

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. The defence of a trade mark against imitation often begins with opposition to a new trade mark application. This paper studies trade mark opposition to determine whether firms can benefit from a reputation for toughness in the defence of their brands. Building on a model of asymmetric stakes in trade mark opposition a sample selection model of the trade mark opposition process is estimated. Results confirm that asymmetric stakes exist in trade mark opposition and that reputation has a very strong effect on a leader's ability to reduce the costs of trade mark defence.

JEL: K41; L00; O31; O34

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

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1 Introduction

Without property rights on trade marks incentives for firms to differentiate and improve their products would be substantially weakened. Trade marks enable consumers to reliably distinguish amongst producers and branded goods.¹ In turn this provides incentives for producers to exploit product differentiation and build brand reputation. However, a system of trade mark registration by itself cannot support this mechanism. Trade marks are passive rights: brand owners must defend their brands against imitation if a trade mark system is to be effective. An important mechanism in the defence of existing trade marks is the possibility to oppose trade mark applications before they are registered. This paper analyses trade mark opposition to establish how the interests of brand owners and applicants in a trade mark system are balanced.

Analysis of trade mark opposition fits into an important strand of recent research which seeks to establish how the 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)). This paper focuses on the way in which a reputation for toughness in opposition helps brand owners to reduce the costs of defending a trade mark portfolio. Previous work on trade marks has not analysed trade mark registration or defence of trade marks against infringement. In fact, as Graham and Somaya (2006) note, there is surprisingly little previous research on trade marks.²

It is often said that imitation is the sincerest form of flattery; trade marks protect brand owners against such flattery. After registration, a trade mark protects a brand against exact imitation. Where the brand owner seeks protection against similar trade marks, they must be able to show that their own trade mark is in use and is known by consumers of the branded product. They must also establish that the applicant's trade mark will confuse these consumers. Greater brand reputation affords the brand more extensive protection. However, it only confers protection if the brand owner can prove in court that it exists.

In a sufficiently large pool of registered trade marks, avoiding similarity between a trade mark 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 further connection in markets or technology. Then, opponent and applicant will possess little information about one another and a reputation for aggressive opposition may be valuable. Such a reputation will suggest that the opponent can produce good evidence for use and reputation of their brand. This is by no means a foregone conclusion as such evidence can be costly to produce. To establish the reputation of a brand it is necessary to survey consumers in each market where the branded product is sold (Phillips (2003)).

The analysis of trade mark opposition in this paper is guided by a model of asymmetric stakes. Asymmetric stakes arise whenever the similarity of trade marks does not have equal and opposite effects for applicant and opponent. If, as argued above, the parties in trade mark opposition generally do not produce similar products this will be the norm. Asymmetric stakes provide an explanation for the inability of opponent and applicant in trade mark opposition to

¹In 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.

²Theoretical 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).

³The trade mark systems of the United States, Germany and of the Office for Harmonisation in the Internal Market all provide the possibility of opposition.

settle their dispute. Models of asymmetric stakes are used to analyse patent litigation by Lanjouw and Lerner (1998), Lanjouw and Schankerman (2001) and Somaya (2003). They provide an alternative to models of asymmetric information or uncertainty which have been used to study a wide range of litigation cases (Waldfogel (1998), Waldfogel and Siegelmann (1999)). These latter models do not fit the trademark data analysed in this paper well.

In trade mark opposition both the applicant and the brand owner have the outside option of not settling and letting the trade mark office adjudicate their dispute. The value of this outside option depends on the asymmetry of stakes and brand owners' reputations for toughness in opposition. The theoretical model predicts that trade mark opposition leads to adjudication if the applicant stands to gain from the similarity of the trade marks in dispute but is unable to compensate the brand owner for their simultaneous loss. If the gain to the applicant is sufficiently large they will prefer adjudication to settlement. Additionally, the theoretical model shows how the brand owner's reputation for tough opposition determines the probability of adjudication. If the brand owner is known to be tough they are more likely to have invested in strong evidence proving use and reputation of their brand already. Then, the applicant will anticipate higher costs in responding to the case made by the brand owner and may prefer to settle. Therefore, a reputation for toughness is attractive for the brand owner because it can lower their effective costs of defending a brand across several trade mark opposition cases.

These predictions are tested on a comprehensive dataset of trade mark opposition cases from the Office for Harmonisation in the Internal Market (the Office)⁴, which began to operate an trade mark system for the European Union in 1996. The Office offers an important and cheap way for firms to acquire trade mark protection in Europe. Between 1996 and 2004, there were over 400,000 applications for trade marks at this office of which over 225,000 were registered as trade marks.⁵ An important feature of the trade mark system operated by the Office is the opposition process. This allows brand owners to oppose a trade mark application within a period of three months after the Office publish the application as otherwise unobjectionable. More than 17% of all trade mark applications at the Office are the subject of at least one such opposition.⁶ Interviews with trade mark attorneys suggest that at least a similar number of potential disputes between brand owners and applicants is settled without opposition arising.

Trade marks registered at the Office exist side by side with trade marks registered at national trade mark offices 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 already exist in a single language trade mark system. These features suggest that trade mark opposition has a more important role to fulfil within the European trade mark system administered by the Office than in existing national trade mark systems.

The theoretical model of the trade mark opposition process developed in this paper shows that there is selection into adjudication of trade mark disputes. The model leads to a selection equation which determines the probability of adjudication. Several predictions are derived. The selection equation is identified by variables that capture the effects of reputation and asymmetric stakes on the probability of entering into adjudication of trade mark opposition. To deal with selection into adjudication the selection equation is jointly estimated with an out-

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

⁵The 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 58000 and 90000 per year between 1999 and 2004.

⁶The 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.

come equation for trade mark opposition. Additional restrictions for this equation are derived from the theoretical model. Selection and outcome equations are estimated as a Heckman probit selection model in which both selection and outcome equations are probit equations.

The results of the empirical analysis support the theoretical model. In particular, they show that the opponent’s reputation for tough opposition has a very strong effect on the probability that a trade mark opposition case will be settled. Additionally, the results confirm the existence of asymmetric stakes in trade mark opposition. The outcome equation results show that trade mark applications are adjudicated consistently over the sample period by the Office. 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 applicant’s and opponent’s trade marks are good predictors of the damage which an applicant’s trade mark is likely to do to the opponent’s trade mark.

The paper is organised as follows: Section 2 presents descriptive data on trade mark opposition and firms’ opposition strategies. The following section (3) contains the theoretical model. An empirical specification with which the predictions of this model can be tested is also derived. The data are described in Section 4. The effect of an opponent’s reputation for tough opposition on the probability of adjudication are estimated in section 5. Section 6 concludes.

2 Trade mark registration at the Office

This section describes the trade mark application process at the Office. First, aggregate information on trade mark application and oppositions is discussed to illustrate trade mark registration at the Office. Then, the process of trade mark registration and opposition is analysed. Finally, I briefly discuss application and opposition behaviour of individual firms.

2.1 Applications, oppositions and registrations

This paper is based on an administrative dataset provided by the Office (the office). It contains information on the population of trade mark applications, trade mark applicants and their representatives at the Office. The dataset comprises the history of trade mark registration at the Office from 1996 to the end of 2004. Table 1 below displays the number of trade mark applications and the incidence of opposition to trade marks in the dataset.

Table 1: Applications and oppositions

Status	Application Year									Total
	1996	1997	1998	1999	2000	2001	2002	2003	2004	
Unopposed	35,590	22,193	25,334	33,211	46,861	40,197	37,320	50,665	56,790	348,161
%	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
%	16.73	17.43	19.00	18.92	17.76	17.15	16.67	11.28	0.07	14.26
Total	42,743	26,878	31,275	40,960	56,980	48,519	44,788	57,109	56,828	406,080
Oppositions	9,531	6,252	8,112	10,492	13,487	11,094	9,662	8,277	42	76,949
Word pairs	4,575	5,310	7,743	10,117	12,808	10,001	8,270	5,907	6	64,737

On average 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 the table the line “Oppositions” details the total number of opposition cases filed against applications of a given year. Table 1 also shows the number of opposition cases out of these

involving only word marks. These are the focus of the analysis below as additional data is available for word mark pairs.

