowest 50% CSF Payouts	9.923	10.301	4.89**	540
	(0.339)	(0.338)	(0.490)	
Lowest 25% CSF Payouts	15.175	15.642	3.49**	270
	(0.499)	(0.490)	(0.624)	
Lowest 10% CSF Payouts	22.965	23.357	2.45**	108
	(0.560)	(0.728)	(0.931)	

Notes:

a. Figures in brackets are standard errors.

b. ** indicates that the null hypothesis that $M_d = 0$ is rejected by a matched pairs t-test at the 1% level.

c. Prices are multiplied by a factor of 100.

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[1]Several authors (for example, Gabriel and Marsden, 1990, 1991; Cain, Law and Peel, 1997) confirm that returns to bets with bookmakers tend to be lower than equivalent bets with the Tote.