UNIVERSITY OF LJUBLJANA
FACULTY OF ECONOMICS

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THE IMPACT OF INDEBTEDNESS ON A FIRM'S PERFORMANCE: EVIDENCE FROM EUROPEAN COUNTRIES

DOCTORAL DISSERTATION

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The undersigned **Denis Marinšek**, a student at the University of Ljubljana, Faculty of Economics, (hereafter: FELU), declare that I am the author of the doctoral dissertation entitled **The impact of indebtedness on a firm's performance: Evidence from European countries**, written under supervision of **prof. dr. Marko Pahor,** and co-supervision of **prof. dr. Dušan Mramor**.

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THE IMPACT OF INDEBTEDNESS ON A FIRM'S PERFORMANCE: EVIDENCE FROM EUROPEAN COUNTRIES

SUMMARY

Theoretical explanation of firms' capital structures, i.e. the ratio between debt and equity in a firm's financing, has been a central issue in financial research for over 50 years. However, the factors that influence how decisions regarding capital structure are made remain elusive even after decades of numerous theoretical proposals and many performed empirical tests (Frank & Goyal, 2009). Lemmon et al. (2008) argued that an important question remains regarding why some firms seem to have persistently high leverage, while others always seem to have persistently low leverage, despite having many similar characteristics. However, despite the differences in indebtedness among firms, existing empirical research, performed mostly on American firms (e.g. Lemmon et al. (2008)), shows that in addition to the long-term leverage ratios persistence, there is also a strong convergence toward the target capital structure. Graham & Leary (2011) recently argued that even if convergence exists, there remains an open question as to which economic forces motivate within-firm movements of leverage. The next important question is thus why firms converge toward the target capital structure. In this doctoral dissertation I used an alternative statistical tool to explain the capital structure heterogeneity, i.e. multilevel linear modeling, and showed why it is more suitable than the existing methods. Then I checked whether convergence toward the target capital structure is present also among European firms. Finally, through the analysis of the impact of indebtedness on a firm's performance I answered what motivates these within-firm movements of capital structure.

In *Chapter 1* I chronologically depicted the most important papers in the field of the capital structure theory using citation and co-citation analysis. The literature review demonstrates that the *modern capital structure theory* developed from the *neoclassical theory of the firm*, which started in 1930s. In 1958, Modigliani & Miller developed the irrelevance theorem, which states that under certain (unrealistic) assumptions capital structure has no impact on a firm's value. The theorem was later modified with the inclusion of tax-deductibility of interest on debt that led to the conclusion that firm's value is maximized at 100 percent of debt financing. However, it became clear already in the 1970s that in addition to positive effects of debt, there are also negative. Donaldson (1961) argued that the main determinant of corporate debt capacity should be the probability of insolvency in times of recession, analyzed through cash flows. Similarly, Kraus & Litzenberger (1973) suggested that the best candidate for an offsetting cost of debt is a deadweight cost of bankruptcy. Researchers thus soon came to the conclusion that the capital structure must be relevant for a value of a firm. DeAngelo & Masulis (1980) were among the first researchers who clearly showed that each firm has a unique optimal capital structure. One of the most important contributions came from Jensen & Meckling (1976), who developed the *trade-off theory*. It formally defines factors that determine the optimal capital structure,

which can be reached by trading-off benefits and costs of debt. Lemmon & Zender (2010) summarized that the *trade-off theory* describes the firm's optimal capital structure as a mix of financing that equates the marginal costs to marginal benefits of debt financing. In parallel to the *trade-off theory*, Myers & Majluf (1984) developed the *pecking order hypothesis*, which prescribes the order of financing that would maximize a firm's value. Costs and benefits of debt are of secondary importance compared to the high costs that arise when a new equity is issued under the conditions of highly asymmetric information (Shyam-Sunder & Myers, 1999). Myers (1984) summarized that a firm is said to follow the pecking order if it prefers internal to external financing and debt to equity, when external financing is actually used. In 1960s, researchers started with empirical tests of capital structure, using various determinants predicted by both theories. More recently, Frank & Goyal (2008) concluded that the *target adjustment hypothesis*, which was developed from the *dynamic trade-off theory*, receives much better empirical support than either the *static trade-off theory* or the *pecking order hypothesis* do. Its main idea is that firms gradually converge toward the target capital structure, meaning that leverage exhibits partial adjustment mechanism so that deviations from the target are gradually eliminated over time. In 2002, Baker & Wurgler presented the *market timing theory*, which stated that observed capital structures are nothing but a result of firms' past market-to-book values.

In *Chapter 2* I showed that multilevel linear modeling (MLM) can successfully be applied to explain capital structure heterogeneity, and that it is a more suitable statistical tool than the regression techniques, which are typically used in financial studies. High intraclass correlation of firms operating within the same industry/country shows that there is a high cross-sectional dependency, which needs to be modeled through hierarchical structure. Additionally, I listed other advantages of MLM that can be very useful in many financial studies. In this chapter I presented a 4-level linear model (the first level is a firm-year observation, the second level is a firm, the third level is an industry, the fourth level is a country), which is developed on a large sample of firms from 25 European countries during the period 2005–2011. To explain indebtedness I used 10 explanatory variables of capital structure, measured at different levels. Moreover, I showed that separating within- and between-firm effects is crucial for correctly understanding the impact of the first level explanatory variables of observed capital structures. Frank & Goyal (2009) presented a comprehensive review of determinants that have significant power at explaining the capital structure heterogeneity of American firms, and found that industry median leverage, tangibility, profitability, firm size, and inflation are among the most reliable factors. I found that all of these factors have statistically significant explanation power also for European firms. The strong improvement in the model fit with the inclusion of random effects on the third and the fourth level demonstrates the importance of industry and country norms for capital structure analysis. Furthermore, I showed that profitability has a stronger between-firm effect, which means that more profitable firms need less external financing. I demonstrated that without separating within- and between-firm size effects, conclusions are extremely misleading. I showed that when comparing firms cross-sectionally by their average size (the between-firm effect) there are practically no differences in indebtedness. On the other hand, the within-firm increase in size reveals substantial leveraging – firms' expansions are largely financed with new debt. I further demonstrated that an increase in growth needs additional external financing (preferring debt over new equity) and that tangibility has a stronger between-firm effect, which highlights the importance of the average share of tangible assets: firms that operate with more tangible assets are able to use more debt. Moreover, I found that firms with a higher variability of operating income are supplied with less debt financing, and that public firms and firms producing unique products are less indebted. Finally, I found that management is more inclined to take new debt in times of stronger GDP growth and during periods of high inflation. Contrary to the results of the multiple regression model, MLM shows that the nominal corporate tax rate does not explain differences in indebtedness of European firms. In addition to the high importance of controlling for industry and country differences in indebtedness, I found that between-firm tangibility, within-firm size, between-firm profitability, probability of financial distress and within-firm growth are the strongest explanatory variables of the observed capital structure of European firms.

Kayhan & Titman (2007) concluded that there is a considerable disagreement about the importance of the concept of the target capital structure. They argued that it is intuitive to think about how trade-off between the costs and the benefits of debt financing leads to the optimum. On the other hand, it is also possible that near the optimum, the relationship between leverage and firm value is weak, so that the cost of deviating from the optimum is quite small. If that is the case, the idea of the target capital structure is much less important, and actual capital structures are likely to be influenced by transaction costs and market considerations that can temporarily affect the relative costs of leverage. However, my graphical analysis of micro level of firms in *Chapter 3* demonstrates that there is a universal pattern that within-firm leverage variation, defined either as a ratio of long term debt to total assets or as total financial debt to total assets, is directed toward the target capital structure. I showed that regardless of various classifications of firms into groups, both persistence and convergence are clearly evident; the same was found for American firms. Moreover, I can say that such pattern is apparent also for smaller, privately held firms. The separation of firms into different groups and comparing convergence speed before and during the crisis reveal the following conclusions. Contrary to the findings of Lev (1969), I found that medium-sized firms adjusted faster than large and very large firms. Furthermore, I showed that during the crisis, the speed of convergence fell. More importantly, the same general pattern of convergence, observed both before and during the crisis, shows that findings from my analysis are not time dependent. Finally, firms from the new EU member countries and firms from southern European countries exhibited faster leveraging dynamics during the period 2005–2011 than the rest of the sample. As a matter of fact, I showed that there is a statistically significant correlation between the observed and predicted movement toward the target capital structure, estimated with multilevel linear model. The analysis of the speed of convergence reveals that defining leverage as a ratio of long-term debt to total assets exhibits significantly slower adjustment speed than defining it as a ratio of total financial debt to total assets, which also includes short-term debt. This is consistent with Taggart (1977), who claimed that short-term debt plays an important role in absorbing short-run fluctuations in the external financing deficit. Furthermore, consistent with findings of Byoun (2008), the sample of European firms shows that above-target indebted firms are faster at adjusting than below-target indebted firms.

In *Chapter 4* I showed that firms which operate within the target capital structure range have a higher median average return on equity and a higher median average return on capital employed, compared to overleveraged firms. Underleveraged firms, on the other hand, demonstrate the highest profitability ratios. This partially confirms the hypothesis of Lev & Pekelman (1975) that a firm incurs costs whenever the debt-equity ratio is below or above the target. Higher profitability can be a strong motive for convergence toward the target capital structure for overleveraged firms. I further investigated which balance sheet and income statement categories are most influenced by convergence. I found that an increase in leverage facilitates growth of fixed assets – firms are sometimes unable to finance the growth internally and need external financing. According to the *pecking order hypothesis*, debt is preferred over new equity (controlling for firm's debt capacity), which well explains why least-indebted firms lever up. External capital helps these firms to facilitate growth and increase sales. On the other hand, the results show that highly leveraged firms experience the slowest sales growth, which has a strong theoretical grounding in Opler & Titman (1994). Firms that successfully decrease high leverage and move closer to the target capital structure significantly improve sales growth and net assets turnover, which ultimately results in an improved performance.

In this doctoral dissertation I showed that MLM can be successfully applied to the analysis of capital structure heterogeneity and is useful for estimating the target capital structures. I argued that this method can be applied also to other financial studies, and that separating within- and between-firm effect of explanatory variables is crucial. Similarly to American firms, European firms also converge toward the target capital structure. With an empirical analysis I came to the conclusion that the *target adjustment hypothesis* is most successful at explaining firms' capital structure dynamics, which is consistent with the findings of Frank & Goyal (2008). Finally, I demonstrated that firms which operate close to the target capital structure are more successful than firms that operate below or above their targets. Through the convergence toward the target, both low and high leveraged firms achieve an improvement in various aspects of performance.

VPLIV ZADOLŽENOSTI NA USPEŠNOST POSLOVANJA PODJETJA: ŠTUDIJA EVROPSKIH DRŽAV

POVZETEK

Razlaga strukture kapitala podjetja, tj. razmerje med dolgom in lastniškim kapitalom, je že več kot 50 let pomembno raziskovalno vprašanje na področju financ. Mnoge empirične študije so poskušale razložiti razlike v kapitalskih strukturah podjetij, vendar pa dejavniki ostajajo še vedno nepojasnjeni, kot ugotavljata Frank in Goyal (2009). Odprto namreč ostaja pomembno vprašanje, zakaj so nekatera podjetja visoko zadolžena, druga pa nizko, kljub temu da so si med seboj podobna (Lemmon in drugi, 2008). Kljub razlikam v zadolženosti pa ameriška empirična raziskava, ki so jo izvedli Lemmon in drugi (2008), dokazuje, da sta pri kapitalskih strukturah prisotna tako vztrajnost (bolj zadolžena podjetja ostajajo v povprečju bolj zadolžena daljše časovne obdobje, manj zadolžena podjetja ostajajo v povprečju manj zadolžena) kot tudi približevanje ciljni strukturi kapitala. Graham in Leary (2011) menita, da tudi če približevanje obstaja, ekonomski motivi zanj še vedno niso popolnoma pojasnjeni. Naslednje odprto vprašanje torej ostaja, zakaj se podjetja približujejo ciljni kapitalski strukturi. V doktorskem delu sem uporabil novo statistično metodo za pojasnjevanje raznovrstnosti kapitalskih struktur, tj. večnivojsko linearno modeliranje, in pokazal, zakaj je primernejše od obstoječih metod. Nato sem preveril, ali je približevanje ciljni kapitalski strukturi prisotno tudi med evropskimi podjetji, in s pomočjo analize vpliva zadolženosti na uspešnost poslovanja podjetja odgovoril, kaj so ekonomski motivi zanj.

V prvem poglavju sem uporabil analizo citatov in kocitatov (angl. Citation and Co-citation analysis), s pomočjo katere sem predstavil kronološki pregled najpomembnejših del s področja strukture kapitala. Analiza je pokazala, da se je sodobna teorija strukture kapitala razvila iz neoklasične teorije podjetja, ki ima začetke v 30. letih 20. stoletja. Leta 1958 sta Modigliani in Miller predstavila teorem, da ob množici nerealnih predpostavk struktura kapitala ne vpliva na tržno vrednost podjetja. Teorem je bil kasneje dopolnjen z vključitvijo obrestnega davčnega ščita, kar je privedlo do mnenja, da je vrednost podjetja maksimirana pri 100-odstotnem dolžniškem financiranju, vendar pa je že v 70. letih 20. stoletja postalo jasno, da ima dolg poleg pozitivnih učinkov tudi negativne. Donaldson (1961) je trdil, da mora biti verjetnost dogodka insolventnosti osrednji dejavnik pri izbiri stopnje dolžniškega financiranja. Podobno sta menila tudi Kraus in Litzenberger (1973), in sicer, da je koristi dolžniškega financiranja treba tehtati s stroški, ki nastanejo v primeru stečaja podjetja. Raziskovalci so tako kmalu ugotovili, da struktura kapitala vpliva na tržno vrednost podjetja. DeAngelo in Masulis (1980) sta bila med prvimi, ki sta jasno pokazala, da ima vsako podjetje enolično določeno optimalno strukturo kapitala. Pomemben je bil tudi prispevek Jensena in Mecklinga (1976), ki sta med drugim razvila teorijo tehtanja (angl. Trade-off theory), s pomočjo katere so raziskovalci določili dejavnike, ki vplivajo na optimalno strukturo kapitala. Osrednja ideja te teorije je, da je optimalna struktura kapitala

določena s tehtanjem med koristmi in stroški dolžniškega financiranja. Lemmon in Zender (2010) sta povzela, da teorija tehtanja opisuje optimalno strukturo kapitala kot mešanico financiranja, ki izenači mejne stroške dolžniškega financiranja z njegovimi mejnimi koristmi. Vzporedno sta Myers in Majluf (1984) razvila hipotezo vrstnega reda (angl. Pecking order hypothesis), ki predpisuje vrstni red financiranja, ki maksimira vrednost podjetja. Po tej hipotezi so koristi in stroški dolžniškega financiranja nepomembni v primerjavi s stroški, ki nastanejo ob izdaji novih lastniških vrednostnih papirjev v pogojih visoke stopnje asimetričnosti informacij (Shyam-Sunder in Myers, 1999). Myers (1984) je povzel, da podjetje sledi hipotezi vrstnega reda, če daje prednost notranjim virom financiranja pred zunanjimi, in dolžniškemu financiranju pred lastniškim, če je zunanje financiranje dejansko uporabljeno. V 60. letih 20. stoletja so raziskovalci začeli izvajati empirične analize strukture kapitala, pojasnjevalne dejavnike pa so iskali predvsem v omenjenih dveh teorijah. Frank in Goyal (2008) sta povzela, da hipoteza postopnega prilagajanja (angl. Target adjustment hypothesis), ki je nastala iz dinamične različice teorije tehtanja (angl. Dynamic trade-off theory), najuspešneje pojasnjuje dejansko obnašanje podjetij. Osrednja ideja te hipoteze je, da se podjetja postopoma približujejo svoji ciljni strukturi kapitala, kar pomeni, da so odstopanja pričakovana, vendar postopoma odpravljena. Poleg omenjenih teorij strukture kapitala je veliko zanimanja doživela tudi teorija tržnega načrtovanja (angl. Market timing theory), ki sta jo leta 2002 predstavila Baker in Wurgler, po njej pa je struktura kapitala le rezultat preteklih tržnih vrednosti delnice podjetja.

V drugem poglavju sem ugotovil, da je večnivojsko linearno modeliranje (angl. Multilevel linear modeling) ustrezno statistično orodje za analizo raznolikosti strukture kapitala, in da je primernejše od regresijske tehnike, ki se najpogosteje uporablja v finančnih študijah. Stopnja medsebojne odvisnosti med podjetji, ki poslujejo v isti panogi/državi, je namreč pokazala, da obstaja med njimi visoka stopnja odvisnosti, ki jo je treba ustrezno modelirati s pomočjo hierarhične strukture podatkov. Opozoril sem tudi na druge prednosti večnivojskega linearnega modeliranja, ki so lahko zelo uporabne pri analizi različnih finančnih študij. V tem poglavju sem uporabil štirinivojski linearni model (prvi nivo je posamično opazovanje podjetja, drugi nivo je podjetje, tretji nivo je panoga in četrti nivo je država), ki sem ga razvil na velikem vzorcu podjetij iz 25 evropskih držav v obdobju 2005–2011. Za razlaganje zadolženosti podjetij sem uporabil 10 pojasnjevalnih spremenljivk strukture kapitala, merjenih na različnih nivojih. Dodatno sem pokazal, da je pri pojasnjevalnih spremenljivkah na prvem nivoju treba ločiti dva vpliva: vpliv znotraj podjetja in vpliv med podjetji. Frank in Goyal (2009) sta naštela spremenljivke z visoko pojasnjevalno močjo pri analizi strukture kapitala ameriških podjetij. To so mediana zadolženosti panoge, stopnja otipljivih sredstev, dobičkonosnost, velikost podjetja in inflacija. Ugotovil sem, da vsi omenjeni dejavniki statistično značilno pojasnjujejo tudi razlike v strukturi kapitala evropskih podjetij. Močno izboljšanje modela ob vključitvi slučajnih vplivov na tretjem in četrtem nivoju kaže na pomembnost razlik med panogami in državami pri analizi strukture kapitala. Nadalje sem ugotovil, da ima dobičkonosnost močnejši vpliv med podjetji, kar kaže na dejstvo, da bolj dobičkonosna podjetja potrebujejo manj zunanjih virov financiranja. Velikost podjetja pokaže, da je vpliv velikosti med podjetji mnogo manjši kot vpliv znotraj podjetja. Razlike med zadolženostjo manjših in večjih podjetij so zelo majhne, medtem ko je povečanje velikosti podjetja v času povezano z visoko stopnjo dodatnega zadolževanja. Ugotovil sem še, da je povečanje stopnje rasti povezano z dodatnim zadolževanjem in da ima stopnja otipljivih sredstev močnejši vpliv med podjetji, kar kaže na pomembnost povprečne stopnje oprijemljivih sredstev: podjetja, ki poslujejo z višjo stopnjo oprijemljivih sredstev, lažje pridobijo dolžniško financiranje. Rezultati so razkrili, da imajo podjetja z višjo razpršenostjo operativnega dobička nižjo stopnjo zadolženosti in da so javna podjetja ter podjetja, ki proizvajajo trajne izdelke, manj zadolžena. Večnivojski linearni model je razkril, da se podjetja bolj pogosto zadolžujejo v času višje rasti BDP-ja in v času višje inflacije. V nasprotju z rezultati multiple regresijske funkcije, večnivojski linearni model pokaže, da nominalna stopnja davka na dobiček ne pojasnjuje razlik v zadolženosti evropskih podjetij.

Kayhan in Titman (2007) sta ugotovila, da obstaja visoka stopnja nesoglasja o pomembnosti koncepta ciljne strukture kapitala. Menita, da je intuitivno razmišljati o tem, kako tehtanje med koristmi in stroški dolžniškega financiranja vodi k ciljni strukturi, vendar pa je možno, da je blizu ciljne strukture povezava med stopnjo dolžniškega financiranja in tržno vrednostjo podjetja šibka, kar pomeni, da bodo stroški odstopanja dejanske strukture kapitala od ciljne relativno majhni. V tem primeru je ideja o ciljni strukturi kapitala mnogo manj pomembna, dejanska struktura pa bo odvisna od transakcijskih stroškov in tržnih razmer, ki začasno vplivajo na stroške dolžniškega financiranja. Grafična analiza mikroravni podjetij, ki sem jo izvedel v tretjem poglavju, dokazuje, da obstaja splošna težnja gibanja strukture kapitala k ciljni strukturi, ne glede na to, ali je zadolženost opredeljena kot dolgoročni dolg ali kot celotni finančni dolg v deležu celotnih sredstev podjetja. Kljub različnim razdelitvam podjetij v skupine sta tako vztrajnost zadolženosti na eni strani kot tudi približevanje ciljni strukturi na drugi strani jasno izraženi, enako, kot je bilo ugotovljeno za ameriška podjetja. Še več, enak vzorec sprememb v strukturi kapitala se pojavlja tudi med manjšimi, zasebnimi podjetji. Razdelitev podjetij v skupine je razkrila, da se v nasprotju z ugotovitvijo Leva (1969) srednje velika podjetja približujejo hitreje kot večja podjetja. Ugotovil sem, da je hitrost približevanja ciljni strukturi v času krize upadla, vendar pa je kljub temu iz analize razvidno, da obstaja enaka oblika približevanja v obeh obdobjih, kar še dodatno potrjuje zamisel o ciljni kapitalski strukturi. Ugotovil sem, da so se podjetja iz novih članic EU in podjetja iz južnoevropskih držav v analiziranem obdobju hitreje zadolževala kot preostala podjetja. Dokazal sem še, da obstaja statistično značilna povezanost med dejanskim in napovedanim premikom proti ciljni strukturi kapitala, ocenjeni s pomočjo večnivojskega linearnega modela. Analiza hitrosti približevanja je razkrila, da se celotni finančni dolg prilagaja ciljni strukturi hitreje kot samo dolgoročni dolg, kar je skladno z ugotovitvami Taggarta (1977), ki je trdil, da ima kratkoročni dolg pomembno vlogo pri kratkoročnih nihanjih finančnega primanjkljaja. V celotnem vzorcu evropskih podjetij se prezadolžena podjetja približujejo ciljni strukturi hitreje kot podzadolžena podjetja, enako, kot je pokazal Byoun (2008) za ameriška podjetja.

V četrtem poglavju sem ugotovil, da dosegajo podjetja, ki poslujejo blizu svoje ciljne strukture kapitala, višjo mediano povprečnega donosa na lastniški kapital (angl. ROE) in višjo mediano povprečnega donosa na celotni investirani kapital (angl. ROCE), kot prezadolžena podjetja. Podjetja, ki so podzadolžena, dosegajo najvišjo dobičkonosnost. To delno potrjuje hipotezo Leva in Pekelmana (1975), ki sta menila, da podjetje utrpi stroške, kadar je dejansko razmerje med dolžniškim in lastniškim kapitalom nad ali pod ciljno strukturo. Višja dobičkonosnost je tako lahko močan motiv, da se prezadolžena podjetja približujejo ciljni strukturi kapitala. Nadalje sem raziskal, na katere kategorije bilance stanja in izkaza uspeha vpliva takšno približevanje. Ugotovil sem, da zmerna zadolženost omogoča hitrejšo rast osnovnih sredstev – podjetja ne zmorejo vedno sama financirati svoje rasti, zato potrebujejo zunanja finančna sredstva, dolžniški kapital pa ima po hipotezi vrstnega reda prednost pred novimi izdajami lastniškega kapitala. Zunanji vir financiranja omogoča manj zadolženim podjetjem hitrejšo rast in povečanje prodaje. Ugotovil sem tudi, da visoko zadolžena podjetja dosegajo najpočasnejšo rast prihodkov, kar ima teoretično podlago v razpravi Oplerja in Titmana (1994). Podjetja, ki zmanjšajo zadolženost in se premaknejo proti svoji ciljni strukturi, bistveno izboljšajo rast prodaje in koeficient obračanja sredstev, kar se pokaže v izboljšanju uspešnosti poslovanja.

V doktorski disertaciji sem pokazal, da se model za razlaganje raznolikosti kapitalskih struktur in ocenjevanje ciljne kapitalske strukture lahko izboljša z večnivojskim linearnim modeliranjem, ki se ga lahko uporabi tudi v drugih finančnih študijah, pomembno pa je tudi ločevanje med vplivom pojasnjevalnih spremenljivk znotraj podjetja in vplivom med podjetji. Izkazalo se je, da se enako kot ameriška podjetja tudi evropska približujejo ciljni kapitalski strukturi. Z empirično analizo sem prišel do zaključka, da hipoteza postopnega prilagajanja najuspešnejše pojasnjuje finančno obnašanje podjetij, kar je skladno z ugotovitvami Franka in Goyala (2008). Na koncu sem pokazal, da so podjetja, ki poslujejo blizu svoje ciljne strukture kapitala, bolj uspešna, kot podjetja, ki so pod ali nad ciljno strukturo. S pomočjo približevanja ciljni strukturi dosežejo tako nizko kot visoko zadolžena podjetja izboljšanje uspešnosti poslovanja.

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INTRODUCTION

Theoretical explanation of firms' capital structures, i.e. the ratio between debt and equity in a firm's financing, has been a central issue in financial research for over 50 years. In 1958, Modigliani & Miller presented the hypothesis that under certain (unrealistic) assumptions capital structure does not affect a firm's value. Subsequent theories introduced more realistic assumptions and showed that capital structure affects the market value of a firm (e.g. Modigliani & Miller (1963), Hamada (1969), Rubenstein (1973), Miller (1977), Grossman & Hart (1982)). These findings led to the development of two major theories that attempt to explain the financing of firms: the *trade-off theory* and the *pecking order hypothesis*. The former is built on the idea that leverage boosts the risk adjusted return on equity (to a certain level of indebtedness), while the latter assumes that debt should be used after internal resources are exhausted to minimize the overall costs of issuing new equity (Kester, Hoover, & Pirkle, 2004). However, there are theoretical disagreements and inconclusive empirical findings regarding which of the two theories better explains observed capital structures. Fama & French (2002; 2005) argued that both theories have their strengths and weaknesses and that neither of them is able to fully explain a modern firm's capital structure. They continued that both theories should be used as supplements in explaining the capital structure decisions of firms.

Many empirical studies have attempted to test capital structure theories (e.g. Jensen & Meckling (1976), Taggart (1977), Ross (1977), DeAngelo & Masulis (1980), Leland (1994), Hovakimian et al. (2001), Kester et al. (2004), Liu (2005), Lemmon et al. (2008), Frank & Goyal (2008), Lemmon & Zender (2010)). However, studies have shown that modern capital structure theory and its empirical tests still insufficiently explain differences in firms' indebtedness (Črnigoj & Mramor, 2009). Therefore, the factors that influence how decisions regarding capital structure are made remain elusive even after decades of numerous theoretical proposals and many performed empirical tests (Frank & Goyal, 2009). Regardless of whether one takes a short-run or a long-run perspective, determinants of capital structure defined by the two prevailing theories appear to explain a relatively small fraction of the variation in leverage. For example, it was recently found that a firm's history is a more important determinant of the capital structure than a firm's characteristics that proxy the costs and benefits of debt financing. Traditionally used determinants alone (e.g. firm size, profitability, tangibility, etc.) explain approximately 16 percent of total variation, however, when including the firm's fixed effects, their explanatory power decreases to only three percent (Lemmon, Roberts, & Zender, 2008). This means that the traditional determinants explain the capital heterogeneity to a certain extent because they at least partially capture the time-invariant unobservable determinants of the capital structure.

Lemmon et al. (2008) argued that an important question remains regarding why some firms seem to have persistently high leverage, while others always seem to have persistently low leverage, despite having many similar characteristics. The reason can be traced back to

1961, when Donaldson argued that whether the person in power is either conservative or venturesome by nature will be one of the most important determinants of the amount borrowed by a firm. He wrote that the formal reason of acquiring new debt may follow rather than precede the financial decision (Donaldson, 1961). More recently, Bertrand & Schoar (2003) found that CFO fixed effects are highly correlated with leverage. The fact that the CFO's personality plays an important role in the capital structure decisions was corroborated by Graham et al. (2011).

In an attempt to better and more reliably explain the capital structure heterogeneity, I analyze firms' indebtedness over the period 2005–2011, using a sample of 8,777 firms from 25 European countries. I am not aware of any existing analysis on such a diversified dataset of European firms. I survey the theory and past empirical findings and develop a multilevel linear model for explaining capital structure decisions. It can be expected that firms operating within the same industry or the same country are similar to a certain extent, and thus not completely independent. Many researchers empirically showed that both industry and country norms importantly determine firms' capital structure dynamics (e.g. Stonehill & Stitzel (1969), Toy et al. (1974), Ferry & Jones (1979), Bradley et al. (1984), Frank & Goyal (2009), Ruah & Sufi (2010)). Since I analyze a large sample of firms, operating within 18 different industries and 25 European countries, many firms are clustered within the same group – they operate within the same industry and within the same country, which can importantly influence their behavior. Performing a regression analysis on such data, assuming that these observations are completely independent, can lead to biased results (Tabachnick & Fidell, 2012; Gelman & Hill, 2007).

An advanced regression technique, called multilevel linear modeling (hereafter MLM), is an elegant solution for the unmet assumption of independency of observations, because it assumes that units within the same group are more similar than they would be by chance (the presence of cross-sectional dependency). Further, the capital structure of each firm is observed over six years (from the year 2006 to the year 2011), so time-series dependency is present. Again, MLM allows nesting repeated measurements within the firm (longitudinal analysis). Based on the structure of the data, I thus decide to use MLM that accounts for cross-sectional and time-series dependency at the same time, the two forms of dependency very common in many financial studies. The former one is the dependency of residuals across firms in a given year – cross-sectional dependency (*unobserved time effect*), while the latter one is the dependency of residuals of a firm that is observed over the years – time-series dependency (*unobserved firm effect*). I additionally show that cluster confounding (i.e. separating within- and between-firm effects), as highlighted by Bartels (2008), should not be neglected when capital structure analyses are performed.

The determinants of capital structure are examined and findings are compared with recent research (e.g. Frank & Goyal (2009)). I show that results obtained by multiple regression analysis, which does not control for data hierarchy, can produce misleading conclusions. For example, the multiple regression model shows a statistically significant relationship between nominal corporate tax rate and leverage, while MLM reveals that there is no statistically significant relationship between the two. On the other hand, the multiple regression model indicates no statistical evidence that more profitable firms would be less indebted, while MLM does. Moreover, MLM reveals that in addition to the high importance of controlling for industry and country norms, the following variables have the highest power at explaining the capital structure of European firms: between-firm tangibility, within-firm size, between-firm profitability, probability of financial distress and within-firm growth.

Existing empirical research, performed mostly on American firms (e.g. Lemmon et al. (2008)), shows that in addition to the long-term leverage ratios persistence, there is also a strong convergence toward the target capital structure. I verify whether persistence and convergence also exist among European firms, and how they can be explained. Moreover, I analyze the speed of convergence of different groups of firms (e.g. old vs. new EU members), and check if this speed is influenced by the crisis that hit the European economy in 2008. Because the majority of the capital structure literature assumes, consistent with Modigliani & Miller (1958), that the capital supply is perfectly elastic (Graham & Leary, 2011), capital structures should be determined solely by corporate demand of debt. However, recent studies have challenged this assumption, suggesting that capital market segmentation and supply conditions significantly influence the observed capital structures.

Ultimately, I am interested in the reasons why firms actually converge toward the target capital structure. Graham & Leary (2011) recently argued that even if convergence exists, there remains an open question as to which economic forces motivate within-firm movements of leverage. I try to confirm the hypothesis of Lev & Pekelman (1975), who developed the idea that a firm incurs costs whenever its debt-equity ratio is below or above the target, and that these costs increase with the extent of the deviation from that target. Many researchers argued that excessive leverage negatively affects a firm’s performance (e.g. Saffieddine & Titman (1999), Fama & French (2002) and Jandik & Makhija (2005), Gonzales (2013)). For example, Opler & Titman (1994) found that, in times of economic downturn, highly leveraged firms are the first to lose their customers. Furthermore, Tan (2012) argued that the firms in the top leverage decile underperformed in return on equity compared to the rest of the firms. Additionally, he found that crises magnify the negative impact of leverage on a firm's performance. On the other hand, some researchers argued that the market value of a firm can be successfully increased through improved performance by moving from no-debt financing toward moderate leverage (e.g. Muradoglu & Sivaprasad (2009), Champion (1999)). Hadlock & James (2002) found that firms prefer debt financing in anticipation of a higher return, which was similarly argued by Lemmon & Zender (2010), who confirmed that debt appears to be preferred over equity, controlling for debt capacity limitations. Kortweg (2010) showed that 5.5 percent of a median firm value can be attributed to net benefits of debt, which means that firms that have too low leverage can successfully benefit by moving toward the target. Kortweg continued that net benefits of increased leverage grow for low leveraged firms but start decreasing when indebtedness becomes high, which supports the existence of the target capital structure. I try to determine which economic factors could motivate European firms to converge toward the target capital structure over the period 2005–2011. I consider differences in various aspects of a firm's performance by comparing the optimally indebted firms (close to the estimated target) with the under- and over-indebted ones, and by contrasting the firms which successfully converged toward the moderate indebtedness with those that remain high or low indebted during the observed period.

Based on the introduction I propose four main hypotheses, which will be tested throughout this dissertation:

1. The model for explaining capital structure heterogeneity and estimating the target capital structure can be significantly improved with multilevel linear modeling. Such modeling can be successfully applied to numerous other financial studies. Additionally, cluster confounding should be addressed.
2. The capital structure dynamics of European firms can best be described with the *dynamic trade-off theory*.
3. Firms within an optimal range of indebtedness (close to the target capital structure) perform better than their above- and below-target indebted peers – indebtedness thus affects a firm's performance. This can explain the presence of convergence toward the target capital structure.
4. The main reason why less indebted firms lever up is to support growth that cannot be financed internally, while the main reason why more indebted firms deleverage is to improve sales growth and efficiency.

Methodology and limitations

MLM is the main statistical technique used in this dissertation. It is an extension of regression analysis in which data is structured in more hierarchical groups and coefficients can vary among them. There are many motivations for using MLM. It is useful for analyzing treatment effects that vary among groups, it allows using all the data to perform inference for groups with small sample size, it importantly improves prediction, it allows controlling for structure of the data (e.g. cross-sectional dependency), it offers more efficient inference for regression parameters, it allows including explanatory variables on more levels, it improves the estimation of standard errors, it is suitable for unbalanced datasets, and it is not affected by missing observations (Gelman & Hill, 2007). As a supplementary statistical technique, non-parametric tests are used. All calculations are done with the statistical software SPSS (IBM Corp., 2012). The emphasis is also given on a graphical presentation of the data, which is performed with the statistical software R (Core Team, 2013; Wickham, 2009). Additionally, in *Chapter 1* I utilize citation and co-citation analysis with Bibexcel and Pajek software (De Bellis, 2009), while the dataset in *Chapter 2* is presented with various descriptive statistics.

Sample of firms is obtained from Amadeus Database (Bureau van Dijk, 2013). The procedure of preparing the dataset is precisely explained in *Subchapter 2.5*. The main limitation is the quality of the data. However, every effort has been made to get as representative and quality sample as possible. Additionally, because only firms with complete and consistent financial data during the analyzed period are included in the analysis, there can be a certain degree of survivorship bias.

Structure of dissertation

In *Chapter 1* I give an extensive overview of the capital structure theory. The overview starts with citation and co-citation analysis, which helps to determine articles that are the most influential in the analyzed area. After that, the *theory of the firm* and the *modern capital structure theory* are presented, most emphasis being given to the *trade-off theory* and the *pecking order hypothesis*.

In *Chapter 2* I present the theory of the target capital structure and describe the multilevel linear model for explaining capital structure heterogeneity and estimating the target capital structure. Then I present the dependent and explanatory variables and summarize the past empirical findings on how these determinants should impact the leverage. After that the process of acquiring data is explained and the dataset is explored with the descriptive statistics. The theory of MLM is elaborated and applied to my model. Finally, model is developed in six steps and results are explained and compared with other studies.

In *Chapter 3* I research the leveraging dynamics of European firms during the period 2005–2011. I graphically show the convergence of leverage ratios toward the target capital structure and address the leverage persistence. I also estimate the speed of adjustment numerically, contrasting it between different subgroups of firms. Findings are compared with the recent literature on this topic.

In *Chapter 4* I determine the effect of leverage on a firm's performance, measured with various indicators. I start the analysis by comparing the performance of firms that have their leverage close to the estimated target, with firms that are either above- or below-target indebted. At the end, I try to determine whether convergence toward the target capital structure is influenced by motives for improved performance.

The last chapter concludes and summarizes this doctoral dissertation.

1 CAPITAL STRUCTURE THEORY

In the first chapter I present the capital structure theory, starting with Modigliani and Miller's irrelevance theorem and then concentrating on two theories that attempt to explain the observed capital structure decisions. To determine the most influential articles, citation and co-citation analysis is performed.

1.1 Introduction

In 1958, Modigliani and Miller developed the hypothesis that, under certain unrealistic assumptions, capital structure does not affect a firm's value – The Modigliani-Miller irrelevance theorem (1958). Subsequent theories introduced more realistic assumptions and showed that the capital structure affects market value of the firm (e.g. Modigliani & Miller (1963), Hamada (1969), Hamada (1972), Rubenstein (1973), Miller (1977), Grossman & Hart (1982)). Findings led to the development of two major theories that attempt to explain the financing of firms: the *trade-off theory* and the *pecking order hypothesis*. Thereafter, many researchers tried to determine the target capital structure (e.g. Jensen & Meckling (1976), Taggart (1977), Ross (1977), DeAngelo & Masulis (1980), Fischer et al. (1989), Leland (1994), Leland & Toft (1996), Bolton & Scharfstein (1996), Leland (1998), Hovakimian et al. (2001), Kester et al. (2004), Liu (2005), Frank & Goyal (2009)). However, recent studies showed that modern capital structure theories still insufficiently explain the differences in firms' indebtedness (Črnigoj & Mramor, 2009), leading researchers to complement and improve the existing models.

Two other groups of research, both highly related to the capital structure theory, are the analysis of convergence of capital structure toward the target (e.g. Lev (1969), Taggart (1977), Marsh (1982), Jalilvand & Harris (1984), Auerbach (1985), Flannery & Rangan (2006), Lemmon et al. (2008), Byoun (2008), Oztekin & Flannery (2012), Faulkender et al. (2012)), and the empirical research on the impact of indebtedness on a firm's performance (e.g. Opler & Titman (1994), Tan (2012), Zuraidah et al. (2012), Gonzales (2013)). Hence, empirical research on capital structure concentrates on three topics: determining the factors that influence the target capital structure and explaining the observed heterogeneity, analyzing leveraging dynamics toward the target capital structure, and evaluating the impact of capital structure on a firm's performance. Since this doctoral dissertation connects all three topics, the theory is presented in the following way. *Chapter 1* explains the development of capital structure theory and gives a theoretical base for determinants that should affect the target capital structure. These determinants are then further discussed in *Chapter 2*, where variables, used in the multilevel linear model, are precisely defined. In *Chapter 3* the empirical findings on the convergence of debt ratios toward the target capital structure are overviewed, while *Chapter 4* highlights the theoretical and empirical research on the impact of leverage on a firm's performance.

Chapter 1 begins with the chronological overview of the main articles, published in the field of the capital structure theory. I performed citation and co-citation analysis, which uncovers articles that have been the most important and influential for the development of the capital structure theory.

1.2 Chronological overview of capital structure theory with citation and co-citation analysis

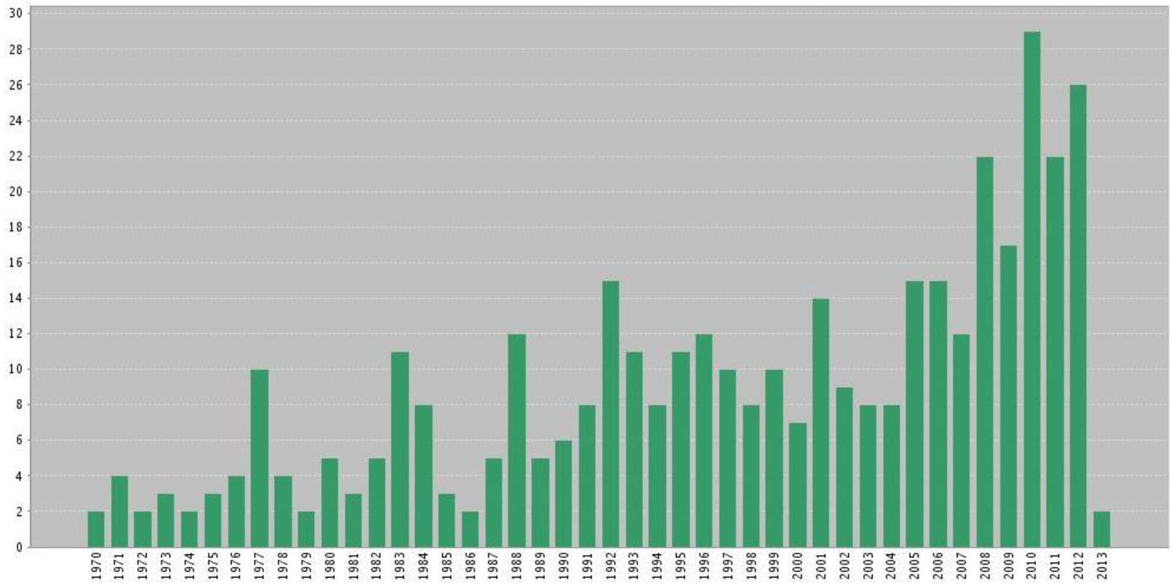
The literature overview begins with citation and co-citation analysis. This is a simple, yet powerful educational tool for detecting the most relevant articles from any research field. It can reveal connections among different schools of thoughts and offer greater objectivity as a result of the outcome of a composite judgment of many citing authors (White & Griffith, 1981; Bayer, Smart, & McLaughlin, 1990; De Bellis, 2009). Additionally, it helps to determine the most influential articles in the analyzed topic. For my analysis, I used the database of articles offered by ISI Web of Science (Thomson Reuters, 2013). That database consists of three citation sources: Science Citation Index Expended (SCI-Expended) for period 1970–present, Social Sciences Citation Index (SSCI) for period 1970–present, and Arts & Humanities Citation Index (A&HCI) for period 1975–present. At the time of downloading the database of articles, the last refresh of the database was on 22nd February 2013. The articles were found with the use of keywords. Out of all results, I retained only English articles from four Web of Science categories: Economics, Business Finance, Management, and Business. Further, I went through abstracts of all potentially interesting articles and excluded those that are not related to the capital structure theory. Finally, I kept 400 primary articles which are, in my opinion, the most relevant, and are the base for citation and co-citation analysis, presented in the following subchapters.

1.2.1 Citation analysis – the analysis of primary article

With the use of ISI Web of Science I gathered articles related to the capital structure theory. As a search inquiry I used the following keywords: "*Theory of capital structure*" or "*Modigliani-Miller theorem*" or "*Pecking order theory*" or "*Trade-off theory*" or "*Optimal debt level*" or "*Optimal leverage*" or "*Leverage and firm's performance*" or "*Financing decision*" or "*Target capital structure*" or "*Modern capital structure theory*". With this search inquiry I got 8,980 articles. However, I chose only articles from fields of Economics, Business Finance, Management, and Business, which reduced the database to 4,120 articles. Finally, these articles were checked for actual relevance and final analysis was performed on 400 primary articles that are the most relevant for my research.

Figure 1-1 shows distribution of 400 primary articles by year of publishing. The majority of articles were published more recently; however, also earlier published articles are not negligible. Even more, most crucial articles were published in the period 1970–1990. Number of published articles in the year 2013 is not directly comparable since only the first two months are included.

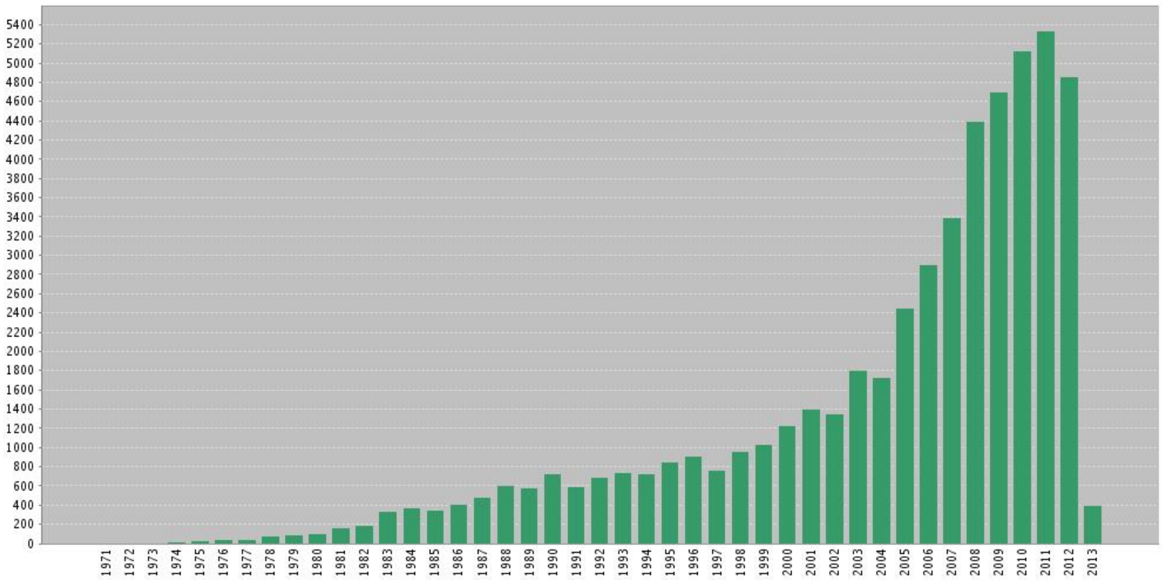
Figure 1-1: Distribution of primary articles by the year of publishing



Source: ISI Web of Science, 2013.

Figure 1-2 shows the citation frequency of 400 primary articles during the period 1971–Feb. 2013. Exponential trend is expected since more and more articles are cumulatively included in the sample as years go by, although in the period 2008–2012 the increase is quite significant. An average citation per article over the observed period is 132.39 and h-index is 90, meaning that there are 90 articles among 400 primary articles that have at least 90 citations.

Figure 1-2: Citation frequency of primary articles



Source: ISI Web of Science, 2013.

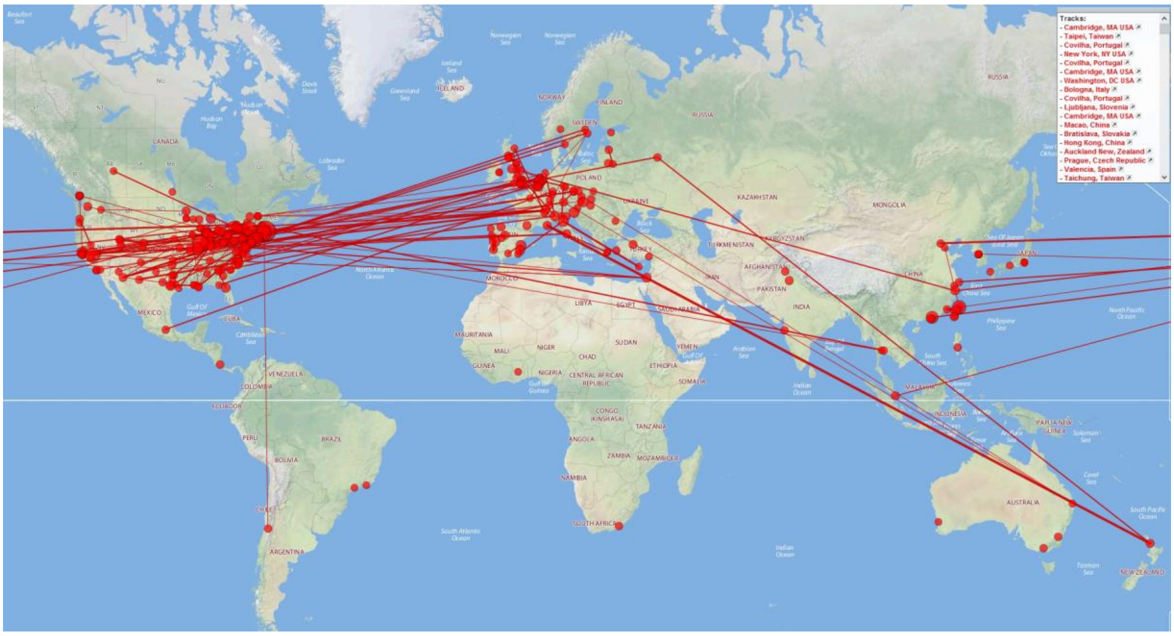
Next, I was interested where the majority of these articles was published and how researchers from different universities are connected. To do that, I extracted authors' addresses with Bibexcel software and utilize GPS Visualizer (Persson, 2009a). Geographical locations of researchers are shown in *Figure 1-3*.

Figure 1-3: Geographical locations of authors of primary articles

Source: ISI Web of Science, 2013.