What outcomes do trade mark applications at the Office normally have? Table 2 tabulates the legal status of all trade marks at the end of 2004 against an indicator of opposition to the application. The table distinguishes four statuses for a trade mark application: application has failed, application is in process, application is published and finally application is registered. Published applications have been vetted by the Office but may still be in the process of opposition while applications in process were being vetted by the Office in 2004.

In the first column of Table 2 it is shown that the number of applications that fail without being opposed is three times as high as the number of applications that fail due to opposition. These applications mainly fail on absolute grounds; this means that the applications did not comply with the rules governing the trade mark application process. If we compare the cells for failed and registered applications in the lower row of the table it is also evident that two times more opposed trade marks are eventually registered than fail in opposition.

Table 2: Legal status of applications at end 2004

Opposition	Legal Status end 2004				Total
	Failed	In process	Published	Registered	
No	45,090	56,166	42,752	204,153	348,161
Yes	13,929	16,379	2,137	25,474	57,919
Total	59,019	72,545	44,889	229,627	406,080

2.2 The trade mark opposition process

The data reviewed above shows that opposition to a trade mark application is a significant hazard for the applicant. How then does the opposition process work? The process of opposition to a trade mark application at the Office has three phases which are set out below. Figure 1 indicates how long each phase should take according to the Office. The analysis of the data further below shows that the entire process of opposition is somewhat longer than suggested by this figure.

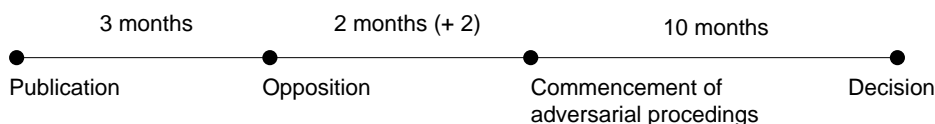


Figure 1: The trade mark opposition procedure

Figure 1 shows that the applicant and the opponent can bargain over the application prior to notification of opposition and after this point in time. Bargaining delay is costly to the applicant because they ought to delay the launch of a product connected to their trade mark until the dispute is resolved⁷. Delay is also costly for the opponent, because they incur legal fees and costs of proving that the value of their trade mark will be reduced.

Table 3 summarises how the minimum, mean and maximum length of a trade mark application procedure varies by type of outcome. The left half of the table focuses on failed applications while the right focuses on registered applications. The top part of the table provides information by trade mark application. The lower part of the table provides information

⁷In practice new products are often launched in spite of lacking clearance for the associated trade marks. This is due to lack of timely communication between marketing and trade mark divisions within companies. Interviewed trade mark attorneys noted this is a very common problem.

by opposition case. Eight types of opposition outcome are distinguished in the table: the first two capture decisions in favour of the opponent, the next four capture settlement outcomes and the last two capture decisions in favour of the applicant.

Table 3: Duration in years of trade mark registration by outcome

Opposition outcome	Failed				Registered			
	N	min	mean	max	N	min	mean	max
Total unopposed	45173	0.01	1.86	8.71	204273	0.93	1.76	8.75
Total opposed	13912	0.51	2.77	8.73	25434	1.12	3.23	8.76
Application rejected	2034	1.01	4.37	8.73	1	7.42	7.42	7.42
Application rejected in part	646	2.22	4.79	8.73	1165	2.29	4.71	8.72
Application withdrawn	13777	0.51	2.19	8.29	5	2.39	2.70	3.14
Application limited	1353	1.15	3.42	8.73	14651	1.21	2.99	8.68
Opposition withdrawn	803	1.07	3.67	8.57	9899	1.12	3.17	8.76
Agreement	15	2.70	4.64	6.53	207	1.52	3.76	7.87
Opposition failed	18	1.84	4.34	8.24	83	1.16	3.40	8.50
Opposition rejected	806	1.32	4.62	8.73	5032	1.52	4.35	8.70
Total	19624	0.51	2.76	8.73	31556	1.12	3.33	8.76

Table 3 demonstrates that opposition lengthens the trade mark application procedure considerably. 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 on whether the parties come to an agreement (< 4 years) or whether the Office makes a ruling (> 4 years).

Three types of cost are associated with trade mark opposition: administrative costs, delay in the use of a trade mark and the costs of providing evidence. The administrative costs are minimal at 350 €. In contrast the costs of delay may be very substantial if the applicant 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. It is important to note that neither the costs of delay, nor the costs of evidence can be shifted to the loser of a trade mark opposition case. This has important implications for firms' incentives in trade mark opposition as the following section shows.

Opponents will object to a trade mark application for two main reasons: the applicant's trade mark is very similar to their own and registration is sought for similar goods and services. Both forms of similarity increase the possibility that consumers may be confused between two trade marks. In Table 4 below I measure the similarity of a trade mark application and the opposing trade mark through similarity of the word marks.

Table 4 shows how the similarity between the applicant's and opponent's 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 . For both algorithms higher values indicate greater similarity. The algorithms are further discussed in Appendix 6. Table 4 distinguishes between opposition cases in which both parties are from different countries (left half) or from the same country (right half). This distinction is

made as one might expect that settlement is less likely when firms come from different countries. The first three outcomes listed in Table 4 correspond to rulings made by the Office. The next three correspond to settlement by the parties.

Table 4: Similarity of trade marks by opposition outcome

Opposition outcome	Different countries			Same country		
	Jaro Winkler	Levenshtein	N	Jaro Winkler	Levenshtein	N
Opposition rejected	0.78	-0.26	4920	0.80	-0.27	867
Application rejected	0.83	-0.21	1562	0.84	-0.22	236
Application rejected in part	0.85	-0.19	1788	0.86	-0.19	245
Application withdrawn	0.83	-0.22	10048	0.83	-0.23	1762
Application limited	0.83	-0.23	13653	0.84	-0.24	2143
Opposition withdrawn	0.82	-0.24	8661	0.83	-0.24	1498
Total	0.82	-0.23	40700	0.83	-0.24	6765

Table 4 shows that the outcome of trade mark disputes depends on the similarity of trade-marks. The average quality of outcomes does not depend on whether the parties come from the same country. Irrespective of origin of the parties in a dispute approximately 20% of opposition cases fail to settle. From Table 4 it can be deduced that the opponent’s win rate in adjudication is 40% if the parties come from different countries and 35% if they are from the same country. The string distance measures in Table 4 show that the average similarity of word marks is lower in cases decided in favour of the applicant than in settled cases.⁸ The lower similarity of word marks suggests that it should have been easier to agree as the offending application is less likely to damage the opponent’s trade mark. Why are opposition cases of such low quality pursued?

In the remainder of this section explanations for the observed incidence of lost opposition cases are investigated. The first of these is that opponents derive strategic benefits from pursuing opposition cases even if these are likely to be lost. Such benefits could derive from the delay that opposition cases cause for the applicant as documented in Table 3. Practitioners I interviewed have discounted the use of opposition to delay applicants as unlikely.

Table 5: Opposition outcome by inside opposition

Opposition status	Inside Opposition					
	No		Yes		Total	
	%	N	%	N	%	N
Opposition rejected	13.74	5,651	8.55	1,249	12.38	6,900
Application rejected	3.74	1,540	3.69	539	3.73	2,079
Application rejected in part	4.34	1,783	3.81	556	4.20	2,339
Application withdrawn	23.98	9,863	27.21	3,976	24.83	13,839
Application limited	32.17	13,231	34.07	4,978	32.67	18,209
Opposition withdrawn	21.82	8,975	22.50	3,288	22.00	12,263
Total	100.00	41,124	100.00	14,612	100.00	55,736

Table 5 displays opposition outcomes depending on whether the opponent has registered their trade mark at the Office. Define such trade marks as “inside” trade marks. On average inside trade marks will be more valuable than outside trade marks because they are protected in a larger geographical area. Greenhalgh and Rogers (2006) show that UK firms which have

⁸Tests of equality of means show that the difference between *Opposition rejected* and any other outcome is highly significant using either distance measure.

registered a CTM have higher Tobin's q than UK firms which register national trade marks. Additionally, owners of inside trade marks will have greater experience with the Office. Table 5 shows two things: first, disputes involving opponents with inside trade marks are more likely to be settled than disputes involving opponents with outside trade marks. Second, the rate at which opponents win opposition cases approaches 50% as we move from outside to inside opposition. Priest and Klein (1984) predict this result. Their model of divergent expectations also predicts settlement rates increase if the costs of adjudication rise, the value of the dispute falls and as the degree of uncertainty about cases is reduced.

