



Széchenyi István University
Doctoral School of Regional Science and Economics

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Master of Science in Economics

Measuring Market Power Indirectly in the Insurance Market

PhD Thesis

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1. Research antecedents and motivation

I developed an interest in research and academic activity at a relatively young age. I was awarded first prize at the Scientific Student Conferences (TDK) held by Széchenyi István University in 2001 and 2003 where I also won a second prize and a special award at the national level in 2003. I wrote one of my TDK studies about analysing the concentration processes of the Hungarian insurance market which was also the subject of my MSc thesis for the insurance and finance specialization programme in 2004. This initial research has driven me to further study the application of market power measurement methods in the insurance market. Both my TDK activities and university studies were dominated by my interest in economic theory and financial markets with special respect to the insurance market.

In line with my interests and field of research, I focused on economic theory also in teaching. I taught macroeconomics as a fifth-year student and undergraduate assistant of the General Economics Department in 2004. I joined the PhD programme in the academic year 2005/2006 while working as an economist for the National Employment Office. Between 2006 and 2008 I worked as a PhD student for the Department of International Economics and Economic Theory of Kautz Gyula Faculty of Economics of Széchenyi István University where I was appointed to teaching assistant in 2008. I was driven back to the University by my love of teaching and scientific research.

I've been teaching economics and finance subjects including micro- and macroeconomics, international economics and its e-learning version, international insurance, corporate finance and public finance since February 2006 and I've also been involved in teaching personal finance, financial case studies and pro-seminars. In 2008, I developed the curriculum of subjects Market Theories and Price and Market Theory. I've been teaching these subjects and developing their curriculum since the academic year 2008/2009. I've been teaching Price and Market Theory also in English.

Market power measurement and analysis from the point of view of competition authorities and companies has been a key concept in the literature of the subjects Market Theories and Price and Market Theory. Consequently, these subjects as well as microeconomics are closely related to my field of scientific research and the subject matter of my thesis. It is a major research motivation for me that I can directly apply the gained knowledge in my teaching activities.

Besides teaching, I've also been involved in curriculum development and research projects managed by the Faculty, the Department of International Economics and Economic

Theory and its legal predecessor. Since February 2006, I've worked on six major research projects of which three were closely related to the subject matter of my thesis. My understanding of methodology and literature were greatly improved by projects titled "The Impact of Monetary and Fiscal Policy on the Insurance Market" and "The Financial Behaviour of Hungarian Households and Factors Shaping the Cost of Insurance" conducted in 2007. The project titled "Measuring Market Power Directly and Indirectly in the Insurance Market" sponsored by the Competition Culture Centre of the Hungarian Competition Authority in 2010 made a great contribution to my PhD thesis.

2. The objective and structure of the PhD thesis

This thesis has four key objectives. The *first one* is to provide a critical overview of literature on the methodology for indirectly measuring market power in the insurance industry. The *second one* is to analyse the market power of insurers present in the Hungarian insurance market using indirect methods. The *third one* is to analyse the use of indirect measurement methods in terms of the opportunities and limitations of their application and interpretation. The *fourth one* is to prove that using the pure Markov chain model in indirect measurements provides a more accurate view of market power than traditional indirect measures using the same data.

In the *first* chapter of my thesis, I present the key concepts and common indirect measures of market power and their application in the insurance market based on Hungarian and international literature. I describe the uncertainties related to indirect measurement concepts and methods, the limitations of their application and their implications for the insurance market.

The *second* chapter is about the practical application of the indirect measurement methodology described in the first chapter and the limitations of its application. After giving a definition for the market and describing it in economic terms, I calculate and evaluate the most common indirect measures of market power. I identify the factors that influence market concentration the most. I classify the Hungarian insurance market into theoretical market structure categories derived from oligopoly theories and I use these categories to assess market power, and I also evaluate whether this method enables a more accurate understanding of market power. After this, I deal with the interpretation limitations of indirect methods.

In the *third* chapter I present a common mathematical method used in other types of social science research suitable to improve the efficiency of traditional indirect methods of measuring market power. I demonstrate how the pure Markov chain model can be used to support the indirect analysis of market power.

The *fourth* chapter summarizes the conclusions of the thesis.

During the empirical application of indirect market power methods and the pure Markov chain model, I used the gross annual premium revenue and contract volume data of insurance companies in the period between 1999 and 2009. The data are based on the Hungarian Insurance Yearbook published by the Association of Hungarian Insurance Companies (MABISZ). The analyses were made using SPSS 15.0. and MS Excel 2010 software.

