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EMPIRICAL ANALYSIS OF THE ASSESSMENT OF INNOVATION EFFECTS IN U.S. MERGER CASES

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ABSTRACT

In this empirical study all mergers that have been challenged by the U.S. antitrust agencies FTC and DOJ between 1995 and 2008 were analyzed in regard to the question to what extent and how the agencies assessed the innovation effects of mergers. Theoretical background is the still open question how negative effects of mergers on innovation should be taken into account in merger policy. Although we can show in our study that in one third of all challenged mergers also innovation concerns were raised, the results also point to a still existing large degree of uneasiness and inconsistencies of the agencies in regard to the assessment of innovation effects. A particularly interesting result is that - despite the wide-spread rejection of the "innovation market approach" in the antitrust debate - the agencies used more an innovation-specific assessment approach that includes also innovation in the market definition than the pure traditional product market concept. Additionally, we also found significant differences between the assessment approaches of the FTC and the DOJ.

JEL: K21, L12, L41, O31

Keywords: innovation, merger policy, US antitrust, innovation market

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1. Introduction

Despite the consensus that competition policy should also protect innovation competition, it is still very unclear whether and how competition authorities should take innovation effects into account. This is particularly true for merger policy, where the growing emphasis on case-specific economic analysis has led to a greater focus on the assessment of short-term price effects of mergers, whereas the potentially negative effects on consumer welfare through less innovation are in danger of being ignored. This asymmetry can also be seen very clearly in the Horizontal Merger Guidelines both of the EU and the U.S., in which innovation effects of mergers play only a small role (EU Commission 2004, DOJ/FTC 2010). One important reason is the uncertainty of competition authorities (as well as lawyers and economists) about how innovation effects of mergers can and should be assessed (for an overview about the discussion Katz/Shelanski 2007). A crucial part of the problem concerns a basic conceptual issue: Is the traditional approach of first defining product markets and subsequently analyzing the anticompetitive effects of a merger on these markets also suitable for assessing innovation effects of mergers or is it necessary to use a more innovation-specific assessment approach?

In the U.S., this question led to the development of the Innovation Market Analysis (IMA) as a new approach for the assessment of innovation effects in antitrust law in the mid 1990s (Gilbert/Sunshine 1995). The problems with the traditional product market approach are, firstly, that the competitors in regard to the innovation of new products might not be identical with the competitors in a traditional product market, as some incumbent firms might not innovate or also non-incumbent firms might take part in innovation competition. Secondly, market shares and concentration levels on product markets might not be good indicators for assessing the effectiveness of innovation competition. Therefore, the basic idea of the innovation market analysis focusses on a direct identification of the relevant innovation competitors by asking for the firms that have the necessary resources for innovation (in form of specialized assets), leading to so-called innovation markets. Subsequently, it is asked whether a merger would lead to negative effects on innovation, i.e. by delaying or reducing investment in R&D (with the possibility of balancing anticompetitive effects with efficiency effects).

This new approach of the innovation market analysis had been criticized vigorously from its beginning. The major points of criticism were that a new concept is not necessary (claiming that the traditional concepts are sufficient) and that such an analysis is unfeasible, given our

limited knowledge about the innovation effects of mergers.¹ Nevertheless, and despite this critique, the innovation market analysis appears to have influenced considerably U.S. antitrust policy. One important application was the explicit inclusion of the concept of innovation markets in the "Antitrust Guidelines for the Licensing of Intellectual Property" in 1995 (DOJ/FTC 1995). At the same time, a considerable increase of concerns in regard to innovation effects in the merger reviews of U.S. antitrust authorities can be observed (Gilbert 2008a). However, afterwards the support for the innovation market analysis in the academic discussion has waned dramatically. This has become evident in the discussion about the reform of the U.S. Horizontal Merger Guidelines (DOJ/FTC 2010) with its mixture of broad support for assessing innovation effects in merger analysis but its rejection of recommending the innovation market analysis.²

The objective of our paper is an empirical analysis to what extent and how the U.S. antitrust authorities, i.e. the Federal Trade Commission (FTC) and the Department of Justice (DOJ), took account of negative innovation effects in their assessments of mergers. Although the EU merger policy also considered innovation effects to some extent, the U.S. experiences with the assessment of innovation effects in merger reviews is much richer and more interesting, because the innovation market discussion allowed for a more explicit experimentation with new assessment approaches. In our empirical analysis, we have examined all 399 mergers that were challenged by the FTC and DOJ between 1995 and 2008.³ Our sources are the "complaints", "decision and orders", "final judgments", etc. By analyzing all 399 complaints in these cases, we could identify a sub-sample of 135 merger cases, in which innovation concerns have been investigated explicitly (FTC: 91, DOJ: 44). Therefore, in the U.S., a large number of relevant cases exists. In addition to that, the innovation concerns of the agencies also led to a considerable number of settlements with structural remedies. These settlements required the merging firms to far-reaching divestitures, especially in regard to parallel R&D projects, which had to be sold to competing firms in order to maintain innovation competition (for an overview see, e.g., Carrier 2008).

¹ See for a critical discussion, e.g., Rapp (1995), Lang (1997), Morse (2001), Carlton/ Gertner (2003), Davis (2003), Kent (2011); see for a more balanced perspective Katz/Shelanski (2007, 41-44), Carrier (2008), and Kern (2014).

² The respective public comments and records of the FTC/DOJ joint workshops can be found on: <http://www.ftc.gov/news-events/events-calendar/2010/01/horizontal-merger-guidelines-review-project-0> (Aug. 14, 2014).

³ See the "Annual Competition Enforcement Reports to Congress" of the agencies between the fiscal year 1995 and fiscal year 2008.

Although there is considerable literature on merger cases with respect to innovation aspects, which analyze particular cases in a qualitative way,⁴ only Gilbert (2008a) has so far analyzed cases also quantitatively. Our study is the first econometric study about the question how the U.S. merger policy assessed innovation effects of mergers. In comparison to Gilbert (2008a), our study encompasses more cases due to a longer investigation period (1995 - 2008) but also focusses not only on the question to what extent but also *how* the U.S. agencies assessed innovation effects of mergers. Additionally, we also ask whether the two agencies FTC and DOJ used the same or different assessment approaches in regard to innovation effects of mergers, and whether we can observe developments during our investigation period 1995 - 2008 in regard to these assessments.⁵

The first part of our empirical study (in section 2) focusses on the extent the antitrust agencies took innovation concerns into account. How important were innovation concerns? Under what circumstances did the agencies assess a merger also in regard to innovation effects? Were there differences between the agencies? Our results will show that in a third of all challenged merger cases the agencies also raised innovation concerns, and in this regard we also could not find significant differences between the agencies or a change during the entire period. We can also show that the probability that the agencies assess innovation concerns increases with the innovativeness of the industry of the merging firms.

In the following sections 3 and 4, we examine how the FTC and the DOJ assessed innovation effects in particular. This analysis takes place on the level of markets. Section 3 addresses the crucial question whether the agencies try to assess innovation effects more within the traditional approach of defining product markets, and only investigate negative effects on innovation in the ensuing competitive assessment, or whether they use a newer, more innovation-specific approach, which already considers innovation in the market definition. We will see that in a large number of markets, innovation was explicitly taken into account already in the market definition, and not only in the competitive assessment analysis. Our results will also show that both assessment approaches were used by both agencies, however, to a significantly

⁴ See, e.g., Davis (2003), Morse (2001), Rubinfeld/Hoven (2001), Landman (1999), Katz/Shelanski (2007), Carrier (2008), Kern (2014).

⁵ Whereas this paper presents the econometric results of our study, a broader discussion of these (and additional) results within the context of the theoretical and empirical knowledge about innovation effects of mergers and the recent discussion in U.S. antitrust policy can be found in Kerber/Kern (2014)

different extent. It is particularly interesting that the FTC used more an innovation-specific approach than the DOJ in regard to market definition, whereas the DOJ stuck more to the traditional product market approach. Other empirical questions refer to the extent of the use of conventional (market shares, HHI) or more innovation-specific concentration measures (number of firms).

