# Which Reputations Does a Brand Owner Need? Evidence from Trade Mark Opposition

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**Abstract**

At least two: the reputation of their brand and a reputation for being tough on imitators of this brand. Sustaining a brand requires both investment in its reputation amongst consumers and the defence of the brand against followers that infringe upon it. I study the defence of trade marks through opposition at a trade mark office. A descriptive analysis of trade mark opposition is provided. Building on this a model of opposition and adjudication of trade mark disputes is presented. This is applied to trade mark opposition in Europe. Empirical results show that brand owners can benefit from a reputation for tough opposition to trade mark applications. Such a reputation induces applicants to settle trade mark opposition cases more readily.

JEL: K41; L00; O31; O34

Keywords: Trade marks, Opposition, Intellectual property rights, Reputation

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# 1 Introduction

Trade marks enable consumers to reliably distinguish amongst producers and branded goods.[1] In turn, this provides incentives for producers to differentiate products and build brand reputation. However, trade mark registration by itself cannot support this mechanism. Trade marks are passive rights: brands must be defended against imitation if trade marks are to be effective. Trade mark opposition provides a first line of defence for owners of established brands.

In trade mark opposition owners of existing trade marks (leaders) seek to protect these against infringement by similar trade mark applications of other firms (followers). The process is similar to litigation and therefore the question arises why firms often fail to settle disputes about similarity of trade marks ? I investigate this 'litigation puzzle' (Waldfogel, 1998) using data on trade mark opposition in Europe. The paper shows how a reputation for toughness in opposition helps brand owners to reduce the costs of defending a trade mark portfolio. It contributes to the literature on the 'litigation puzzle' by providing and estimating an empirical model of reputational effects when some parties litigate more frequently than others. The paper is also the first study of trade mark opposition. It contributes to a literature studying how costs of defending intellectual property rights affect their value to different kinds of firms (Lanjouw and Schankerman, 2001; Lanjouw and Lerner, 2001; Crampes and Langinier, 2002; Harhoff and Reitzig, 2004). To date this literature focuses solely on patents. Finally, as Graham and Somaya (2006) note there is surprisingly little previous research on trade marks.[2] This paper shows how data from trade mark registration can be used to study this fundamentally important and understudied property right.

It is often said that imitation is the sincerest form of flattery; trade marks protect brand owners against such flattery. A registered trade mark protects a mark against exact imitation. If brand owners seek protection against use of similar marks, they must show their own trade mark is in use and is known by consumers. They must also establish that the follower's trade mark will confuse consumers. Greater brand reputation affords a trade mark more extensive protection only if it can be proven in court that a mark is well known among consumers (Phillips, 2003).

In a sufficiently large pool of registered trade marks, avoiding similarity between an application and existing trade marks becomes extremely costly. Trade marks may be considered similar in several dimensions, including visual, phonetic and meaning. Since brand owners are best placed to determine when a trade mark application becomes too similar to their brands many trade mark systems allow brand owners to oppose applications.[3] Trade mark opposition cases frequently pit firms against one another that have no connection in markets or technology. Then, leader and follower possess little information about one another and a reputation for aggressive opposition may be valuable to the leader. Such a reputation will suggest that the leader can produce good evidence for use and reputation of their brand. This is by no means a foregone

[1] In this paper trade marks are understood to be property rights which protect brands. A brand may be protected by several trade marks belonging to the same firm.

[2] Theoretical work on the role of trade marks and brands includes Perry and Groff (1986), Cabral (2000) and Choi (1998). Recent empirical studies which make use of trade mark data are Mendonca et al. (2004) , Greenhalgh and Rogers (2006) and Graham and Somaya (2006).

[3] The trade mark systems of the United States, Germany and of the Office for Harmonisation in the Internal Market (OHIM or simply the Office) all provide the possibility of opposition.

conclusion as such evidence can be costly to produce. It is often necessary to survey consumers in several markets to provide good evidence of a reputation.

Drawing on Waldfogel (1998) I investigate whether models of divergent expectations or asymmetric information can explain why leaders and followers fail to settle disputes about trade mark applications. Of these explanations divergent expectations emerges the more likely. Additionally, I show that firms which behave aggressively in opposition obtain favourable outcomes in later opposition cases. The hypothesis that reputation building allows trade mark owners to benefit from a tough stance in protecting their trade marks is the focus of this paper. Since a leader must adapt their case in each new opposition proceedings, followers will be uncertain about the quality of the case that they must answer.

A tough stance in trade mark opposition is given if a brand owner builds a reputation for opposition of any trade mark application similar to their own. Tough opponents have previously invested in evidence proving use and reputation of their trade mark. Then followers, whose new trade mark is opposed, will anticipate higher costs in answering to the case made by the leader and may prefer to settle. Therefore, a reputation for toughness can lower the effective costs of defending a trade mark across several opposition cases.

This theory is tested on a comprehensive dataset of trade mark opposition cases from the Office for Harmonisation in the Internal Market (the Office).[4] This institution began to operate a trade mark system for the European Union in 1996. The Office offers an important and cheap way for firms to acquire trade mark protection throughout Europe. Between 1996 and 2004, there were over 400,000 applications for trade marks at this office of which over 225,000 were registered.[5] Opposition is an important feature of the trade mark system operated by the Office. More than $17\%$ of all trade mark applications at the Office are the subject of at least one opposition.[6] Interviews with trade mark attorneys suggest a similar number of potential disputes is settled without opposition proceedings being started.

I present a model of selection into adjudication and of adjudication of trade mark disputes. From this an empirical model is derived which incorporates a selection and an outcome equation. Identification of the model is based on measures of reputation for tough opposition and of uncertainty about the leader. The selection equation is jointly estimated with the outcome equation in a bivariate probit selection model. Theory indicates that the model will be affected by heteroscedasticity. Taking this into account the model is estimated by full information maximum likelihood (FIML).

Table 1 shows the top 20 applicants at the Office between 1996 and 2004. Many come from countries outside the European Union. There is considerable heterogeneity in the number of oppositions that firms receive and generate relative to applications. A high ratio of oppositions generated to applications may reflect reputation building. For instance, the two most frequent

[4]The abbreviation for this office is OHIM, but it refers to itself as the Office in its publications.

[5]The USPTO had a stock of 1,216,691 trade marks end of 2004. The annual number of trade mark applications at the USPTO was above 200,000 every year between 1996 and 2004. The German trade mark office (DPMA) had a stock of 716,123 trade marks end of 2004. The annual number of trade mark applications there was between 58,000 and 90,000 per year between 1999 and 2004.

[6]The level of opposition at the USPTO was below $5\%$ in 2005 and the level of opposition at DPMA fell from $12\%$ to $6\%$ between 1999 and 2004.

opponents in this table have built a large and very homogeneous set of brands (Deutsche Telecom) and a globally unified set of brands (Unilever). In both cases use of similar trade marks by other firms could be very damaging, and a reputation for tough opposition advantageous.

Trade marks registered at the Office exist side by side with national trade marks registered in Europe. As a consequence the pool of potential opponents to a trade mark application at the Office is especially large. Furthermore, the existence of different languages within this trade mark system multiplies the possible forms of similarity beyond those that exist in national trade mark systems. These features suggest that opposition has a more important role to fulfil within the trade mark system administered by the Office than in national trade mark systems.

## Table 1: The top 20 applicants at the Office, 1996-2004
### Applications, oppositions received and oppositions generated

| Origin | Applicant | Applications | Oppositions received | Applications rejected | Oppositions generated |
|---|---|---|---|---|---|
| JP | KONAMI | 1313 | 102 | 2 | 8 |
| US | PROCTER & GAMBLE | 1065 | 162 | 4 | 82 |
| DE | DEUTSCHE TELEKOM | 1035 | 345 | 18 | 240 |
| US | MARS | 897 | 215 | 18 | 196 |
| DE | DAIMLER CHRYSLER | 812 | 103 | 6 | 113 |
| DE | REWE ZENTRAL | 621 | 372 | 39 | 149 |
| FR | L' OREAL | 608 | 72 | 1 | 36 |
| DE | BASF | 570 | 113 | 10 | 85 |
| NL | UNILEVER | 490 | 110 | 1 | 235 |
| FR | LANCOME | 439 | 64 | 1 | 38 |
| US | IBM | 420 | 52 | 1 | 38 |
| US | MICROSOFT | 392 | 35 | 1 | 21 |
| JP | SONY | 372 | 73 | 2 | 49 |
| DE | VOLKSWAGEN | 360 | 78 | 6 | 46 |
| DE | BMW | 351 | 31 | 0 | 27 |
| US | VIACOMINT | 326 | 57 | 2 | 46 |
| CH | SYNGENTA | 325 | 132 | 8 | 141 |
| DE | ALTANA | 324 | 101 | 19 | 98 |
| US | PFIZER | 315 | 108 | 4 | 107 |
| US | ELI LILLY | 311 | 104 | 4 | 42 |

The results of the empirical analysis support the theoretical model. They show that the leader's reputation for tough opposition has a strong effect on the probability that a trade mark opposition case will be settled. Measures of damage and trade mark value are shown to predict the decision of the Office in adjudication. In particular, it is shown that simple measures of string similarity applied to leaders' and followers' trade marks are good predictors of the damage which a follower's trade mark is likely to do to the leader's trade mark. These measures are also used to measure the leader's reputation for toughness in opposition.

The paper is organised as follows: Section 2 analyses firms' opposition strategies descriptively. Section 3 presents a theoretical model of opposition from which an empirical specification is derived. The data are described in Section 4. The effect of a leader's reputation for tough opposition on the probability of adjudication is estimated in section 5. Section 6 concludes.

# 2 Descriptive Analysis of Trade Mark Opposition

This section analyses the trade mark application process at the Office using a descriptive approach. First, outcomes of trade mark opposition are described. Then, I show that frequent opponents are able to protect their trade marks against a wider range of followers' trade marks than infrequent opponents. I also show that increased certainty about the value of the leader's trade mark increases settlement of disputes. These findings indicate that uncertainty affects the probability of settlement in trade mark opposition. Additionally, they suggest frequent opponents may acquire reputations that they can exploit in protecting new trade marks through opposition.

Trade mark opposition disputes revolve around the extent of reputation which the leader's trade mark enjoys with consumers and the likelihood of confusion between the opposed and the opposing trade marks on the part of consumers. Greater reputation of a trade mark with consumers increases the degree of protection the trade mark enjoys. Firms owning trade marks with very high reputations are in a position similar to the owner of the chainstore in the chainstore game (Selten, 1978; Milgrom and Roberts, 1982; Kreps and Wilson, 1982). They face a potentially large number of infringing followers who they wish to dissuade from pursuing applications similar to their own trade mark. These followers may observe outcomes of previous opposition cases. They will be able to see how similar opposed trade marks were in past cases to the leader's own trade marks: this conveys information about the reputation a leader thought their trade mark possessed and their willingness to prove this. Followers will also be able to observe how often previous opposition cases settled and who won those cases. From this information they must distill an expectation about the effort which the leader will expend in opposing them.

In this context frequent opposition has two effects: (i) it lowers leaders' average costs of opposition as they build up evidence necessary to demonstrate the reputations of their trade marks with consumers and (ii) it creates a reputation for leaders' ability and willingness to pursue opposition cases in adjudication.

The first of these effects reduces the bargaining surplus, as pursuing adjudication of cases is less costly to the leader. If we assume that parties split the surplus which settlement offers evenly, as in Nash bargaining, then the improvement of the leader's outside offer means the follower will receive less than if they faced a leader with higher costs of adjudication (Binmore et al., 1986). If bargaining is over how much similarity between trade marks the leader must tolerate such a shift implies that they tolerate less similarity. I show below that leaders with more prior oppositions are able to settle and win cases against trade marks that are less similar to their own. This implies that their trade marks enjoy a greater range of protection. Secondly, a leader's reputation for tough opposition raises the expected costs of evidence the follower must bear in opposition. This raises the surplus from settlement and reduces the likelihood of bargaining breakdown.

Below measures of string similarity are introduced to measure the range of protection which leaders' trade marks enjoy. These measures are applicable to word marks: trade marks consisting only of words and not of pictorial or other elements. Therefore, I focus on opposition cases revolving around word marks in what follows.

## 2.1 Applications, Oppositions and Registrations

The dataset used here is derived from administrative data on trade marks provided by the Office. It contains information on applications, applicants and opposition cases between 1996 and 2004.