3. Hypotheses

The thesis evaluates the following seven hypotheses:

H1: Based on the traditional indirect measures of market power, competition increased in the insurance market in the period between 1999 and 2009. Competition increased in the life insurance market to a greater extent than in the non-life insurance market.

H2: The value of HHI (Herfindahl-Hirschman-index) was influenced by endogenous market factors to a higher extent than by exogenous factors in the period between 1999 and 2009.

H3: The classification of the insurance market into theoretical market structure categories gives a more accurate view of market power than traditional measures.

H4: The value of HHI doesn't clearly identify market structure which means that it has limitations in measuring market power.

H5: The data used for calculation and the market selected for the analysis have a significant impact on the measures of market concentration, that is, the existence of data and market effects can be proved.

H6: The data used for calculation and the market selected for the analysis have a significant impact on classification into market structure categories, that is, the existence of data and market effect can also be proved for market structure categories.

H7: Applying the Markov chain model to indirectly measure market power provides a more accurate view of market power than traditional indirect measures using the same data. This method enables a more in-depth analysis of market structure and the prediction of transition processes.

4. Methodology used to verify the hypotheses

The logical curve of this PhD thesis is based on the above described seven hypotheses that were verified using the following methodologies.

Testing the *first hypothesis* I calculated the market shares of insurers and market concentration based on insurers' gross annual premium revenue and contract volume data. Calculating market concentration I used three concentration measures commonly used by international competition authorities and in Hungarian and international literature: the two-firm concentration ratio (hereinafter referred to as CR(2)), the five-firm concentration ratio (hereinafter referred to as CR(5)), and the Herfindahl-Hirschman index (hereinafter referred to as HHI). To estimate barriers of entry, I used the ratio of the change in the number of market players to the total number of market players as an indirect measure. In terms of concentration analysis methodology, I relied on the works of Bain [1951], Schmalensee-Willig [1989] and Motta [2004], as well as the available rich Hungarian and international industrial organization literature.

The *second hypothesis* was tested with regression analysis. In the analysis, I divided explanatory variables into endogenous and exogenous explanatory variables based on the idea of Klüver [2002]. I used the combined market share of the two largest firms and the number of firms in the market as endogenous explanatory variables and market demand as an exogenous explanatory variable. I used two predictor variables for market demand. One demand proxy was contract volume, representing demand in volume terms. The other proxy was gross annual premium revenue representing current demand in value terms (Hungarian forints). The first step in building the model was to analyse the correlation between explanatory variables to avoid multi-collinearity. To eliminate heteroscedasticity, I took the natural logarithm of variables, and applied linear regression to analyse the relationship between the logarithms of such variables. I assessed the model's goodness of fit with an F-test and the appropriateness of explanatory variables with a t-test. The normality of distribution of error components was tested using the Kolmogorov-Smirnov test. In terms of the used statistical methods, I relied on the works of Hunyadi-Vita [2002], Hajdú [2003] and Sajtos-Mitev [2007] (just like when verifying the below hypotheses).

Testing the *third hypothesis* I classified insurance product markets into five market structure categories derived from oligopoly theories based on market shares calculated from insurers' gross annual premium revenue and contract volume data and the relationship of these market shares. In the analysis I assumed that the shift from the most concentrated

category (dominant firm) to a less concentrated one and more balanced market shares indicates a reduction in the market power of dominant firms and increased competition. Naming and operationalising categories I relied on Hungarian and international literature including OECD publications "Glossary of Statistical Terms" and "Glossary Of Industrial Organisation Economics and Competition Law", as well as the works of Schmalensee-Willing [1989] and Tirole [1988] and earlier empirical applications such as Dobson, W. P.–Waterson, M.–Davies, S. W. [2003], and Juhász-Seres-Stauder [2005].

Testing the *fourth hypothesis* I used the previously identified concentration values and market structure categories. Since HHI is the concentration measure most commonly used by international competition authorities, I focused on its analysis. Findings obtained from testing hypotheses H1 to H3 revealed that HHI, the concentration measure used in international competition law and particularly in authorizing mergers, may have significantly different values with the same theoretical market structure categories, and roughly identical HHI values may indicate different market structures and competition intensities. This finding led me to the fourth hypothesis. Testing this fourth hypothesis I used the methods of discriminant analysis and multinomial logistic regression because of the non-metric dependent variable (market structure category) and the metric independent variable (HHI). Normality was assessed using the Kolmogorov-Smirnov test, while variance homogeneity was verified by the Box's M test.

Testing the *fifth hypothesis* I used the method of variance analysis because analysing data and market effects I worked with non metrics-dependent variables (data type and market type) and metrics-dependent variables (concentration measures). The impact of the independent variable was verified by the F-test, while variance homogeneity was verified by the Levene test.