The last part of our empirical study (in section 4) analyzes the theoretical reasonings the agencies gave why the mergers might have negative effects on innovation. We investigate not only what kind of theoretical reasonings have been mentioned (e.g., innovation incentives or diversity arguments), but also to what extent the agencies provided specific arguments at all. Although increasingly innovation incentive arguments were used, the results will show that in more than 50% of all assessed markets the agencies gave no specific reasons for their alleged innovation concerns (particularly the FTC). A surprising result is that increasingly the agencies (and in particular the DOJ) also claimed static price effects in those markets, in which they had innovation concerns. In combination with the high share of cases without specific reasonings, this outcome raises critical questions about the quality and development of the policies of the agencies in regard to the assessment of innovation effects in merger cases. Our concluding section 5 will integrate the results of all three parts of the empirical study, discuss and relate these critical questions to the recent reform discussion of the Horizontal Merger Guidelines, and give some hints for further research.

2. Extent of Assessing Innovation Effects in U.S. Merger Policy

2.1 Hypotheses

How often and under what circumstances did the U.S. agencies investigate mergers not only in regard to price effects but also in regard to negative effects on innovation as another possibility how consumers can be harmed? For our empirical analysis, we consider a merger case as an innovation merger case, whenever the agencies have mentioned in the "complaint" innovation aspects in at least one market, either in the market definition or in the competitive assessment. Typical wordings, indicating that innovation is considered in the market definition, are provided by terms like "the research, development, manufacture and sale of [...]", whereas a consideration of innovation effects within the competitive assessments is shown through explicitly claimed anticompetitive innovation effects. For identifying an innovation

merger case, it was sufficient that such innovation aspects were mentioned in at least one of the investigated markets.

From the overall 399 merger challenges of the FTC and DOJ between 1995 and 2008, we identified 135 mergers, in which the agencies have mentioned innovation aspects in either the market definition and/or anticompetitive effects (FTC: 91; DOJ: 44; see Table 1). In this subsample of 135 cases, the agencies have analysed 341 different markets. After excluding 18 markets, in which only concerns in regard to price increases were raised, we received a second subsample, consisting of 323 analyzed markets (FTC: 218; DOJ: 105), in which innovation aspects were mentioned (either in the market definition or in the anticompetitive effects or in both).⁶ Whereas our analysis in this section focusses entirely on the case level (by investigating the 135 innovation merger cases in comparison to all 399 challenged mergers), our analyses *how* the agencies assessed these innovation effects (sections 3 and 4), are carried out on the market level and therefore use the subsample of the 323 markets with innovation aspects.

What makes a merger case an innovation merger case in U.S. merger policy? When can one expect that antitrust agencies have concerns about negative innovation effects of mergers? It can be presumed that in high technology industries, in which innovation activities are particularly important, more concerns about innovation effects will be raised than in other industries, which can be characterized by a lower relevance of innovation. Therefore, our first hypothesis is that mergers in more innovative industries will be assessed more often in regard to innovation effects (see Gilbert 2008a). A rejection of this hypothesis would raise critical questions about the appropriateness of the selection of cases for assessing innovation effects by the antitrust agencies.

H 1.1: It is more likely that the FTC and DOJ consider negative effects on innovation when mergers take place in innovation-intensive industries.

Since both agencies are in the same way authorized for merger reviews, we expect that no systematic differences between both agencies should be observed in regard to assessing innovation effects. However, there are also strong arguments why one could suspect that there are still remarkable differences with respect to the way how they assess mergers. Apart from the

⁶ Please note that we do not call these markets innovation markets, because they need not be identical with how the innovation market approach would define innovation markets.

fact that the two agencies are composed differently (the DOJ as a part of the Administration and the FTC with a bipartisan mixture of Commissioners), some scholars also claimed that the Department of Justice and the Federal Trade Commission do generally differ with respect to their skill sets, cultures, and capabilities. However, experience shows that the agencies have developed some kind of division of labour in regard to merger reviews. Although there are no legally binding rules about which agency scrutinizes what kind of mergers, in certain industries mergers are mostly assessed by the FTC, whereas in other industries this is done by the DOJ.⁷ As a consequence, it is necessary to control for these effects by using the industry classification as control variable.

H 1.2: There are no differences between the FTC and DOJ in regard to the probability that innovation effects are taken into account.

Can we identify changes within the time span of 1995 to 2008 in regard to the question whether the agencies did consider innovation aspects in merger reviews? In his empirical analysis, Gilbert (2008a) divided his observed period from 1990 to 2003 into three sub-periods 1990-1994, 1995-1999, and 2000-2003. The study of Gilbert showed clearly that innovation effects of mergers played only a negligible role in the time before the Innovation Market Analysis was introduced in 1995. We decided for a simpler, two-period approach. The reason is that since the end of the 1990s an ever-increasing critique can be observed in regard to the application of the innovation market analysis, leading to claims that the *Genzyme/Novazyme* landmark decision of the FTC in January 2004, in which the FTC did not challenge a 2:1 merger in regard to the development of a specific drug, might have been the result of a changing attitude towards the assessment of innovation effects of mergers (Muris 2004, Balto/Sher 2004, Gilbert 2008b, Rosch 2009). Hence, we decided to use the sub-periods 1995-2003 and 2004-2008. Our hypothesis is that the agencies challenged fewer mergers on the basis of innovation concerns since 2004 than before.

H 1.3: The probability that innovation effects are claimed is lower for mergers that fall into the period 2004-2008 compared to those falling in the period 1995-2003.

⁷ See for this discussion Maria Barroso Gomes (2013), Carroll (2009), Blumenthal (2013), Memorandum (2002).

2.2. Data and Empirical Model

For analyzing the determinants of merger cases being investigated for innovation effects, we defined a dummy variable (INNOV_CASE) which is equal to unity when innovation aspects were mentioned in the complaint and zero otherwise. Our first set of explanatory variables encompasses the innovativeness of the industry. By using the variables HITEC 0 - HITEC 5 we accounted for the different degrees of technology intensity of the relevant industries. In this respect we follow Peneder (2010) in order to classify the industries of our sample into “Low” (HITEC 1), “Med-low” (HITEC 2), “Med” (HITEC 3), “Med-high” (HITEC 4) and “High” (HITEC 5) technology industries, according to their 2-digit ISIC/NACE denotation (Table A-1 in the appendix). The dummy HITEC 0 captures all industries which were not part of Peneder’s taxonomy but were characterized by much less innovative activity than HITEC 1-industries.⁸ In order to obtain the ISIC/NACE number for the merger cases of our sample we used the relevant markets as they were defined in the complaints.⁹ The Dummy FTC, which is equal to one for FTC cases and zero for DOJ cases, indicates whether a case was challenged by the FTC or the DOJ. We also defined a dummy variable D04-08, which is set equal to unity whenever the respective case was challenged in the period 2004 - 2008.

In order to test our hypotheses 1.1 - 1.3, we used probit¹⁰ techniques by regressing the INNOV_CASE dummy on the explanatory variables: FTC, the time period (D04-08), and the technological intenseness of the industries (HITEC 1 to HITEC 5). Next, we built several industry dummies as controls to account for possible heterogeneity induced by different industries. For this purpose, we used the classification scheme of the FTC (according to the FTC Competition Enforcement Database¹¹), with which the agency classified each of its actions

⁸ According to the 2-digit ISIC/NACE, HITEC 0 encompasses “construction” (45), “sale, maintenance and repair of motor vehicles” (50), “retail trade, except of motor vehicles” (52), “hotels and restaurants” (55), “real estate activities” (70), “renting of machinery and equipment” (71), “public administration and defense” (75), “Education” (80), “health and social work” (85), “sewage and refuse disposal, sanitation and similar activities” (90), “activities of membership organizations n.e.c.” (91), “recreational, cultural and sporting activities” (92), “other service activities” (93), “private households with employed persons” (95), “extra-territorial organizations and bodies” (99).

⁹ Thereby we avoided possible biases as a consequence of the usage of, e.g., firm primary codes and safeguarded that we assign each merger case the appropriate industry classification number (on a 4-digit level) from an antitrust perspective.

¹⁰ As our left hand side variable INNOV_CASE is binary the application of OLS yields inefficient estimates. We therefore used probit models for all our regressions. We also used logit techniques and linear probability models in order to check for robustness. Overall, the results did not change qualitatively throughout the analysis in dependence of the respective method used.

¹¹ For a detailed overview *see* <http://www.ftc.gov/enforcement/cases-proceedings> (Aug. 14, 2014).

into one of seven main categories (Defense, Energy, Health Care, Information and Technology, Manufacturing, Professional Services and Retail), and into 28 subcategories. Since our sample does not entail cases from all the industries, we end up with a maximum of 16 industry classes (see Table A-2 in the appendix).