Under inside opposition the value of the trademark dispute is most likely to increase, which would suggest a decrease in settlement rates, exactly the opposite of what is observed. However, it is also likely that the costs of a trademark case involving an inside trademark will be higher and that uncertainty in such cases will be lower. Thus divergent expectations may explain the patterns in Table 5. However Waldfoegel (1998) points out that divergent expectations implies two sided selection of cases for trial. This prediction is not borne out in Table 5. Rather, it displays one-sided selection, suggesting a model of one-sided asymmetric information. Selection towards settlements by opponents can be explained if opponents are better informed about case quality than applicants (Waldfoegel (1998)). Then, applicants offer settlements to opponents and these accept if their cases are weak. As we move to inside opposition, presumably reflecting higher costs of adjudication, we would expect selection to lead to stronger cases remaining in the pool of adjudicated cases.

Table 6: Similarity by inside opposition

Opposition Status	Inside Opposition					
	No			Yes		
	Jaro Winkler	Levenshtein	N	Jaro Winkler	Levenshtein	N
Opposition rejected	0.79	-0.26	4555	0.78	-0.28	1232
Application rejected	0.84	-0.20	1262	0.82	-0.23	536
Application rejected in part	0.85	-0.19	1480	0.84	-0.20	553
Total	0.81	-0.23	7297	0.80	-0.25	2321

Table 6 shows that on average the similarity of trademarks decreases as we move from outside- to inside opposition. This finding is difficult to reconcile with a selection process as described above. Therefore the data we have investigated here do not seem to support either divergent expectations nor asymmetric information as explanations of trademark opposition behaviour well. This leaves the question what can explain the findings in Tables 5 and 6?

Table 7: Opposition status by application year

Opposition status		Application Year					Total
		1996	1997	1998	1999	2000	
Opposition rejected	N	1,536	977	1,309	1,389	1,237	6,449
	%	17.24	16.65	17.31	14.60	11.18	15.02
Application rejected	N	400	263	376	436	446	1,921
	%	4.49	4.48	4.97	4.58	4.03	4.47
Application rejected in part	N	457	343	402	546	470	2,218
	%	5.13	5.84	5.31	5.74	4.25	5.17
Settlement	N	6,519	4,286	5,475	7,143	8,914	32,337
	%	73.15	73.03	72.40	75.08	80.55	75.34
Total	N	8,912	5,869	7,564	9,515	11,067	42,930
	%	100.00	100.00	100.00	100.00	100.00	100.00

An alternative explanation for firms' unwillingness to drop poor quality opposition cases may be uncertainty about the extent of protection against imitation which the Office provides. To investigate this I tabulate how the settlement rate changed across cohorts of trade mark applications. If uncertainty about the Office's decision standard dissipated over time the proportion of trade mark disputes settled should increase. Table 7 below supports this. Cohorts after 2000 are left out of the table due to the long duration of the opposition processes ending in rejection.

This section has demonstrated that adjudication of trade mark cases often ends in favour of the applicant. Various explanations have been investigated. Most likely the finding is the result of uncertainty regarding the Office's standard of protection and overconfidence on the part of less experienced opponents. However, the evidence presented here does not resolve the question why applicants faced with an inside opponent are more likely to settle than applicants faced with outside opponents.

2.3 Firms' opposition strategies

In this section firms' opposition strategies at the Office are briefly presented. The main purpose of the section is to describe the behaviour of firms that frequently oppose trade mark applications.

Table 8: The top 20 leaders, followers and applicants

Origin	Leader	Oppositions generated	Origin	Follower	Oppositions received	Applications	Origin	Applicant	Applications
DE	HENKEL	848	DE	REWE	372	621	JP	KONAMI	1313
CH	NESTLE	277	DE	D.TELEKOM	345	1035	US	P&G	1065
DE	LIDL	255	US	MARS	215	897	DE	D. TELEKOM	1035
DE	GLAXO	251	US	P&G	162	1065	US	MARS	897
ES	CORTE INGLES	250	CH	NOVARTIS	149	127	DE	DAIM. CHRYSL.	812
DE	D. TELEKOM	240	GB	GLAXO	138	147	DE	REWE	621
NL	UNILEVER	229	SE	ASTRAZEN.	133	271	FR	L'OREAL	608
DE	SANOFI	211	CH	SYNGENTA	132	325	DE	BASF	570
DE	HEXAL	196	DE	PREMIERE	131	290	NL	UNILEVER	490
DE	MERCK	187	CH	NESTLE	123	129	FR	LANCOME	439
DE	BYK GULDEN	175	DE	BOEHR. ING	116	86	US	IBM	420
DE	STADA	174	DE	BASF	113	570	US	MICROSOFT	392
ES	ARBORA AUS.	169	NL	UNILEVER	110	490	JP	SONY	372
ES	LAB. INDAS	163	US	PFIZER	108	315	DE	VW	360
DE	M. STEIFF	158	US	ELI LILLY	104	311	DE	BMW	351
DE	ALDI	153	DE	DAIM. CHRYSL.	103	812	US	VIACOM	326
DE	REWE	149	JP	KONAMI	102	1313	CH	SYNGENTA	325
ES	ALMIRAL PR. F.	142	DE	ALTANA	101	324	DE	ALTANA	324
CH	SYNGENTA	141	DE	MERCK	93	257	US	PFIZER	315
GB	EASYGROUP	141	US	PHARM.UPJ	89	49	US	ELI LILLY	311

Table 8 shows which firms oppose trade mark applications most frequently at the Office, which firms are most frequently opposed and which firms most frequently apply for trade marks. Two facts emerge: i) only half the top twenty applicants are among the top twenty opposed firms and ii) only four of the top twenty applicants are among the top twenty opponents. If the top applicants also hold the largest portfolios of trade marks and opposition is driven purely by the random likelihood of infringement the latter result is very unlikely. Turning to fact i) more applications should also lead to more oppositions received. While this expectation is partly confirmed in the table, it is interesting to observe that most of the exceptions are pharmaceuticals companies. Pharmaceuticals companies also make up half of the top twenty opponents in this dataset. This shows that trade marks are particularly important assets in the pharmaceuticals industry. The group of top twenty opponents also contains a sizeable group of supermarket chains.

Most applicants at the Office have not applied for trade mark protection for their whole

portfolio. Therefore one explanation for the large number of opposition cases due to firms with comparatively small portfolios in this dataset is that 80% of all oppositions due to the top twenty opponents are based on outside firms compared with a sample mean of 70%.

The high frequency of their opposition activity implies that the top 20 opponents have a reputation for frequent opposition. Additionally, the average similarity of trade marks in the disputes generated by these firms is significantly lower than the sample mean; the average Levenshtein distance is -0.28 for instance. This raises the question whether a reputation for frequent and aggressive opposition has any effects within the trade mark system?

Table 9: Opposition outcomes of the most frequent opponents

Opposition Status	N	%
Opposition rejected	270	9.98
Application rejected	107	3.96
Application rejected in part	88	3.25
Application withdrawn	594	21.96
Application limited	1,032	38.15
Opposition withdrawn	609	22.51
Total	2,705	100.00

Table 9 reveals that the top twenty opponents enjoy a similarly low rate of lost adjudication cases as owners of inside trade marks, in spite of the fact that 80% of their trade marks are outside trade marks.

This shows that a reputation for toughness in trade mark opposition can have beneficial effects for those holding the reputation. In the following section a model of trade mark opposition is developed which encompasses the effects of such a reputation.

