# Patent Oppositions as Strategic Tools and Error Correction Mechanisms*

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## Abstract

This paper examines the determinants and outcomes of patent oppositions between the main competitors in the European market of large domestic appliances (aka white goods). Due to a stagnating demand, in this medium-tech industry the level of competition has increased, especially in terms of product quality and innovations. Among the consequences of that, the major white goods companies have made an intensive use of patents and patent oppositions before the European Patent Office.
By considering 961 patents granted by the EPO, during the period 2000-2005, to the top ten companies in Europe, the paper show that the probability of receiving an opposition from industry rivals is not associated with patent quality indicators. This would suggest that patent oppositions are mainly used as strategic tools. However, looking at the different outcomes of the opposition proceedings, I found that only in the cases ending with a patent revocation a strategic motivation can be inferred. Instead, the probability of maintaining a patent valid is affected by forward and backward citations, while that of having an amended patent significantly increases with the number of claims. Accordingly, patent oppositions also play the role of correction mechanisms of the errors made by EPO examiners.

**Key words**: Strategic patenting; Patent oppositions; Opposition outcomes; Domestic appliances industry

**JEL Codes:** O34 (Intellectual Property Rights), L68 (Industry studies - Appliances; Other Consumer Durables)

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## 1. Introduction

This paper examines the role and determinants of patent oppositions between the main competitors in a given industry. Differently from previous studies, it is not concerned with a high-tech industry but considers the leading companies in the European market of large domestic appliances, aka "white goods", i.e. refrigerators and freezers, cooking appliances, washing machines and dishwashers Thus, we are dealing with a medium-tech, scale intensive industry which, during the last two decades, has been characterised by a stagnating demand. As a result, the level of competition has increased, especially in terms of product quality and innovations. Among the consequences of that, the major industry players in Europe have not only intensified their patenting activities but also the usage of oppositions before the European Patent Office against the patents of direct competitors.

By considering 961 patents granted by the EPO, during the period 2000-2005, to the top ten companies in Europe, the paper shows, among other things, that the probability of receiving an opposition from industry rivals is not significantly affected by the patents' quality or value (approximated by forward and backward citations, claims and family size). Accordingly, the extent and direction of patent oppositions seem mainly due to idiosyncratic corporate characteristics and strategies.

However, by considering the different outcomes of the opposition proceedings (validity, revocation, and amendments of opposed patents) I found that only in the cases ending with a patent revocation a strategic motivation can be inferred. Instead, the probability of maintaining a patent valid is positively and negatively affected by, respectively, forward and backward citations, while that of having an amended patent significantly increases with the number of claims. Accordingly, patent oppositions play both the role of strategic tools and that of correction mechanisms of the errors made by EPO examiners.

The paper is structured in the following sections. Section 2, after a survey of the literature concerned with patent litigation and oppositions, illustrates the motivations and additional contributions provided by this study. Section 3 describes the main features of the European market of "white goods" and identifies its major players in terms of sales and units sold and patenting activities. Section 4 examines the patent oppositions among the above companies; a matrix of reciprocal oppositions is built with a view to identify the most aggressive and vulnerable companies in terms of patent challenges; then, to test whether the patent quality

plays any role in explaining the probability of receiving an opposition, a Logit regression is run. Section 4 is devoted to the outcomes of the opposition proceedings before the EPO; after a descriptive analysis, a Multinomial Logit regression is performed with a view to test whether the different outcomes are associated with patent quality indicators. Section 6 contains some concluding remarks.

## 2. Patent litigation and oppositions: a survey

The last two decades have witnessed an explosion of patent applications and grants all over the world and, especially, in the United States and Europe. The literature has offered several explanations of this phenomenon, but that attracting more consensus refers to the increasing role of strategic patenting, that is for reasons other than that of achieving the exclusive right to commercialise or licence an invention[1].

Firms may build a sort of "patent wall" around the original invention by patenting some of its potential developments and extensions. Since the obvious aim is that of blocking competitors, Arundel and Patel (2003) termed this strategy *offensive*. Instead, a *defensive* strategy occurs when firms apply for patents in order to avoid infringement suits as well as to increase their bargaining power with competitors and the scope for technological exchanges. While the purpose of the former strategy was that of restricting the competitors' margins of manoeuvre, in the second case the firms try to secure their freedom of operation (see also Cohen et al., 2002).

By examining the patenting activities in the US semiconductor industry, Hall and Ziedonis (2001) contended that companies were building up large patent portfolios mainly to enhance their contractual capability and, then, the access to external technologies. Thus, in presence of a mutual technological dependence among firms, a *defensive* strategic patenting is likely to prevail. Subsequent studies have shown that this is the case of many industries belonging to the ICT sector (computing, software, telecommunication equipment) which, in fact, are characterised by an extensive use of cross-licensing, information sharing and related negotiations (see, among others, Graham et al., 2003; Calderini and Scellato, 2004).

One of the consequences of the mounting recourse to strategic patenting has been an increase of the legal disputes on IPRs, both in terms of patent litigation (heard before a court) and patent oppositions (heard before a patent office, which is asked to re-examine its decision to

[1] For two recent surveys of the various motives to patent see Blind et al. (2009) and Corbel and Le Bas (2011).

grant a patent)[2]. Thus, as far as patents have been increasingly used as strategic weapons, also the legal challenges to the patents held by competitors have increased over time.

Although remarkable, the augment of patent litigation and oppositions does not mean that the propensity to legal disputes on patent rights has raised too. In fact, during the 1990s, the shares of oppositions (or re-examinations) on patents granted by the EPO (or the USPTO) remained almost constant in the fields of pharmaceuticals and biotechnology while declining in semiconductors and software (Graham et al., 2003)[3]. Also looking at the patents challenged in front of US courts, the average rate of litigation has not shown remarkable changes over time (Lanjouw and Schankerman, 2004)[4].