Testing the *sixth hypothesis* I applied the method of cross table analysis because the dependent (type of market structure) and independent (data type and market type) variables used in the analysis are non-metric variables. The statistical significance of the correlation between the dependent and independent variables was verified by Chi-square statistics and the likelihood ratio.

Testing the *seventh hypothesis* and discussing the theoretical mathematical model of Markov chains and their empirical application I relied mostly on the works of Adelman [1958], Karlin-Taylor [1985], Major [2008], Stokey-Lucas [1989], and Sydsaeter-Hammond [2006]. I studied the transitions between market positions, market structure and size

categories and I attempted to predict changes in market structure processes based on the transition likelihood matrices specified using the pure Markov chain model.

5. Findings of the PhD thesis

H1: *Based on the traditional indirect measures of market power, competition increased in the insurance market in the period between 1999 and 2009. Competition increased in the life insurance market to a greater extent than in the non-life insurance market.*

By traditional indirect measures of market power I mean the measures most commonly used in the methodology of competition authorities and in market power measurement literature including the market share(s) of the largest company (or companies), HHI, CR(2) and CR(5) whose threshold values critical for competition law are not governed by a consensus either in literature or in competition authority practice.

In European competition law, a market share permanently in excess of 25% is considered to be the critical value of the largest market player's market share, that is, an indication of dominant market power (dominant position). There are several approaches to the threshold values of HHI as well. According to the concept most common in theoretical literature, values permanently above 1,800 basis points are critical, values between 1,000 and 1,800 basis points indicate moderate market concentration, while values below 1,000 basis points suggest low concentration requiring no market intervention. For CR(2) and CR(5), critical values are 50% and 80%, respectively, above which leading companies have a dominant market power. For the purposes of evaluation these values were used.

In life insurance product markets including risk, composite, unit linked and other life insurance markets – other than the endowment insurance market –, the market shares of leading market players indicating a dominant position shrank and the market shares of follower companies increased which created a more balanced market structure in general. In life insurance product markets, leading market players tend to have a smaller market share than in non-life insurance markets. In the non-life insurance market and its product markets including retail, general liability insurance, corporate and other property insurance markets, the market shares of leading market players are around and above the threshold indicating a dominant position. These values remained above the critical threshold over a relatively long period between 1999 and 2009. The analysis of market shares indicates that competition is less intense in the non-life insurance market which gives the market leader a better chance to enforce monopolistic premiums.

Based on insurers' gross annual premium revenue data, the life insurance market and its product markets – except the endowment insurance market – have a declining

concentration which means that dominant positions got weaker and competition grew more intense. The high concentration values of contract volume, however, failed to decrease to the same high extent in the period under survey.

In the non-life insurance market and its product markets, HHI and closely correlated CR(2)/CR(5) values significantly declined but permanently exceeded the value considered as critical by competition authorities. The only exceptions are HHI and CR(2) calculated for the corporate property insurance market and CR(5) calculated for the market of other property insurance products. In the non-life insurance market there is a much smaller difference between the concentration values calculated based on premium revenue and contract volume data than in the life insurance market.

Overall, market concentration measures show a highly concentrated market which applies especially to non-life insurance product markets. Market shares, as well as the values of HHI, CR(2) and CR(5) measures calculated based on gross annual premium revenue and contract volume data indicate the dominant market power of leading market players especially in the non-life insurance market.

T1: *Traditional indirect market power measures show that the dominant power of market leaders decreased in the insurance market between 1999 and 2009 which indicates increasing competition from a structural aspect. In life insurance product markets, dominant positions are weaker and the values of indirect measures are closer to those accepted by competition authorities than in non-life insurance markets. Based on the findings, I confirm hypothesis H1.*

H2: *The value of HHI (Herfindahl-Hirschman-index) was influenced by endogenous market factors to a higher extent than by exogenous factors in the period between 1999 and 2009.*

I presented and evaluated market concentration using indirect measures HHI, CR(2) and CR(5). Of these measures, HHI is the one most commonly used in market theory literature and competition authority practice. It is vital to identify the factors having the greatest impact on HHI. My hypothesis is that the value of HHI is influenced by endogenous structural market processes to a higher extent than by exogenous factors. This hypothesis was verified using two regression models. One model focused on the analysis of variables specifying the concentration of gross annual premium revenue data, while the other focused on that of contract volume data.