3 A model of selection into adjudication

In this section I develop a model of selection into adjudication at a trade mark office. The model encompasses the decision to oppose a rival firm's trade mark and the opposition process including adjudication. The endogenous emergence of adjudication in a model of a dispute between two parties may arise either because of uncertainty, asymmetric information or because of asymmetric stakes. The previous section showed that there is some evidence for asymmetry of stakes (Table 5) and also for uncertainty about the Office's decision rule (Table 7). The model set out here incorporates asymmetric stakes and also allows for some uncertainty about the way in which the trade mark office will decide each case.

I model the interaction between owners of existing trade marks and applicants for new trade marks. These are referred to as leaders and followers. The leaders are owners of established trade marks which support brand names. The followers are firms attempting to establish brands of their own. In applying for a new trade mark followers may have positioned their trade mark close to that of a leader. In such cases the leader may oppose the follower's application. If the leader chooses to oppose an application there are two possible outcomes: settlement or adjudication in which the office determines whether a trade mark application is too similar to the leader's trade mark. In adjudication both parties are called upon to provide evidence. This process is modelled as a three stage game between the follower, the leader and the trade mark office:

- Stage 0 Nature provides the applicant with a trade mark. The applicant believes the trade mark to be sufficiently different from existing trade marks to apply for it.
- Stage 1 The trade mark office examine the application and find that it is similar to the leader's trade mark and inform them of this fact. The leader's trade mark has value V . They observe the damage D to their trade mark flowing from the follower's trade mark and decide whether to oppose or not. Simultaneously the follower chooses whether to uphold their application. Due to the similarity of the trade marks they now value their trade

mark as $S = D + \epsilon$. Here $\epsilon \in [-\infty, +\infty]$ captures an asymmetry of stakes between leader and follower.

Stage 2 If there is 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 office⁹. Simultaneously the leader builds a reputation for defending their trademark. This reputational gain G may bias the opponent towards opposition. The follower faces a cost e of responding to the leader's evidence.

Stage 3 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.

The value of the leader's trade mark (V) and the damage which will be caused by the registration of the follower's trade mark (D) are assumed to be known to both firms. While the value of the leader's trade mark will always be positive ($V > 0$) I allow for the possibility that the damage inflicted by the follower's trade mark is actually a gain for the leader, i.e. $D \in [-\infty, \infty]$. While the damage is assumed to be known to the firms, it is costly to provide evidence on the similarity of trade marks to the office ($E > 0, e > 0$).

The follower's gain from the similarity of the two trade marks may be larger or smaller than the damage inflicted on the leader. Only if there are no asymmetric stakes ($\epsilon = 0$) is the damage to the leader equal to the follower's gain from the trade mark. If $\epsilon > 0$ there is a net gain to both firms from registration of the new trade mark while $\epsilon < 0$ represents cases in which the damage to the leader exceeds the follower's gain. In these last cases leader and follower will disagree about the solution to their dispute. If the costs of adversarial proceedings are low enough the opposition case will terminate with a decision by the office.

3.1 Stage 3

If the adjudication stage is reached, the trade mark office decide whether or not the follower's trade mark is too similar to the leader's trade mark. 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 $y_w = 1$ if the leader wins. Correspondingly the office's standard is observed with error μ and the probability of the leader winning may be defined as:

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

where it is assumed that the error μ regarding the office's decision standard, is normally distributed and Φ 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 $\bar{D} - D$ 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 of the leader's trade mark will depend on its ability to positively affect purchasing decisions, called *goodwill*. 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

⁹While 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.

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:

$$\frac{\partial \bar{D}(V)}{\partial V} < 0 \quad (\text{A1})$$

The probit model set out here generates a probability that the follower's trade mark is too similar to the leader's trade mark, $\hat{p}(D, \bar{D}(V))$ which 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} :

$$\frac{\partial \hat{p}}{\partial D} > 0, \quad \frac{\partial \hat{p}}{\partial \bar{D}} < 0 \quad (\text{A2})$$

i.e. the probability increases in the degree of damage and decreases in the decision standard. Finally I assume that it is impossible to win a trade mark case if the follower's trade mark application benefits the leader:

$$\forall D \leq 0 \quad \hat{p}(D, \bar{D}) = 0, \quad (\text{A3})$$

$\hat{p}(D, \bar{D})$ is known to both firms. A disagreement between them cannot arise from divergent expectations about the merits of a trade mark dispute.

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. The surplus is: $(1 - \delta)^{-1}(V + \delta\tilde{\epsilon})$ where $\tilde{\epsilon} = \max[0, \epsilon]$. This is the discounted stream of the leader's value from their trade mark and the discounted difference between the leader's loss and the follower's gain from the new trade mark. δ is the discount rate. If $\epsilon > 0$ the trademark application adds value and the parties will negotiate how to split this value. If $\epsilon < 0$ the trademark application destroys value and the parties negotiate at which price it is dropped.

If one of the parties withdraws from bargaining at this stage, then adversarial proceedings ensue. Therefore, the parties' outside options in this bargaining game are defined by their expected value of adversarial proceedings:

$$A_l = V + \frac{\delta}{(1 - \delta)} \hat{p}(D, \bar{D})V + (1 - \hat{p}(D, \bar{D})) \left[\frac{\delta}{(1 - \delta)} (V - D) \right] - \delta(E - G) \quad , \quad (2)$$

$$A_f = \frac{\delta}{(1 - \delta)} (1 - \hat{p}(D, \bar{D})) (D + \epsilon) - \delta e \quad . \quad (3)$$

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)) the leader's expected payoff (v_l^2) is:

$$v_l^2 = \begin{cases} \frac{1}{2}((V + \delta\tilde{\epsilon})(1 - \delta)^{-1} + V) & \text{if } \frac{(V + \delta\tilde{\epsilon})}{2(1 - \delta)} \geq A_l \quad \text{and} \quad \frac{(V + \delta\tilde{\epsilon})}{2(1 - \delta)} \geq A_f \\ (V + \delta\tilde{\epsilon})(1 - \delta)^{-1} - A_f & \text{if } \frac{(V + \delta\tilde{\epsilon})}{2(1 - \delta)} \geq A_l \quad \text{and} \quad \frac{(V + \delta\tilde{\epsilon})}{2(1 - \delta)} < A_f \\ A_l & \text{if } \frac{(V + \delta\tilde{\epsilon})}{2(1 - \delta)} < A_l \quad \text{and} \quad \frac{(V + \delta\tilde{\epsilon})}{2(1 - \delta)} \geq A_f \end{cases} . \quad (4)$$

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 the follower's expected payoff (v_f^2) is:

$$v_f^2 = \begin{cases} \frac{1}{2}((V + \delta\tilde{\epsilon})(1 - \delta)^{-1} - V) & \text{if } \frac{(V + \delta\tilde{\epsilon})}{2(1 - \delta)} \geq A_l \quad \text{and} \quad \frac{(V + \delta\tilde{\epsilon})}{2(1 - \delta)} \geq A_f \\ A_f & \text{if } \frac{(V + \delta\tilde{\epsilon})}{2(1 - \delta)} \geq A_l \quad \text{and} \quad \frac{(V + \delta\tilde{\epsilon})}{2(1 - \delta)} < A_f \\ ((V + \delta\tilde{\epsilon})(1 - \delta)^{-1} - A_l) & \text{if } \frac{(V + \delta\tilde{\epsilon})}{2(1 - \delta)} < A_l \quad \text{and} \quad \frac{(V + \delta\tilde{\epsilon})}{2(1 - \delta)} \geq A_f \end{cases} . \quad (5)$$

Settlement between the parties is now fully characterised. Due to the presence of asymmetric stakes it is possible that both the leader and the follower will prefer adjudication to settlement. In the following I characterise the conditions under which this is true.