2.3 Results

In a first step we report the absolute and relative frequencies of innovation cases challenged by FTC and DOJ. As can be seen from Table 1 the agencies have analysed innovation aspects in 135 of the 399 challenged merger cases over the entire period, i.e., in 34% of all cases.

Table 1: All challenges of mergers (by DOJ and FTC) and cases with innovation aspects

	Σ		FTC + DOJ		Σ FTC		Σ DOJ		FTC		DOJ							
	95-'08		95-'03		95-'03		04-'08		95-'03		04-'08							
	total	%	total	%	total	%	total	%	total	%	total	%						
all challenged mergers*	399	100%	298	100%	101	100%	252	100%	147	100%	189	100%	63	100%	109	100%	38	100%
cases with innovation aspects** (% of all challenges)	135	34%	100	34%	35	35%	91	36%	44	30%	67	35%	24	38%	33	30%	11	29%

Sources: DOJ/FTC Annual Competition Enforcement Reports and agency complaints. The years shown are fiscal years which start on October 1st.

* including consent decrees, injunctive reliefs, administrative complaints, abandonments.

** innovation aspects in market definition and/or in anticompetitive effects.

This result supports the view that innovation concerns have been relevant in U.S. merger policy. Overall, differences between the agencies are only small with respect to the share of innovation mergers (FTC: 36%; DOJ: 30%) over the entire period. Also the comparison between 1995-2003 and 2004-2008 does not indicate significant differences between the time periods, neither in regard to all challenged mergers from both agencies nor in regard to FTC and DOJ separately. Therefore, the descriptive results do not suggest significant changes in regard to the extent of taking innovation aspects into account.

Table 2: Probit Regression: Cases with innovation effects

INNOV_CASE	Probit 2.1	Probit 2.2	Probit 2.3	Probit 2.4
FTC	-	0.101 (0.45)	-	0.096 (0.44)
D04-08	-	-	-0.089 (0.67)	-0.085 (0.67)
HITEC 1 („low“)	3.799 (0.00)	3.766 (0.00)	3.802 (0.00)	3.822 (0.00)
HITEC 2 („med-low“)	4.650 (0.00)	4.592 (0.00)	4.680 (0.00)	4.676 (0.00)
HITEC 3 („med“)	5.010 (0.00)	4.961 (0.00)	5.036 (0.00)	5.041 (0.00)
HITEC 4 („med-high“)	5.085 (0.00)	5.030 (0.00)	5.106 (0.00)	5.105 (0.00)
HITEC 5 („high“)	5.647 (0.00)	5.589 (0.00)	5.665 (0.00)	5.661 (0.00)
FTC Classes	YES	YES	YES	YES
Constant	-5.387 (0.00)	-5.362 (0.00)	-5.381 (0.00)	-5.410 (0.00)
Pseudo R ²	0.31	0.31	0.31	0.31
Log Pseudolikelihood	-141.81	-141.70	-141.71	-141.61
Obs	297	297	297	297

Note: p-values given in parentheses. All values are calculated using robust and clustered standard errors.

We now turn to the results of our regression analyses. Table 2 presents the results from different specifications (Probit 2.1.-2.4) of our probit analysis of a merger case being identified as an innovation case by the agencies. All of the models show that the assessment of innovation effects is more likely with an increasing innovation intensity measured by HITEC-dummies. Estimated coefficients of HITEC-classes are steadily increasing in each of the regressions which indicates an increasing impact of the degree of technological intenseness (“Low”, “Med-low”, “Med”, “Med-high” and “High” technology industries), in comparison to our base category HITEC 0. This result is also supported by the marginal effects calculated at the sample means which can be seen from Table A-3 in the appendix. Therefore, hypothesis H1.1, i.e. that the agencies assess more innovation aspects if the mergers take place in more innovation-intensive industries, is confirmed by the data. The results also show no significant differences between the agencies (hypothesis H 1.2), i.e., both agencies take innovation effects into account to a similar degree. Finally, there is no evidence that the probability of assessing innovation effects has changed significantly over time. As can be seen from Table 2,

our dummy D04-08 is statistically insignificant, indicating that, as suggested by our descriptive results, there is no evidence for a suspected change in regard to the consideration of innovation aspects after 2004 (hypothesis H 1.3). The Pseudo- R^2 is identical for all of the regressions. About 31% of the variation of our dependent variable can be described by our model. Hence, at least about a third of the variation in INNOV_CASES is explained by HITEC-classes as well as FTC classes.

3. Market Definition and Competitive Effects: Are the Agencies Using an Innovation-specific Approach?

3.1 Theoretical Background and Hypotheses

The traditional concept for assessing mergers uses the product market concept for identifying the relevant competitors in the market (hypothetical monopoly test) before carrying out a competitive assessment whether the merger is expected to harm consumers by raising prices or reducing innovation activities. This is the approach described in the Horizontal Merger Guidelines, both before and after their reform in 2010 (DOJ/FTC 2010). In this approach the innovation dimension is not considered in the market definition, and can only be taken into account in the competitive assessment part of the merger review. The main problem with this approach is that not all firms that are competing for innovation by investing in R&D need be active in the current product market, and that not all incumbents in the product market need be competitors in regard to innovation. Therefore, the set of relevant firms in innovation competition might be different from the relevant competitors in the current product market, leading to a wrong assessment of mergers through an erroneous market definition (for a deeper analysis, see Kern 2014).

This is the reason why the "innovation market analysis" (IMA) introduced "innovation markets" as an additional way of identifying the relevant competitors in regard to innovation. It proposed a five step procedure for assessing the innovation effects of mergers (Gilbert/Sunshine 1995, 594-597; Gilbert/Tom 2001). In a first step, it is analyzed whether R&D activities of the merging firms overlap. This step is followed by an investigation of alternative sources of innovation (step 2). This requires an analysis of the necessary resources in form of specialized assets, as, e.g., laboratory equipment or intellectual property rights. Through these two steps the innovation competitors are identified (defining the innovation market). In the

following steps 3 and 4, it is assessed whether the merged firms would have the incentives and capabilities to reduce their R&D activities through either unilateral or coordinated behaviour, or whether other competitors would render such strategies as either not feasible or not profitable. This represents the analysis of potential anticompetitive effects in regard to innovation competition, which is followed by an analysis whether an expected reduction in R&D investments through the merger could be defended through innovation-related efficiencies (step 5).

In this section, we want to analyze whether the agencies in their innovation merger cases used the above-described traditional approach or used a new, more innovation-specific concept, which might be inspired by the innovation market analysis. In fact, in our data set we identified many innovation merger cases, in which we encountered market definitions in the form of "research, development, production and sale of [...]", whereas in many others we found only "production and sale of [...]" in the market definition and innovation concerns are only mentioned in the competitive assessment of the merger. If innovation is already considered as a part of the market definition, it can be suggested that the agencies did not rely on the traditional product market approach but used a more innovation-specific approach. Thus, our decisive criterion for distinguishing both concepts is whether innovation is already considered in the market definition, or only as an additional part of the anticompetitive effects analysis after defining markets along the product market concept. We think that the other steps of the IMA approach are less crucial for defining a new innovation-specific approach, because they also can be carried out within the traditional assessment approach.

The question whether a traditional product market concept is used or a more innovation-specific approach is also relevant for the usually most important first assessment criterion, i.e. the (change of) market concentration through the merger. Although this criterion is now seen much more critically than in former times even for the assessment of static price effects, there is a broad consensus that market concentration as measured by market shares and the Herfindahl-Hirschman-Index (HHI) might not be an appropriate criterion for assessing the intensity of innovation competition, since these measures refer only to the market shares on current product markets. If firms compete for innovation, then the mere number of independent innovating firms might be a simpler but more accurate innovation-specific measure for the market concentration that is relevant for the assessment of innovation competition. This is also the way how the U.S. Antitrust IP Licensing Guidelines of 1995 take account of market concen-

tration in regard to innovation competition. There it is stated that an agreement is unlikely to have anticompetitive effects on innovation, if there are at least four other independently controlled entities competing for innovation (4 plus-rule) (DOJ/FTC 1995, § 3.2.3). Therefore, we also can distinguish two basic different groups of measures for concentration: First, conventional approaches as HHI and market shares, which refer to current product markets and are therefore aligned with the traditional assessment approach. Secondly, the agencies can also use more the pure number of competitors as a measure which is better suited for assessing innovation competition concerns.