The predictive variable influencing the concentration of gross annual premium revenue as measured in HHI to the highest (statistically significant) extent was the two largest companies' combined share of gross annual premium revenue (lnCR2_db_sz). If this value increases, HHI increases too, and if this value decreases, HHI decreases too. Of endogenous factors, the change in the number of companies (lnbsz) did not have a significant impact on the HHI value of gross annual premium revenue. Of exogenous factors (representing demand), both gross annual premium revenue (lnbdb) and contract volume (lnszerza) proved to be significant explanatory variables. Their impact on HHI, however, was smaller than that of the combined market share of the two largest companies.

Table 1
Factors influencing the HHI value of contract volume

	Non- standardized coefficients	t-value	Level of significance
(Constant)	3.995	8.785	.000
lnCR2_db_sz	0.967	12.839	0.000
lnbsz	-.094	-1.028	.307
lnbdb	-.074	-3.250	.002
lnszerza	.061	3.357	.001

a. Dependent variable: lnHHI_db

The concentration of contract volume as measured in HHI is influenced to the highest extent by the combined market share of the two largest companies based on contract volume (lnCR2_szá_sz). Of endogenous factors, the number of companies (lnbsz) didn't have a significant impact on the contract HHI. Of exogenous factors (representing market demand), both contract volume (lnszerza) and gross annual premium revenue (lnbdb) had a significant impact on HHI which was lower than that of the endogenous factor.

Table 2
Factors influencing the HHI value of contract volume

	Non- standardized coefficients	t-value	Level of significance
(Constant)	1.820	7.122	.000
lnCR2_szá_sz	1.453	28.947	.000
lnbsz	-.076	-1.786	.077
lnbdb	-.046	-3.636	.000
lnszerza	.054	5.503	.000

a. Dependent variable: lnHHI_szá

I studied the correlation of HHI and endogenous/exogenous factors for life and non-life insurance markets separately, and also for the individual product markets. Based on the results of correlation analysis, the value of HHI is influenced by the combined market share of the two largest companies as an endogenous factor to a higher extent than by exogenous factors.

T2: *Based on the results of the five-variable regression models considering all product markets established to test the hypothesis, as well as the separate correlation analyses of the life and non-life insurance markets, it is clear that the value of HHI was influenced by endogenous factor CR(2) more than by exogenous factors. The impact of the number of companies, however, was not higher than that of exogenous factors. **Based on the findings, I partly confirm hypothesis H2.***

H3: *The classification of the insurance market into theoretical market structure categories gives a more accurate view of market power than traditional measures.*

As a first step of testing the hypothesis, I operationalised market structure categories known from oligopoly theories (dominant company, duopoly, asymmetric oligopoly, non-concentrated market). After this, I classified every product market into these categories based on market players' market share and their relative size for every year in the period between 1999 and 2009. I evaluated the competitive situation of the individual markets based on the change and occurrence of the individual market structure categories. Based on the findings of the analysis, I reached the following four conclusions.

The *first* conclusion is that individual product markets can be classified into different market structure categories based on sales value and sales volume. Every product market – other than business and other property insurance markets – was classified into a less competitive market structure category based on contract volume for every year of the period under survey. Consequently, research findings confirm the earlier conclusion that the market is more concentrated based on contract volume. In this sense, market structure analysis *has confirmed* the information obtained through the use of traditional indirect measures.

The *second* conclusion is that market structures indicating a dominant market power occurred more frequently in non-life insurance product markets in the period under survey. This confirms the finding obtained when testing hypothesis H1 about the higher frequency of market situations indicating a dominant market power in non-life insurance product markets. In this sense, market structure analysis *has confirmed* the information obtained through the use of traditional indirect measures.

The *third* major conclusion is that a product market can have a balanced and competitive structure at a concentration value considered to be more critical from a competition law perspective. *On the one hand*, this highlights a contradiction between the interpretation and critical threshold values of indirect measures used in competition law and market structure categories derived from oligopoly theories. *On the other hand*, the findings also highlight that a deeper analysis is required to accurately assess the actual intensity of market competition. In this sense, market structure analysis *has complemented* the information obtained through the use of traditional indirect measures.

The *fourth* conclusion is that the limitations of market structure analysis should be considered. One limitation is that compliance with the individual categories largely depends on the pre-determined criteria. Another limitation is that similarly to traditional indirect measures, this method fails to identify companies in the first, second and other positions by name.