Table 2 below displays the number of trade mark applications and the incidence of opposition to trade marks. 17.61% of trade mark applications received by end of 2002 were opposed at least once. Many of these applications received several oppositions. In the lower part of Table 2 the line 'Opposition cases' details the total number of opposition cases filed against applications of a given cohort. The line 'Word mark cases' shows opposition cases involving only trade marks consisting of words. This paper focuses on opposition cases between such word marks. Using measures of string similarity I obtain information about the quality of each case. These measures can be derived for a subsample of opposition cases consisting of all oppositions between word marks concluded before the end of 2004. This subsample contains 42,433 opposition cases.

Table 2: Applications of trade marks and incidence of opposition at the Office

| **Status of trade mark applications** | **Application Year** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | Total |
| Total applications | 42,743 | 26,878 | 31,275 | 40,960 | 56,980 | 48,519 | 44,788 | 57,109 | 56,828 | 406,080 |
| Unopposed | 35,590 | 22,193 | 25,334 | 33,211 | 46,861 | 40,197 | 37,320 | 50,665 | 56,790 | 348,161 |
| % of total | 83.27 | 82.57 | 81.00 | 81.08 | 82.24 | 82.85 | 83.33 | 88.72 | 99.93 | 85.74 |
| Opposed | 7,153 | 4,685 | 5,941 | 7,749 | 10,119 | 8,322 | 7,468 | 6,444 | 38 | 57,919 |
| % of total | 16.73 | 17.43 | 19.00 | 18.92 | 17.76 | 17.15 | 16.67 | 11.28 | 0.07 | 14.26 |
| Opposition cases* | 9,531 | 6,252 | 8,112 | 10,492 | 13,487 | 11,094 | 9,662 | 8,277 | 42 | 76,949 |
| Word mark cases** | 4,575 | 5,310 | 7,743 | 10,117 | 12,808 | 10,001 | 8,270 | 5,907 | 6 | 64,737 |

* Distinguishes separate opposition cases against the same trade mark application.

** Count of opposed and opposing trade mark pairs which contain only words.

Before the opposition process can begin the Office will have examined a trade mark application. If the Office is satisfied that the application meets the requirements for a trade mark it will publish the application. Only then, are rival firms in a position to oppose.

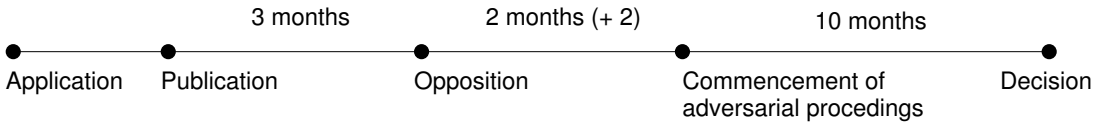


Figure 1: The trade mark opposition procedure

If there is an opposition, the ensuing opposition process has three phases illustrated in Figure 1. Firms must lodge their opposition with the Office within three months of publication. Thereafter the formal opposition process begins. Figure 1 indicates how long each phase should take according to the Office. Leaders and followers can bargain over the trade mark application before and after notification of opposition. They may also withdraw from the opposition case at any time. The case is then closed by the Office.

What outcomes do word mark opposition cases at the Office normally have? Table 3 shows the proportion of settled and adjudicated opposition cases at the Office which terminated before the end of 2004. The "trial rate" for these cases at the Office is 19,3%. Of these, 58,7% are decided in favour of the follower.[7] 8% of word mark applications that are opposed fail. These data show that opposition is a significant risk for applicants at the Office. Even if an opposition case is eventually settled or won this may take a long time. On average an unopposed trade mark application takes 1.76 years to register from the date of filing. The vast majority of trade marks take this route. In contrast applications that encounter opposition are in the system for much longer. Conditional on opposition the average length of the application process depends largely on whether the parties come to an agreement or whether the Office makes a ruling. Opposition cases adjudicated by the Office take in excess of four years to end on average. Cases settled by the parties conclude after about three years on average.

Table 3: Outcomes of opposition cases decided by 2004

| **Outcome** | **Adjudication decision** | | | | | |
|---|---|---|---|---|---|---|
| | **No** | | **Yes** | | **Total** | |
| | N | % | N | % | N | % |
| Leader wins | 0 | 0 | 3,377 | 41,26 | 3,377 | 7,96 |
| Leader loses | 0 | 0 | 4,807 | 58,74 | 4,807 | 11,34 |
| Settlement | 34,249 | 100,00 | 0 | 0 | 34,249 | 80,71 |
| Total | 34,249 | 100,00 | 8,184 | 100,00 | 42,433 | 100,00 |

Three types of cost are associated with trade mark opposition: administrative costs, costs due to the delay in the use of a trade mark and the costs of providing evidence. The administrative costs are minimal at 350 Euro. In contrast the costs of delay may be very substantial if the follower has already embarked on a marketing campaign to promote their trade mark. Another important source of costs in trade mark opposition is the provision of evidence to the Office. These costs can also be substantial. They are discussed in greater detail below. Since each party carries its own costs, neither the costs of delay, nor the costs of evidence can be shifted to the loser of a trade mark opposition case.

## 2.2 Adjudication of Trade Mark Disputes

Trademark opposition imposes significant delays and may lead to the rejection or amendment of trademark applications by the Office. Why then do the parties to trade mark opposition cases ever fail to settle their disputes? The question why legal disputes in general are ever adjudicated has been extensively analysed in theoretical and empirical work.[8] Explanations for occurrence

[7] Cases in which only part of a trade mark application is rejected are deemed to be "won" by the leader. Any restriction of a trade mark application will improve the leader's position, even if only partly.

[8] Early work includes Png (1987), Bebchuk (1984) Priest and Klein (1984), Schweizer (1989) and Spier (1992). Empirical work on litigation includes Fenn and Rickman (1999), Waldfogel and Siegelmann (1999). In the literature

of adjudication centre on divergent expectations and asymmetric information (Waldfogel, 1998).

Trade mark opposition differs from most other litigation settings as parties have very asymmetric exposure to opposition and often have no interaction outside of the realm of trade marks. In trade mark opposition some leaders are very active opponents whilst most firms are inactive followers who have much less experience with opposition. For instance, in the sample investigated here $91.25\%$ of applicants had previous experience of 6 opposition cases or fewer when encountering opposition. In contrast, only $80.60\%$ of opponents had previously opposed $6$ or fewer applications. As a consequence 401 of the 19,263 opposing firms in the sample account for $25\%$ of opposition cases. Additionally, leaders and followers in trade mark opposition cases do not usually come from similar industries. I use the NICE classification to determine for which goods and services firms protect their trade marks. Using this information it emerges that there was no overlap at all between firms' trade mark portfolios in the space of goods and services in $49,27\%$ of opposition cases between word marks.

Leaders with higher frequency of opposition reduce uncertainty about their willingness to pursue damaging trade marks and about the quality of the evidence they possess.[9] This is likely to increase the rate of settlement of opposition cases and will allow leaders to seek more favourable outcomes. To demonstrate that this happens, I use similarity measures for word marks. These capture aspects of the strength of an opposition case to a word mark application. In particular, such similarity measures pick up string similarities, which are often the basis of confusion in word mark disputes. Consider for instance the dispute between Compaq and Premiere Medien over the trade marks ARMADA and AMANDA. These words are measurably more similar than the average pair of trade marks in all word mark opposition disputes brought at the Office between 1996 and 2004.

Table 4: Similarity by inside opposition

| | **Inside Opposition*** | | | | Differences of means tests | |
|---|---|---|---|---|---|---|
| | Yes | | No | | | |
| **Opposition outcomes** | **Levenshtein** | **Jaro Winkler** | **Levenshtein** | **Jaro Winkler** | **p-values** Lev. | J.W. |
| **Adjudication outcomes** | | | | | | |
| Application rejected | -0.23 | 0.82 | -0.21 | 0.84 | 0.010 | 0.065 |
| Application rejected in part | -0.20 | 0.84 | -0.19 | 0.85 | 0.074 | 0.086 |
| Opposition rejected | -0.26 | 0.87 | -0.23 | 0.85 | 0.001 | 0.061 |
| Opposition failed | -0.28 | 0.78 | -0.26 | 0.79 | 0.287 | 0.795 |
| Total | -0.25 | 0.80 | -0.24 | 0.81 | | |

* Inside opposition is opposition based on a trade mark registered at the Office as opposed to opposition based on a trade mark registered at a national office.

on intellectual property determinants of patent litigation and opposition have also been studied empirically. This work includes Lerner (1995), Lanjouw and Schankerman (2001), Somaya (2003), Harhoff and Reitzig (2004) and Lanjouw and Schankerman (2004).

[9] In fact, trade mark attorneys I have interviewed state that large firms sometimes "bombard" opponents with evidence regarding a case and similar previous cases in order to extract favourable settlements.

Table 4 shows how the similarity between the leaders' and followers' trade marks varies by opposition outcome. Similarity of trade marks is greater for both similarity measures set out in the Table if the measure takes a higher value. The similarity of word marks is measured with the help of two computer implemented algorithms (Levenshtein and Jaro Winkler) that calculate string distances. The Levenshtein algorithm used here produces values between $-1$ and $0$, while the Jaro Winkler algorithm used produces values between $0$ and $1$. In case of the example brought above the values are $-0.33$ and $0.9$ respectively, whereas the averages over all word mark opposition cases are $-0.23$ and $0.82$. For both algorithms higher values indicate greater similarity. The algorithms are further discussed in Appendix A. I distinguish between opposing word marks that are themselves registered at the Office, giving rise to 'inside opposition' and those that are not. On average trade marks registered at the Office will be more valuable than national trade marks because they are protected in a larger geographical area.[10]

Table 4 shows two things: first, the similarity of word marks is lower on average if opposition cases fail or are rejected. Second, the average similarity of trademarks is lower under inside- than outside opposition. As the p-values reported in the Table demonstrate these results are generally significant at the 10% level and in two cases even at the 1% level. The first finding also holds for all word marks in the sample and is significant. While this finding is reassuring from the point of view of the Office - which rejects cases which are more similar on average - it is puzzling when we consider the leaders. Why do they pursue such cases? As indicated previously, leaders may pursue low quality cases to establish a reputation for toughness in opposition. This reputation is beneficial in future cases as it lowers the expectations that future followers have of the value of adjudication.

Table 5: Opposition cases based on new trade marks

| **Opposition status** | **Preceding opposition activity low** Levenshtein | **N** | **high** Levenshtein | **N** | **Differences of means test** p-values |
|---|---|---|---|---|---|
| **Adjudication outcomes** | | | | | |
| Application rejected | -0,218 | 232 | -0,177 | 21 | 0.147 |
| Application rejected in part | -0,189 | 190 | -0,265 | 12 | 0.053 |
| Opposition rejected | -0,257 | 428 | -0,336 | 32 | 0.010 |
| Opposition failed | -0,243 | 15 | . | 0 | |
| **Settlement outcomes** | | | | | |
| Application limited | -0,221 | 1934 | -0,244 | 155 | 0.068 |
| Application withdrawn | -0,205 | 1684 | -0,249 | 174 | 0.001 |
| Opposition withdrawn | -0,219 | 1322 | -0,243 | 142 | 0.070 |
| Total | -0,218 | 5817 | -0,249 | 536 | 0.001 |

[10] Greenhalgh and Rogers (2006) show that UK firms which have registered a trade mark at the Office have higher Tobin's q than UK firms which register national trade marks.

In fact, the proportion of trade mark disputes that go to trial falls slightly with the number of previous opposition cases brought by an opposing firm as I show below. However, Table 5 shows that firms with previous experience of trade mark opposition oppose rival trade marks with significantly lower average similarity than firms that lack such experience. In other words, they oppose trade mark applications that are less likely to confuse consumers and even extract settlements with greater frequency. In order to make this point convincing Table 5 contains only opposition cases in which opposing trade marks are not previously registered at other trade mark offices and therefore have the same geographic spread and age when opposing.

Table 5 focuses only on the Levenshtein similarity measure as it provides very similar results to Jaro-Winkler. A comparison of the first columns in Tables 4 and 5 reveals that on average the similarity of trade marks is greater when the inside trade mark has no seniorities, has not been involved in opposition previously and in which the trade mark owner has not undertaken opposition on the basis of other trade marks very often, i.e. in Table 5. This shows that leaders are more conservative when their own reputation for aggressive opposition is low.

Table 5 also contains information on the behaviour of leaders who themselves will have a reputation for opposition, even if the trade mark their current case rests on is not well known. This reputation rests on the greater frequency with which they oppose trade mark applications of other firms. The Table reveals that these leaders are not at all conservative when undertaking opposition cases. The p-values reported in Table 5 indicate that such leaders are significantly more aggressive than those who have little experience with opposition. Note also, that in spite of their greater aggression the trial rate for these cases is significantly below average at $12,12\%$.