Thus, rather than focusing on time variations, the attention of scholars has been mainly devoted to explain why the probability to incur in a patent litigation or opposition is significantly different among technological areas (and, then, industries), types of patent holders (small or large companies) and types of patents (less or more valuable).

Whit respect to patent litigation, Lanjouw and Schankerman (2004) show that in the US, over the period 1991-95, the share of litigated patents was, on average, equal to 2%. There were relevant differences across technological areas, but a clear distinction between more or less technology advanced industries did not emerge. The only interesting finding was that, among the areas showing a grater propensity to patent litigation, both computers and biotechnology were included. By considering German patents over the period 1978-93, Cremers (2004) finds an average litigation rate of about 1% which, however, was significantly higher in the mechanical area (a group composed of different technological fields and products) and lower in pharmaceuticals, chemicals and electronics. These findings, probably due to the different technological specialisation of German companies, are quite at odds with those emerged in the US. In any case, what the evidence suggests is that the probability of having a litigated patent cannot be easily associated with a particular technology or industry.

Looking at the features of patent holders, Lanjouw and Schankerman (2001) contend that in the US there are two types of patentees overexposed to the risk of patent litigation: small firms and independent inventors holding patents in new or technology-advanced industries.

[2] The opposition procedure before the European Patent Office (EPO) allows any third party to file an opposition against the decision to grant a patent on the grounds that the prerequisites of patentability (novelty, inventiveness, and utility) were not fulfilled. A parallel procedure of re-examination is adopted by the United States Patent and Trademark Office (USPTO).

[3] Recent data provided by the EPO annual reports show that, also over the 2000s, the average opposition rate is slightly declining.

[4] In any case, as stressed by Hall and Haroff (2004), the absolute amount of litigation has grown giving rise to increasing private and public costs of the whole system of patent protection.

Similar results emerge in Lanjouw and Schankerman (2004) who, moreover, show that the probability of litigation is lower for companies with large patent portfolios, i.e. with a greater ability to prevent legal disputes by resorting either to cross-licensing or credible threats of retaliation. The evidence for German companies (Cremers, 2004) confirms the negative impact exerted by the extent of patent portfolios while the results concerned with the size of patentees are mixed.

The above mentioned studies converge in showing that the probability of litigation is significantly associated with the patent quality or value. The latter can be approximated by different indicators, each having strengths and weaknesses (for a recent survey, see van Zeebroeck, 2011). Among them, the most diffused and effective quality measures are the number of citations received by a patent (forward citations) and the size of patent families (given by the number of countries in which patent protection is sought for the same invention). Other indicators, less diffused and/or effective in capturing the value of a patent, are the number of backward citations (references to previous patents), claims (the specific property rights that the patent should protect) and years for which the renewal fees are paid (and, then, a patent is in force).

Lanjouw and Schankerman (2001 and 2004) find that the probability of litigation raises significantly with the number of claims and forward citations. These results are confirmed by Cremers (2004) who, moreover, shows that also the number of backward citations and the extent of patent families exert positive effects.

The analysis of patent oppositions confirms only in part the above findings. This is not surprising, since filing an opposition to a patent office is not only inherently different than litigating a patent in a court but implies different costs. In fact, the exclusive aim of an opposition is that of challenging the validity of a patent (see footnote 2), while patent lawsuits, along with the same motive, are mainly undertaken to protect a patented invention from infringements[5]. However, from an economic viewpoint, the most important difference is that patent lawsuits are much more expensive than oppositions. According to Graham and Haroff (2006), the total costs of an opposition before the EPO vary from €10,000 to €25,000 for each party, while the range reported in Mejer and van Pottelsberghe (2011) is a bit wider: from €6,000 to €50,000 (including patent lawyers' fees). Instead, the costs of European patent litigation are much higher: considering the proceedings before first instance courts and patent

[5] Looking at the different European jurisdictions, direct challenges to the validity of a patent before the courts are admitted in some countries (such as Germany) while in others (e.g. Italy) they are admitted only for defensive purposes within a lawsuit for infringement. On the jurisdictional heterogeneity among EU countries see Mejer and van Pottelsberghe (2011).

cases of small and medium scale, the average cost ranges from €50,000 to €500,000, although in Great Britain the maximum cost can be up to €1.5 million (see EPO, 2006)[6]. Although the cost motive is likely to play a dominant role, the fact that, in Europe, the opposition rates are much higher than those of litigation (see below) also depends on other reasons. First, the opposition procedure is attractive for opponents because a decision of the EPO to revoke a patent implies that it will be cancelled in all the states were it was validated (while the same does not apply when the EPO decides to uphold a patent; cf. Mejer and van Pottelsberghe, 2011). Secondly, the litigation rate could be low because most of the legal disputes can be solved by resorting to extrajudicial settlements[7]. Thus, being more frequent than patent litigation, the analysis of opposition data is likely to provide, from a statistical point of view more robust results (Haroff, 2005).

Before moving to the evidence, it should be stressed that while in the United States the attention of scholars has been mainly concentrated on patent litigation, in Europe the analyses have almost exclusively focused on the oppositions to the patents granted by the EPO[8]. The reason is that, in the European context, the presence of multiple national jurisdictions makes almost impossible to collect comprehensive information on patent litigation[9] and the only centralised procedure dealing with patent challenges is that of an EPO opposition.

During the Eighties and Nineties, the overall share of opposed patents was about 8% of all the patents granted by the EPO, a share much higher than that of litigated patents (see above). However, the opposition rate decreased over the subsequent years: between 2000-2008, in fact, 5.3% of all the patents granted by the EPO were opposed (Scellato et al., 2011).

The differences among sectors or technological areas are remarkable. For instance, the opposition rate for patents concerned with TLC and ICT was found to be lower both with respect to the average and to that recorded in biotechnology and pharmaceuticals. For EPO

[6] Graham and Haroff (2006) report that in the US the direct legal costs of a typical patent lawsuit are estimated to be $4 million.