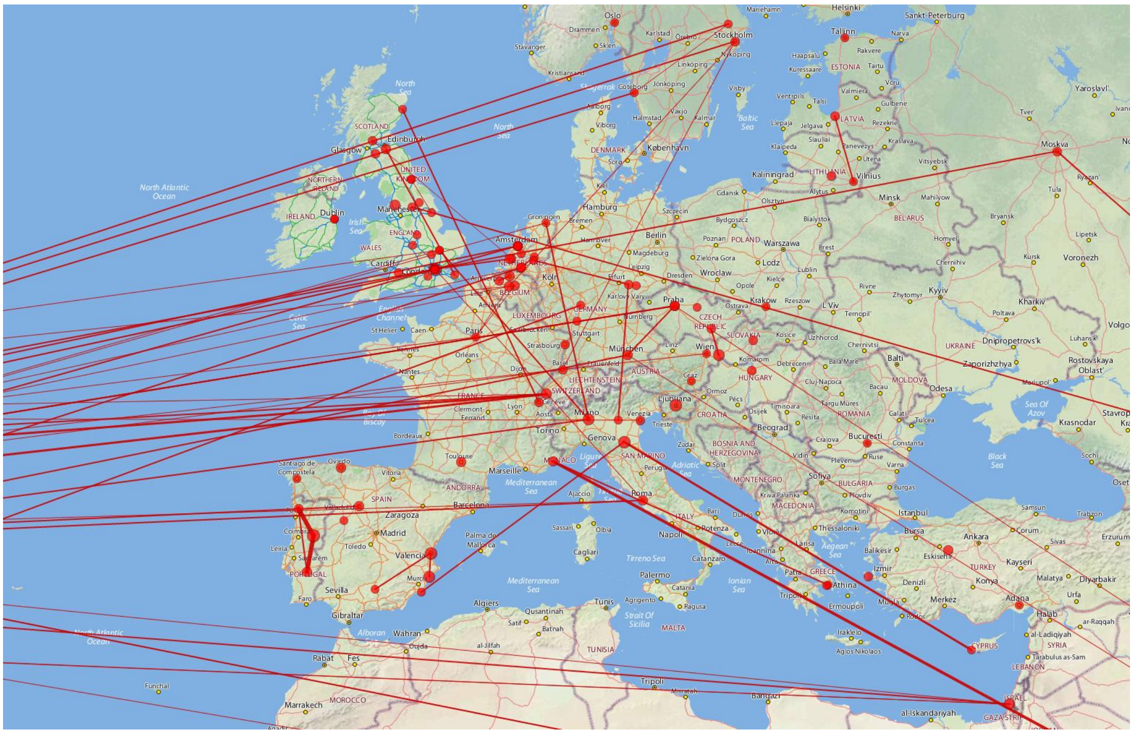
The next step was to connect researchers that are coauthoring articles together. *Figures 1-4* to *1-6* show these connections for the whole world and, in greater detail, for Europe and the United States.

Figure 1-4: Worldwide connections among authors of primary articles



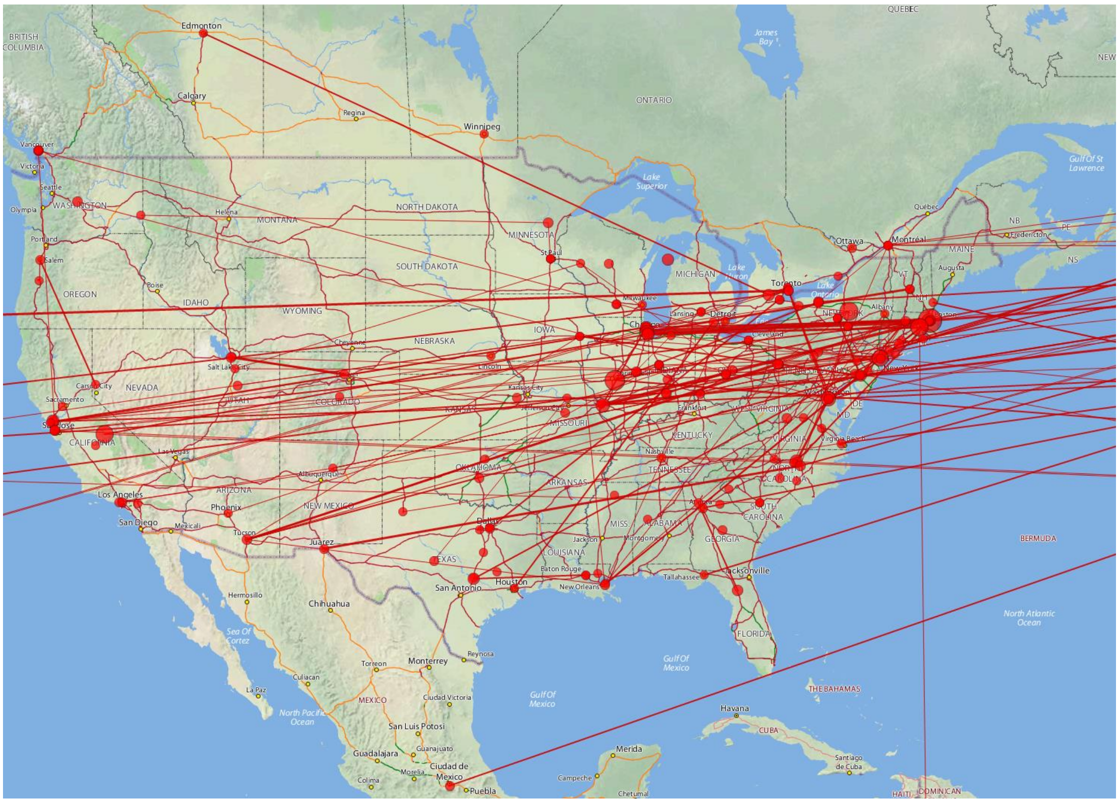
Source: ISI Web of Science, 2013.

Figure 1-5: Connections among authors of primary articles in Europe



Source: ISI Web of Science, 2013.

Figure 1-6: Connections among authors of primary articles in the United States



Source: ISI Web of Science, 2013.

As expected, the majority of research was done in the United States, more specifically in Cambridge (MA), Springfield (IL), New York (NY), Washington (DC), Berkeley (CA), and Chicago (IL). In Europe, articles were most often published in Covilha (Portugal), followed by Bologna (Italy), Valencia (Spain) and London (UK). Other important centers are in Taipei (Taiwan), Macao (China), and Hong Kong (China). Connections among researchers are quite dispersed with some stronger paths between Cambridge (MA) – Chicago (IL), Cambridge – St. Louis (MO), among three Portuguese cities, Monaco – Auckland (New Zealand) and Bologna (Italy) – Cyprus.

Next, I subdivided the analyzed period into five time sections: 1970–1979, 1980–1989, 1990–1999, 2000–2009 and 2010–2013. For each period, I listed most often cited articles among 400 primary articles. In *Tables 1-1* and *1-2* each period is presented separately.

Table 1-1: Most cited primary articles during the period 1970–1989

Period		Title	Authors	Journal	Year of publishing	Number of citations	Average citations per year
1970–1979	**1.**	Theory of the firm – managerial behavior, agency costs and ownership structure	Jensen, M. C. & Meckling, W. H.	Journal of Financial Economics	1976	7192	189.26
	2.	Production, information costs, and economic organization	Alchian, A. A. & Demsetz, H.	American Economic Review	1972	2673	63.64
	3.	Determinants of corporate borrowing	Myers, S. C.	Journal of Financial Economics	1977	1545	41.76
	4.	Informational Asymmetries, financial structure, and financial intermediation	Leland, H. E. & Pyle, D. H.	The Journal of Finance	1977	863	23.32
	5.	Debt and taxes	Miller, M. H.	The Journal of Finance	1977	627	16.95
	6.	Determinants of financial structure – incentive-signaling approach	Ross, S. A.	Bell Journal of Economics	1977	573	15.49
	7.	Bankruptcy costs – some evidence	Warner, J. B.	The Journal of Finance	1977	232	6.27
	8.	State-preference model of optimal financial leverage	Kraus, A. & Litzenberger, R. H.	The Journal of Finance	1973	164	4.00
1980–1989	**1.**	Separation of ownership and control	Fama, E. F. & Jensen, M. C.	Journal of Law and Economics	1983	2178	70.26
	2.	Corporate financing and investment decisions when firms have information that investors do not have	Myers, S. C. & Majluf, N. S.	Journal of Financial Economics	1984	2071	69.03
	3.	Agency problems and the theory of the firm	Fama, E. F.	Journal of Political Economy	1980	1667	49.03
	4.	Agency problems and residual claims	Fama, E. F. & Jensen, M. C.	Journal of Law and Economics	1983	693	22.35
	5.	The capital structure puzzle	Myers, S. C.	The Journal of Finance	1984	682	22.73
	6.	The determinants of capital structure choice	Titman, S. & Wessels, R.	The Journal of Finance	1988	537	20.65
	7.	Dividend policy under asymmetric information	Miller, M. H. & Rock, K.	The Journal of Finance	1985	452	15.59
	8.	The structure of ownership and the theory of the firm	Demsetz, H.	Journal of Law and Economics	1983	352	11.35

Source: ISI Web of Science, 2013.

Table 1-2: Most cited primary articles during the period 1990–2013

Period	No.	Title	Authors	Journal	Year of publishing	Number of citations	Average citations per year
1990–1999	**1.**	Law and finance	La Porta, R., et al.	Journal of Political Economy	1998	2355	147.19
	2.	Towards a knowledge-based theory of the firm	Grant, R. M.	Strategic Mng. Journal	1996	2243	124.61
	3.	A survey of corporate governance	Shleifer, A. & Vishny, R. W.	The Journal of Finance	1997	1500	88.24
	4.	Legal determinants of external finance	La Porta, R., et al.	The Journal of Finance	1997	1403	82.53
	5.	Property-rights and the nature of the firm	Hart, O. & Moore, J.	Journal of Political Economy	1990	967	40.29
	6.	Making knowledge the basis of a dynamic theory of the firm	Spender, J. C.	Strategic Mng. Journal	1996	838	46.56
	7.	Financial development and economic growth: Views and agenda	Levine, R.	Journal of Economic Literature	1997	711	41.82
	8.	What do we know about capital structure – some evidence from international data	Rajan, R. G. & Zingales, L.	The Journal of Finance	1995	624	32.84
2000–2009	**1.**	Investor protection and corporate governance	La Porta, R., et al.	Journal of Fin. Economics	2000	621	44.36
	2.	Estimating standard errors in finance panel data sets: Comparing approaches	Petersen, M. A.	Review of Financial Studies	2009	604	120.80
	3.	The theory and practice of corporate finance: evidence from the field	Graham, J. R. & Harvey, C. R.	Journal of Financial Economics	2001	468	36.00
	4.	Testing trade-off and pecking order predictions about dividends and debt	Fama, E. F. & French, K. R.	Review of Financial Studies	2002	253	21.08
	5.	Market timing and capital structure	Baker, M. & Wurgler, J.	The Journal of Finance	2002	244	20.33
	6.	Capital structures in developing countries	Booth, L. et al.	The Journal of Finance	2001	184	14.15
	7.	The value of corporate voting rights and control: A cross-country analysis	Nenova, T.	Journal of Fin. Economics	2003	180	16.36
	8.	The debt-equity choice	Hovakimian, A. & Opler T. & Titman S.	Journal of Financial and Quantitative Analysis	2001	178	13.69
2010–2013	**1.**	Sudden stops, financial Crisis, and Leverage	Mendoza, E. G.	American Economic Review	2010	22	5.50
	2.	The net benefits to leverage	Kortweg, A.	The Journal of Finance	2010	17	4.25
	3.	Human capital, bankruptcy, and cap. structure	Berk, J., et al.	The Journal of Finance	2010	17	4.25
	4.	Debt capacity and tests of capital structure theories	Lemmon, M. L. & Zender, J. F.	Journal of Financial and Quantitative Analysis	2010	11	2.75

Source: ISI Web of Science, 2013.

Next, *Table 1-3* shows frequency of authorships of 400 primary articles. The technique of assigning weights to authors assumes that if someone is the only author of the article, weight 1.00 is given, if there are 2 authors, each gets 0.50 weight, etc.

Table 1-3: Frequency by authors of primary articles with weight at least 1.50

w	**Name**	*w*	**Name**	*w*	**Name**
5.50	Graham, John R.	2.16	Serrasquerio, Zelia M.	2.00	Watts, Ross L.
5.00	Hart, Oliver	2.16	Morellec, Erwan	1.83	Smith, Clifford Jr.
4.16	Leland, Hayne E.	2.00	Scott, James H.	1.75	Vishny, Robert W.
4.00	Myers, Stewart C.	2.00	Zingales, Luigi	1.75	Shleifer, Andrei
3.83	Miller, Merton H.	2.00	Merton, Robert C.	1.50	Raviv, Artur
3.50	Taggart, Robert R.	2.00	Sogorb Mira, Francisco	1.50	Thakor, Anjan V.
3.33	Titman, Sheridan	2.00	Baron, David P.	1.50	Harris, Milton
3.00	Fama, Eugene F.	2.00	Berk, Ales	1.50	Demsetz, Herold
2.83	Modigliani, Franco	2.00	Jensen, Michael C.	1.50	Tirole, Jean
2.66	Kim, E. Han	2.00	Israel, Ronen	1.50	Williams, Joseph
2.50	Masulis, Ronald W.	2.00	Rajan, Rahurum G.	1.50	Warner, Jerold B.
2.50	Chang, Chun	2.00	Ross, Stephan A.	1.50	Psillaki, Maria
2.16	Hovakimian, Armen	2.00	Resek, Robert W.	1.50	Petersen, Mitchell A.
2.16	Nunes, Paulo J.	2.00	Zwiebel, Jeffrey	1.50	Bauer, Patrik

Source: ISI Web of Science, 2013.

In the last step I analyzed which are the most frequently cited references by 400 primary articles. *Table 1-4* shows the results.

Table 1-4: Most frequently cited references by 400 primary articles

f	**First author, year and publication**	*f*	**First author, year and publication**
169	Jensen M, 1976, V3, P305, J Financ Econ	49	Stulz R, 1990, V26, P3, J Financ Econ
144	Modigliani F, 1958, V48, P261, Am Econ Rev	48	MacKie-Mason J, 1990, V45, P1471, J Financ
141	Myers S, 1977, V5, P147, J Financ Econ	47	Frank M, 2003, V67, P217, J Financ Econ
136	Myers S, 1984, V13, P187, J Financ Econ	47	Marsh P, 1982, V37, P121, J Financ
122	Titman S, 1988, V43, P1, J Financ	46	Baker M, 2002, V57, P1, J Financ
117	Rajan R, 1995, V50, P1421, J Financ	44	Fischer E, 1989, V44, P19, J Financ
113	Jensen M, 1986, V76, P323, Am Econ Rev	42	Graham J, 2001, V60, P187, J Financ Econ
95	Myers S, 1984, V39, P575, J Financ	41	Titman S, 1984, V13, P137, J Financ Econ
85	Harris M, 1991, V46, P297, J Financ	36	Leary M, 2005, V60, P2575, J Financ
81	Modigliani F, 1963, V53, P433, Am Econ Rev	35	Welch I, 2004, V112, P106, J Polit Econ
80	Bradley M, 1984, V39, P857, J Financ	35	Booth L, 2001, V56, P87, J Financ
73	Miller M, 1977, V32, P261, J Financ	34	Kraus A, 1973, V28, P911, J Financ
73	DeAngelo H, 1980, V8, P3, J Financ Econ	32	Smith C, 1979, V7, P117, J Financ Econ
70	Shyam-Sunder L, 1999, V51, P219, J Financ Econ	32	Graham J, 2000, V55, P1901, J Financ
70	Fama E, 2002, V15, P1, Rev Financ Stud	31	Flannery M, 2006, V79, P469, J Financ Econ
67	Ross S, 1977, V8, P23, Bell J Econ	30	Leland H, 1977, V32, P371, J Financ
55	Hovakim. A, 2001, V36, P1, J Financ Quant Anal	30	Jalilvand A, 1984, V39, P127, J Financ

Source: ISI Web of Science, 2013.

The citation analysis reveals which authors and articles are the most influential in the field of the capital structure theory. The research of these authors will therefore be the base for building the theory. After analyzing the primary articles, I performed the analysis on the target articles, i.e. on the references of primary articles. That is the co-citation analysis.

1.2.2 Co-citation analysis – the analysis of target articles

Table 1-5 shows co-citations of articles among references within primary articles. In other words, that is the number of joint occurrence of target articles within the primary articles. Co-occurrence analysis, performed with the use of BibExcel software, is therefore the study of mutual appearances of pairs of units in analyzed bibliographic records (Persson, Danell, & Wiborg Schneider, 2009).

Table 1-5: Top co-cited references by 400 primary articles

f	**Reference 1 (First author, year and publication)**	**Reference 2 (First author, year and publication)**
95	Jensen M, 1976, V3, P305, J Financ Econ	Myers S, 1977, V5, P147, J Financ Econ
81	Myers S, 1977, V5, P147, J Financ Econ	Myers S, 1984, V13, P187, J Financ Econ
81	Jensen M, 1986, V76, P323, Am Econ Rev	Jensen M, 1976, V3, P305, J Financ Econ
78	Jensen M, 1976, V3, P305, J Financ Econ	Myers S, 1984, V13, P187, J Financ Econ
75	Jensen M, 1976, V3, P305, J Financ Econ	Modigliani F, 1958, V48, P261, Am Econ Rev
75	Rajan R, 1995, V50, P1421, J Financ	Titman S, 1988, V43, P1, J Financ
74	Jensen M, 1986, V76, P323, Am Econ Rev	Myers S, 1977, V5, P147, J Financ Econ
73	Myers S, 1984, V13, P187, J Financ Econ	Titman S, 1988, V43, P1, J Financ
71	Myers S, 1984, V13, P187, J Financ Econ	Rajan R, 1995, V50, P1421, J Financ
69	Jensen M, 1976, V3, P305, J Financ Econ	Titman S, 1988, V43, P1, J Financ
69	Modigliani F, 1958, V48, P261, Am Econ Rev	Myers S, 1984, V13, P187, J Financ Econ
68	Myers S, 1977, V5, P147, J Financ Econ	Titman S, 1988, V43, P1, J Financ
66	Myers S, 1977, V5, P147, J Financ Econ	Rajan R, 1995, V50, P1421, J Financ
64	Jensen M, 1986, V76, P323, Am Econ Rev	Myers S, 1984, V13, P187, J Financ Econ
63	Jensen M, 1976, V3, P305, J Financ Econ	Rajan R, 1995, V50, P1421, J Financ
58	Modigliani F, 1958, V48, P261, Am Econ Rev	Myers S, 1977, V5, P147, J Financ Econ
57	Jensen M, 1986, V76, P323, Am Econ Rev	Titman S, 1988, V43, P1, J Financ

Source: ISI Web of Science, 2013.

Authors, which co-occur together, are the base for the analysis of different schools of thoughts. Finally, *Table 1-6* shows the most important journals where target articles (i.e. all the references of 400 primary articles) were published. This can help as an orientation where further research on this topic can be published.

Table 1-6: Journals, which published the target articles

f	**Journal name**
2723	The Journal of Finance
2005	Journal of Financial Economics
746	American Economic Review
369	Review of Financial Studies
350	Journal of Political Economy
271	Journal of Financial and Quantitative Analysis
236	Financial Management
211	Quarterly Journal of Economics
210	Journal of Business
195	Bell Journal of Economics
184	Econometrica
131	Review of Economic Studies

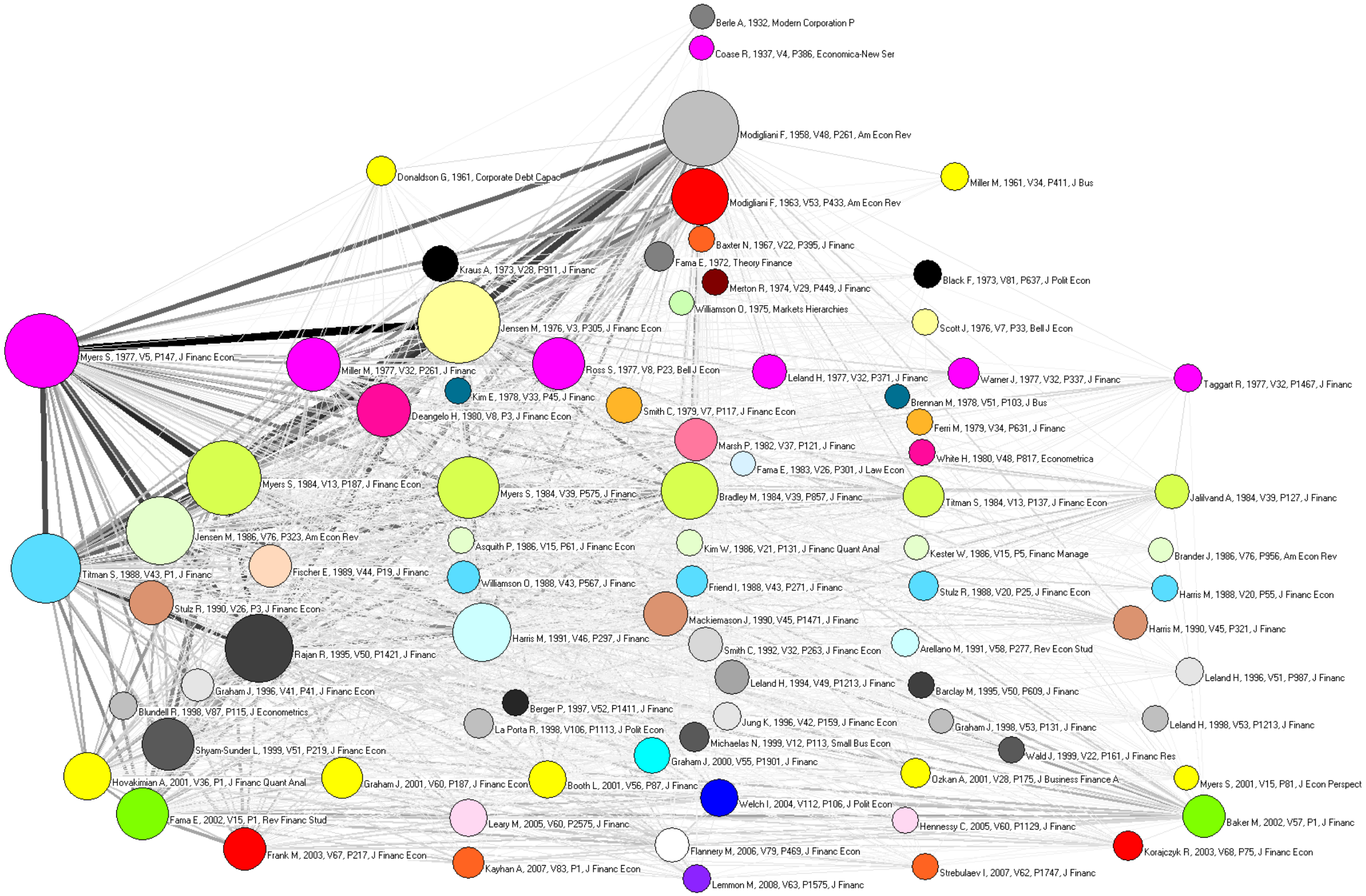
Source: ISI Web of Science, 2013.

With information gathered from citation and co-citation analysis, and with the help of Pajek software (Batagelj & Mrvar, 1998; Persson, 2009b), I presented 81 most important target articles, i.e. articles that were most often cited by primary articles (see *Figure 1-7*).

The size of the circle represents the importance of article by number of citations, while the thickness of lines among articles depends on the number of co-citations among them. Additionally, articles are presented in a chronological order from the earliest articles on the top of the figure to the most recent ones at the bottom (each year has a unique color). In *Subchapters 1.3* and *1.4* the theory of capital structure is presented by closely following *Figure 1-7*.

Figure 1-7: Chronological overview of most often cited articles and connections among them

A size of the circle represents the number of citations, while a thickness of lines among articles depends on the number of co-citations. Articles are presented in a chronological order from the earliest articles on the top of the figure to the most recent ones at the bottom (color labels a year).



Source: ISI Web of Science, 2013.

1.3 The neoclassical and modern theory of the firm

Capital structure theory emerged from the *neoclassical theory of the firm*, which began with Berle & Means (1932) and was continued by Coase (1937). On the basis of their work, two separate theories developed, both trying to explain what a firm is and how it operates. The first one is the *agency cost theory* that advocates a firm's existence because of its positive effects, created by team production. The second one is the *property rights theory* that concentrates on the contractual relationships within the firm. Grant (1996) summarized that both theories compete in offering a rival explanation of the same phenomena, and complement one another in explaining different phenomena.

The beginning of the *neoclassical theory of the firm* goes back to the 1930s, when Berle & Means (1932) defined two types of firms: the private corporation as a small-scale venture that is directly managed by its owners, and the large firm, called quasi-public corporation, with a dispersed ownership, which cannot efficiently operate due to two reasons. First, directors have a tendency to enrich themselves at the expense of the shareholders and second, ownership of firm's shares is not a private property because the classical definition of property involves a person managing his or her business. Berle & Means' book, named "Modern Corporation and Private Property", had in that time, right after the Great Depression of 1929, a big influence on legislation and public opinion (Hessen, 1983). Time magazine called it "The Economic Bible of the Roosevelt administration" because authors' reasoning was reflected in the Securities Act of 1933 in a sense that, for the first time, a full disclosure of facts, relevant to the value of the firm, was required. Besides, authors tried to explain how firms behave and highlighted the importance of corporate governance. Overall, their arguments, although they seem somehow naïve from today's perspective, grounded an important direction in the development of the *neoclassical theory of the firm* (Harris & Raviv, 1991).

On the other hand, Coase (1937) published a seminal work "The Nature of the Firm" where he tried to define the firm from a technological perspective. He wondered why the firm exists and what determines its economies of scale and scope. The main conclusion was that the firm exists to minimize the costs of coordinating economic activity. This happens as a result of reduced transaction costs, which emerge during the production and exchange, capturing efficiencies that individuals cannot. He argued that if markets were costless to use, firms would not exist. On the basis of Coase's definition of the firm, researchers later developed two main theories, explaining the existence of the firm. These were the *agency costs theory* and the *property rights theory*, both being the foundation of the *modern capital structure theory*, which began in the late fifties with the irrelevance theorem by Modigliani & Miller (1958).

The *agency costs theory* acknowledges that a firm exists because of the benefits of team production and economies of scale and scope, however, such production organization causes agency problem that manifests in agency costs. One of the most influential articles, written in this field, was the "Theory of the firm: Managerial Behavior, Agency Costs and

Ownership Structure" by Jensen & Meckling (1976). Authors joined the *theory of agency costs* with the *theory of finance* and developed the *theory of ownership structure* (synonym for the *theory of capital structure*). They argued that the capital structure should be analyzed from the perspective of firm's liabilities, held by insiders (management) and outsiders (investors with a no direct role in management). Fama (1980) and Demsetz (1983), for example, broadly elaborated why such separation of ownership and control can result in an efficient form of economic organization. However, observed capital structures may be well explained by the hypothesis that the management is primarily concerned with a job security and other agency costs – in order to avoid bankruptcy, maximization of shareholders' wealth could be sacrificed (Donaldson, 1963; Jensen & Meckling, 1976). Jensen & Meckling (1976) developed their theory with a strong reference to Coase (1937), who argued that a firm is a "black box", which maximizes profits or, more precisely, present value of shareholders' wealth. Since this definition has some limitations, acknowledged already by Adam Smith and Alfred Marshall, new debates over the "social responsibility" of a firm, separation of ownership and control, and a new definition of the firm have emerged. The inadequacy and limitations of the existing *neoclassical theory of the firm* was therefore one of the reasons for the development of *agency costs theory* stream. The main idea of agency relationship is that one or more people (the principals) hire one or more managers (the agents) to perform some services on their behalf, which results in a delegation of some decision making authority. Authors argued that as soon as both parties maximize their self-interest, the agent will not always act in the best interest of the principal. In order to reduce that anomaly, the principal should establish proper incentives. This situation may cause agency costs, which are the sum of the monitoring expenditures by the principal, the bonding expenditure by the agent, and the residual loss (Fama & Jensen, 1983a; Fama & Jensen, 1983b). Shleifer & Vishny (1997) surveyed studies, related to empirical evidences on different forms of agency problem, and summarized that agency problem most often manifests in the following forms: managers prefer to reinvest free cash flow instead of returning it to the investors (Jensen, 1986), management is resistant to takeovers in order to protect their private benefits (DeAngelo & Rice, 1983; Walkling & Long, 1984; Jarrell & Poulson, 1987; Malatesta & Walkling, 1988), and finally, agency costs have a strong impact on the stakeholders' perception of the corporate control (Lease, McConnell, & Mikkelson, 1983; DeAngelo & DeAngelo, 1985; Barclay & Holderness, 1992; Zingales, 1994; Zingales, 1995). Jensen & Meckling (1976) argued that an explanation of formation of agency costs would lead to the *theory of the ownership (capital) structure*.

The second theory of the firm is the *property rights theory*. The theory identifies a firm through its assets under control. The most important work came from Demsetz (1967) and later from Alchian & Demsetz (1972), who published the article "Production, Information Costs and Economic Organization", where authors tried to answer why a firm exists. They defined the firm as an entity, which is based on the terms of the contracts. A firm's main characteristic is a joint use of inputs that yield a higher output than would be the sum of separately used inputs – the benefit of team production. Jensen & Meckling (1976) argued that the main idea of the *property rights theory* is a specification of individual rights that determine how costs and rewards are allocated among the participants.

1.4 Modern capital structure theory

In 1958, Modigliani & Miller published an influential article "The cost of capital, corporation finance and the theory of investments", which was based on the neoclassical definition of the firm. Before this work, there was no generally accepted theory of the capital structure (Frank & Goyal, 2008). In the article, authors assumed numerous unrealistic assumptions, which were, however, gradually omitted in their further publishing:

- Maximization of the shareholders' value is the only goal of the firm.
- A firm is financed only with equity and debt.
- Cash flows are infinite.
- There are no taxes.
- Operating cash flows are completely unaffected by changes in capital structure.
- Individuals can borrow and lend at the risk-free rate.
- Markets have no frictions (no transaction costs, assets trade restrictions or bankruptcy costs).
- Firms operate in competitive markets.
- There is no asymmetric information.
- A firm's financial policy reveals no information.

Under these assumptions two propositions were made. The first proposition says that market value of any firm is independent of its capital structure and is given by capitalizing its expected return at the rate ρ_k, appropriate to its class. This means that the value of a levered firm is equal to the value of an unlevered firm. Authors argued that if two firms were identical (if generated the same cash flow), but differed only in their capital structure, then arbitrage opportunities would force values of both firms to become equal. Expressed mathematically:

$$V_j = V_{equity_j} + V_{debt_j} = \frac{E(return)_j}{\rho_k},$$

which can be rearranged into

$$\frac{E(return)_j}{V_j} = \frac{E(return)_j}{V_{equity_j} + V_{debt_j}} = \rho_k.$$

This means that the average cost of the capital of any firm j in class k is completely independent of its capital structure and is equal to capitalization rate of a pure equity stream of its class (Modigliani & Miller, 1958). As a result, the leverage has no effect on the market value of a firm. Soon after, Baxter (1967) argued that with a high level of indebtedness, the 'risk of ruin' becomes very real and cannot be nullified by arbitrage. He concluded that when reliance on the financial debt is small, the tax-shelter effect dominates, but as soon as leverage increases too much, "risk of ruin" prevails. The same conclusion was proposed by Donaldson (1961), Robichek & Myers (1966) and Kraus &

Litzenberger (1973). Kraus & Litzenberger proposed a state-preference model with wealth taxes and bankruptcy costs, and suggested a stochastic dynamic programming approach to determine the optimal capital structure that would balance the positive and negative effects of debt. However, their analysis was too complex to be implemented in practice (Kim, 1978).

The second proposition, developed by Modigliani & Miller says that the expected yield of a share of stock is equal to the appropriate capitalization rate ρ_k for a pure equity stream in the class, plus a premium related to financial risk equal to the debt-to-equity ratio times the spread between ρ_k and r. Expressed mathematically:

$$i_j = \rho_k + (\rho_k - r)\frac{D_j}{S_j}.$$

This equation means that the expected rate of return on the stock j belonging to the class k is a linear function of its leverage. Benefits, obtained from the increased use of the low cost debt and decreased use of the high cost equity, are completely offset by the increase in the risk level of equity. Shortly, leverage has no effect on the cost of capital.

In 1961, Modigliani & Miller developed the dividend irrelevance proposition. It implied that the value of the firm is unaffected by the distribution of dividends and is determined solely by the earning power and risk of its assets (Miller & Modigliani, 1961). Two years later, Modigliani & Miller (1963) developed the investor indifference proposition, which says that equity-holders are indifferent about the firm's financial policy, the thesis which was later deeply elaborated by Stiglitz (1969; 1974). In their latest work, Modigliani & Miller introduced corporate taxes and showed that leverage increases a firm's value because interest costs are tax-deductible and consequently increase the income available to the shareholders. Authors were, however, careful about implying that the value of the firm would be maximized when using 100 percent debt financing. They argued that some other forms of financing, like retained earnings, can be cheaper than debt, and that lenders can impose limitations that prevent too high indebtedness. They concluded that firms need to preserve a certain rate of flexibility in maintaining reserve borrowing capacity (Modigliani & Miller, 1963). Miller later introduced the effect of personal taxes into the analysis and argued that in equilibrium, tax advantage of debt would be exactly offset by the increased personal taxation, which means that a shareholder would be indifferent to how much leverage the firm uses (Miller M. H., 1977). He argued that if the optimal capital structure is simply a matter of rebalancing tax advantages against bankruptcy costs, why then the observed capital structures show so little variation over the time. Contrary, DeAngelo & Masulis (1980) argued that Miller's theorem is extremely sensitive to the realistic and simple modifications in the corporate tax code. DeAngelo & Masulis included into the analysis a tax shield that is not a result of the interest costs (e.g. accounting depreciation, depletion allowance, and investment tax credits) and showed that there is a market equilibrium, where every firm has a unique optimal capital structure. They continued that market prices reflect personal and corporate taxes in such a way that the bankruptcy costs are a significant consideration in a trade-off between interest tax-deductibility and risk of financial distress.

Modigliani (1980) summarized the Modigliani-Miller irrelevance theorem in the following way: "… with well-functioning markets (and neutral taxes) and rational investors, who can 'undo' the corporate financial structure by holding positive or negative amounts of debt, the market value of the firm – debt plus equity – depends only on the income stream generated by its assets. It follows, in particular, that the value of the firm should not be affected by the share of debt in its financial structure or by what will be done with the returns – paid out as dividends or reinvested (profitably)". However, at the same time Chen & Kim (1979) made a synthesis of theoretical and empirical research, and figured out that the theory somehow acknowledges the benefits of debt on aggregate level but is unable to answer why firms are using risky debt on the individual level. Therefore it soon became clear that Modigliani-Miller irrelevance theorem could not exist in a real economy, and researchers came to the conclusion that the capital structure must be relevant for a market value of a firm. Different theories emerged, explaining which factors are the most relevant when management is trying to find the optimal sources of financing, i.e. the capital structure that would maximize a market value of a firm. The two most important theories are the *trade-off theory* and the *pecking order hypothesis.*

1.4.1 Modern capital structure as a result of agency costs – the trade-off theory

In the year 1961 Donaldson wrote an influential book called "Corporate Debt Capacity", where he acknowledged that setting an appropriate limit for the borrowed amount of long-term debt is a major challenge for financial management. The reason is in the importance that a debt-equity ratio has for future solvency and profitability of a firm. Donaldson therefore tried to address a problem firms face every day: "Given the need for new permanent capital and ability to borrow, how does a company approach the determination of the wise and proper limit to such borrowing?" He argued that the main determinant of corporate debt capacity should be the probability of insolvency in times of recession, analyzed thorough firm's cash flows. His reasoning is popular even today, as for example in Kester et al. (2004), who argued that debt capacity should not be determined solely by industry averages or the availability of collateral, but also by borrower's ability to repay the interest and the principal with a generated cash flow. In his book, Donaldson introduced the concept of risk and fear of insolvency with the help of objective risk assessment (management of cash flows) and subjective risk assessment (management inclination to risk-taking).

It is generally accepted that the primary incentive to use long-term debt is the fact that debt is theoretically a cheaper source of financing than retained earnings or new equity issues. If the primary objective of a business is the maximization of net revenues, Donaldson (1961) continued, the use of debt should be a desirable source of financing and should be exercised as continuously as possible. The advantage of debt financing was especially well recognized in the period of high taxes during and after the World War 2 (Donaldson, 1961). It can be concluded that Donaldson was one of the first researchers who argued that the capital structure must be determined by weighing positive and negative effects of leverage, which is the main idea of the *trade-off theory*.

The *trade-off theory* developed as a response to the Modigliani-Miller irrelevance theorem. When Modigliani & Miller (1963) added the effect of corporate tax, while ignoring the offsetting costs of debt (increased possibility of financial distress), 100 percent leverage was suggested as an optimal capital structure, although this was in contradiction with the observed firms' behavior. Kraus & Litzenberger (1973) suggested that the best candidate for an offsetting cost of debt is a deadweight cost of bankruptcy, while Jensen & Meckling (1976) more formally defined two types of conflicts, one resulting as debt benefits and the other as costs of debt financing.

The first conflict, highly elaborated by Donaldson (1963), is between shareholders and managers (principal-agent problem), and it is expressed in a form of debt benefits. The explanation is that higher leverage reduces the principal-agent problem, because managers have less available free cash flow to invest it unwisely. The second conflict is between debt-holders and equity-holders, thoroughly presented by Smith & Warner (1979). In that case, higher leverage increases agency costs of debt, because benefits are borne primarily by equity-holders, while costs by debt-holders. Optimal capital structure can then be found by trading-off benefits and costs of debt, which is the basic idea of the *static version of trade-off theory.* Myers (1984) later argued that a firm, which follows the *trade-off theory*, sets target leverage and then gradually moves toward that target – the main idea of the *dynamic trade-off theory*, which has become popular more recently.

Conflict, resulting in a positive effect of debt, occurs when managers are not the only owners of the firm. Consequently, they do not gain the total profit from their activities. As a result, managers will not always behave in a way to maximize the firm's value. Instead, they will exploit personal benefits to a larger extent than it would be optimal. Jensen & Meckling (1976) showed that an increasing amount of debt somehow resolves this suboptimal behavior. First, the larger is the amount of debt issued by the firm, the larger is the owning share of managers, forcing them to act rationally (Jensen & Meckling, 1976). Second, the firm needs to pay interests on debt which decreases free cash flow available for spending it irrationally (Jensen, 1986). Third, as Grossman & Hart (1982) pointed out, debt can create an incentive for managers to behave more optimally because bankruptcy would harm their reputation and financial inflow. Their theory is based on the idea that managers in firms, which are mainly equity financed, do not have that strong incentive to maximize profits, meaning that the usage of debt can increase the firm's market value. An additional benefit, as argued by Harris & Raviv (1990), is the option for firm liquidation. Harris & Raviv (1991) continued that firms with low growth rates and large operating cash inflows will use more debt financing to decrease managers' suboptimal behavior.

Conflict, resulting in a negative effect of debt, occurs because large gains are primarily captured by equity-holders, while losses are borne by debt-holders. This incentive encourages equity-holders to act suboptimal and accept riskier investments than it would be optimal. This effect, called “asset substitution”, is an agency cost of debt financing. Consequently, debt-holders offer less for a purchase of a firm’s debt than they would otherwise (Harris & Raviv, 1991). Myers (1977) also offered another example of agency cost of debt, called “underinvestment”: if the firm is near the bankruptcy, equity-holders will be unwilling to put additional money into the firm, even if it was used for value-increasing projects. A similar finding was confirmed also by Stulz (1988). The theory of agency costs offers a lot of additional implications. Because of contradicting interests, bond contract often includes covenants that prevent risky behavior of management. Risky behavior arises in the following situations: dividend payments, claim dilutions, under-investments and assets substitution (Smith & Warner, 1979). Harris & Raviv (1991), for example, argued that firms operating in industries with smaller probability for assets substitution will be, holding everything else equal, more indebted. This goes in line with Diamond (1989), who argued that younger firms without established reputation for not engaging in asset substitution behavior will be less indebted.

Jensen & Meckling (1976) claimed that Modigliani & Miller (1963) were unable to offer an adequate theory of the observed capital structures. Similarly, Fama & Miller (1972) wrote the following sentence: “We must admit that at this point there is little in the way of convincing research, either theoretical or empirical, that explains the amount of debt that firms do decide to have in their capital structure.” The main reason for Modigliani-Miller irrelevance theorem to be unrealistic, based on Jensen & Meckling (1976), is that “existence of positive costs associated with bankruptcy and the presence of tax subsidies on corporate interest payments will invalidate the theorem because the probability distribution of future cash flow changes as the probability of the incurrence of the bankruptcy costs changes – as the ratio of debt to equity rises.” Jensen & Meckling (1976) argued that agency costs provide strong reasons for dependency between probability distribution of future cash flow and capital/ownership structure. Jensen & Meckling additionally argued that while introduction of bankruptcy costs and presence of tax subsidies lead to the theory of the optimal capital structure, that theory has a serious drawback since it implies that no debt should ever be used in the absence of tax subsidies in case of positive bankruptcy costs. However, because firms have been using debt already when there were no tax benefits of interest costs, there must be some additional determinants of corporate capital structure. Additionally, neither the bankruptcy costs nor the tax subsidies can explain the use of preferred stocks or warrants, even more, the theory says nothing about the division of equity claims between insiders and outsiders. Researchers argued that bankruptcy costs themselves are unlikely to be the major determinant of corporate capital structure because empirical researches showed (e.g. Warner (1977)) that these costs represent a very small percentage of the firm’s value. However, Baxter (1967) and Stanley & Girth (1971) showed that for smaller firms this percentage can be considerably higher.

Kim (1978) was one of the important advocators of the idea that a firm reaches an optimal capital structure at a level of indebtedness far below theoretically proposed 100 percent, as argued by some authors before him. He continued that only when the target debt level is strictly lower than the firm's debt capacity, the firm can search for its optimal trade-off between the tax advantage of debt and the cost of bankruptcy. Value of the firm can therefore be defined as the value of equity only financed firm, increased for the value of the tax savings and decreased for the value of the costs of financial distress. Value of the firm is therefore maximized at less than 100 percent debt financing (Morris, 1982).

According to the *trade-off theory*, there exists the optimal (target) capital structure. The theory describes the firm's optimal capital structure as a mix of financing that equates the marginal costs to marginal benefits of debt financing (Lemmon & Zender, 2010). An interesting overview of tendency movements toward the target capital structure is given by Lemmon et al. (2008). They clearly showed that although leverage ratios exhibit strong persistence, there is also a strong convergence toward the target. Furthermore, many researchers numerically estimated the speed of convergence (e.g. Lev (1969), Flannery & Rangan (2006), Huang & Ritter (2009), Byoun (2008), Baker & Wurgler (2002), Welch (2004), and Iliev & Welch (2010)), while Frank & Goyal (2009) performed a comprehensive review of past empirical studies that analyzed the determinants that had a significant power at explaining observed capital structures and that gave consistent conclusions over many tests. The six main determinants are industry median leverage (firms in industries in which the median firm has high leverage tend to have higher leverage), tangibility (firms that have more tangible assets tend to have higher leverage), profits (firms that have more profits tend to have lower leverage), firm size (firms that have larger assets or higher sales tend to have higher leverage), market-to-book-assets ratio (firms that have a high market to book ratio tend to have lower leverage), and inflation (when inflation is expected to be high, firms tend to have high leverage). Frank & Goyal found that these six determinants explained more than 27 percent of the variation in leverage.

However, it is important to distinguish between the *static trade-off theory*, where firm balances tax savings of debt against deadweight bankruptcy costs, and more recently introduced *dynamic trade-off theory*. A firm is said to follow the *static trade-off theory* when a firm's leverage is determined by a single period trade-off between the tax benefits of debt and the deadweight costs of bankruptcy (Frank & Goyal, 2008). However, the main drawback of this theory is that it says nothing about a mean reversion of leverage. Consequently, the *dynamic trade-off theory* developed, proposing that a firm exhibits the target adjustment behavior if it has target leverage and if deviations from that target are gradually eliminated over time (Frank & Goyal, 2008). According to this theory, the optimal leverage today depends on the expectations about what will the optimal leverage be in the next period. The *dynamic trade-off theory* has advanced in recent years because it offers a good explanation of tendency movements of leverage, the role of profits, the role of retained earnings and the path dependency. Frank & Goyal (2008) concluded that the *target adjustment hypothesis* receives much better empirical support than either the *static trade-off theory* or the *pecking order hypothesis* did, which is presented in the next subchapter.

1.4.2 Modern capital structure as a result of asymmetric information – the pecking order hypothesis

Conflicts, related to the existence of inside information, were the main driving force for the development of the *theory of asymmetric information*, under which managers and owners have more accurate information about a firm's true performance than those who lend the money. This theory has evolved into two directions. The first direction is connected to Ross (1977) and Leland & Pyle (1977), who argued that the choice of the firm's capital structure gives an important signal (inside information) to outside investors. The second direction is represented by Myers & Majluf (1984) and Myers (1984), who argued that the capital structure is used to solve inefficiencies in the firm's investment decisions, which are caused by the information asymmetry. This direction is associated with the so called *pecking order hypothesis* (Myers & Majluf (1984), Krasker (1986) and Narayanan (1988)). The costs and benefits of debt (the *trade-off theory*) are of secondary importance compared to the importance of costs which arise when a new equity is issued under the conditions of highly asymmetric information (Shyam-Sunder & Myers, 1999).

Ross (1977) hypothesized that managers benefit when market positively values a firm's shares and are penalized if the firm goes bankrupt. He continued that investors associate higher debt usage with higher quality of the firm. Additionally, firms of lower quality will use less debt because their expected bankruptcy costs are high. That led to the conclusion that both value of the firm and firm's profitability are positively correlated with debt-to-equity ratio. Similar findings were proposed by Heinkel (1982) and Poitevin (1989). Leland & Pyle (1977), on the other hand, argued that higher leverage allows managers to retain higher share of equity. That reduces managerial welfare due to the risk aversion, however, the higher the quality of the firm, the lower this reduction is. Higher leverage thus signals the better quality of the firm (Harris & Raviv, 1991). Leland & Pyle (1977) continued that information asymmetry between the borrower and the lender strongly affects the firm's financial structure – high information asymmetry can even destroy venture capital markets because lenders will be unable to distinguish between higher and lower quality borrowers. The solution can only be found in the transfer of information. This can be done by willingness of insiders to mutually invest in the project together with lenders. Additionally, it was shown that the greater the variance of the project's outcome, the lower the optimal debt financing. Leland & Pyle (1977) concluded that information asymmetry must be the main reason for the development of financial intermediaries.

On the other hand, Myers & Majluf (1984) advocated the idea that if the potential new shareholder is not equally informed as the existing shareholders, the former one will underprice new equity issues, the problem called "adverse selection". That would primarily cause a loss to the existing shareholders. The problem can be mitigated by giving priority to all other types of financing before issuing a new equity. These other types of financing are retained earnings and different forms of debt. This behavior is called the *pecking order hypothesis*. As a direct consequence, share price should fall after the announcement of new equity issue. Krasker (1986) confirmed this finding and additionally showed that the larger the stock issue, the larger will the fall in the stock price be. This problem can result in underinvestment, which is more severe for firms with relatively low levels of tangible assets (Harris & Raviv, 1991). Myers (1984) summarized the *pecking order hypothesis* in the following way: "A firm is said to follow a pecking order if it prefers internal to external financing and debt to equity, when external financing is used." A more recent empirical analysis of the *pecking order theory* was performed by Frank & Goyal (2003), who found that internal financing is often not sufficient to cover investment spending, which means that external financing is heavily used, often prioritizing debt.

1.4.3 Alternative theories of modern capital structure

Market timing. The market timing plays an important role in describing observed capital structures. That was proposed already by Myers (1984), but it became more popular recently (e.g. Berry et al. (2008)). Graham & Harvey (2001) found empirical support that management actively uses market timing when deciding whether to issue debt or equity – they found that firms issue equity after the increases of stock prices. Baker & Wurgler (2002) argued that capital structure can best be understood as the cumulative effect of past attempts to time the market. Frank & Goyal (2009) summarized this theory as management analyzing the current market conditions in debt and equity markets. When a firm needs new financing, management uses the type of financing which is more favorable at the moment. If neither of them looks favorable, management can defer the issuances. On the other hand, if current conditions look unusually favorable, funds may be raised even if the firm currently does not need new funds. The shortfall of this theory is that it cannot be linked with the traditional determinants of capital structure; however, it suggests that stock returns and debt market conditions are important when management is evaluating capital structure decisions (Frank & Goyal, 2009).

Industrial organization. Capital structure models that are based on industrial organization theory can be divided into two groups. The first group of research explains relations between firm's capital structure and firm's strategy, while the second group of research explains relations between firm's capital structure and the characteristics of its products and inputs (Harris & Raviv, 1991). Allen (1985), Brander & Lewis (1986) and Maksimovic (1988) were the initiators of the idea that financial theory of maximizing shareholders' value can be linked to industrial organization, where researchers normally used assumption of maximization of a total profit. These authors referred to the finding of Jensen & Meckling (1976) that increased leverage encourages equity holders to accept riskier strategies. In Brander & Lewis model (1986), oligopolists increased the risk through aggressive production policy, and in order to finance it, firms in a subsequent Cournot game choose more and more debt. As a result, Brander & Lewis argued, oligopolists will often use more debt financing compared to monopolists or firms in competitive markets. Additionally, debt will be of long-term nature. Maksimovic (1988) also proved that debt capacity is increased with the elasticity of the demand. The second group of research is concentrated around Titman's (1984) observations that customers and suppliers of unique and durable products would bare high costs if firm goes bankrupt, which means that such firms will be less indebted, ceteris paribus. When it is likely that a firm will stop operating, these costs are transferred to the shareholders through lower product prices. Titman argued that capital structure can be used to commit the shareholders to have optimal liquidation policy. He showed that firms with higher costs of liquidation will use lower amounts of debt. Sarig (1988) also pointed out that another advantage of debt is strengthened bargaining position of equity holders in dealing with input suppliers. His idea was that because bondholders bear the largest risk of negotiation failure, they will try to prevent it. As a result, debt can increase firm value due to stronger negotiation position. Looking from the other side, the higher the bargaining power of the firm, the more indebted the firm will be. It follows that unionized firms or firms that employ workers with easily transferable skills will be more indebted (Harris & Raviv, 1991).