The combined evidence presented in Tables 4 and 5 shows that frequent opponents have an advantage over infrequent opponents in opposition. They are able to extract more settlements and simultaneously oppose less similar trade marks on average. This implies that their trade marks enjoy greater protection. Additionally, I have regressed the probability that a trade mark is withdrawn by the follower on a dummy for high previous experience of opposition ($n > 6$) for the leader. Here the sample consists of all those observations in which an opposing trade mark was first used in opposition.[11] It emerges that the log odds of withdrawal are significantly above one ($1.111$) at the one percent level in such a regression. This results also indicates that leaders benefit from previous oppositions in later cases.

Next, I investigate whether registration of trade marks at the Office by a leader reduces uncertainty for followers. Such a registration puts the mark on the register at the Office making it much easier for opposed firms to extract information about the trade mark and its owner. I can show that there is an increase in the percentage of cases settled and a reduction in the percentage of cases lost by the leader in adjudication. These findings indicate that followers are making more offers which leaders are willing to accept when the leader's trade mark is registered at the Office. This is commensurate with a fall in uncertainty for followers.

Table 6 shows three things: first, disputes involving leaders with inside trade marks are more likely to be settled than disputes involving leaders with outside trade marks. The odds ratio for 'Applications withdrawn' is significantly in excess of one. Second, the rate at which

[11] This regression is not shown here to save space, but is available on request.

leaders win opposition cases approaches $50\%$ if we compare outside to inside opposition. The percentage of applications partly or wholly rejected under 'inside opposition' is $7,15\%$ while the percentage of oppositions that fail or are rejected is $7,97\%$. In the absence of 'inside opposition' the percentage of oppositions rejected is much greater at $12\%$. Finally, selection affects mainly rejected oppositions and is therefore one sided. The odds ratio testing whether the proportion of oppositions rejected is the same under inside and outside opposition rejects the null hypothesis clearly. Similarly, the proportion of applications partly rejected also diminishes significantly. However, the proportion of cases in which the application is rejected is stable.

Differences in trial rates between 'inside opposition' and 'outside opposition' show that uncertainty about cases diminishes under 'inside opposition'. It seems that uncertainty falls particularly for followers, as would be expected if followers can learn about leaders more easily when trade marks are registered at the Office instead of national trade mark offices.

Table 6: Opposition outcome by inside opposition

| **Opposition outcome** | **Inside opposition*** | | | | | | **Test** | |
|---|---|---|---|---|---|---|---|---|
| | No | | Yes | | Total | | Odds ratio | Std. error |
| | % | N | % | N | % | N | | |
| **Adjudication outcomes** | | | | | | | | |
| Application rejected | 4.17 | 1,236 | 4.06 | 523 | 4.13 | 1,759 | 0.97 | 0.052 |
| Application rejected in part | 3.85 | 1,141 | 3.09 | 398 | 3.62 | 1,539 | 0.80 | 0.047 |
| Opposition rejected | 12.82 | 3,805 | 7.78 | 1,002 | 11.30 | 4,807 | 0.57 | 0.021 |
| Opposition failed | 0.18 | 54 | 0.19 | 25 | 0.19 | 79 | | |
| **Settlement outcomes** | | | | | | | | |
| Application withdrawn | 26.37 | 7,824 | 30.44 | 3,919 | 27.60 | 1,743 | 1.22 | 0.028 |
| Application limited | 32.20 | 9,553 | 32.76 | 4,218 | 32.37 | 13,771 | 1.02 | 0.023 |
| Opposition withdrawn | 20.13 | 5,972 | 21.46 | 2,763 | 20.53 | 8,735 | 1.08 | 0.028 |
| Total | 100.00 | 29,585 | 100.00 | 12,848 | 100.0 | 42,433 | | |

* 'Inside opposition' arises if the opposing trade mark is registered at the Office itself.

These various explanations of the propensity to take trade mark opposition cases to adjudication are further pursued in Sections 4 and 5. The following section briefly considers the process of bargaining under the shadow of adjudication.

# 3 A Model of Trade Mark Opposition

In trade mark opposition bargaining takes place in a setting in which some parties repeatedly participate in bargaining over trade mark applications with parties having little or no prior experience of such bargaining. Leaders and followers have the outside option to proceed to adjudication and there is uncertainty about the other party's efforts there. The previous section shows that leaders may exploit reputations derived from previous opposition cases. It also shows uncer-

tainty about the quality of opposition cases affects the probability of observing adjudication. The model presented here builds on Meurer (1989) and Lanjouw and Lerner (1998). It shows how a standard bargaining model can be used as the basis for an empirical specification with which selection into adjudication can be studied.

There is a sizeable literature on bargaining with private information. Ausubel et al. (2002) point out that empirical tests of such models are challenging as their predictions depend on details of the bargaining procedure, on the source of private information and on costs of delay. I have no information about the process of bargaining or costs of delay for individual trade mark opposition cases. Therefore, I adapt a standard model of bargaining with outside options to trade mark opposition. In this model uncertainty about key variables can lead to breakdowns of bargaining and adjudication of trade mark opposition cases.

Leaders' reputations will matter if they interact repeatedly with many different followers in trade mark opposition and if there is uncertainty about a leader's efforts in each new case. Uncertainty is likely to arise as leaders must adjust their evidence to the particulars of each new opposition case. How well this is done will depend in part on their efforts. Followers costs of adjudication will depend directly on the leader's efforts: the better the case that will be brought, the costlier the defence of a trade mark application. Therefore, leaders with reputations for tough behaviour may be able to induce followers to settle.

The process of trade mark opposition set out in Figure 1 above is modelled as a three stage game between the follower, the leader and the Office:

Stage 0 Nature provides the follower with a trade mark. The follower believes the trade mark to be sufficiently different from existing trade marks to apply for it.

Stage 1 The trade mark office examines the application and finds it to be similar to the leader's trade mark and inform them of this fact. Leader and follower simultaneously decide whether to oppose the trade mark application and whether to uphold it. Each has a belief about the value of the leader's trade mark and the damage done by the followers if granted.

Stage 2 Under opposition, leader and follower bargain over a settlement. If settlement can be achieved the game ends. If settlement fails the leader faces a cost $E$ of providing evidence to the Office[12]. The follower faces a cost $e$ of responding to the leader's evidence.

Stage 3 If settlement fails, the trade mark office determines whether the follower's trade mark is too similar to the leader's, conditional on a legal standard $\bar{D}$.

The game is solved by backwards induction and subgame perfection is applied.

I assume that the beliefs of leader and follower about the value of the leader's trade mark and the effects of the follower's trade mark on this value are independent random draws from the same distribution. If $V$ is the true value of the leader's trade mark, then the leader's and follower's beliefs are $V_i = V + \nu_i$ respectively where $\nu_i$ is a normal error ($i \in \{l, f\}$) with standard deviation $\sigma_\nu$.

[12]While the Office apportions the fees for an opposition procedure to the losing party, the costs of providing evidence during such a procedure cannot be recovered in the same manner.

The true value of the damage that is done to the leader's trade mark if the follower's trade mark is registered is $D$ and beliefs about this are $D_i = D + \chi_i$ where $\chi_i$ is a normal error ($i \in \{l, f\}$) with standard deviation $\sigma_\chi$. I allow for the possibility that the damage inflicted by the follower's trade mark is actually a gain for the leader, i.e. $D \in [-\infty, \infty]$. $D < 0$ might occur if the follower's brands are better known than the leader's.

The interaction of leader's and follower's trade marks may affect the value of the follower's trade mark. The follower values their trade mark as $S = D_f + \epsilon$ where $\epsilon \in [-\infty, +\infty]$. $\epsilon$ captures asymmetry of stakes between leader and follower. The follower's gain from the similarity of the two trade marks may be larger or smaller than the damage inflicted on the leader. If $\epsilon > 0$ there is a net gain to both firms from registration of the follower's trade mark and vice versa.

Finally, I assume that it is costly to provide evidence on the similarity of trade marks to the office ($E > 0, e > 0$).

## 3.1 Stage 3

If adjudication is reached, the trade mark office decide whether the follower's trade mark is too similar to the leader's. They will reject the follower's trade mark if the damage $D$ it inflicts on the leader's trade mark exceeds the office's decision standard: $D > \bar{D}$. The standard at the trade mark office ($\bar{D}$) is imperfectly observed. In fact, I only observe the outcome of adversarial proceedings: define this as $y_o = 1$ if the leader wins. Correspondingly the office's standard is observed with error $\mu$ and the probability of the leader winning may be defined as:

$$\begin{aligned} \text{prob}(y_o = 1) &= \text{prob}(D > \bar{D} - \mu) \\ &= \text{prob}(\mu > \bar{D} - D) \\ &= \Phi(D - \bar{D}), \end{aligned} \tag{1}$$

where it is assumed that the error $\mu$ regarding the office's decision standard, is normally distributed and $\Phi$ represents the standard normal distribution. This leads to a probit model for the probability that the office reject the trade mark application in adversarial proceedings. The difference $D - \bar{D}$ can be represented as a linear function of variables that determine the level of damage and of variables that determine the decision standard.

The value of the leader's trade mark will depend on its ability to positively affect purchasing decisions, called *goodwill*.[13] Where a trade mark can be shown to possess a high degree of goodwill it will be more likely that a follower's trade mark can be shown to be free riding on- or damaging to it. Then the Office is more likely to reject the follower's trade mark. Therefore, I assume that the decision standard is a decreasing function of the value of the leader's trade mark and that the probability of successful opposition is decreasing in the decision standard:

$$\frac{\partial \text{prob}(y_o = 1)}{\partial \bar{D}} < 0 \qquad\qquad \frac{\partial \bar{D}(V)}{\partial V} < 0 \tag{A1}$$

[13]Note that this definition of goodwill is specific to trade mark law and differs from the accounting definition of goodwill.

This probit model implicitly generates a probability that the follower's trade mark is too similar to the leader's trade mark, $\hat{p}(D, \bar{D}(V))$. This is conditional on the value of the leader's trade mark and the level of damage which the follower's trade mark might inflict. I impose the following conditions on $\hat{p}$:

$$\frac{\partial \hat{p}}{\partial D} > 0, \qquad \frac{\partial \hat{p}}{\partial \bar{D}} < 0 \tag{A2}$$

i.e. the probability increases in the degree of damage and decreases in the decision standard. Leader and follower are assumed to have a common understanding of the function $\hat{p}(D, \bar{D})$ as it is clearly defined by the Office in its guidelines. However, beliefs about the level of $\hat{p}$ may diverge if beliefs about $V$ and $D$ diverge.

Note that assumptions (A1) and (A2) imply more valuable trademarks are more easily defended in opposition: $\frac{\partial \text{prob}(y_o=1)}{\partial V} > 0$.

## 3.2 Stage 2

Given their knowledge of the merits of the trade mark dispute, leader and follower will bargain over the distribution of the joint surplus from the follower's trade mark application. In a standard model of bargaining the outside options and the surplus from agreement are objectively given - for instance the outside option may be an wage offer from another company to an employee. Here, I assume that both the leader and the follower have beliefs about the value of the leader's trade mark and the damage which the follower's trade mark might do to it.

Below it is shown that leader and follower can simultaneously believe that there are gains to settling, even if their underlying beliefs about $V$ and $D$ diverge. I define the surplus from settlement for both leader and follower, given their beliefs. I argue that failure to settle is more likely if these surpluses diverge substantially. Then, it is likely that offers made by one party will seem too low, given beliefs about the surplus held by the other party.

Beliefs about the surplus are: $V_i(1+\delta) + \delta\tilde{\epsilon}$ where $\tilde{\epsilon} = \max[0, \epsilon]$ and $i \in \{l, f\}$. This is the discounted stream of the belief about the leader's value from their trade mark plus the discounted difference between the beliefs about the leader's loss and the follower's gain from the new trade mark $\tilde{\epsilon}$. $\delta$ is the discount rate. If $\epsilon > 0$ the trade mark application adds value and the parties negotiate how to split this. If $\epsilon < 0$ the trade mark application destroys value and the parties negotiate at which price it is dropped.