T3: *The assessment of compliance with theoretical market structure categories has partly confirmed and partly complemented (increased the accuracy of) findings obtained through the use of traditional indirect measures. However, this method fails to provide a more accurate view of market power in itself due to its limitations (e.g. sensitivity to category boundaries, failure to identify market players by name), but can be useful to complement traditional indirect measures. Based on the findings, I do not confirm hypothesis H3.*

H4: *The value of HHI doesn't clearly identify market structure which means that it has limitations in measuring market power.*

When verifying hypothesis H3, I found that the market structure derived from oligopoly theories can indicate lower market power even with a higher HHI value and it can indicate a dominant market power also with a lower HHI value. This finding led me to hypothesis H4.

To evaluate this hypothesis, I had to analyse the relationship of a non-metric dependent variable (market structure) and a metric independent variable (HHI). To analyse the relationship between such types of data, discriminant analysis and/or more robust logistic regression analysis should be used. In the latter case, the multinomial (polychotomous) version of regression analysis is to be applied because the number of dependent variable categories is more than two. During the analysis, I treated HHI values and theoretical market structure categories identified based on gross annual premium revenue and contract volume separately. The analysis was performed on two data sets. One data set covered the period between 1999 and 2006 with 72 variable elements each, while the other data set covered the period between 1999 and 2009 with 99 variable elements each.

In the analysis *involving all product markets*, the hypothesis was confirmed only for data calculated from gross premium revenue in the 1999 to 2006 period. In the other cases, that is for data calculated from contract volume for 1999 to 2006, and for data calculated from gross premium revenue and contract volume for 1999 to 2009, the hypothesis was not confirmed because the variance homogeneity condition was not met despite the fact the differences in average HHI values are clearly visible (*see table 38*).

Confining the analysis only to *life insurance product markets*, I virtually got the same result. For *non-life insurance product markets*, the hypothesis was confirmed only for gross premium revenue data for the 1999 to 2006 data set. For contract volume data, however, the hypothesis was confirmed for both data sets (*see table 38*).

In the course of the analysis, the variance homogeneity condition was not met on several occasions, therefore, the hypothesis was not confirmed for the total market using discriminant analysis. Therefore, I analysed the relationship between market structure categories and HHI also using the more robust method of multinomial logistics regression. Findings show that the rise in HHI value decreases the likelihood of getting from a dominant company category to categories with a more balanced market structure for both types of data. In the duopoly category, however, “ β ” coefficients, based on gross premium revenue data, are negative but not significant, the intercepts are not significant, and the Nagelkerke- R^2 values

range between 30% and 60% indicating moderate explained variance. This means that an increase in the value of HHI does not necessarily lead to transition to a more concentrated market structure category.

T4: *The analysis of the relationship between HHI and market structure categories revealed that HHI fails to clearly identify market structure. The market structure can include dominant positions with a lower HHI, and it can be more balanced with a higher HHI value. That is, HHI has limitations in measuring market power, therefore, the precise conditions of its application should be further studied. **Based on the findings, I confirm hypothesis H4.***

H5: *The data used for calculation and the market selected for the analysis have a significant impact on the measures of market concentration, that is, the existence of data and market effect can be proved.*

Hypothesis H5 is based on the findings of the concentration analysis prepared to verify H1, namely, that calculations based on gross premium revenue and contract volume data – that is, two sales-related data – can provide highly different concentration values for the same product market. The same analysis revealed that non-life insurance product markets have a higher level of concentration. The impact of the *data* used for the analysis is demonstrated by the fact that there is only a moderate relationship between HHI calculated based on gross annual premium revenue data and HHI calculated based on contract volume data for all product markets and for life and non-life insurance product markets. The same applies to CR(2) – which changes together with HHI. For CR(5), this relationship is stronger but the values calculated based on the two basic data are not fully correlated. There is a significant difference also in the concentration values calculated for life and non-life insurance markets.

The existence of data and market effects was verified using variance analysis because of non-metric independent and metric dependent variables. The analysis was performed based on two data sets also for H5. One data set covered the period between 1999 and 2006 with 72 variable elements each, while the other data set covered the period between 1999 and 2009 with 99 variable elements each.

Based on the findings of variance analysis, there is a verifiable *data effect* in the case of all three concentration measures used for measuring market power including CR(2), CR(5) and HHI. For CR(2), the data effect did not prove to be significant for the 1999 to 2009 data set, but it did prove to be significant for the smaller 1999 to 2006 data set. For the other two measures, the presence of the data effect was verified for both data sets.

The *market effect* was confirmed for HHI and CR(5) using a statistical method for the 1999 to 2009 data set, while it was confirmed for CR(2) on both data sets. Based on the findings of variance analysis on the 1999 to 2006 data set for HHI and CR(5), the market effect is not significant despite the fact that the average concentration values of non-life insurance product markets are clearly higher than those of life insurance product markets. In light of the findings, life and non-life insurance markets have different levels of concentration with the concentration level of the non-life insurance market being higher.