[7] Instead, once an opposition is filed, the parties have no longer the chance of reaching an agreement before the EPO. For an empirical analysis of settlements during patent litigation trials in Germany see Cremers (2009).

[8] Graham et al. (2003) perform a parallel analysis of EPO oppositions and USPTO re-examinations. The rate of re-examinations turns out to be much lower than that of oppositions (on average, 0.2% versus 8%). As a consequence, the USPTO re-examinations do not seem particularly effective in reducing the likelihood of further legal disputes. Being the latter aim socially desirable, some scholars have contended that also in the US an opposition procedure similar to that of the EPO should be introduced (see Levin and Levin, 2003; Hall et al., 2003; Hall and Haroff, 2004; Graham and Haroff, 2006).

[9] Thus, it is not by chance that, to my knowledge, the only available study on patent litigation in Europe (Cremers, 2005) refers exclusively to Germany. Aside from the data issue, a system of multiple jurisdictions implies that a patent can be challenged in different States and the filing of multiple lawsuits is often necessary in order to effectively fight infringements. Moreover, for both kinds of litigation there is no certainty that the outcomes will be similar across national jurisdictions. Schettino and Sterlacchini (2009) show that the high cost and uncertainty of legal disputes reduce the propensity to patent of European small companies.

patents concerned with TLC the share of oppositions was about 4% over the period 1980-2002 (Calderini and Scellato, 2004) while for biotechnology and pharmaceutical patents, examined between 1979 and 1996, it was 8.5% (Haroff and Reitzig, 2004). With respect to other technology areas and considering the period 1980-1995, Hall and Haroff (2004) report an opposition rate ranging from 5.3% in the area of Electric Engineering to 9.7% in that of Process Engineering.

With respect to the oppositions' determinants, contrary to what has been found for patent litigation, the probability of an EPO opposition is not significantly affected by firm size and inventor status (independent patent holders versus companies). Instead, similar results emerge for the extent of patent portfolio which reduces the chance of patentees to incur in an opposition. Finally, looking at the patents' quality, the number of forward citations and claims, the extent of patent families and, to a lesser extent, the number of backward citations are found to significantly increase the probability of an opposition. In short, the most valuable patents (according to the above proxies) are more likely to be opposed. Also on the basis of these findings, it has become common to take the same occurrence of an opposition as an indicator of patent quality (cf. Haroff et al., 2002; Cremers, 2004; van Zeebroeck, 2011).

However, it should be stressed that a strong correlation between EPO oppositions and patent quality indicators arises when the analysis refers to all the EPO patents of a country (Belgium in Cincera, 2011) or those of some industries or technology areas (biotechnology, pharmaceutical, software and semiconductors in Graham et al., 2003; biotechnology and pharmaceutical in Haroff and Reitzig, 2004). In fact, taking into account only the major producers of TLC equipment (such as Siemens, Motorola, Nokia, Alcatel, Ericsson, and others) Calderini and Scellato (2004) show that the quality of opposed patents is not different from that of the others.

This paper, in line with Calderini and Scellato (2004), Haroff (2005) and Schneider (2011), deals explicitly with the patent disputes of the main competitors in a given industry. Differently from most of the previous studies, it is not concerned with a high-tech industry but examines the main European producers of “white goods”, a label attached to large domestic appliances, including refrigerators and freezers, cooking appliances (ovens and cookers), washing machines and dishwashers[10]. Thus, we are dealing with a medium-tech, scale intensive industry which, as documented in the next section, has been characterised by an

[10] They are usually distinguished from “brawn goods” (household appliances used outside the kitchen, such as TV and video recorders) as well as small domestic appliances (such as vacuum cleaners, mixers, coffee makers, etc.).

almost stagnating demand. These features make the white good industry quite opposite to the fast-growing, R&D-intensive industries of biotechnology, ICT and TLC, which have been extensively analysed in the literature concerned with strategic patenting.

Moreover, the focus on the major industry players allows one to identify not only the extent of patent oppositions and the patents that are more likely to be opposed but also "who is opposing the patents of whom". As stressed by Haroff (2005), opposition activities generate unique information that allow one to observe rivalry directly, rather than presuming it on the basis of industry, product or technology classifications. Thus, we will be able to identify which companies are more exposed than others to a patent opposition as well as those more inclined to oppose the patents of (specific) competitors. By taking into account company behaviour and characteristics, this paper enlarges the set of the possible determinants of patent oppositions with a view of improving our understanding of the role played by strategic patenting and technological competition.

## 3. The major players in the European market of white goods: sales and patenting activities

During the last two decades the global demand of white goods has grown at a slow pace. The positive impulse has coming from the developing and emerging economies while OECD countries, and especially those of Western Europe, have recorded a sluggish if not declining demand. According to Nichols and Cam (2005), due the saturation of Western European markets, the European white goods industry has become more and more competitive as witnessed by the declining or flat unit prices. The major European players have reacted by extending their presence in Eastern Europe, Asia and the Middle East whose patterns of demand and unit values have been more favourable.

As a consequence, while in the past the leaders in the white goods industry have thrived on economies of scale, strong presence in regional (and sometimes national) markets, tight control of distribution channels and relatively simple innovations, in recent years they have been compelled to undertake radical changes in terms of competitive strategies. In the face of a stagnating demand and declining prices, companies have become more globalized (both in terms of production and commercialization), more oriented to exploit scope (rather than scale) economies, and invest in product differentiation, R&D and innovation (Segan-Horn et al.,1998; Nichols and Cam, 2005; Bonaglia et al., 2007). In fact, although both products and production processes are viewed as rather mature, in recent times, the emphasis on

environment preservation and energy saving as well as the application of micro-electronic, connectivity and wireless technologies have given a remarkable impulse to product innovations.