If one of the parties withdraws from bargaining, adversarial proceedings ensue. The parties' beliefs about each other's outside options are defined by their expected value of adversarial proceedings:

$$A_{l,i} = V_i(1+\delta) - \left(1 - \hat{p}(D_i, \bar{D}(V_i))\right)\delta D_i - \delta E\,, \qquad A_{f,i} = \delta(1 - \hat{p}(D_i, \bar{D}(V_i)))(D_i + \epsilon) - \delta e\,. \tag{2}$$

The leader's payoff from adversarial proceedings consists of the return $V$ during the proceedings, and the expected value of the result of the proceedings net of the costs of providing evidence ($E$).

During adversarial proceedings the follower receives nothing. They anticipate a value from the new trade mark, if that is not rejected. Additionally they face a cost of providing evidence at trial equivalent to $e$. If their trade mark application is rejected the follower has a payoff of zero.

The parties' disagreement point is defined by their payoffs during the bargaining process. The follower receives nothing in this period while the leader continues to enjoy the full benefit of their trade mark, $V$. By the outside option principle (Binmore (1985), Binmore et al. (1989)) firm $i$'s belief about the leader's expected payoff $(v^2_{l,i})$ is:

$$v^2_{l,i} = \begin{cases} \frac{1}{2}(V_i(1+\delta)+\delta\tilde{\epsilon}) & \text{if } \frac{(V_i(1+\delta)+\delta\tilde{\epsilon})}{2} \geq A_{l,i} \quad \text{and} \quad \frac{(V_i(1+\delta)+\delta\tilde{\epsilon})}{2} \geq A_{f,i} \\ V_i(1+\delta)+\delta\tilde{\epsilon}-A_{f,i} & \text{if } \frac{(V_i(1+\delta)+\delta\tilde{\epsilon})}{2} \geq A_{l,i} \quad \text{and} \quad \frac{(V_i(1+\delta)+\delta\tilde{\epsilon})}{2} < A_{f,i} \\ A_{l,i} & \text{if } \frac{(V_i(1+\delta)+\delta\tilde{\epsilon})}{2} < A_{l,i} \quad \text{and} \quad \frac{(V_i(1+\delta)+\delta\tilde{\epsilon})}{2} \geq A_{f,i} \end{cases} . \tag{3}$$

where it is assumed that both parties are equally impatient and the delay between offers and counter offers is zero. This has the implication that both parties have equal bargaining power and the joint surplus is split evenly between them if the outside option constraints do not bind.

By the same principle firm $i$'s belief about the follower's expected payoff $(v^2_{f,i})$ is:

$$v^2_{f,i} = \begin{cases} \frac{1}{2}(V_f(1+\delta)+\delta\tilde{\epsilon}) & \text{if } \frac{(V_f(1+\delta)+\delta\tilde{\epsilon})}{2} \geq A_{l} \quad \text{and} \quad \frac{(V_f(1+\delta)+\delta\tilde{\epsilon})}{2} \geq A_{f} \\ A_{f,i} & \text{if } \frac{(V_i(1+\delta)+\delta\tilde{\epsilon})}{2} \geq A_{l,i} \quad \text{and} \quad \frac{(V_i(1+\delta)+\delta\tilde{\epsilon})}{2} < A_{f,i} \\ V_i(1+\delta)+\delta\tilde{\epsilon}-A_{l,i} & \text{if } \frac{(V_i(1+\delta)+\delta\tilde{\epsilon})}{2} < A_{l,i} \quad \text{and} \quad \frac{(V_i(1+\delta)+\delta\tilde{\epsilon})}{2} \geq A_{f,i} \end{cases} . \tag{4}$$

Given their beliefs each party will determine the surplus from settlement $\Sigma_i$ as:

$$\Sigma_i = V_i(1+\delta)+\delta\tilde{\epsilon}-A_{l,i}-A_{f,i} \Leftrightarrow \Sigma_i = E+e+(\tilde{\epsilon}-\epsilon)+\epsilon\hat{p}(D_i,\bar{D}(V_i)) \quad . \tag{5}$$

This expression shows that settlement is more valuable than adjudication for either party. Also, the level of the surplus is determined almost exclusively by factors that are objective such as the costs of adjudication. Subjective beliefs enter only through the probability $\hat{p}$ that the Office will reject the follower's trade mark application.

The model shows that lower costs of providing evidence increase the likelihood of adjudication as the surplus from settlement falls. Additionally, the probability of adjudication depends on the extent of asymmetric stakes between the parties. If $\epsilon > 0$, then the first term in brackets in Equation (5) is zero and an increase in asymmetric stakes ($\epsilon$) increases the surplus from settlement. If $\epsilon \leq 0$, then the first term in brackets and the last term jointly become $-(1-\hat{p})\epsilon > 0$. Again increased asymmetry of stakes reduces the probability of observing adjudication. Here, this reflects the decreasing gain for the follower from their trademark application. Note that increases in asymmetric stakes ($\epsilon$) always *raise* the surplus from settlement.

Condition (5) characterises the boundary between the settlement and the adjudication region as long as $A_{f,f} > 0$. If this is the case, then the Nash Bargaining solution will indicate an expected settlement amount as a function of each firm's beliefs. If beliefs about $V$ and $D$ coincide

firms will share the same expectations about the level of this settlement. As soon as beliefs diverge, it becomes increasingly likely that expectations of the settlement will also diverge. For instance, assume $\epsilon > 0$ and $D > 0$, i.e. the new trade mark damages the leader's trade mark but the gain to the follower outweighs this gain. Then, if the leader has a distorted positive appreciation of the value of their trade mark $\nu_l > 0$ and the follower has a distorted negative appreciation $\nu_f < 0$, $\hat{p}_l > \hat{p}_f$ if $\chi_l \geq \chi_f$. In this case the leader will believe settlement to be more valuable than the follower. If the divergence in beliefs is large enough, the leader may come to regard the follower's settlement offers to be insufficiently high and may prefer adjudication to settlement. Note that beliefs which imply $\hat{p}_f > \hat{p}_l$ will naturally lead to settlements as the follower is willing to offer more than the leader will expect to receive to settle the case.

Will such divergent beliefs survive? The literature on litigation is critical of divergent expectations models (Waldfogel, 1998). Recently, Yilmaz (2004) has shown that divergent beliefs can subsist for a finite period and may cause substantial bargaining delays.

## 3.3 Stage 1

At this stage of the game the leader decides whether to oppose or not. Simultaneously, the follower must determine whether to uphold their application. While it is possible to derive precise predictions about the impact of damage, litigation costs and asymmetric stakes on the probability of observing opposition this is not pursued here.

The dataset to which the model is applied only contains observations for which the decision to oppose has already been taken. In the context of litigation the equivalent would be a dataset covering litigated cases but omitting cases which are settled between parties before the case ever reaches a court. It is conceivable that the inability to observe such settlements gives rise to a sample selection problem. This problem affects any study of litigation or disputes that relies only on institutional data. The problem may be neglected to the extent that we are interested in the population of opposition cases (litigation cases) and not so much in the population of all possible disputes and disagreements, no matter how small they might be. Therefore, I do not pursue the solution of the first stage model here. This is left to future work in which selection into opposition will be studied at a more aggregate level.

## 3.4 Predictions of the Model

The model derived above shows that determinants of the outcome of adversarial proceedings affect the selection process into adversarial proceedings. I characterise both the determinants of successful opposition and those of settlement in the population of opposed trade mark applications. To do this the dependence of selection into adjudication and adjudication outcomes must be incorporated in an econometric model.

Therefore, the correct empirical specification in which to test the predictions of this model is a sample selection model. The outcome equation of this model has been specified in section 3.1. Conditional on the follower's decision to uphold their application the selection equation can

be derived from the definition of the gap between the value of adjudication and settlement (5). Together with a measure of uncertainty this determines the probability that settlement fails.

**The Outcome Equation** The hypotheses to test in the outcome equation are contained in assumptions (A1) and (A2):

**Hypothesis 1**
*Greater damage to the leader's trade mark raises the probability that the trade mark office will reject the follower's trade mark application.*

**Hypothesis 2**
*A higher value of the leader's trade mark raises the probability that the trade mark office will reject the follower's trade mark application.*

These hypotheses test whether the Office really adjudicate trade mark opposition cases on the basis of the criteria set out in their guidelines (OHIM (2004)).

**The Selection Equation** The probability of observing adjudication depends on the parties' choice between settlement and adjudication. Settlement is likely if firms' beliefs about $V$ and $D$ are similar and if the costs of adjudication are large. In this case $\Sigma_f$ and $\Sigma_l$ are very similar. In contrast, if $\sigma_\nu$ and $\sigma_\chi$ are large and the costs of adjudication small, settlement becomes less likely as I argued previously. To capture this intuition formally, consider a leader with a preference $\tau \in [0, 1]$ for settlement. Such a leader may accept settlement offers that are lower than expected if their preference is sufficiently high. Then, the probability of adjudication may be defined as:

$$\begin{aligned} \text{prob}(y_a = 1) =& \text{prob}\left(\Sigma_l > \Sigma_f(\tau + 1)\right) \\ =& \text{prob}\left(\hat{p}_l - \hat{p}_f > \frac{\Sigma_f}{|\epsilon|}\tau\right) \end{aligned} \tag{6}$$

A leader with $\tau = 0$ prefers adjudication if beliefs diverge. A leader, with $\tau = 1$ always settles. Several hypotheses follow directly from Equation (6):

**Hypothesis 3**
*Greater uncertainty about the leader increases the probability of adjudication.*

Such uncertainty leads to greater variance in firms' beliefs about the value of the leader's trade mark and the damage that it might suffer if the follower's trade mark were registered.

**Hypothesis 4**
*The probability of adjudication is decreasing in the probability, $\hat{p}(D, \bar{D})$, that the trade mark application is rejected by the Office.*

Note that any systematic influence on $\hat{p}$ cancels out on the right hand side of the inequality in Equation (6), while $\Sigma_f$ is increasing in $\hat{p}_f$. I showed above (Equation (5)) that a greater probability that the Office rejects a follower's application raises the surplus from settlement.

**Hypothesis 5**

*The probability of adjudication is decreasing in the leader's and follower's expected costs of providing evidence:* $E$ *and* $e$*.*

Increases in the leader's and follower's costs of opposition increase the deterministic element of the surplus from settlement, reducing the probability of observing adjudication. The follower will have to deduce the level of adjudication costs from the leader's past behaviour. A reputation for aggressive opposition will increase the follower's estimate of these costs.

**Hypothesis 6**

*The probability of adjudication is decreasing in the leader's preference for settlement.*

Leaders who have demonstrated a higher preference for settlement are more likely to settle again.

**The Empirical Model** Hypotheses 1- 6 can be tested by joint estimation of the outcome and the selection equations outlined here. In order to allow for selection into adjudication a bivariate sample selection model is required. In the outcome equation the leader's probability of winning ($y_o$) is a linear function of vectors of observed measures of expected damage ($\boldsymbol{D}$) and value ($\boldsymbol{V}$), viz. equation (1). I also include control variables ($\boldsymbol{C}_o$) such as time- and experience dummies to control for decreasing uncertainty about opposition at the Office as time passes.

In the selection equation the probability of observing adjudication ($y_a$) is a linear function of vectors of observed measures of expected damage ($\boldsymbol{D}$), value ($\boldsymbol{V}$), reputation ($\boldsymbol{R}$) as well as measures of uncertainty ($U$). The sample selection model is identified by the reputation ($\boldsymbol{R}$) and uncertainty ($U$) variables. This model also contains control variables ($\boldsymbol{C}_s$) such as time- and experience dummies. Therefore, the estimated model has the form:

$$
\begin{aligned}
y_o^* &= \beta_0 + \boldsymbol{D}'\beta_D + \boldsymbol{V}'\beta_V + \boldsymbol{C}_o'\beta_C + \mu \qquad (7)\\
y_a^* &= \gamma_0 + \boldsymbol{D}'\gamma_D + \boldsymbol{V}'\gamma_V + \boldsymbol{R}'\gamma_R + \gamma_U U + \boldsymbol{C}_s'\gamma_C + \eta \\
y_o &= \begin{cases} 1 & \text{if} \quad y_o^* > 0 \\ 0 & \text{if} \quad y_o^* \leq 0 \end{cases} \\
y_a &= \begin{cases} 1 & \text{if} \quad y_a^* > 0 \\ 0 & \text{if} \quad y_a^* \leq 0 \end{cases}.
\end{aligned}
$$

This bivariate probit selection model can be estimated by FIML.

# 4 Data

In this section variables entering the empirical model are discussed. Table 7 sets out descriptive statistics for the sample of word mark opposition cases already introduced in section 2. [14]

[14] Several of the variables set out below depend implicitly on the identification of firms as entities. Firm names in this dataset were cleaned using do-files provided by Bronwyn Hall. Additionally the largest 250 firms were further consolidated by hand.