Corporate control. Harris & Raviv (1988) and Stulz (1988) argued that capital structure affects the outcome of takeovers through its effect on the distribution of voting shares, especially the fraction owned by the management. Similarly, Israel (1991) analyzed how capital structure affects the distribution of cash flows between voting and nonvoting shares. Researchers concluded that the takeover targets will often be more indebted, which will be expressed in an increased share price. Additionally, leverage will be negatively related to whether a takeover is successful.

1.5 Conclusions

Chapter 1 offers a comprehensive overview of the capital structure theory. I showed that citation and co-citation analysis is a useful tool for detecting the most influential researchers and published articles, and that can be applied to any research field. *Figure 1-7* shows a chronological overview of the most important articles in the field of the capital structure theory, and reveals the strength of connections among researchers.

The literature review shows that the *modern capital structure theory* developed from the *neoclassical theory of the firm*, which started in 1930s. In 1958, Modigliani & Miller developed the irrelevance theorem, which stated that capital structure does not impact a firm's value. The theorem was later modified with the inclusion of tax-deductibility of interest on debt, which led to the conclusion that a firm's value is maximized at 100 percent of debt financing. However, already in the 1970s it became clear that in addition to positive effects of debt, there are also negative. Donaldson (1961) argued that the main determinant of corporate debt capacity should be the probability of insolvency in times of recession, analyzed through cash flows. Similarly, Kraus & Litzenberger (1973) suggested that the best candidate for an offsetting cost of debt is a deadweight cost of bankruptcy. Researchers thus soon came to the conclusion that capital structure must be relevant for a firm's value. DeAngelo & Masulis (1980) were among the first researchers who clearly showed that each firm has a unique optimal capital structure. Jensen & Meckling (1976) developed the *trade-off theory*, which formally defined factors that determine the optimal capital structure. Their main idea was that the conflict between shareholders and managers (principal-agent problem) results in a positive effect of debt, while the conflict between debt-holders and equity-holders causes the agency costs of debt. Optimal capital structure can then be found by trading-off benefits and costs of debt. Lemmon & Zender (2010) summarized that the *trade-off theory* describes the firm's optimal capital structure as the mix of financing that equates the marginal costs to marginal benefits of debt financing. In parallel to the *trade-off theory*, Myers & Majluf (1984) developed the *pecking order hypothesis*. It prescribes the order of financing, which would maximize a firm's value. Costs and benefits of debt are of secondary importance compared to the high costs that arise when a new equity is issued under the conditions of highly asymmetric information (Shyam-Sunder & Myers, 1999). Myers (1984) summarized that a firm is said to follow a pecking order if it prefers internal to external financing and debt to equity, when external financing is used. In the 1960s, researchers started with empirical tests of target capital structures. Both theories determine numerous factors that influence the amount of leverage firms should employ. The most frequently used determinants are industry median leverage, tangibility, profitability, firm size, market-to-book-assets ratio, and inflation (Frank & Goyal, 2009). More recently, Frank & Goyal (2008) concluded that the *target adjustment hypothesis*, which developed from the *dynamic trade-off theory*, receives much better empirical support than do either the *static trade-off theory* or the *pecking order hypothesis*. Its main idea is that firms gradually converge toward the target capital structure, meaning that leverage exhibits partial adjustment mechanism so that deviations from the target are gradually eliminated. Short-term deviations are thus expected and have a strong theoretical support.

Up to this point I theoretically explained that there are advantages and disadvantages of using debt financing – for each firm there must be a target mix of debt and equity that facilitates firm's operations and maximizes the market value of a firm. According to the *trade-off theory*, a firm that needs new financing would issue equity whenever its current debt level is above the target, and acquire new debt whenever its current debt level is below the target. However, because of high flotation costs, the process of adjusting capital structure with the target is not as continuous as it should be, but rather consists of infrequent, lumpy issues of equity and acquisitions of debt, which results in debt level fluctuating around the target. On the other hand, according to the *pecking order hypothesis,* a firm will issue equity only when its debt capacity will reach the limit.

2 MULTILEVEL LINEAR MODEL FOR EXPLAINING CAPITAL STRUCTURE HETEROGENEITY

In this chapter I analyze the heterogeneity of capital structures of European firms – I examine how different factors influence a firm's capital structure, and estimate the target indebtedness that was used for the analysis of convergence in *Chapter 3* and for measuring the impact of indebtedness on a firm's performance in *Chapter 4*. First, I theoretically present the idea of the target capital structure and graphically show the multilevel linear model, together with a short description of its content. Then I present the dependent and explanatory variables, used for determining the target capital structure. After that, the dataset is described. I then give an overview of multilevel linear modeling and explain why it is useful for my analysis. Finally, I develop the multilevel linear model and present the results.

2.1 Target capital structure

A primary goal of capital structure research is to explain the observed heterogeneity in firms' capital structures (Graham & Leary, 2011). Capital structure theory suggests that firms have a target leverage that is determined by various trade-offs between the costs and benefits of debt versus equity (Kayhan & Titman, 2007). In 2001, Graham & Harvey performed a survey among CFOs, and found that 37 percent of firms have a flexible target, 34 percent somewhat tight target or a range, and 10 percent a strict target (Graham & Harvey, 2001). Since only a small percent of firms uses the strict target, the theory of capital structure provides arguments that the actual capital structure would temporary deviate from the target, determined by the trade-off variables. These arguments could be the existence of information asymmetry, market inefficiencies, or positive transaction costs (Kayhan & Titman, 2007). Recent literature on capital structure (e.g. the *dynamic trade-off theory*) focuses on forces that move firms away from their target capital structure; however, these deviations are gradually eliminated. For example, it was found that a firm's history is a more important determinant of the observed capital structures than a firm's characteristics which proxy the costs and benefits of debt financing are (e.g. Lemmon et al. (2008)).

One of more influential books, explaining the characteristics of debt financing, was written by Donaldson (1961), who argued that the use of long-term debt needs to be associated only with the investments into a firm's main operations. His idea was that debt can be understood as a current use of the earnings retained in the future, and since debt has limited duration, it is often a more convenient source of financing than issuing new shares and later repurchasing them. Additionally, the process of acquiring new debt is much faster than issuing new shares, and requires much less public disclosure of information. However, Donaldson believed that the fact that the person in power is either conservative or venturesome by nature, will be one of the most important determinants of the borrowed amount of debt. He wrote that the formal reason of acquiring new debt may follow rather than precede the financial decision. More recently, Bertrand & Schoar (2003) found that CFO fixed effects are highly correlated with leverage. The fact that the CFO's personality plays an important role in capital structure decisions was corroborated by Graham et al. (2011).

Through in-depth interviews of 25 firms in ten different industries, Donaldson (1961) systematically presented reasons for and against the usage of long-term debt, described in accordance with the idea of the existence of the target capital structure. Donaldson defended the idea that the leverage should neither be too high, neither too low. However, it is important to recognize that firms have numerous debt policies, some very subjective, while others being more objective by nature. Donaldson thus classified firms according to their debt policies into two broad groups. Group of firms with subjective debt policies can be further divided into two subgroups. The first subgroup consists of firms that strictly avoid any long-term debt because management does not want to get any reliable appraisal of the risk, associated with it. Such firms, however, usually have enough internally generated cash for financing their operations. At the other extreme is a subgroup of firms that borrow the maximum amount that is provided by creditors. In such firms, management relies on capital markets appraisal of appropriate leverage, and would, hopefully, not provide too much debt financing. The argument goes that those who lend money are more experienced and better equipped with the models to properly assess the suitable amount of debt that should be available to a firm. In the middle is the group of firms with more objective debt policies, which rely, in addition to the external, also on the internal risk appraisal. The first subgroup of such firms uses the debt policy under which a firm can borrow the maximum available, but under the prime rate conditions. The reason is that the interest rate paid on the long-term debt became an important status symbol. The next subgroup includes firms that limit the principal amount of borrowed long-term debt to the pre-determined percentage of total firm capitalization. Closely related is also the practice to limit the maximum amount borrowed to the level, under which a firm still reaches the required earnings coverage ratio. Under both policies, management would consider any amount of debt above the limit to be too risky, regardless of the reward. Certain firms, operating in more cyclical and risky industries, exercise so called single-project-approach or the rapid-payback-approach debt policy. In industries with high fluctuations in sales and earnings, using debt as a continuous source of financing can be unjustified. However, projects which are less risky than the general business model can be partially financed with debt. In the cyclical industries, repayment of debt in good times is desirable. From Donaldson's debate (1961) it can be concluded that debt policies highly influence the range of the target leverage, set by the management, although sometimes without a good theoretical justification – subjective determinants could often prevail over the objective reasoning.

If an important advantage for using debt is its characteristic of limited duration and tax shield, Donaldson (1961) listed several reasons against its usage. For example, management expressed the opinion that earnings from debt savings should not be treated the same as earnings from regular operations because of debt adverse potential during the crisis period. Consequently, debt often has a negative reputation in public. The next reason can be attributed to the fact that a management follows their industry peers, who in certain periods have a negative perspective of debt – they perceive leverage to negatively affect a firm's credit rating, shareholders' opinion, and market perception. Next, some managers expressed a problem recognizing when the reasonable amount of debt becomes too excessive. They also noted that CFOs are often among the most conservative decision makers and prefer less debt over more. Management sometimes also considers another important aspect of debt financing – the question of control. Someone could expect that management would favor debt over equity because in case of new share issues, the proportion of voting control would change. However, one can argue that when ownership is widely dispersed, the new equity would not importantly shift the voting power. Moreover, with acquisition of new debt the financial institution that lent the money can have an important influence on a firm's internal decision making process. Donaldson (1961) went one step further and concluded that all arguments against the usage of debt can be reduced to one fundamental problem. That is uncertainty about the nature, amount, and time of future cash flows. He continued that all factors affecting the cash flow position must be carefully examined, with emphasis on how these factors would behave in the time of recession, the conclusion very similar to recent arguing by Kester et al. (2004). Donaldson (1961) believed that well informed management can determine with a considerable confidence the expected impact on any future recession on the business with respect to sales and other elements of net cash flow.

From Donaldson's theoretical and empirical debate follows that there are subjective and objective determinants that influence a firm's target capital structure. Among others, two of the most important theories of modern capital structure, the *trade-off theory* and the *pecking order hypothesis*, try to determine these factors and predict the direction of relationship between individual determinant and the amount of leverage. However, it is not rare that both theories predict a different direction for the same determinant. These factors are presented and thoroughly explained in *Subchapter 2.4*, where explanatory variables of a model for explaining capital structure heterogeneity are listed. For each factor, empirical findings on its impact on leverage are presented. The requirement for an individual factor to be included in the model is that it was found in the past research to statistically influence the target capital structure or that it has a good theoretical background that it should. Additionally, it needs to be available for my sample of firms. Toy et al. (1974) argued that the variables, used for explanation of firms' debt ratios, should have a theoretical support in the financial literature, should be acknowledged by financial executives, and should be in the form that can be tested with publicly available data. It is important to stress that simply calculating a firm's average leverage during the analyzed period and taking it as the target, is, according to Marsh (1982), extremely problematic and misleading. First, firms acquire new debt through lumpy issues over longer time intervals so even ten years would usually be too short a period of time to get a reliable estimate of the firm's target. Next, favorable short-term conditions (e.g. strong economic expansion) could give a reason to significant temporary departures from the long-term targets. Finally, the targets could change in time. Because of that, determinants that define the target leverage must be appropriately modeled and will act as a proxy for the true, but unobservable target.

2.2 Model introduction

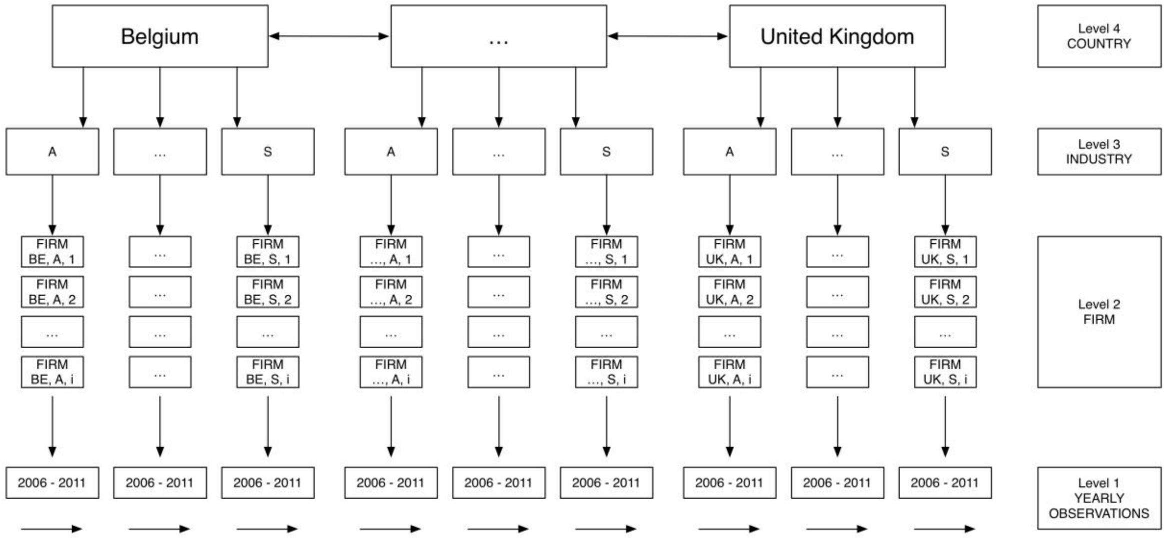
It can be expected that firms operating within the same industry and within the same country are similar and thus not completely independent from one another. Multilevel linear modeling (MLM) is an elegant solution for a violated assumption of independency of observations, because it assumes that units within the same group are more similar than they would be by chance (Gelman & Hill, 2007). Since I analyzed a large sample of firms, operating within 18 different industries in 25 countries, many of them are clustered in the same group – more firms operate within the same industry and within the same country and this can importantly influence their behavior. Analyzing these firms as completely independent observations can result in biased model estimation. Consequently, I decided to use MLM that accounts for cross-sectional dependency. Furthermore, each firm is observed six times (from the year 2006 to the year 2011), which means that time-series dependency is present. Again, MLM allows nesting repeated measurements inside the firm (longitudinal study), controlling for that source of dependency. The hierarchy of a 4-level model is shown in *Figure 2-1*. The lowest level represents six repeated yearly observations for each firm[1] (level 1). These repeated measurements are then nested within a firm (level 2), which is the unit of study. Firms are further nested within 18 different industries (level 3), and these industries are nested within 25 European countries (level 4). With the model I analyzed how total financial indebtedness (i.e. leverage), measured at the lowest level, can be explained by independent variables, measured at different levels. Moreover, the model gives the estimated targets that are used in later chapters of this dissertation.

It was required that each firm-year observation has non-missing values for all explanatory variables and that leverage, expressed as a percentage of total assets, lies in the closed interval [0, 100]. Wherever needed explanatory variables are winsorized at the upper and lower one-percentile to mitigate the effect of outliers and fundamental errors in the data, as recently suggested in a similar study by Lemmon et al. (2008). Frank & Goyal (2008) surveyed recent studies on capital structure determinants and found that the rule-of-thumb truncation with combinations of robust regressions were also used, however, I prefer winsorizing because it does not decrease the number of observations. Further, the majority of past research on this topic was performed on the publicly traded firms. These are large firms that can be expected to behave accordingly to the financial theory and that have publicly available data. In order to mitigate this problem, I required that all firms, included in multilevel linear model, have total assets equal or greater to €5 million[2]. This gives me

[1] Missing observations are allowed. Since data is checked for multilevel outliers and scanned with influential statistics, some observations are removed, which means that not all firms have all six year observations.
[2] In other studies, for example in Byoun (2008), €10 million was usually the limit.

50,584 firm-year observations or equivalently 8,777 firms, the majority of which have full six-year observations.[3] The dependent variable is measured during the period 2006–2011, while explanatory variables are measured with a lag of one year (2005–2010).

Figure 2-1: Graphical presentation of hierarchy of the model



Source: Own presentation.

2.3 Dependent variable

The dependent variable $Leverage_{tijk}$ is defined as the percentage share of total financial debt (long- plus short-term) in total assets.[4] The major debate among researchers is whether market or book value should be used for leverage calculation. The pure theory of capital structure suggests using market values; however, researchers (Toy, Stonehill, Remmers, Wright, & Beekhuisen, 1974; Stonehill, et al., 1975) found that managers tend to think in terms of book rather than market value ratios. Moreover, Lev & Pekelman (1975) argued that book value is more appropriate for modelling the target leverage, while Myers (1977) claimed that there may even be a theoretical justification for giving preference to book value, since it measures the value of assets in place, usually without the capitalized value of future growth opportunities. Myers argued that future growth opportunities are too uncertain to be financed with leverage. Marsh (1982), for example, tried to determine the target capital structure both with market and book value ratios and found no statistical difference. This finding is consistent also with Taggart (1977), who argued that there is very little to choose from between the book and market value formulation. Frank & Goyal (2009) surveyed past empirical research and found that book value is often preferred because financial markets fluctuate greatly and managers believe that market leverage numbers are consequently unreliable as a guide to corporate financial policy. Graham & Harvey (2001) found that only few managers rebalance their capital structure in response to equity market movements, the main reason being the adjustment

[3] As will be explained later, these firm-year observations are cleaned for multivariate outliers.
[4] *t* is used to index time, *i* is used to index firms, *j* is used to index industries, and *k* is used to index countries.

costs. Lemmon et al. (2008) performed a study on the determinants of capital structure both on the book and market definition of leverage, however, the findings did not differ. In line with the existing research, I therefore chose to adopt the book value of equity in leverage calculation. This also allowed me to include in my sample firms which are not publicly traded and therefore do not have a reliable estimate for the market value of equity.

The next concern refers to components included in the definition of leverage. In the past, researchers (Remmers, Stonehill, Wright, & Beekhuisen, 1974; Ferri & Jones, 1979) defined leverage as long-term debt or total financial debt in total assets[5], but sometimes also included accounts payable or even all liabilities (Frank & Goyal, 2009). However, accounts payable may reflect day-to-day business arrangements rather than financing considerations (Strebulaev & Yang, 2013). More recently (e.g. Lemon et al. (2008)) total financial debt (long- plus short-term) was usually used. I followed recent research and defined leverage as shown in *Equation 2-1*.

$$Leverage_{tijk} = \left(\frac{Total\ financial\ debt_{tijk}}{Total\ assets_{tijk}}\right)100 \tag{2-1}$$

In *Equation 2-1* $Leverage_{tijk}$ represents the dependent variable in time *t* for firm *i*, operating within industry *j* and within country *k*.

2.4 Explanatory variables

Lemmon et al. (2008) estimated within- and between- firm variations of book leverage for a large sample of American firms over 20-year period. Consistent with earlier findings, the within-firm variation was approximately 50 percent smaller than between-firm variation, which means that leverage varies significantly more across firms than it varies within firms over time. Further, they decomposed the variance with ANCOVA and found that the majority of sum of squares of explained variance can be attributed to the firm fixed effects. Firm fixed effects alone explained around 60 percent of variability of leverage, while time fixed effects explained only 1 percent. Traditionally used determinates alone (e.g. firm size, profitability, tangibility, etc.) explained approximately 16 percent of total variation, however, when including firm fixed effects into the model their explanation power decreased to only 3 percent. This means that traditional determinants explain the capital heterogeneity well because they at least partially capture the time-invariant unobservable determinants of the capital structure.

Frank & Goyal (2009) performed a comprehensive review of past empirical studies that analyzed the determinants with a significant power at explaining observed capital structures and that gave consistent conclusions over many tests. The six main determinants are industry median leverage (firms in industries in which the median firm has high leverage tend to have higher leverage), tangibility (firms that have more tangible assets

[5] However, Marsh (1982) argued that the aggregation of long and short term debt into a single variable leads to a loss of information.

tend to have higher leverage), profits (firms that have more profits tend to have lower leverage), firm size (firms that have larger assets or higher sales tend to have higher leverage), market-to-book-assets ratio (firms that have a high market to book ratio tend to have lower leverage), and inflation (when inflation is expected to be high, firms tend to have high leverage). Frank & Goyal found that these six determinants explained more than 27 percent of the variation in leverage. Overall, exclusion of the main determinants can have an important consequence that some other variables can become insignificant or even change the sign. However, because my sample includes many firms that are not publicly quoted, market-to-book-assets ratio is unavailable[6]. The remaining five main determinants are included in the model, together with some other determinants that were found to significantly determine the observed capital structures in the past research. As Kayo & Kimura (2011) showed, industry and country level determinants exhibit significant role in explaining capital structure heterogeneity.

2.4.1 First level – Firm-year observations

Explanatory variables, measured at the first level, are time-variant variables. These are variables that can have different values for each firm-year observation. The majority of traditional determinants of capital structure belong to this level. A range of time-variant determinants with sound theoretical background and wide support in the existing research was selected; I list them below.

Profitability. The *trade-off theory* predicts that more profitable firms have lower expected bankruptcy costs and higher tax shields, and should thus be more leveraged (Frank & Goyal, 2008). Additionally, higher profits increase the agency costs of the free cash flow problem, which can successfully be mitigated with higher leverage (Jensen, 1986). However, empirical studies usually find a negative relationship between profitability and leverage (Baxter & Cragg, 1970; Martin & Scott, 1972; Taub, 1975; Titman & Wassels, 1988; Toy, Stonehill, Remmers, Wright, & Beekhuisen, 1974; Byoun, 2008). It has been observed that the importance of profits for determining capital structure has recently decreased. According to Frank & Goyal (2009), equity markets are becoming more willing to fund currently unprofitable firms with good growth prospects. It can be argued that empirical findings are consistent with the *pecking order hypothesis*, while inconsistent with the *trade-off theory*. However, Frank & Goyal (2008) argued that profitability can be understood as a proxy for growth opportunities and in that case, the negative sign is consistent with the predictions of the *trade-off theory*. Moreover, the *dynamic trade-off theory* acknowledges that leverage and profitability can be negatively correlated due to various market frictions (Strebulaev, 2007). One of the possible explanations can be found in the argument that firms passively accumulate profits and thus more profitable firms need less external financing (Kayhan & Titman, 2007). Another argument stipulates that profitable firms have more investment opportunities. For such firms it makes sense to

[6] Frank & Goyal (2009) argued that in case of book value defined leverage, market-to-book-assets ratio can be omitted without serious consequences.

retain more earnings because investors will be unable to earn such high profits elsewhere. The *trade-off theory* thus offers ambiguous predictions regarding leverage and profitability. On the basis of previous empirical research I expect to find a negative relationship. The definition of *Profitability*, used also by Byoun (2008), is given in *Equation 2-2*.

$$Profitability_{tijk} = \left(\frac{EBIT_{tijk}}{Total\ assets_{tijk}}\right)100 \qquad (2\text{-}2)$$

Firm size. Firm size significantly affects capital structure, as argued, for example, by Gupta (1969), Lev (1969), Baxter & Cragg (1970), Martin & Scott (1972), and Ferri & Jones (1979). The *trade-off theory* predicts that larger firms will have more leverage because they are more diversified, have lower default risk and are more mature. Consequently, they have a better reputation in debt markets and face lower agency costs of debt. The *trade-off theory* thus predicts that firm size positively affects leverage (Frank & Goyal, 2008). Graham & Leary (2011) surveyed recent empirical studies and found that, according to research, highly leveraged firms are significantly larger. The main argument goes that larger firms have lower probability of default and, consequently, a higher target debt ratio. On the other hand, it could be argued that larger firms face lower adverse selection and hence have easier access to external equity. However, larger firms have more assets and thus adverse selection may be more important. The *pecking order hypothesis* therefore predicts an ambiguous effect of size on leverage. Baxter & Cragg (1970), Martin & Scott (1972), and Taub (1975) performed empirical analyses where they found that smaller firms are more likely to issue equity than debt, which goes in line with the *trade-off theory*. However, Toy et al. (1974) argued that it is highly inconclusive how firm size affects the target capital structure. More recently, Kortweg (2010) argued that smaller firms have higher optimal debt ratio. Although different theories propose different predictions about the relationship between firm size and leverage, the majority of past research (e.g. Lemmon et al. (2008), Byoun (2008)) show that larger firms are more heavily leveraged. I chose total assets as an indicator of firm size because it is a more stable indicator compared to total sales, especially during times of crisis. Due to distributional properties of total assets, I logged the chosen indicator and defined *Firm size* as shown in *Equation 2-3*, expecting to find a positive relationship.

$$Firm\ size_{tijk} = log_{10}(Total\ assets_{tijk}) \qquad (2\text{-}3)$$

Firm growth. Fast growth increases the costs of financial distress, reduces the free cash flow problem, and increases debt-related agency problems like underinvestment or asset substitution (Jensen & Meckling, 1976). The *trade-off* and other agency costs theories thus predict that firms with faster growth will be less indebted (Frank & Goyal, 2009). This is in line with Martin & Scott (1972), who showed with multivariate discriminant analysis that firms with more rapid short-term sales growth are less likely to issue debt. On the other hand, Toy et al. (1974) empirically proved that firms with high assets growth rate have higher debt ratios. This is consistent with the *pecking order hypothesis*, which predicts that firms with fast growth would accumulate more debt over time, because investments cannot be all financed solely with internally generated funds. Although the majority of empirical research shows that firms with higher growth are less indebted (e.g. Bradley et al. (1984), Smith & Watts (1992), Rajan & Zingales (1995), Barclay et al. (1995), Frank & Goyal (2009), and Barclay et al. (2013)), I defined the *Firm growth* as shown in *Equation 2-4*, allowing a negative or positive relationship.

$$Firm\ growth_{tijk} = \left(\frac{Total\ assets_{(t+1)ijk}}{Total\ assets_{tijk}} - 1\right) 100 \qquad (2\text{-}4)$$

Assets composition. Firms usually try to match the maturity of assets with maturity of liabilities, which means that fixed assets should be financed with long-term debt and shareholders' equity (Marsh, 1982). Many researchers (Baxter & Cragg, 1970; Martin & Scott, 1972; Taub, 1975) found the positive correlation between high proportion of fixed assets and new debt issues. Similarly, high fixed assets turnover can lead to the high use of debt (Gupta, 1969). More recently, scholars started paying attention to the importance of tangible assets as a determinant of capital structure (e.g. Harris & Raviv (1990), Stultz (1990), Hirshleifer & Thakor (1992), and Byoun (2008)). Kortweg (2010) showed that the leverage is positively related to the proportion of tangible assets. High levels of tangible assets, such as property, plant, and equipment, lower the expected costs of financial distress, because they are easier to value than intangible assets, which means that the *trade-off theory* predicts a positive relationship. Additionally, as argued by Frank & Goyal (2009), tangibility reduces the problem of assets substitution. On the other hand, the *pecking order hypothesis* concentrates on the relationship between information asymmetry and tangibility. The theory predicts that higher tangibility reduces the information asymmetry and makes issuing equity less costly. This consequently results in lower debt ratios (Harris & Raviv, 1991). I defined the *Tangibility* as shown in *Equation 2-5*, and expected to find a positive relationship as in most empirical research.

$$Tangibility_{tijk} = \left(\frac{Tangible\ assets_{tijk}}{Total\ assets_{tijk}}\right) 100 \qquad (2\text{-}5)$$

2.4.2 Second level – Firm

The second level includes variables that are time-invariant – the permanent characteristics of a firm. As was recently found by Lemmon et al. (2008), time-invariant factors can explain the observed capital structures much better than time-variant factors.

Probability of financial distress. Many researchers confirmed that cross-sectional variation in capital structures can be explained by differences in probability of a firm's risk of financial distress (e.g. Gupta (1969), Lev (1969), Scott (1972), Toy et al. (1974), Stonehill et al. (1975), Brealey, et al. (1976), Brisoce & Hawke (1976), Carleton & Silberman (1977), Ferri & Jones (1979), and Flath & Knoeber (1980)). There have been numerous attempts in the past to proxy financial distress with evaluation of the costs of bankruptcy.

There are two types of such costs: direct and indirect costs (Warner, 1977). Direct costs include lawyers', accountants' and other professionals' fees, and the value of managerial time spent in administering the process of bankruptcy. One of the indirect costs is loss in sales, because potential buyers of the firm's product perceive the default to be likely, which results in lower profits. Another type of indirect costs is the inability of the firm to obtain loan or to issue securities except under very unfavorable terms. Kim (1978), on the other hand, classified bankruptcy costs into three categories. First, the shortfall arising from the liquidation of physical assets below their economic value, second, fees and other compensations to third parties included in the process of liquidation or bankruptcy, and third, tax court's refusal to grant tax credits for the tax losses of a bankrupt firm. Because bankruptcy costs are practically impossible to measure ex ante, researchers used different surrogates for modeling it. Castanias (1983) tested the *trade-off theory* by studying the cross-sectional relationship between probability of failure and leverage. The theory predicts that this relationship will be negative. As a proxy for bankruptcy costs, he used historical failure rates across industries and with the use of Kendall and Pearson correlation coefficients proved a negative relationship between failure rates and a firm's indebtedness. He concluded that ex ante default costs are large enough to force a firm to use the target capital structure. Another important type of bankruptcy costs are costs borne by employees, who lose their job (Berk, Stanton, & Zechner, 2010). This indirect cost of financial distress is ultimately borne by the firm through higher wages and thus discourages the use of debt in a trade-off sense. Authors argued that human cost is an example of indirect bankruptcy cost, which is large enough to offset the benefits of debt.

Ferri & Jones (1979) argued that the variability of a firm's income is the main factor in ex ante estimates of the firm's ability to meet fixed charges, and suggested the degree of operating leverage as an appropriate measure. Similarly, Marsh (1982) proposed to use the standard deviation of EBIT, scaled by total firm's sales. Gupta (1969) showed that uncertainty, measured with the instability of sales, negatively affects leverage. The same was found by Martin & Scott (1972). Toy et al. (1974) argued that firms with higher variability of earnings should be less indebted because of increased probability of bankruptcy and limits imposed by lenders. Also shown by Brennan & Schwartz (1978), firms with higher business risk will have, all else equal, lower optimal leverage. More recently, Kortweg (2010) confirmed a negative relationship between earnings variability and indebtedness. Alternatively, Lemmon et al. (2008) suggested modeling the risk of financial distress using the standard deviation of operating income. I followed Marsh's approach and, expecting a negative relationship, I modeled the probability of financial distress as shown in *Equation 2-6*.

$$Fin.distress_{ijk} = \left(\frac{SD\ (EBIT_{tijk})}{Average\ (Total\ assets_{tijk})}\right)100 \qquad (2\text{-}6)$$

Legal status of the company. Public firms are more profitable, invest more, and use more equity financing, according to Frank & Goyal (2008). I supposed that public firms will have, on average, lower leverage and defined public firms with a dummy variable as shown in *Equation 2-7*.

$$D_{Public} = \begin{cases} Public\ firm = 1 \\ Otherwise = 0 \end{cases} \quad (2\text{-}7)$$

Firms producing unique and durable goods. Shareholder co-investment theory (Titman, 1984; Titman & Wassels, 1988) predicts that firms which are producing unique and durable products should be less indebted. The indirect costs of distress can be high when such distress would bring difficulties for its customers (they are reluctant to purchase goods from a firm that might default and stop offering service for its products) or suppliers (they can stop supplying firms in or near the distress). These issues are heightened for durable goods producers because for such products future service is important (Graham & Leary, 2011). Firms, producing unique and durable products (Nace Rev. 2: Division 26–32) have more specialized labor, which results in increased financial costs of distress. The selection of industry follows the suggestion by Banerjee et al. (2008) and Frank & Goyal (2009). The uniqueness of assets usually results from larger expenditures on selling, general and administrative expenses or high research and development costs. It was found that customers of unique and durable products expect the firm to supply support during the product life cycle. Therefore firms operating in these industries are expected to be less indebted to decrease the probability of bankruptcy. They are coded with a dummy variable equal 1, otherwise 0, as shown in *Equation 2-8*.

$$D_{Unique\ products} = \begin{cases} Unique\ products = 1 \\ Otherwise = 0 \end{cases} \quad (2\text{-}8)$$

2.4.3 Third level – Industry

Industry characteristics importantly affect firm operations. For example, Rauh & Sufi (2010) found that the overall degree of asset tangibility is highly correlated across firms within the same industry. Consequently, firms operating within the same industry will have similar amount of business risk, which importantly determines the amount of debt the capital markets will provide (Ferri & Jones, 1979). As shown by Brennan & Schwartz (1978), firms with higher business risk will have, all else equal, lower optimal leverage. Gupta (1969) emphasized that leverage is a function of multivariates that have different importance in different industries. Industry classification is thus an important factor that will influence how determinants on lower levels affect the target capital structure. The within industry forces, which could affect firms' financing decisions, could appear in the form of product market interactions, nature of the competition, the types of assets used in the production process, business risk, state of technology, or regulations (Frank & Goyal, 2009).

Schwartz & Aronson (1967), Scott (1972), Bowen et al. (1982), and Bradley et al. (1984) found that firms within an industry are more homogenous compared to firms from different industries. Additionally, industries tend to retain relative leverage ratio ranking over time.

This important finding led to the conclusion that each industry has a unique target capital structure. Schwartz & Aronson (1967) argued that if the target capital structure does not exist, then theoretically there should be no recognizable patterns of financial structures among industries. Bradley et al. (1984) surveyed 851 firms from 25 different industries and calculated the average 20-year ratio (1962–1981) between book value of long-term debt and the sum of book value of long term debt and the market value of equity. With the use of ANOVA they found significant differences among leverage ratios and concluded that industry classification alone could explain up to 54 percent of total leverage variability. On the other hand, Remmers et al. (1974), Ferri & Jones (1979), and Chaplinsky (1984) did not find enough evidence to support the differences in capital structures among industries.

Bowen et al. (1982) summarized that previous empirical studies showed conflicting conclusions on the existence of differences in target capital structure among industries. They proposed three main hypotheses, which would determine the importance of industry classifications:

H1: Firms in different industries have systematically different capital structure.
H2: The relative rankings of mean industry financial structures across time are stable.
H3: The leverage of firms within an industry tends to converge to the mean industry leverage.

When testing the first hypothesis, Schwartz & Aronson (1967), Scott (1972), and Scott & Martin (1975) found statistical differences among industries. The study by Scott & Martin (1975) is especially interesting, because both parametric and non-parametric statistical techniques were used and the analysis was controlled by firm size through the analysis of covariance. Remmers et al. (1974) and Belkaoui (1975), on the other hand, did not find statistical differences among industries. Bowen et al. (1982) performed an analysis of variance for 9 different industries and calculated ω^2, which measures the percentage of variance of firms' leverage explained by the knowledge of industry classification. The analysis was performed for 1951–1969 for a sample of American firms and results were highly statistically significant. The average ω^2-statistics was 0.275. They continued with pairwise tests of arithmetic means with the least significant difference test and got a large number of pairwise comparisons to be significant. The second hypothesis was usually tested with the help of Spearman rank correlation coefficient and the Kendall-W coefficient of concordance. Bowen et al. (1982) found that relative rankings of average industry capital structures across time are stable. Similarly, Schwartz & Aronson (1967) argued that the leverage structure of industries does not change much. When testing the third hypothesis, Bowen et al. (1982) performed Fisher exact probability test. This is a non-parametric test which gives the probability of the actual or more extreme configuration under the null hypothesis if no directionality is observed. Over the 5- and 10-year period, authors proved the existence of tendency movements towards the industry median indebtedness. Industry median indebtedness is thus an important determinant of firm's capital structure. Scott (1972) critically reexamined the empirical study of Schwartz & Aronson (1967), who claimed that leverage significantly differs among industries and that financial structures within the industries remain relatively stable over time. Scott selected a sample of 77 firms from 12 unregulated industries. The time span of the research was 10 years (1959–1968). With the use of ANOVA, author proved the statistical difference in at least one industry at a very high level of significance. In order to prove differences more thoroughly, Scott (1972) used multiple comparison test. For the year 1968 he showed that 62.5 percent of all possible pairs among 12 industries were statistically significant at 5 percent level, from which it follows that the differences in financial structures are quite persistent.

I wanted to verify whether there are statistically significant differences in firms' indebtedness across European industries during the period 2006–2011. Past research was usually performed with one-way ANOVA, analyzing whether industry (or country) factor statistically explains the difference in the average indebtedness. I first tried with two-way ANOVA, including both factors (i.e. industry and country) at the same time, and got statistically significant results for both. Even more, cross product effect between both factors was especially strong, meaning that the industry factor affects the average indebtedness differently in different countries. However, because assumptions of normality of the dependent variable and equality of variances across groups were violated, I also used non-parametric version of one-way ANOVA – Kruskal-Wallis test. Because the Kruskal-Wallis test assumes that observations in each group come from the population with the same shape of distribution, I additionally performed Mood's median test, which, instead of analyzing ranks, tests if samples are drawn from a population with the same median, and is robust to different distributional shapes (Field, 2009). Both tests were performed on the share of the long term debt in the total assets, on the share of the total financial debt (long- and short-term debt) in the total assets, and on the share of the total debt (long- and short-term debt & accounts payable) in the total assets, using industry as a grouping variable. Tests were performed for each year separately. In the *Table 2-1* results are shown.

Table 2-1: Testing differences in indebtedness – grouping variable is industry

		Kruskal-Wallis test			**Mood's median test**		
		Long-term debt to TA	Long- and short-term debt to TA	Long- and short-term debt & payables to TA	Long-term debt to TA	Long- and short-term debt to TA	Long- and short-term debt & payables to TA
Grouping by industry (df = 17)	2006	$\chi^2 = 1102.7$	$\chi^2 = 795.2$	$\chi^2 = 621.2$	$\chi^2 = 587.5$	$\chi^2 = 476.9$	$\chi^2 = 502.3$
	2007	$\chi^2 = 1147.9$	$\chi^2 = 817.3$	$\chi^2 = 639.3$	$\chi^2 = 623.9$	$\chi^2 = 530.6$	$\chi^2 = 502.9$
	2008	$\chi^2 = 1112.6$	$\chi^2 = 759.6$	$\chi^2 = 587.6$	$\chi^2 = 583.1$	$\chi^2 = 510.7$	$\chi^2 = 467.2$
	2009	$\chi^2 = 1138.0$	$\chi^2 = 827.1$	$\chi^2 = 619.0$	$\chi^2 = 588.0$	$\chi^2 = 526.9$	$\chi^2 = 514.6$
	2010	$\chi^2 = 1134.1$	$\chi^2 = 822.7$	$\chi^2 = 637.7$	$\chi^2 = 599.9$	$\chi^2 = 520.5$	$\chi^2 = 527.0$
	2011	$\chi^2 = 1127.1$	$\chi^2 = 780.9$	$\chi^2 = 609.3$	$\chi^2 = 581.3$	$\chi^2 = 485.6$	$\chi^2 = 510.3$

Note: All differences are statistically significant at p-value below 0.001, sample size is 8,777 firms.

Source: Amadeus, 2013.

In compliance with the results obtained with two-way ANOVA, non-parametric tests show that industry classification has determining power for analyzing differences in the average and median indebtedness. Because all significance levels are very high, I can conclude that there were statistical differences in the average and median indebtedness among European firms operating in different industries during the period 2006–2011.

Frank & Goyal (2009) argued that empirical studies show that firms converge to industry norms. Industry leverage is thus a powerful predictor because it reflects a number of otherwise omitted common factors that influence a firm's capital structure (Byoun, 2008). More recently, Leary & Roberts (2014) found evidence that industry leverage is that important determinant because firms are directly influenced by the financing choices of their peers. For example, Hovakimian, Opler & Titman (2001) provided evidence that firms actively adjust their indebtedness toward the target, expressed as industry median debt ratio. The same was found by Gilson (1997), Hull (1999), Facio & Masulis (2005), and Flannery & Rangan (2006). MacKay & Phillips (2005) provided a comprehensive review of industry effects on leverage and showed that capital structure, technology, and risk are jointly determined within industries. There is, according to researchers, a strong interdependence of firms operating within the same industry. With MLM I controlled for similarity of firms operating within the same industry on the one hand, and for heterogeneity among them, on the other. As will be shown later, intraclass correlation between firms (i.e. a measure of similarity between two randomly selected units, clustered within the same group), operating within the same industry, is far above permissible 10%. With the random intercept at industry level, differences in industry indebtedness are effectively modeled, substituting the commonly used *Industry median leverage* as an explanatory variable of capital structure research.

2.4.4 Fourth level – Country

Stonehill & Stitzel (1969) showed that large cross-country differences exist in indebtedness of the same industry. They concluded that debt ratios are more clustered by countries than by industries. Reasons can be found in cultural, institutional, and accounting differences. Country norms could therefore be more important than industry norms. Toy et al. (1974) argued that international monetary variables (e.g. the need for foreign borrowing, the exchange rate risk, and the repatriation of capital), capital-market conditions, the role of government in case of bankruptcy, the historical development of debt ratios, etc. should importantly influence the target capital structure. It is thus important to incorporate into the model the fact that firms operating within the same country are not independent. This is done through the fourth level of MLM. As in the previous subchapter, I wanted to verify whether there are statistically significant differences in firms' indebtedness across European countries. In *Table 2-2* results are shown.

Table 2-2: Testing differences in indebtedness – grouping variable is country

		Kruskal-Wallis test			Mood's median test		
		Long-term debt to TA	Long- and short-term debt to TA	Long- and short-term debt & payables to TA	Long-term debt to TA	Long- and short-term debt to TA	Long- and short-term debt & payables to TA
Grouping by country (df = 24)	2006	$\chi^2 = 1176.9$	$\chi^2 = 1108.4$	$\chi^2 = 1268.2$	$\chi^2 = 803.5$	$\chi^2 = 718.5$	$\chi^2 = 804.7$
	2007	$\chi^2 = 1018.1$	$\chi^2 = 1022.4$	$\chi^2 = 1360.8$	$\chi^2 = 677.6$	$\chi^2 = 707.6$	$\chi^2 = 956.6$
	2008	$\chi^2 = 1027.6$	$\chi^2 = 1016.7$	$\chi^2 = 1149.0$	$\chi^2 = 699.1$	$\chi^2 = 738.6$	$\chi^2 = 778.1$
	2009	$\chi^2 = 1030.2$	$\chi^2 = 959.9$	$\chi^2 = 1192.9$	$\chi^2 = 750.4$	$\chi^2 = 736.0$	$\chi^2 = 837.6$
	2010	$\chi^2 = 1066.1$	$\chi^2 = 1046.0$	$\chi^2 = 1265.9$	$\chi^2 = 773.7$	$\chi^2 = 761.7$	$\chi^2 = 865.5$
	2011	$\chi^2 = 1064.2$	$\chi^2 = 1035.9$	$\chi^2 = 1253.3$	$\chi^2 = 778.9$	$\chi^2 = 754.8$	$\chi^2 = 852.3$

Note: All differences are statistically significant at *p*-value below 0.001, sample size is 8,777 firms.
Source: Amadeus, 2013.

Since all significance levels are very high, I can conclude that there were statistical differences in average and median indebtedness among the firms operating in different European countries during the period 2006–2011. In addition to the random intercept at the fourth level, three explanatory variables are used.

GDP growth. The *trade-off theory* predicts that during expansions expected bankruptcy costs are reduced and firms borrow more. On the other hand, the *pecking order hypothesis* predicts that during expansions firms generate more internal funds and have a lower need for new borrowing. Additionally, GDP growth is also a good control variable for a recession, as suggested by Frank & Goyal (2009). I included the variable (real) $GDPgrowth_{tk}$ in the model, allowing a positive or negative relationship.

Inflation. Since the real value of interest tax deductions on debt is higher in times of high inflation (Taggart R. A., 1985), the *trade-off theory* predicts that leverage is positively related to inflation. A positive relationship can also arise when management is timing debt issues. This means that debt is issued when expected inflation is high relative to the current interest rates (Frank & Goyal, 2008). I used the official inflation rate ($Inflation_{tk}$), expecting a positive relationship.

Tax rate. In 1960 researchers started debating which factors determine the target capital structure. At that time, the majority agreed that taxes were an important determinant (Marsh, 1982; Taub, 1975). The *trade-off theory* predicts that firms will use more debt when taxes are higher to take advantage of the interest tax shield. Increase in the tax rate should therefore increase the desired debt-equity ratio because of the tax advantage of debt, or as argued by Scott (1976), the optimal level of debt is an increasing function of the corporate tax rate. However, Marsh (1982) believed that modeling tax effect as a determinant of target capital structure is challenging. The problem is that in a given year firms in the same country usually have the same taxation, so the cross-sectional effect cannot be determined. The tax rate can therefore be modeled only in a time-series analysis, under the condition that the tax regime changed during the analyzed period. Because my sample includes firms from 25 European countries with different corporate tax rates, I tried to determine whether statuary corporate tax rate[7] (as suggested by Graham (1996)) has significant power in explaining observed capital structures ($Tax\ rate_k$). It is expected that tax rate will be positively related to leverage.

2.5 Dataset description

The empirical analysis utilizes the Amadeus database, provided by Bureau van Dijk (2013). The database contains comprehensive financial information of firms from 34 European countries. Using one single provider ensures consistency in the treatment of the basic accounting information. The final selection includes firms from the following 25 countries: Belgium, Bulgaria, Croatia, Czech Republic, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland, and the United Kingdom (See *Figure 2-2*).

Figure 2-2: Graphical presentation of included countries

Source: Own presentation.

There are two main reasons why firms of some European countries are excluded from the analysis. First, some countries do not provide firms' financial information back to the year 2005 (e.g. some of the Balkan countries), and second, some countries do not report all financial categories which are crucial for this study (e.g. for Austrian firms the amount of financial debt was not available). The time period chosen for the analysis is 2005–2011. Before 2005 only the main balance sheet categories are available in certain countries (e.g. Spain, Slovenia), while at the time of preparing the dataset, firms' financial data for the year 2012 was not yet available. Every firm was individually tested for consistency of financial statements with a series of logical tests. Firms which failed to satisfy those tests,

[7] I was aware that statutory (nominal) tax rate and effective tax rate (the amount of taxes actually paid by a firm) can be quite different; however, I was unable to obtain the effective rate. Additionally, Huizinga et al. (2008) made a research on 32 European countries during the period from 1994 to 2003 and found that larger firms face international tax incentives, while my analysis ignores this possibility.

although very few, were removed, with rounding errors being ignored. After all consistency checks, firms with average total assets during the period 2005–2011 above €5 million were selected for the multilevel linear model. The next step was downsizing of individual datasets for a few countries with a high number of firms. For dataset reduction, I used simple random sampling. Selecting an equal number of firms for each country was inappropriate, because in some countries there were not enough firms with financial statements of required quality. In addition, bigger economies should have a somewhat bigger impact on the final sample. Therefore I used the GDP indicator as a proxy for the size of the economy and adjusted the number of firms accordingly, up to the level allowed by different constraints in the quality of the data. Finally, firms operating in regulated industries, i.e. gas, water & electric utilities (Nace Rev. 2: Devision 35), were excluded from the analysis, as was done by past researchers (e.g. Byoun (2008), Lemmon et al. (2008)). The sample also excludes financial firms (e.g. banks, insurance companies, pension funds). Jensen & Meckling (1976) and Stulz (1990) argued that the more regulated the industry is, the lower is the probability of assets substitution, which leads to higher indebtedness. Additionally, such firms can have very different capital structures and their financing decisions may not show the same information as for non-regulated firms. For example, high leverage can be normal for financial and regulated firms, while the same leverage may indicate possible financial distress for other firms, as discussed by Byoun (2008).

For each firm, balance sheet and income statement data were obtained for all seven years, together with NACE Rev. 2 classification, the indicator of a publicly-quoted firm (a dummy variable), the category of a firm (small, medium-sized, large, very large), and the legal form of a firm (private, public, other legal form, no legal form). *Table 2-3* shows the frequency distribution of firms by country.

Table 2-3: Frequency distribution of firms by country

	Country	Number of firms	Share in %		Country	Number of firms	Share in %
1.	Belgium	736	8.4	14.	Latvia	234	2.7
2.	Bulgaria	178	2.0	15.	Lithuania	252	2.9
3.	Croatia	92	1.0	16.	Luxembourg	99	1.1
4.	Czech Republic	229	2.6	17.	Norway	81	0.9
5.	Estonia	51	0.6	18.	Poland	476	5.4
6.	Finland	109	1.2	19.	Portugal	150	1.7
7.	France	244	2.8	20.	Slovakia	135	1.5
8.	Germany	1,392	15.9	21.	Slovenia	141	1.6
9.	Greece	334	3.8	22.	Spain	930	10.6
10.	Hungary	184	2.1	23.	Sweden	110	1.3
11.	Iceland	19	0.2	24.	Switzerland	387	4.4
12.	Ireland	187	2.1	25.	UK	1,691	19.3
13.	Italy	336	3.8		Σ	8,777	100.0

Source: Amadeus, 2013.