In this section 3, we will analyze our data set in regard to the question to what extent the agencies have made their assessment more along the traditional product market approach or a newer, more innovation-specific concept focusing on the question whether they use innovation already in the market definition and the pure number of innovating firms instead of conventional concentration measures. In regard to our econometric analysis the following hypotheses will be tested. First, we have seen in section 2 that the probability that the agencies consider innovation aspects increases with the innovation intensity of the industries. Therefore, it could also be presumed that the agencies do also use a more innovation-specific approach for the assessment of innovation effects in innovation merger cases, if the merger takes place in a more innovative industry.

H 2.1: It is more likely that innovation is already considered in the market definition, whenever mergers take place in industries with high innovation intensity.

In section 2, we could not find differences between the agencies regarding the probability of assessing innovation effects of mergers. However, the question arises whether there are differences regarding the approach for the assessment of innovation effects, both for the question whether innovation is included in market definition and what kind of concentration measure is used.

H 2.2a: There are no differences between the agencies in regard to the probability that innovation is already considered in the market definition.

H 2.2b: There are no differences between the agencies in regard to the probability that the number of firms is used as a concentration measure.

What developments can we observe with respect to the applied approaches over time? In section 2, we did not find evidence for our hypothesis that the agencies have generally assessed innovation effects to a smaller extent in the period 2004-2008 in comparison with the prior period. Hence, we might also observe a similar development in regard to the use of innovation in the market definition. However, the mounting critique in the academic debate in regard to the innovation market approach suggests that the application of the new concept might have declined, leading both to a decline of the use of innovation in market definition and the use of the number of firms as concentration measure.

H 2.3a: The probability that innovation effects are considered in the market definition is lower for mergers that fall into the period 2004-2008 compared to those falling in the period 1995-2003.

H 2.3b: The probability that the number of firms is used as a concentration measure is lower for mergers that fall into the period 2004-2008 compared to those falling in the period 1995-2003.

3.2 Data and Empirical Model

The dependent variable in this model is "innovation in market definition" (INNOV_DEF), which is a dummy variable equal to one, if innovation aspects are mentioned in the market definition, otherwise it is set to zero. Regarding the different measures of concentration, we analyzed all markets with innovation aspects and determined whether the agencies provided HHIs and/or market shares, or whether they relied on the number of firms as a concentration measure. The latter concentration measure is captured by the dummy variable UNCONVENTIONAL_CONC, which is set to 1, if the agencies have mentioned the number of competitors; otherwise it is set to 0. However, it is worth noting that in some cases the agencies used both kinds of concentration measures (HHIs/market shares and the number of competitors), leading to aggregated percentages which exceed 100%. Moreover, apart from this distinction in more traditional and innovation-specific concentration measures, we also encountered statements with non-quantitative information about concentration, e.g., "highly concentrat-

ed"¹² or that the merging parties are “two of the leading suppliers in the world”¹³. Our first explanatory variable refers to the innovation intensity of the relevant markets.¹⁴ As a proxy we use the R&D expenditures (provided in U.S. Dollars spent) divided by employment (provided in percent of total employment of U.S. economy) (RDEXP/EMPL) of the industry to which the relevant market, defined in the complaint, belongs. We used the ISIC scheme on a 2-digit level and matched the corresponding relevant markets with the "STAN Indicators 2009" dataset of the OECD. In regard to the other independent variables FTC and the time period, we applied the same proxies as in the model in section 2. We used again the FTC classification as control variable for controlling industry effects. Additionally, we used the employment shares of the respective industries (EMPL) in order to control for industry heterogeneity.¹⁵ Our data set consists of all markets affected by the 135 innovation merger cases, in which the agencies have used innovation aspects in the market definition and/or the anticompetitive effects.

3.3 Results

Overall, within the set of 135 challenged mergers, the agencies considered innovation aspects in 323 relevant markets (see Table 3). The distribution of markets with innovation aspects between FTC and DOJ is similar to the one on the case level: While the FTC found 218 such markets, the DOJ investigated only 105. An important result is that in 222 markets the agencies mentioned innovation aspects in the market definition (69 % of all markets). However, while the FTC mentioned innovation in about 82% of the markets in the market definition, the DOJ refers to innovation in the market definition in only 41%. In regard to the explicit claiming of negative innovation effects in the competitive effects analysis (overall: 79%), we see the reverse picture: Here in 99% of all markets with innovation aspects, the DOJ claimed explicitly negative effects on innovation, in contrast to only 69% at the FTC. Regarding the two periods of interest, the share of markets with innovation in the market definition has overall

¹² See, e.g., The Boeing Company, File No. 001 0092, Docket No. C-3992.

¹³ See, e.g., Svedala Industri AB/Metso Oyj Corp., FTC File No. 001-0186, Docket No. C-4024.

¹⁴ In contrast to our analysis on the case level, carried out in the previous section, we were now able to use the R&D expenditures as a control variable for the innovativeness of an industry instead of the HITEC variables. Due to a significant number of transactions taking place in hardly innovative industries, we had the problem of missing data regarding the R&D expenditures on the case level.

¹⁵ Again, we used the ISIC scheme on a 2-digit level and matched the corresponding relevant markets with the "STAN Indicators 2009" dataset of the OECD.

increased from 65% (1995-2003) to 82% (2004-2008). While for FTC cases this share increased from 78% to a 95%, the DOJ mentioned innovation in market definition in about 41% of the markets in both sub-periods. When analyzing competitive effects, the DOJ mentioned innovation effects in nearly 100% in both periods, while the corresponding percentage of the FTC decreased from about 76% to 50%.

Table 3: Innovation aspects in innovation merger cases at the market level

	Σ		FTC + DOJ				Σ FTC		Σ DOJ		FTC		DOJ	
	95-'08		95-'03		04-'08		95-'08		95-'08		95-'03		04-'08	
	total	%	total	%	total	%	total	%	total	%	total	%	total	%
markets with innovation aspects	323	100%	250	100%	73	100%	218	100%	105	100%	162	100%	56	100%
innovation aspects in market definition *	222	69%	162	65%	60	82%	179	82%	43	41%	126	78%	53	95%
innovation aspects in anti-competitive effects *	255	79%	210	84%	45	62%	151	69%	104	99%	123	76%	28	50%

Sources: Agency complaints. Years shown are fiscal years.

* in % of markets with innovation aspects

Table 4 summarizes the results from the probit regressions. Surprisingly, there seems to be no statistically significant effect of the industries' innovation intensities on the probability that agencies use more innovation-specific analytical concepts (non-confirmation of hypothesis H 2.1). RDEXP/EMPL is not significant in any of the specifications. However, the descriptive results of large differences between the agencies in the extent of considering innovation already in the market definition are supported by the probit analysis. The FTC is more likely to use the innovation-specific market definition concept than the DOJ (H 2.2a). Calculating the marginal effects at the sample means (see Table A-4 in the appendix) leads, depending on the specification, to a higher probability of 15-20% that innovation is mentioned in the market definition in FTC cases.

Table 4: Probit Regression: Markets with innovation in market definition

INNOV_DEF	Probit 4.1	Probit 4.2	Probit 4.3	Probit 4.4
FTC	0.681 (0.02)	-	0.731 (0.00)	0.622 (0.01)
D04-08	-	0.543 (0.07)	0.661 (0.00)	-0.006 (0.97)
FTC*D04-08	-	-	-	1.122 (0.00)
FTC Classes	YES	YES	YES	YES
RDEXP/EMPL	6.17e-12 (0.44)	4.00e-12 (0.58)	9.82e-13 (0.88)	-3.73e-12 (0.65)
Constant	-0.684 (0.01)	-0.001 (0.07)	-0.731 (0.14)	-0.621 (0.11)
Pseudo R ²	0.35	0.34	0.36	0.37
Log Pseudolikelihood	-88.43	-90.70	-86.87	-85.91
Obs	254	254	254	254

Note: p-values given in parentheses. All values are calculated using robust and clustered standard errors.