T5: *Data and market effects are present in market concentration measures. The analysis of the market effect revealed that in the Hungarian insurance market, gross annual premium revenue has a lower level of concentration than contract volume does. This also means that even those market players can realise a substantial gross premium revenue that have a lower contract volume. This is an indirect indication of increased competition for customers. In terms of methodology, this finding shows that calculating and interpreting market concentration based on both gross annual premium revenue and existing contract volume provides more information on market power and competition than calculating concentration based on gross premium revenue or contract volume alone. The existence of the market effect also serves as a proof for the higher concentration of the non-life insurance market, and the higher market power of leading players in the non-life insurance market. From a methodology perspective, it is also important that the market selected for the analysis has a significant impact on analysis results which confirms the vital importance of identifying the relevant product and geographical market and collecting the appropriate data. **Based on the findings, I confirm hypothesis H4.***

H6: *The data used for calculation and the market selected for the analysis have a significant impact on classification into market structure categories, that is, the existence of data and market effects can also be proved for market structure categories.*

Findings obtained from testing H3 confirm that there is a difference in the most frequent market structure categories depending on the data and market selected for the analysis.

Table 3
The most frequent types of market structure

Product market	1999-2009		1999-2006	
	Gross premium revenue	Contract volume	Gross premium revenue	Contract volume
Risk	DUO	AO	DUO	AO
Endowment	DC	AO	DUO	AO
Composite	AO	DC	AO	DC
Unit linked	AO	AO	AO	DUO
Other life	AO	DC	DC	DC
Retail	AO	AO	AO	DC
General liability	DUO	AO	DUO	AO
Corporate	DUO	AO	DUO	DC
Other property	DC	DC	DC	DC

DC: dominant company, DUO: duopoly, AO: asymmetric oligopoly

These results lead to the question whether the data and market used for the analyses have a significant impact on classification into market structure category.

The *data effect* can be identified using cross-table analysis because the dependent variable used in the analysis (type of market structure) as well as the independent variable (data used for the analysis) are both non-metric variables.

The Chi-square and likelihood ratio results of the cross-table analysis show that the selection of the basic data has a significant impact on classification into theoretical market structure categories based on both data sets (1999 to 2009 and 1999 to 2006).

The *market effect* can also be identified using cross table analysis. The Chi-square and likelihood ratio results of the cross-table analysis show a significant market effect only based on the 1999 to 2009 data set. This means that the difference in the frequency of different theoretical market structures clearly present in the life and non-life insurance markets in the 1999 to 2006 period cannot be considered as significant.

T6: *The presence of data and market effects can be verified also for theoretical market structure categories. The testing of the data effect revealed that the structure of individual product markets is more concentrated and has more dominant attributes based on contract volume than based on gross annual premium revenue. On the one hand, this means that smaller companies can acquire a major share from annual sales which is an indirect indication of increased competition and, therefore, is an important piece of information for the market as a whole. On the other hand, the presence of the data effect confirms that the*

*combined use of gross annual premium revenue and existing contract volume enhances the accuracy of conclusions when measuring market power using indirect measures. The market effect analysis also confirmed that dominant market structures are more frequent in non-life product markets. The presence of the market effect shows that using aggregate data covering the entire market in the analysis may conceal results important for the appropriate evaluation of market power. **Based on the findings, I confirm hypothesis H6.***

H7: *Applying the Markov chain model in indirectly measuring market power provides a more accurate view of market power than traditional indirect measures using the same data. This method enables a more in-depth analysis of market structure and prediction of transition processes.*

The analysis of the indirect measures of market power identified a contradiction between the individual indirect methods, and revealed that the information obtained through indirect measures is distorted by data and market effects. These methods fail to identify the individual market players by name which may conceal information vital for the evaluation of market power. The use of the pure Markov chain model is justified by its capability of providing the analyst with substantial extra information on market structure and market power using the same data as traditional indirect analysis (that is, gross annual premium revenue and contract volume data). Using this method, the likelihood of transitions between the market positions of leading players (categories established by company size) and theoretical market structure categories can be assessed. This model enables the dynamic analysis of market structure and the prediction of expected structural processes which may enhance the role of prevention at competition authorities.

The Markov chain model, however, has its limitations. The first one is the stationary condition that transition likelihood values do not change which supports prediction but reduces accuracy. Another limitation is that a specific number of market players is used to establish transition matrices. The next limitation observed during the empirical testing of the model is that the transition likelihood matrix is sensitive to category boundaries. The Markov chain model tends to overestimate categories with a higher weight (more players) and underestimate those with a smaller weight. Due to these limitations, the results obtained using traditional market power measures should also be considered.