The final sample includes 8,777 firms from 25 European countries. The largest subsamples come from the United Kingdom and Germany, while the smallest subsamples from Iceland and Estonia. It needs to be stressed that there is a possible survivorship bias because only firms with complete and consistent financial data during the analyzed time period are included. However, I believe that this does not affect the main findings of this analysis, because as recently shown in a similar study by Lemmon et al. (2008), firms' capital structure behavior does not differ between the general population and the population of survivors.

Further, *Table 2-4* shows the distribution of firms by their primary activity (NACE classification). Most firms come from section C – "Manufacturing", and section G – "Wholesale and retail trade; repair of motor vehicles and motorcycles". On the other hand, the fewest firms operate in section O – "Public administration and defense; compulsory social security", and section P – "Education".

Table 2-4: Distribution of firms by NACE classification

Section	NACE Description	Frequency	Share in %
A	Agriculture, forestry and fishing	127	1.4
B	Mining and quarrying	57	0.6
C	Manufacturing	2,340	26.7
E	Water supply; sewerage, waste management and remediation activities	210	2.4
F	Construction	714	8.1
G	Wholesale and retail trade; repair of motor vehicles and motorcycles	2,273	25.9
H	Transportation and storage	534	6.1
I	Accommodation and food service activities	215	2.4
J	Information and communication	250	2.8
K	Financial and insurance activities	258	2.9
L	Real estate activities	535	6.1
M	Professional, scientific and technical activities	621	7.1
N	Administrative and support service activities	326	3.7
O	Public administration and defense; compulsory social security	14	0.2
P	Education	15	0.2
Q	Human health and social work activities	149	1.7
R	Arts, entertainment and recreation	66	0.8
S	Other service activities	73	0.8
	Σ	8,777	100.0

Source: Amadeus, 2013.

In *Figure 2-3*, structure and time-series movement of selected balance sheet categories are shown with a boxplot graph[8].

The first five columns show the structure of firms' assets. During the analyzed period, median share of fixed assets in total assets (the 1st column) and median share of current assets in total assets (the 3rd column) represent around 45 and 65 percent, respectively. Both categories are stable. Fixed assets are mainly composed of tangible assets (the 2nd column) with slightly increasing dispersion from the year 2005 to the year 2011. Stocks as a share of current assets (the 4th column) and debtors as a share of current assets (the 5th column) show no significant movements during the analyzed period.

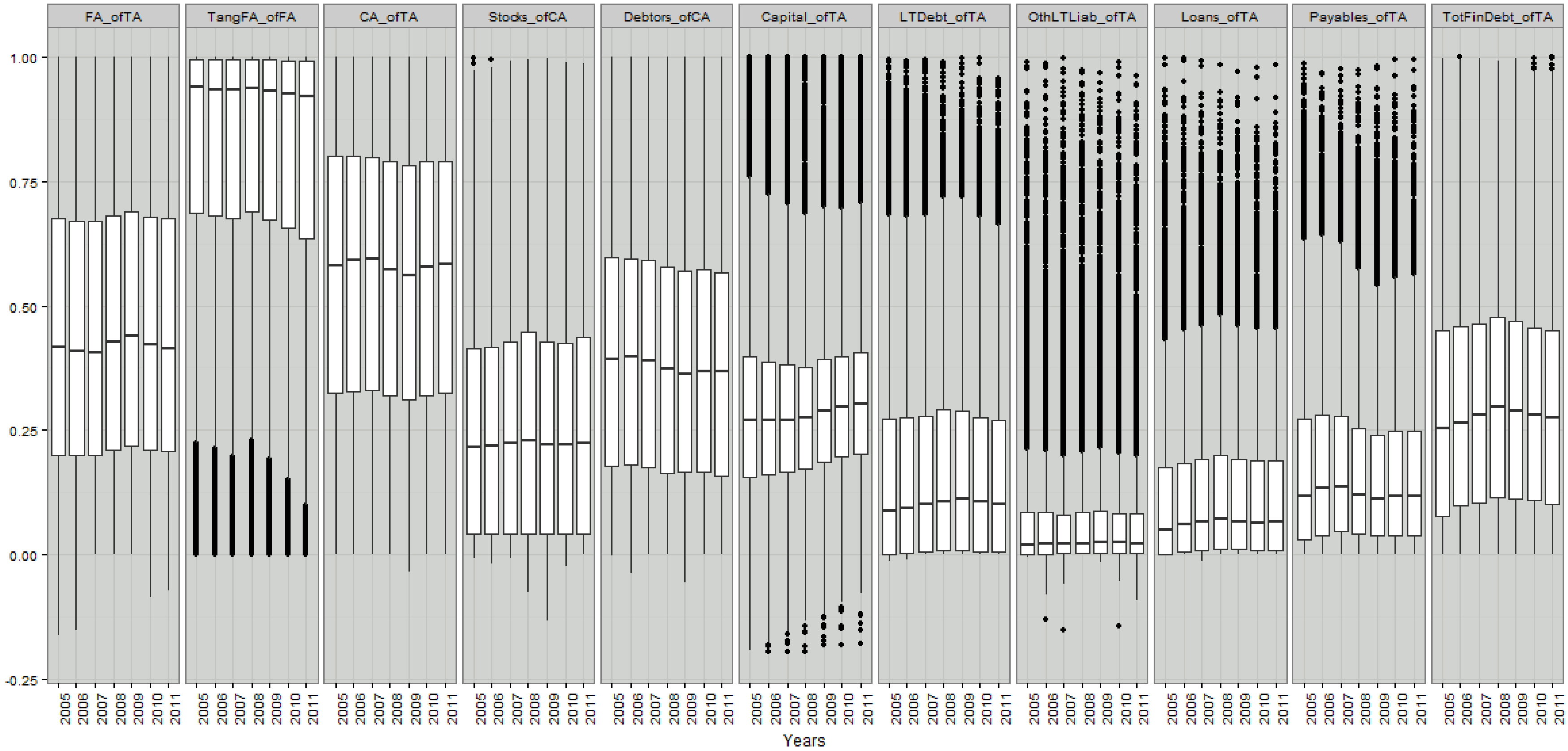
The median share of equity capital in total assets (the 6th column) increased from 28 percent in the period 2005–2008 to 32 percent in the year 2011. On the other hand, the median share of long-term debt in total assets (the 7th column) increased from the year 2005 to the year 2009 and then fall. Median share of other long-term liabilities in total

[8] Each boxplot is composed of minimum, first quartile, median, third quartile, and maximum, while outliers are denoted by black points. It gives a good impression of where the data is centered and how is dispersed.

assets (the 8th column) was stable. Median share of short-term debt in total assets (the 9th column) shows similar pattern as long-term debt. However, the fall is seen already in the year 2009. Median share of accounts payable in total assets shows an increase in the period 2005–2007, then a slight fall in 2008 and 2009, and afterwards it stabilizes. The last column, median share of total financial debt in total assets reveals a strong leveraging process in the period 2005–2008. In the year 2005 this share was 25 percent, while in the year 2008 it reached a peak at 30 percent. After the year 2008, deleveraging process can be observed.

Figure 2-3: Structure of selected balance sheet categories during the period 2005–2011

Sample size is 8,777 firms. Structure and time-series movement of selected balance sheet categories are shown with boxplots (minimum, first quartile, median, third quartile, and maximum; black points represent outliers). Columns from left to right: **FA_ofTA**: Fixed assets as a share of total assets; **TangFA_ofFA**: Tangible fixed assets as a share of fixed assets; **CA_ofTA**: Current assets as a share of total assets; **Stocks_ofCA**: Stocks as a share of current assets; **Debtors_ofCA**: Debtors as a share of current assets; **Capital_ofTA**: Equity capital as a share of total assets; **LTDebt_ofTA**: Long-term debt as a share of total assets; **OthLTLiab_ofTA**: Other long-term liabilities as a share of total assets; **Loans_ofTA**: Short-term debt as a share of total assets; **Payables_ofTA**: Acc. payable as a share of total assets; **TotFinDebt_ofTA**: Total financial debt as a share of total assets. R-code can be found in Appendix A-1.



Source: Amadeus, 2013.

2.6 Descriptive statistics of variables used in the model

Table 2-5 shows the descriptive statistics for each variable used in the multilevel linear model. These values relate to the sample of 8,777 firms, however, not all firms have full six year observations, because some firm-year observations are detected by different diagnostic tools and removed from the analysis, as is explained in the *Subchapter 2.8*. Furthermore, the majority of variables are winsorized at the upper and lower one-percentile.

The dependent variable, *leverage*, is winsorized at 0.00 and 86.18 percent. The average and median values are 30.27 and 28.47 percent, respectively. The first explanatory variable, *profitability*, is distributed between -15.00 and 35.00 percent. The average and median values are 6.12 and 4.96 percent, respectively. The second explanatory variable, *firm size*, is expressed in logarithms of total assets, and has values between 3.46 and 6.73. The average and median values are 4.45 and 4.26, respectively. The third explanatory variable, *firm growth*, has values between -36.90 and 94.54 percent. The average and median values are 7.41 and 3.80 percent, respectively. The fourth explanatory variable, *tangibility*, is distributed between 0.01 and 96.93 percent. The average and median values are 35.54 and 29.16 percent, respectively. All first level explanatory variables are winsorized at 1st and 99th percentile.

The fifth explanatory variable, *financial distress*, is dispersed between 0.22 and 18.63 percent and is winsorized. The average and median values are 3.84 and 3.04 percent, respectively. A dummy variable for public firms, *D-public*, reveals that 36 percent of all observations belong to public firms. Dummy for firms with unique products, *D-unique*, reveals that 6 percent of all observations belong to firms that are producing unique and durable products.

The last three variables belong to the fourth level and are not winsorized. During the analyzed period, GDP growth was dispersed between -8.50 and 10.10 percent, with average and median values 1.53 and 2.30 percent, respectively. Inflation was distributed between -1.20 and 11.10 percent. The average and median values are 2.59 and 2.30 percent, respectively. Corporate tax rate was distributed between 10.00 and 33.99 percent, with average and median values 25.50 and 25.00 percent, respectively.

Table 2-5: Descriptive statistics of variables used in the model

Descriptive statistics relate to the sample of 8,777 firms with average total assets larger or equal to €5 million, excluding firm-year observations that are removed by diagnostic check. Variables, denoted with an asterisk (*) are winsorized so that values below 1st percentile (above 99th percentile) are replaced with value of 1st percentile (99th percentile). The descriptive statistics for the dependent variable relate to the period 2006–2011 and for the 10 explanatory variables to the period 2005–2010.

Variable	Mean	Standard deviation	1st percentile	Q1	Median	Q3	99th percentile
Dependent variable							
Leverage (% of TA)	30.27	22.30	* 0.00	11.10	28.47	46.33	* 86.18
Level 1							
Profitability (% of TA)	6.12	6.53	* -15.00	2.34	4.96	8.97	* 35.00
Firm size ($\log_{10}$(€))	4.45	0.68	* 3.46	3.93	4.26	4.80	* 6.73
Firm growth (% Δ in TA)	7.41	20.94	* -36.90	-4.11	3.80	15.22	* 94.54
Tangibility (% of TA)	35.54	28.16	* 0.01	11.31	29.16	54.75	* 96.93
Level 2							
Financial distress (% of TA)	3.84	3.05	* 0.22	1.64	3.04	5.16	* 18.63
D_{PUBLIC}	0.36	/	0	0	0	1	1
$D_{UNIQUE\ PRODUCTS}$	0.06	/	0	0	0	0	1
Level 4							
GDP growth (%)	1.53	3.88	-8.50	-0.10	2.30	3.60	10.10
Inflation (%)	2.59	1.93	-1.20	1.80	2.30	3.30	11.10
Tax rate (%)	25.50	6.47	10.00	22.00	25.00	32.00	33.99

Sources: Amadeus, 2013; Eurostat, 2014.

2.7 Multilevel linear modeling

There are two forms of dependency that are common for financial studies (Petersen, 2009). The first one is the dependency of residuals of a firm that is observed over the years – time-series dependency (i.e. unobserved firm effect). The second one is the dependency of residuals across firms in a given year – cross-sectional dependency (i.e. unobserved time effect). Petersen (2009) summarized numerous alternative estimations of standard errors, which are applied in the analyses of capital structure from panel data. Researchers typically use classical OLS standard errors, White-corrected standard errors, and Fama–MacBeth-corrected standard errors. While the first option violates numerous assumptions of regression analysis, the latter two options show a significant downward bias because only the unobserved time effect is controlled (Petersen, 2009). Serial correlation among observations of a given firm – the unobserved firm effect, is, on the other hand, not appropriately addressed. He concluded that to solve the problem of the unobserved firm effect, standard errors, clustered by firms, need to be used. More recently, Thompson (2011) argued that standard errors, which simultaneously cluster both by firm and time, should be preferred. Multilevel linear modeling effectively controls at the same time both for cross-sectional dependency through data hierarchy, and for time-series dependency through repeated measurements, nested within the unit of observation (Gelman & Hill, 2007), so it should be the preferred alternative to the methods used in the past empirical research of capital structure. Moreover, recent research has demonstrated that multilevel linear modeling is more successful at avoiding falsely rejecting the null hypothesis due to artificially inflated testing statistics (Cheah, 2009). Cheah concluded that modeling data by controlling for its multilevel structure is a better approach than simply correcting the standard errors obtained by OLS regression. Gelman (2006) presented a similar conclusion that, compared to classical OLS regression, multilevel linear modeling is always an improvement, but to varying degrees: for prediction it can be essential, for data reduction it can be useful, and for causal inference it can be helpful.

Multilevel linear modeling (also known as hierarchical modeling or linear mixed models) is used for research design, where data is structured in more than one level. The lowest level of data is usually defined as a subject or as a repeated measurement of a subject. These subjects or repeated measurements are then nested within higher level units (e.g. pupils – classes – schools) (Gelman & Hill, 2007). West, Welch & Galecki (2007) defined MLM as parametric linear models for clustered, longitudinal, or repeated-measurements data that quantifies the relationship between a continuous dependent variable and various explanatory variables. It may include both fixed effect parameters associated with one or more continuous or categorical covariates, and random effects with one or more random factors. According to West, Welch & Galecki (2007) there are three general types of data that can be analyzed with MLM. The first type is clustered data, where each unit is measured once and these units are clustered within higher level units. The second type is repeated-measurements data, where the dependent variable of each unit is measured more than once. The third type is longitudinal data, where dependent variable of each unit is measured at several points in time, usually with equal intervals. Finally, there is also a combination, called clustered-longitudinal data, which combines features of both clustered and longitudinal data at the same time. In my analysis, leverage is measured for each firm at several points in time with equal intervals, while firms are nested within industries and countries – clustered-longitudinal data.

MLM can be understood as a technique of partial-pooling (Gelman & Hill, 2007), giving results that are between the complete- and no-pooling outcomes. At complete-pooling, the differences among groups are completely ignored because categorical predictors are excluded from the model. On the other hand, no-pooling method addresses the data as separate groups for each categorical predictor individually. Both approaches have shortcomings (Gelman & Hill, 2007). Complete-pooling suppresses variation that can be crucial for a study, while no-pooling technique ignores part of information and this can be problematic for statistical inference (Bartels, 2008). Both techniques can be useful as preliminary estimates, but a researcher should prefer the partial pooling – the result of MLM (Gelman & Hill, 2007). The reason is that when there is little group-level variation, the MLM will be automatically reduced to classical regression analysis with no group indicators. Additionally, when there is a small number of groups (less than five, according to authors), there is often not enough information to estimate group-level variation. On the other hand, when there is a large variation in group-level coefficients, MLM will be transformed to classical regression analysis with group indicators. In all other cases, MLM will provide a more realistic analysis and better statistical inference compared to the classical regression analysis, as argued by Gelman & Hill (2007), who also concluded that whenever applicable, preference should be given to MLM. Furthermore, Raudenbush & Bryk (2002) argued that MLM is most effective when final results are closer to complete-pooling than to no-pooling method. Under such conditions, estimates are allowed to vary by groups while still being estimated precisely. Estimates are effectively pooled when between-group standard deviation is relatively small, meaning that groups are relatively homogenous. On the other hand, when between-group standard deviation is large, MLM will not be much more effective compared to simple no-pooling estimation (Gelman & Hill, 2007). However, between-group standard deviation can always be effectively reduced by including group-level predictors.

MLM should be used whenever data has a hierarchical structure, meaning that units that are clustered within the same group are expected to be similar (Field, 2009). The most often used measure for this similarity is intraclass correlation (ICC). Ignoring the co-dependency can lead into biased results. Whenever units are clustered within groups, or the same unit is measured more than once, the assumption of independency of errors, one of the fundamental assumptions in many statistical techniques, including multiple regression, is violated (Field, 2009). Another mistake that can be done is performing an analysis on higher level, while interpreting results on lower level (ecological fallacy). On the other hand, analysis performed on lower level should not be interpreted at higher level (atomistic fallacy). Both fallacies can be avoided by MLM, which allows that intercept and slopes vary between higher level units (Hox, 2010).

When analyzing multilevel linear models, it is crucial to distinguish between fixed and random factors (West, Welch, & Galecki, 2007). Fixed factors are commonly used at analysis of variance (ANOVA) and covariance (ANCOVA). A fixed factor can be defined as a categorical or classification variable, for which all levels of interest are included. The examples of such fixed factors are qualitative covariates (e.g. gender), classification variables (e.g. region, stratum, treatment method), or ordinal classification variables (e.g. age groups). Levels of a fixed factor are selected in such a way that they represent specific conditions and can be used to define contrasts of interests in the research study. On the other hand, a random factor is a classification variable with levels that can be understood as being randomly sampled from a population of levels being studied. Not all possible levels of the random factor are present in the sample data; however, the researcher's intention is to make inference about the entire population of levels (West, Welch, & Galecki, 2007). Another crucial component of any MLM is the distinction between fixed and random effects (West, Welch, & Galecki, 2007). Fixed effects, called regression coefficients or fixed effect parameters, describe the relationship between the dependent variable and explanatory variables for an entire population of units of analysis. Fixed effects can be fixed factors or continuous covariates. They can be used to describe contrast between levels of a fixed factor (e.g. between males and females) in terms of mean response for the continuous dependent variable, or they may describe the effect of continuous covariates on the dependent variable. Fixed effects are unknown fixed quantities and are estimated based on the analysis of the data, collected in a given research study. On the other hand, random effects are random values, associated with the levels of a random factor. They represent the deviations from the relationships, captured by fixed effects. They can be in a form of random intercept (representing random deviations for a given subject or cluster from the overall fixed intercept), or in a form of random coefficients (representing random deviations for a given subject or cluster from the overall fixed effect). The main goal of allowing intercept to vary across groups is to handle the increased Type I error, which happens when groups in the hierarchical data structure significantly differ in the average value of the dependent variable (Tabachnick & Fidell, 2012). Since there are important differences in average indebtedness across industries and countries, as shown in *Subchapter 2.4*, I believe that random intercept model will importantly improve the estimates of standard errors.

As an example, I present the basic logic of estimation of a regression intercept with MLM. Let's assume that we perform a partial-pooling with only group-level classification and no other predictor variables. In that case, intercept for a group *j* is estimated by *Equation 2-9*.

$$\hat{\beta}_{oj} \approx \frac{\frac{n_j}{\hat{\sigma}_w^2}\,\bar{y}_j + \frac{1}{\hat{\sigma}_b^2}\,\bar{y}_{all}}{\frac{n_j}{\hat{\sigma}_w^2} + \frac{1}{\hat{\sigma}_b^2}} \tag{2-9}$$

The multilevel estimation of intercept for group j is a weighted average of no-pooled estimate of the arithmetic mean in the group j ($\bar{y}_j$) and completely-pooled estimate over all groups ($\bar{y}_{all}$). $\hat{\sigma}_w^2$ and $\hat{\sigma}_b^2$ are estimates of within and between group variances of the dependent variable, respectively. A group with a larger sample size (n_j) contains more information and the corresponding multilevel estimate is close to the group average ($\bar{y}_j$). In the limit, as $n_j \to \infty$, the multilevel estimate would simply be the group average, $\bar{y}_j$. On the other hand, groups with small sample sizes contain less information, and the weighting pulls the multilevel estimates closer to the overall group average ($\bar{y}_{all}$). In the limit, as $n_j \to 0$, the multilevel estimate would simply be the overall average, $\bar{y}_{all}$. Weighting process thus reflects the relative amount of information available from the individual group on the one hand, and the information available from all groups on the other. A more generalized equation for estimating intercept with one predictor is written in *Equation 2-10.*

$$\hat{\beta}_{oj} \approx \frac{\frac{n_j}{\hat{\sigma}_w^2}}{\frac{n_j}{\hat{\sigma}_w^2} + \frac{1}{\hat{\sigma}_b^2}}\left(\bar{y}_j - \hat{\beta}_1\bar{x}_j\right) + \frac{\frac{1}{\hat{\sigma}_b^2}}{\frac{n_j}{\hat{\sigma}_w^2} + \frac{1}{\hat{\sigma}_b^2}}\hat{\mu}_{\beta_0} \tag{2-10}$$

The intercept can be expressed as a weighted average of no-pooled estimate of its group $(\bar{y}_j - \beta_1 \bar{x}_j)$ and completely-pooled arithmetic mean $\hat{\mu}_{\beta_0}$. From the *Equation 2-10* it can be noticed that there is more pooling towards overall arithmetic mean when there is small group-level standard deviation $(\hat{\sigma}_{\mathrm{b}})$, and more smoothing for groups with fewer observations (n_j) (Gelman & Hill, 2007). To summarize, MLM can be understood as a method that compromises between complete-pooling, where categorical predictor for a group classification is excluded, and no-pooling, where separate model for each level of the categorical predictor is estimated. When complete-pooling method is chosen, regression analysis estimates the average that completely pools the data across all groups. That method ignores all the variation between groups. On the other hand, no-pooling analysis overstates the variation between groups and tends to make the individual groups look more different than they actually are (Gelman & Hill, 2007).

Unlike the decision for including random intercept, random slope is used when relationship between the dependent and independent variable is expected to differ among groups (Tabachnick & Fidell, 2012). The decision whether to include a random slope must be evaluated for each explanatory variable separately. This can be done by testing whether the slope variance is statistically different from zero. It is important, however, to note that slopes of explanatory variables on the highest level are always fixed. Since I did not find any theoretical justifications for explanatory variables to have different impact on observed leverage in different industries or countries, my model omits random slopes.[9]

There are many advantages of MLM. Assumptions of independence of errors, as assumed at standard OLS regression analysis, and of homogeneity of regression slopes, as assumed at analysis of covariance, are not required (Field, 2009). Another advantage comes when someone works with the missing observations. Many authors argued that missing observations in the longitudinal studies have only a minor effect on MLM. Even more, model estimates are more accurate compared to the use of various imputation methods (Field, 2009; Tabachnick & Fidell, 2012). Additional advantage of MLM over the classical regression analysis is the inclusion of higher level variables which allow testing the between-group effects (Bartels, 2008; Tabachnick & Fidell, 2012). Furthermore, higher level predictors are often helpful at explaining lower level differences in intercepts and slopes. Additionally, Gelman & Hill (2007) argued that one important advantage of MLM is the possibility for estimating regression coefficients for groups with particularly small sample sizes. Even with just two observations per group, multilevel linear model can successfully be fitted. In such cases, group-level standard deviation is not estimated precisely, but it still provides some information that allows estimation of the coefficients and variance parameters on different levels. Since my sample includes a relatively low number of firms for some groups of industry-country combinations, MLM is expected to perform better than pooled OLS regression analysis.

---

[9] One could argue that capital structure determinants could have different effects in more or less developed European countries. However, Booth et al. (2001) clearly showed that there are no systematic differences in the model for estimating the target capital structure between developed and developing countries.

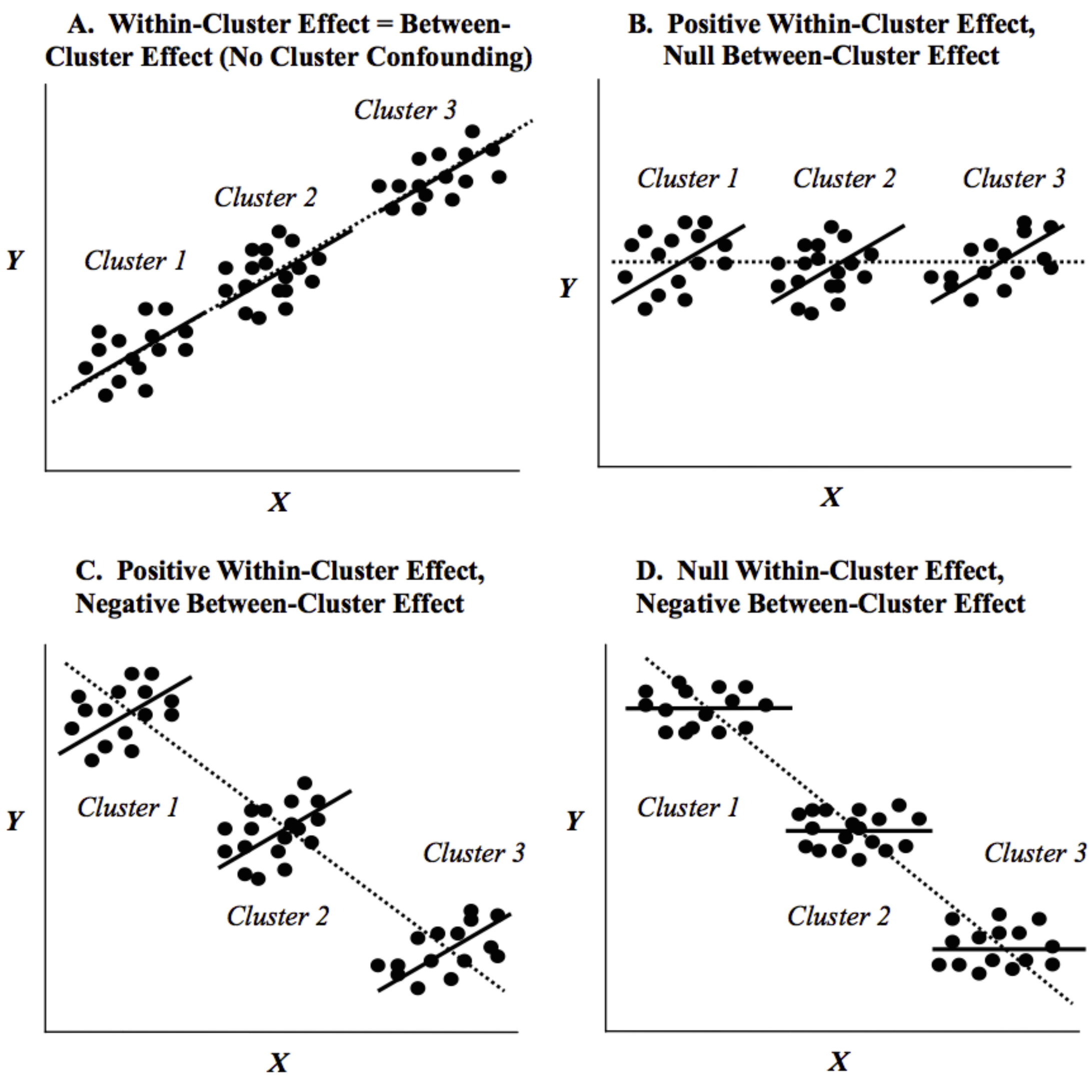
On the other hand, the main disadvantage of MLM comes in the form of more complicated models that are harder to understand and summarize (Gelman & Hill, 2007). Additional limitation is that MLM is very sensitive to correlated predictors (Tabachnick & Fidell, 2012). Therefore, a smaller number of relatively uncorrelated explanatory variables should be used. A strong theoretical framework often helps to limit the number of predictors and facilitates decisions about how to treat them. Problem with multicolinearity can sometimes be successfully resolved by just simply centering the variables (Twisk, 2006; Field, 2009). Centering can be done on group-mean or grand-mean. Often, the latter choice is safer and easier to interpret (Raudenbush & Bryk, 2002; Tabachnick & Fidell, 2012). Since MLM is an extension of multiple linear regression, problems with outliers should be considered. Raudenbush & Bryk (2002) suggested that within each level of data, both univariate and multivariate outliers are considered.

Research typically starts with a multiple regression model which is gradually developed into MLM (Raudenbush & Bryk, 2002). First, the series of multiple regression analyses can be performed, e.g. complete-pooling and no-pooling models. Additionally, separate regression analyses can be performed within each group of data; however, this strategy will not work for groups with small sample sizes. Moreover, inclusion of group-level predictors in MLM has a goal to get best estimates for each group rather than to prove statistical differences among them. Statistical significance should therefore not influence inclusion or exclusion of a particular indicator. However, estimating many coefficients can complicate the fitting procedure and increase model complexity (Gelman & Hill, 2007). Therefore, the change in log-likelihood is the preferred measure of model fit over *t*-tests of fixed effects or the Wald-tests of random effects. The majority of researchers thus suggest that explanatory variables on different levels are added step by step, analyzing the overall fit of the model. The reference model (i.e. the more general model, which includes both the null and the alternative hypotheses) is compared to the nested model (i.e. the simpler model, which satisfies only the null hypothesis) through the log-likelihood ratio test (LRT). Likelihood theory states that LRT statistics follows asymptotical χ^2-distribution, with degrees of freedom equal to the number of additional parameters in the reference model. If the reference model has a statistically significant lower value of -2 log-likelihood function, this means that the overall fit of the model is better. When comparing two models which differ in fixed effects, maximum LRT is preferred. On the other hand, when comparing two models which differ in random effects, restricted maximum LRT must be used (West, Welch, & Galecki, 2007). When performing Wald-tests, *p*-values at variance terms should be divided by two, because the test of variance is one-tailed test. A researcher is only interested if the variance is greater than the expected by chance. However, at covariance term, two-tailed test must be used (Tabachnick & Fidell, 2012). When working with non-nested models, the model with the lowest AIC or BIC should be preferred, since changes in log-likelihood are not directly comparable (West, Welch, & Galecki, 2007).

Finally, cluster confounding is an important issue that needs to be addressed (Bartels, 2008). MLM, as any other regression techniques, assumes that within- and between-group effects of unit-level predictors are equal, which means that there is no problem with cluster confounding. *Figure 2-4* shows four possible relationships between the dependent and explanatory variable. However, only *Panel A* exhibits no cluster confounding – the relationship between both variables is the same within- and between-clusters.

Because effects are not always equal, Bartels suggested transforming unit-level variable to within- and between-group part. First, the group-specific arithmetic mean of X_{ijk} must be estimated, denoted as $\bar{X}^{b}_{ijk}$. This variable is used for estimating the between-firm effect. The within-firm effect is then estimated with the help of a new variable, denoted and transformed as $X^{w}_{tijk} = X_{tijk} - \bar{X}^{b}_{ijk}$. It can be noticed that $\bar{X}^{b}_{ijk}$ and X^{w}_{tijk} are independent, because within-group and between-group variations are completely separated. Additionally, specifying the model this way satisfies the problematic assumption of independence of the unit-level variable and the random effect term.[10]

Figure 2-4: Cluster confounding issue



Source: Bartels, 2008.

[10] Hausman (1978) developed a test to assess the adequacy of this assumption.

To summarize, performing MLM can be done in the following steps[11]:

1. Analyze the simplest intercept-only model and examine the intraclass correlation, which measures the degree of homogeneity of units that are clustered within the same group. Already very low intraclass correlation is a reason to build the hierarchical model.
2. Analyze a model with all level 1 predictors fixed. Assess the contribution of each predictor and look at the differences in the models, using -2 log-likelihood criteria. The lower the value, the better the fit.
3. If there are theoretical reasons, assess the models in which the slope for each predictor is permitted to be random one at a time.
4. Test the difference between the model with all necessary random components and the model from the second step in which all predictors are fixed.
5. Add higher level predictors and cross level interaction when needed.
6. Assess different structures of residual matrix and the presence of cluster-confounding.

In the next subchapter the model is mathematically presented.

[11] The steps closely follow the suggestions of Hox (2010).

2.8 Model for explaining capital structure heterogeneity

The general model for explaining capital structure heterogeneity is written in *Equation 2-11*.

$$
\begin{aligned}
Leverage_{tijk} &= \beta_0 X^{(0)}_{(t-1)ijk} + \beta_1 X^{(1)}_{(t-1)ijk} + \beta_2 X^{(2)}_{(t-1)ijk} + \cdots \\
&\quad + \beta_{p-1} X^{(p-1)}_{(t-1)ijk} + \quad \Big\} fixed\ effects \\
&u_{0\,k} Z^{(0)}_{(t-1)ijk} + u_{1\,k} Z^{(1)}_{(t-1)ijk} + \cdots + u_{q-1\,k} Z^{(q-1)}_{(t-1)ijk} + r_{0\,j|k} W^{(0)}_{(t-1)ijk} \\
&\quad + r_{1\,j|k} W^{(1)}_{(t-1)ijk} + \cdots + r_{r-1\,j|k} W^{(r-1)}_{(t-1)ijk} \\
&\quad + \varepsilon_{tijk} \quad \Big\} random\ effects
\end{aligned}
\tag{2-11}
$$

In *Equation 2-11*, *t* indexes longitudinal observations of the dependent variable for a given firm (*t = 2006, 2007, 2008, 2009, 2010, 2011*), *i* indicates the *i*-th firm ($i = 1, 2, \ldots, m_{jk}$), *j* indexes industries (*j = 1, 2, …, 18*) and *k* indexes countries (*k = 1, 2, …, 25*). β_0 is the regression intercept, $\beta_1, \ldots, \beta_{p-1}$ is a set of partial regression coefficients – fixed effects, and $X^{(0)},\ X^{(1)}, \ldots, X^{(p-1)}$ is a set of *p* covariates, lagged for one year. Articles, published more recently (e.g. Lemmon et al. (2008), Frank & Goyal (2009)), used 1-year lag for incorporating the fact that firm needs some time to incorporate new information and adjust its leverage accordingly.[12] *p* covariates are explanatory variables on one of four levels. Explanatory variables on the first level are time-varying characteristics of an individual firm (e.g. share of tangible assets in time *t*), explanatory variables on the second level are time-invariant characteristics of an individual firm (e.g. legal status of the firm), and explanatory variables on the fourth level are country characteristics (e.g. GDP growth in time *t*). Variables on higher levels can either be time-varying or time-invariant.

The second set in *Equation 2-11* contains *q* covariates, $Z^{(0)}, \ldots, Z^{(q-1)}$, associated with random effects $u_{0\,k}, \ldots, u_{q-1\,k}$, that are specific to country *k* – random effects on the fourth level. The third set contains r covariates, $W^{(0)}, \ldots, W^{(r-1)}$, associated with the random effects $r_{0\,j|k}, \ldots, r_{r-1\,j|k}$, that are specific to industry *j* in country *k* ($j|k$) – random effects on the third level. Finally ε_{tijk} is a residual. There are no random effects on the second-level because estimating random effects on the firm level is computationally infeasible, due to large sample size. In case that only intercept is allowed to be random across industries and countries, the random part of the model simplifies into $u_{0\,k} + r_{0\,j|k} + \varepsilon_{tijk}$. Model can also be written in a matrix form, as shown in *Equation 2-12*.

$$
\begin{gathered}
\boldsymbol{Leverage_{ijk}} = \boldsymbol{X_{ijk}\beta} + \boldsymbol{Z_{ijk}u_k} + \boldsymbol{W_{ijk}r_{j|k}} + \boldsymbol{\varepsilon_{ijk}} \\
\boldsymbol{u_k} \sim N(\boldsymbol{0}, \boldsymbol{D_k}) \\
\boldsymbol{r_{j|k}} \sim N(\boldsymbol{0}, \boldsymbol{D_{j|k}}) \\
\boldsymbol{\varepsilon_{ijk}} \sim N(\boldsymbol{0}, \boldsymbol{R_{ijk}})
\end{gathered}
\tag{2-12}
$$

[12] I additionally performed the MLM with 2- and 3-year lag, and found that results are robust. However, because incorporating higher order lag results in fewer longitudinal observations, 1-year lag was used, which goes in line with a contemporary research.

In *Equation 2-12*, dependent variable represents a vector of continuous responses for the *i*-th firm, as shown in *Equation 2-13*.

$$\boldsymbol{Leverage_{ijk}} = \begin{pmatrix} Leverage_{2006ijk} \\ Leverage_{2007ijk} \\ \vdots \\ Leverage_{2011ijk} \end{pmatrix} \tag{2-13}$$

$\boldsymbol{X_{ijk}}$ is $n_i \times p$ design matrix, which represents the known values of the *p* covariates for each of the n_i observations, collected on the *i*-th firm. This is written in *Equation 2-14.*

$$\boldsymbol{X_{ijk}} = \begin{pmatrix} 1 & X^{(1)}_{2005ijk} & \cdots & X^{(p-1)}_{2005ijk} \\ 1 & X^{(1)}_{2006ijk} & \cdots & X^{(p-1)}_{2006ijk} \\ \vdots & \vdots & \ddots & \vdots \\ 1 & X^{(1)}_{2010ijk} & \cdots & X^{(p-1)}_{2010ijk} \end{pmatrix} \tag{2-14}$$

The first column is set to 1 for all observations, representing the regression constant. Similarly, time-invariant explanatory variables (e.g. firm specific characteristics) also have equal values in the entire column. The $\boldsymbol{\beta}$ is a vector of regression constant and *p-1* unknown partial regression coefficients (fixed effect parameters), associated with the *p* covariates in $\boldsymbol{X_{ijk}}$ matrix, as shown in *Equation 2-15.*

$$\boldsymbol{\beta} = \begin{pmatrix} \beta_0 \\ \beta_1 \\ \vdots \\ \beta_{p-1} \end{pmatrix} \tag{2-15}$$

The next term in *Equation 2-12*, $\boldsymbol{Z_{ijk}}$, which is associated with random effects, represents the known values of the *q* covariates for the *i*-th firm. This matrix is very much like the $\boldsymbol{X_{ijk}}$, however, it usually has a lower number of columns because not all covariates are allowed to have a random effect. Very often only intercept is allowed to vary randomly from subject to subject. In that case, $\boldsymbol{Z_{ijk}}$ would consist of one column of 1's. The matrix is written in *Equation 2-16.*

$$\boldsymbol{Z_{ijk}} = \begin{pmatrix} 1 & Z^{(1)}_{2005ijk} & \cdots & Z^{(q-1)}_{2005ijk} \\ 1 & Z^{(1)}_{2006ijk} & \cdots & Z^{(q-1)}_{2006ijk} \\ \vdots & \vdots & \ddots & \vdots \\ 1 & Z^{(1)}_{2010ijk} & \cdots & Z^{(q-1)}_{2010ijk} \end{pmatrix} \tag{2-16}$$

The $\boldsymbol{u_k}$ is a vector of *q* random effects of the *k*-th country, as written in *Equation 2-17.*

$$\boldsymbol{u_k} = \begin{pmatrix} u_{o\,k} \\ u_{1\,k} \\ \vdots \\ u_{q-1\,k} \end{pmatrix} \tag{2-17}$$

By definition, random effects are random variables. I assume that the *q* random effects in the $\boldsymbol{u_k}$ vector follow a multivariate normal distribution, with mean vector $\mathbf{0}$ and a variance-covariance matrix denoted by $\boldsymbol{D_k}$. This can be written as $\boldsymbol{u_k} \sim N(\mathbf{0}, \boldsymbol{D_k})$.

In $\boldsymbol{D_k}$ matrix, elements along the main diagonal represent the variances of each random effect in $\boldsymbol{u_k}$, and off-diagonal elements represent the covariances between pairs of corresponding random effects. Because there are *q* random effects in the model associated with the *k*-th country, $\boldsymbol{D_k}$ is a $q \times q$ matrix that is symmetric and positive definite, as written in *Equation 2-18*.

$$\boldsymbol{D_k} = Var(\boldsymbol{u_k}) = \begin{pmatrix} Var(u_{o\,k}) & cov(u_{o\,k}, u_{1\,k}) & \cdots & cov(u_{o\,k}, u_{q-1\,k}) \\ cov(u_{o\,k}, u_{1\,k}) & Var(u_{1\,k}) & \cdots & cov(u_{1\,k}, u_{q-1\,k}) \\ \vdots & \vdots & \ddots & \vdots \\ cov(u_{o\,k}, u_{q-1\,k}) & cov(u_{1\,k}, u_{q-1\,k}) & \cdots & Var(u_{q-1\,k}) \end{pmatrix} \qquad (2\text{-}18)$$

Elements of random effects on the fourth level, $\boldsymbol{Z_{ijk}}$, $\boldsymbol{u_k}$ and $\boldsymbol{D_k}$, can analogously be applied to the elements of random effects on the third level, $\boldsymbol{W_{ijk}}$, $\boldsymbol{r_{j|k}}$ and $\boldsymbol{D_{j|k}}$, therefore they will not be repeated. Different covariance structures can be applied for the $\boldsymbol{D}$ matrix. The elements of such matrix are usually denoted with a vector $\boldsymbol{\theta_D}$. The covariance structure with no constraints on the values of elements is referred to as an unstructured $\boldsymbol{D}$ matrix, which is the preferred choice for random coefficient models. Another often used covariance structure is variance component (or diagonal) structure, in which each random effect in $\boldsymbol{u}$ has its own variance, while all covariances are set to zero.

The last element of *Equation 2-12*, $\boldsymbol{\varepsilon_{ijk}}$, is a vector of n_i residuals, with each element denoting the residual associated with an observed response at time *t* for the *i*-th firm, as shown in *Equation 2-19*.

$$\boldsymbol{\varepsilon_{ijk}} = \begin{pmatrix} \varepsilon_{2006\,ijk} \\ \varepsilon_{2007\,ijk} \\ \vdots \\ \varepsilon_{2011\,ijk} \end{pmatrix} \qquad (2\text{-}19)$$

Contrary to the assumption of the standard OLS regression, multilevel linear model assumes that residuals can be dependent. This dependency is controlled through different covariance structures of residuals. It is assumed that a vector of residuals follows a multivariate normal distribution with a mean vector $\boldsymbol{0}$ and a positive definite symmetric covariance matrix $\boldsymbol{R_{ijk}}$. This can be written as $\boldsymbol{\varepsilon_{ijk}} \sim N(\boldsymbol{0}, \boldsymbol{R_{ijk}})$. $\boldsymbol{R_{ijk}}$ is presented in *Equation 2-20*.

$$\boldsymbol{R_{ijk}} = Var(\boldsymbol{\varepsilon_{ijk}}) = \begin{pmatrix} Var(\varepsilon_{2006\,ijk}) & cov(\varepsilon_{06\,ijk}, \varepsilon_{07\,ijk}) & \cdots & cov(\varepsilon_{06\,ijk}, \varepsilon_{11\,ijk}) \\ cov(\varepsilon_{06\,ijk}, \varepsilon_{07\,ijk}) & Var(\varepsilon_{2007\,ijk}) & \cdots & cov(\varepsilon_{07\,ijk}, \varepsilon_{11\,ijk}) \\ \vdots & \vdots & \ddots & \vdots \\ cov(\varepsilon_{06\,ijk}, \varepsilon_{11\,ijk}) & cov(\varepsilon_{07\,ijk}, \varepsilon_{11\,ijk}) & \cdots & Var(\varepsilon_{2011\,ijk}) \end{pmatrix} \qquad (2\text{-}20)$$

There are different possibilities for modeling covariance structure of the $\boldsymbol{R_{ijk}}$ matrix. The elements of such matrix are usually denoted with a vector $\boldsymbol{\theta_R}$. The simplest covariance matrix is the diagonal structure, in which the residuals associated with observations on the same subject are assumed to be uncorrelated and to have equal variance. Another possibility is the compound symmetry covariance structure, which assumes constant covariance and constant variance term. The structure is often used when an assumption of equal correlation of residuals is plausible. The covariance structures, used in my models, are first-order autoregressive structure (AR(1)), and unstructured correlation structure (UNR). The AR(1) structure can be written as in *Equation 2-21*.

$$\boldsymbol{R_{ijk}} = Var(\boldsymbol{\varepsilon_{ijk}}) = \begin{pmatrix} \sigma^2 & \sigma^2\rho & \cdots & \sigma^2\rho^{n_i-1} \\ \sigma^2\rho & \sigma^2 & \cdots & \sigma^2\rho^{n_i-2} \\ \vdots & \vdots & \ddots & \vdots \\ \sigma^2\rho^{n_i-1} & \sigma^2\rho^{n_i-2} & \cdots & \sigma^2 \end{pmatrix} \tag{2-21}$$

The AR(1) covariance structure has only two parameters so it can be parsimoniously written as in *Equation 2-22*.

$$\boldsymbol{\theta_R} = \begin{pmatrix} \sigma^2 \\ \rho \end{pmatrix} \tag{2-22}$$

The σ^2 is a positive number, while ρ lies between -1 and 1. AR(1) covariance structure is often used to fit models where observations have equally spaced longitudinal observations on the same unit of analysis. The structure implies that observations closer to each other in time have higher correlation than observations further apart in time. A more complicated version is unstructured correlation matrix (UNR), which allows that each variance and covariance terms are different.

There are two commonly used methods for estimating fixed and random effects in MLM. These are maximum likelihood method (ML) and restricted maximum likelihood method (REML). Both procedures try to estimate the vectors $\boldsymbol{\beta}$ and $\boldsymbol{\theta}$ in such a way that the likelihood function is maximized, meaning that the values of the parameters are set to make the observed values of the dependent variable most likely, given the distribution assumptions (West, Welch, & Galecki, 2007). However, ML estimates of the covariance parameters are biased, whereas REML estimates are not. On the other hand, ML estimates have an important advantage when testing a hypothesis, as will be explained shortly. The MLM, used in this dissertation, is performed by SPSS Mixed Linear Models function, which allows estimating the model by both procedures, using Newton-Raphson and Fisher scoring computational algorithms (West, Welch, & Galecki, 2007).

MLM requires testing hypothesis in a similar way as any regression analysis. Testing individual parameters can be done in two (equivalent) ways. The first way is specifying the hypothesis whether parameter in question has statistically significant impact on the dependent variable and testing it with the appropriate *t*-test, while the second way is comparing the fit of two nested models. A more general model encompasses both the null and the alternative hypothesis, and is called a reference model. A second, simpler model, satisfies the null hypothesis, and is called a nested (null hypothesis) model. These two models are then compared with Likelihood Ratio Test (LRT). The test is based on comparing the values of likelihood function of nested and reference model, which differ in the hypothesis being tested. LRT test can be used for both testing fixed effects and covariance parameters (random effects). Both models, however, need to be fitted on the same subset of data, otherwise log-likelihood values are not comparable. The testing statistics is then defined as shown in *Equation 2-23*.

$$-2log\left(\frac{L_{nested}}{L_{reference}}\right) = -2\log(L_{nested}) - \left(-2\log(L_{reference})\right) \sim \chi^2_{df} \qquad (2\text{-}23)$$

Likelihood theory states that LRT statistics follows asymptotical χ^2-distribution. Degrees of freedom are obtained by subtracting the number of parameters of the reference model from the number of parameters of the nested model (West, Welch, & Galecki, 2007). However, testing fixed effects by LRT is allowed only with ML estimates of -2 log-likelihood, which are comparable among nested models with different number of fixed effect parameters (Field, 2009; Morrell, 1998; Pinheiro & Bates, 1996; Verbeke & Molenberghs, 2000). The model *A* is said to be nested in model *B* if model *A* is a special case of model *B*, meaning that the parameter space for the nested model *A* is a subspace of that for the more general model *B*. The model with the lowest -2 log-likelihood value is assumed to fit the data best. On the other hand, some authors suggest (e.g. Morrell (1998), West, Welch & Galecki (2007)) that for testing covariance parameters (random effects) with LRT method, REML estimations of -2 log-likelihood should be used. REML reduces the bias inherent in ML estimates of covariance parameters. In case when models are not nested, but still fitted to the same set of the data, Akaike information criteria (AIC) or Bayes information criteria (BIC) should be used. As a general rule, a lower value of either statistics indicates a better fit (West, Welch, & Galecki, 2007).

Any statistical software for fitting multilevel models (e.g. SPSS, SAS, R, Stata, HLM, MLwiN) automatically provides *t*-tests for estimated fixed effects. The hypotheses and calculation of *t*-test are shown in *Equation 2-24*.

$$\mathrm{H_0}: \beta_j = 0 \qquad \mathrm{H_1}: \beta_j \neq 0$$
$$t = \frac{\hat{\beta}_j - 0}{se(\hat{\beta}_j)} \qquad (2\text{-}24)$$

However, there are different methods for determining the appropriate number of degrees of freedom. SPSS uses the Satterthwaite approximation, which takes into account the presence of random effects and correlated residuals in MLM (West, Welch, & Galecki, 2007). Alternatively, Type I and Type III *F*-tests are usually estimated. The latter one, which is more often used, is conditional on the effects of a particular covariate in all other terms in a given model, so it is useful when cross-effects are modeled.

Similarly as for fixed effects, two options for testing covariance parameters are available. The first option is Wald *z*-test, which is already given by SPSS. However, researchers (e.g. West, Welch, & Galecki (2007), Verbeke & Molenberghs (2000)) strongly suggest using the LRT method. Determining the correct *p*-value is done through χ^2- or a mixture of χ^2-distributions. The first option is used when covariance parameter, satisfying the null hypothesis, does not lie on the boundary of the parameter space (e.g. testing whether a covariance between two random effects is equal to zero). In such cases, testing statistics is asymptotically distributed as a χ^2-distribution, with degrees of freedom calculated by subtracting the number of covariance parameters of the nested model from that of the reference model. The second option is used when the covariance parameter, satisfying the null hypothesis, lies on the boundary of the parameter space (e.g. testing whether a given random effect should be kept in a model or not). For example, in a case of testing variance term of a random effect, the *p*-value is calculated as a mixture of χ_0^2 and χ_1^2, each having 0.5 weight. Furthermore, in a case when there is a variance and one covariance term related to a particular random effect, which is being tested, the *p*-value is calculated as a mixture of χ_1^2 and χ_2^2, each having 0.5 weight, etc. (Verbeke & Molenberghs, 2000).