The leader will strictly prefer adjudication to the follower's best offer if:

$$A_l > \frac{1}{(1 - \delta)} (V + \delta\tilde{\epsilon}) \Leftrightarrow \hat{p}(D, \bar{D}) > 1 + \frac{(E - G)(1 - \delta) + \tilde{\epsilon}}{D} . \quad (6)$$

A leader will prefer adjudication if the associated reputation gain (G) is large enough. An increase in damage due to the trademark has ambiguous effects: it increases the probability of successful opposition (\hat{p}) and it increases the right hand side of the inequality as well.

Settlement will also fail if the follower can do better from adjudication. However, if the leader is willing to leave the full surplus from the new trade mark to the follower, then the follower will never strictly prefer trial to a settlement. The only remaining possibility for a failure to settle arises if the leader and follower both expect greater returns from adjudication than from settlement:

$$A_l + A_f > \frac{1}{(1 - \delta)} (V + \delta\tilde{\epsilon}) \Leftrightarrow G > E + e + \left[(\tilde{\epsilon} - \epsilon) + \epsilon\hat{p}(D, \bar{D}) \right] \frac{1}{1 - \delta} . \quad (7)$$

This inequality shows that the reputation gain for the leader must be larger than the sum of both parties' costs of adjudication for the leader to prefer adjudication. Additionally it depends on the extent of asymmetric stakes between the parties. If $\epsilon > 0$, then the first term in square brackets is zero and an increase in asymmetric stakes decreases the probability of adjudication. This reflects the increase in surplus which both parties can divide if they settle. If $\epsilon \leq 0$, then the term in square brackets becomes $-(1 - \hat{p})\epsilon > 0$. Once more, an increase in asymmetry of stakes reduces the probability of observing adjudication. In this case this reflects the decreasing gain for the follower from their trademark application.

Condition (7) characterises the boundary between the settlement and the adjudication region as long as $A_f > 0$. In this case the leader and the follower must be adequately compensated under a settlement. Unsurprisingly this is harder than just compensating the leader as required by condition (6).

3.3 Stage 1

Here the leader must decide whether to oppose or not. Simultaneously, the follower who is appraised of the looming trademark dispute must determine whether they will uphold their trade mark application. First, I consider whether the follower will prefer to withdraw their application if they are faced with the threat of opposition. Thereafter the leader's choice to oppose is analysed.

The follower's decision

The follower will anticipate whether the threat of opposition leads to a settlement or to adversarial proceedings. In the case of settlement they will always weakly prefer this to abandoning their trade mark application as settlements are worth at least 0 to the applicant. In the case of adversarial proceedings it is less clear whether the follower is likely to pursue an application.

Anticipating the possibility of adversarial proceedings a follower must choose whether to enter opposition or not. They will receive a payoff of 0 if they withdraw their application and will prefer adversarial proceedings if $A_f > 0$. Note that $A_f > 0$ implies either an adversarial setting: $D > -\epsilon$ and $\epsilon < 0$ and $D > 0$, a cooperative setting: $\epsilon > -D$ and $\epsilon > 0$ and $D < 0$ or $D > 0$ and $\epsilon > 0$, a highly cooperative setting. In the adversarial setting the follower damages the leader's trade mark, derives a gain from the similarity of their trade marks but cannot compensate the leader fully. In the cooperative settings the follower creates a benefit for the leader and gains from the similarity of both trade marks. A limit for the adjudication region can be derived as follows:

$$\delta A_f > 0 \Leftrightarrow D > e \frac{(1 - \delta)}{(1 - \hat{p}(D, \bar{D}))} + (-\epsilon) \quad . \quad (8)$$

This inequality shows that the follower will withdraw their trade mark application if the probability of losing in adjudication is high enough. Greater costs of providing evidence (e) decrease the follower's willingness to pursue an application that will end in adjudication. On the other hand an increase in the spillover from the leader's trade mark ($D + \epsilon$) raises the follower's willingness to uphold a trade mark application facing adjudication.

The leader's decision

It can be shown that a leader will always oppose if they anticipate adjudication. The leader will prefer adjudication if $A_l > (V - \delta D)(1 - \delta)^{-1}$. By rewriting the condition characterising the adjudication region (7) I can show that if adjudication is preferred to settlement, opposition is always more profitable than accommodating the follower:

$$A_l + A_f > \frac{V + \delta \tilde{\epsilon}}{1 - \delta} \Leftrightarrow A_l > \frac{V - \delta D}{1 - \delta} + (D + \epsilon) \frac{\delta \hat{p}(D, \bar{D})}{1 - \delta} + \frac{\delta}{1 - \delta} (\tilde{\epsilon} - \epsilon) + \delta e \quad . \quad (9)$$

Note that all terms on the right hand side of this inequality are positive. Therefore, adjudication arises if both conditions (7) and (8) hold simultaneously; then the leader cannot be persuaded to end opposition and the follower does not wish to withdraw their application.

3.4 Predictions of the model

This model shows that determinants of the outcome of adversarial proceedings also affect the selection process into adversarial proceedings. By implication the outcome of adversarial proceedings cannot be estimated independently of the selection process. Any unobserved

heterogeneity in the empirical model will induce correlation between the error terms of the outcome and selection equations. Ignoring this would lead to inconsistency of the estimator in the outcome equation.

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 inequalities (7) and (8) which jointly characterise the adjudication region. This is done below.

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 office will reject the follower's trade mark application,

and

Hypothesis 2

A higher value of the leader's trade mark raises the probability that the 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, as well as the follower's preceding decision to uphold their application in the face of opposition. In the data we can only observe the joint outcome of both decisions. Figure 2 represents the adjudication region that results from these decisions in E - D space:

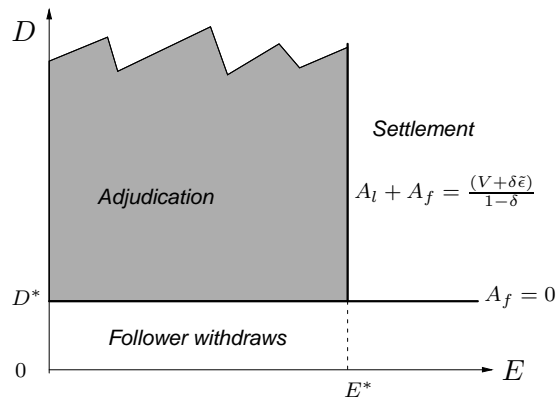


Figure 2: The adjudication region in E - D space

The boundaries, E^* and D^* , of the adjudication region are derived from (7) and (8):

$$E^* = G - e - \left[(\tilde{\epsilon} - \epsilon) + \epsilon \hat{p}(D, \bar{D}) \right] \frac{1}{1 - \delta} \quad D^* = e \frac{(1 - \delta)}{(1 - \hat{p}(D, \bar{D}))} + (-\epsilon) \quad (10)$$

If the area of the adjudication region in E - D space increases this implies that the probability of observing adjudication increases. Therefore it is possible to show that:

Hypothesis 3

The probability of adjudication is decreasing in the follower's expected costs of providing evidence.

To see this note that: $\frac{\partial E^*}{\partial e} = -1 < 0$ and $\frac{\partial D^*}{\partial e} = \frac{(1-\delta)}{(1-\hat{p}(D,D))} > 0$. Thus, increases in the follower's expected costs of providing evidence reduce the probability of observing adjudication at both selection stages. At stage 2 it will increase a follower's propensity to settle and at stage 1 it increases the follower's propensity to withdraw their application.

Inspection of the boundary conditions for the adjudication region (10) shows that neither the leader's probability of winning in adjudication $\hat{p}(D, \bar{D})$ nor the asymmetry of stakes ϵ have clear effects. Consider the leader's probability of winning in adjudication. If this increases the leader will be less likely to settle ($\frac{\partial E^*}{\partial \hat{p}(D,D)} > 0$) if the follower's application damages their trademark ($\epsilon < 0$). In contrast, the follower will be less likely to uphold their trade mark application ($\frac{\partial D^*}{\partial \hat{p}(D,D)} > 0$). These effects counteract one another.

Nonetheless, a restriction on the effects of the probability of successful opposition $\hat{p}(D, \bar{D}(V))$ can be derived from this model. The model outlined above implies that this probability enters into the decision problem of leader and follower at the selection stage. This is testable.