The hypothesis that innovation in market definition has decreased from the first to the second period (H 2.3a) is not supported by the data and has to be rejected. In contrast, at least two of the specifications show evidence for a more innovation-specific approach applied in the second period (D04-08). Marginal effects show a higher probability of about 11% in 2004-2008 (see Table A-4 in the appendix). However, following specification 4.4, this increase of innovation in the market definition over time is mainly driven by the FTC. This is captured by the interaction term FTC*D04-08 which renders the main effect of period D04-08 insignificant. In contrast to the DOJ, the Federal Trade Commission seems to have used innovation aspects in the market definition more frequently in the later sub-period.

In regard to the use of concentration measures, our descriptive results of Table 5 show that the agencies used either HHIs or market shares in 50% of the markets with innovation aspects. Apart from that, the DOJ apparently relied more often on these traditional concentration measures, but the use of these measures seems to increase over time, both at the FTC and the DoJ.

Table 5: Types of applied concentration measures

	Σ		FTC + DOJ				Σ FTC		Σ DOJ		FTC				DOJ			
	95-'08		95-'03		04-'08		95-'08		95-'08		95-'03		04-'08		95-'03		04-'08	
	total	%	total	%	total	%	total	%	total	%	total	%	Total	%	total	%	total	%
markets with HHIs and/or market shares*	162	50%	118	47%	44	60%	98	45%	64	61%	67	41%	31	55%	51	58%	13	76%
markets with the number of competitors*	124	38%	87	35%	37	51%	81	37%	43	41%	52	32%	29	52%	35	40%	8	47%
markets with non-quantitative concentration measures*	81	25%	70	28%	11	15%	70	32%	11	10%	60	37%	10	18%	10	11%	1	6%

Sources: Agency complaints. Years shown are fiscal years.

* in % of markets with innovation aspects (see Table 3)

Note: The sum of all three lines exceeds 100%, because in some cases the agencies relied on more than only one kind of concentration measure.

However, in 38% of all markets, the agencies provided the number of firms for characterizing the competitive situation and also here we can observe an increase in the use of this kind of concentration measure at both agencies. The DOJ seems to use this criterion more often than the FTC. This is a surprise, because we would have expected that the FTC, which in regard to the market definition used more an innovation-specific approach than the DOJ, would also use more the number of competitors as the innovation-specific concentration measure. The overall increase of quantitative concentration measures is mirrored by a decrease of the markets with only inconcrete, non-quantitative information about concentration. Especially in the first period the FTC has challenged mergers rather often without providing quantitative concentration measures. However, in the second period these inconcrete concentration measures were mentioned only in 10% of the analyzed markets. The results of the corresponding econometric analysis can be found in Table 6 (for the marginal effects see Table A-5).

Table 6: Probit Regression: The use of the number of firms as concentration measure

UNCONVENTIONAL_CONC	Probit 6.1	Probit 6.2	Probit 6.3	Probit 6.4
FTC	-0.918 (0.02)	-	-1.059 (0.09)	-1.249 (0.05)
D04-08	-	0.843 (0.01)	1.007 (0.01)	0.020 (0.69)
FTC*D04-08	-	-	-	1.485 (0.03)
HITEC Dummies	NO	NO	NO	NO
FTC Classes	YES	YES	YES	YES
RDEXP/EMPL	-7.50e-12 (0.13)	-1.96e-11 (0.00)	-2.30e-11 (0.00)	-2.98e-11 (0.00)
Constant	0.920 (0.02)	0.007 (0.01)	1.068 (0.08)	1.260 (0.07)
Pseudo R ²	0.09	0.06	0.13	0.14
Log Pseudolikelihood	-154.98	-160.64	-148.67	-146.75
Obs	251	251	251	251

Note: p-values given in parentheses. All values are calculated using robust and clustered standard errors. The population is all markets with innovation aspects.

The surprising descriptive results regarding the lower usage of the number of firms as a concentration measure by the FTC in comparison to the DOJ is confirmed by our econometric analysis (refuting our hypothesis H. 2.2b). Regarding the use of the number of firms over time, we found evidence that the use of this concentration measure increased significantly from the first to the second period, leading to a rejection of Hypothesis H. 2.3b. However, following specification 6.4, this increase is mainly driven by the FTC. This is captured by the interaction term FTC*D04-08 which renders the main effect of period D04-08 insignificant. Therefore, with respect to the FTC, we identified a significant increase of this more innovation-specific way of concentration measuring as well as an increasing consideration of innovation effects already in the market definition (see Table 4). However, since the Pseudo-R² is rather low, the results should be interpreted with caution.¹⁶

¹⁶ It is worth noting that we also empirically tested our descriptive observations regarding the use of HHIs and market shares as traditional concentration measures and the use of non-quantitative concentration measures. However, we did not get any significant results with respect to the use of HHIs and market shares. But, we confirmed our descriptive results regarding the use of non-quantitative/inconcrete concentration measures. The observation that the FTC uses this kind of concentration measure more often and that its use decreases from the first to the second period could both be confirmed at a 1% significance level.

4. Assessment of Innovation Effects: Theories and Reasonings

4.1. Theoretical Background and Hypotheses

To what extent did the agencies also offer clear reasons how the mergers could negatively affect innovation, and what kind of theories they relied on? It is not possible here to give an overview on the broad theoretical and empirical literature that might be relevant for the assessment of innovation effects of mergers (for an overview: Gilbert 2008a). One group of arguments encompasses all reasonings that claim that mergers might reduce the innovation incentives of firms with the consequence of fewer investments in R&D or a slowing down of the innovation process.¹⁷ Although this group comprises a large number of different models and effects, we can summarize them under the heading of "innovation incentives". However, mergers might also have a negative effect on innovation, because they might reduce the number of parallel R&D projects and/or reduce the number of independent sources for future innovation in an industry. Hence, from an evolutionary economics perspective, mergers can lead to less parallel experimentation with new innovation projects, which - due to the uncertainty of the innovation process - might lead to fewer successful innovation processes. Since mergers can reduce the benefits of diverse research paths, such kind of arguments can be called diversity arguments.¹⁸ However, whereas arguments about the effects of mergers on innovation incentives are much in line with mainstream industrial economics, diversity arguments are closer aligned with evolutionary approaches to innovation economics. Although the literature on such evolutionary arguments is small, we decided to include diversity arguments in our empirical study, because in a number of cases the agencies have used very similar arguments. Particularly the settlements in pharmaceutical merger cases, in which parallel research was protected through divestitures, can be interpreted as being based upon such a diversity argument. Unfortunately, however, as it is shown in our descriptive statistics below (Table 7), the number of markets in which diversity arguments were used by the agencies (23 markets; FTC: 14; DOJ: 9) is too small for allowing an econometric analysis. Therefore, we could include them only in our descriptive statistics.

¹⁷ See Arrow (1962), Loury (1979), Lee/Wilde (1980), Dasgupta/Stiglitz (1980), Reinganum (1989), Boone (2000, 2001), Aghion et al. (2005).

¹⁸ See for evolutionary and diversity reasonings Metcalfe (1989), Nelson (1995), Farrell (2006), and Kerber (2011) with additional references.

Perhaps equally important is the question to what extent the agencies gave at all specific reasons about how a merger could lead to negative effects on innovation, or whether they merely claimed the existence of such anticompetitive effects without providing any specific arguments or evidence. Due to the general uncertainty about the consideration of innovation effects in merger cases, the specificity of reasoning regarding these effects is particularly crucial for the quality of merger reviews. Linked to this problem might be the question to what extent the agencies in addition to their innovation concerns simultaneously claimed on the same markets also static price effects. The agencies might deem it as a prudent strategy to challenge mergers in regard to innovation effects only in those cases, in which they can also claim price effects of mergers, since the latter are much more well-accepted arguments in antitrust law. Another important question is whether this uncertainty about the assessment of innovation effects in U.S. merger policy has been reduced over time due to the increasing experience during our investigation period and whether the observed differences between the agencies in the last section appear also in regard to these issues.

Based on these questions we developed the following hypotheses for our econometric analysis. Again, we presume that there are no differences between the agencies.

H. 3.1a: There are no differences between the agencies in regard to the probability that innovation incentive arguments are put forward.

H. 3.1b: There are no differences between the agencies in regard to the probability that an agency claims static price effects in addition to innovation effects.