Table 7:Variable definitions and descriptive statistics

| Variable | | Description | Mean | Std. dev. | Min. | Max. | Obs. |
|---|---|---|---|---|---|---|---|
| Leader wins | | Outcome dummy | 0.413 | | 0 | 1 | 8184 |
| Adjudication | | Selection dummy | 0.193 | | 0 | 1 | 42433 |
| Inside opposition | $\boldsymbol{V}$ | Opposing mark is CTM | 0.303 | | 0 | 1 | 42433 |
| Oppositions | $\boldsymbol{V}$ | Concurrent oppositions | 1.699 | 1.248 | 1 | 20 | 42433 |
| Opposition intensity | $\boldsymbol{V}$ | Leader's previous oppositions | 1.872 | 3.335 | 1 | 88 | 42433 |
| Jaro Winkler | $\boldsymbol{D}$ | Similarity measure | 0.824 | 0.186 | 0 | 1 | 42433 |
| Levenshtein | $\boldsymbol{D}$ | Similarity measure | -0.233 | 0.178 | -1 | 0 | 42433 |
| Rivalry dummy | | | 0.083 | | 0 | 1 | 42433 |
| Rivalry | $\boldsymbol{D}$ | Product market overlap | 0.147 | 0.226 | 0 | 1 | 38930 |
| Seniorities | $\boldsymbol{D}$ | Follower's Seniorities | 0.363 | 2.266 | 0 | 116 | 42433 |
| Follower's words | | Words in follower's mark | 1.398 | 0.662 | 1 | 5 | 42433 |
| Leader's words | $\boldsymbol{D}$ | Words in leader's mark | 1.273 | 0.570 | 1 | 5 | 42433 |
| Goods & services | $\boldsymbol{C}$ | Follower's Nice classes | 3.015 | 3.514 | 0 | 42 | 42433 |
| Low stakes | $\boldsymbol{C}$ | Weakness of leader's stakes | 8.570 | 28.805 | 1 | 406 | 42433 |
| Dummy 13 | $\boldsymbol{C}$ | Leader's first three oppositions | 0.619 | 0.486 | 0 | 1 | 42433 |
| Dummy 46 | $\boldsymbol{C}$ | Leader's next three oppositions | 0.118 | 0.322 | 0 | 1 | 42433 |
| Levenshtein 13 | $\boldsymbol{R}$ | Similarity in oppositions 1-3 | -0.060 | 0.108 | -0.726 | 0 | 42433 |
| Levenshtein 46 | $\boldsymbol{R}$ | Similarity in oppositions 4-6 | -0.051 | 0.110 | -0.736 | 0 | 42433 |
| Adjudication 13 | $\boldsymbol{C}$ | Adjudicated cases in 1-3 | 0.261 | 0.603 | 0 | 3 | 42433 |
| Adjudication 46 | $\boldsymbol{C}$ | Adjudicated cases in 4-6 | 0.236 | 0.576 | 0 | 3 | 42433 |
| Leader's costs | $\boldsymbol{C}$ | Dummy trade mark's oppositions $> 1$ | .0580 | | 0 | 1 | 42432 |
| Opposition lag | $\boldsymbol{G}$ | Frequency of oppositions | -5.926 | 23.549 | -256.607 | 113.619 | 42432 |
| Follower size | $\boldsymbol{C}$ | Total applications end 2004 | 49.364 | 153.531 | 1 | 1417 | 42433 |
| Leader size | $\boldsymbol{C}$ | Total oppositions end 2004 | 16.532 | 52.219 | 1 | 420 | 42433 |
| Leader's experience | $\boldsymbol{U}$ | Leader's previous oppositions $+1$ | 14.794 | 52.62 | 1 | 808 | 42432 |
| Previous encounters | $\boldsymbol{U}$ | Leader-Follower encounters | 1.144 | .742 | 1 | 22 | 42432 |
| D9699 | | Year dummy 96-99[15] | 0.048 | | 0 | 1 | 42433 |
| D2000 | | Year dummy | 0.119 | | 0 | 1 | 42433 |
| D2002 | | Year dummy | 0.237 | | 0 | 1 | 42433 |
| D2003 | | Year dummy | 0.200 | | 0 | 1 | 42433 |
| D2004 | | Year dummy | 0.197 | | 0 | 1 | 42433 |

**The Dependent Variables** The dependent variable for the selection equation, *Adjudication*, is a dummy capturing whether or not an opposition case ended in adjudication. Where *Adjudication* is zero this could be due to settlement between the parties or a withdrawal of the trade mark by the follower. In the data these alternatives are not clearly distinguished. The unconditional probability that an opposition case enters adjudication is $0.193$. This is much higher than for opposition at the EPO (Harhoff and Reitzig (2004)) or opposition to trade marks at the USPTO.

[15]There are so few observations before 1999 that I have subsumed these all into one variable.

The dependent variable for the outcome equation, *Leader wins* , is also a dummy variable. It takes the value one if the follower's trade mark was rejected either wholly or in part.[16] Conditional on entry into adversarial proceedings the probability that the leader wins is 0.413.

**$V$: The Value of the Leader's Trade Mark** Direct measures of trade mark value do not exist in the dataset. As the valuation of trade marks is not a trivial matter (Smith (1997)) this is not surprising. However, more valuable trade marks can be identified from the way their owners use them. I observe several proxies for the value of the leader's trade mark.

The variable *Inside opposition*, is used as an indicator for greater value of the opposing trade mark. As noted in Section 2.2 above, a leader's trade mark registered at the office will have a higher value than a leader's national trade mark, ceteris paribus. Table 7 shows that 30.3% of opposing trade marks are registered as a community trade mark (CTM) by their owners by the time they are used as a basis for an opposition.

The variable *Oppositions* measures the number of concurrent oppositions that a trade mark application faces. Higher values of this variable indicate that the follower has located their trade mark in a larger group of similar, preexisting trade marks. Such groups will arise where the preexisting trade marks have clustered around a source of value, for instance a particularly valuable market. 39.7% of all opposed trade marks face at least two leaders.

Finally, more valuable trade marks will be protected more vigorously by their owners. Under the maintained assumption that similarity of trade marks is largely random[17], this will lead to more opposition cases based on valuable trade marks. The variable *Opposition intensity* is a count of how often a trade mark has previously been the basis for an opposition by the leader. On average opposing trade marks have appeared in 1.87 previous opposition cases.

**$D$: Damage Created by the Follower's Application** Opposition against a trade mark application may be lodged if a firm believes the follower's trade mark will be confused with- , will damage- or is seeking to take unfair advantage of their trade mark and its reputation (Phillips (2003)). Every registered trade mark enjoys absolute protection against identical copies. Where a follower's trade mark is not identical a leader may nonetheless be able to prove that its registration will damage their trade mark(s). In examining such cases the Office will take into account both overlap in goods and services covered by the trade marks and their similarity.

The similarity of trade marks should be assessed on the basis of visual, aural and conceptual similarity according to the decision of the European Court of Justice (ECJ) in the landmark case of Sabèl v Puma[18]. Additional elements that are considered by the Office are the reputation of the leader's trade mark, which is correlated with its value and the sophistication of the affected group of consumers as well as the possible coexistence of the trade marks in some markets and any evidence of actual confusion on the part of consumers (OHIM (2004), Chapter 2.).

I have no measures of consumers' sophistication or confusion. However, the names of the

[16] Compare footnote 7 above for a diuscussion of this coding of the variable.
[17] Compare the discussion of similarity of opponents' trade mark portfolios in Section 2.2 above.
[18] Sabèl v Puma AG, Rudolf Dassler Sport, Case C-251/95 [1998] ETMR 1.

trade marks in a dispute are known, which allows us to assess their similarity. The ECJ's decision in Sabèl v Puma implies that the Office will take into account the visual similarity of the strings (e.g. RESVIN and RESVERIN), their phonetic similarity (e.g. PHOTONICA and PHOTOKINA) and possible similarity of meaning (e.g. CINCO OCEANOS and 5 OCEANS). Similarity is measured using string similarity in this paper. This mostly captures the first of the aspects noted above and sometimes the second. Similarity of meaning is not measurable in this way.

Specifically, I use two algorithms to capture similarity of strings: the *Levenshtein* and the *Jaro Winkler* algorithms which result in similarity measures of the same name.[19] These two algorithms which are used in computer science and computational biology (Gusfield (1997), Navarro and Raffinot (2002)) represent slightly different methods of capturing the similarity of word marks: the Levenshtein algorithm measures similarity on the basis of operations in the transformation of one string into another while the Jaro Winkler algorithm measures similarity on the basis of common elements in both strings. The precise definition of these algorithms and their relation to one another is further discussed in Appendix A. Both capture an aspect of the likelihood that consumers will confuse the two trade marks, damaging that of the leader.

The variable *Rivalry* captures product market rivalry between firms in an opposition case. Ceteris paribus, an increase in rivalry between two firms will increase the damage caused by similar trade marks held by the firms. *Rivalry* is defined as the uncentered correlation coefficient[20] between two vectors, which characterise the distribution of leader's and follower's trade marks over different product markets at the time of an opposition case. Here the product market measure is based on the 45 Nice classes that underlie the Nice classification system for trade marks. This system is used to classify for which kinds of goods and services a trade mark owner seeks protection. The underlying vectors for the measure are constructed as a list of counts of the number of trade marks that a firm has applied for in each Nice class. Table 7 shows that the measure is not available for opposition cases in which the leader has not applied for a trade mark at the Office. These cases are captured by the *Rivalry dummy*.

*Leader's words* and *Follower's words* measure the words in each trade mark. Ceteris paribus, a higher number of words, lowers the damage caused by similarity of parts of two marks.

*Seniorities* measures the number of identical previous registrations in other jurisdictions of a follower's trade mark. As these increase it is more likely that a group of consumers is already confronted with both the leader's and the follower's trade marks. Then it is harder to prove that the follower's trade mark will confuse consumers of products protected by the leader's mark.

***U*: Uncertainty** A leading explanation for the breakdown of bargaining in litigation is uncertainty about the quality of the case likely to be made by each party (Waldfogel, 1998). If both parties have encountered one another previously they will face much lower uncertainty about each other's behaviour. Therefore, *Previous encounters* counts how often leader and follower have encountered one another. Similarly, as the leader appears on the record in more and more

[19] To calculate the similarity of leader's and follower's trade mark in the dataset I employed *Secondstring*, an open source java toolkit described by Cohen et al. (2003).

[20] This measure used by Jaffe (1986) and in subsequent work on patents to measure similarity of firms' patent portfolios.

opposition cases, the amount of information the follower has at their disposal also increases. *Leader's experience* captures this aspect of reduced uncertainty.[21]

***R*: Reputation** In the process of trade mark application leaders and followers are generally paired together at random. 10% of opposition cases in the dataset involve two parties that have had at least one previous dispute and only in 3% of cases do two parties have more than three encounters altogether. Furthermore the incidence of repeat encounters is decreasing over time. This suggests that a proportion of the repeat encounters observed are the result of conflicts between well established trade mark families from different countries. Such conflicts were more likely in the phase after the opening of the Office.

In this initial period followers will have had little information on which to base their expectation of the strength of the leader's evidence. A leader's reputation for aggressive defence of their trade mark portfolio provides important information to followers. It implies that a leader has invested in collection of evidence which may be relevant to the current trade mark dispute.[22] Such evidence raises the costs of defending a trade mark application for the follower.

To provide evidence in trade mark opposition cases leaders must regularly survey the public in order to demonstrate that their trade mark is well known. Legal representatives of trade mark owners therefore assemble "Fame packs" which document the reputation of valuable trade marks. These are regularly updated. Surveying the public regarding the reputation of a trade mark is expensive: such surveys may cost in excess of $15,000$ .[23]. Additionally the leader must show that there could be a link between the currently opposed trade mark and their own in consumer's minds. This requires evidence tailored to the individual case. The level of effort a leader is willing to exert in each case is of course uncertain for the follower. However, by examining past cases or employing lawyers with experience of past cases fought by the leader, a follower may develop an expectation of the effort the leader will exert in opposition proceedings.

The variables *Levenshtein 13* and *Levenshtein 46* capture the average similarity of leaders' and followers' trade marks in the first three and subsequent three opposition cases which a leader started. Higher values indicate that past trademark disputes were about more similar trademarks: the variables measure leading firms' past aggressiveness. Aggressive firms will have built up strong evidence for the reputaton of their trade marks suggesting a willingness to exert high effort to protect these. I focus on early opposition cases since it has been shown in other settings that reputations in repeated games are established early on in a sequence of repeated interactions between long lived players and a series of short run players (Livingston (2005)).