Checking the model assumptions

Before building the multilevel model, data needs to be checked. The analysis usually starts with estimating the preliminary model, and then analyzing residuals and performing influential diagnostic, which is the name for techniques that allow to identify observations that heavily influence estimates of the parameters in either $\boldsymbol{\beta}$ or $\boldsymbol{\theta}$. However, because the majority of programs for MLM (including SPSS) does not currently offer procedures to perform influential diagnostic, the full model is first estimated as a multiple regression function and in addition to analyzing residuals, influential diagnostic is performed. I assume that the same observations that would importantly influence the results obtained with multiple regression analysis would also impact the results obtained with MLM. Analysis of residuals and all influential diagnostics together, presented in this subchapter, decreased the sample size from 8,996 firms with all six year observations to 8,777 firms with a different number of observations, which are used in different analyses in this dissertation.[13] As a robustness check, MLM was also performed on the full sample of 8,996 firms and none of the estimated regression coefficients significantly changed; however, the model fit was worse.

Winsorizing variables

Winsorizing is the transformation of variables by limiting extreme values to reduce the effect of possible spurious outliers. This is usually done in a way that the top and bottom percentiles of an individual variable are transformed into the same value. For example, any value above the ninety-ninth percentile of the chosen variable is replaced by the ninety-ninth percentile and any value below the first percentile is replaced by the value of the first percentile. This gives winsorizing an advantage over trimming because observations with extreme values are not removed and thus not lost (Ghosh & Vogt, 2012). The majority of continuous explanatory variables, used in MLM, are winsorized at the top and bottom one percentile.[14] This is in line with recently published articles (e.g. Flannery & Rangan (2006)).

[13] After the influential diagnostics, 7,670 firms have all six year observations, 594 firms have five year observations, 239 firms have four year observations, 136 firms have three year observations, 92 firms have two year observations, and 46 firms have one year observation.

[14] In *Subchapter 2.6,* winsorized variables were marked.

Outliers and residuals

An outlier is a case that differs substantially from the main trend of the data (Field, 2009). The difference between the observed outcome and the outcome, predicted by the model, is known as a residual, and is estimated by *Equation 2-25*.

$$\hat{\varepsilon}_{tijk} = y_{tijk} - \hat{y}_{tijk} \tag{2-25}$$

There are three types of residuals used to analyze the model assumptions. The first are normal or unstandardized residuals, but they are hard to compare among units. This can be solved by analyzing standardized residuals, most often converting them into z-scores. There is also another option, called studentized residuals, which are the unstandardized residuals, divided by an estimate of their standard deviation that varies point by point (Field, 2009). These residuals have the same properties as the usual standardized residuals, but provide a more precise estimate of the error variance of a specific case.

Influential diagnostics

There are six influential diagnostics, which are often used in the regression analysis.

- Cook's distance

It measures the aggregate impact of each observation on the group of regression coefficients, as well as on the group of fitted values. It is thus a measure of the change in the regression coefficients that would occur if this case was omitted, revealing which cases are most influential in affecting the regression equation (Stevens, 2009). Values, larger than $4/n$, where n is the number of observations, are considered highly influential (Chen, Ender, & Wells, 2003).

- Mahalanobis distance

It measures the distance of cases from the means of the explanatory variables. Mahalanobis distance is distributed by χ^2-distribution with degrees of freedom equal to the number of explanatory variables. Units, for which Mahalanobis distance exceeds the critical χ^2-value, are considered to be outliers. The usual level of significance is set to 0.001 (Tabachnick & Fidell, 2012).

- Centered leverage value (Hat Diag)

It measures how far an observation is from others in terms of the levels of the independent variables. There are different suggestions for a cut-off point, however, $(2(k+1))/n$, $(2(k+2))/n$, or $(3(k+1))/n$ are used most often, k being the number of predictors and n being the sample size (Field, 2009; Chen, Ender, & Wells, 2003).

- Standardized DFBETAs

They measure how much an observation affects the estimates of regression coefficients - there are that many DFBETAs as there are regression coefficients, including the intercept.

When using the standardized DFBETAs, cases with absolute values above $2/\sqrt{n}$, where n is number of observations, have substantial influence (Field, 2009; Chen, Ender, & Wells, 2003).

- Standardized DFFITS

This statistic indicates how much predicted value of an observation will change if this observation is removed from the analysis (Stevens, 2009). It is thus a difference between the predicted value for a case when a model is estimated including that case, and when the model is estimated excluding this case. Standardized values in absolute terms, larger than $2\sqrt{(k+1)/n}$, where k is the number of predictors and n is sample size, are considered highly influential (Field, 2009; Chen, Ender, & Wells, 2003).

- Covariance ratio

It measures whether a case influences the variance of the regression parameters. Values outside the interval $1 \pm 3(k+1)/n$, where k is the number of predictors and n is sample size, are considered highly influential (Field, 2009).

Multicolinearity

Many statisticians stress the importance of centering a variable around its grand mean (e.g. Snijders & Boske (2012)). There are two main benefits of doing this. First, it facilitates the explanation of the model in a way that it gives the meaning to the regression intercept. Second, the more important reason is that centering reduces the problem of multicolinearity among explanatory variables, which can have quite a negative impact on the estimation of multilevel model (Tabachnick & Fidell, 2012). Multicolinearity is defined as a strong correlation between two or more explanatory variables in a regression model. One possible way to identify multicolinearity is to scan correlation matrix of explanatory variables to see if any correlate highly (usually above $|0.8|$). The other option is to check variance inflation factor (VIF), where values above 10 are considered high. Equivalently, tolerance statistic for variables with value below 0.10 is considered problematic (Field, 2009).

Estimation of multiple regression model for initial diagnostic check

The full model with all 10 explanatory variables was fitted as a multiple regression function. For each observation (53,976 firm-year observations), all of the previously described diagnostics were checked. These are studentized residuals, Cook's distance, Mahalanobis distance, centered leverage value, standardized DFBETAs, standardized DFFITS, and covariance ratio. Additionally, multicolinearity check was done for the explanatory variables. As explained in the *Subchapter 2.2* only firms with all available values of explanatory variables for the entire analyzed period were used so there was no problem with missing data. *Table 2-6* shows the cutting values for each of diagnostics used.

Table 2-6: Diagnostic check

Check	Statistic used	Removed observations/variables
Outliers	Studentized residuals (SR)	$\|SR\| \geq 3.29$
Influential diagnostic	Cook's distance (CD)	$CD \geq 0.00007$
	Mahalanobis distance (MD)	$MD \geq 29.59$
	Centered leverage value (LV)	$LV \geq 0.0004$
	Standardized DFBET (DFB)	$\|DFB\| \geq 0.0086$
	Standardized DFFITS (DFF)	$\|DFF\| \geq 0.0286$
	Covariance ratio (CR)	$0.9994 \leq CR\ or\ CR \geq 1.00061$
Multicolinearity	VIF	$VIF \geq 10$
	Tolerance (T)	$T \leq 0.10$

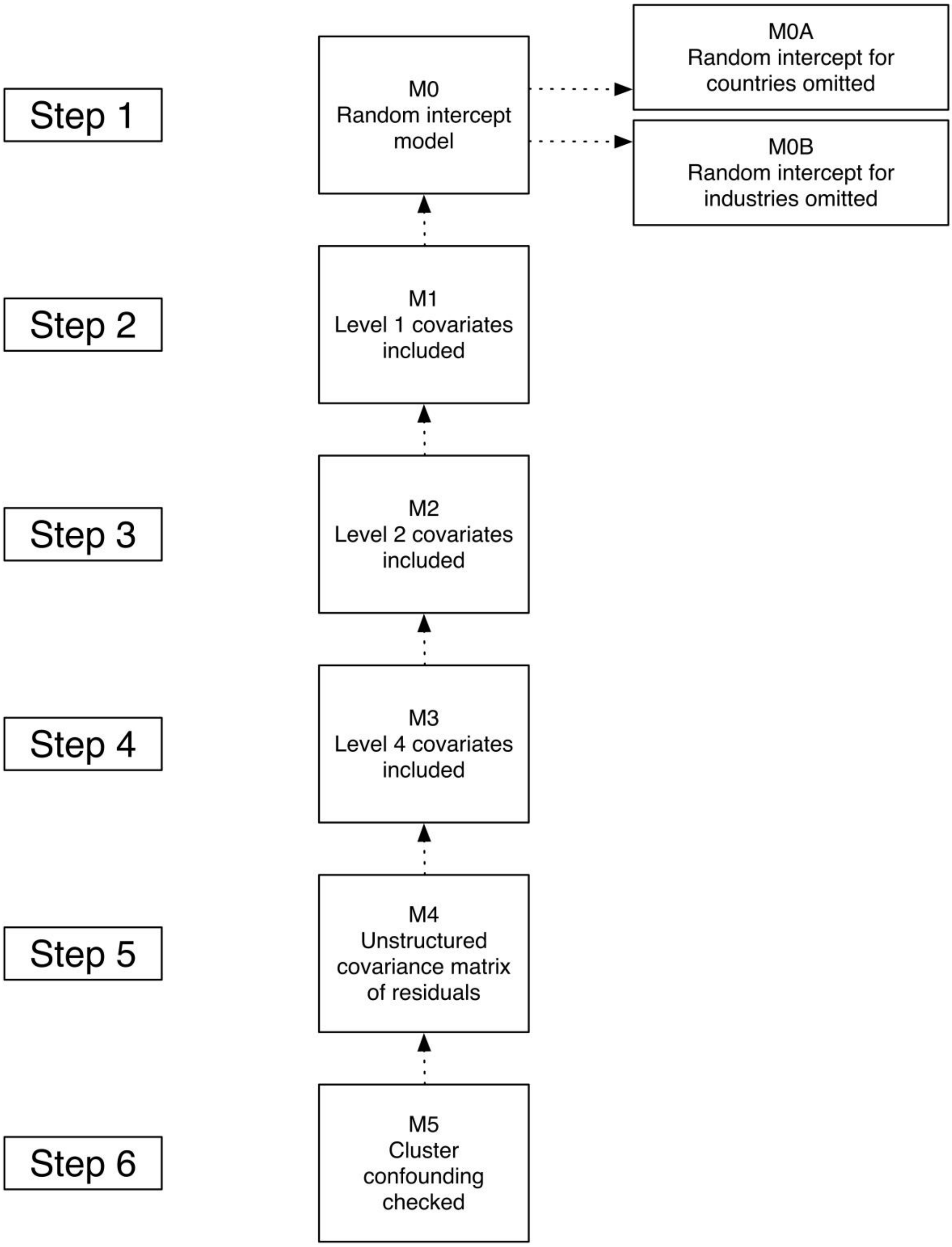
Source: Amadeus, 2013.

I removed all firm-year observations that did not fulfill requirements described in *Table 2-6*. This procedure decreased my sample size from 53,976 firm-year observations to 50,584 firm-year observations. However, one of the important advantages of MLM is that the method does not require that firms have the same number of repeated observations, as argued by many authors (e.g. Gelman & Hill (2007), Field (2009), Tabachnik & Fidell (2012)). In some other multivariate methods (e.g. ANOVA or ANCOVA), such units would simply be removed from the analysis. I also checked multicolinearity among 10 explanatory variables. Explanatory variable *Tax rate* has the highest VIF, which is equal to 1.254 (tolerance 0.797). Since this value is below the critical boundary, I assumed that there is no problem with multicolinearity. Consequently, I did not center my data, which is one of the options for decreasing correlation among explanatory variables. The result of multiple regression, which is already fitted on 50,584 observations, is shown in *Appendix B-0*. However, this model was neither controlled for cross-sectional dependency neither for time-series dependency. The results are therefore not reliable and will not be explained. In *Appendix B-0*, a histogram of residuals and P-P plot for normality are presented. Both show that residuals are approximately normally distributed. Moreover, I estimated the multiple regression model which is controlled for time-series dependency, and will be compared with the results of MLM in *Subchapter 2.10* (see *Appendix B-1*).

2.9 Developing a multilevel linear model

In this subchapter I develop the multilevel linear model for explaining capital structure heterogeneity. As seen in *Figure 2-5*, the model is developed in six steps. The first step is fitting a random intercept model (M0), and then gradually adding level 1 through level 4 explanatory variables. Then unstructured correlation matrix for residuals is used instead of AR(1) method. Finally, cluster confounding is addressed. Multilevel linear models are more precisely compared in *Table 2-7*.

Figure 2-5: Steps in MLM



Source: Own presentation.

Table 2-7: Comparison of fitted multilevel linear models

				Model					
		Term/Variable	Notation	0	1	2	3	4	5
Fixed effects		Intercept	β_0	√	√	√	√	√	√
	Level 1	PROFITABILITY	β_1		√	√	√	√	
		SIZE	β_2		√	√	√	√	
		GROWTH	β_3		√	√	√	√	
		TANGIBILITY	β_4		√	√	√	√	
	Level 2	FIN. DISTRESS	β_5			√	√	√	√
		D_{PUBLIC}	β_6			√	√	√	√
		$D_{UNIQUE\ PRODUCTS}$	β_7			√	√	√	√
	Level 4	GDP GROWTH	β_8				√	√	√
		INFLATION	β_9				√	√	√
		TAX RATE	β_{10}				√	√	√
Cluster confounding	Level 1	PROFITABILITY SIZE GROWTH TANGIBILITY	β_1^w β_1^b β_2^w β_2^b β_3^w β_3^b β_4^w β_4^b						√
Random effects	Industry (j)	Intercept	$r_{0\ j\mid k}$	√	√	√	√	√	√
	Country (k)	Intercept	$u_{0\ k}$	√	√	√	√	√	√
Residuals	Firm-year observation (t)		ε_{tijk}	√	√	√	√	√	√
Covariance parameters $\boldsymbol{\theta_D}$ for D matrix	Industry level (L3)	Variance of intercepts	$\sigma^2_{int:\,Industry}$	√	√	√	√	√	√
	Country level (L4)	Variance of intercepts	$\sigma^2_{int:\,Country}$	√	√	√	√	√	√
Covariance parameters $\boldsymbol{\theta_R}$ for R matrix	Firm-year level (L1)	Residual variance (AR1)	$\sigma^2,\ \rho$	√	√	√	√		
		Residual variance (UNR)	$\sigma^2_t,\ cov_{t_a,t_b}$					√	√

Source: Own presentation.

Model 0

The first fitted model, Model 0, is the model without any explanatory variables, controlled only for the hierarchical structure of data – random intercept model. Model includes the random intercept for industries and countries.[15] It is written in *Equation 2-26*.

$$Leverage_{tijk} = \beta_0 + u_{0\,k} + r_{0\,j|k} + \varepsilon_{tijk}$$
$$u_{0\,k} \sim N\left(0, \sigma^2_{int:\,Country}\right) \quad r_{0\,j|k} \sim N\left(0, \sigma^2_{int:\,Industry}\right) \quad \varepsilon_{tijk} \sim N\left(0, \sigma^2\right) \qquad \text{(2-26)}$$

In this specification, $Leverage_{tijk}$ represents the value of the dependent variable in time *t* for firm *i*, operating within industry *j* and country *k*. β_0 is a fixed intercept. $u_{0\,k}$ is the random effect associated with the intercept for country *k*, $r_{0\,j|k}$ is the random effect associated with the intercept for industry *j* within country *k*, and ε_{tijk} is the residual. The distribution of random effects is assumed to follow normal distribution. $\sigma^2_{int:\,Country}$ represents the variance of the country-specific random intercept, and $\sigma^2_{int:\,Industry}$ represents the variance of the random industry-specific intercepts at any given country. Finally, σ^2 represents the residual variance. The full SPSS output of this model is presented in Appendix B-2, with the main findings highlighted in *Equation 2-27*.

$$\widehat{Leverage}_{tijk} = 27.332$$
$$u_{0\,k} \sim N\left(0, 65.71\right) \quad r_{0\,j|k} \sim N\left(0, 95.04\right) \quad \varepsilon_{tijk} \sim N\left(0, 384.00\right) \qquad \text{(2-27)}$$

Hypothesis testing

$$H_0\colon \sigma^2_{int:\,Country} = 0\ (drop\ u_{0\,k}) \qquad H_1\colon \sigma^2_{int:\,Country} > 0\ (retain\ u_{0\,k})$$

Test of random intercept on the country level was performed indirectly through testing its variance: comparing -2 REML log-likelihood of a nested model ($\mathrm{H_0} - \mathrm{Model\ 0A}$) with a reference model ($\mathrm{H_1} - \mathrm{Model\ 0}$). Test statistic is distributed asymptotically as $0.5 \cdot \chi^2_{df=0} + 0.5 \cdot \chi^2_{df=1}$.

-2 REML log-likelihood of a nested model (M0A): 378210.3
-2 REML log-likelihood of a reference model (M0): 378141.6

$$\chi^2_{df=0:1} = \Delta - 2\ REML\ LL = (-2\ LL_{M0A}) - (-2\ LL_{M0}) = 378210.3 - 378141.6 = 68.7$$
$$p - value = 0.5 \cdot P\left(\chi^2_{df=0} > 68.7\right) + 0.5 \cdot P\left(\chi^2_{df=1} > 68.7\right) < 0.001$$

Based on χ^2-test I can conclude that the variance of intercepts among countries is positive, and retain the random effect associated with intercept on country level in this and all subsequent models (M0 is preferred over model M0A).

$$H_0\colon \sigma^2_{int:\,Industry} = 0\ (drop\ r_{0\,j|k}) \qquad H_1\colon \sigma^2_{int:\,Industry} > 0\ (retain\ r_{0\,j|k})$$

Test of random intercept on the industry level was performed indirectly through testing its variance: comparing -2 REML log-likelihood of a nested model ($\mathrm{H_0} - \mathrm{Model\ 0B}$) with a

[15] I would like to stress that estimating the model with inclusion of random intercept for firms (level 2) was infeasible due to a very large number of firms and the model did not converge.

reference model ($H_1 - \text{Model } 0$). Test statistic is distributed asymptotically as $0.5 \cdot \chi^2_{df=0} + 0.5 \cdot \chi^2_{df=1}$.

-2 REML log-likelihood of a nested model (M0B): 379475.6
-2 REML log-likelihood of a reference model (M0): 378141.6

$$\chi^2_{df=0:1} = \Delta - 2\ REML\ LL = (-2\ LL_{M0B}) - (-2\ LL_{M0}) = 379475.6 - 378141.6 = 1334$$
$$p - value = 0.5 \cdot P(\chi^2_{df=0} > 1334) + 0.5 \cdot P(\chi^2_{df=1} > 1334) < 0.001$$

Based on χ^2-test I can conclude that the variance of intercepts among industries in a given country is positive, and retain the random effect associated with intercept on industry level in this and all subsequent models (M0 is preferred over model M0B).

Intraclass correlation

The model without explanatory variables is useful for calculation of intraclass correlation, which indicates the proportion of variance that can be explained by inclusion of higher level units (Hox, 2010; Tabachnick & Fidell, 2012). It was shown that even small intraclass correlations (10%) can importantly inflate Type I error if model is not controlled for data hierarchy. With inclusion of two random intercepts, I can estimate two intraclass correlations (ICC). Equations for ICC for third and fourth level are shown in *Equation 2-28*.

$$ICC_3 = \frac{\sigma_r^2}{\sigma_u^2 + \sigma_r^2 + \sigma^2} \qquad ICC_4 = \frac{\sigma_u^2}{\sigma_u^2 + \sigma_r^2 + \sigma^2} \tag{2-28}$$

ICC can also be interpreted as the expected correlation between two randomly selected units, clustered within the same group. However, in that case Hox (2010) suggested using adjusted equation for lower level ICC, because two randomly selected units in the same lower level group are automatically nested within the same higher level group (*Equation 2-29*).

$$ICC_3^* = \frac{\sigma_r^2 + \sigma_u^2}{\sigma_u^2 + \sigma_r^2 + \sigma^2} \qquad ICC_4 = \frac{\sigma_u^2}{\sigma_u^2 + \sigma_r^2 + \sigma^2} \tag{2-29}$$

Results of intraclass correlations are shown in *Table 2-8.*

Table 2-8: Intraclass correlations on industry and country level

Industry level		Country level
ICC_3	ICC_3^*	ICC_4
0.174	0.295	0.121

Note: All variance terms, used to estimate ICCs, are statistically significant at $p < 0.01$.
Source: Amadeus, 2013.

Table 2-8 shows that 17.4% (29.5%) of total variability of leverage is associated with differences among industries (among industries and countries), while 12.1% is associated with differences among countries. Because both intraclass correlations are above 10%, controlling for a hierarchical structure of the data is highly advisable. Results clearly show that performing classical OLS regression analysis would importantly violate the assumption of cross-sectional independence among analyzed firms. Further, AR(1) covariance type shows that ρ is 0.894, which reveals high serial correlation among repeated observations of the same firm. According to Hox (2010), the next step is including fixed effect of the first level explanatory variables.

Model 1

In Model 1, fixed effects on the first level are added. The model is written in *Equation 2-30*.

$$Leverage_{tijk} = \beta_0 + \beta_1 \cdot Profitability_{(t-1)ijk} + \beta_2 \cdot Firm\ size_{(t-1)ijk} + \beta_3 \cdot Firm\ growth_{(t-1)ijk} + \beta_4 \cdot Tangibility_{(t-1)ijk} + u_{0\ k} + r_{0\ j|k} + \varepsilon_{tijk}$$
$$u_{0\ k} \sim N\left(0, \sigma^2_{int:\ Country}\right) \quad r_{0\ j|k} \sim N\left(0, \sigma^2_{int:\ Industry}\right) \quad \varepsilon_{tijk} \sim N\left(0, \sigma^2\right) \tag{2-30}$$

In this specification, $Leverage_{tijk}$ represents the value of the dependent variable in time *t* for firm *i*, operating within industry *j* and country *k*. β_0 is a fixed intercept and β_1 till β_4 are fixed effects for the first level explanatory variables. $u_{0\ k}$ is the random effect associated with the intercept for country *k*, $r_{0\ j|k}$ is the random effect associated with the intercept for industry *j*, and ε_{tijk} is the residual. The distribution of random effects is assumed to follow normal distribution. $\sigma^2_{int:\ Country}$ represents the variance of the country-specific random intercept, and $\sigma^2_{int:\ Industry}$ represents the variance of the random industry-specific intercepts at any given country. Finally, σ^2 represents the residual variance. The full SPSS output of this model is presented in Appendix B-3, while the main findings are shown in *Equation 2-31*.

$$\widehat{Leverage}_{tijk} = 3.738 - 0.017 \cdot Profitability_{(t-1)ijk} + 4.291 \cdot Firm\ size_{(t-1)ijk} + 0.028 \cdot Firm\ growth_{(t-1)ijk} + 0.120 \cdot Tangibility_{(t-1)ijk}$$
$$u_{0\ k} \sim N\left(0, 60.26\right) \quad r_{0\ j|k} \sim N\left(0, 69.81\right) \quad \varepsilon_{tijk} \sim N\left(0, 365.18\right) \tag{2-31}$$

Hypothesis testing

I wanted to test whether first level covariates have statistically significant effect on leverage. This can be done with *t*-tests, which are all highly statistically significant for all variables, except *Profitability* (see Appendix B-3). However, it is suggested to compare -2 log-likelihood of reference model with four fixed effects (Model 1) with nested model (Model 0).

$$H_0: Fixed\ effects\ of\ 1^{st}\ level\ covariates\ are\ zero\ (\beta_1 = \beta_2 = \beta_3 = \beta_4 = 0)$$
$$H_1: At\ least\ one\ of\ fixed\ effects\ at\ the\ 1^{st}\ level\ is\ different\ from\ zero$$

I compared -2 ML log-likelihood of nested model ($\mathrm{H_0} - \mathrm{Model\ 0}$) with reference model ($\mathrm{H_1} - \mathrm{Model\ 1}$). Test statistic is distributed asymptotically by $\chi^2_{df=4}$.

-2 ML log-likelihood of nested model (M0): 378141.6

-2 ML log-likelihood of reference model (M1): 377307.7

$$\chi^2_{df=4} = \Delta - 2\, ML\, LL = (-2\, LL_{M0}) - (-2\, LL_{M1}) = 378141.6 - 377307.7 = 833.9$$
$$\chi^2_{df=4,\ critical,\ \alpha=0.0001} = 23.5$$

Model 1 is preferred over Model 0 at a very high level of significance. Additionally, three *t*-tests of fixed effects of the first level explanatory variables are highly statistically significant, while *p*-value of *Profitability* is 0.055. In Model 2, fixed effects on the second level are added.

Model 2

In Model 2, fixed effects on the first and second level are estimated, as shown in *Equation 2-32*.

$$\begin{aligned} &Leverage_{tijk} = \beta_0 + \beta_1 \cdot Profitability_{(t-1)ijk} + \beta_2 \cdot Firm\ size_{(t-1)ijk} + \\ &\beta_3 \cdot Firm\ growth_{(t-1)ijk} + \beta_4 \cdot Tangibility_{(t-1)ijk} + \beta_5 \cdot \\ &Fin.distress_{ijk} + \beta_6 \cdot Public_{ijk} + \beta_7 \cdot Unique\ products_{ijk} + u_{0\,k} + \\ &r_{0\,j|k} + \varepsilon_{tijk} \\ &u_{0\,k} \sim N\left(0, \sigma^2_{int:\,Country}\right) \quad r_{0\,j|k} \sim N\left(0, \sigma^2_{int:\,Industry}\right) \quad \varepsilon_{tijk} \sim N\left(0, \sigma^2\right) \end{aligned} \tag{2-32}$$

In this specification, $Leverage_{tijk}$ represents the value of the dependent variable in time *t* for firm *i*, operating within industry *j* and country *k*. β_0 is a fixed intercept and β_1 till β_7 are fixed effects for the first and second level explanatory variables. $u_{0\,k}$ is the random effect associated with the intercept for country *k*, $r_{0\,j|k}$ is the random effect associated with the intercept for industry *j*, and ε_{tijk} is the residual. The distribution of random effects is assumed to follow normal distribution. $\sigma^2_{int:\,Country}$ represents the variance of the country-specific random intercept, and $\sigma^2_{int:\,Industry}$ represents the variance of the random industry-specific intercepts at any given country. Finally, σ^2 represents the residual variance. The full SPSS output of this model is presented in Appendix B-4, while the model is written in *Equation 2-33*.

$$\begin{aligned} &\widehat{Leverage}_{tijk} = 7.746 - 0.011 \cdot Profitability_{(t-1)ijk} + 4.265 \cdot \\ &Firm\ size_{(t-1)ijk} + 0.028 \cdot Firm\ growth_{(t-1)ijk} + 0.113 \cdot \\ &Tangibility_{(t-1)ijk} - 0.563 \cdot Fin.distress_{ijk} - 3.117 \cdot Public_{ijk} - \\ &3.068 \cdot Unique\ products_{ijk} \\ &\quad u_{0\,k} \sim N\,(0, 62.85) \quad r_{0\,j|k} \sim N\,(0, 64.63) \quad \varepsilon_{tijk} \sim N\,(0, 361.89) \end{aligned} \tag{2-33}$$

Hypothesis testing

I wanted to test whether second level covariates have statistically significant effect on leverage. All *t*-tests are statistically significant. The comparison of -2 log-likelihood of reference model with additional three fixed effects on the second level (Model 2) with the nested model (Model 1) is done below.

$$H_0: Fixed\ effects\ of\ 2^{nd}\ level\ covariates\ are\ zero\ (\beta_5 = \beta_6 = \beta_7 = 0)$$
$$H_1: At\ least\ one\ of\ fixed\ effects\ at\ the\ 2^{nd}\ level\ is\ different\ from\ zero$$

I compared -2 ML log-likelihood of nested model ($\mathrm{H_0}$ − Model 1) with reference model ($\mathrm{H_1}$ − Model 2). Test statistic is distributed asymptotically by $\chi^2_{df=3}$.

-2 ML log-likelihood of nested model (M1): 377307.7
-2 ML log-likelihood of reference model (M2): 377169.5

$$\chi^2_{df=3} = \Delta - 2\ ML\ LL = (-2\ LL_{M1}) - (-2\ LL_{M2}) = 377307.7 - 377169.5 = 138.2$$
$$\chi^2_{df=3,\ critical,\ \alpha=0.0001} = 21.1$$

Model 2 is preferred over Model 1 at a very high level of significance. Additionally, all *t*-tests of fixed effects of the second level explanatory variables are highly statistically significant. In Model 3, fixed effects on the third level are included.

Model 3

In Model 3, fixed effects on the first, second and fourth level are estimated, as shown in *Equation 2-34*.

$$\begin{aligned} Leverage_{tijk} &= \beta_0 + \beta_1 \cdot Profitability_{(t-1)ijk} + \beta_2 \cdot Firm\ size_{(t-1)ijk} + \\ &\beta_3 \cdot Firm\ growth_{(t-1)ijk} + \beta_4 \cdot Tangibility_{(t-1)ijk} + \beta_5 \cdot \\ &Fin.distress_{ijk} + \beta_6 \cdot Public_{ijk} + \beta_7 \cdot Unique\ products_{ijk} + \beta_8 \cdot \\ &GDP_{(t-1)k} + \beta_9 \cdot Inflation_{(t-1)k} + \beta_{10} \cdot Tax\ rate_k + u_{0\,k} + r_{0\,j|k} + \varepsilon_{tijk} \\ &u_{0\,k} \sim N\left(0, \sigma^2_{int:\,Country}\right) \quad r_{0\,j|k} \sim N\left(0, \sigma^2_{int:\,Industry}\right) \quad \varepsilon_{tijk} \sim N\,(0, \sigma^2) \end{aligned} \tag{2-34}$$

In this specification, $Leverage_{tijk}$ represents the value of the dependent variable in time *t* for firm *i*, operating within industry *j* and country *k*. β_0 is a fixed intercept and β_1 till β_{10} are fixed effects for the first, second and fourth level explanatory variables. $u_{0\,k}$ is the random effect associated with the intercept for country *k*, $r_{0\,j|k}$ is the random effect associated with the intercept for industry *j*, and ε_{tijk} is the residual. The distribution of random effects is assumed to follow normal distribution. $\sigma^2_{int:\,Country}$ represents the variance of the country-specific random intercept, and $\sigma^2_{int:\,Industry}$ represents the variance of the random industry-specific intercepts at any given country. Finally, σ^2 represents the residual variance. The full SPSS output of this model is presented in Appendix B-5, while the model is written in *Equation 2-35*.

$$\begin{aligned} \widehat{Leverage}_{tijk} &= 5.456 - 0.016 \cdot Profitability_{(t-1)ijk} + 4.224 \cdot \\ &Firm\ size_{(t-1)ijk} + 0.029 \cdot Firm\ growth_{(t-1)ijk} + 0.114 \cdot \\ &Tangibility_{(t-1)ijk} - 0.562 \cdot Fin.distress_{ijk} - 3.105 \cdot Public_{ijk} - \\ &3.064 \cdot Unique\ products_{ijk} + 0.035 \cdot GDP_{(t-1)k} + 0.105 \cdot \\ &Inflation_{(t-1)k} + 0.092 \cdot Tax\ rate_k \\ &\quad u_{0\,k} \sim N\,(0, 62.19) \quad r_{0\,j|k} \sim N\,(0, 64.45) \quad \varepsilon_{tijk} \sim N\,(0, 361.54) \end{aligned} \tag{2-35}$$

Hypothesis testing

I wanted to test whether fourth level covariates have statistically significant effect on leverage; GDP growth and inflation have statistically significant fixed effects, but *t*-test for tax rate is insignificant. However, statistical insignificance is not yet a reason to exclude variable from the model, as argued for example by Tabachnik & FIdell (2012). The comparison of -2 log-likelihood of reference model with fixed effects on the fourth level (Model 3) with the nested model (Model 2) is performed.

$$H_0: Fixed\ effects\ of\ 4^{th}\ level\ covariates\ are\ zero\ (\beta_8 = \beta_9 = \beta_{10} = 0)$$
$$H_1: At\ least\ one\ of\ fixed\ effects\ at\ the\ 4^{th}\ level\ is\ different\ from\ zero$$

I compared -2 ML log-likelihood of nested model ($\mathrm{H_0}$ − Model 2) with reference model ($\mathrm{H_1}$ − Model 3). Test statistic is asymptotically distributed by $\chi^2_{df=3}$.

-2 ML log-likelihood of nested model (M2): 377169.5
-2 ML log-likelihood of reference model (M3): 377114.5

$$\chi^2_{df=3} = \Delta - 2\ ML\ LL = (-2\ LL_{M2}) - (-2\ LL_{M3}) = 377169.5 - 377114.5 = 55.0$$
$$\chi^2_{df=3,\ critial,\ \alpha=0.0001} = 21.1$$

Model 3 is preferred over Model 2 at a very high level of significance. Additionally, two out of three *t*-tests for fixed effects on the fourth level are highly statistically significant.

It can be noticed that 10 explanatory variables decreased the variance of random intercepts on the third and fourth level, as was expected. There is also a decrease in residual variance of ε_{tijk}: the difference between Model 0 and Model 3 is 22.46 ($384.0 - 361.54$), the decrease of 5.8%.

In the next step Model 4 is estimated. Instead of AR(1) residual matrix, unstructured residual matrix is used.

Model 4

In Model 4, 10 explanatory variables from Model 3 are used, as shown in *Equation 2-36*. The difference between both models is in the structure of the residual matrix.

$$\begin{gathered} Leverage_{tijk} = \beta_0 + \beta_1 \cdot Profitability_{(t-1)ijk} + \beta_2 \cdot Firm\ size_{(t-1)ijk} + \\ \beta_3 \cdot Firm\ growth_{(t-1)ijk} + \beta_4 \cdot Tangibility_{(t-1)ijk} + \beta_5 \cdot \\ Fin.distress_{ijk} + \beta_6 \cdot Public_{ijk} + \beta_7 \cdot Unique\ products_{ijk} + \beta_8 \cdot \\ GDP_{(t-1)k} + \beta_9 \cdot Inflation_{(t-1)k} + \beta_{10} \cdot Tax\ rate_k + u_{0\,k} + r_{0\,j|k} + \varepsilon_{tijk} \\ u_{0\,k} \sim N\left(0, \sigma^2_{int:\,Country}\right) \quad r_{0\,j|k} \sim N\left(0, \sigma^2_{int:\,Industry}\right) \quad \varepsilon_{tijk} \sim N\left(0, \sigma^2_t\right) \end{gathered} \tag{2-36}$$

In this specification, $Leverage_{tijk}$ represents the value of the dependent variable in time *t* for firm *i*, operating within industry *j* and country *k*. β_0 is a fixed intercept and β_1 till β_{10} are fixed effects for the first, second and fourth level explanatory variables. $u_{0\,k}$ is the random effect associated with the intercept for country *k*, $r_{0\,j|k}$ is the random effect associated with the intercept for industry *j*, and ε_{tijk} is the residual. The distribution of random effects is assumed to follow normal distribution. $\sigma^2_{int:\,Country}$ represents the variance of the country-specific random intercept, and $\sigma^2_{int:\,Industry}$ represents the variance of the random industry-specific intercepts at any given country. Finally, σ^2_t represents the residual variance. The full SPSS output of this model is presented in Appendix B-6, while the model is written in *Equation 2-37*.

$$\widehat{Leverage}_{tijk} = 3.464 - 0.050 \cdot Profitability_{(t-1)ijk} + 4.746 \cdot Firm\ size_{(t-1)ijk} + 0.030 \cdot Firm\ growth_{(t-1)ijk} + 0.118 \cdot Tangibility_{(t-1)ijk} - 0.542 \cdot Fin.distress_{ijk} - 3.260 \cdot Public_{ijk} - 3.079 \cdot Unique\ products_{ijk} + 0.020 \cdot GDP_{(t-1)k} + 0.146 \cdot Inflation_{(t-1)k} + 0.080 \cdot Tax\ rate_k \quad (2\text{-}37)$$

$$u_{0\,k} \sim N\,(0, 68.97) \quad r_{0\,j|k} \sim N\,(0, 61.18) \quad \varepsilon_{tijk} \sim N\,(0, \sigma_t^2)$$

Hypothesis testing

The difference between the nested model (M3) and the reference model (M4) is in the structure of the R-matrix. Model 3 has a restriction that the R-matrix is AR(1) type, while Model 4 has unstructured matrix. All Wald *z*-tests for unstructured matrix are highly statistically significant (see Appendix B-6), however, it is recommended to perform log-likelihood test.

$$\boldsymbol{H_0}: \boldsymbol{R} = \begin{pmatrix} \sigma^2 & \sigma^2\rho^1 & \sigma^2\rho^2 & \sigma^2\rho^3 & \sigma^2\rho^4 & \sigma^2\rho^5 \\ \sigma^2\rho^1 & \sigma^2 & \sigma^2\rho^1 & \sigma^2\rho^2 & \sigma^2\rho^3 & \sigma^2\rho^4 \\ \sigma^2\rho^2 & \sigma^2\rho^1 & \sigma^2 & \sigma^2\rho^1 & \sigma^2\rho^2 & \sigma^2\rho^3 \\ \sigma^2\rho^3 & \sigma^2\rho^2 & \sigma^2\rho^1 & \sigma^2 & \sigma^2\rho^1 & \sigma^2\rho^2 \\ \sigma^2\rho^4 & \sigma^2\rho^3 & \sigma^2\rho^2 & \sigma^2\rho^1 & \sigma^2 & \sigma^2\rho^1 \\ \sigma^2\rho^5 & \sigma^2\rho^4 & \sigma^2\rho^3 & \sigma^2\rho^2 & \sigma^2\rho^1 & \sigma^2 \end{pmatrix} \qquad \boldsymbol{H_1}: \boldsymbol{R} = \begin{pmatrix} \sigma_1^2 & Cov_{1,2} & Cov_{1,3} & Cov_{1,4} & Cov_{1,5} & Cov_{1,6} \\ Cov_{2,1} & \sigma_2^2 & Cov_{2,3} & Cov_{2,4} & Cov_{2,5} & Cov_{2,6} \\ Cov_{3,1} & Cov_{3,2} & \sigma_3^2 & Cov_{3,4} & Cov_{3,5} & Cov_{3,6} \\ Cov_{4,1} & Cov_{4,2} & Cov_{4,3} & \sigma_4^2 & Cov_{4,5} & Cov_{4,6} \\ Cov_{5,1} & Cov_{5,2} & Cov_{5,3} & Cov_{5,4} & \sigma_5^2 & Cov_{5,6} \\ Cov_{6,1} & Cov_{6,2} & Cov_{6,3} & Cov_{6,4} & Cov_{6,5} & \sigma_6^2 \end{pmatrix}$$

I compared -2 REML log-likelihood of nested model ($\text{H}_0 - \text{Model 3}$) with reference model ($\text{H}_1 - \text{Model 4}$). Test statistic is asymptotically distributed by $\chi^2_{df=19}$.

-2 REML log-likelihood of nested model (M3):377155.6
-2 REML log-likelihood of reference model (M4): 375572.8

$$\chi^2_{df=19} = \Delta - 2\ REML\ LL = (-2\ LL_{M3}) - (-2\ LL_{M4}) = 377155.6 - 375572.8 = 1582.8$$
$$\chi^2_{df=19,\ critial,\ \alpha=0.0001} = 50.8$$

Model 4 is preferred over Model 3. Finally, in Model 5, cluster confounding of the first level explanatory variables is addressed.

Model 5

In Model 5, separation of the first level variables into two parts is performed. These are within-firm and between-firm variability parts. The between-firm part is defined as the average value of a particular explanatory variable during the analyzed period, which is calculated for each firm separately, and is denoted as $\bar{X}^{b}_{ijk}$. After that, the within-firm part is calculated using *Equation 2-38*.

$$X^{w}_{tijk} = X_{tijk} - \bar{X}^{b}_{ijk} \tag{2-38}$$

The separation of within- and between-firm effect is done for all first level explanatory variables. The full model is written in *Equation 2-39*.

$$\begin{aligned} &Leverage_{tijk} = \\ &\beta_0 + \beta_1^w \cdot Profitability^{w}_{(t-1)ijk} + \beta_1^b \cdot \overline{Profitability}^{b}_{ijk} + \beta_2^w \cdot \\ &Firm\ size^{w}_{(t-1)ijk} + \beta_2^b \cdot \overline{Firm\ size}^{b}_{ijk} + \beta_3^w \cdot Firm\ growth^{w}_{(t-1)ijk} + \beta_3^b \cdot \\ &\overline{Firm\ growth}^{b}_{ijk} + \beta_4^w \cdot Tangibility^{w}_{(t-1)ijk} + \beta_4^b \cdot \overline{Tangibility}^{b}_{ijk} + \beta_5 \cdot \\ &Fin.distress_{ijk} + \beta_6 \cdot Public_{ijk} + \beta_7 \cdot Unique\ products_{ijk} + \beta_8 \cdot \\ &GDP_{(t-1)k} + \beta_9 \cdot Inflation_{(t-1)k} + \beta_{10} \cdot Tax\ rate_k + u_{0\,k} + r_{0\,j|k} + \varepsilon_{tijk} \\ &u_{0\,k} \sim N\left(0, \sigma^2_{int:\,Country}\right) \quad r_{0\,j|k} \sim N\left(0, \sigma^2_{int:\,Industry}\right) \quad \varepsilon_{tijk} \sim N\left(0, \sigma_t^2\right) \end{aligned} \tag{2-39}$$

In this specification, $Leverage_{tijk}$ represents the value of the dependent variable in time *t* for firm *i*, operating within industry *j* and country *k*. β_0 is a fixed intercept and β_1 till β_{10} are fixed effect for the first, second and fourth level explanatory variables. $u_{0\,k}$ is the random effect associated with the intercept for country *k*, $r_{0\,j|k}$ is the random effect associated with the intercept for industry *j*, and ε_{tijk} is the residual. The distribution of random effects is assumed to follow normal distribution. $\sigma^2_{int:\,Country}$ represents the variance of the country-specific random intercept, and $\sigma^2_{int:\,Industry}$ represents the variance of the random industry-specific intercepts at any given country. Finally, σ_t^2 represents the residual variance. The full SPSS output of this model is presented in Appendix B-7, while the model is written in *Equation 2-40*.

$$\begin{aligned} &\widehat{Leverage}_{tijk} = 14.674 - 0.049 \cdot Profitability^{w}_{(t-1)ijk} - 0.253 \cdot \\ &\overline{Profitability}^{b}_{ijk} + 17.801 \cdot Firm\ size^{w}_{(t-1)ijk} + 0.264 \cdot \overline{Firm\ size}^{b}_{ijk} + \\ &0.062 \cdot Firm\ growth^{w}_{(t-1)ijk} + 0.071 \cdot \overline{Firm\ growth}^{b}_{ijk} + 0.033 \cdot \\ &Tangibility^{w}_{(t-1)ijk} + 0.258 \cdot \overline{Tangibility}^{b}_{ijk} - 0.425 \cdot \\ &Fin.distress_{ijk} - 1.501 \cdot Public_{ijk} - 1.402 \cdot Unique\ products_{ijk} + \\ &0.000 \cdot GDP_{(t-1)k} + 0.160 \cdot Inflation_{(t-1)k} + 0.179 \cdot Tax\ rate_k \\ &\qquad u_{0\,k} \sim N\left(0, 67.47\right) \quad r_{0\,j|k} \sim N\left(0, 43.63\right) \quad \varepsilon_{tijk} \sim N\left(0, \sigma_t^2\right) \end{aligned} \tag{2-40}$$

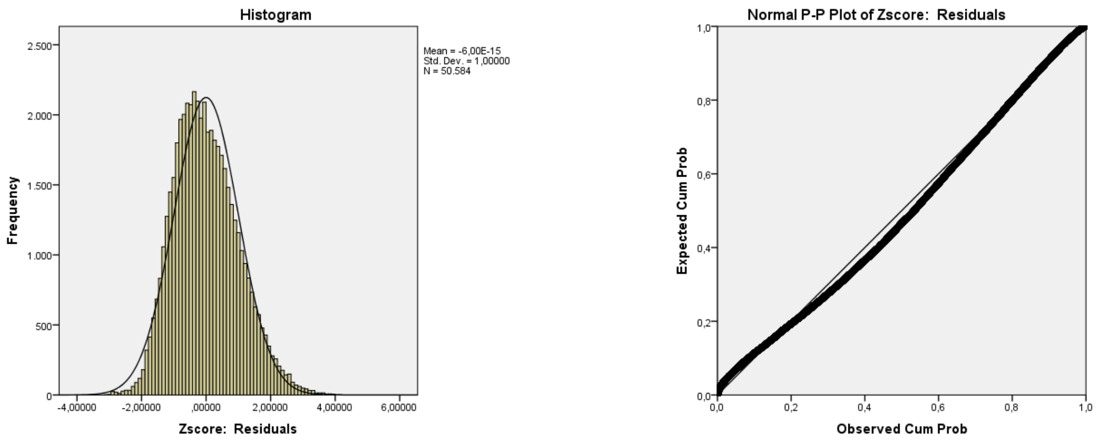
Hypothesis testing

I wanted to test whether cluster confounding is present among level 1 explanatory variables. Both AIC and BIC statistics of Model 5 are lower compared to the values of Model 4 (see Appendix B-7). That means that controlling for cluster confounding of the first level explanatory variables improves the overall fit of the model.

Goodness of fit

The multiple regression model without controlling for any source of dependency shows that 10 covariates explain 16.8 percent of total variability of leverage. However, there is no general agreement on how coefficient of determination in MLM should be estimated (Hox, 2010; Gelman & Hill, 2007; Snijders & Bosker, 2012). It is interesting that there are numerous in-depth works about MLM which completely ignore the concept of the coefficient of determination in MLM (e.g. West et al. (2007), Tabachnick & Fidell (2012), Field (2009)). Instead, their analysis is concentrated on the analysis of goodness of fit through log-likelihood statistics. This stems from the fact that MLM is typically based on maximum likelihood method, while coefficient of determination belongs to the method of least squares. Through the analysis of goodness of fit I found, as expected, that MLM fits the data significantly better than pooled regression analysis (AIC of pooled regression analysis with controlling for time-series dependency is 378872.1, while AIC of Model 4 which additionally controls for cross-sectional dependency is reduced to 375618.9). I further analyzed how much of leverage heterogeneity is explained by traditional determinants only, without controlling for a hierarchical structure of the data, but still controlling for time-series dependency among observations. Frank & Goyal (2009) performed a comprehensive review of past empirical studies and found that the six main determinants (industry median leverage, tangibility, profits, firm size, market-to-book-assets ratio, and inflation) explained 27 percent of the variation in leverage. Since market-to-book assets ratio is unavailable for my sample, I checked the explanatory power of the remaining five covariates and got the reduction of residual variance equal to 17.6 percent, a result very similar to findings of Lemmon et al. (2008). Finally, I checked the distribution of residuals for Model 5 and found that the assumption of normally distributed residuals is well met (*Figure 2-6*).

Figure 2-6: Histogram of residuals and normal P-P plot



Source: Amadeus, 2013.

2.10 Results

Table 2-9 shows estimated regression coefficients for the multiple regression model, which is controlled for time-series dependency (standard errors are clustered by firm), and six multilevel linear models, which also control for the hierarchical structure of the data (allowing intercept to vary freely among third and fourth level units). AIC statistics show that multilevel linear models have a statistically better fit than the multiple regression model with clustered standard errors by firm. For robustness purposes, all estimates are shown; however, as a base model for explaining results, Model 4 is used, while findings are also compared to the multiple regression model and Model 5, which addresses cluster confounding.

As expected, more profitable firms have lower leverage, holding all other covariates unchanged. This goes in line with the *pecking order hypothesis* and with the *dynamic trade-off theory*. Each additional percentage point of profitability decreases the expected leverage by 0.05 of a percentage point, controlling for all other covariates (p-value < 0.001). Multiple regression model shows no statistically significant effect, while Model 5 reveals that between-firm effect is stronger, which is supported by the formal test[16] at very high level of significance. Graham & Leary (2011) surveyed recent empirical studies and found that highly leveraged firms are significantly larger. The main argument goes that larger firms have a lower default risk and consequently have a higher target debt ratio. Model 4 shows that a ten times larger firm, as measured by total assets, has on average a 4.75 percentage point higher leverage, controlling for all other covariates. Arguably, most interesting is the results for Model 5. It shows that the within-firm effect is especially strong, while the between-firm effect is much weaker and statistically insignificant (there is a statistically significant difference between both effects at very high level of

[16] The formal test is performed by modifying *Equation 2-39* in the following way. Instead of using within-firm operationalization of each first level variable, the untransformed variables are used. These untransformed variables still capture the within-firm effects, but the meaning of regression coefficients of between-firm operationalization of these variables is changed. They show whether the differences between the within- and between-firm effects are statistically significant (see Bartels (2008)).

confidence). Specifically, a within-firm increase in total assets of ten times is associated with an average 17.80 percentage point higher leverage, ceteris paribus (p-value < 0.001). On the other hand, comparing firms cross-sectionally, a ten times larger firm has on average a higher leverage of only 0.26 of a percentage point, ceteris paribus, however, the result is insignificant. Contrary to the conclusion of the survey made by Graham & Leary (2011), my results thus show that larger and smaller firms do not differ in their average indebtedness. However, a firm that substantially increases its size also substantially increases its indebtedness. Separating within- and between-firm effects is thus crucial for properly understanding the effect of size on a firm's leverage. Contrary to the majority of past empirical studies, higher growth positively affects expected leverage. The finding is, however, consistent with Toy et al. (1974), who argued that the *pecking order hypothesis* predicts that fast growth needs to be financed externally and debt is the first choice. The result is probably also a reflection of the time period under analysis. At that time, access to bank loans was relatively easy and firms typically financed growth with new debt. For each additional percentage point of growth in total assets, the expected leverage increases by 0.03 of a percentage point, holding all other covariates unchanged (p-value < 0.001). Within- and between-firm effects show no statistical difference, although the standardized regression coefficient of the within-firm effect is almost twice as large. Similarly as found in prior studies, tangibility positively affects leverage. Each additional percentage point of tangible assets increases leverage on average by 0.12 of a percentage point, holding all other covariates unchanged (p-value < 0.001). In the case of separating effects, the between-firm effect is much stronger (the effects are different at very high level of statistical significance).