The second group of hypotheses refers again to the development over time. Since the consideration of innovation effects was new in the 1990s, we could expect that the uncertainty regarding the assessment of these effects has decreased over time, leading to an increase of the share of challenges, in which the agencies gave specific reasons about the innovation effects of mergers. Based upon the increasing critique of the new concept of innovation markets in the antitrust discussion since the end of the 1990s, we expect that the agencies, over time, relied stronger on innovation incentive arguments, which are more compatible with the established industrial economics literature. It can furthermore be expected that the critical discussion of innovation markets also induced the agencies to back up the claimed anticompetitive innovation effects with well-accepted static price effects. This leads to the following hypotheses about the differences between the first period 95-03 and the second period 04-08:

H 3.2a: The probability that innovation incentive arguments are put forward is higher for mergers that fall into the period 2004-2008 compared to those falling in the period 1995-2003.

H 3.2b: The probability that an agency claimed also static price effects in addition to innovation effects is higher for mergers that fall into the period 2004-2008 compared to those falling in the period 1995-2003.

4.2 Data and Empirical Model

In this section the following variables have been used: The dummy variable `INCEN-TIVE_ASP` is set to 1, if the agencies have mentioned in their complaints that the merger would lead to less innovation incentives. We considered this condition as fulfilled whenever the agencies either explicitly referred to decreased innovation incentives (by using the exact wording), or by relying on reasons which can still be considered as arguments in line with the theory about innovation incentive aspects (e.g. that “[...] innovation competition among producers [...]”¹⁹ will be lessened, or that it will lead to a ‘slowdown’ in the pace of innovation²⁰). For our descriptive statistics we also investigated whether the agencies have used arguments in their complaints that can be associated with diversity aspects. We regarded an argument as driven by diversity considerations, whenever the agencies either claimed that the merger will lead to a ‘reduction or redirection’ of research and development tracks²¹, or when they highlighted the relevance of the preservation of a number of independent entities for future innovations²². However, there were also some cases in which the agencies used both kinds of arguments. If, in addition to claiming negative innovation effects, the agencies have also claimed explicitly static price effects on the same markets, then the dummy variable `EXPL_STATICCON` is set to 1, otherwise 0. Our independent variables `FTC` and the time period `D04-08` are the same as in the sections 2 and 3.

¹⁹ *Ciba-Geigy Ltd.*, 123 F.T.C. 842, at 851 (1997).

²⁰ See, e.g., *United States v. Halliburton Co.*, Civ. No. 98-2340 (D.D.C. complaint filed Sept. 29, 1998).

²¹ See, e.g., *The Upjohn, Co.*, 121 F.T.C. 44 (1996); *Glaxo plc*, 119 F.T.C. 815(1995); *Ciba-Geigy Ltd.*, 123 F.T.C. 842, at 851 (1997); *Hoechst AG/Rhone-Poulenc S.A.*, Docket No. C-3919 (consent order issued January 18, 2000).

²² See, e.g., *United States v. Lockheed Martin Corp.*, Civ. No. 98-00731 (D.D.C. complaint filed March 23, 1998).

4.3 Results

Table 7: Theories and reasonings in the competitive assessment analysis

	Σ		FTC + DOJ				Σ FTC		Σ DOJ		FTC				DOJ			
	95-'08		95-'03		04-'08		95-'08		95-'08		95-'03		04-'08		95-'03		04-'08	
	total	%	total	%	To- tal	%	total	%	total	%	total	%	total	%	total	%	total	%
markets with innovation incentive arguments*	105	33%	73	29%	32	44%	67	31%	38	36%	45	28%	22	39%	28	32%	10	59%
markets with diversity arguments*	23	7%	21	8%	2	3%	14	6%	9	9%	13	8%	1	2%	8	9%	1	6%
inconcrete reasonings*	210	65%	171	68%	39	53%	148	68%	62	59%	115	71%	33	59%	56	64%	6	35%
markets with static price concerns*	272	84%	204	82%	68	93%	168	77%	104	99%	117	72%	51	91%	87	99%	17	100%

Sources: Agency complaints. Years shown are fiscal years.

Note: The sum of the first three lines exceeds 100%, because in some cases the agencies mentioned both diversity and innovation incentive arguments.

* in % of the markets with innovation aspects (see Table 3)

The results of our descriptive statistics can be found in Table 7. Out of 323 relevant markets, on which negative effects on innovation have been claimed, the agencies have mentioned innovation incentive arguments for 105 markets (32.5%). FTC and DOJ mentioned diversity-related arguments for only 23 markets (7%). Since for the period D04-08 our sample contains only 2 markets (FTC: 1 and DOJ: 1), this might be a sign for a decline of the use of diversity arguments (but we cannot test this econometrically due to too few observations). A very important result is that in 65% of the relevant markets the agencies have not given any specific reasoning how the mergers might lead to negative effects on innovation. This encompasses both cases, in which innovation was used in the market definition and only a general claim of anticompetitive effects has been made, as well as cases, in which negative effects on innovation were claimed in the anticompetitive effects but without giving any specific arguments (as, e.g., innovation incentives).

Comparing the agencies, the DOJ has given more specific reasonings than the FTC, although even the share of the DOJ is still rather low (DOJ: 41%; FTC: 32%). Over time an increase of explicit reasonings can be observed (95-03: 32%; 04-08: 47%). But even in the latter period the share of markets without clear specific arguments is still over 50%. In contrast to this, it is noteworthy that in over 80% of markets with innovation concerns (84%) the agencies have

also claimed explicitly static price effects. A closer look reveals that particularly the DOJ has nearly always (99%) also claimed static price effects (while the FTC did so in 77% of the markets with innovation aspects). Moreover, the overall percentage of markets with claims about static price effects has increased from the first to the second period (95-03: 82%; 04-08: 93%).

Table 8: Probit Regression: Markets with innovation incentive arguments

INCENTIVE_ASP	Probit 8.1	Probit 8.2	Probit 8.3	Probit 8.4
FTC	-0.341 (0.42)	-	-0.423 (0.35)	-0.326 (0.54)
D04-08	-	0.715 (0.06)	0.790 (0.05)	1.479 (0.00)
FTC*D04-08	-	-	-	-0.914 (0.34)
FTC Classes	YES	YES	YES	YES
RDEXP/EMPL	4.79e-12 (0.79)	-5.40e-12 (0.76)	-6.34e-12 (0.71)	-2.82e-12 (0.47)
Constant	0.207 (0.43)	0.2342 (0.47)	0.449 (0.15)	0.309 (0.86)
Pseudo R ²	0.07	0.09	0.10	0.10
Log Pseudolikelihood	-144.66	-142.52	-140.67	-139.97
Obs	252	252	252	252

Note: p-values given in parentheses. All values are calculated using robust and clustered standard errors.

Although the descriptive statistics might suggest that the DOJ uses a bit more often innovation incentive arguments than the FTC, the regression results (see Table 8; marginal effects in Table A-6) confirm our hypothesis H. 3.1a claiming that there are no differences in regard to the use of innovation incentive arguments between both agencies. Possible differences are not statistically significant when controlling for other impacts. We also found a statistically significant positive impact of the time period D04-08 on the use of innovation incentives arguments (confirming the hypothesis H. 3.2a). Again RDEXP/EMPL is not statistically significant at any usual level.²³

²³ Note that we also empirically tested for markets with inconcrete reasonings. However, in these regressions we did not obtain any significant results. Hence, although the descriptive observations have suggested that the DOJ made less unspecific arguments than the FTC and that the share of inconcrete claims of negative innovation effects is furthermore slightly falling in the second period, we did not find econometric evidence for these descriptive results.

Table 9: Probit Regression: Markets with static price effects arguments

EXPL_STATICCON	Probit 9.1	Probit 9.2	Probit 9.3
FTC	-2.515 (0.00)	-	-2.588 (0.00)
D04-08	-	-0.018 (0.91)	0.595 (0.00)
FTC Classes	YES	YES	YES
RDEXP/EMPL	7.96e-11 (0.01)	5.36e-11 (0.00)	6.69e-11 (0.00)
Constant	0.586 (0.00)	-1.173 (0.00)	1.023 (0.00)
Pseudo R ²	0.37	0.21	0.38
Log Likelihood	-64.30	-80.52	-63.51
Obs	171	171	171

Note: p-values given in parentheses. All values are calculated using robust and clustered standard errors.