Discussions with lawyers suggest that firms with large trade mark portfolios have very heterogeneous approaches to opposition and to adjudication. Some firms are well known to gener-

[21] It might be expected that this variable also reflects learning about the opposition process on the part of the leader. This interpretation of the variable is weaker as the leader is likely represented by a law firm that may have accumulated much more experience than the variable reflects.

[22] In opposition cases that are not based on allegations of identity leaders need to demonstrate that their trade marks are i) used and ii) well known to the public in a specific market and iii) that the follower's trade mark will damage the reputation of their own trade mark in that market.

[23] This figure was quoted by the representative of a law firm with extensive experience in European trade mark practice.

ally prefer adjudication to settlement. A follower may base their expectation of the preferences of a leader for adjudication on the leader's past behaviour. *Adjudication 13* and *Adjudication 46* control for the proportion of opposition cases out of the first three - and subsequent three oppositions that were adjudicated. This also captures aspects of leaders' reputations for tough opposition behaviour.

**$C$: Control Variables** The regressions reported below all contain time dummies which capture variation in uncertainty about the procedures adopted by the Office. Additionally, I control for growing experience of the leader through the dummy variables *Dummy 13* and *Dummy 46*. These capture the first three and next three opposition cases brought by a leader, respectively. $26,3\%$ of opposition cases are brought by leaders with more than six previous opposition cases to their name. The variable *Goods & services* captures the breadth of the follower's application in the space of NICE classes. This variable controls for heterogeneity in the breadth of trade marks.

The variable *Low stakes* measures the number of other trade marks a leader has previously defended in trade mark opposition cases. The greater this number the lower the importance of the current opposition case for the leader. The variable does not measure asymmetry of stakes $(\epsilon)$ but controls for an element of diverging stakes between leader and follower.

The variable *Opposition lag* measures the difference of lags between opposition cases started by the leader. If the leader is building a reputation for aggressive opposition, then we may expect a quick succession of opposition cases. In contrast, if the leader perceives a low reputation gain from opposition, the probability that any specific application will be opposed falls and so does the lag between opposition cases. Therefore, I construct the average lag between past opposition cases and subtract from this the lag between the current opposition case and the most recent case. This variable is close to zero if firms oppose with a constant frequency, negative if they oppose less and less often and positive if they oppose increasingly often. It will have higher values if lags decrease in a regular sequence from a high initial value, reflecting greater potential for establishing a reputation early on.

An important determinant of the bargaining surplus which leader and follower are in dispute over is depends on the costs of a dispute. There are several ways of measuring changes in the leader's costs of adjudication. *Later oppositions* is a dummy indicating whether the opposing trade mark was previously used as the basis for opposition. If so the leader will certainly face lower costs of opposition.

Finally *Follower size* and *Leader size* control for the size of both parties. *Follower size* measures the follower's total trade mark applications at the end of 2004. *Leader size* measures the total number of opposition cases which a leader was involved as leader at end of 2004.

# 5 Results

Firms with large trade mark portfolios invariably acquire a reputation for the manner in which they look after their portfolio. Interviews with trade mark practitioners show that firms likely to settle trade mark disputes and firms that vigorously protect their trade marks are well known for

this behaviour. What then, is the effect of leaders' reputations on the outcome of a given trade mark dispute? Does a firm's reputation for aggressive trade mark opposition benefit it?

The theoretical model developed in section 3 predicts that followers' costs of providing evidence in trade mark opposition, $e$, will have a negative effect on their propensity to pursue adjudication. If a leader's reputation for aggressive opposition behaviour raises the expected value of the follower's costs of providing evidence, then followers facing aggressive leaders should settle trade mark disputes more often. To test the importance of this reputational mechanism a sample selection model (Equation 7) is estimated taking account of possible heteroscedasticity.

Results from estimating sample selection models, one allowing for heteroskedasticity, are set out in Table 8.[24] I also estimate outcome and selection equations independently allowing for heteroscedasticity. Results are reported in Table 11 in the appendix.[25]

Table 8 provides several results: (i) there is strong evidence for sample selection, (ii) selection into adjudication is more likely if opponent's costs of opposition drop and less likely if uncertainty about leader's behaviour falls, (iii) there is evidence for heterogeneity of types with respect to preferences for adjudication, (iv) tough opposition early on leads to increased settlement later providing support for effects of reputation for toughness in opposition and (v) measures of damage and value of trade marks affect settlement decisions and outcomes of opposition as hypothesized. These findings are consistent with the theoretical model developed in the previous section. I discuss each of these points in turn further below.

First consider identification of the selection model. The outcome equation in the sample selection model is identified by variables measuring reputation for aggressive opposition: *Levenshtein 13, Levenshtein 46*. Additional identifying restrictions result from *Low stakes* and the measure of frequency of oppositions, *Opposition lag* as well as *Adjudicated 13 and Adjudicated 46* which measure heterogeneity in preferences for adjudication. Apart from *Low stakes* these variables are all highly significant. Additionally, the measure of correlation ($\rho$) between the error terms of the outcome and the selection equations is positive and highly significant. This shows that there is sample selection. A likelihood ratio test comparing the sample selection model with heteroscedastic errors to the restricted sample selection model with homoscedastic errors clearly rejects the restricted model ($\chi^2_{11} = 515.5$). Therefore, the following discussion focuses on the sample selection model with heteroscedastic errors reported in columns (3) and (4) of Table 8.

The results reported there strongly support the theoretical model. In particular, none of the hypotheses derived from the theoretical model can be rejected. Coefficients on which the hypotheses are tested are generally highly significant and their signs are stable across the different models. This indicates that the underlying model is quite robust. In a model with discrete dependent variables heteroskedasticity implies that the marginal effects and coefficients do not necessarily bear the same sign (Greene (1996)). Therefore, Table 10 reports the most important marginal effects for the sample selection model with heteroscedastic errors.

[24] All models reported in these tables were estimated by ML and FIML using LIMDEP 7. All models but the sample selection model allowing for heteroscedasticity were also estimated using STATA 9.2 . The results reported by both packages are identical.

[25] Although the estimates for the outcome equation are affected by selection bias the results provide a useful point of comparison to the sample selection model presented below.

Table 8: Sample selection models for outcomes of and selection into adjudication

| Independent Variable | | Homoscedastic specification | | Heteroscedastic specification | |
|---|---|---|---|---|---|
| | | Pr(Leader wins) | Pr(Adjudication) | Pr(Leader wins) | Pr(Adjudication) |
| | | (1) | (2) | (3) | (4) |
| Inside opposition | V | 0.151*** | -0.218*** | 0.021*** | -0.055*** |
| | | (0.038) | (0.018) | (0.005) | (0.006) |
| Opposition intensity | V | 0.015 | -0.053*** | 0.130*** | -0.191*** |
| | | (0.008) | (0.005) | (0.037) | (0.020) |
| Oppositions | V | -0.020** | 0.013*** | -0.269*** | 0.022*** |
| | | (0.008) | (0.003) | (0.054) | (0.004) |
| Levenshtein | D | 1.058*** | -0.314*** | 1.078*** | -0.337*** |
| | | (0.111) | (0.055) | (0.123) | (0.057) |
| Jaro Winkler | D | 0.601*** | -0.020 | 0.538*** | 0.015 |
| | | (0.122) | (0.061) | (0.117) | (0.062) |
| Rivalry dummy | D | -0.045 | 0.021 | -0.139 | 0.037 |
| | | (0.050) | (0.027) | (0.086) | (0.026) |
| Rivalry | D | 0.643** | -1.114*** | 0.883*** | -1.164*** |
| | | (0.226) | (0.107) | (0.226) | (0.120) |
| Rivalry$^2$ | D | -1.103*** | 0.991*** | -1.41*** | 1.034*** |
| | | (0.302) | (0.141) | (0.305) | (0.158) |
| Seniorities | D | 0.085*** | -0.081*** | 0.096*** | -0.081*** |
| | | (0.015) | (0.007) | (0.017) | (0.008) |
| Followers words | D | 0.051 | 0.084*** | -0.137*** | 0.069*** |
| | | (0.028) | (0.015) | (0.027) | (0.014) |
| Leaders words | D | -0.150*** | 0.070*** | 0.096*** | 0.093*** |
| | | (0.026) | (0.013) | (0.029) | (0.015) |
| Goods & services | C | -0.035*** | -0.014*** | -0.208*** | -0.087*** |
| | | (0.004) | (0.002) | (0.024) | (0.009) |
| Follower size | C | -0.001*** | 0.000 | -0.001*** | -0.000** |
| | | (0.000) | (0.000) | (0.000) | (0.000) |
| Dummy 13 | C | 0.112** | 0.269*** | 0.145*** | 0.333*** |
| | | (0.034) | (0.036) | (0.035) | (0.055) |
| Dummy 46 | C | | 0.126*** | | 0.299*** |
| | | | (0.038) | | (0.059) |
| Levenshtein 13 | R | | 0.531*** | | 0.656*** |
| | | | (0.115) | | (0.127) |
| Levenshtein 46 | R | | 0.855*** | | 1.041*** |
| | | | (0.126) | | (0.166) |
| Adjudicated 13 | R | | 0.108*** | | 0.111*** |
| | | | (0.016) | | (0.018) |
| Adjudicated 46 | R | | 0.231*** | | 0.281*** |
| | | | (0.015) | | (0.019) |
| Leader's experience | U | | -0.004* | | -0.016*** |
| | | | (0.002) | | (0.003) |
| Previous encounters | U | | -0.044** | | -0.085*** |
| | | | (0.014) | | (0.017) |
| Low stakes | C | | -0.004 | | -0.008 |
| | | | (0.003) | | (0.005) |

Table 8: Sample selection models for outcomes of and selection into adjudication

| Independent Variable | | Homoscedastic specification | | Heteroscedastic specification | |
|---|---|---|---|---|---|
| | | Pr(Leader wins) | Pr(Adjudication) | Pr(Leader wins) | Pr(Adjudication) |
| | | (1) | (2) | (3) | (4) |
| Opposition lag | C | | 0.002*** | | 0.010*** |
| | | | (0.000) | | (0.001) |
| Leader size | C | | 0.006*** | | 0.002*** |
| | | | (0.000) | | (0.000) |
| Leader's costs | C | | 0.911*** | | 1.063*** |
| | | | (0.034) | | (0.050) |
| Constant | | -1.276*** | -1.218*** | -0.919*** | -1.019*** |
| | | (0.176) | (0.088) | (0.172) | (0.094) |
| $\rho$ | | | 0.185** | | 0,146** |
| | | | (0.060) | | (0.052) |
| $-\ln L$ | | | 23409.77 | | 23152 |

Standard errors in parentheses: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

Table 9: Variance equations of the sample selection model with heteroscedasticity

| Independent Variable | Pr(Leader wins) | | Pr(Adjudication) | |
|---|---|---|---|---|
| | (1) | Standard errors | (2) | Standard errors |
| Rivalry dummy | 0.267* | (0.113) | | |
| Opposition intensity | -0.035** | (0.012) | | |
| Seniorities | 0.117*** | (0.021) | | |
| Goods & services | 0.099*** | (0.010) | 0.055*** | (0.004) |
| Followers words | -0.144*** | (0.040) | | |
| Opposition lag | | | 0.002* | (0.001) |
| Leader size | | | 0.003*** | (0.000) |
| Follower size | | | 0.001*** | (0.000) |

Standard errors in parentheses: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

Hypothesis 5 states that adjudication will be more likely if the firms' costs of adjudication are lower. Consider the follower's reaction if the leader has a reputation for toughness in opposition: they anticipate higher costs of adjudication. The significant positive marginal effects for *Levenshtein 13* and *Levenshtein 46* show that adjudication is more likely if a leader opposed word marks with greater similarity in the past. Conversely, opposition cases are more likely to settle if the leader has opposed word marks with a lower average similarity in the past. This can be explained in two ways: either the leader was overoptimistic about the strength of their word marks in the past and is more likely to settle now, or they have acquired a reputation for toughness in opposition and this leads to a higher propensity to settle on the part of followers they face. The first explanation does not fit in well with evidence that leaders' propensity to prefer adjudication persists as is evident from the positive effects of *Adjudication 13* and *Adjudication 46*. Additionally, the strong positive coefficient on *Levenshtein 46* would then indicate that overoptimism only dissipates after six opposition cases have already been brought. This is

highly unlikely. Therefore, the positive marginal effects for *Levenshtein 13* and *Levenshtein 46* show that followers do indeed take into account how aggressive a leader has been in past opposition cases. This shows that followers make use of information on leaders' past oppositions in order to establish the likely costs of the opposition cases they are currently involved in. In case of the leader, their costs are lower if the trade mark which the current case is based on was used in a previous opposition case. The effect of *Leader's costs* is positive and highly significant.