The traditional time-variant covariates have a relatively low explanatory power of the observed capital structure (Miller M. H., 1977), so I included some explanatory variables on the firm level. As expected, higher probability of financial distress, measured as variability of EBIT, leads to lower target leverage. Each additional percentage point of variability decreases the expected leverage by 0.54 of a percentage point, ceteris paribus (p-value < 0.001). Moreover, according to the results, public firms and firms producing unique and durable products are less indebted, ceteris paribus, which goes in line with the findings of Frank & Goyal (2008).

First explanatory variable on a country level shows that GDP growth is positively related to leverage (p-value = 0.025). As predicted, inflation positively affects leverage: each additional percentage point of inflation is associated with a 0.15 percentage point higher expected leverage, controlling for all other covariates (p-value < 0.001). Finally, multiple regression predicts that the nominal tax rate positively affects the leverage. Surprisingly, none of the multilevel linear models show a statistically significant relationship. There can be numerous reasons for that. Tax policies are often complicated and therefore hard to proxy with publicly available data (Graham, 2000). Graham (1996) proposed using a special version of marginal tax rate, however, it is difficult to model. When such version of marginal tax rate is unavailable, Graham proposed using statutory tax rate, as is done in my analysis. More recently, Huizinga et al. (2008) made a research on 32 European countries during the period from 1994 to 2003 and found that larger firms face international tax incentives, while my analysis takes the perspective of a domestic-only firm, which can explain why I did not find that the nominal statuary tax rate would statistically impact observed leverage.

Table 2-9: Summary of results of MLM

On a sample of 8,777 firms (50,584 firm-year observations), seven models are estimated. For baseline purposes, the standard (pooled) multiple regression model is fitted as a repeated measurement model with AR(1) residual matrix. The six multilevel linear models are fitted with AR(1) or UNR residual matrix, and are controlled for hierarchical structure of the data (firms are nested within industries and within countries). In multilevel linear models 1 to 3, explanatory variables on different levels are gradually included. Model 4 allows for an unstructured residual matrix, which improves the fit of the model. Finally, Model 5 shows the importance of separating the within- and between-firm effects of first-level explanatory variables. Reference and nested models (M0-M4) are compared with -2 log-likelihood statistics that shows the fit of the model – lower value indicates a better fit. All models together are compared with AIC – lower value indicates a better fit.

			Multiple regression	**Multilevel linear models**						
				M0	**M1**	**M2**	**M3**	**M4**	**M5** UNR	
	Variable	**Expected sign**	AR(1)	AR(1)	AR(1)	AR(1)	AR(1)	UNR	W	B
	SE clustered by firm		Yes	Yes						
	Hierarchical structure - allowing a random intercept		No	Yes						
	INTERCEPT	β_0	2.962	27.332	3.738	7.746	5.456	3.464	14.674	
Level 1 covariates	PROFITABILITY	β_1	-.010		-.017	-.011	-.016	-.050	-.049	-.253
	Sig. (2-tailed)	−	*.260*		*.055*	*.185*	*.060*	*.000*	*.000*	*.000*
	SIZE	β_2	4.702		4.291	4.265	4.225	4.746	17.801	.264
	Sig. (2-tailed)	+	*.000*		*.000*	*.000*	*.000*	*.000*	*.000*	*.424*
	GROWTH	β_3	.030		.028	.028	.029	.030	.062	.071
	Sig. (2-tailed)	±	*.000*		*.000*	*.000*	*.000*	*.000*	*.000*	*.000*
	TANGIBILITY	β_4	.136		.119	.113	.114	.118	.033	.258
	Sig. (2-tailed)	+	*.000*		*.000*	*.000*	*.000*	*.000*	*.000*	*.000*
Level 2 covariates	FIN. DISTRESS	β_5	-.906			-.563	-.562	-.542		-.425
	Sig. (2-tailed)	−	*.000*			*.000*	*.000*	*.000*		*.000*
	D_{PUBLIC}	β_6	-3.305			-3.117	-3.105	-3.260		-1.501
	Sig. (2-tailed)	−	*.000*			*.000*	*.000*	*.000*		*.002*
	$D_{UNIQUE\ PRODUCTS}$	β_7	-2.602			-3.068	-3.064	-3.080		-1.402
	Sig. (2-tailed)	−	*.002*			*.000*	*.000*	*.000*		*.093*
Level 4 covariates	GDP_{GROWTH}	β_8	.025				.035	.020		.000
	Sig. (2-tailed)	±	*.012*				*.000*	*.025*		*.968*
	INFLATION	β_9	.127				.105	.146		.160
	Sig. (2-tailed)	+	*.000*				*.000*	*.000*		*.000*
	TAX RATE	β_{10}	.219				.092	.080		.179
	Sig. (2-tailed)	+	*.000*				*.718*	*.763*		*.494*
	-2 log-likelihood		378,868	378,142	377,308	377,170	377,115	375,573		374,394
	χ^2		/	/	834	138	55	1,583		/
	Sig.		/	/	*.000*	*.000*	*.000*	*.000*		/
	AIC		378,872	378,150	377,326	377,193	377,145	375,619		374,470

Source: Amadeus, 2013.

2.11 Conclusions

I showed that MLM can be used to explain capital structure heterogeneity and that it provides more reliable estimates of regression coefficients and corresponding standard errors than multiple regression analysis with standard errors clustered only by firm. A high intraclass correlation of firms operating within the same industry and country shows that there is a high cross-sectional dependency and it is thus important to control for data hierarchy. Moreover, non-parametric tests showed that there are statistically significant differences in average and median indebtedness across industries and countries, which means that random intercept model is needed. All in all, the overall fit of the model was statistically significantly improved under multilevel settings – multilevel linear models fit the data significantly better than the multiple regression model (lower AIC). The reason can be found in the high importance of controlling for industry (and country) differences in indebtedness, because many researchers found that industry median leverage is the strongest explanatory variable of capital structure heterogeneity. Additionally, I demonstrated that separating within- and between-firm effects is crucial for correctly understanding the impact of the first level explanatory variables. I believe that MLM and cluster confounding can successfully be applied also to other financial studies, which use such type of data.

Frank & Goyal (2009) presented a comprehensive review of determinants that have significant power at explaining the observed capital structure heterogeneity of American firms and found that industry median leverage, tangibility, profitability, firm size, and inflation are among the most reliable factors. I found that all of these factors also have statistically significant explanation power for European firms.[17] Furthermore, I showed that profitability has a stronger between-firm effect, which means that more profitable firms need less external financial support. I demonstrated that without separating within- and between-firm size effects, conclusions are extremely misleading. I showed that when comparing firms cross-sectionally by their average size (the between-firm effect), there are no differences in indebtedness. On the other hand, the within-firm increase in size reveals substantial leveraging – firms' expansions are largely financed with new debt. I further demonstrated that stronger growth needs additional external financing (preferring debt over new equity), and that tangibility has a much stronger between-firm effect, which demonstrates the importance of the average share of tangible assets: firms that operate with a higher share of tangible assets are able to use more debt. Moreover, I found that firms with a higher variability of operating income are supplied with less debt financing, and that public firms and firms producing unique products use less debt. Moreover, I showed that management is more inclined to take new debt in times of stronger GDP growth and during periods of high inflation. Contrary to the results of the multiple regression model, MLM shows that the nominal corporate tax rate does not explain differences in the indebtedness of European firms. In addition to the high importance of controlling for industry

[17] Industry median leverage is modeled through a random intercept at the industry level.

differences in indebtedness, as for example argued by Lemmon et al. (2008), I found that between-firm tangibility, within-firm size, between-firm profitability, probability of financial distress and within-firm growth are the strongest explanatory variables of the observed capital structure of European firms (compared using standardized partial regression coefficients). Within-firm profitability, between-firm size, between-firm growth, and within-firm tangibility show lower or insignificant explanatory power.

Lemmon et al. (2008) emphasized that an important question remains as to why some firms always seem to have high leverage, while others always seem to have low leverage, despite being similar along many dimensions, which results in a relatively low determination power of models for explaining capital structure. The answer to this question is explored in the following chapter.

3 EUROPEAN FIRMS' LEVERAGING DYNAMICS

In this chapter I analyze the leveraging dynamics of 8,777 European firms during the period 2006–2011. First I decompose the leverage variation between four levels, introduced in *Chapter 2*. Then I analyze the persistence and convergence of leverage during the period 2006–2011, similarly as was done by Lemmon et al. (2008). I contrast the convergence by classifying firms into different groups, and estimate the convergence speed, comparing it before and during the financial crisis, which hit in the year 2008.

3.1 Variation of leverage

Researchers found that there are large cross-sectional differences in indebtedness among firms (Kayhan & Titman (2007), Lemmon et al. (2008), Strebulaev & Yang (2013)). I would like to decompose total variation of leverage, defined either as a ratio of long-term debt or total financial debt to total assets, into four parts: within-firm variability, between-firm variability, between-industry variability, and between-country variability. Lemmon et al. (2008) found that during a 20-year period, approximately 60 percent of leverage variation is cross-sectional, which means that leverage varies more cross-sectionally than within-firms. Graham & Leary (2011) performed a similar analysis over even longer time period and found that 42 percent of variation is within-firm, 44 percent within-industry and 14 percent between-industry. The majority of cross-sectional variation is contributed by firms operating within the same industry, which was confirmed also by MacKay and Phillips (2005); within-industry variability of book leverage was found to be three times larger than between-industry variation. To decompose the leverage variation into four parts, *Equation 3-1* is used.

$$\begin{aligned}\sum_t\sum_i\sum_j\sum_k\left(L_{tijk}-\bar{L}_{....}\right)^2 &= \sum_t\sum_i\sum_j\sum_k\left[\left(L_{tijk}-\bar{L}_{.ijk}\right)+\left(\bar{L}_{.ijk}-\bar{L}_{..jk}\right)\right.\\&\quad\left.+\left(\bar{L}_{..jk}-\bar{L}_{...k}\right)+\left(\bar{L}_{...k}-\bar{L}_{....}\right)\right]^2\\&= \sum_t\sum_i\sum_j\sum_k\left(L_{tijk}-\bar{L}_{.ijk}\right)^2\\&\quad+\sum_t\sum_i\sum_j\sum_k\left(\bar{L}_{.ijk}-\bar{L}_{..jk}\right)^2\\&\quad+\sum_t\sum_i\sum_j\sum_k\left(\bar{L}_{..jk}-\bar{L}_{...k}\right)^2\\&\quad+\sum_t\sum_i\sum_j\sum_k\left(\bar{L}_{...k}-\bar{L}_{....}\right)^2\end{aligned} \quad (3\text{-}1)$$

In this specification, L_{tijk} is leverage in year *t* for firm *i*, operating within industry *j* and country *k*; $\bar{L}_{.ijk}$ is the average leverage for firm *i* operating within industry *j* and country *k*; $\bar{L}_{..jk}$ is the average leverage for industry *j* within country *k*; $\bar{L}_{...k}$ is the average leverage for country *k*; and $\bar{L}_{....}$ is the grand mean – the average leverage of all firm-year observations. The results are shown in *Table 3-1*.

Table 3-1: Decomposition of variability of leverage

	% of total variation of leverage	
	Long-term debt	Total financial debt
Within firm	14.8	15.2
Between firms within the same industry	51.8	59.6
Between industries within the same country	24.2	15.4
Between countries	9.2	9.8

Sample size is 8,777 firms. Time period is 2006–2011.

Source: Amadeus, 2013.

Table 3-1 reveals that during the six year period, between-firm heterogeneity of leverage is much larger compared to within-firm heterogeneity. When comparing within-firm heterogeneity of long-term debt and total financial debt, there is little difference between the two. This means that firms are rarely taking and returning new short-term credit, which would result in an increased heterogeneity of the total financial debt. The between-firm heterogeneity shows a significant increase when leverage is defined as total financial debt. This means that there is a significant share of firms that are financed primarily with short-term debt, which causes that heterogeneity. On the contrary, between-industry heterogeneity is significantly decreased when total financial debt is analyzed. This means that access to long-term debt is highly influenced by the industry where a firm operates. The distinction between the ability to borrow long- or short-term was highlighted by Diamond (1991). Finally, between-country heterogeneity is the smallest, meaning that European countries are relatively homogenous regarding corporate indebtedness defined either as long-term debt or total financial debt. This analysis reveals that over the 6-year period there is a strong persistence of leverage (between-firm variation of leverage within the same industry is the largest); however, there is also a certain degree of within-firm variation. I am interested in whether this within-firm variation is oriented toward the target capital structure. In *Subchapter 3.2* I graphically and numerically analyze the leveraging dynamics, which shows both persistence and convergence.

3.2 Convergence of capital structure toward the target and speed of adjustment

In this subchapter I would like to analyze whether firms converge toward the target capital structure. For example, Bosworth (1971), Taggart (1977), and Flath & Knoeber (1980) confirmed that firms in aggregate converge toward the target capital structure. Flath & Knoeber (1980) showed that interest tax deductibility (a positive effect of debt) and the costs of financial distress (a negative effect of debt) imply the existence of the target capital structure, at least on the industry level. Even more, Lev (1969), Lev & Pekelman (1975), Ang (1976), and Brealey et al. (1976) displayed that convergence toward the target also exists on the firm level. More recently, Lemmon et al. (2008) clearly indicated that there is convergence; however, there is also a strong persistence of leverage ratios. This means that although less indebted firms on average increase leverage and more indebted firms decrease it, more (less) indebted firms remain above (below) the average indebted ones also after a 20-year period. Lemmon et al. also showed that highly indebted private American firms remain above the average indebted ones even after going public, regardless of the changes in the information environment, the distribution of control, and the access to capital. They summarized this pattern as follows:

> "… examination of leverage ratios suggests the presence of a transitory or short-run component that leads to a gradual convergence in leverage ratios, as well as a permanent or long-run component that leads to highly persistent cross-sectional differences in leverage."

The authors empirically demonstrated that historical leverage is one of the most important determinants of future leverage, even after controlling for traditional determinants of capital structure. Similarly, Kayhan & Titman (2007) confirmed that history has a major influence in observed leverage ratios, and that these effects partially persist for at least ten years. Further, it was found that family-owned firms are much more likely to have zero leverage in their capital structure (Strebulaev & Yang, 2013). Strebulaev & Yang thoroughly investigated the persistence of zero leverage firms and concluded that the CEOs' conservatism plays an important role in the decision regarding the amount of leverage the firm will use. Similarly, the importance of conservatism was highlighted by Donaldson (1961), claiming that the fact that the person in power is either conservative or venturesome by nature is one of the most important determinants of the amount borrowed by a firm.

Lev (1969) thoroughly analyzed the adjustment of firms' financial ratios toward the targets, defined as the median industry values. He explained that moving toward the target is usually done in two ways. The first approach, more accounting related, is called smoothing: management uses measurement rules to decrease or increase the ratios which are above or below the standard. In the second approach, management includes the desired ratios, the target, in the firm's budgets, and then navigates the business operations in a way that the actual ratios will comply with predefined targets as much as possible. Lev (1969) stressed that there are two conflicting types of costs that cause fluctuations around the target: the cost of being out of equilibrium and the cost of adjustment. Lev also raised an interesting question of the stability of the target. According to him, management incorporates in the adjustment process the likelihood whether the change in the target is a fundamental movement or just a temporary (random) fluctuation. He also found that larger firms adjust faster because some balance sheet categories are indivisible. Furthermore, Taggart (1977) found that management bases stock and bond issue decisions on the need of permanent capital and on long-term debt capacity. He discovered that whenever a bond issue leads to an excessive debt level, the firm starts issuing stocks to decrease that leverage. Additionally, Taggart claimed that adjustments to the permanent capital targets are relatively slow, but liquid assets and short-term debt play an important role in absorbing short-run fluctuations in the external financing deficit. He concluded that movement toward the target capital structure is definitely present over the longer period.

There have been numerous attempts to measure the speed of convergence. The positive speed of adjustment toward the target was documented by many researchers (e.g. Lev (1969), Jalilvand & Harris (2006), Auerbach (1985), Byoun (2008), Lemmon et al. (2008)). On the other hand, Fama & French (2002), Baker & Wurgler (2002), Welch (2004) and Iliev & Welch (2010) argued that although there is a convergence, the speed is negligible. To estimate the speed of convergence for the sampled European firms, I used the target as defined by the multilevel Model 5 (see *Equation 2-40* in *Chapter 2*). By using MLM instead of a classical OLS regression, I believe that target capital structure is estimated more precisely, since Gelman (2006) argued that when data has a hierarchical structure (repeated observations are nested within a firm, which operates within industry and within country), multilevel linear model is essential for a precise prediction. The speed of convergence was additionally contrasted for various separations of firms into groups. Although the speed of adjustment was usually performed on long-term debt only, I also performed the analysis on total financial debt.

The majority of past empirical research on convergence is based on partial adjustment models, where the average yearly rate of adjustment toward the predefined target is estimated, i.e. the speed. The most recent published speed estimates for long-term debt are 31 percent per year by Flannery & Rangan (2006), 25 percent by Lemmon et al. (2008), 23 percent by Huang & Ritter (2009), 22 percent by Byoun (2008), 7–18 percent by Fama & French (2002), to practically zero by Baker & Wurgler (2002), Welch (2004), and Iliev & Welch (2010). Lemmon et al. (2008) demonstrated that the estimated speed of adjustment is practically unaffected, whether the target is specified as a firm-specific constant or as a function of its time-varying characteristics. This finding is, however, inconsistent with earlier research that firms appear to be adjusting toward the time-varying target (Flannery & Rangan, 2006; Hovakimian, Opler, & Titman, 2001). Cross-sectional variation in capital structure, as opposed to time-series variation, is thus more important when the target capital structure is determined (Leary & Roberts, 2010).

One of the first models for estimating the speed of adjustment was suggested by Lev (1969), and is written in *Equation 3-2*.

$$log(D_{ti}) - \log(D_{(t-1)i}) = \beta_0 + \beta_1\big(log(x_{(t-1)i}) - \log(D_{(t-1)i})\big) + \varepsilon_{ti} \qquad (3\text{-}2)$$

In *Equation 3-2*, D_{ti} is the actual leverage of firm *i* at time *t*; $D_{(t-1)i}$ is the actual leverage of firm *i* in the preceding period; $x_{(t-1)i}$ is the target leverage of firm *i* in the preceding period. This model, however, is problematic because many firms have long-term debt equal to zero, for which a logarithm cannot be calculated. Lemmon et al. (2008) suggested transforming zeroes into a very small real number in such cases. However, models without the use of logarithm were proposed more recently. A model for estimating target adjustment speed, as suggested by Byoun (2008), is written in *Equation 3-3*.

$$\frac{\Delta D_{ti}}{A_{ti}} = \beta_0 + \beta_1 \left(x_{ti} - \frac{D_{(t-1)i}}{A_{ti}} \right) + \varepsilon_{ti} \qquad (3\text{-}3)$$
$$\varepsilon_{ti} \sim N\,(0, \sigma^2)$$

In this specification, ΔD_{ti} can be written as $D_{ti} - D_{(t-1)i}$ and is the difference in leverage over one year period for a firm *i*. A_{ti} denotes total assets for a firm *i* in time *t*, while x_{ti} the target debt-to-assets ratio.[18] In *Equation 3-3*, β_1 measures the financial leverage adjustment speed. Furthermore, the model can incorporate two adjustment speeds – one for above-target indebted firms and one for below-target indebted firms, as written in *Equation 3-4*.

$$\frac{\Delta D_{ti}}{A_{ti}} = \beta_0 + \beta_1^A \left(x_{ti} - \frac{D_{(t-1)i}}{A_{ti}} \right) D_{ti}^{Above} + \beta_1^B \left(x_{ti} - \frac{D_{(t-1)i}}{A_{ti}} \right) D_{ti}^{Below} + \varepsilon_{ti} \qquad (3\text{-}4)$$
$$\varepsilon_{ti} \sim N\,(0, \sigma^2)$$

In *Equation 3-4*, D_{ti}^{Above} and D_{ti}^{Below} are dummy variables, equal to one if actual leverage is above or below the target, determined by Model 5 (*Equation 2-40)*, otherwise zero.[19] β_1 is separated into two parts: β_1^A and β_1^B, showing the effects for above- and below-target indebted firms. Similarly as in *Chapter 2*, both *Equation 3-3* and *3-4* are estimated using multilevel linear modeling (Mixed procedure: REML), as is done by Byoun (2008).[20]

Finally, I wanted to check if firms' actual movement of leverage (decrease or increase) is consistent with the predicted above- and below-target indebtedness. Above-target indebted firms are expected to decrease the leverage, while below-target indebted firms are expected to increase it. For each definition of leverage, I classified firm-year observations based on actual movement of leverage (25 percent of largest decreases in leverage, 25 percent of largest increases in leverage, and the remaining 50 percent of movements), and based on distance from the estimated targets (25 percent of highly over-target indebted firm-year observations, 25 percent of highly under-target indebted firm-year observations, and the remaining 50 percent of observations, which were the closest to the estimated target). I thus formed nine portfolios, as shown in *Table 3-2*. At each combination the first number represents the actual frequency of firm-year observations, while the second number, given in parentheses, represents the expected frequency in case of no correlation between both classification factors. Based on Pearson-χ^2 and the contingency coefficient, results show that there is a statistically significant correlation between the actual and the predicted direction of movements for both definitions of leverage, which provides additional

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[18] The important difference vis-a-vis Lev's (1969) models is the time period of the target leverage. While Lev (1969) assumed that expected target is set at the end of the preceding period, Byoun (2008) suggested that the position of target is set for the end of the current period. This was a preferred choice also by Welch (2004) and Flannery & Rangan (2006).

[19] For each firm-year observation, I first estimated the optimal capital structure by *Equation 2-40* and in the second step I estimated the speed of adjustment by *Equation 3-3* and *Equation 3-4*.

[20] Standard errors are clustered by firm, as suggested by Petersen (2009). In addition to using a multilevel linear modeling (Mixed procedure: REML), Byoun (2008) estimated the model by the Fama and MacBeth approach; however, the overall results lead to the same conclusion. Since this analysis is not concentrated on measuring absolute speeds of adjustments but rather on numerical and graphical comparison of relative speeds between different groups of firms and during two time periods, I choose Byoun's preferred estimation method.

evidence of convergence toward the targets, defined by traditional explanatory variables of capital structure heterogeneity.

Table 3-2: Analysis of actual and expected movements of leverage

For each definition of leverage (long-term debt - Panel A and total financial debt - Panel B), 52,662 firm-year observations are classified into one of the nine portfolios, based on actual movement of leverage (25 percent of largest decreases in leverage, 25 percent of largest increases in leverage, and the remaining 50 percent of movements), and based on distance from the estimated target (25 percent of highly over-target indebted firm-year observations, 25 percent of highly under-target indebted firm-year observations, and the remaining 50 percent of observations, which were the closest to the estimated target). Results are shown in contingence table below. At each combination, the first number represents the actual frequency of firm-year observations, while the second number, given in parentheses, represents the expected frequency in case of no correlation between both classification factors. Based on the actual and the expected frequencies, Pearson-χ^2 and contingence coefficient are shown.

Panel A: Long-term debt			
	Highly over-target obs.	Close-to-the-target obs.	Highly under-target obs.
Strong decrease in leverage	7,129 (3,290)	5,239 (6,580)	791 (3,290)
Small changes in leverage	3,003 (6,582)	14,476 (13,166)	8,850 (6,582)
Strong increase in leverage	3,033 (3,293)	6,618 (6,588)	3,523 (3,293)
	Pearson-χ^2: 9,547 (p = 0.000)	Contingency coefficient: 0.392 (p = 0.000)	
Panel B: Total financial debt			
	Highly over-target obs.	Close-to-the-target obs.	Highly under-target obs.
Strong decrease in leverage	6,574 (3,292)	5,770 (6,584)	824 (3,293)
Small changes in leverage	4,561 (6,582)	13,219 (13,164)	6,549 (6,584)
Strong increase in leverage	2,029 (3,291)	7,341 (6,582)	3,795 (3,292)
	Pearson-χ^2: 7,090 (p = 0.000)	Contingency coefficient: 0.344 (p = 0.000)	

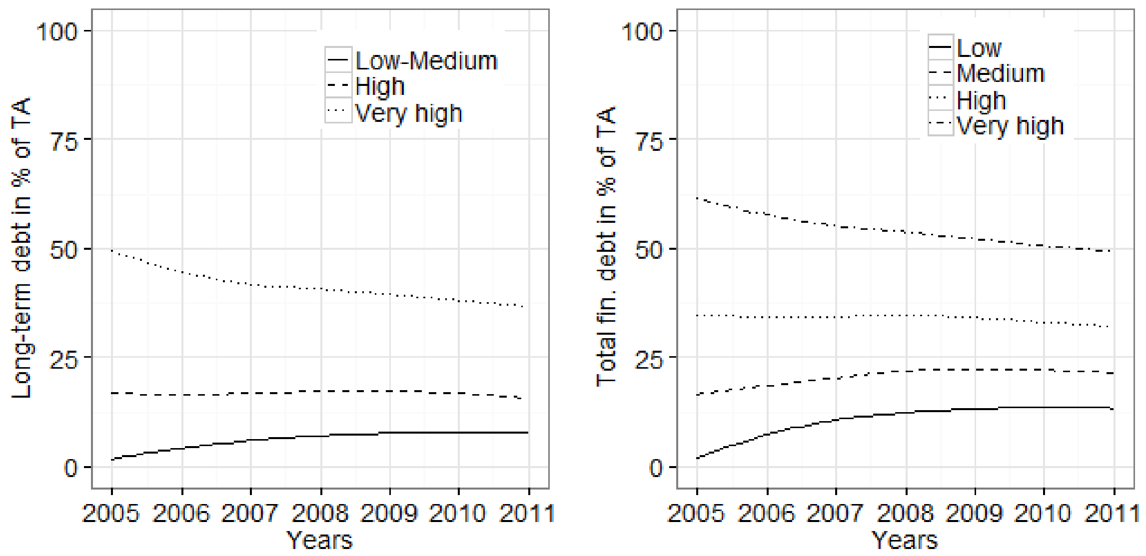
Source: Amadeus, 2013.

I demonstrated leveraging dynamics graphically[21], concentrating on micro level capital structure changes during the period 2005–2011. I defined leverage either as long-term debt or total financial debt in percent of total assets. First, in the year 2005 I ranked firms based on the amount of leverage in their capital structure. Firms at the first, second (i.e. median), and third quartile were determined. After that, firms that have lower leverage than the firm at the first quartile were grouped into the first portfolio, named *low*. Firms between the first and the second quartile (i.e. median) were grouped into the second portfolio, named *medium*. Firms between the second quartile (i.e. median) and the third quartile were grouped into the third portfolio, named *high*. Firms above the third quartile were grouped into the fourth portfolio, named *very high*. In the case of defining leverage as long-term debt, the firm at the first quartile has leverage equal to zero. Consequently the first and the second portfolio were grouped together (*low-medium* portfolio), consisting of firms with leverage below the median firm. Once a firm was classified into one of the four (three) portfolios in the year 2005, it was followed until the year 2011. For each portfolio separately, the micro changes in capital structure of each firm determine the movement of a portfolio, which is shown by a curve that is created with a local regression procedure (LOESS). *Figure 3-1* shows the capital structure behavior of all 8,777 sampled firms together.

[21] All figures are produced by statistical software R (R Core Team, 2013; Wickham, 2009).

Figure 3-1: Leveraging dynamics for European firms in the period 2005–2011

The sample consists of 8,777 firms with total assets above €5 million. In 2005 firms were ranked based on the amount of leverage (long-term debt to total assets or total financial debt to total assets) and sorted into one of the four quartile portfolios, which are denoted as low, medium, high, and very high portfolio (in case of long-term debt, the first two portfolios are joined). Once a firm is classified into one of the four portfolios, it is kept in that portfolio for the next six years, and analyzed how its capital structure was changing. For each portfolio separately, the curve represents the average movement of firms' leverage ratios, classified in that portfolio. R-code can be found in Appendix A-2.



Source: Amadeus, 2013.

The pattern of capital structure dynamics of European firms is highly consistent with the findings for American firms by Lemmon et al. (2008). Most of the convergence occurs in the first few years after sorting firms into portfolios, but both statistical and economical differences in average portfolio indebtedness persist. Leverage is thus characterized by a transitory and a permanent component also among European firms. The transitory component can effectively be explained by active management of leverage, which leads to mean reversion in leverage ratios, as was argued by Graham & Harvey (2001), Flannery & Rangan (2006), Hovakimian (2006), Kayhan & Titman (2007), and Leary & Roberts (2010). Lemmon et al. (2008) showed that dynamic rebalancing, expressed in the form of above average net debt issuing among less indebted firms on the one hand, and below average net debt issuing among more indebted firms on the other, is directed toward the largely time-invariant target.

The numerical results of the speed of convergence are given in *Table 3-3*. The general observation is that the separation of speed for the above- and below-target indebted firms reveals that the adjustment process is much stronger for the above-target indebted firms than for the below-target indebted firms, in line with the finding of Byoun (2008); a difference which is highly statistically significant (p-value < 0.001). This can be successfully explained by the finding that the cost of being over-levered is asymmetrically higher than the cost of being under-levered (Binsbergen, Graham, & Yang, 2010). As expected, long-term debt shows slower adjustment speed than total financial debt. The average speed for long-term debt is 0.201 per year, which is close to speed estimate by Byoun (2008).

Table 3-3: Estimated speed of adjustment toward target financial leverage

The sample consists of 52,662 firm-year observations during the period 2006–2011 for 8,777 European firms. The dependent variable is either long-term debt to total assets or total financial debt to total assets. Regression coefficients β_1 represent the average yearly speed of adjustment toward the predefined target (see *Equation 2-40*), estimated with partial adjustment model, given in *Equation 3-3*. Further, regression coefficient is separated into two parts, β_1^A and β_1^B, to show the speed for above-target and below-target indebted firms, as shown in *Equation 3-4*. *t*-statistics are given in parentheses. Speeds are estimated with multilevel linear model (Mixed procedure: REML), controlled for repeated measurements of the same firm, as suggested by Petersen (2009).

	Long-term debt to total assets				Total financial debt to total assets			
	Equation 3-3		*Equation 3-4*		*Equation 3-3*		*Equation 3-4*	
All firms together	β_1	0.201 (87.12)	β_1^A	0.227 (64.50)	β_1	0.234 (100.69)	β_1^A	0.318 (78.91)
			β_1^B	0.147 (24.87)			β_1^B	0.113 (21.64)

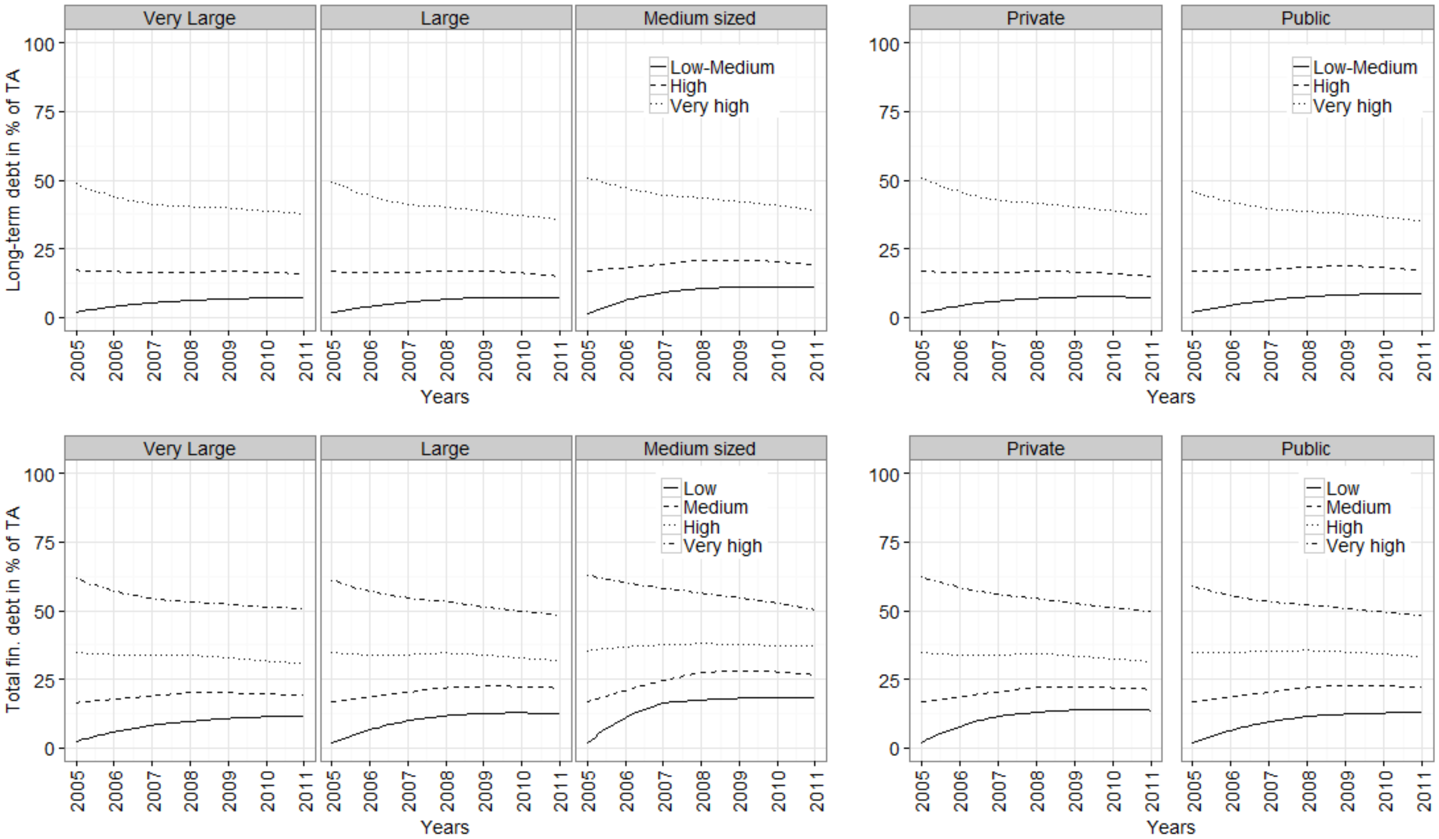
Note: All pairs of estimated speeds are statistically significantly different at p-value < 0.001.

Source: Amadeus, 2013.

I was interested in how firm size affects the capital structure dynamics. I classified firms into one of three classes, i.e. very large (2,307 firms), large (5,004 firms), and medium-sized (1,466 firms). The precise definition of size classification can be found in Appendix C. *Figure 3-2* shows the dynamics for each size class separately. It is shown that regardless of firm size, the convergence is clearly evident. Moreover, it can be observed that medium-sized firms had stronger leveraging. This means that the medium-sized firms (i.e. firms with total assets between €2 and €20 million) contributed the most to the strong leveraging process in the pre-crisis period. The next division is between private (5,664) and public (3,113) firms. Lemmon et al. (2008) performed an analysis on public firms, but showed that a sample of privately held UK firms also exhibits the same dynamics. Results are shown in *Figure 3-2*. Private firms show the same pattern as public firms, regardless of differences in the distribution of control and access to capital. In *Table 3-4* speeds of adjustment are compared. I found that medium-sized firms have a statistically significant higher adjustment speed for below-target indebted firms, compared to large and very large firms (p-value < 0.001). Moreover, above-target indebted firms (analyzing long-term financial debt) adjusted slower than below-target indebted ones only in the group of medium-sized firms, significant at p-value < 0.001. Furthermore, results showed that private firms have a slightly higher speed of adjustment than public firms, which can be a result of private firms being on average smaller than public firms.

Figure 3-2: Leveraging dynamics for European firms classified by size and ownership

The sample consists of 8,777 firms with total assets above €5 million. In 2005 firms were ranked based on the amount of leverage (long-term debt to total assets or total financial debt to total assets) and sorted into one of the four quartile portfolios, which are denoted as low, medium, high, and very high portfolio (in case of long-term debt, the first two portfolios are joined). Once a firm is classified into one of the four portfolios, it is kept in that portfolio for the next six years, and analyzed how its capital structure was changing. For each portfolio separately, the curve represents the average movement of firms' leverage ratios, classified in that portfolio. Firms are classified into one of three size classes, i.e. very large (2,307 firms), large (5,004), or medium-sized (1,466) (defined in Appendix C), or as private (5,664) or public (3,113). R-code can be found in Appendix A-2.



Source: Amadeus, 2013.

Table 3-4: Estimated speed of adjustment toward target financial leverage classified by size and ownership

The sample consists of 52,662 firm-year observations during the period 2006–2011 for 8,777 European firms. The dependent variable is either long-term debt to total assets or total financial debt to total assets. Regression coefficients β_1 represent the average yearly speed of adjustment toward the predefined target (see *Equation 2-40*), estimated with partial adjustment model, given in *Equation 3-3*. Further, regression coefficient is separated into two parts, β_1^A and β_1^B, to show the speed for above-target and below-target indebted firms, as shown in *Equation 3-4*. *t*-statistics are given in parentheses. Speeds are estimated with multilevel linear model (Mixed procedure: REML), controlled for repeated measurements of the same firm, as suggested by Petersen (2009). Results are contrasted between three size categories and as private and public.

	Long-term debt to total assets				Total financial debt to total assets			
	Equation 3-3		*Equation 3-4*		*Equation 3-3*		*Equation 3-4*	
Panel A: Subsample analysis classified by firm size								
Very large firms	$\beta_1{}^{VL}$	0.180 (40.65)	$\beta_1^{A^{VL}}$	0.219 (29.90)	$\beta_1{}^{VL}$	0.210 (46.78)	$\beta_1^{A^{VL}}$	0.317 (37.49)
			$\beta_1^{B^{VL}}$	0.117 (11.23)			$\beta_1^{B^{VL}}$	0.091 (10.14)
Large firms	$\beta_1{}^{L}$	0.207 (66.65)	$\beta_1^{A^{L}}$	0.239 (51.127)	$\beta_1{}^{L}$	0.241 (76.67)	$\beta_1^{A^{L}}$	0.334 (61.98)
			$\beta_1^{B^{L}}$	0.141 (17.64)			$\beta_1^{B^{L}}$	0.105 (14.74)
Medium-sized firms	$\beta_1{}^{M}$	0.224 (39.79)	$\beta_1^{A^{M}}$	0.217 (26.38)	$\beta_1{}^{M}$	0.266 (47.66)	$\beta_1^{A^{M}}$	0.291 (32.02)
			$\beta_1^{B^{M}}$	0.242 (14.95)			$\beta_1^{B^{M}}$	0.218 (15.13)
Panel B: Subsample analysis based on private vs. public firms								
Private firms	$\beta_1{}^{Private}$	0.209 (73.66)	$\beta_1^{A^{Private}}$	0.242 (56.26)	$\beta_1{}^{Private}$	0.246 (85.15)	$\beta_1^{A^{Private}}$	0.326 (65.52)
			$\beta_1^{B^{Private}}$	0.138 (18.76)			$\beta_1^{B^{Private}}$	0.127 (18.81)
Public firms	$\beta_1{}^{Public}$	0.182 (45.78)	$\beta_1^{A^{Public}}$	0.189 (30.67)	$\beta_1{}^{Public}$	0.205 (53.04)	$\beta_1^{A^{Public}}$	0.293 (42.44)
			$\beta_1^{B^{Public}}$	0.167 (17.01)			$\beta_1^{B^{Public}}$	0.09 (11.20)

Source: Amadeus, 2013.

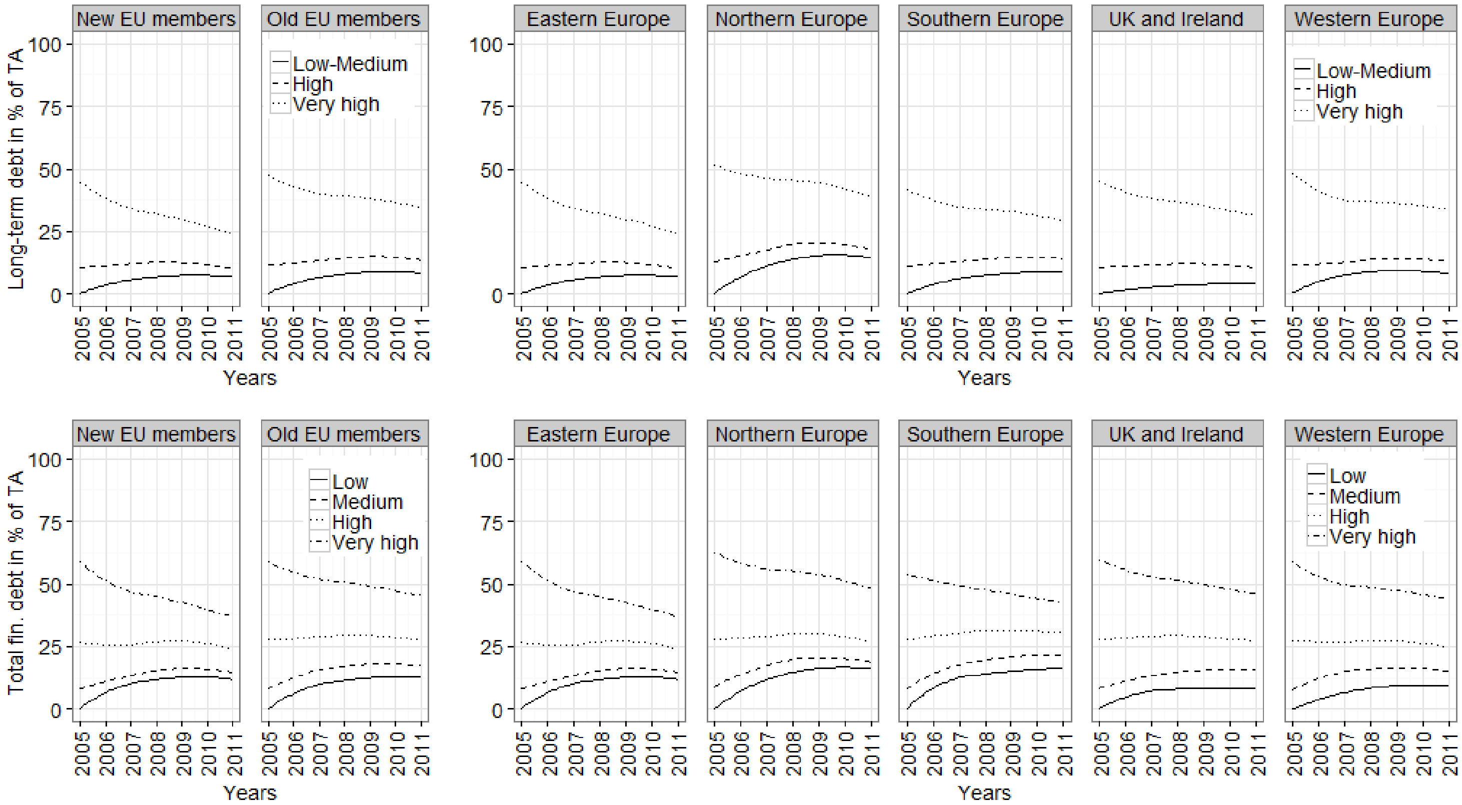
Further, I was interested in the differences in leveraging dynamics between firms from the old and the new EU members. Mokhova and Zinecker (2013) found that EU membership influences the corporate capital structure. I hypothesized that with joining EU, firms get easier access to debt financing, which results in a temporary stronger leveraging process of these firms. Moreover, much empirical research was done on various economic differences among European geographical regions. For example, different economic indicators show much worse performance of Southern European countries compared to Northern Europe (e.g. Petrakis (2011)). Likewise, chief economist for Europe and Central Asia at the World bank recently claimed that the EU economy can be viewed as three lanes of traffic, a slow-speed lane in Western Europe, a high-speed lane in formerly Communist Eastern Europe and a third lane, the South – "where cars are going in reverse" (Martin, 2012). I hypothesized that part of the problems of Southern European countries can be attributed to excess leveraging process and consequent over-indebtedness, compared to the rest of the Europe.

I thus separated firms based on political and geographical regions. First, I used the 2004 enlargement of the European Union as a reference point. Countries that joined the EU in that year are classified as new EU members[22] (1,972 firms), while the rest as old EU members[23] (6,805 firms). Second, firms were separated into five geographical regions: Eastern Europe (1,972 firms – the same as new EU members), Northern Europe[24] (319 firms), Southern Europe[25] (1,750 firms), UK and Ireland (1,878 firms), and Western Europe[26] (2,858 firms). *Figure 3-3* shows both divisions. Again, the pattern of persistence and convergence is clearly evident. However, there is an important difference between firms from the old and the new EU members – the degree of convergence during the observed period. Firms from the new EU members had both faster leveraging among least indebted firms and faster deleveraging among most indebted firms, which resulted in a higher degree of convergence. Higher leveraging speed of new EU members is evident also from *Table 3-5*. The division of firms based on geographical regions shows that although the general pattern remains the same, firms from Southern European countries had the strongest leveraging process, similar to firms from Eastern European countries. However, there is an important difference: the deleveraging process among most indebted firms was more successful in Eastern Europe than in Southern Europe. Southern Europe is also the only group where speed of long-term debt adjustments is faster for below-target indebted firms, as seen in *Table 3-5*.

[22] Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia, and Slovenia.
[23] Belgium, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Norway, Portugal, Spain, Sweden, Switzerland, and the United Kingdom. Switzerland and Norway are classified among old EU members although they are officially not part of the EU.
[24] Finland, Iceland, Norway, and Sweden.
[25] Greece, Italy, Portugal, and Spain.
[26] Belgium, France, Germany, Luxembourg, and Switzerland.

Figure 3-3: Leveraging dynamics for European firms classified by EU membership and geographical regions

The sample consists of 8,777 firms with total assets above €5 million. In 2005 firms were ranked based on the amount of leverage (long-term debt to total assets or total financial debt to total assets) and sorted into one of the four quartile portfolios, which are denoted as low, medium, high, and very high portfolio (in case of long-term debt, the first two portfolios are joined). Once a firm is classified into one of the four portfolios, it is kept in that portfolio for the next six years, and analyzed how its capital structure was changing. For each portfolio separately, the curve represents the average movement of firms' leverage ratios, classified in that portfolio. Firstly, firms are separated based on a country where they operate – firms from the new (1,972 firms) vs. the old EU members (6,805) (reference point is 2004 EU enlargement). Secondly, firms are separated based on a geographical region where they operate – firms from Eastern Europe (1,972), Northern Europe (319), Southern Europe (1,750), UK and Ireland (1,878), and Western Europe (2,858). R-code can be found in Appendix A-2.



Source: Amadeus, 2013.

Table 3-5: Estimated speed of adjustment toward target financial leverage classified by EU membership and geographical regions

The sample consists of 52,662 firm-year observations during the period 2006–2011 for 8,777 European firms. The dependent variable is either long-term debt to total assets or total financial debt to total assets. Regression coefficients β_1 represent the average yearly speed of adjustment toward the predefined target (see *Equation 2-40*), estimated with partial adjustment model, given in *Equation 3-3*. Further, regression coefficient is separated into two parts, β_1^A and β_1^B, to show the speed for above-target and below-target indebted firms, as shown in *Equation 3-4*. *t*-statistics are given in parentheses. Speeds are estimated with multilevel linear model (Mixed procedure: REML), controlled for repeated measurements of the same firm, as suggested by Petersen (2009). Results are contrasted between old and new EU members and between five geographical regions.