In spite of the increasing globalization of the white goods industry, high degrees of market concentration are still observed at regional level (Europe, North America, etc.). Over the 2000s, no single producer owned more than 10% of the global market. The first four companies in the world commanded less than 27% of the market, while the cumulated shares of the top fours in North America and Western Europe were, respectively, 44 and 55% (see CSIL, various years). In fact, contrary to smaller appliances whose trade is more intense and global, the market of white goods is still geographically segmented because of high transportation costs, persistent differences in terms of consumer preferences and standards, and, last but not least, brand loyalty (Bonaglia et al., 2007). Accordingly, and in line with the practice of industry experts and companies, the European market of white goods usually encompasses both Western and Eastern European countries (including Russia).

Table 1 identifies the major companies (or groups) in the European market of white goods by reporting their rankings with respect to sales and units sold in 2005 and patents granted by the EPO over 2000-2005. Data on sales and units sold are mainly based on company data provided by the reports published by CSIL (2006 and 2008). It must be noticed that for some companies it was difficult to find precise figures for the sales exclusively concerned with the European market. However, by merging some rough estimates obtained from the above reports with the information contained in previous studies, it was possible to identify company rankings that should be considered sufficiently reliable.

The four major players in the European market of white goods are BSH (Bosch and Siemens Hausgërate), Electrolux Europe, Indesit Company (formerly Merloni Elettrodomestici) and Whirlpool Europe. BSH is the leading company in terms of sales, while Electrolux prevails with respect to the units of domestic appliances sold. Obviously, this is due to different unit prices (lower in the Electrolux case; cf. Sterlacchini, 2012), in line with the effective or perceived product quality. Both for sales and output volumes Indesit and Whirlpool are, respectively, the third and four main player in the European market. However, especially in terms of sales, they are closely followed by the Turkish Arçelik which, considering its performance in previous years, results as the emerging European company (Bonaglia et al., 2007).

Table 1 - Leading companies in the European market of white goods: sales and patents' rankings

| | Sales (million euro) 2005* | Ranking sales** | Units (million) 2005* | Ranking units** | EPO patents granted 2000-2005° | Ranking patents |
|---|---|---|---|---|---|---|
| BSH | 5500 | 1 | 18.0 | 2 | 364 | 1 |
| Electrolux | 5150 | 2 | 14.0 | 1 | 174 | 2 |
| Indesit | 2880 | 3 | 12.0 | 3 | 38 | 8 |
| Whirlpool | 2400 | 4 | 10.0 | 4 | 113 | 3 |
| Arcelik | n.a. | 5 | n.a. | 5 | 23 | 10 |
| Miele | n.a. | 6 | n.a. | 8 | 62 | 4 |
| Fagor-Brandt | 1420 | 7 | 7.0 | 6 | 49 | 7 |
| Candy | 850 | 8 | 4.5 | 7 | 55 | 5 |
| LG | n.a. | 9 | n.a. | 9 | 29 | 9 |
| Samsung | n.a. | 10 | n.a. | 10 | 54 | 6 |

*Own computations based on CSIL (2006 and 2008) *Profiles of 50 major appliance manufacturers worldwide*. **Rankings in terms of sales and units sold are based on different but consistent sources: CSIL (2006 and 2008), Nichols and Cam (2005), Bonaglia et al. (2007), and Indesit (company presentation diffused in 2006); °= Data taken from the EPO; n.a.= not available (existent sources do not allow one to derive reliable estimates of sales and units sold in the European market but only the rankings of different companies).

Miele attains the sixth position for sales and the last one for units sold. Again, such a big discrepancy is due to fact that the German company, specialised in top quality ("premium" and professional) white goods, applies the highest unit prices among the observed companies (remarkably higher also with respect to those of BSH; see Sterlacchini, 2012).

The Fagor-Brandt group is the result of the 2005 merger between two companies: Fagor (based in Spain) and Brandt (France). Together, their reach a good position only in terms of units sold. The last among the major European producers of white goods is the Italian Candy. Finally, LG Electronics and Samsung (or, to be precise, their respective "digital appliance divisions") recorded in 2005 a low share of the European market of white goods: according to some estimates, their cumulative market share in terms of units sold was below 4%, with Samsung behind LG. However, in the subsequent years both companies have significantly increased their sales in the European markets[11] and this, along with their patenting activities in Europe (see the last two columns of Table 1), justifies their inclusion in our study.

[11] According to company press releases, during the first six-months of 2010, Samsung's share in the European market for refrigerators was 8.3%. On the other hand, although no figures are available for the whole European market, LG has particularly increased its sales of washing machines. For instance, in 2010, LG achieved a 7.3% share of the Italian market.

According to some estimates (cf. Sterlacchini, 2012), in 2005 the first eight companies listed in Table 1 (i.e. with the exclusion of Samsung and LG) accounted for about 61% of total sales and 73% of total units sold in the European market of white goods. Such a high level of concentration is mainly due to an intense process of mergers and acquisitions that occurred in previous years. In consequence of that, each of the top European companies but Miele owns a considerable number of brands. This has allowed the largest producers of domestic appliances to enlarge their presence in foreign countries while maintaining the brand loyalty of consumers. However, as mentioned above, to face the problems of a stagnating demand and declining unit values, the white good companies have also had to pay more attention to product innovations, especially in the fields of efficiency (i.e. energy saving), reliability, multi-tasking, digital and programming facilities.

For the major players in the European market of white goods, including the digital appliance division of LG Electronics and Samsung, we collected comprehensive information, including the occurrence of an opposition, on the patents exclusively concerned with white goods (refrigerators and freezers, cooking appliances, washing machines and dishwashers) granted by the EPO from 2000 to 2005. We found the remarkable figure of 961 granted patents (about 160 per year).