Hypothesis 4

The determinants of the leader's probability of winning, i.e. measures of damage or value, must have consistent signs in the outcome and the selection equation.

This means that all variables entering into the probability of successful opposition with the same sign in the outcome equation, must have a common sign in the selection equation too. While indirect, this test will be stronger as the number of determinants of damage and value included in the model grows.

Finally, it may be shown that only E^* increases in G and therefore:

Hypothesis 5

The probability of observing adjudication is increasing in the reputation gain which the firm obtains from opposition.

The empirical model Hypotheses 1- 5 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_w) is a linear function of vectors of observed measures of expected damage (\mathbf{D}) and value (\mathbf{V}). In the selection equation the probability of observing adjudication (y_a) is a linear function of vectors of observed measures of expected damage (\mathbf{D}), value (\mathbf{V}), reputation (\mathbf{R}) as well as measures of reputation gain (G) and asymmetric stakes (S). The sample selection model is identified by the reputation (\mathbf{R}), reputation gain (G) and asymmetric stakes S variables. Additionally I include time dummies in the sample selection model which strengthen identification further. The estimated model has the form:

$$\begin{aligned}
 y_w^* &= \beta_0 + \mathbf{D}'\beta_D + \mathbf{V}'\beta_V + \mu & (11) \\
 y_a^* &= \gamma_0 + \mathbf{D}'\gamma_D + \mathbf{V}'\gamma_V + \mathbf{R}'\gamma_R + \gamma_S S + \eta \\
 y_w &= \begin{cases} 1 & \text{if } y_a^* > 0 \\ 0 & \text{if } y_a^* \leq 0 \end{cases} \\
 y_a &= \begin{cases} 1 & \text{if } y_a^* > 0 \\ 0 & \text{if } y_a^* \leq 0 \end{cases},
 \end{aligned}$$

where η is a normally distributed error. This bivariate probit selection model can be estimated using full-information maximum likelihood (FIML).

4 Data

In this section the variables entering the empirical model are discussed. Table 10 sets out descriptive statistics. It is based on all word-mark opposition cases that were decided at the Office between 1996 and 2004.¹⁰

Estimation of the empirical model (11) requires variables that capture variation in the value of the leader's trade mark (V) and in the damage that would be inflicted on this trade mark by the follower's application (D). Additionally, variables that capture variation in leaders' reputations (R), reputational gain from opposition (G) and a measure of asymmetric stakes (S) are needed to identify the model.

Table 10: Variable definitions and descriptive statistics

Variable		Description	Mean	Std. dev.	Min.	Max.	Obs.
Leader wins		Outcome dummy	0.403	0.491	0.000	1.000	9703
Adversarial		Selection dummy	0.204	0.403	0.000	1.000	47479
Inside opposition	V	Opposing mark is CTM	0.306	-	0.000	1.000	47479
Oppositions	V	Concurrent oppositions	1.788	1.349	1.000	20.000	47479
Family	V	Leader's family size	1.020	0.211	1.000	8.000	47479
Opposition intensity	V	Leader's previous oppositions	1.894	3.389	1.000	88.000	47479
Jaro Winkler	D	Similarity measure	0.824	0.186	0.000	1.000	47465
Levenshtein	D	Similarity measure	-0.232	0.178	-1.000	0.000	47465
Rivalry	D	Product market overlap	0.149	0.226	0.000	1.000	43601
Seniorities	D	Follower's Seniorities	0.343	2.174	0.000	116.000	47479
Follower's words	D	Words in follower's mark	1.397	0.663	1.000	9.000	47479
Leader's words	D	Words in leader's mark	1.274	0.573	1.000	6.000	47479
Goods & services	D	Follower's Nice classes	3.175	3.900	0.000	45.000	47479
Low stakes	S	Weakness of leader's stakes	8.875	29.870	1.000	411.000	47479
Reputation -J.W.	R	Leader's aggression using J.W.	0.346	0.322	0.000	0.894	47465
Reputation -L.	R	Leader's aggression using L.	-0.109	0.122	-0.675	0.000	47465
Reputation gain	G	Leader's reputation gain	-6.933	25.098	-278.250	162.286	47479
Country		Dummy for different countries	0.857	-	0.000	1.000	47479
1997		Year concluded	0.000	-	0.000	0.000	47479
1998		Year concluded	0.000	-	0.000	1.000	47479
1999		Year concluded	0.005	-	0.000	1.000	47479
2000		Year concluded	0.047	-	0.000	1.000	47479
2001		Year concluded	0.112	-	0.000	1.000	47479
2002		Year concluded	0.189	-	0.000	1.000	47479
2003		Year concluded	0.225	-	0.000	1.000	47479
2004		Year concluded	0.190	-	0.000	1.000	47479

The dependent variables The dependent variable for the selection equation, *Adversarial*, is a dummy that captures whether or not an opposition case ended in adversarial proceedings.

¹⁰Several 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.

Where *Adversarial* 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 the adversarial stage is 0.204.

The dependent variable for the outcome equation, *Leader wins*, is also a dummy variable. This takes the value one if the follower's trade mark was rejected either wholly or in part. Conditional on entry into adversarial proceedings the probability that the leader wins is 0.403.

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, if trade marks are more valuable, then it is likely that their owners treat them in identifiable ways. The dataset contains several variables that capture aspects of 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. *Ceteris paribus* a leader's trade mark registered at the office will have a higher value than a leader's trade mark that is not. A leader's trade mark will already be registered in another jurisdiction or will be in use there. If the leader decides to register the trade mark at the office as well, then this confers additional protection. However, it also leads to additional costs, since the risk of opposition at the office is not negligible. If such an opposition is successful this may damage the leader's trade mark as it shows up the limits of the trade mark clearly. Therefore leaders will only seek to register particularly valuable trade marks at the office for which protection throughout the European Union is worthwhile. Table 10 shows that 30% 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. Where this variable takes a higher value this indicates that the applicant 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. In the data over 40% of all opposed trade marks face more than one opponent.

The variable *Family* measures the size of a trade mark family used in an opposition case by the leader. Such families may consist of the same trade mark name which is registered for different combinations of goods and services. An example from our data is *MTV Music Television* which was applied for in 18 different combinations of goods and services and of which 15 had been registered at the end of 2004. Alternatively a family of trade marks may consist of different trade mark names that share a few common elements. An example of this type of family is given by Deutsche Telekom's trade mark "T" which appears in 31 applications by itself and in at least the same number in conjunction with other elements such as "Mobile", "Info" or "DSL". While the mere existence of such families of trade marks suggests that they provide additional protection, this is also explicitly noted by practitioners: Olsen (2000) argues that the use of trade mark families by the leader in opposition procedures raises their probability of success. In this dataset trade mark families are rarely used as Table 10 shows. The maximal size of a trade mark family in an opposition case is 8.

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, 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 just under two previous opposition cases and the maximum number of previous oppositions based on the same trade mark is 88. This was for the trade mark SPA.

D: Damage created by the follower’s application Opposition against a trade mark application may be lodged if a firm believes that the applicant’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 the overlap in goods and services covered by both trade marks and the similarity of the trade marks themselves. Interestingly, the guidelines which the office issues have much to say about the assessment of the similarity of goods and services and much less to say about similarity of the trade marks themselves (OHIM (2004), Chapter 2.).

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*¹¹. 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 (OHIM (2004), Chapter 2.).

The sophistication of consumers or evidence of actual confusion are not contained in the dataset. However, the names of the 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). To capture similarity measures of string similarity are employed in this paper. These will mainly capture the first of the aspects noted above and sometimes the second. Similarity of meaning is not measured by them.

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 name¹². 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 6. Both capture an aspect of the likelihood that consumers will confuse the two trade marks, damaging that of the leader.

The variable *Rivalry* captures the product market rivalry between the 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 coefficient¹³ 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 (Nice Agreement (1957)) 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.

The variables *Leader’s words* and *Follower’s words* capture the number of words in

¹¹*Sabèl v Puma AG, Rudolf Dassler Sport*, Case C-251/95 [1998] ETMR 1.