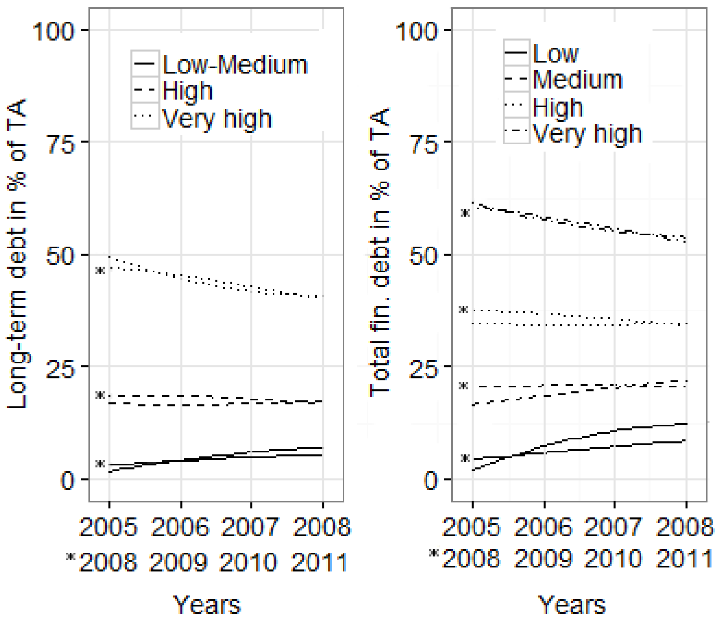
	Long-term debt to total assets				Total financial debt to total assets			
	Equation 3-3		*Equation 3-4*		*Equation 3-3*		*Equation 3-4*	
Panel A: Subsample analysis based on EU membership								
New EU member states	${\beta_1}^{New}$	0.218 (41.79)	$\beta_1^{A^{New}}$	0.224 (29.47)	${\beta_1}^{New}$	0.239 (47.07)	$\beta_1^{A^{New}}$	0.285 (33.12)
			$\beta_1^{B^{New}}$	0.206 (15.46)			$\beta_1^{B^{New}}$	0.167 (13.82)
Old EU member states	${\beta_1}^{Old}$	0.197 (76.77)	$\beta_1^{A^{Old}}$	0.229 (57.62)	${\beta_1}^{Old}$	0.232 (89.15)	$\beta_1^{A^{Old}}$	0.328 (72.14)
			$\beta_1^{B^{Old}}$	0.132 (20.05)			$\beta_1^{B^{Old}}$	0.098 (16.95)
Panel B: Subsample analysis based on geographical region								
Eastern Europe	${\beta_1}^{E}$	0.218 (41.79)	$\beta_1^{A^{E}}$	0.224 (29.47)	${\beta_1}^{E}$	0.239 (47.07)	$\beta_1^{A^{E}}$	0.285 (33.12)
			$\beta_1^{B^{E}}$	0.206 (15.46)			$\beta_1^{B^{E}}$	0.166 (13.82)
Northern Europe	${\beta_1}^{N}$	0.186 (15.84)	$\beta_1^{A^{N}}$	0.280 (14.38)	${\beta_1}^{N}$	0.194 (16.25)	$\beta_1^{A^{N}}$	0.360 (16.42)
			$\beta_1^{B^{N}}$	0.085 (7.30)			$\beta_1^{B^{N}}$	0.125 (9.34)
Southern Europe	${\beta_1}^{S}$	0.210 (38.08)	$\beta_1^{A^{S}}$	0.191 (21.95)	${\beta_1}^{S}$	0.248 (46.81)	$\beta_1^{A^{S}}$	0.369 (36.62)
			$\beta_1^{B^{S}}$	0.244 (17.23)			$\beta_1^{B^{S}}$	0.118 (10.93)
UK and Ireland	${\beta_1}^{UK}$	0.188 (42.20)	$\beta_1^{A^{UK}}$	0.218 (31.76)	${\beta_1}^{UK}$	0.267 (54.53)	$\beta_1^{A^{UK}}$	0.350 (41.61)
			$\beta_1^{B^{UK}}$	0.126 (10.26)			$\beta_1^{B^{UK}}$	0.136 (11.41)
Western Europe	${\beta_1}^{W}$	0.196 (48.82)	$\beta_1^{A^{W}}$	0.249 (39.93)	${\beta_1}^{W}$	0.194 (49.57)	$\beta_1^{A^{W}}$	0.283 (42.35)
			$\beta_1^{B^{W}}$	0.096 (9.79)			$\beta_1^{B^{W}}$	0.064 (7.23)

Source: Amadeus, 2013.

Since it can be argued that the observed pattern of convergence (especially the strong leverage adjustment process among the least indebted firms) is time-dependent, *Figure 3-4* combines the results of capital structure dynamics if firms are sorted into leverage portfolios both in 2005 and in 2008, when the availability of debt financing importantly changed. In *Figure 3-4*, it is evident that although the speed of convergence was significantly lower during the crisis, the least indebted firms were still on average leveraging up, moving toward the target capital structure. Additional details about the decrease in adjustment speeds during the crisis can be found in *Table 3-6*.

Figure 3-4: Leveraging dynamics for European firms before and during the crisis

The sample consists of 8,777 firms with total assets above €5 million. In years 2005 and 2008 firms were ranked based on the amount of leverage (long-term debt to total assets or total financial debt to total assets) and sorted into one of the four quartile portfolios, which are denoted as low, medium, high, and very high portfolio (in case of long-term debt, the first two portfolios are joined). Once a firm is classified into one of the four portfolios, it is kept in that portfolio for the next three years (2006–2008 or 2009–2011), and analyzed on how its capital structure was changing. For each portfolio separately, the curve represents the average movement of firms' leverage ratios, classified in that portfolio. Because there are two classifications, curves showing movements during the crisis are denoted with an asterisk (*). R-code can be found in Appendix A-2.



Source: Amadeus, 2013.

Table 3-6: Estimated speed of adjustment toward target financial leverage before and during the crisis

The sample consists of 52,662 firm-year observations during the period 2006–2011 for 8,777 European firms. The dependent variable is either long-term debt to total assets or total financial debt to total assets. Regression coefficients β_1 represent the average yearly speed of adjustment toward the predefined target (see *Equation 2-40*), estimated with partial adjustment model, given in *Equation 3-3*. Further, regression coefficient is separated into two parts, β_1^A and β_1^B, to show the speed for above-target and below-target indebted firms, as shown in *Equation 3-4*. *t*-statistics are given in parentheses. Speeds are estimated with multilevel linear model (Mixed procedure: REML), controlled for repeated measurements of the same firm, as suggested by Petersen (2009). Results are contrasted between two time periods: before and during the financial crisis.

	Long-term debt to total assets				Total financial debt to total assets			
	Equation 3-3		*Equation 3-4*		*Equation 3-3*		*Equation 3-4*	
Before the crisis	${\beta_1}^{Before}$	0.230 (65.34)	${\beta_1^A}^{Before}$	0.265 (49.56)	${\beta_1}^{Before}$	0.265 (74.65)	${\beta_1^A}^{Before}$	0.345 (55.52)
			${\beta_1^B}^{Before}$	0.158 (17.52)			${\beta_1^B}^{Before}$	0.154 (19.41)
During the crisis	${\beta_1}^{During}$	0.178 (58.60)	${\beta_1^A}^{During}$	0.199 (42.65)	${\beta_1}^{During}$	0.208 (68.11)	${\beta_1^A}^{During}$	0.300 (57.07)
			${\beta_1^B}^{During}$	0.135 (17.38)			${\beta_1^B}^{During}$	0.074 (10.63)

Source: Amadeus, 2013.

Results show that the availability of debt financing influences the observed capital structures; however, the general pattern of partial adjustment toward the target capital structure, as predicted by the *dynamic trade-off theory*, still holds.

It can be clearly seen that, regardless of classifying firms into different groups or analyzing two extremely different time periods, leveraging dynamic is aligned with the theory of target capital structure, specifically the *dynamic trade-off theory*. Less (more) indebted firms on average increase (decrease) leverage, converging toward targets. On the other hand, firms in the middle show the most stable capital structure. I can generalize that the pattern is evident for all European firms, both public and privately held. As an additional robustness check, I performed the analysis on each of the 25 European countries separately (results are not shown) and found the same pattern. Moreover, I showed that convergence exists regardless of the definition of leverage (long-term debt only or total financial debt).

3.3 Conclusions

Kayhan & Titman (2007) pointed to the considerable disagreement about the importance of the concept of a target capital structure. They argued that it is intuitive to think about how the trade-off between the costs and benefits of debt financing results in a target capital structure. On the other hand, it is also possible that near the target, the relationship between leverage and firm value is weak, which means that the cost of deviating from the optimum is quite small. If that is the case, the idea of the target capital structure is much less important, and capital structures are likely to be influenced by transaction costs and market considerations that will temporarily affect the relative costs of leverage.

Graphical analysis demonstrates, however, a universal pattern among European firms: within-firm leverage variation, defined either as a ratio of long-term debt to total assets or as total financial debt to total assets, is directed toward the target capital structure, which can best be explained by the *dynamic trade-off theory*. I also showed that there is a statistically significant correlation between the actual and predicted movements toward the target capital structure, defined by a set of trade-off variables. In contrast, the *pecking order hypothesis* says nothing about mean reversion and the existence of target capital structure, while according to the *market timing theory*, equity issues would be preferred over strong leveraging in the pre-crisis period, when investors were overly optimistic. I further showed that regardless of different classification of firms into groups or comparing the before crisis period with the period during the crisis, both persistence and convergence are clearly evident, the same as was found for US firms. Moreover, I showed that such pattern is apparent for medium-sized and privately held firms as well. One of the possible explanations for strong persistence of leverage can be traced back to 1961, when Donaldson argued that whether the person in power is either conservative or venturesome by nature is one of the most important determinants of the amount borrowed by a firm.

Consistent with findings of Byoun (2008), the general sample of European firms reveals that above-target indebted firms adjust faster than below-target indebted firms. Moreover, the separation of firms into different groups and comparing convergence speed before and during the crisis pointed to the several conclusions. I found that medium-sized firms adjust faster than large or very large firms. More specifically, medium-sized firms are the only group with faster convergence among below-target indebted firms. Further, I found that firms from the new EU member states (i.e. firms from Eastern European countries) and firms from Southern European countries exhibit a faster leveraging process than the rest of the sample. However, the former demonstrate stronger deleveraging of the most indebted firms, which resulted in a higher degree of convergence. One of the possible explanations for the weak economic performance of Southern European countries is thus unsuccessful corporate deleveraging. Finally, I found that although the speed of convergence significantly decreased during the crisis, the general pattern of capital structure dynamics is still headed toward the target. The supply of external financing is thus an important determinant of observed capital structures, but more importantly, the same general pattern of convergence, observed both before and during the crisis, shows that the findings from my analysis are not time dependent but rather a universal pattern of capital structure dynamics.

Graham & Leary (2011) recently argued that even if convergence toward the target capital structure is proven, the question regarding which economic forces motivate within-firm movements of leverage remains open. In the last chapter of this dissertation I will test the hypothesis of Lev & Pekelman (1975), who developed the idea that a firm incurs costs whenever the debt-equity ratio is below or above the target. Since graphical analysis shows that firms behave accordingly to the existence of the target capital structure, I am interested whether Lev & Pekelman's hypothesis can be confirmed for a sample of European firms.

4 THE IMPACT OF INDEBTEDNESS ON A FIRM'S PERFORMANCE

Why do firms converge toward the target capital structure, as shown in *Chapter 3*? Graham & Leary (2011) recently argued that even if convergence exists, there remains an open question as to which economic forces motivate within-firm movements of leverage. Lev & Pekelman (1975) hypothesized that below- and above-target indebted firms incur costs that increase with the extent of deviation from the target. More recently, Kortweg (2010) showed that 5.5 percent of a median firm value can be attributed to the net benefits of debt, which means that firms that have too low leverage can successfully benefit by moving toward the target. Kortweg continued that net benefits of increased leverage grow for low leveraged firms but start decreasing when indebtedness becomes high, which supports the existence of the target capital structure. Similarly, Binsbergen et al. (2010) found that the net benefit of the optimal financial choice equals on average 3.5 percent of asset value.

Many researchers argued that excessive leverage negatively affects a firm's performance (e.g. Saffieddine & Titman (1999), Fama & French (2002) Jandik & Makhija (2005), and Gonzales (2013)). For example, Opler & Titman (1994) found that, in times of economic downturn, highly leveraged firms are the first to lose their customers. Furthermore, Tan (2012) argued that the firms in the top leverage decile underperform in return on equity compared to the rest of the firms. Additionally, he found that crises magnify the negative impact of leverage on a firm's performance. On the other hand, some researchers argued that the market value of a firm can be successfully increased through improved performance by moving from no-debt financing toward moderate leverage (e.g. Muradoglu & Sivaprasad (2009), Champion (1999)). Hadlock & James (2002) demonstrated that firms prefer debt financing in anticipation of a higher return, which was similarly argued by Lemmon & Zender (2010), who confirmed that debt appears to be preferred over equity, controlling for debt capacity limitations.

In this chapter I try to determine which economic factors could motivate European firms to converge toward the target capital structure during the period 2005–2011. I consider the differences in various aspects of a firm's performance by comparing optimally indebted firms (close to estimated targets in *Chapter 2*) with their under- and over-indebted peers, and by contrasting firms which successfully converged toward the target capital structure with those that remain high or low indebted throughout the observed period.

4.1 The impact of deviation from the target capital structure

Although a large deviation from the target capital structure may be costly, there may be little incentive for firms with moderate leverage to frequently optimize capital structure in a way that corresponds to the changes in the trade-off variables. Furthermore, the importance of capital structure trade-offs may be modest over a wide range of leverage choices, which can explain the low explanatory power of models for explaining capital structure heterogeneity (Graham & Leary, 2011). Binsbergen et al. (2010) showed that in a range of 20 percent above or below the optimal leverage, the firm value function is practically flat. Still, far out-of-equilibrium choices (e.g. using excessive leverage) can have disastrous effects. Similarly, the costly adjustment model is built on the idea that management weighs tax benefits of debt on the one hand, and distress costs of debt on the other, but the firm nonetheless experiences annual shocks to assets value, which moves its capital structure position away from the target. Since constant recapitalization is costly, this implies that instead of an optimal level of leverage, an optimal range is a more realistic assumption (Graham & Leary, 2011).

Because of that, simply regressing the differences between the actual and the target capital structure on various performance ratios is problematic. Instead, my analysis was done in the following way. For each firm I estimated the average leverage (the ratio of total financial debt to total assets) during the period 2006–2011 and compared it with the average predicted (target) leverage for that firm, estimated with a multilevel Model 5 (*Equation 2-40*). The differences between the average actual and the average target leverage were calculated, and based on these differences, firms were classified into three groups: 25 percent of firms that have the largest positive difference (above-target indebted firms), 50 percent of firms that are the closest to the estimated target (these firms are assumed to be within optimal range), and 25 percent of firms that have the largest negative difference (below-target indebted firms). As a measure of performance I selected two ratios, one measuring the return for shareholders and another measuring the return for all providers of capital. These are return on equity (ROE – *Equation 4-1*) and return on capital employed (ROCE – *Equation 4-2*). Both were calculated as arithmetic means during the period 2006–2011 for each firm separately.

$$ROE_t = \frac{Net\ income_t}{Equity\ capital_t} \cdot 100 \qquad (4\text{-}1)$$

Return on equity measures a firm's profitability by analyzing how much profit a firm generates with the money shareholders have invested. Brigham & Daves (2004) wrote that ROE is the single most important accounting ratio of performance.

$$ROCE_t = \frac{EBIT_t}{Equity\ capital_t + Noncurrent\ liabilities_t} \cdot 100 \qquad (4\text{-}2)$$

Return on capital employed measures the return that a business achieves with the total invested capital, showing the firm's profitability and efficiency. A higher ROCE indicates a more efficient use of capital. Compared to ROE, ROCE provides a better indication of financial performance for firms with a significant amount of debt (CFA Institute, 2012).

Table 4-1 shows that firms within the optimal range of leverage have higher median average ROE and ROCE, compared to overleveraged firms. Underleveraged firms, on the other hand, have higher median average ROE and ROCE, compared to optimally indebted firms. This can be explained by the fact that more profitable firms need less external financing because of high internally generated funds. Lev & Pekelman's hypothesis (1975) is thus only partially confirmed for the sample of European firms – firms which were highly overleveraged compared to the target incurred costs in the form of lower return on equity and lower return on capital employed. In other words, overleveraged firms underperformed compared to the group of firms that had leverage within the optimal range.

Table 4-1: Profitability ratios for three leverage portfolios

The sample size is 8,777 firms. For the period 2006–2011, the average actual total financial indebtedness of each firm was compared with average target total financial indebtedness, estimated by a multilevel linear model (*Equation 2-40*). Deviations were estimated and firms were grouped into three portfolios: 25% of firms with the largest positive deviation (overleveraged firms), 50% of firms with actual leverage closest to the target (optimal range), and 25% of firms with the largest negative deviation (underleveraged firms). For each leverage portfolio, first quartile (p25), median (p50), and third quartile (p75) were estimated for two profitability ratios: average ROE and average ROCE, calculated for each firm separately over the period 2006–2011.

	ROE			ROCE		
	p25	p50	p75	p25	p50	p75
Overleveraged	1.90	**9.84**	21.00	5.61	**11.11**	19.56
Optimal range	3.39	**10.22**	20.00	6.12	**12.42**	21.75
Underleveraged	4.77	**12.23**	22.81	7.22	**14.88**	26.53

Source: Amadeus, 2013.

To confirm the statistical differences in average and median profitability ratios between the three portfolios, two non-parametric tests were performed, as shown in *Table 4-2*. These include Mood's median test and Kruskal-Wallis test, both of which show statistically significant differences. Additionally, all pairs of Mann-Whitney tests of two independent conditions were performed, showing that firms within an optimal range have statistically higher mean rank for both ROE and ROCE, compared to overleveraged firms.

Table 4-2: Testing differences in profitability of three leverage portfolios

		> Median	≤ Median	**Mood's median test**	**Kruskal-Wallis test**
ROE	Overleveraged	1049	1137	$\chi^2 = 25.88$, df = 2, p = 0.000	$\chi^2 = 44.11$, df = 2, p = 0.000
	Optimal range	2134	2252		
	Underleveraged	1199	994		
ROCE	Overleveraged	910	1172	$\chi^2 = 78.77$, df = 2, p = 0.000	$\chi^2 = 84.61$, df = 2, p = 0.000
	Optimal range	2057	2102		
	Underleveraged	1179	874		

		Mean rank	**Mann-Whitney test**	
ROE	Optimal range Overleveraged	3320.3 3218.7	4645812	z = -2.04 p = 0.041
	Optimal range Underleveraged	3198.9 3472.1	4409852	z = -5.50 p = 0.000
	Overleveraged Underleveraged	2074.1 2305.5	2317022	z = -6.06 p = 0.000
ROCE	Optimal range Overleveraged	3182.7 2997.8	4073024	z = -3.82 p = 0.000
	Optimal range Underleveraged	2999.0 3324.3	3822067	z = -6.73 p = 0.000
	Overleveraged Underleveraged	1903.4 2234.9	3962843	z = -8.93 p = 0.000

Source: Amadeus, 2013.

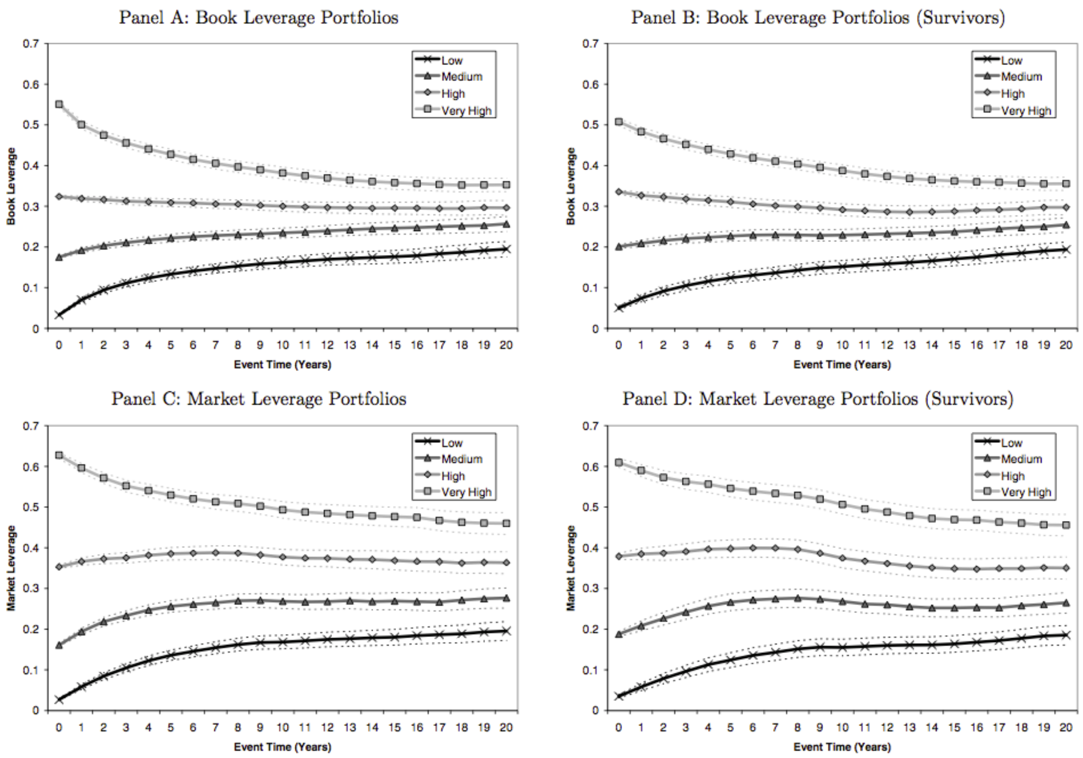
In *Subchapter 4.2* I want to gain additional insights about the impact of indebtedness on a firm's performance by analyzing what is behind the convergence toward the target capital structure, as shown in *Chapter 3*. I want to determine which accounting categories improve when low and high indebted firms move toward moderate indebtedness. My analysis thus compares the differences between the selected balance sheet and income statement categories for firms that had constant leverage during the analyzed period, with firms that successfully converged.

4.2 Motives for convergence toward the target capital structure

Lemmon et al. (2008) confirmed the convergence over a 20-year period for publicly traded American firms during 1965–2003. Their analysis is shown in *Figure 4-1*.

Figure 4-1: Convergence toward target leverage for American firms

The sample consists of all nonfinancial firms in the Compustat database from 1965 to 2003. Each panel presents the average leverage of four portfolios in event time, where year zero is the portfolio formation period. That is, for each calendar year, four portfolios were formed by ranking firms based on their actual leverage. Holding the portfolios fixed for the next 20 years, the average leverage for each portfolio was computed. For example, in 1975 firms were sorted into four groups based on their leverage ratios. For each year from 1975 to 1994, the average leverage for each of these four portfolios was computed. This process of sorting and averaging was repeated for every year in the sample horizon. After performing this sorting and averaging for each year from 1965 to 2003, the average leverages across "event time" were averaged to obtain the bold lines in the figure. The surrounding dashed lines represent 95% confidence intervals. The results for book and market leverage are presented in Panels A and C, where book (market) leverage is defined as the ratio of total debt to total assets (sum of total debt and market equity). Panels B and D present similar results for book and market leverage, respectively, but for a subsample of firms required to exist for at least 20 years (consequently, only the portfolio formation through 1984 can be performed for this sample).



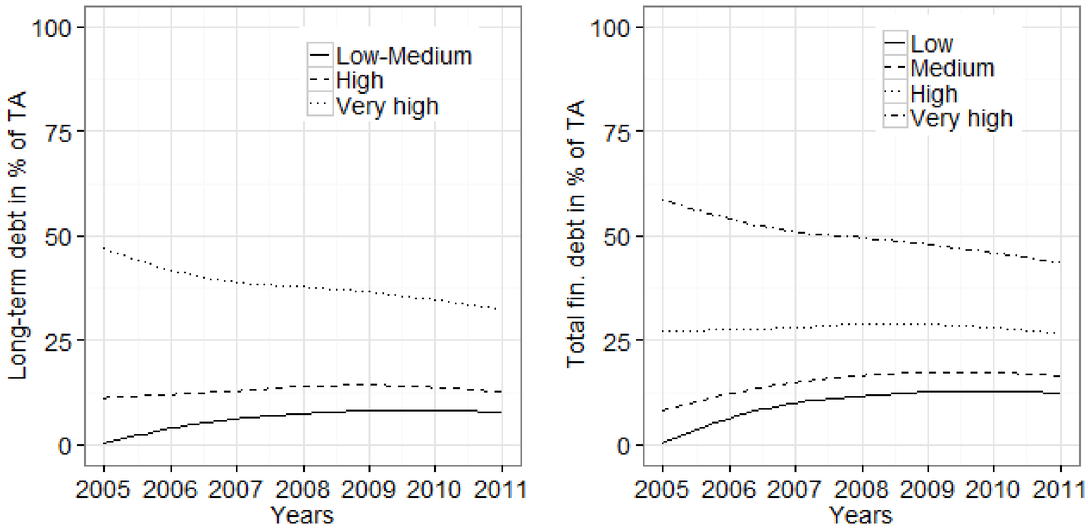
Source: Lemmon et al. (2008)

Figure 4-1 shows the same pattern as I found for a sample of European firms (see *Figure 3-1*). However, I can generalize the capital structure pattern, presented by Lemmon et al.

(2008). Firstly, my sample of 8,777 firms includes many privately held firms without public quotation, while the analysis of Lemmon et al. was performed on publicly traded firms only. Secondly, I performed analysis on different groups of firms and for two distinct time periods, as shown in *Figures 3-2* to *3-4*, for each European country separately (results are not shown), and on a bigger sample of over 26,000 firms, which includes also many small firms[27] (see *Figure 4-2*). The pattern of convergence is clearly evident in each case. Moreover, I demonstrated that convergence exists also when leverage is defined as a ratio of long-term debt to total assets, while the analysis of Lemmon et al. was performed on total financial debt only.

Figure 4-2: Convergence toward target leverage for a sample of European firms

This is a generalized analysis of *Figure 3-1*. It is performed on a sample of 26,240 firms, including also firms with the average total assets below €5 million. In the year 2005, firms were ranked based on the level of leverage and sorted into four portfolios, which are denoted as low, medium, high, and very high portfolio. Each panel represents different definition of leverage. Left panel is defined as long-term debt as percent of total assets and right panel as total financial debt (long- and short-term debt) as percent of total assets. Because there are more than 25 percent of firms with zero long-term debt, the first and second portfolios were joined into one group: low – medium portfolio. Once a firm was classified into one of the four portfolios, it was kept in that portfolio for the next six years. For each portfolio separately, the curve represents the average movement of firms' leverage ratio. R-code can be found in Appendix A-2.



Source: Amadeus, 2013.

The idea is to explain how performance is influenced by convergence – I wanted to determine which accounting categories improve when low and high indebted firms move toward moderate indebtedness. My analysis thus compares the differences between selected balance sheet and income statement categories for firms that had constant leverage during the analyzed period, with firms that moved toward moderate leverage. The separation of firms into leverage portfolios is shown in *Figure 4-3*.

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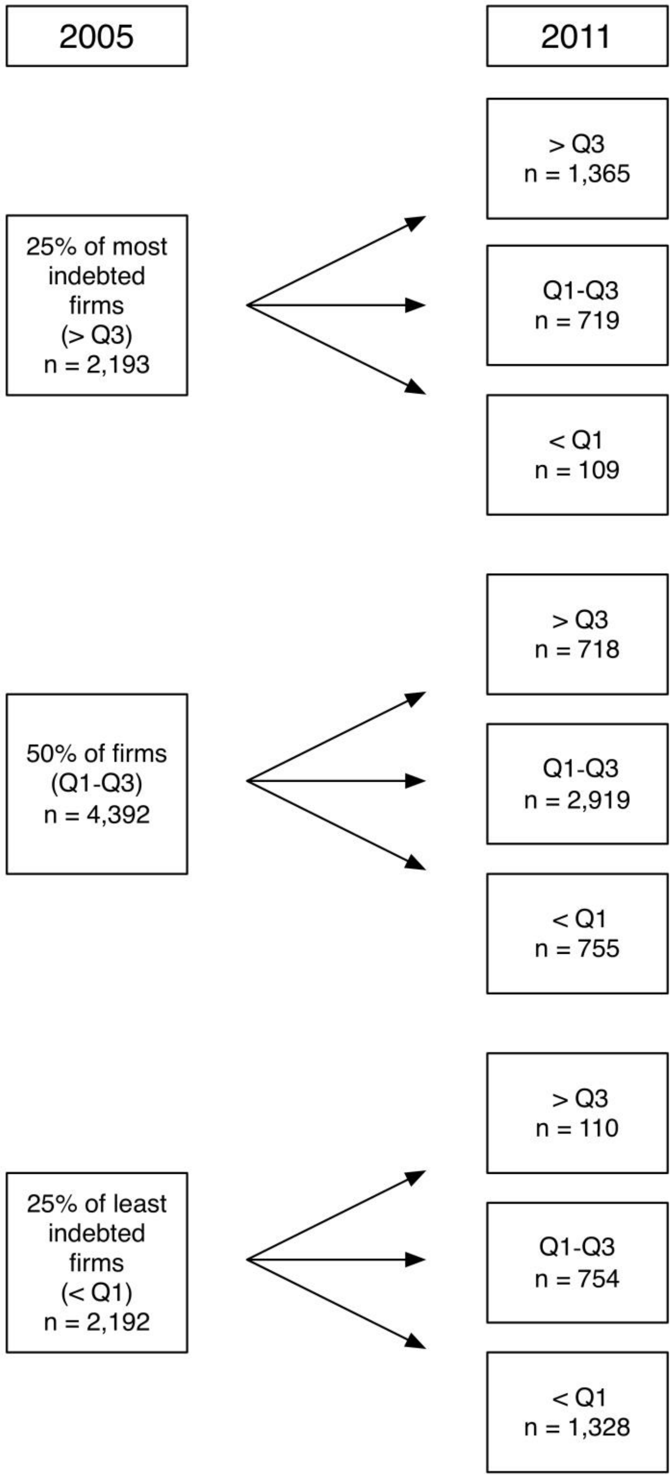
[27] Sample includes 9.6 percent of very large firms, 24.3 percent of large firms, 38.3 percent of medium-sized firms, and 27.7 percent of small firms. Definitions can be found in Appendix C.

Figure 4-3: Shifts among leverage portfolios



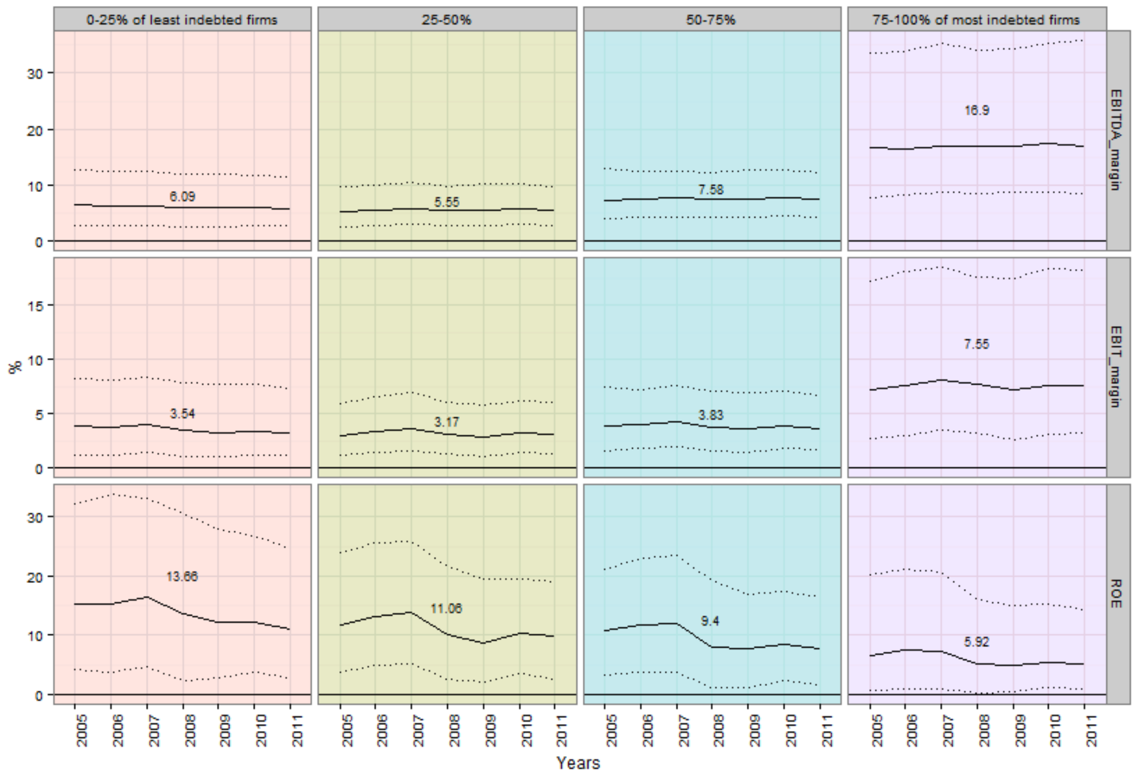
Source: Amadeus, 2013.

In the year 2005, firms were ranked by the share of total financial debt in total assets (i.e. leverage). 25 percent of firms with the lowest leverage were grouped into the first portfolio (< Q1), 50 percent of firms in the middle were grouped into the second portfolio (Q1–Q3), and 25 percent of firms with the highest leverage were grouped into the third portfolio (> Q3). In the year 2011, the procedure was repeated and firms were again classified into three portfolios. Based on all possible shifts among leverage portfolios, nine groups were formed. Since convergence analyses showed that shifts are evident especially among least and most indebted firms, my analysis concentrates on 25% of least and 25% of most indebted firms.

First I analyzed what motivates firms to increase the leverage. Kester et al. (2004) argued that the two basic reasons why firms borrow money are to increase financial leverage and boost the return on equity, or when a firm needs additional financing. *Figure 4-4* shows three profitability ratios for four leverage classes. These profitability ratios are earnings before interest, taxes, depreciation, and amortization, divided by total operating revenue and expressed in percent (EBITDA margin), earnings before interest and taxes, divided by operating revenue and expressed in percent (EBIT margin), and return on equity (ROE – net income divided by equity capital and expressed in percent).

Figure 4-4: Profitability ratios for European firms during the period 2005–2011

The sample size is 8,777. Columns from left to right: Firms were divided into four quartile classes (each containing 25% of firms). The left-most column contains 25% of least financially indebted firms (long- and short-term debt), the right-most column contains 25% of most financially indebted firms. Rows from top down: EBITDA margin is defined as earnings before interest, taxes, depreciation, and amortization, divided by operating revenues, multiplied by 100; EBIT margin is defined as earnings before interest and taxes, divided by operating revenues, multiplied by 100; ROE is defined as net income divided by equity capital, multiplied by 100. In each year, firms were classified into one of four indebtedness classes based on the share of financial debt to total assets. For each combination, first quartile, median, and third quartile are shown with lines. The number above the median line is the median profitability during the analyzed period. R-Code can be found in Appendix A-3.



Source: Amadeus, 2013.

Both EBITDA and EBIT margins show constant profitability for firms in the first three leverage classes (75% of least indebted firms) and then start rising. However, this pattern is firm specific – highly leveraged firms have a higher share of fixed (tangible) assets, which results in a higher share of fixed costs, creating high operating leverage. On the other hand, ROE shows that once the interest costs are deducted, higher debt is associated with lower profitability. *Figure 4-4* thus does not support the hypothesis that European firms used leverage to boost return on equity.

To further investigate whether profitability ratios motivate firms to move among leverage classes (i.e. whether firms that were least indebted in the year 2005 levered up during the analyzed period to increase ROE), *Table 4-3* is presented. Arithmetic means for ROE (*Eq. 4-1*) and ROCE (*Eq. 4-2*) during the period 2006–2011 were calculated for each firm. Firms were then classified into nine leverage classes, as shown in *Figure 4-3*. For each group separately, the first quartile (p25), the median (p50), and the third quartile (p75) were estimated. Both ROE and ROCE show that firms, which increased the leverage during the period 2005–2011, experienced lower average profitability ratios at the first, second, and third quartile. However, the median firm that moved from 25% of least indebted firms in the year 2005 (< Q1) into the moderate leverage portfolio in the year 2011 (Q1–Q3) experienced a decrease in ROE of only 7.5%, while the median firm that moved into the highest leverage portfolio (> Q3) lost 38% of ROE. That means that convergence toward a moderate leverage portfolio only slightly deteriorates profitability.

On the other hand, firms that levered up during the period 2005–2011 significantly increased both total assets and fixed assets growth, as shown in *Table 4-3*. This means that the main reason why European firms increased leverage during the analyzed period was to support the growth with external financing, because many firms were unable to finance the fast growth internally. This goes in line with the findings of Frank & Goyal (2003) for a sample of American firms during the period 1971–1998.

Table 4-3: Average ROE, ROCE, TA growth, and FA growth

In the year 2005, firms were divided into three leverage portfolios: 25% of least indebted firms (< Q1), 50% of firms with moderate indebtedness (Q1–Q3), and 25% of most indebted firms (> Q3). In the year 2011, firms were again classified into three leverage portfolios and the classification is compared to the year 2005. Based on that, nine leverage portfolios were formed. For each firm, average performance ratios during the period 2006–2011 were estimated. For each leverage portfolio separately, the first quartile, the median, and the third quartile of average performance ratios are shown.

		ROE (%)			ROCE (%)			Total assets growth (%)			Fixed assets growth (%)		
2005	2011	p25	p50	p75	p25	p50	p75	p25	p50	p75	p25	p50	p75
> Q3	> Q3	1.53	**6.29**	17.72	3.94	**7.39**	14.41	-0.59	3.22	9.14	-1.32	0.88	4.24
> Q3	Q1–Q3	4.38	**10.93**	21.69	7.46	**12.91**	20.83	-0.84	4.17	10.55	-1.33	0.62	3.13
> Q3	< Q1	3.49	**10.54**	27.43	6.70	**13.39**	26.46	-2.12	3.72	11.52	-2.92	-0.01	2.74
Q1–Q3	> Q3	0.97	6.99	15.87	5.65	10.76	18.99	3.90	10.33	18.36	0.21	3.23	7.31
Q1–Q3	Q1–Q3	4.08	10.06	17.95	7.33	13.01	20.80	2.12	6.65	13.12	-0.33	1.42	4.16
Q1–Q3	< Q1	5.79	13.32	23.96	8.55	17.05	27.36	0.83	5.75	11.98	-1.03	0.23	2.19
< Q1	> Q3	-2.28	**7.71**	23.69	3.82	**9.40**	23.84	4.53	**15.57**	42.40	-0.19	**3.51**	13.23
< Q1	Q1–Q3	3.84	**11.50**	21.84	6.51	**14.90**	25.71	4.39	**11.65**	20.41	0.29	**3.08**	6.63
< Q1	< Q1	4.22	**12.44**	27.01	7.66	**17.38**	33.80	1.48	**7.05**	14.45	-0.31	**0.54**	3.19

Source: Amadeus, 2013.

Next, I was interested in why most indebted firms converged toward a moderate leverage. As seen from *Table 4-3*, one of the possible motives is to increase ROE and ROCE. The median firm that moved from 25% of the most indebted firms in the year 2005 (> Q3) into the moderate portfolio in the year 2011 (Q1–Q3) experienced an increase in ROE of 73.8% (the increase in ROCE is similar). However, an important question remains whether the increase in profitability is the reason for or the consequence of successful deleveraging – the question of leverage endogeneity. Opler & Titman (1994) argued that leverage can be an indicator of economic and financial vulnerability of a firm. For example, if the least-efficient firms are more likely to go out of business during the crisis period, and if highly leveraged firms tend to be less efficient, one could expect a negative relation between leverage and performance even when financial distress is not costly. They argued that this bias can be successfully reduced if leverage is measured in book values instead of market values. The reason is that the correlation between profitability and leverage is substantially weaker when leverage is defined in book values, as for example shown by Titman & Wessels (1988). Additionally, Opler & Titman (1994) argued that using book value defined leverage avoids the problem that market value of equity can forecast future sales performance (e.g. the market value of equity of a firm that experiences a decline in growth opportunities of sales will fall and leverage will be inflated). Since I defined leverage in book value terms, and classified firms into leverage portfolios already in the year 2005, while the average performance ratios are estimated for the period 2006–2011, I assume that the problem of endogeneity is minimized. [28]

Opler & Titman (1994) measured the impact of leverage on a firm's performance in times of industry downturn. The analysis was based on the existence of significant and positive indirect costs of financial distress, as argued by researchers in the past (e.g. Kim (1978), Morris (1982)). Financial distress can be defined as a costly event, and its possibility is important in determining a firm's optimal capital structure. Maksimovic & Titman (1991) and Opler & Titman (1994) concluded that these costs arise because financial distress creates a tendency for firms to do things that are harmful both to debt-holders and non-financial stakeholders (e.g. customers, suppliers, and employees), impairs access to credit, and raises costs of stakeholder relationships. Additionally, financial distress encourages an aggressive response by competitors, who see the opportunity to gain market share (Bolton & Scharfstein, 1990). However, quantifying the overall costs and benefits of financial distress is difficult (e.g. Andrade & Kaplan (1998)). The most well-known attempt was done by Altman (1984), who examined the characteristics of firms that later went bankrupt. He showed that distressed firms lost both earnings and sales, although Altman did not address the causality. Similarly, Opler & Titman (1994) found that as a consequence of too high leverage, firms in the top leverage decile experienced 26 percent

[28] In 2005, firms either chose high leverage ratio because of tax advantages or some other positive effects of debt, or remain more conservatively leveraged to be better prepared in the event of an industry downturn. The same was assumed for firms that moved among leverage classes during the analyzed period.

stronger sales decline in time of crisis than firms in the bottom leverage decile. Maksimovic & Titman (1991) found evidence that even consumers of non-durable goods and services (e.g. hospitals, pharmaceuticals, and air travels) are concerned with the financial status of the producer, especially because of safety issues (i.e. in order to avoid bankruptcy, firms can reduce the quality of products). Because of possible lower quality of the products, demand decreases, prices fall, and firms lose profit, which is the indirect cost of bankruptcy, as argued already by Altman (1984). Opler & Titman (1994) assumed that if financial distress is costly, then highly leveraged firms would have greater difficulties during the economic downturn then their lower leveraged peers. Opler & Titman continued that the two possible explanations of encountered difficulties are a reluctance by customers to do business with distressed firms (customer driven losses) or that competitors would improve their market share through aggressive advertising or price cuts (competitor driven losses). On the other hand, it can be argued that more leveraged firms are quicker to efficiently downsize in response to an industry downturn (manager driven losses). While the first two types of losses are costly to shareholders, the last one is a benefit of financial distress. For example, Hoshi et al. (1990), Asquith et al. (1991), Sharpe (1994), and Ofek (1993) argued that financially distressed firms have a greater tendency to cut investments, sell assets, and reduce employment than their lower leveraged peers. Similarly, Jensen (1989) and Wruck (1990) explained that if it is found that highly leveraged firms perform better than less leveraged firms, this can be understood as meaning that financial distress benefits firms by forcing efficient operating changes. In order to determine the relative importance of positive and negative effects of financial distress, Opler & Titman (1994) suggested analyzing the changes in operating income. *Table 4-4* shows the distribution of the average growth of sales, the average EBITDA growth, the average EBIT growth, and the average net assets turnover during the period 2006–2011 for nine leverage portfolios, presented in *Figure 4-3*.

Table 4-4: Average sales growth, EBITDA growth, EBIT growth, and net assets turnover

In the year 2005, firms were divided into three leverage portfolios: 25% of least indebted firms (< Q1), 50% of firms with moderate indebtedness (Q1–Q3), and 25% of most indebted firms (> Q3). In the year 2011, firms were again classified into three leverage portfolios and classification was compared with the year 2005. Based on that, nine leverage portfolios were formed. For each firm, the average performance ratios during the period 2006–2011 were estimated. For each leverage portfolio separately, the first quartile, the median, and the third quartile of the average performance ratios are shown.

		Sales growth (%)			EBITDA growth (%)			EBIT growth (%)			Net assets turnover (x)		
2005	2011	p25	p50	p75	p25	p50	p75	p25	p50	p75	p25	p50	p75
> Q3	> Q3	1.01	**3.64**	8.79	-0.10	**0.19**	0.78	-0.14	**0.13**	0.58	0.21	**0.71**	2.59
> Q3	Q1–Q3	2.53	**6.85**	13.22	-0.23	**0.49**	1.57	-0.21	**0.37**	1.31	1.32	**2.57**	4.95
> Q3	< Q1	1.58	**7.13**	14.67	-0.15	**0.47**	1.33	-0.19	**0.44**	1.45	1.00	**3.16**	6.95
Q1–Q3	> Q3	2.24	6.89	13.77	-0.29	0.29	1.00	-0.44	0.10	0.59	0.93	2.06	4.17
Q1–Q3	Q1–Q3	3.00	7.36	13.32	-0.23	0.40	1.20	-0.28	0.23	0.88	1.79	3.23	5.60
Q1–Q3	< Q1	3.11	7.52	13.19	-0.21	0.46	1.60	-0.19	0.31	1.32	2.24	4.42	8.45
< Q1	> Q3	1.38	**8.73**	34.63	-0.39	**0.24**	1.40	-0.26	**0.19**	1.16	0.48	**1.60**	4.06
< Q1	Q1–Q3	3.63	**9.10**	16.90	-0.28	**0.50**	1.37	-0.51	**0.17**	0.91	1.67	**3.32**	6.30
< Q1	< Q1	2.25	**6.95**	14.94	-0.44	**0.26**	1.24	-0.48	**0.15**	0.96	1.66	**3.88**	7.97

Source: Amadeus, 2013.

In *Table 4-4*, EBITDA growth, EBIT growth and net assets turnover are defined as shown in *Equations 4-3* to *4-5*.

$$EBITDA\ growth_t = \frac{EBITDA_t - EBITDA_{t-1}}{Average\ total\ assets} \cdot 100 \qquad (4\text{-}3)$$

$$EBIT\ growth_t = \frac{EBIT_t - EBIT_{t-1}}{Average\ total\ assets} \cdot 100 \qquad (4\text{-}4)$$

$$Net\ assets\ turnover_t = \frac{Operating\ revenues_t}{Equity\ capital_t + Noncurrent\ liabilities_t} \cdot 100 \qquad (4\text{-}5)$$

Table 4-4 shows that the median firm that was classified as one of the 25% of most indebted firms in the year 2005, and successfully shifted into a moderate leverage portfolio (Q1–Q3), experienced 88% higher average sales growth during the period 2006–2011, compared to the median firm that remained highly leveraged during that period (moving into a low leverage portfolio resulted in 96% higher sales growth). The finding, that the most indebted firms are the first to lose sales in time of economic downturn is thus consistent with Opler & Titman (1994). It is expected that if financial distress is costly, operating income falls more for highly leveraged firms during the economic crisis, which would result in a lower average growth of operating income (EBITDA or EBIT) during the period 2006–2011. *Table 4-4* shows that the median firm that moved from the most indebted portfolio in the year 2005 to a more moderate leverage portfolio in the year 2011 experienced a higher average EBITDA growth and a higher average EBIT growth, meaning that the slower sales growth of most indebted firms is not a result of a quicker and more efficient downsize in response to an industry downturn, but rather a result of customer and competitor driven losses. Additionally, net assets turnover, which measures a firm's efficiency, shows that firms that successfully deleveraged generated more revenue per unit of assets.

On the other hand, the median firm that was classified as one of the 25% of least indebted firms in the year 2005, and successfully shifted into a moderate leverage portfolio (Q1–Q3), improved both average sales growth and average EBITDA growth, while average EBIT growth was economically unchanged. However, net assets turnover slightly deteriorated.

4.3 Conclusions

In the last chapter of this dissertation, I showed that firms which operate within the target leverage range have a higher median average return on equity and a higher median average return on capital employed, compared to overleveraged firms. On the other hand, underleveraged firms demonstrate the highest median profitability ratios. This partially confirms the hypothesis of Lev & Pekelman (1975) that a firm incurs costs whenever the debt-equity ratio is below or above the target. Higher profitability can be a strong motive for convergence of overleveraged firms toward target capital structure. I further investigated which balance sheet and income statement categories are most influenced by convergence toward moderate indebtedness. I found that a moderate leverage facilitates growth of fixed assets – firms are sometimes unable to finance the growth internally and need external financing. According to the *pecking order hypothesis*, debt is preferred over new equity (controlling for firm’s debt capacity), which explains why least indebted firms increase leverage. This helps them facilitate growth and increase sales. On the other hand, results show that highly leveraged firms experience the slowest sales growth, which has a strong theoretical grounding in Opler & Titman (1994). Firms that decrease high leverage and move toward moderate indebtedness (closer to the target capital structure), significantly improve sales growth and net assets turnover (efficiency), which ultimately results in an improved firm’s performance.

CONCLUSION

In 1958, Modigliani & Miller developed the irrelevance theorem, which stated that capital structure has no impact on a firm's value. The theorem was later modified with the inclusion of tax-deductibility of interest on debt, which led to the conclusion that a firm's value is maximized at 100 percent of debt financing. However, already in the 1970s it became clear that in addition to the positive effects of debt, there are also negative ones. Donaldson (1961) argued that the main determinant of corporate debt capacity should be the probability of insolvency in times of recession, analyzed thorough cash flows. Similarly, Kraus & Litzenberger (1973) suggested that the best candidate for an offsetting cost of debt is a deadweight cost of bankruptcy. Researchers thus soon came to the conclusion that capital structure must be relevant for a firm's value. DeAngelo & Masulis (1980) were among the first researchers who clearly showed that each firm has a unique optimal capital structure. Jensen & Meckling (1976) developed the *trade-off theory*, which formally defined factors that determine the optimal capital structure. Their main idea was that the conflict between shareholders and managers (principal-agent problem) results in a positive effect of debt, while the conflict between debt holders and equity holders causes the agency costs of debt. Optimal capital structure can then be found by trading-off the benefits and the costs of debt. Lemmon & Zender (2010) summarized that the *trade-off theory* describes the firm's optimal capital structure as the mix of financing that equates the marginal costs to marginal benefits of debt financing. In parallel to the *trade-off theory*, Myers & Majluf (1984) developed the *pecking order hypothesis*, which prescribes the order of financing, which would maximize firm's value. Costs and benefits of debt are of secondary importance compared to the high costs that arise when a new equity is issued under the conditions of highly asymmetric information (Shyam-Sunder & Myers, 1999). Myers (1984) summarized that a firm is said to follow a pecking order if it prefers internal to external financing and debt to equity, when external financing is used.