With respect to company performances, the last two columns of Table 1 show that BSH clearly emerges as the leading company (being the assignee of almost 38% of the whole set of observed patents) while Electrolux and Whirlpool rank second and third respectively, each owing less than half of the BSH patents. Together these three companies account for about 68% of all the patents considered. The patents granted to the other seven companies are by far lower. For some of them, this can be partly justified by their relatively small size: Miele and Samsung, for instance, rank relatively high in terms of patents (4th and 6th, respectively) and relatively low with respect to sales and especially units sold (8th and 10th). Other companies, instead, rank very low in terms of patents while having a quite good position in terms of market share: this is particularly the case of Indesit and Arçelik.

## 4. Patent oppositions among the leading white good companies

For the ten companies considered, Table 2 shows, in increasing order, the number of EPO patent grants and, then, the number and percentage of opposed patents, by also distinguishing those received by one of the major competitors. The overall opposition rate is 9.8%, a figure

greater than that concerned with the overall population of EPO patents (between 5 and 6%; see Section 2). The most important finding that must be stressed is that such a high presence of patent challenges is mainly due to the behaviour of the same top companies considered: 74 out of the 94 opposed patents (78.7%) are challenged by one of the competitors listed in Table 2. Moreover, the overwhelming majority of other opponents (that have challenged the remaining 20 patents) was not made of direct competitors in the final market of white goods, but companies producing control systems and apparatus for domestic appliances[12].

Table 2 – Patents granted by the EPO, oppositions received and filed by the leading companies of the European white good market: 2000-2005

| | Patents granted | Total oppositions received | | Oppositions received by listed competitors | | Oppositions filed against listed competitors | |
|---|---|---|---|---|---|---|---|
| | Number | Number | Ratio on patents granted | Number | Ratio on patents granted | Number | Ratio on patents granted |
| BSH | 364 | 38 | 0.104 | 27 | 0.074 | 30 | 0.082 |
| Electrolux | 174 | 22 | 0.126 | 19 | 0.109 | 14 | 0.081 |
| Whirlpool | 113 | 6 | 0.053 | 6 | 0.053 | 3 | 0.027 |
| Miele | 62 | 7 | 0.113 | 5 | 0.081 | 28 | 0.452 |
| Candy | 55 | 3 | 0.055 | 3 | 0.055 | 1 | 0.018 |
| Samsung | 54 | 3 | 0.056 | 3 | 0.056 | 0 | 0.000 |
| Fagor-Brandt | 49 | 3 | 0.061 | 0 | 0.000 | 1 | 0.020 |
| Indesit | 38 | 9 | 0.237 | 8 | 0.211 | 3 | 0.079 |
| LG | 29 | 2 | 0.069 | 2 | 0.069 | 0 | 0.000 |
| Arçelik | 23 | 1 | 0.043 | 1 | 0.044 | 1 | 0.044 |
| Total | 961 | 94 | 0.098 | 74 | 0.077 | 81* | 0.084 |

*=Due to the presence of multiple opponents (two in twelve opposition cases and three in one case), the number of total oppositions filed is greater than that of oppositions received.

Looking at the opposition rate across companies, it emerges that almost 24% of the patents assigned to Indesit have been challenged (an opposition rate more than twice that observed on average) and this is almost entirely due to the behaviour of direct competitors. Although with much lower rates, the other companies more exposed to patent oppositions are Electrolux,

[12] Namely (and in decreasing order of filed oppositions): Diehl AKO Stiftung (8); E.G.O. Elektro-Gerätebau (3); Vaillant (3); Aweco Appliance System (2); Stiebel Eltron (2); Schott Glas (2); Rational Aktiengesellschaft (1); Schutzrechtsverwertung & Co (1). All these companies are based in Germany and, together, account for 22 out of the 25 oppositions filed by "indirect" competitors of white goods' producers.

Miele and BSH. According to these figures, there is no evidence that the size of patent portfolios reduces the probability to incur in an opposition. Companies with a relatively undersized portfolio of patents (such as Fagor, Arçelik, LG, Brand and Indesit) record quite different opposition rates and the same happens to companies with intermediate (Samsung, Candy and Miele) and large patent portfolios (BSH, Electrolux, Whirlpool). In particular, the Indesit case might suggest that the likelihood of receiving an opposition is higher not necessarily for companies with small patent portfolios but for those that share with the above feature that of having a relevant market share (Indesit being the third major player in the European market; cf. Table 1). On the other hand, the fact that Electrolux, Miele, and BSH, in spite of having quite different patent portfolios and market shares, record similar opposition rates suggests that the probability to incur in a challenge could be affected by other factors, such as the propensity to challenge the patents of competitors and the different quality of patents. Both factors are examined in the remain of this section.

The last two columns of Table 2 report the number of oppositions filed against the patents of direct competitors and their share on the patents held by the opponent. Miele indisputably appears as the most aggressive company, having filed a number of opposition (28) quite close that that of BSH (30). This suggests that the role of technology leaders that both companies are playing (or claiming to play) is also sustained by an intensive usage of patent oppositions, probably used strategically with a view to establish a reputation for toughness (Haroff, 2005). The other companies showing a propensity to challenge the patent of competitors similar to that of BSH are Electrolux and Indesit, while all the other players record lower shares of filed oppositions (with respect to their own patents).

Other useful insights about company behaviour emerge from the analysis of the matrix of reciprocal oppositions, i.e. the direct observation of firms' rivalry. Table 3 shows that the reciprocal oppositions among Miele, Electrolux and BSH (see the cells emphasised in gray) account for 64% of the total patent challenges undertaken by the main European players (81). Although Whirlpool does not act as a strong opponent, if we add also this company to the above group (light gray cells) the same percentage increases up to 73%. Finally, by adding either the oppositions received and done by Indesit with respect to the above companies, we reach about 84% of the total oppositions filed by the main competitors. Reminding that four of the above mentioned five companies were the top four in terms of sales and units sold in 2005, with Miele ranking 6th, these findings clearly indicate that patent oppositions are strongly concentrated within the group of the main industry players.