¹²To 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).

¹³This measure is also used by Jaffe (1986) and subsequent work on patents to measure closeness of firms’ patent portfolios.

each trade mark. *Ceteris paribus*, the higher the number of words in either trade mark, the lower the damage caused by similarity of parts of the trade marks.

The variable **Seniorities** measures the number of identical previous registrations in other jurisdictions of a follower's trade mark. As the number of seniorities increases it is increasingly likely that some group of consumers is already confronted with both the leader's and the follower's trade marks. This makes it more difficult to prove that the follower's trade mark will confuse consumers of the product protected by the leader's trade mark.

The variable **Goods & services** captures the breadth of the follower's application in the space of NICE classes. This may be related to the damage done to the leader's trade mark. The broader the follower's trade mark the greater the probability that it overlaps with the leader's trade mark in all classes.

S: Asymmetric stakes The variable **Low stakes** captures the number of other trade marks which the leader has previously defended in a trade mark opposition case. The greater this number the lower the importance of the current opposition case for the leader. This variable does not capture asymmetry of stakes in the present case (ϵ) but it controls for an element of diverging stakes between leader and follower.

R: Reputation In the process of trade mark application leader's and follower's 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 are more likely in the phase after the opening of the office.

The vast majority of trade mark disputes arise between parties that have not interacted previously. In this setting follower's will have 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 will provide important information to followers. It implies that a leader has already invested in the collection of evidence which may be relevant to the current trade mark dispute¹⁴. Such evidence raises the costs of defending a trade mark application for the follower.

The variables **Reputation - L.** and **Reputation - J.W.** capture the average similarity of leaders' and followers' trade marks in all past opposition cases in which a leader was involved. If the variables take on higher values this indicates that past trademark disputes were about more similar trademarks. Therefore, these variables measure leading firms' aggressiveness in the past. If firms were very aggressive in the past this suggests that they built up strong evidence for the reputation of their trademarks which will raise the costs of defending an application in the current case.

To provide evidence in trade mark opposition cases leaders must regularly survey the public in order to demonstrate that their trade mark is indeed well known and to what extent. Legal representatives of owners of highly valuable trade marks therefore assemble "Fame packs" which document the reputation of such trade marks. These are regularly updated in order to provide the best possible evidence on the reputation of leaders' trade marks. Surveying the public regarding the reputation of a trade mark is expensive: such surveys may cost in excess of 15,000 €¹⁵.

¹⁴In opposition cases that are not based on allegations of identity leader's will 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.

¹⁵ This figure was quoted by the representative of a law firm with extensive experience in European trade mark

G: Reputation gain This variable is based on a 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. Therefore, we construct the average lag between past trademarks and subtract from this the lag between the current opposition case and the most recent case. This variable increases as the interval between disputes falls, reflecting a higher reputation gain from frequent opposition cases.

Further control variables The variable *Country* is a dummy variable which indicates whether the leader and follower come from the same country. We might expect that firms from the same country encounter less difficulties in settling, due to shared norms which govern the process of bargaining.

Finally I include time dummies which capture the year in which the final legal status of an application is determined. These dummies will sweep out any variation in firms' experience with the trade mark opposition process which is due to the passage of time.

5 Effect of reputation on entry into adversarial proceedings

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 model 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 (11) is estimated.

Table 11 provides results of two probit regressions for the outcome and the selection equations of the empirical model as well as Heckman's probit selection model. The results of the selection model show that there is strong evidence for selection in trade mark opposition. The measure of correlation (ρ) between the error terms of the outcome and the selection equations is negative and highly significant. Comparing the parameter estimates of the independent outcome model (1) with the selection model also reveals biases in the estimated coefficients if selection is not accounted for. Note however that the biases do not affect the interpretation of the coefficients in any case, which implies that the underlying model is quite robust.

A comparison of the goodness of fit of the sample selection model and two independent probit regressions was performed. This is based on the receiver operating characteristics (ROC) approach suggested by Cameron and Trivedi (2005). The area under the ROC curve is a measure of the predictive power of a binary outcome model. The comparison shows that the outcome equation of the sample selection model predicts (ROC area=0.6431) slightly worse than the simple probit regression (ROC area=0.6529). This difference is highly significant ($\chi^2(1) = 24$). Similarly the selection equation of the sample selection model predicts worse (ROC area=0.43) than a simple probit regression (ROC area=0.68). This difference is also highly significant ($\chi^2(1) = 2043$). Although the sample selection model introduces some loss

practice.

of predictive power as measured by the ROC criterion, I focus on the selection model in the following discussion. This is due to the significance of the selection effect measured by this model.

Table 11: Coefficients for selection into - and outcome of adversarial proceedings

Independent Variable		Pr(Leader wins) (1)	Pr(Adversarial) (2)	Sample Selection Model	
				Pr(Leader wins) (3)	Pr(Adversarial) (4)
Levenshtein	(D)	1.305***	-0.302***	1.183***	-0.302***
<i>Levenshtein similarity measure</i>		(0.11)	(0.052)	(0.094)	(0.052)
Jaro_Winkler	(D)	0.532***	-0.112**	0.454***	-0.111**
<i>Jaro Winkler similarity measure</i>		(0.12)	(0.056)	(0.10)	(0.056)
Rivalry	(D)	-0.138*	-0.358***	0.125**	-0.357***
<i>Product market rivalry</i>		(0.071)	(0.037)	(0.062)	(0.037)
Family	(D)	-0.0854	0.0442	-0.0700	0.0485
<i>Size of leader's trade mark family</i>		(0.088)	(0.033)	(0.064)	(0.033)
Inside_opposition	(V)	0.278***	-0.247***	0.323***	-0.247***
<i>Opposing trade mark is a CTM</i>		(0.033)	(0.017)	(0.027)	(0.017)
Opposition_intensity	(V)	0.00384	-0.0221***	0.0152***	-0.0217***
<i>Leader's previous oppositions</i>		(0.0069)	(0.0027)	(0.0053)	(0.0027)
Oppositions	(V)	0.0916***	-0.0440***	0.109***	-0.0444***
<i>Concurrent oppositions</i>		(0.014)	(0.0064)	(0.012)	(0.0064)
Seniorities	(D)	-0.0252**	0.0106***	-0.0220***	0.0106***
<i>Follower's seniorities</i>		(0.011)	(0.0032)	(0.0077)	(0.0031)
Followers_words	(D)	0.0345	0.0849***	-0.0244	0.0848***
<i>Words in follower's trade mark</i>		(0.028)	(0.014)	(0.023)	(0.014)
Leaders_words	(D)	-0.165***	0.0765***	-0.176***	0.0760***
<i>Words in leader's trade mark</i>		(0.025)	(0.013)	(0.021)	(0.013)
Goodsservices		-0.0327***	-0.00426**	-0.0242***	-0.00378*
<i>Follower's Nice classes</i>		(0.0047)	(0.0022)	(0.0037)	(0.0021)
Country			-0.00909		0.00899
<i>Different countries</i>			(0.020)		(0.019)
Low_stakes			-0.00119***		-0.00111***
<i>Weakness of leader's stakes</i>			(0.00028)		(0.00027)
Reputation_JW			-0.0482		-0.0412
<i>Jaro Winkler reputation measure</i>			(0.036)		(0.034)
Reputation_L			0.453***		0.477***
<i>Levenshtein reputation measure</i>			(0.10)		(0.094)
Reputation gain			0.00171***		0.00149***
<i>Leader's reputation gain</i>			(0.00026)		(0.00025)
Year dummies			YES		YES
Constant		-0.221	-0.272	0.732***	-0.328
		(0.18)	(0.55)	(0.15)	(0.51)
Rho				-0.696***	
				(0.038)	
Observations		8788	43594	8788	43594

Robust standard errors in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

The outcome equation in the sample selection model is identified by the Low stakes,

the Reputation-L. and the Reputation gain variables as well as year dummies for the years 1998-2004 (not shown). In an alternative specification the year dummies were included in the outcome equation. That model was identified and also showed highly significant evidence of selection effects ($\rho = -0.628(0.139)$). However, not one year dummy was significant in the outcome equation of that model. This finding shows that the office have not changed their approach to the adjudication of trade mark disputes over the sample period.