Marginal effects for *Levenshtein 13* and *Levenshtein 46* show that these effects are important. The probability that an opposition case is settled increases by $0.12$ and $0.19$ if the leader opposes trade marks that are one standard deviation less similar at the mean. To put this effect into perspective note that the average similarity measured by the Levenshtein algorithm of trade marks in opposition decreased from -.137 to -.275 for Sony from -0.037 to -0.100 for Microsoft and increased from -0.227 to -0.121 for Mars and -0.137 to -0.067 for Pfizer. In the case of Sony the reduced similarity of trade marks in opposition cases four five and six leads to an increase in the probability of settlement of $0.026$ for later opposition cases.

Next consider the effects of uncertainty about the leader. In cases in which both parties have encountered one another before, settlement is significantly more likely. The marginal effect of an additional previous encounter between leader and follower shows that the probability of adjudication falls by $0.018$. The effect of previous opposition cases the leader has brought against other firms -*Leader's experience*- is appreciably weaker but significant. This confirms Hypothesis 3.

Now consider the measures of value of the leader's trade mark and of the level of damage which the follower's trade mark might create. Hypothesis 1 states that increases in the expected damage from the follower's trade mark will raise the probability that the Office reject the application. The coefficients and marginal effects for the string similarity measures (*Levenshtein, Jaro Winkler*) and for *Rivalry* which measure the expected damage from registration of the follower's trade mark are significant and positive in the outcome equation (3). The coefficients and marginal effects of variables which capture a reduced level of damage to the leader's trade mark (*Seniorities, Follower's words, Leader's words*), are all significant and negative save *Follower's words* where the marginal effect is not significant. Therefore Hypothesis 1 is confirmed.

Hypothesis 2 states that leaders with more valuable trade marks are more likely to win in adjudication. Coefficients on the value measures for the leader's trade mark (*Inside opposition, Opposition intensity, Oppositions*) are all highly significant and are positive in the outcome equation. Only the marginal effect for *Opposition intensity* is not significant. These results are consistent with Hypothesis 2.

Hypothesis 4 states that increases in the leader's probability of winning in opposition reduce the probability of observing adjudication. In the selection equation of the sample selection model (4), all components of the damage ($\mathbf{D}$) and value (($\mathbf{V}$)) vectors entering the outcome equation as components of the leader's probability of winning switch signs. In case of *Follower's words* this is not true, but the marginal effect of this variable is not significant in the outcome equation. Therefore, the results support Hypothesis 4.

Finally Hypothesis 6 states that a leader will be less likely to settle if they have shown a lower preference for settlement in the past. The coefficients on *Adjudication 13* and *Adjudication 46*

support this hypothesis. Coefficients and marginal effects are significant.

Table 10: Marginal effects for selection into - and outcome of adversarial proceedings

| | Pr(Leader wins) | | Pr(Adjudication) | |
|---|---|---|---|---|
| **Independent variable** | Marginal effect (1) | Standard errors (2) | Marginal effect (3) | Standard errors (4) |
| Levenshtein | 0.385*** | (0.039) | -0.070*** | (0.011) |
| Jaro Winkler | 0.184*** | (0.039) | | |
| Rivalry dummy | 0.014 | (0.022) | 0.008 | (0.006) |
| Rivalry* | 0.123* | (0.058) | -0.211*** | (0.031) |
| Inside opposition | 0.052*** | (0.012) | -0.038*** | (0.004) |
| Opposition intensity | 0.000 | (0.003) | -0.012*** | (0.002) |
| Seniorities | -0.065*** | (0.013) | 0.005*** | (0.001) |
| Oppositions | 0.037*** | (0.005) | -0.017*** | (0.002) |
| Followers words | 0.005 | (0.010) | 0.019*** | (0.003) |
| Leaders words | -0.049*** | (0.009) | 0.014*** | (0.003) |
| Goods & services | -0.048*** | (0.004) | -0.007*** | (0.001) |
| Dummy 13 | 0.040** | (0.012) | 0.012 | (0.010) |
| Dummy 46 | | | -0.004 | (0.013) |
| Levenshtein 13 | | | 0.137*** | (0.027) |
| Levenshtein 46 | | | 0.219*** | (0.036) |
| Adjudicated 13 | | | 0.023*** | (0.004) |
| Adjudicated 46 | | | 0.059*** | (0.004) |
| Low stakes | | | -0.002 | (0.001) |
| Opposition lag | | | 0.000*** | (0.000) |
| Follower size | | | 0.000 | (0.000) |
| Leader size | | | 0.003*** | (0.000) |
| Leader's experience | | | -0.003*** | (0.001) |
| Leader's costs | | | 0.324*** | (0.016) |
| Previous encounters | | | -0.018*** | (0.004) |

Standard errors in parentheses: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

* The marginal effects for *Rivalry* take into account the quadratic functional form for this variable.

All reported models include the measure of product market rivalry between leader and follower, *Rivalry*. This measure is not available for followers facing a leader who has not applied for a trademark at the Office. The *Rivalry dummy* indicates whether an leader has not applied for a trademark at the Office.[26] This variable is never significant, indicating that there is no significant difference between leaders that have not applied for trademarks themselves and those that have. Additionally, all models include a quadratic specification of the effects of *Rivalry*. In the

[26] At the selection stage 3503 (8.25%) of opposition cases are brought by leaders who have not applied for trademarks at the Office. At the outcome stage 792 of these cases remain. This corresponds to 9.67% of all cases.

outcome equation ((3) in Table 8) the overall effect of this variable is positive even one standard deviation above the mean.

All reported specifications include time dummies. The reference year in each case is 2001. The marginal effects indicate that in the outcome equation there was a significant increase in the probability that leaders won opposition cases after 2001. This coincides with a reorganisation of the opposition process at the Office.

# 6 Conclusion

In this paper I study opposition to trade mark applications at the Office for the Harmonization in the Internal Market (OHIM). This institution began to operate a trade mark registration system for the internal market in Europe in 1996. The start up phase of this institution offers a rare opportunity to investigate how firms adapt to a new institution. The opening of the Office reduced the costs of protecting a trade mark across the internal market substantially. At the same time the trade mark system administered by the Office presents an environment in which a much larger group of trade mark owners interact than at any national trade mark office in Europe.

This paper studies how firms have used the possibility to oppose other firms' trade mark applications in order to protect their own trade mark portfolios. I show that leaders who frequently oppose trade mark applications of other firms can build reputations for being tough in opposition. The benefit of such a reputation is an increased likelihood of settlement of later opposition cases coupled with a greater range of protection for the leader's trade marks.

To measure the degree of protection which a trade mark enjoys I employ string similarity measures applied to word trade marks. It is shown that these measures capture the similarity of trade marks in individual opposition cases in meaningful ways. Additionally, the measures help identify the effects of reputation for tough opposition: similarity of trade marks in past opposition cases brought by a leader is interpreted as a measure of their confidence and toughness. These measures are shown to predict adjudication in current cases and have large effects.

Trade mark opposition has not yet been studied by economists. It is interesting for three reasons: (i) trade marks are an important intellectual property right that has received little attention in the economics literature; (ii) trade mark opposition is similar to litigation which allows to test theories of litigation in this context; (iii) trade mark opposition frequently pits the same leader against a sequence of followers who have imperfect information about the leader's intentions and their ability to provide evidence of likely damage to their trade mark. This asymmetry of information means leaders have the opportunity to build reputations. The paper shows trade mark opposition at the Office is comparatively frequent and poses a significant risk for new trade marks. Therefore, building a reputation for being tough in opposition is valuable for some firms.

Due to the dearth of previous empirical work employing administrative data from trade mark offices this paper contains several new measures of trade mark value and of the damage that one trade mark may onflict on another. Additionally, new measures of competition between firms and of firms attitudes to adjudication of trade mark opposition are derived.

The effects of reputations in trade mark opposition are studied using a bivariate probit model capturing selection into adjudication of trade mark opposition. This model is derived from a model of bargaining in which followers expectations of their legal costs reflect leader's reputations for toughness in opposition. The theoretical model developed in the paper shows that firms facing tough opponents will be more likely to settle trade mark disputes. In estimating the model I allow for heteroscedasticity at both the outcome and the selection stages of the model. The results show that a reputation for tough opposition in early opposition cases at the Office has a strong impact on the probability that subsequent opposition cases are settled. The model also provides evidence for selection into adjudication of trade mark disputes. Allowing for heteroscedasticity is shown to be important.

Given that reputations help owners of large trade mark portfolios to protect these against infringement the question of the implications of reputation building arises. In the context of patent litigation it has been argued that the bias against small firms that results from reputation building by large firms may reduce welfare (Lanjouw and Schankerman, 2001). Reputation erects barriers to entry for smaller patent applicants who may possess very valuable innovations. In the case of trade marks it is less obvious that a reputation for tough opposition is detrimental to welfare. Economics lacks theories which explain how an optimal trade mark system should work. Such theories would provide the basis to analyse the effects of reputation in trade mark opposition. This is a challenge for future work on trade marks.

# References


AUSUBEL, L. M., P. CRAMTON, AND R. J. DENECKERE (2002): *Bargaining with Incomplete Information*, Elsevier, vol. 3 of *Handbook of Game Theory*, chap. 50.

BEBCHUK, L. A. (1984): "Litigation and Settlement under Imperfect Information," *Rand Journal of Economics*, 15, 404–415.

BINMORE, K. (1985): "Bargaining and Coalitions," in *Game Theoretic Models of Bargaining*, ed. by A. Roth, Cambridge University Press.

BINMORE, K., A. RUBINSTEIN, AND A. WOLINSKY (1986): "The Nash bargaining solution in economic modelling," *The RAND Journal of Economics*, 17, 176–188.

BINMORE, K., A. SHAKED, AND J. SUTTON (1989): "An Outside Option Experiment," *The Quarterly Journal of Economics*, 753–770.

CABRAL, L. M. (2000): "Stretching, Firm and Brand Reputation," *RAND Journal of Economics*, 31, 658 – 673.

CHOI, J. P. (1998): "Brand Extension as Informational Leverage," *Revue of Economic Studies*, 65, 655–669.

COHEN, W. W., P. RAVIKUMAR, AND S. E. FIENBERG (2003): "A Comparison of String Metrics for Matching Names and Records," *American Association for Artificial Intelligence*.

CRAMPES, C. AND C. LANGINIER (2002): "Litigation and Settlement in Patent Infringement Cases," *RAND Journal of Economics*, 33, 258–274.

FENN, P. AND N. RICKMAN (1999): "Delay and Settlement in Litigation," *The Economic Journal*, 109, 476–491.

GRAHAM, S. AND D. SOMAYA (2006): "Vermeers and Rembrandts in the Same Attic: Complementarity between Copyright and Trademark Leveraging Strategies in Software," Working paper, Georgia Institute of Technology, http://ssrn.com/abstract=887484.

GREENE, W. H. (1996): "Marginal Effects in the Bivariate Probit Model," Working Paper EC-96-11, Stern School of Business, New York.

GREENHALGH, C. AND M. ROGERS (2006): "Trade Marks and Market Value in UK Firms," Melbourne Institute Working Paper Series 4, University of Melbourne, http://www.law.unimelb.edu.au/ipria/publications/workingpapers/2006/IPRI

GUSFIELD, D. (1997): *Algorithms on strings, trees, and sequences: computer science and computational biology*, New York, NY, USA: Cambridge University Press.

HARHOFF, D. AND M. REITZIG (2004): "Determinants of Opposition Against EPO Patent Grants - The Case of Biotechnology and Pharmaceuticals," *International Journal of Industrial Organization*, 22, 443–480.

JAFFE, A. B. (1986): "Technological Opportunity and Spillovers of R&D: Evidence from Firms' Patents, Profits and Market Value," *American Economic Review*, 76, 984–1001.

JARO, M. (1995): "Probabilistic Linkage of Large Public Health Data Files," *Statistics in Medecine*, 14, 491–498.

KREPS, D. AND R. WILSON (1982): "Reputation and Imperfect Information," *Journal of Economic Theory*, 27, 253–279.

LANJOUW, J. AND J. LERNER (1998): "The Enforcement of Intellectual Property Rights: A Survey of the Empirical Literature," *Annales D' Economie et de Statistique*, 49, 223–246.