T7: *Based on the analyses of the Hungarian insurance market, the Markov chain model provides a more accurate view of market power than traditional indirect measures using the*

*same data. Using the Markov chain model for indirect measurement enables a more in-depth analysis of the market positions of the largest companies, and that of transitions between market structure and size categories. As a result, it provides a more accurate understanding of market structure processes which is essential for analysing market power. The pure Markov chain model can be used also to predict structural processes in the market. Predictions are more accurate if they are based on gross premium revenue. Accuracy substantially deteriorates when increasing the time horizon of predictions. The improvement of accuracy requires further research. **Based on the finding, I confirm hypothesis H7.***

6. New scientific findings of the PhD thesis

The new findings of the PhD thesis are summarised as follows:

1. The thesis includes the first Hungarian language summary of market power measurement literature with a focus on the insurance market.
2. Calculation and analysis of indirect market power measures – market shares and the three measures of market concentration: CR(2), CR(5), HHI – for the Hungarian insurance market in the period between 1999 and 2009 and the evaluation of market power based on these indirect measures. I confirmed that traditional indirect market power measures show increased competition in the insurance market. Competition increased to a greater extent in the life insurance market and its product markets than in non-life insurance markets.
3. Identifying factors determining HHI values using the regression model. I proved that CR(2) is the endogenous market factor influencing HHI values the most.
4. Classifying the Hungarian insurance market into market structure categories derived from oligopoly theories in the period between 1999 and 2009, and analysing market power based on these categories. Comparing this method to traditional indirect measures.
5. I proved that the indirect market power measure most commonly used in literature and merger authorizations, that is, HHI-based market concentration fails to give an accurate view of market power and it doesn't unambiguously identify market structure. Market structure can be balanced or include dominant positions with both a low and a high HHI value.
6. Identifying new limitations and opportunities for the use of concentration analysis in the insurance market through evaluating and interpreting the impact of the selected data and market on the value of concentration measures. I verified that the values of market concentration measures significantly depend on the basic data and the market selected for the analysis, that is, both the *data effect* and the *market effect* apply. I also presented the implications of the verified existence of these effects on market power and competition intensity values, as well as on the theory and practice of measurement methodology.
7. Analysing and interpreting the effect of the data and market selected for the analysis on market structure categories. I presented the implications of the verified existence of these effects on market power and competition intensity values, as well as on the theory and practice of measurement methodology.
8. Evaluating the applicability of the Markov chain model in market structure analyses. I demonstrated that the pure Markov chain model provides a more accurate view of market power than traditional indirect measures even if data limitations apply, because the model

enables the analysis of internal structural dynamics and supports the prediction of market structure transitions.

7. Future research directions

In the future, I wish to conduct research in the following areas:

1. Rethinking and clarifying the fundamental concepts and systems of market power measurement methods
2. Further improving the indirect analysis of market power using stochastic models; extending research in the Hungarian insurance market to cover the insurance markets of other countries in Central and Eastern Europe
3. Understanding the models and analytical tools of behavioural economics and evaluate their applicability by competition authorities
4. Improving the business application of competition analysis methods of market theory

8. Publications and presentations on the subject

Publications

1. Kovács Norbert [2010]: Piaci részesedések eloszlásának előrejelzése Markov-modellel a biztosítási piacon. *In: Válság közben, fellendülés előtt, Kautz Gyula Emlékkonferencia elektronikus formában megjelenő kötete, (ISBN 978-963-7175-57-2)*
2. Kovács Norbert [2009]: Gépjármű-biztosítási tendenciák 1995-2006. *Biztosítási Szemle, LV. évfolyam, 1. szám, 27-37.o.*
3. Kovács Gábor – Kovács Norbert – Losoncz Miklós – Solt Katalin – Takács Dávid [2008]: A költségvetési és monetáris politika hatása az életbiztosítási piacra. *Külgazdaság, LII. évf., 60-74.o.*
4. Kovács Norbert [2007]: A magyar biztosítási piac szerkezetének átalakulása, *in: „Versenyképesség – Fejlődés – Reform”, CD-kiadvány, Sopron, (ISBN: 978-963-06-6387-8)*
5. Kovács Norbert [2007]: The Transition Of The Hungarian Insurance Market Structure In Market Economy, *in: "The problems of Ukrainian financial system development in the conditions of eurointegration", Lviv State University, 218-224.o.*
6. Kovács Norbert [2007]: A magyar biztosítási piac átalakulása 1986 után. *In: „20. századi magyar gazdaság és társadalom”, Konferenciakötet, Széchenyi István Egyetem, Kautz Gyula Gazdaságtudományi Kar, Győr, 483-491.o. (ISBN 978-963-7175-38-1)*
7. Kovács Norbert [2007]: A magyar biztosítási piac szerkezetének átalakulása. *In: Európai Integráció – Elvek és döntések I., II., Pannon Gazdaságtudományi Konferencia Tanulmánykötet I., 237-245.o. (ISBN 978-963-9696-29-7)*
8. Kovács Norbert [2007]: How to Analyze the Structure of the Insurance Market? ? *in: European Scientific Conference of PhD students, published on CD, Mendel University Brno (ISBN 978-80-903966-6-1)*
9. Kovács Norbert [2006]: Meghatározó-e a múlt a magyar biztosítási piac szerkezetében? *in: Apáczai Napok Tanulmánykötet I-II., NYME, Győr, 114-121.o. (ISBN 978-963-7287-18-3)*
10. Kovács Norbert [2006]: Versenyző biztosítási piac Magyarországon? *Biztosítási Szemle, LII. évfolyam, 3. szám, 31-42.o.*