The results reported in Table 11 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.

In the outcome equation of the sample selection model (3) the string similarity measures (Levenshtein, Jaro Winkler) and Rivalry which measure the expected damage from registration of the applicant's trade mark are significant at the 1% and 5% level respectively. This confirms Hypothesis 1.

Variables measuring the value of the leader's trade mark are all significant apart from the size of the leader's trade mark family (Family). The descriptive statistics on this variable suggest that trade mark families are very rarely used in opposition. Oppositions, Opposition Intensity and Inside Opposition are all highly significant and positive. These results are consistent with Hypothesis 2.

Finally, variables which capture a reduced level of damage to the leader's trade mark, are all significant and negative save Follower's words which is not significant. This finding indicates that the Office disregard the additional words in the follower's trade mark while placing emphasis on additional words in the leader's trade mark. These findings further support Hypothesis 1.

Turning to the selection equation of the sample selection model (4), the variables measuring damage are all significant and negative, although Jaro Winkler is close to being not significant. Furthermore the variables measuring reduced damage are all positive and highly significant, including Follower's words which is not significant in the outcome equation. These findings are consistent with Hypothesis 4. This finding is quite robust as it is based on seven coefficients that are highly significant in both outcome and selection equations.

The selection equation also shows that a reputation for meekness in opposition, as measured by Reputation-L., has a highly significant effect on the probability of entering adjudication. By implication a reputation for toughness reduces the probability of entering adjudication. This finding is consistent with Hypothesis 3. It shows that reputation effects have strong effects within the trade mark opposition process at the Office. Note that this reputation measure is based on the Levenshtein algorithm while the variable Reputation-J.W. is based on the Jaro Winkler algorithm. The latter is not significant, which is consistent with the poor performance of the Jaro Winkler similarity measure in the selection equation.

Increased frequency of opposition as measured by Reputation gain also has the expected positive effect on the probability of observing opposition. Once more this coefficient is highly significant. I interpret this as evidence that increased gains from the reputation building can be attained by not settling opposition cases. This induces the opponent to prefer adjudication over settlement.

Finally, note that the selection equation shows that Low stakes has a significant negative effect on the probability of observing adjudication. This effect confirms the importance of variation of stakes in trade mark opposition.

In order to better understand the importance of reputation and string similarity in determining selection into and outcomes of adjudication of trade mark opposition consider the marginal effects for the sample selection model set out in Table 12 below.

The most interesting effect is that of a change in the reputation measure Reputation-L.. This effect is highly significant and strong. An increase in the leader's reputation for

meekness in opposition from -0.11 (the sample mean) to -0.1 increases the probability of adjudication by 0.12. To put this effect into perspective note that Henkel's reputation for meekness decreased from -0.278 to -0.292 between 2000 and 2004. Henkel are the firm with most oppositions at the Office as reported in Table 9. This shows that a reputation for being tough in trade mark opposition can have a significant effect on a leader's chances of extracting concessions from followers during settlement.

Note that the similarity of trade marks in a dispute (Levenshtein) also has a strong and significant effect on the probability of entering adjudication. A decrease in the similarity of trade marks in opposition from -0.23 (the sample mean) to -0.22 will reduce the probability of entry into adjudication by 0.08.

A similarly strong effect can be observed for the effect of Rivalry, which measures how similar leader's and follower's exposure to product markets are. Here an increase of the uncentered correlation coefficient from 0.15 to 0.16 reduces the probability of adjudication by 0.09.

Table 12: Marginal effects for selection into - and outcome of adversarial proceedings

Marginal effects	Pr(Leader wins) (3)	Pr(Adversarial) (4)
Levenshtein	0.353***	-0.0807***
<i>Levenshtein similarity measure</i>	(0.035)	(0.014)
Jaro_Winkler	0.136***	-0.0297**
<i>Jaro Winkler similarity measure</i>	(0.031)	(0.015)
Rivalry	0.0372**	-0.0955***
<i>Product market rivalry</i>	(0.018)	(0.0099)
Inside_opposition	0.0921***	-0.0634***
<i>Opposing trade mark is a CTM</i>	(0.0087)	(0.0041)
Opposition_intensity	0.00453***	-0.00579***
<i>Leader's previous oppositions</i>	(0.0016)	(0.00072)
Seniorities	-0.00656***	0.00284***
<i>Follower's seniorities</i>	(0.0023)	(0.00083)
Oppositions	0.0326***	-0.0119***
<i>Leader's oppositions</i>	(0.0038)	(0.0017)
Followers_words	-0.00728	0.0226***
<i>Words in follower's trade mark</i>	(0.0069)	(0.0038)
Leaders_words	-0.0526***	0.0203***
<i>Words in leader's trade mark</i>	(0.0067)	(0.0034)
Goodsservices	-0.00722***	-0.00101*
<i>Follower's goods and services</i>	(0.0012)	(0.00057)
Low_stakes	0	-0.000297***
	(0)	(0.000071)
Reputation_L	0	0.128***
<i>Levenshtein reputation measure</i>	(0)	(0.025)
Reputation_gain	0	0.000399***
<i>Leader's reputation gain</i>	(0)	(0.000067)
Observations	43594	43594

Standard errors in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

These results confirm the importance of reputation in trade mark opposition. Firms that

have a reputation for toughness in trade mark opposition can significantly lower the probability of adjudication and the associated hazards of losing a case. Clearly such firms are able to extract satisfactory concessions from the followers they oppose.

6 Conclusion

Economists have studied effects of firm reputation on other firms as well as on consumers. This paper shows that reputations of both types matter in the trade mark system. Trade marks allow firms to establish brand names on which to build a reputation for quality of production. At the same time a functioning trade mark system requires that brand owners defend successful brands against imitation. The analysis here shows that brand defence is easier in the presence of a reputation for toughness.

The first line of defence against imitation of a brand is opposition against new trade mark applications. The opposition process in a sufficiently large trade mark system will frequently match brand owners and applicants connected by nothing other than the similarity of their trade marks. In this context a firm's reputation for toughness in dealing with imitating trade marks is a valuable asset. Empirical analysis of this effect in this paper shows that a firm's reputation for tough opposition can substantially lower the probability of losing trade mark opposition cases.

If opponent and applicant have little prior knowledge of one another then an opponent's reputation for toughness in trade mark opposition has two benefits: it signals a willingness to let the trade mark office adjudicate and it signals that the opponent is able to demonstrate the use and reputation of their brand. Both of these factors increase the applicant's desire to settle the trade mark dispute.

The expected damage which an opponent will suffer if the applicant's trade mark is registered is measured exploiting string similarity between word marks. String similarity is also used to construct a measure of reputation for tough opposition. This paper shows that string similarity measures contribute significantly to the understanding of trade mark opposition.

Adjudication of trade mark opposition cases is explained using a model of asymmetric stakes in this paper. If a new trade mark is similar to an existing trade mark this may confer benefits on the applicant. As long as these benefits do not equal the costs of registering the new trade mark to the owner of the existing trade mark the parties in a trade mark dispute will have asymmetric stakes in the dispute. The theoretical model developed in the paper shows that asymmetry of stakes combined with reputation effects can explain why firms fail to settle a trade mark dispute even if there is full information about the case. The empirical analysis shows that asymmetry of stakes is a significant determinant of the probability that trade mark opposition cases are adjudicated.

The probability of trade mark opposition in the European trade mark system administered by the Office is found to be higher than in large national trade mark systems. The costs of monitoring new trade mark applications and of preventing infringement of existing brands are significant in this trade mark system. The paper demonstrates how large firms with significant trade mark portfolios benefit from reputation building which lowers their costs of defending a trade mark portfolio. This shows that trade mark systems may be biased in favour of larger companies, which echos similar findings for patent systems.

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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
Cost	0	0	0	1	0	1	1	1	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:

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

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.