——— (2001): "Tilting the Table? The use of Preliminary Injunctions," *Journal of Law and Economics*, XLIV, 573–603.

LANJOUW, J. AND M. SCHANKERMAN (2001): "Characteristics of Patent Litigation: A Window on Competition," *RAND Journal of Economics*, 13, 129–151.

LANJOUW, J. O. AND M. SCHANKERMAN (2004): "Protecting Intellectual Property Rights: Are Small Firms Handicapped?" *The Journal of Law and Economics*, 47, 4574.

LERNER, J. (1995): "Patenting in the Shadow of Competitors," *Journal of Law and Economics*, 38, 463–495.

LIVINGSTON, J. A. (2005): "How Valuable is a Good Reputation? A Sample Selection Model of Internet Auctions," *The Review of Economics and Statistics*, 87, 453–465.

MENDONCA, S., T. S. PEREIRA, AND M. M. GODINHO (2004): "Trademarks as an Indicator of Innovation and Industrial Change," *Research Policy*, 33, 1385 – 1404.

MEURER, M. J. (1989): "The Settlement of Patent Litigation," *RAND Journal of Economics*, 20, 77–91.

MILGROM, P. AND J. ROBERTS (1982): "Predation, Reputation and Entry Deterrence," *Journal of Economic Theory*, 27.

NAVARRO, G. AND M. RAFFINOT (2002): *Flexible Pattern Matching in Strings – Practical online search Algorithms for Texts and Biological Sequences*, New York, NY, USA: Cambridge University Press.

OHIM (2004): *Guidelines Concerning Proceedings before the Office for Harmonization in the Internal Market: Opposition Guidelines*, Office for Harmonization in the Internal Market.

PERRY, M. K. AND R. H. GROFF (1986): "Trademark Licensing in a Monopolistically Competitive Industry," *RAND Journal of Economics*, 17, 189–200.

PHILLIPS, J. (2003): *Trademark Law: A Practical Anatomy*, Oxford University Press.

PNG, I. (1987): "Litigation, Liability, and Incentives for Care," *Journal of Public Economics*, 34, 61–85.

PRIEST, G. AND B. KLEIN (1984): "The Selection of Disputes for Litigation," *Journal of Legal Studies*, 13, 1–56.

SCHWEIZER, U. (1989): "Litigation and Settlement under Two-Sided Incomplete Information," *Review of Economic Studies*, 56, 163–178.

SELTEN, R. (1978): "The Chain-store Paradox," *Theory and Decision*, 127–159.

SMITH, G. V. (1997): *Trademark Valuation*, Wiley.

SOMAYA, D. (2003): "Strategic Determinants of Decisions not to Settle Patent Litigation," *Strategic Management Journal*, 17–38.

SPIER, K. (1992): "The Dynamics of Pretrial Negotiation," *Review of Economic Studies*, 59, 93–108.

WALDFOGEL, J. (1998): "Reconciling Asymmetric Information and Divergent Expectations Theories of Litigation," *Journal of Law and Economics*, XLI.

WALDFOGEL, J. AND P. SIEGELMANN (1999): "Toward a Taxonomy of Disputes: New Evidence Through the Prism of the Priest Klein Model," *The Journal of Legal Studies*, XXVIII, 101–130.

WINKLER, W. (1999): "The State of Record Linkage and Current Research Problems," Technical report, U.S. Bureau of the Census, Statistical Research Division, U.S. Bureau of the Census, Washington D.C.

YILMAZ, M. (2004): "Waiting to Persuade," *The Quarterly Journal of Economics*, 223–248.

# Appendix

# A - String Similarity Measures

Above the Levenshtein - and the Jaro Winkler measure as defined by Cohen et al. (2003) are used. The Levenshtein measure is an *edit distance* measure which determines similarity of strings through the number of insertions (i), deletions (d) and replacement (r) operations needed when transforming one string into another. For an in depth explanation of the algorithm and its implementation refer to Gusfield (1997). The Jaro Winkler measure is a metric which captures number and order of common elements shared by two strings. It is based on the work of Jaro (1995) and Winkler (1999) and implemented according to Cohen et al. (2003).

**The Levenshtein Algorithm** Consider the two hypothetical trade marks (s) RESSVETIN and (t) RESVRIN. The following example demonstrates how string (s) is transformed into string (t) by insertion of two letters and the deletion of two others:

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| String s | R | E | S | S | V | E | | T | I | N |
| String t | R | E | S | | V | | R | | I | N |
| Operation | c | c | c | d | c | i | d | i | c | c |
| Cost | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 0 |

In this example three operations are used: insertion (i) and deletion (d), each of which has a cost of $1$ and copying (c) which is costless. The Levenshtein measure for this example is $-4$. The maximum value of the Levenshtein algorithm for a given pair depends on the length of the longer string in the pair. To make the measure comparable across strings it is divided by the length of the longer string in a pair. In this case the result is $-0.4$. Two strings are identical if the measure has the value $0$ and maximally dissimilar if it has the value $-1$.

To deal with multiple words and similarity which is due to parts of a trade mark I use a level two distance function as defined by Cohen et al. (2003) which calculates the similarity for all combinations of words from both trade marks and uses the maximum of the calculated similarities, discarding all remaining information. The results may differ from the Levenshtein algorithm in those cases in which at least one of the trade marks in a pair consists of multiple words.

**The Jaro Winkler Algorithm** This algorithm is based on the number of similar elements in two strings and their order. Define as $s'$ the number of common elements of strings (s) and (t) in string (s) and similarly as $t'$ the number of common elements in string (t). Then define $T$ as the number of transpositions of common elements in (s) and (t). Finally define $P$ as the length of

the longest common prefix of (s) and (t). The Jaro Winkler metric is then defined as:

$$\text{Jaro Winkler}(s,t) = \frac{1}{3}\left(\frac{s'}{s} + \frac{t'}{t} + \frac{s'-T}{s'}\right) + \frac{\max(P,4)}{10}\left[1 - \frac{1}{3}\left(\frac{s'}{s} + \frac{t'}{t} + \frac{s'-T}{s'}\right)\right] \tag{A1}$$

by Cohen et al. (2003). They note that this measure works well for short strings such as personal last names. I also implement this measure as a level two distance function in the sense of Cohen et al. (2003) to deal with multiple words in a trade mark. The measure lies in the interval $[0, 1]$, with a value of $1$ indicating absolute similarity and $0$ indicating maximal dissimilarity.

In the example provided above the measure produces a value of $0.903$. The Jaro Winkler measure gives more weight to pairs of trade marks that are similar at the beginning. This feature means that it is a useful complement to the Levenshtein measure for which it is unimportant where similarity between two strings occurs.

# B - Additional Empirical Results

Table 11: Independent probit models for outcomes of and selection into adjudication

| | | Pr(Leader wins) | | Pr(Adjudication) | |
|---|---|---|---|---|---|
| **Independent** | | **Homoskedastic** | **Heteroscedastic** | **Homoskedastic** | **Heteroscedastic** |
| **variable** | | (1) | (2) | (3) | (4) |
| Levenshtein | | 1.101*** | 1.230*** | -0.314*** | -0.314*** |
| | | (0.111) | (0.154) | (0.055) | (0.053) |
| Jaro Winkler | | 0.629*** | 0.584*** | -0.020 | 0.011 |
| | | (0.123) | (0.139) | (0.061) | (0.056) |
| Rivalry Dummy | | -0.049 | -0.101 | 0.021 | 0.033 |
| | | (0.050) | (0.082) | (0.027) | (0.024) |
| Rivalry | | 0.821*** | 1.140*** | -1.114*** | -1.046*** |
| | | (0.219) | (0.254) | (0.107) | (0.112) |
| Rivalry$^2$ | | -1.277*** | -1.717*** | 0.990*** | 0.920*** |
| | | (0.298) | (0.348) | (0.141) | (0.143) |
| Inside opposition | | 0.181*** | 0.162*** | -0.218*** | -0.176*** |
| | | (0.037) | (0.042) | (0.018) | (0.019) |
| Opposition intensity | | 0.016* | 0.019*** | -0.053*** | -0.048*** |
| | | (0.008) | (0.005) | (0.005) | (0.005) |
| Seniorities | | -0.023** | -0.293*** | 0.013*** | 0.020*** |
| | | (0.008) | (0.066) | (0.003) | (0.004) |
| Oppositions | | 0.097*** | 0.127*** | -0.081*** | -0.073*** |
| | | (0.015) | (0.024) | (0.007) | (0.008) |
| Followers words | | 0.042 | 0.064* | 0.084*** | 0.084*** |
| | | (0.029) | (0.029) | (0.015) | (0.014) |

Table 11: Independent probit models for outcomes of and selection into adjudication

| | Pr(Leader wins) | | Pr(Adjudication) | |
|---|---|---|---|---|
| **Independent** | **Homoskedastic** | **Heteroscedastic** | **Homoskedastic** | **Heteroscedastic** |
| **variable** | (1) | (2) | (3) | (4) |
| Leaders words | -0.161*** | -0.154*** | 0.070*** | 0.063*** |
| | (0.026) | (0.030) | (0.013) | (0.013) |
| Goodsservices | -0.034*** | -0.206*** | -0.014*** | -0.086*** |
| | (0.004) | (0.026) | (0.002) | (0.011) |
| Applicant size | -0.001*** | -0.001** | 0.000 | -0.001* |
| | (0.000) | (0.000) | (0.000) | (0.000) |
| Dummy 13 | 0.107** | 0.160*** | 0.268*** | 0.291*** |
| | (0.034) | (0.039) | (0.036) | (0.054) |
| Dummy 46 | | | 0.128*** | 0.260*** |
| | | | (0.038) | (0.057) |
| Levenshtein 13 | | | 0.533*** | 0.593*** |
| | | | (0.115) | (0.116) |
| Levenshtein 46 | | | 0.861*** | 0.926*** |
| | | | (0.127) | (0.156) |
| Adjudicated 13 | | | 0.106*** | 0.098*** |
| | | | (0.016) | (0.016) |
| Adjudicated 46 | | | 0.230*** | 0.251*** |
| | | | (0.015) | (0.017) |
| Low stakes | | | -0.004 | -0.008 |
| | | | (0.003) | (0.004) |
| Opposition lag | | | 0.002*** | 0.001** |
| | | | (0.000) | (0.000) |
| Leader size | | | 0.006*** | 0.009*** |
| | | | (0.000) | (0.001) |
| Leader's experience | | | -0.004* | -0.014*** |
| | | | (0.002) | (0.003) |
| Leader's costs | | | 0.913*** | 0.956*** |
| | | | (0.034) | (0.047) |
| Previous encounters | | | -0.043** | 0.008 |
| | | | (0.014) | (0.016) |
| Year dummies | Yes | Yes | Yes | Yes |
| Constant | -1.026*** | -0.796*** | -1.217*** | -1.009*** |
| | (0.160) | (0.183) | (0.088) | (0.086) |
| $-\ln L$ | 5079.36 | 4968.86 | 18335.26 | 18169.24 |
| Variance equations for heteroscedastic specifications | | | | |
| Rivalry Dummy | | 0.295* | | |
| | | (0.131) | | |
| Opposition intensity | | -0.039*** | | |
| | | (0.011) | | |

Table 11: Independent probit models for outcomes of and selection into adjudication

| | Pr(Leader wins) | | Pr(Adjudication) | |
|---|---|---|---|---|
| **Independent** | **Homoskedastic** | **Heteroscedastic** | **Homoskedastic** | **Heteroscedastic** |
| **variable** | (1) | (2) | (3) | (4) |
| Seniorities | | 0.134*** | | |
| | | (0.026) | | |
| Oppositions | | 0.059 | | |
| | | (0.031) | | |
| Goodsservices | | 0.103*** | | 0.050*** |
| | | (0.012) | | (0.005) |
| Followers words | | -0.143*** | | |
| | | (0.043) | | |
| Applicant size | | 0.000 | | 0.001*** |
| | | (0.000) | | (0.000) |
| Opposition lag | | | | 0.002** |
| | | | | (0.001) |
| Leader's size | | | | 0.004*** |
| | | | | (0.000) |
| Previous encounters | | | | -0.099*** |
| | | | | (0.017) |
| Dummy 13 | | | | -0.201*** |
| | | | | (0.052) |
| Dummy 46 | | | | -0.282*** |
| | | | | (0.056) |
| R-squared | | | | |
| N | 8184 | 8184 | 42432 | 42432 |

Standard errors in parentheses: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.