Table 3 – Matrix of EPO oppositions between the leading white good companies in Europe

| Opponent / Patentee | | A | B | C | D | E | F | G | H | I | J | Total | Other oppo-nents |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Arçelik | A | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 |
| LG | B | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 2 | 0 |
| Indesit | C | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 4 | 8 | 1 |
| Fagor-Brandt | D | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| Samsung | E | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 3 | 0 |
| Candy | F | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 3 | 0 |
| Whirlpool | G | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 3 | 6 | 0 |
| Miele | H | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 6 | 2 |
| Electrolux | I | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 6 | 0 | 12 | 20 | 5 |
| BSH | J | 0 | 0 | 2 | 1 | 0 | 0 | 1 | 17 | 11 | 0 | 32 | 14 |
| Total | | 1 | 0 | 3 | 1 | 0 | 1 | 3 | 28 | 14 | 30 | 81 | 25 |

These results are at odds with the evidence provided by Calderini and Scellato (2004) for the major companies in the industry of TLC equipment. In fact, as they point out on page 4 of their paper, “considering the major patentees in the TLC patent classes the matrix of reciprocal opposition cases is nearly empty”, suggesting that these companies have restrained themselves from using patent challenges as strategic tools in order to avoid retaliations and, then, leave open the door to cross-licensing.

Why, in the case of white good companies, the matrix of reciprocal oppositions is rather full?

A plausible explanation is that the resort to patent challenges by dominant players is less intense in industries characterised by better demand prospects and higher technological opportunities, such as those of ICT and TLC. Instead, in industries facing an almost stagnating demand and lower technological opportunities the competition, also in terms of product innovations, becomes more fierce. Thus, as in the case of the white good industry, the companies must sustain their market shares and/or their reputation as innovation leaders with all means, patent challenges included.

Obviously, an extensive use of patent oppositions is not equally diffused among companies. Thus, the probability of receiving an opposition is also associated with the company propensity to challenge the patents of competitors, which clearly exposes the former to retaliations. In this regard, it is worth noticing that the number of reciprocal oppositions between BSH and Electrolux is almost identical (12 and 11). In the same vein, it is interesting

to compare the cases of Miele and Whirlpool. As already stressed, Miele results as the second most aggressive company, and its challenges were mainly targeted on BSH (17 out of 28); the latter company fought back by opposing 5 of the 62 patents assigned to Miele, which received other 3 oppositions for a total of 8. Whirlpool, on the contrary, acted as opponent only 3 times and, in spite of owing 114 patents, received 6 oppositions only.

Having stressed the strategic role of patent oppositions, it remains to be seen if some patents are more likely to be opposed than others. In order to test whether the probability of an opposition was significantly associated with patent quality or value, I performed two Logit regressions for the EPO patents under examination: one for the overall probability of an opposition and another for the probability of being opposed by the one of the main competitors. Among the explanatory variables, I employed, in line with previous studies (see Section 2), the number of backward and forward citations, the number of claims, and the extent of patent families (i.e. the number of countries in which patent protection is sought)[13]. Moreover, a dummy for the patents held by one of the four largest companies in terms of European market shares (BSH, Electrolux, Indesit and Whilrpool) is included in the regression. This binary variable should capture the strategic role of patent oppositions which, according to the previous descriptive analysis, are mainly diffused among the top industry players.

Table 4 – Logit regressions for the occurrence of a patent opposition

| | Total oppositions | | Competitors' oppositions | |
|---|---|---|---|---|
| | Coefficient | Standard error | Coefficient | Standard error |
| Constant | -2.766 | 0.379 *** | -3.063 | 0.411 *** |
| Backward citations | -0.054 | 0.053 | -0.041 | 0.060 |
| Forward citations | 0.131 | 0.051 *** | 0.085 | 0.052 |
| Patent family size | 0.010 | 0.030 | 0.002 | 0.035 |
| Claims | 0.019 | 0.014 | 0.020 | 0.016 |
| Four largest companies (dummy) | 0.490 | 0.271* | 0.573 | 0.306* |
| Chi-squared likelihood ratio test(p-value) | 12.149 (0.032) | | 7.557 (0.182) | |

***= significant at 0.01; **=significant at 0.05; *= significant at 0.10.

[13] All the measures of patent quality were taken from the OECD/EPO patent citation database by using, as a search key, the application number of the 961 EPO patents considered in this study.

Table 4 shows that when the overall probability of opposition is taken into account the only patent quality indicator that exerts a positive and significant effect is the number of forward citations. So, contrary to previous studies, we do not find that patent families and claims increase the likelihood of an opposition; instead, the non significant impact of backward citations is not new in the empirical literature (see Section 2). The coefficient of the dummy for the patents granted to the four largest companies turns out to be positive and significant, although at a 10% level of confidence only.

Moving to the probability of receiving an opposition from a direct competitor, the regression results show that none of the measures of patent quality exerts a significant effect. Instead, the patents held by the top four companies in the European market remain more likely to be opposed (though, again, the estimated coefficient is barely significant).

To summarise, by comparing the results of the two regressions it emerges that patent quality (captured by forward citations) plays a significant role only when also the patent challenges of "other" opponents are taken into account. The latter, as already said, do not compete in the final market of white goods and, as such, are more likely to oppose valuable patents only. Instead, the major players of the European market seem to pay less attention to patent quality and use patent oppositions mainly as competitive weapons. As a consequence, the patents of some companies can be more exposed to challenges not because of their value but for other strategic motives.

## 5. The outcomes of the opposition proceedings

Having analysed the determinants of patent oppositions, this section addresses a further interesting question: are there specific factors that help explaining the different outcomes of the opposition cases?

In the opposition proceedings, three EPO examiners (including the one in charge of the first examination) are asked to re-assess the decision to grant a patent on the basis of the arguments put forward by the opponent(s). The process of re-examination can end in the following ways: a) the patent is revoked; b) the patent is amended (by reducing or changing the claims); c) the opposition is rejected; d) the opposition proceeding is closed (either because the patentee stops to pay the renewal fees or the opponent stops to pursue the case).