11. Kovács Norbert [2006]: Piaci szerkezet és teljesítmény. Mérési módszerek és lehetőségek. *In: Tavaszi Szél 2006, Konferencia Kiadvány, 423-426.o. (ISBN 963 229 773 3)*
12. Kovács Norbert [2006]: Okozhat-e az aszimmetrikus információ instabilitást a biztosítási piacon? *In: Pénzügyi Stabilitás mikro, mezo- és makro szinten, Széchenyi István Egyetem, Kautz Gyula Gazdaságtudományi Intézet, Tudományos Füzetek, Universitas Kht., Győr, 191-213.o. (ISSN 1589-2697)*
13. Kovács Norbert [2005]: Biztosításverseny Magyarországon? *In: Széchenyi István Egyetem, Jog- és Gazdaságtudományi Kara, Multidiszciplináris Társadalomtudományi Doktori Iskola, Évkönyv, 191-201.o. (ISSN 1787-9698)*

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1. Kovács Norbert [2011]: The Application of Markov Chain Models in Indirect Measurement of Market Power. *Workshop on Stochastic Methods in Financial Markets Ljubljana*
2. Kovács Norbert [2011]: Biztosítástechnikai tartalékok válság- és versenykörnyezetben, *Széchenyi István Egyetem, Kautz Gyula Gazdaságtudományi Kara „Magyarország társadalmi-gazdasági helyzete a 21. század első évtizedeiben” c. konferencia*
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6. Kovács Norbert [2007]: A magyar biztosítási piac átalakulása 1986 után, *„20. századi magyar gazdaság és társadalom”, c. konferencia, Széchenyi István Egyetem, Kautz Gyula Gazdaságtudományi Kar, Győr*
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8. Kovács Norbert [2007]: How to Analyze the Structure of the Insurance Market? *European Scientific Conference of PhD students, Mendel University Brno*

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11. Kovács Norbert [2006]: Okozhat-e az aszimmetrikus információ instabilitást a biztosítási piacon? *Pénzügyi Stabilitás mikro, mezo- és makro szinten konferencia, Széchenyi István Egyetem, Kautz Gyula Gazdaságtudományi Intézet, Győr*

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2. Koppány Krisztián – Kovács Norbert [2011]: Fundamentális elemzés. *Széchenyi István Egyetem, (megjelenés alatt)*
3. Farkas Szilveszter – Kovács Norbert [2010]: Egyetemi és főiskolai hallgatók vállalkozói aktivitása Magyarországon. *In: 8th International Conference on Management, Enterprise and Benchmarking, June 4-5, 2010 Budapest, Proceedings, 277-287. p. (ISBN 978-615-5018-01-5)*
4. Dusek Tamás – Kovács Norbert [2009]: A Széchenyi István Egyetem hatása a helyi munkaerőpiacra. *In: A Virtuális Intézet Közép-Európa Kutatására (VIKEK) Évkönyve 2009. I. évfolyam, 1. szám., Kaposvár, 69-74.o.*
5. Losoncz Miklós – Kovács Norbert [2008]: The relationship between crude oil and natural gas prices, *in: World Commodity Prices 2008-mid 2010, Association of European Conjuncture Institutes, Louvain-la-Neuve, Belgium*
6. Kovács Norbert [2006]: Nemzetközi gazdaságtan, Széchenyi István Egyetem Felnőttképzési Központ, Győr

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