Quite interesting results emerged from our analysis of the hypotheses about static price effects (see Table 9). The FTC claimed significantly less often static price effects than the DOJ in markets where they also claimed innovation concerns (rejection of hypothesis H. 3.1b). Given the marginal effects at the sample means reveals that the probability that the FTC claims also static price effects is about 20% lower compared to the DOJ (for the marginal effects see Table A-7). The results about changes over time have to be interpreted with some caution. D04-08 is only statistically significant in model 9.3. Following this result, static price effects were claimed more in the later period 2004-2008 than in the former one (1995-2003), which would confirm our hypothesis H. 3.2b. Marginal effects suggest a higher probability by about 9% in the period 2004-2008.²⁴ It is a surprising result that the innovation intensity of industries contributes significantly to the explanation of the use of static price effects but not to the use of innovation incentives.

5. Discussion and Conclusions

In our empirical study we analysed to what extent and how the U.S. antitrust agencies assessed potential negative innovation effects of mergers in the period from the emergence of the "innovation market analysis" in 1995 (as the first innovation-specific assessment ap-

²⁴ Note that we also tested for a possible interaction between the FTC and the D04-08 variables. However, the interaction term FTC*D04-08 was omitted due to collinearity.

proach) until 2008. The background is the still unresolved question how innovation effects of mergers should be assessed, and whether the traditional "product market approach" (or other approaches as the "potential competition" or the "future market" concept) are sufficient or the application of a more innovation-specific approach, as, e.g., the "innovation market analysis", is necessary. In this paper we did not intend to discuss this question (for a detailed discussion see Kern 2014), but wanted to analyze empirically the merger case practice of the DOJ and FTC in regard to innovation effects of mergers.

Our empirical study shows that the agencies claimed anticompetitive innovation effects in one third of all challenged mergers as a reason for intervention. The econometric results show neither significant differences between the first and second time period (1995-2003, 2004-2008) nor between the two agencies. Therefore, both the politically more directly dependent Antitrust Division of the DOJ and the more independent (and bipartisan) FTC have taken negative innovation effects of mergers into account to a similar extent. Overall, this supports the view that innovation was taken seriously (at least to a certain degree) in U.S. merger policy - despite the increasingly critical attitude to the "innovation market analysis" in the U.S. antitrust discussion. However, our study cannot contribute to the question in how many cases the agencies have erroneously not claimed negative innovation effects ("false negatives") or wrongly claimed innovation concerns ("false positive"). Such an ex-post case analysis of the assessment of innovation effects is still missing. However, the empirical result that the probability for innovation concerns being raised increases significantly with the innovation intensity of the respective industry supports the claim that innovation effects were taken stronger into account in more innovative industries. This indicates that, overall, the agencies might not have made too many mistakes.²⁵

Although both agencies claimed innovation concerns to a similar extent, our study found considerable differences between the FTC and the DOJ regarding the basic assessment approach. We could identify in our data set two different approaches which were applied to a different degree by the two agencies. Whereas the DOJ more often used a traditional approach, which defines markets according to the product market concept and considers innovation effects only in the competitive assessment, we also found a more innovation-specific approach (mostly at the FTC), which already considers research and development in the market definition and then asks about the competitive effects on these markets. Although we would not

²⁵ See also the empirical study of Park/Sonenshine (2012) from a slightly different perspective.

claim that this second approach is a direct application of the innovation market analysis, we view the rejection of a pure product market concept and the explicit inclusion of innovation in the market definition as a clear sign for an innovation-specific approach, which differs significantly from the traditional one. Since, overall, in nearly 70% of all markets with innovation concerns innovation was already used in market definition, the pure product market approach was applied less often than the more innovation-specific one. Even the DOJ used it in 41% of all markets with innovation concerns. Since our econometric results show that its overall use even increased during the investigation period, this innovation-specific approach seems to have gotten more support in the practice of the agencies over time.

At first sight, it seems to be a surprising result that we could not confirm our hypothesis that the innovation-specific approach was used more in regard to mergers in innovation-intensive industries, although innovation effects are more taken into account in those industries. This result can only be interpreted in that way that the agencies have different opinions about which approach is better suitable for assessing innovation effects generally but do not think that one is better suited for less innovative industries and the other more for more innovative industries. This picture of two different concepts gets a bit more blurred, if we take into account our results about the use of the number of innovating firms as a more innovation-specific measure for concentration compared to market shares and the HHI as concentration measures that are directly linked to the product market concept. Although we have a significant increase of the use of the number of firms from the first to the second sub-period, which would fit nicely to the general increasing use of an innovation-specific assessment approach, we found that it is the DOJ, which used the number of firms as concentration measure more often than the FTC, even though the DOJ relied stronger on the traditional product market approach.

A striking and worrisome result in regard to the reasonings of the agencies is that in the majority of markets, in which they claimed innovation concerns, they gave no specific reasons why the mergers might lead to negative innovation effects. We could also show econometrically that this does not improve from the first to the second time period. In those cases where they provided reasonings, innovation incentive arguments were most important (in a third of all markets with innovation concerns). This kind of reasoning is based upon well-established approaches in industrial economics, and also the innovation market analysis used these reasonings. In our empirical study we found that there are no significant differences between the

FTC and DOJ regarding their use, and the agencies also relied stronger on innovation incentive arguments during the second time period. The increasing use of innovation incentive arguments and the near disappearance of diversity arguments in the second period might be interpreted as the result of a greater cautiousness of the agencies through relying on a more well-established kind of theoretical reasoning.

Such a strategy of greater cautiousness might also be the explanation for another surprising and puzzling result, namely the very large and increasing share of markets, in which the agencies claimed simultaneously innovation concerns and static price effects. Theoretically, anti-competitive effects of a merger on innovation on the one hand and prices on the other hand are very different effects. Price effects of mergers can emerge in established product markets either as a consequence of unilateral effects (due to less competitive pressure) or of coordinated effects through a higher likelihood of successful price collusion - requiring in both cases to take a deeper analysis (e.g., a merger simulation or investigating the specific conditions for successful price collusion). This is, however, very different from any specific analysis regarding the impact of mergers on innovation incentives, particularly, if we take into account that the relevant competitors regarding innovation competition do not necessarily correspond to those of price competition on established product markets. However, our study shows that in 272 of 323 markets with innovation concerns, the agencies claimed both anticompetitive innovation and price effects of mergers. Here we also found significant differences between the agencies: The FTC found significantly less often static price effects in markets with innovation concerns than the DOJ. In fact, the DOJ nearly always claimed also price effects, whenever they claimed innovation concerns. In addition to that, the probability of claiming also price effects seems to have increased significantly from the first to the second period. This also implies that the share of markets, in which primarily negative innovation effects (without explicitly referring to price effects) have been claimed, has decreased considerably - at the FTC from 28% to 9%, whereas none could be found in the second period at the DOJ. Our interpretation of these results is that also due to the critique of the innovation market analysis, the agencies were getting increasingly cautious in challenging a merger without simultaneously claiming also static price effects. If such an interpretation is correct, then the DOJ had used such a strategy from the beginning, whereas the FTC increasingly embarked on such a cautious strategy during the investigation period.

Overall, the results of our study show clearly that the U.S. agencies have taken the analysis of innovation effects of mergers seriously. This is also supported by the fact that in a considerable number of cases settlements were made, in which the remedies explicitly focused on maintaining innovation competition, esp. in regard to mergers in the pharmaceutical industry (Carrier 2008, Kern/Kerber 2014). Here divestitures in regard to R&D projects played an important role with the explicit objective, to impede the reduction of the number of parallel research projects. However, we could not see a clear tendency towards a clarification of the assessment approach for innovation effects. Not only the still very large share of claims about innovation concerns without specific reasonings, but also the differences between the agencies about the applied approaches and the general tendency of greater cautiousness by relying more on traditional, well-established reasonings and the backing up of innovation concerns by simultaneously claiming static price effects are signs for the uncertainty of the agencies how to deal with innovation effects of mergers. This uncertainty also emerged in the U.S. antitrust discussion about the reform of the U.S. Horizontal Merger Guidelines (DOJ/FTC 2010). An analysis of this discussion shows that despite a broad consensus about the importance of assessing innovation effects, there is still a large uncertainty and a great reluctance in recommending innovation-specific assessment approaches (Kerber/Kern 2014 with more references). Despite this discussion, it is surprising how clearly the new U.S. Horizontal Merger Guidelines still stick to the old product market approach, with the consideration of innovation only in the competitive assessment part, because this contradicts to a large extent the practice of the agencies during our investigation period - with its wide-spread consideration of innovation already in the market definition, and the still existing U.S. Antitrust IP Licensing Guidelines of 1995 (with its explicit use of innovation markets) (Feng 2012).