Table 5 - Opposition outcomes in percentages: some comparisons

| | Patent revoked | Patent amended | Opposition rejected | Opposition closed |
|---|---|---|---|---|
| EPO granted patents 1980-1990; Haroff (2005) | 34.70 | 32.70 | 27.40 | 5.30 |
| EPO granted patents 2000-2006; Scellato et al. (2011) | 38.03 | 29.68 | 21.44 | 10.85 |
| Cosmetics 1980-2002: 3114 patents, 840 oppositions; Haroff (2005) | 45.50 | n.a. | n.a. | n.a. |
| Detergents 1980-2002: 2802 patents, 1011 oppositions; Haroff (2005) | 43.90 | n.a. | n.a. | n.a. |
| Plant biotechnology 1978-2007: 885 patents 98 oppositions; Schneider (2011) | 41.10 | 34.25 | 16.44 | 8.22 |
| White goods: 961 patents, 94 oppositions | 31.87 | 39.56 | 24.18 | 4.40 |

n.a. = not available.

Table 5 proposes a comparison of the findings emerged in previous studies and in the present one. Considering all the patents granted by the EPO over 1980-1990, Haroff (2005) found a prevalence of revocations and amendments; the opposition rejections account for a lower share while that of oppositions closed is marginal. Looking at a more recent time span (2000-2006, consistent with that considered in the present paper) the ranking of possible outcomes is similar to that of the previous period although a higher share of revocations is recorded (Scellato at al., 2001). To be stressed is that, in both periods, the patents revoked and amended account together for about 67% of the opposition outcomes. This clearly indicates that the opponents are much more successful than the defendants of granted patents or, to put it another way, that patent oppositions act as very effective correction mechanisms of the errors made during the examination process (Schneider, 2011).

Table 5 also reports the findings concerned with three specific and narrowly defined industries or technological areas: those of cosmetics and detergents (Haroff, 2005) and that of plant biotechnology (Schneider, 2001). In general, but especially in the case of detergents, the opposition ratios are much higher than that found for the whole set of EPO granted patents and those concerned with white goods. Moreover, and most importantly for the purpose of this section, also the shares of oppositions ending with a patent revocation are higher: 44-45% in detergents and cosmetics, 41% in plant biotechnology; in the latter case, if we add the share of amended patents, it emerges that the 75% of the oppositions have been successful in

nullifying the patent right or reducing its scope or width. A similar share (71%) arises when our sample of white goods patents is considered: however, contrary to the findings of previous studies, the share of amended patents (39.6%) turns out to be higher than that of revocations (about 32%).

Table 6 - Opposition outcomes among white good companies

| | Oppositions received | Share revoked | Share amended | Share revoked & amended | Oppositions filed | Share revoked | Share amended | Share revoked & amended |
|---|---|---|---|---|---|---|---|---|
| BSH | 27 | 33.33 | 29.63 | 62.96 | 30 | 20.00 | 46.67 | 66.67 |
| Electrolux | 19 | 47.37 | 31.58 | 78.95 | 14 | 35.71 | 28.57 | 64.29 |
| Whirlpool | 6 | 16.67 | 33.33 | 50.00 | 3 | 66.67 | 33.33 | 100.00 |
| Miele | 5 | 0.00 | 60.00 | 60.00 | 28 | 28.57 | 46.43 | 75.00 |
| Candy | 3 | 0.00 | 33.33 | 33.33 | 1 | 100.00 | 0.00 | 100.00 |
| Samsung | 3 | 33.33 | 33.33 | 66.67 | 0 | n.a. | n.a. | n.a. |
| Fagor-Brandt | 0 | n.a. | n.a. | n.a. | 1 | 0.00 | 0.00 | 0.00 |
| Indesit | 8 | 37.50 | 50.00 | 87.50 | 3 | 33.33 | 66.67 | 100.00 |
| LG | 2 | 0.00 | 100.00 | 100.00 | 0 | n.a. | n.a. | n.a. |
| Arcelik | 1 | 0.00 | 100.00 | 100.00 | 1 | 100.00 | 0.00 | 100.00 |
| Total | 74 | 31.08 | 37.84 | 68.92 | 81 | 29.63 | 39.51 | 71.60 |

n.a. = not available.

Table 6 reports the shares of revocations and amendments of the patents defended or attacked by the with goods companies considered in our study (the patents opposed by other companies not competing in the final markets of white goods are neglected). The first four columns describe how the companies have been unsuccessful in defending their granted patents while the last four illustrate how the same companies have been successful in opposing the patents held by competitors.

Starting from the defendants' point of view, the shares of revoked patents are unevenly distributed among companies: almost half of them do not record any revocation while in the other half the revocation ratios range from 16.7% of Whirlpool to 47% of Electrolux. Instead, neglecting the cases in which there are fewer than three patent oppositions, the shares of amended patents are less differentiated across companies, ranging from 32% of Electrolux to 60% of Miele. Although the damage for patent holders is obviously by far more severe in the occurrence of a revocation, if one sums up the revocation and amendment ratios, it emerges

that, with exceptions of Candy and Whirlpool, all the companies have experienced a substantial reduction of patent rights.

Moving to the opponents' perspective, the most successful companies in challenging competitors' patents are those that use patent oppositions less frequently. This is particularly true when the revocation outcomes are considered. In fact, the revocation ratios of two most aggressive companies, BSH (20%) and Miele (28.6%), are respectively lower and close to the average ratio (29.6%) while all the other companies record above average shares. This result is consistent with Haroff (2005) who, looking at the evidence for the companies producing cosmetics and detergents, contends that there is a certain trade-off between the oppositions' frequency and success in terms of patent revoked. However, the picture changes when the ratios of amended patents are considered. These are more evenly distributed across companies and BSH and Miele, relatively unsuccessful in achieving revocations, were able to reduce the scope of a substantial share (about 46%) of the patents they challenged.