There are a lot of questions for future research. An obvious question is whether the merger policies of the U.S. agencies in this regard have changed since 2008, e.g., due to a change of antitrust policy by the Obama Administration, or, whether due to the clear decision for the product market concept in the new Horizontal Merger Guidelines in 2010 the agencies changed their assessment approaches. In the same way, a parallel and comparative empirical study about the practice of the European merger policy would be very interesting, especially since they never officially used the innovation market concept but also assessed innovation effects of mergers (and sometimes in the same merger cases). However, most important is further research in regard to the still open question how an appropriate investigation frame-

work for assessing innovation effects of mergers should look like (in more detail Kerber/Kern 2014).

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APPENDIX

Table A - 1: The Sectoral Taxonomies

Nace	Industry	CrType	AcType	ApType	CuType	InnoType
10	Mining: coal, peat	TAD	ACQU	None	Low	Med-low
11	Mining: petroleum, gas	TAD	ACQU	None	Med	Med-low
14	Mining: other	Other	None	None	Low	Low
15	Food products, beverages	TAD	ACQU	FORM	Low	Med-low
16	Tobacco products	TAD	IR&D	FORM	Low	Med-low
17	Textiles	MCRE	IR&D	FORM	Med	Med-high
18	Wearing apparel, fur	Other	None	FORM	Low	Low
19	Leather, -products, footwear	Other	None	FORM	Low	Low
20	Wood, -products, cork	Other	ACQU	None	Low	Med
21	Pulp/paper, -products	MCRE	ACQU	FORM	Med	Med
22	Publishing, reproduction	TAD	ACQU	FORM	Low	Med-low
23	Ref. petroleum, nucl. fuel	MCRE	IR&D	PAT+	Med	Med-high
24	Chemicals	MCRE	IR&D	PAT+	High	Med-high
25	Rubber and plastics	MCRE	IR&D	PAT+	Med	Med-high
26	Mineral products	MCRE	IR&D	BAL	Med	Med-high
27	Basic metals	MCRE	IR&D	PAT+	High	Med-high
28	Fabricated metal products	MCRE	ACQU	None	Low	Med
29	Machinery, nec.	HCRE	HR&D	PAT+	High	High
30	Computers, office machinery	HCRE	HR&D	BAL	Med	High
31	Electrical equipment, nec.	HCRE	IR&D	PAT+	High	High
32	Communication technology	HCRE	HR&D	BAL	High	High
33	Precision instruments	HCRE	HR&D	PAT+	High	High
34	Motor vehicles, -parts	MCRE	IR&D	PAT+	High	Med-high
35	Other transport equipment	MCRE	IR&D	PAT+	Med	Med-high
36	Manufacturing nec.	MCRE	ACQU	BAL	Med	Med
37	Recycling	Other	None	None	Low	Low
40	Electricity and gas	TAD	ACQU	None	Low	Med-low
41	Water supply	TAD	None	None	Low	Med-low
51	Wholesale trade	Other	None	None	Low	Low
60	Land transport, pipelines	Other	None	None	Low	Low
61	Water transport	Other	None	None	Low	Low
62	Air transport	Other	ACQU	None	Low	Med
63	Auxiliary transport services	Other	None	None	Low	Low
64	Post, telecommunications	HCRE	ACQU	FORM	Med	Med-high
65	Financial intermediation	MCRE	ACQU	STRAT	High	Med
66	Insurance, pension funding	TAD	ACQU	STRAT	High	Med-low
67	Auxiliary financial services	Other	None	FORM	Low	Low
72	Computer services	HCRE	HR&D	STRAT	High	High
73	Research and development	HCRE	HR&D	PAT+	High	High
74	Other business services	MCRE	ACQU	STRAT	High	Med

Note: CrType—*HCRE*: highly creative firms with product (and process) innovations; *MCRE*: intermediate creative firms only with process innovations; *TAD*: adaptive firms with technology adoption; *Other*: adaptive firms pursuing opportunities other than from technological innovation. OpType—*HR&D*: high intramural R&D (>5% of firm turnover); *IR&D*: intramural R&D; *ACQU*: acquisition of new knowledge (R&D, machinery, patents, etc.); *None*: no innovation activities. ApType—*PAT+*: high use of patents and other measures; *BAL*: balanced use of various measures; *FORM*: other formal measures; *STRAT*: strategic means; *None*: no measures for appropriation. CuType—*High*: high cumulateness; *Med*: intermediate cumulateness; *Low*: low cumulateness of knowledge.

Source: Peneder (2010: 331)

Table A - 2: Variables description

Variables	Description
INNOV_CASE	Cases with innovation aspects
INNOV_DEF	Markets with innovation in market definition
INCENTIVE_ASP	Markets with innovation incentive aspects
DIV_ASPECTS	Markets with diversity aspects
EXPL_STATICCON	Explicit static effects in addition to innovation
UNCONVENTIONAL_CONC	No. of competitors as concentration measure
FTC	Accounts for the FTC/DoJ
D95-03	Time period 1 (FY 1995 - FY 2003)
D04-08	Time period 2 (FY 2004 – FY 2008)
HITEC 0	Industry was not a part of Peneder’s taxonomy
HITEC 1 („low“)	“Low” technology industries
HITEC 2 („med-low“)	“Med-low” technology industries
HITEC 3 („med“)	“Med” technology industries
HITEC 4 („med-high“)	“Med-high” technology industries
HITEC 5 („high“)	“High” technology industries
FTC CLASS 1	Retail
FTC CLASS 2	Professional Services
FTC CLASS 3	Food & Beverages
FTC CLASS 4	Energy
FTC CLASS 5	Hospitals/Clinics and Pharmacies
FTC CLASS 6	Consumer Goods
FTC CLASS 7	Cable TV
FTC CLASS 8	Chemicals/Industrial Gases
FTC CLASS 9	Defense
FTC CLASS 10	Industrial Goods
FTC CLASS 11	Information and Technology - Hardware
FTC CLASS 12	Information and Technology – Other
FTC CLASS 13	Medical Equipment/Devices
FTC CLASS 14	Prescription Drugs
FTC CLASS 15	Software/Databases
FTC CLASS 16	Professional Services – Other
RDEXP	R&D expenditures of the relevant industry
EMPL	Employment shares of the relevant industry

Source: Authors

Table A-3: Marginal Effects of Table 2

	Probit 2.1	Probit 2.2	Probit 2.3	Probit 2.4
FTC	-	0.0306	-	0.2894
D04-08	-	-	-0.0265	-0.0252
HITEC 1	0.8152	0.8137	0.8155	0.8169
HITEC 2	0.8800	0.8782	0.8808	0.8815
HITEC 3	0.8802	0.8787	0.8809	0.8816
HITEC 4	0.9864	0.9853	0.9868	0.9867
HITEC 5	0.9805	0.9797	0.9808	0.9809

Table A-4: Marginal Effects of Table 4

	Probit 4.1	Probit 4.2	Probit 4.3	Probit 4.4
FTC	0.1847	-	0.1920	0.1541
D04-08	-	0.1051	0.1150	-0.012
FTC*D04-08	-	-	-	0.1614

Table A-5: Marginal Effects of Table 6

	Probit 6.1	Probit 6.2	Probit 6.3	Probit 6.4
FTC	-0.3538	-	-0.4037	-0.4676
D04-08	-	0.3264	0.4082	n.s.
FTC*D04-08	-	-	-	0.5323

n.s.: not statistically significant

Table A-6: Marginal Effects of Table 8

	Probit 8.1	Probit 8.2	Probit 8.3	Probit 8.4
FTC	n.s.	-	n.s.	n.s.
D04-08	-	0.2663	0.2940	0.5384
FTC*D04-08	-	-	-	n.s.

n.s.: not statistically significant

Table A-7: Marginal Effects of Table 9

	Probit 9.1	Probit 9.2	Probit 9.3
FTC	-0.2048	-	-0.2184
D04-08	-	n.s.	0.0898
FTC*D04-08	-	-	-

n.s.: not statistically significant