In the remaining of this section, I will try to shed some light on the possible determinants of opposition outcomes. According to the estimation performed in the previous section, in our sample of EPO granted patents, the probability of receiving an opposition from direct competitors is not affected by patent quality indicators and weekly associated with the size of patent holders. So, it would be interesting to see whether the same conclusion holds when the probabilities of the different opposition outcomes are taken into account. For such a purpose, and considering only the oppositions among competitors, I carried out a Multinomial Logit regression in which the three distinct probabilities of having, respectively, an opposition rejected or closed, a patent amended and a patent revoked are jointly estimated. As far as the explanatory variables are concerned, they are the same used in the previous regression analysis.

Differently from the previous findings, Table 7 shows that the above variables play a significant and distinct role when used as determinants of the opposition outcomes. The probability of upholding a patent is positively affected by the extent of forward citations while the backward cites exert a negative and significant impact. Instead, and in line the with expectations, the probability of having an amended patent is positively associated with the number of claims. Finally, the occurrence of a revocation is not affected by any patent quality indicators but significantly increases for the patents held by the four largest companies.

Table 7 – Multinomial Logit regression for the outcomes of patent oppositions among white good companies

| | Coefficient | Standard error |
|---|---|---|
| *Opposition rejected or closed* | | |
| Constant | -2.826 | 0.712 *** |
| Backward citations | -0.291 | 0.125** |
| Forward citations | 0.153 | 0.073 ** |
| Patent family size | -0.033 | 0.063 |
| Claims | 0.006 | 0.036 |
| Four largest companies (dummy) | 0.290 | 0.510 |
| *Patent amended* | | |
| Constant | -4.083 | 0.546 *** |
| Backward citations | 0.005 | 0.091 |
| Forward citations | 0.027 | 0.082 |
| Patent family size | -0.019 | 0.054 |
| Claims | 0.054 | 0.019*** |
| Four largest companies (dummy) | 0.145 | 0.043 |
| *Patent revoked* | | |
| Constant | -5.884 | 1.284 *** |
| Backward citations | 0.082 | 0.083 |
| Forward citations | 0.082 | 0.084 |
| Patent family size | 0.046 | 0.071 |
| Claims | -0.044 | 0.038 |
| Four largest companies (dummy) | 2.208 | 1.029** |
| Chi-squared likelihood ratio test (p-value) | 25.142 (0.048) | |

***= significant at 0.01; **=significant at 0.05; *= significant at 0.10.

To summarise, only for the subset of opposition proceedings ending with a revocation it is possible to infer that patent challenges, being particularly directed to the patents of the largest companies rather that to those of higher or lower quality, are mainly used strategically as competitive weapons. In the other cases, instead, the patent quality indicators exert a significant impact: the extent of backward (forward) citations reduces (increases) the probability of maintaining a valid patent while the number of claims increases the probability

of having a patent amended. As a consequence, along with that of strategic tools, patent oppositions play the important role of error correction mechanisms.

The fact that the examination process at the EPO (as well as at the USPTO) is characterised by many errors should be mainly ascribed both to the explosion of patent applications and to their increased voluminosity in terms of number of pages and, especially, claims. As Archontopoulus et al. (2007) have documented by observing EPO applications over the period 1980-2004, the number of claims per patent application has increased from 10 to 21. In our study, instead of applications, we are dealing with granted patents, whose original scope is often reduced by EPO examiners: thus, an average number of claims close to 11, arising from our sample of granted patents, is fairly consistent with the above figures. Moreover, the distribution is quite skewed as witnessed by the presence of 67 patents (out of 961) containing more than 19 claims.

Thus, as far as patent oppositions are effective in correcting the errors made in the first examination process and reduce the scope for further (and more expensive) legal disputes[14], the fact that some companies make an extensive usage of them is not necessarily evil from a social point of view.

## 6. Concluding remarks

A consolidated body of evidence indicates that, in each industry or technological area, the overwhelming majority of patent applications and grants are held by the largest companies which resort to them mainly for strategic reasons. As for patents, the leading companies can make use of patent oppositions as competitive weapons, both for defensive and offensive purposes. The problem is that challenging the patents of industry rivals exposes opponents to future retaliations and strongly exacerbates the competitive struggle. In industries characterised by an increasing demand fostered by new technological opportunities, firms can find convenient to avoid an intensive use of patent oppositions (and litigation). Instead, when the economic prospects of an industry are not so brilliant, patent oppositions may become like any other competitive tools that the largest companies employ to keep their market shares. However, since most of the opposition proceedings end with a revocation or an amendment of the granted patents, patents oppositions should be also viewed as an effective means to correct the errors made by patent offices in the examination process.

[14] Although, as stressed by Hall et al. (2003), the evidence is too sparse to conclude that this is the case.

By considering the patent oppositions among the ten major players in the European market of white goods, this paper has attempted to shed some light on both the strategic and error correction role of patent challenges before the EPO.

Through a matrix of reciprocal oppositions, it has been possible to identify the companies that are more inclined to challenge the patents held by competitors and those that are more exposed to patent oppositions. Since in many cases they coincide, a process of retaliation and intense rivalry seems at work. Then, by running a Logit regression, I found that the probability of a patent to be opposed by one of the major competitors is not significantly affected by its quality (approximated by forward and backward citations, claims and family size). This would suggest that patent oppositions are mainly used as strategic tools.

However, by considering the different outcomes of the opposition proceedings (validity, revocation, and amendments of opposed patents) I found that only in the cases ending with a revocation a strategic motivation can be inferred. Instead, the probability of maintaining a patent valid is positively affected by forward citations and negatively by backward cites, while that of having an amended patent significantly increases with the number of claims. Accordingly, patent oppositions, along with that of strategic tools, play also the role of error correction mechanisms.

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