In 1960s, researchers started to empirically test target capital structures. Both the *trade-off theory* and the *pecking order hypothesis* determine numerous factors that influence the amount of leverage that firms should employ. The most frequently used determinants are industry median leverage, tangibility, profitability, firm size, market-to-book-assets ratio, and inflation (Frank & Goyal, 2009). More recently, Frank & Goyal (2008) concluded that the *target adjustment hypothesis*, which developed from the *dynamic trade-off theory*, receives much better empirical support than do either the *static trade-off theory* or the *pecking order hypothesis*. Its main idea is that firms gradually converge toward the target capital structure, meaning that leverage exhibits a partial adjustment mechanism so that deviations from the target are gradually eliminated. Short-term deviations are thus expected and have a strong theoretical support. Alternatively, Baker & Wurgler (2002) argued that capital structure can best be understood as the cumulative effect of past attempts to time the market.

Capital structure research is typically performed with regression techniques, using numerous standard error corrections. However, the structure of data suggests that MLM would be more appropriate, if not even required, since firms are nested within industries and countries, which causes a high cross-sectional dependency. Moreover, having repeated measurements of the same firm produces time-series dependency. Both forms of dependency can successfully be controlled with a 4-level linear model, which was developed in *Chapter 2*. Thomspon (2011) recently argued that both forms of dependency should be addressed in financial studies. My analysis thus demonstrates that MLM can successfully be applied to any financial study. Moreover, Gelman (2006) argued that compared to other regression techniques, MLM essentially improves predictions. Since predicted targets are used in *Chapter 3* to measure the speed of adjustment and in *Chapter 4* to determine the impact of indebtedness on a firm's performance, MLM is strongly preferred. Additionally, since there are statistically significant differences in average indebtedness across industries and countries, building a model with a random intercept importantly improves the accuracy of the estimated standard errors. Two other important benefits of MLM are that model is not affected by missing longitudinal observations, and that the technique gives efficient predictions also for the firm–industry–country combinations with a small number of observations. Finally, I showed that controlling for cluster confounding gives an important additional insight into how capital structure determinants affect the observed leverage. The first hypothesis is thus confirmed: the model for explaining capital structure heterogeneity and estimating the target capital structure can be significantly improved with multilevel linear modeling. Such modeling can be successfully applied to numerous other financial studies. Additionally, cluster confounding should be addressed.

Frank & Goyal (2009) presented a comprehensive review of determinants that have significant power at explaining the observed capital structure heterogeneity of American firms and found that industry median leverage, tangibility, profitability, firm size, and inflation are among the most reliable factors. I found that all of these factors have statistically significant explanation power also for European firms. First, the strong improvement in model fit when random intercepts on the third and the fourth level are included, demonstrates the importance of industry and country norms on capital structure heterogeneity. Furthermore, I showed that profitability has a stronger between-firm effect, which means that more profitable firms need less external financing. I demonstrated that without separating within- and between-firm size effects, conclusions are extremely misleading. I showed that when comparing firms cross-sectionally by their average size (the between-firm effect), there are practically no differences in indebtedness. On the other hand, the within-firm increase in size reveals substantial leveraging – firms' expansions are largely financed with new debt. I further demonstrated that an increase in growth needs additional external financing (preferring debt over new equity), and that tangibility has a stronger between-firm effect, which demonstrates the importance of the average share of tangible assets: firms that operate with more tangible assets are able to use more debt.

Moreover, I found that firms with a higher variability of operating income are supplied with less debt financing, and that public firms and firms producing unique products use less debt. Finally, I showed that management is more inclined to take new debt in times of stronger GDP growth and during periods of high inflation. Contrary to the results of the multiple regression model, MLM shows that the nominal corporate tax rate does not explain differences in indebtedness of European firms. It would be interesting to compare the results by using the effective corporate tax rate. In addition to the high importance of controlling for industry differences in indebtedness, as for example argued by Lemmon et al. (2008), I found that between-firm tangibility, within-firm size, between-firm profitability, probability of financial distress and within-firm growth are the strongest explanatory variables of the observed capital structure of European firms (compared using standardized partial regression coefficients). Within-firm profitability, between-firm size, between-firm growth, and within-firm tangibility show lower or insignificant explanatory power.

Lemmon et al. (2008) emphasized that an important question remains why some firms always seem to have high leverage, while others always seem to have low leverage, despite being similar along many dimensions. I demonstrated that between-firm leverage heterogeneity is significantly stronger than within-firm heterogeneity, similarly as was shown by Lemmon et al. (2008). The between-firm heterogeneity is caused primarily by the differences in indebtedness of firms operating within the same industry. Because such firms are expected to be similar along many dimensions, debt policies, set by management, could affect the range of the target leverage, as for example argued by Donaldson (1961) and Strebulaev & Yang (2013). I additionally found that there is a significant share of firms that need to rely on short-term debt, because they are operating within industries with harder access to long-term credits. This means that access to long-term debt is affected by the industry characteristics, as was highlighted by Diamond (1991). Finally, between-country heterogeneity is the smallest, meaning that countries are relatively homogenous in corporate indebtedness, defined either as long-term debt or total financial debt. Stonehill & Stitzel's (1969) finding that country norms have a stronger effect on a firm's capital structure than industry norms no longer applies (at least not for European countries). I demonstrated that there is a general pattern that within-firm leverage variation, defined either as a ratio of long-term debt to total assets or total financial debt to total assets, is directed toward the target capital structure. I showed that regardless of the different classification of European firms into groups, both persistence and convergence are clearly evident, the same as was found for American firms. Since such behavior can best be described by the *dynamic trade-off theory*, this confirms my second hypothesis. Moreover, I showed that this pattern is also present for smaller, privately held firms. Additionally, my analysis supports recent empirical findings that close to the target capital structure, a firm's value is relatively flat, and the cost of adjustments is too high for firms to adjust leverage regularly. Contrary to the findings of Lev (1969), I found that medium-sized firms adjust faster than large or very large firms. More specifically, medium-sized firms had very strong leveraging among least indebted firms before the crisis. Moreover, I showed that firms from the new EU members (i.e. firms from Eastern European countries) and firms from Southern European countries exhibited a faster leveraging process during the period 2005–2011 than the rest of the sample. However, the former demonstrated stronger deleveraging of the most indebted firms, which resulted in a higher degree of convergence. One of the possible explanations for the weak economic performance of Southern European countries is thus unsuccessful corporate deleveraging. Finally, I found that although the speed of convergence significantly decreased during the crisis, the general pattern of capital structure dynamics was still headed toward the target. The supply of external financing is thus an important determinant of observed capital structures, but more importantly, the same general pattern of convergence, observed both before and during the crisis, shows that the findings from my analysis are not time dependent. As a matter of fact, I showed that there is a statistically significant correlation between the observed and predicted movement toward the target leverage, estimated with the multilevel linear model. The analysis of the speed of convergence also reveals that defining leverage as a ratio of long-term debt to total assets exhibits significantly slower adjustment speed than defining it as a share of total financial debt, which also includes short-term debt. This is consistent with Taggart (1977), who claimed that short-term debt plays an important role in absorbing short-run fluctuations in the external financing deficit. Furthermore, consistent with findings of Byoun (2008), the general sample of European firms shows that above-target indebted firms are faster at adjusting than below-target indebted firms. This can be successfully explained by the finding that the cost of being over-levered is asymmetrically higher than the cost of being under-levered (Binsbergen, Graham, & Yang, 2010).

My analysis demonstrates that firms behave accordingly to the existence of the target capital structure. I showed that firms which operate within the target leverage range have a higher median average return on equity and a higher median average return on capital employed, compared to overleveraged firms. Underleveraged firms, on the other hand, demonstrate better profitability ratios. Profitability ratios can only successfully explain the strong presence of convergence among most indebted firms. I further investigated which balance sheet and income statement categories are most affected by convergence toward the target capital structure. I found that an increase in leverage facilitates growth of fixed assets – firms are sometimes unable to finance the growth internally and need external financing. According to the *pecking order hypothesis*, debt is preferred over new equity (controlling for firm's debt capacity), which explains why least indebted firms lever up. This helps them facilitate growth and increase sales. On the other hand, results show that highly leveraged firms experience the slowest sales growth, which has a strong theoretical grounding in Opler & Titman (1994). Firms that decrease high leverage and move toward the target capital structure, significantly improve sales growth and net assets turnover, which ultimately results in a higher return on equity and a higher return on capital employed. This confirms my third and fourth hypothesis. First, firms within an optimal range of indebtedness (close to the target capital structure) perform better than their above-and below-target indebted peers – indebtedness thus affects a firm's performance. This can explain the presence of convergence toward the target capital structure. Second, the main reason why less indebted firms increase the leverage is to support the growth that cannot be financed internally on the one hand, while more indebted firms decrease the leverage to improve the sales growth and operating efficiency on the other.

I conclude this doctoral dissertation by saying that the chosen capital structure, i.e. the amount of leverage used as a source of financing, affects a firm's performance, which ultimately results in the market value of a firm, as found by other researchers. Consistent with Frank & Goyal (2008), the results of capital structure dynamics of European firms can best be described by the *dynamic trade-off theory*, which means that the majority of firms follow the idea of the target capital structure and actively move toward it in order to improve its operations.

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APPENDICES

LIST OF APPENDICES

Appendix A: R-codes

A-1: Balance sheet structure

```
DrawBalaceSheet <- function(x, my.baza) {

  baza.subset <- droplevels(my.baza[my.baza$Country %in% x, c("FA_ofTA", "TangFA_ofFA",
"CA_ofTA", "Stocks_ofCA","Debtors_ofCA", "Capital_ofTA", "LTDebt_ofTA", "OthLTLiab_ofTA",
"Loans_ofTA", "Payables_ofTA",  "TotFinDebt_ofTA", "Time")])
  baza.subset$Time<-as.factor(baza.subset$Time)
  baza.subset <- melt(baza.subset)

  dummy <- unique(baza.subset[, c("variable", "Time")])
  dummy$value <- 1

  ggplot(baza.subset, aes(x = Time, y = value)) +
    theme_bw()+
    theme(axis.text.x = element_text(angle = 90)) +
    labs(x = "Years", y = "") +
    geom_rect(data = dummy, xmin = -Inf, xmax = Inf, ymin = -Inf, ymax = Inf,
              alpha = 0.02, show_guide = FALSE) +
    geom_boxplot()+
    scale_y_continuous(limits=c(-0.2,1.0))+
    facet_grid(   ~ variable , scales = "free")
}

DrawBalaceSheet (x="all", my.baza=baza)
```

A-2: Convergence

```
DrawLongTermDebtRegion <- function(baza.debt, low=0, high, breaks=c(0, 25, 50, 75, high),
   cut.it = c("quantile", "absolute"), debt, debt.title.y, start.year) {


   baza.debt <- baza.debt[baza.debt[, debt] <= high & baza.debt[, debt] >= low, ]
   baza.debt <- droplevels (baza.debt)

   TMP <- table(baza.debt$BvD_ID_number)
   OK <- TMP[TMP == 7]
   OK1 <- baza.debt$BvD_ID_number %in% names(OK [OK == 7])
   baza.debt <- baza.debt[OK1, ]
   baza.debt <- droplevels (baza.debt)

   x2005 <- baza.debt[baza.debt$Time == start.year, ]

   if (length(breaks) == 5) labels <- c("Low", "Medium", "High", "Very high")
   if (length(breaks) == 4) labels <- c("Low-Medium", "High", "Very high")

   if (cut.it == "quantile") {
      qs <- quantile(x2005[, debt], probs = breaks)
      x2005$Class <- cut(x2005[, debt], breaks = qs, labels = labels, include.lowest =
TRUE)
   }
   if (cut.it == "absolute") {
      x2005$Class <- cut(x2005[, debt], breaks = breaks, labels = labels, include.lowest =
TRUE)
   }

   x2005 <- x2005[, c("BvD_ID_number", "Class")]
   xClass <- merge(baza.debt, x2005, all.x=TRUE, sort=FALSE)

   rm(x2005, baza.debt, OK, OK1)
   gc()

   NE <- c("FINLAND",  "ICELAND", "NORWAY", "SWEDEN")
   B <- c("IRELAND",  "UNITED KINGDOM")
   WE <- c("FRANCE",  "GERMANY", "BELGIUM", "SWITZERLAND", "LUXEMBOURG")
   EE <- c("SLOVENIA", "SLOVAKIA", "POLAND", "LITHUANIA", "LATVIA", "HUNGARY", "ESTONIA",
      "CZECH REPUBLIC", "CROATIA", "BULGARIA")
   SE <- c("PORTUGAL", "SPAIN", "ITALY", "GREECE")

   xClass[, "region"] <- NA
   xClass[, "region"][xClass[, "Country"] %in% NE] <- "Northern Europe"
   xClass[, "region"][xClass[, "Country"] %in% B] <- "UK and Ireland"
   xClass[, "region"][xClass[, "Country"] %in% WE] <- "Western Europe"
   xClass[, "region"][xClass[, "Country"] %in% EE] <- "Eastern Europe"
   xClass[, "region"][xClass[, "Country"] %in% SE] <- "Southern Europe"
   xClass[, "region"] <- as.factor(xClass[, "region"])

   do.smooth <- by(data = xClass, INDICES = list(xClass$Class, xClass$region), FUN =
function(m, debt) {
         mdl <- loess(formula(paste(debt, "~ Time")), data = m)
         nd <- data.frame(Time = seq(from = min(m$Time), to = max(m$Time), by = 0.1))
         nd$fit <- predict(mdl, newdata = nd)
         nd$Class <- unique(m$Class)
         nd$region <- unique(m$region)
         nd
      }, debt = debt)
   do.smooth <- do.call("rbind", do.smooth)

   ggplot(do.smooth, aes(x = Time, y= fit, linetype = Class))+
      theme_bw() +
      theme(legend.position = c(0.7, 0.85), legend.title = element_blank(),
         legend.key.size = unit(5, "mm"), axis.text.x = element_text(angle = 90, vjust =
0.5)) +
      scale_x_continuous(breaks = 2005:2011, labels = 2005:2011) +
      scale_y_continuous(breaks= breaks * 100, labels=breaks * 100, limits = c(0, 100)) +
      labs(x = "Years", y = debt.title.y) +
      geom_line() +
      scale_linetype_manual(values = 1:4) +
      facet_wrap( ~ region, nrow = 1)

}
```

```
setwd("./help/denis")
require(ggplot2)
require(grid)
require(gridExtra)

load("./data/baza.debt1.rdata")
load("./data/baza.debt2.rdata")

baza.debt1 <- baza.debt1[!baza.debt1$Country %in% c("NETHERLANDS", "AUSTRIA"), ]
baza.debt1 <- droplevels(baza.debt1)
baza.debt2 <- baza.debt2[!baza.debt2$Country %in% c("NETHERLANDS", "AUSTRIA"), ]
baza.debt2 <- droplevels(baza.debt2)

graf1 <- DrawLongTermDebtRegion(baza.debt = baza.debt1, low = 0, high = 100,
   breaks = c(0, 0.5, 0.75, 1), debt = "L_Debt_Share", debt.title.y = "Long-term debt in %
of TA",
   start.year = 2005, cut.it = "quantile")
graf2 <- DrawLongTermDebtRegion(baza.debt = baza.debt2, low = 0, high = 100,
   breaks = c(0, 0.25, 0.5, 0.75, 1), debt = "LS_Debt_Share", debt.title.y = "Total fin.
debt in % of TA",
   start.year = 2005, cut.it = "quantile")
grid.arrange(graf1, graf2, nrow = 2)
```

A-3: Profitability ratios

```
names(baza)[names(baza) %in% c("EBITDA_Margin_percent", "EBIT_Margin_percent",
"ROE_using_Net_income_percent")] <-
   c("EBITDA_margin", "EBIT_margin", "ROE")

addNewVariable <- function(x, debt, probs, labels) {
   new.var <- as.character(rep(NA, length(debt)))

   for (i in unique(x)) {
      find.years <- which(x == i)
      if (all(debt[find.years] == 0)) {
         new.var[find.years] <- NA
      } else {
         quant.debt <- quantile(debt[find.years], probs = probs)
         if (any(table(quant.debt) != 1)) stop("Two quantiles have the same value")
         new.var[find.years] <- as.character(cut(debt[find.years],
               breaks = quant.debt, labels = labels, include.lowest = TRUE))
      }
   }
   new.var

}

addNewVariableAbsoluteCut <- function(x, debt, probs, labels) {
#   browser()
#   asf
   new.var <- as.character(rep(NA, length(debt)))

   for (i in unique(x)) {
      find.years <- which(x == i)
      if (all(debt[find.years] == 0)) {
         new.var[find.years] <- NA
      } else {
         debt.years <- debt[find.years]
         cut.debt <- cut(debt.years, breaks = probs * 100, labels = labels, include.lowest
= TRUE)
         new.var[find.years] <- as.character(cut.debt)
      }
   }
   new.var
}

DrawIncomeStatement <- function(x, my.baza, com.cat, probs = c(0,  0.20,  0.40,  0.60,
0.80,  1),
   labels = c("0-20% of total debt in total assets",  "20-40%", "40-60%", "60-80%", "80-
100% of total debt in total assets")) {
   require(ggplot2)
   require(reshape2)
   require(scales)

   id <- readLines("./data/id_unique.csv")
   my.baza <- droplevels(my.baza[my.baza$BvD_ID_number %in% id, ])


   baza.subset <- my.baza
   #baza.subset <- droplevels(baza.subset[baza.subset$Time != 2005,])

   if (com.cat != "all") {
      baza.subset <- droplevels(baza.subset[baza.subset$Category_of_company %in% com.cat,
])
   }

   if (x != "all") {
      baza.subset <- droplevels(baza.subset[baza.subset$Country %in% x,
            c(
               #               "Long_Term_Debt_Share",
               "indebtedness1",
               "EBITDA_margin", "EBIT_margin", "ROE",
               "Time")])
   } else {
      baza.subset <- droplevels(baza.subset[,
            c(
               #               "Long_Term_Debt_Share",
               "indebtedness1",
```

```
                "EBITDA_margin", "EBIT_margin", "ROE",
                "Time")])
   }

   baza.subset$Time <- as.factor(baza.subset$Time)

#    baza.subset$nova_spr <- addNewVariable(x = as.numeric(as.character(baza.subset$Time)),
#       #      debt = baza.subset$Long_Term_Debt_Share,
#       debt = baza.subset$indebtedness1,
#       probs = probs, labels = labels)

   baza.subset$nova_spr <- addNewVariableAbsoluteCut(x =
as.numeric(as.character(baza.subset$Time)),
      #      debt = baza.subset$Long_Term_Debt_Share,
      debt = baza.subset$indebtedness1,
      probs = probs, labels = labels)

   message("Reality check, see if cut was done properly")
   print(head(baza.subset[, c("indebtedness1", "nova_spr", "Time")], 20))

   qs <- sapply(baza.subset[, c("EBITDA_margin", "EBIT_margin", "ROE"
         )], FUN = function(m, baza.subset) {
         aggregate(m ~ Time + nova_spr, data = baza.subset, FUN = quantile,
            probs = c(0.25, 0.5, 0.75), na.rm = TRUE)
      }, baza.subset = baza.subset, simplify = FALSE)
   qs <- doCallAddColumn2(qs)
   qs <- melt(qs)

   mdn <- sapply(baza.subset[, c("EBITDA_margin", "EBIT_margin", "ROE",
         )], FUN = function(m, baza.subset) {
         aggregate(m ~ nova_spr, data = baza.subset, FUN = quantile,
            probs = 0.5, na.rm = TRUE)
      }, baza.subset = baza.subset, simplify = FALSE)
   mdn <- doCallAddColumn1(mdn)


   po.med <- sapply(baza.subset[, c("EBITDA_margin", "EBIT_margin", "ROE"
         )], FUN = function(m, baza.subset) {
         aggregate(m ~ Time + nova_spr, data = baza.subset, FUN = quantile, probs = 0.625,
na.rm = TRUE)
      }, baza.subset = baza.subset, simplify = FALSE)
   po.med <- doCallAddColumn2(po.med)
   po.med <- with(po.med, po.med[Time == "2008", ])

   skp <- merge(x = mdn, y = po.med, by = c("nova_spr", "origin"))
   skp$m.x <- as.character(round(skp$m.x, 2))

   dummy <- unique(qs[, c("nova_spr", "origin", "Time", "variable")])
   dummy$value <- 1

   ggplot(qs, aes(x = Time, y = value)) +
      theme_bw()+
      theme(axis.text.x = element_text(angle = 90)) +
      labs(x = "Years", y = "%") +
      geom_rect(data = dummy, aes(fill = nova_spr), xmin = -Inf, xmax = Inf, ymin = -Inf,
ymax = Inf,
         alpha = 0.01, show_guide = FALSE) +
      geom_hline(h = 0, size = 0.2) +
      geom_line(aes(group = variable, linetype = variable), show_guide = FALSE) +
      scale_y_continuous(labels = comma) +
      geom_text(data = skp, aes(x = "2008", y = m.y, label = m.x), size = 4) +
      scale_linetype_manual(values = c("dotted", "solid", "dotted")) +
      facet_grid(origin ~ nova_spr, scales = "free")
}

doCallAddColumn1 <- function(x) {
   nm <- names(x)

   for(i in nm) {
      x[[i]]$origin <- as.factor(nm[which(nm == i)])
   }
   out <- do.call("rbind", x)
   rownames(out) <- NULL
   out <- with(out, data.frame(nova_spr = nova_spr, m, origin))
}

doCallAddColumn2 <- function(x) {
```

```
   nm <- names(x)

   for(i in nm) {
      x[[i]]$origin <- as.factor(nm[which(nm == i)])
   }
   out <- do.call("rbind", x)
   rownames(out) <- NULL
   out <- with(out, data.frame(Time = Time, nova_spr = nova_spr, m, origin))
}

DrawIncomeStatement(x = "all", my.baza = baza, com.cat = "all")
```

Appendix B: Multilevel linear modeling (MLM)

B-0: Multiple regression analysis – without controlling for time-series dependency

```
REGRESSION
  /MISSING LISTWISE
  /STATISTICS COEFF OUTS R ANOVA COLLIN TOL
  /CRITERIA=PIN(.05) POUT(.10)
  /NOORIGIN
  /DEPENDENT Financial leverage
  /METHOD=ENTER Profitability Firm size Firm’s growth Tangibility Risk Public Uniqueness
   GDP growth Inflation Tax rate
  /RESIDUALS HISTOGRAM(ZRESID) NORMPROB(ZRESID).
```

Model Summary

R	R^2	Adj. R^2	s_e
.409	.168	.167	20.307

ANOVA

	Sum of Squares	df	Mean Square	F	P
Regression	4196039.499	10	419603.950	1017.567	.000
Residual	20854289.315	50573	412.360		
Total	25050328.815	50583			

Coefficients

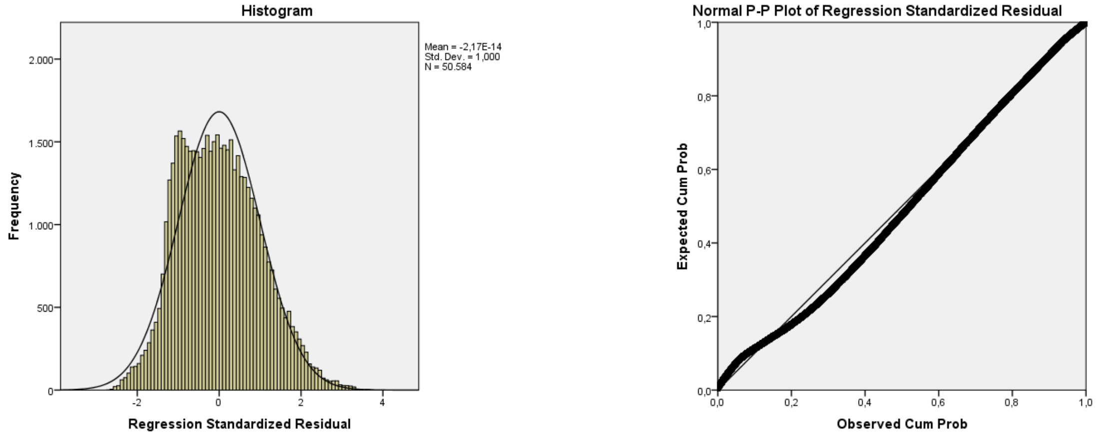
	$\hat{\beta}$	se($\hat{\beta}$)	Standardized $\hat{\beta}$	t	P	Tolerance	VIF
Constant	10.142	.800		12.676	.000		
Profitability	-.173	.015	-.051	-11.758	.000	.885	1.130
Firm size	1.172	.138	.036	8.523	.000	.931	1.074
Firm’s growth	.019	.004	.018	4.337	.000	.960	1.042
Tangibility	.268	.003	.340	80.136	.000	.916	1.091
Financial distress	-.742	.033	-.102	-22.812	.000	.831	1.204
Public	-2.255	.195	-.049	-11.583	.000	.936	1.068
Uniqueness	-.856	.379	-.009	-2.261	.024	.988	1.012
GDP growth	-.294	.024	-.051	-12.088	.000	.918	1.089
Inflation	.590	.052	.051	11.310	.000	.802	1.246
Tax rate	.350	.016	.102	22.372	.000	.797	1.254

Information Criteria

-2 Log Likelihood	448205.321
Akaike's Information Criterion (AIC)	448207.321
Hurvich and Tsai's Criterion (AICC)	448207.321
Bozdogan's Criterion (CAIC)	448217.152
Schwarz's Bayesian Criterion (BIC)	448216.152

The information criteria are displayed in smaller-is-better form.
Dependent variable: Financial leverage

Histogram of residuals and normal P-P plot



Source: Amadeus, 2013.

B-1: Multiple regression analysis – with controlling for time-series dependency (standard errors clustered by firm)

```
MIXED Financial leverage WITH Profitability Firm size Firm growth Tangibility Fin. distress
Public Unique products GDP growth Inflation Tax rate
  /CRITERIA=CIN(95) MXITER(100) MXSTEP(10) SCORING(1) SINGULAR(0.000000000001) HCONVERGE(0,
ABSOLUTE) LCONVERGE(0, ABSOLUTE) PCONVERGE(0.000001, ABSOLUTE)
  /FIXED= Profitability Firm size Firm growth Tangibility Fin. distress Public Unique
products GDP growth Inflation Tax rate | SSTYPE(3)
  /METHOD=REML
  /PRINT=SOLUTION TESTCOV
  /REPEATED=Time | SUBJECT(Firm*Industry*Country) COVTYPE(AR1).
```

Mixed Model Analysis

Model Dimension

		Number of Levels	Covariance structure	Number of Parameters	Subject Variables	Number of subjects
Fixed Effects	Intercept	1		1		
	Profitability	1		1		
	Firm size	1		1		
	Firm gro.	1		1		
	Tangibility	1		1		
	Fin. distress	1		1		
	Public	1		1		
	Unique.	1		1		
	GDP	1		1		
	Inflation	1		1		
	Tax rate	1		1		
Repeated Effects	Time	6	AR(1)	2	Country*Industry*Firm	8777
Total		17		13		

Dependent variable: Financial leverage

Information Criteria

-2 Log Likelihood	378868.121
Akaike's Information Criterion (AIC)	378872.121
Hurvich and Tsai's Criterion (AICC)	378872.121
Bozdogan's Criterion (CAIC)	378891.783
Schwarz's Bayesian Criterion (BIC)	378889.783

The information criteria are displayed in smaller-is-better form.
Dependent variable: Financial leverage

Type III Tests of Fixed Effects

Source	Numerator df	Denominator df	F	P
Intercept	1	10904.994	3.819	.051
Profitability	1	43524.046	1.267	.260
Firm size	1	12395.547	288.457	.000
Firm growth	1	47846.716	300.998	.000
Tangibility	1	29312.726	652.019	.000
Financial distress	1	9087.301	196.827	.000
Public	1	8512.111	58.461	.000
Uniqueness	1	8552.689	9.847	.002
GDP	1	39425.728	6.264	.012
Inflation	1	39626.377	34.395	.000
Tax rate	1	8573.143	45.391	.000

Dependent variable: Financial leverage

Estimates of Fixed Effects

Source	Estimates	Std. Error	df	t	P	Std. Estimates
Intercept	2.962398	1.515875	10904.994	1.954	.051	
Profitability	-.009819	.008723	43524.046	-1.126	.260	-.002885
Firm size	4.702231	.276862	12395.547	16.984	.000	.143757
Firm growth	.029895	.001723	47846.716	17.349	.000	.028134
Tangibility	.135613	.005311	29312.726	25.535	.000	.171577
Financial distress	-.905510	.064543	9087.301	-14.030	.000	-.123984
Public	-3.304749	.432222	8512.111	-7.646	.000	-.071191
Uniqueness	-2.602168	.829239	8552.689	-3.138	.002	-.028038
GDP	.024809	.009913	39425.728	2.503	.012	.004324
Inflation	.126866	.021632	39626.377	5.865	.000	.011010
Tax rate	.218653	.032454	8573.143	6.737	.000	.063543

Dependent variable: Financial leverage

Estimates of Covariance Parameters

Parameter		Estimates	Std. Error	Wald Z	P
Repeated Measures	**AR1 diagonal**	438.937272	5.651100	77.673	.000
	AR1 ρ	.908056	.001314	690.882	.000

Dependent variable: Financial leverage

B-2: MLM - Model 0

```
MIXED Financial leverage
  /CRITERIA=CIN(95) MXITER(100) MXSTEP(10) SCORING(1) SINGULAR(0.000000000001) HCONVERGE(0,
ABSOLUTE) LCONVERGE(0, ABSOLUTE) PCONVERGE(0.000001, ABSOLUTE)
  /FIXED=| SSTYPE(3)
  /METHOD=REML
  /PRINT=SOLUTION TESTCOV
  /RANDOM=INTERCEPT | SUBJECT(Country*Industry) COVTYPE(UN)
  /RANDOM=INTERCEPT | SUBJECT(Country) COVTYPE(UN)
  /REPEATED=Time | SUBJECT(Firm*Industry*Country) COVTYPE(AR1).
```

Mixed Model Analysis

Model Dimension

		Number of Levels	Covariance structure	Number of Parameters	Subject Variables	Number of subjects
Fixed Effects	Intercept	1		1		
Random Effects	Intercept	1	Variance Components	1	Country*Industry	
	Intercept	1	Variance Components	1	Country	
Repeated Effects	Time	6	AR(1)	2	Country*Industry*Firm	8777
Total		9		5		

Dependent variable: Financial leverage

Information Criteria

-2 Log Likelihood	378141.576
Akaike's Information Criterion (AIC)	378149.576
Hurvich and Tsai's Criterion (AICC)	378149.577
Bozdogan's Criterion (CAIC)	378188.902
Schwarz's Bayesian Criterion (BIC)	378184.902

The information criteria are displayed in smaller-is-better form.
Dependent variable: Financial leverage

Type III Tests of Fixed Effects

Source	Numerator df	Denominator df	F	P
Intercept	1	22.887	240.944	.000

Dependent variable: Financial leverage

Estimates of Fixed Effects

Source	Estimates	Std. Error	df	t	P
Intercept	27.332435	1.760842	22.887	15.522	.000

Dependent variable: Financial leverage

Estimates of Covariance Parameters

Parameter		Estimates	Std. Error	Wald Z	P
Repeated Measures	**AR1 diagonal**	384.001017	4.770959	80.487	.000
	AR1 ρ	.894248	.001441	620.787	.000
Intercept (subject = Industry*Country)	**Variance**	95.040448	11.427017	8.317	.000
Intercept (subject = Country)	**Variance**	65.714687	22.849487	2.876	.004

Dependent variable: Financial leverage

B-3: MLM - Model 1

```
MIXED Financial leverage WITH Profitability Firm size Firm growth Tangibility
  /CRITERIA=CIN(95) MXITER(100) MXSTEP(10) SCORING(1) SINGULAR(0.000000000001) HCONVERGE(0,
ABSOLUTE) LCONVERGE(0, ABSOLUTE) PCONVERGE(0.000001, ABSOLUTE)
  /FIXED= Profitability Firm size Firm growth Tangibility | SSTYPE(3)
  /METHOD=ML
  /PRINT=SOLUTION TESTCOV
  /RANDOM=INTERCEPT | SUBJECT(Country*Industry) COVTYPE(UN)
  /RANDOM=INTERCEPT | SUBJECT(Country) COVTYPE(UN)
  /REPEATED=Time | SUBJECT(Firm*Industry*Country) COVTYPE(AR1).
```

Mixed Model Analysis

Model Dimension

		Number of Levels	Covariance structure	Number of Parameters	Subject Variables	Number of subjects
Fixed Effects	Intercept	1		1		
	Profitability	1		1		
	Firm size	1		1		
	Firm's growth	1		1		
	Tangibility	1		1		
Random Effects	Intercept	1	Variance Components	1	Country*Industry	
	Intercept	1	Variance Components	1	Country	
Repeated Effects	Time	6	AR(1)	2	Country*Industry*Firm	8777
Total		13		9		

Dependent variable: Financial leverage

Information Criteria

-2 Log Likelihood	377307.665
Akaike's Information Criterion (AIC)	377325.665
Hurvich and Tsai's Criterion (AICC)	377325.669
Bozdogan's Criterion (CAIC)	377414.148
Schwarz's Bayesian Criterion (BIC)	377405.148

The information criteria are displayed in smaller-is-better form.
Dependent variable: Financial leverage

Type III Tests of Fixed Effects

Source	Numerator df	Denominator df	F	P
Intercept	1	59.168	3.188	.079
Profitability	1	44251.696	3.680	.055
Firm size	1	12806.779	225.792	.000
Firm growth	1	47993.462	265.040	.000
Tangibility	1	32006.954	457.782	.000

Dependent variable: Financial leverage

Estimates of Fixed Effects

Source	Estimates	Std. Error	df	t	P	Std. Estimates
Intercept	3.737852	2.093380	59.168	1.786	.079	
Profitability	-.016575	.008641	44251.696	-1.918	.055	-.004869
Firm size	4.291367	.285589	12806.779	15.026	.000	.131196
Firm growth	.027983	.001719	47993.462	16.280	.000	.026335
Tangibility	.119495	.005585	32006.954	21.396	.000	.151184

Dependent variable: Financial leverage

Estimates of Covariance Parameters

Parameter		Estimates	Std. Error	Wald Z	P
Repeated Measures	**AR1 diagonal**	365.178731	4.608205	79.245	.000
	AR1 ρ	.889428	.001544	576.022	.000
Intercept (subject = Industry*Country)	**Variance**	69.808731	9.104203	7.668	.000
Intercept (subject = Country)	**Variance**	60.257737	20.081949	3.001	.003

Dependent variable: Financial leverage

B4: MLM - Model 2

```
MIXED Financial leverage WITH Profitability Firm size Firm growth Tangibility Fin. distress
Public Unique products
  /CRITERIA=CIN(95) MXITER(100) MXSTEP(10) SCORING(1) SINGULAR(0.000000000001) HCONVERGE(0,
ABSOLUTE) LCONVERGE(0, ABSOLUTE) PCONVERGE(0.000001, ABSOLUTE)
  /FIXED= Profitability Firm size Firm growth Tangibility Fin. distress Public Unique
products | SSTYPE(3)
  /METHOD=ML
  /PRINT=SOLUTION TESTCOV
  /RANDOM=INTERCEPT | SUBJECT(Country*Industry) COVTYPE(UN)
  /RANDOM=INTERCEPT | SUBJECT(Country) COVTYPE(UN)
  /REPEATED=Time | SUBJECT(Firm*Industry*Country) COVTYPE(AR1).
```

Mixed Model Analysis

Model Dimension

		Number of Levels	Covariance structure	Number of Parameters	Subject Variables	Number of subjects
Fixed Effects	Intercept	1		1		
	Profitability	1		1		
	Firm size	1		1		
	Firm gro.	1		1		
	Tangibility	1		1		
	Fin. distress	1		1		
	Public	1		1		
	Unique	1		1		
Random Effects	Intercept	1	Variance Components	1	Country*Industry	
	Intercept	1	Variance Components	1	Country	
Repeated Effects	Time	6	AR(1)	2	Country*Industry*Firm	8777
Total		16		12		

Dependent variable: Financial leverage

Information Criteria

-2 Log Likelihood	377169.471
Akaike's Information Criterion (AIC)	377193.471
Hurvich and Tsai's Criterion (AICC)	377193.477
Bozdogan's Criterion (CAIC)	377311.447
Schwarz's Bayesian Criterion (BIC)	377299.447

The information criteria are displayed in smaller-is-better form.
Dependent variable: Financial leverage

Type III Tests of Fixed Effects

Source	Numerator df	Denominator df	F	P
Intercept	1	62.282	12.883	.001
Profitability	1	43945.055	1.756	.185
Firm size	1	13102.589	213.920	.000
Firm growth	1	48160.409	264.882	.000
Tangibility	1	32378.685	409.126	.000
Financial distress	1	9188.363	83.019	.000
Public	1	8659.029	40.631	.000
Unique products	1	8646.597	13.695	.000

Dependent variable: Financial leverage

Estimates of Fixed Effects

Source	Estimates	Std. Error	df	t	P	Std. Estimates
Intercept	7.745654	2.158011	62.282	3.589	.001	
Profitability	-.011471	.008656	43945.055	-1.325	.185	-.003370
Firm size	4.265166	.291615	13102.589	14.626	.000	.130395
Firm growth	.028043	.001723	48160.409	16.275	.000	.026392
Tangibility	.113380	.005605	32378.685	20.227	.000	.143447
Financial distress	-.563286	.061822	9188.363	-9.111	.000	-.077126
Public	-3.116724	.488956	8659.029	-6.374	.000	-.067141
Unique products	-3.067998	.829025	8646.597	-3.701	.000	-.033057

Dependent variable: Financial leverage

Estimates of Covariance Parameters

Parameter		Estimates	Std. Error	Wald Z	P
Repeated Measures	**AR1 diagonal**	361.888287	4.553429	79.476	.000
	AR1 ρ	.888492	.001552	572.514	.000
Intercept (subject = Industry*Country)	**Variance**	64.627200	8.576682	7.535	.000
Intercept (subject = Country)	**Variance**	62.847088	20.791415	3.023	.003

Dependent variable: Financial leverage

B-5: MLM - Model 3

```
MIXED Financial leverage WITH Profitability Firm size Firm growth Tangibility Fin. distress
Public Unique products GDP growth Inflation Tax rate
  /CRITERIA=CIN(95) MXITER(100) MXSTEP(10) SCORING(1) SINGULAR(0.000000000001) HCONVERGE(0,
ABSOLUTE) LCONVERGE(0, ABSOLUTE) PCONVERGE(0.000001, ABSOLUTE)
  /FIXED= Profitability Firm size Firm growth Tangibility Fin. distress Public Unique
products GDP growth Inflation Tax rate | SSTYPE(3)
  /METHOD=ML
  /PRINT=SOLUTION TESTCOV
  /RANDOM=INTERCEPT | SUBJECT(Country*Industry) COVTYPE(UN)
  /RANDOM=INTERCEPT | SUBJECT(Country) COVTYPE(UN)
  /REPEATED=Time | SUBJECT(Firm*Industry*Country) COVTYPE(AR1).
```

Mixed Model Analysis

Model Dimension

		Number of Levels	Covariance structure	Number of Parameters	Subject Variables	Number of subjects
Fixed Effects	Intercept	1		1		
	Profitability	1		1		
	Firm size	1		1		
	Firm gro.	1		1		
	Tangibility	1		1		
	Fin. distress	1		1		
	Public	1		1		
	Unique	1		1		
	GDP	1		1		
	Inflation	1		1		
	Tax rate	1		1		
Random Effects	Intercept	1	Variance Components	1	Country*Industry	
	Intercept	1	Variance Components	1	Country	
Repeated Effects	Time	6	AR(1)	2	Country*Industry*Firm	8777
Total		19		15		

Dependent variable: Financial leverage

Information Criteria

-2 Log Likelihood	377114.522
Akaike's Information Criterion (AIC)	377144.522
Hurvich and Tsai's Criterion (AICC)	377144.531
Bozdogan's Criterion (CAIC)	377291.993
Schwarz's Bayesian Criterion (BIC)	377276.993

The information criteria are displayed in smaller-is-better form.
Dependent variable: Financial leverage

Type III Tests of Fixed Effects

Source	Numerator df	Denominator df	F	P
Intercept	1	25.943	.814	.375
Profitability	1	43971.708	3.536	.060
Firm size	1	13080.377	209.864	.000
Firm growth	1	48084.029	287.130	.000
Tangibility	1	32252.940	414.612	.000
Financial distress	1	9194.487	82.574	.000
Public	1	8667.837	40.349	.000
Uniqueness	1	8653.612	13.671	.000
GDP	1	38835.553	12.317	.000
Inflation	1	38551.455	23.310	.000
Tax rate	1	23.042	.133	.718

Dependent variable: Financial leverage

Estimates of Fixed Effects

Source	Estimates	Std. Error	df	t	P	Std. Estimates
Intercept	5.455702	6.046768	25.943	.902	.375	
Profitability	-.016360	.008700	43971.708	-1.881	.060	-.004806
Firm size	4.224506	.291613	13080.377	14.487	.000	.129152
Firm growth	.029373	.001733	48084.029	16.945	.000	.027643
Tangibility	.114254	.005611	32252.940	20.362	.000	.144554
Financial distress	-.561725	.061816	9194.487	-9.087	.000	-.076912
Public	-3.104729	.488776	8667.837	-6.352	.000	-.066882
Uniqueness	-3.063917	.828646	8653.612	-3.697	.000	-.033013
GDP	.034946	.009957	38835.553	3.510	.000	.006090
Inflation	.105162	.021781	38551.455	4.828	.000	.009127
Tax rate	.091921	.251602	23.042	.365	.718	.026713

Dependent variable: Financial leverage

Estimates of Covariance Parameters

Parameter		Estimates	Std. Error	Wald Z	P
Repeated Measures	**AR1 diagonal**	361.540659	4.547647	79.501	.000
	AR1 ρ	.888509	.001551	572.854	.000
Intercept (subject = Industry*Country)	**Variance**	64.449726	8.561965	7.527	.000
Intercept (subject = Country)	**Variance**	62.191450	20.641583	3.013	.003

Dependent variable: Financial leverage

B-6: MLM - Model 4

```
MIXED Financial leverage WITH Profitability Firm size Firm growth Tangibility Fin. distress
Public Unique products GDP growth Inflation Tax rate
  /CRITERIA=CIN(95) MXITER(100) MXSTEP(10) SCORING(1) SINGULAR(0.000000000001) HCONVERGE(0,
ABSOLUTE) LCONVERGE(0, ABSOLUTE) PCONVERGE(0.000001, ABSOLUTE)
  /FIXED= Profitability Firm size Firm growth Tangibility Fin. distress Public Unique
products GDP growth Inflation Tax rate | SSTYPE(3)
  /METHOD=REML
  /PRINT=SOLUTION TESTCOV
  /RANDOM=INTERCEPT | SUBJECT(Country*Industry) COVTYPE(UN)
  /RANDOM=INTERCEPT | SUBJECT(Country) COVTYPE(UN)
  /REPEATED=Time | SUBJECT(Firm*Industry*Country) COVTYPE(UNR).
```

Mixed Model Analysis

Model Dimension

		Number of Levels	Covariance structure	Number of Parameters	Subject Variables	Number of subjects
Fixed Effects	Intercept	1		1		
	Profitability	1		1		
	Firm size	1		1		
	Firm gro.	1		1		
	Tangibility	1		1		
	Fin. distress	1		1		
	Public	1		1		
	Unique.	1		1		
	GDP	1		1		
	Inflation	1		1		
	Tax rate	1		1		
Random Effects	Intercept	1	Variance Components	1	Country*Industry	
	Intercept	1	Variance Components	1	Country	
Repeated Effects	Time	6	Unstructured correlations	21	Country*Industry*Firm	8777
Total		19		34		

Dependent variable: Financial leverage

Information Criteria

-2 Log Likelihood	375572.818
Akaike's Information Criterion (AIC)	375618.818
Hurvich and Tsai's Criterion (AICC)	375618.840
Bozdogan's Criterion (CAIC)	375844.935
Schwarz's Bayesian Criterion (BIC)	375821.935

The information criteria are displayed in smaller-is-better form.
Dependent variable: Financial leverage

Type III Tests of Fixed Effects

Source	Numerator df	Denominator df	F	P
Intercept	1	23.824	.301	.588
Profitability	1	40348.978	33.273	.000
Firm size	1	14120.540	262.348	.000
Firm growth	1	41428.061	288.053	.000
Tangibility	1	32930.998	449.717	.000
Financial distress	1	8789.132	72.932	.000
Public	1	8343.143	41.728	.000
Uniqueness	1	8310.904	12.963	.000
GDP	1	10839.470	5.058	.025
Inflation	1	16804.428	47.873	.000
Tax rate	1	21.336	.093	.763

Dependent variable: Financial leverage

Estimates of Fixed Effects

Source	Estimates	Std. Error	df	t	P	Std. Estimates
Intercept	3.464404	6.314159	23.824	.549	.588	
Profitability	-.049852	.008642	40348.978	-5.768	.000	-.014646
Firm size	4.746122	.293022	14120.540	16.197	.000	.145099
Firm growth	.030354	.001788	41428.061	16.972	.000	.028566
Tangibility	.118100	.005569	32930.998	21.207	.000	.149420
Financial distress	-.542344	.063506	8789.132	-8.540	.000	-.074259
Public	-3.259639	.504607	8343.143	-6.460	.000	-.070219
Uniqueness	-3.079603	.855358	8310.904	-3.600	.000	-.033182
GDP	.020417	.009078	10839.470	2.249	.025	.003558
Inflation	.146083	.021113	16804.428	6.919	.000	.012678
Tax rate	.080243	.263287	21.336	.305	.763	.023319

Dependent variable: Financial leverage

Estimates of Covariance Parameters

Parameter		Estimates	Std. Error	Wald Z	P
Repeated Measures	**Var (1)**	374.725965	6.033480	62.108	.000
	Var (2)	376.755984	5.986124	62.938	.000
	Var (3)	381.087304	6.028029	63.219	.000
	Var (4)	362.864857	5.704983	63.605	.000
	Var (5)	348.988170	5.499087	63.463	.000
	Var (6)	346.114030	5.474117	63.227	.000
	Corr (2,1)	.876155	.002652	330.415	.000
	Corr (3,1)	.793344	.004226	187.711	.000
	Corr (3,2)	.873483	.002656	328.828	.000
	Corr (4,1)	.743564	.005087	146.162	.000
	Corr (4,2)	.805381	.003953	203.762	.000
	Corr (4,3)	.880837	.002513	350.483	.000
	Corr (5,1)	.711905	.005607	126.966	.000
	Corr (5,2)	.766822	.004625	165.795	.000
	Corr (5,3)	.828129	.003532	234.478	.000
	Corr (5,4)	.903377	.002048	441.158	.000
	Corr (6,1)	.685630	.006017	113.947	.000
	Corr (6,2)	.726758	.005300	137.116	.000
	Corr (6,3)	.784119	.004312	181.867	.000
	Corr (6,4)	.850417	.003099	274.380	.000
	Corr (6,5)	.916141	.001794	510.571	.000
Intercept (subject = Industry*Country)	**Variance**	61.183139	8.329233	7.346	.000
Intercept (subject = Country)	**Variance**	68.968067	23.489904	2.936	.003

B-7: MLM - Model 5

```
MIXED Financial leverage WITH Profitability W Profitability B Firm size W Firm size B Firm
growth W Firm growth B Tangibility W Tangibility B Fin. distress Public Unique products GDP
growth Inflation Tax rate
  /CRITERIA=CIN(95) MXITER(100) MXSTEP(10) SCORING(1) SINGULAR(0.000000000001) HCONVERGE(0,
ABSOLUTE) LCONVERGE(0, ABSOLUTE) PCONVERGE(0.000001, ABSOLUTE)
  /FIXED= Profitability W Profitability B Firm size W Firm size B Firm growth W Firm growth
B Tangibility W Tangibility B Fin. distress Public Unique products GDP growth Inflation Tax
rate | SSTYPE(3)
  /METHOD=ML
  /PRINT=SOLUTION TESTCOV
  /RANDOM=INTERCEPT | SUBJECT(Country*Industry) COVTYPE(UN)
  /RANDOM=INTERCEPT | SUBJECT(Country) COVTYPE(UN)
  /REPEATED=Time | SUBJECT(Firm*Industry*Country) COVTYPE(UNR).
```

Mixed Model Analysis

Model Dimension

		Number of Levels	Covariance structure	Number of Parameters	Subject Variables	Number of subjects
Fixed Effects	Intercept	1		1		
	Prof. W	1		1		
	Prof. B	1		1		
	Firm s. W	1		1		
	Firm s. B	1		1		
	Firm g. W	1		1		
	Firm g. B	1		1		
	Tangib. W	1		1		
	Tangib. B	1		1		
	Fin. distress	1		1		
	Public	1		1		
	Unique.	1		1		
	GDP	1		1		
	Inflation	1		1		
	Tax rate	1		1		
Random Effects	Intercept	1	Variance Components	1	Country*Industry	
	Intercept	1	Variance Components	1	Country	
Repeated Effects	Time	6	Unstructured correlations	21	Country*Industry*Firm	8777
Total		23		38		

Dependent variable: Financial leverage

Information Criteria

-2 Log Likelihood	374394.358
Akaike's Information Criterion (AIC)	374470.358
Hurvich and Tsai's Criterion (AICC)	374470.417
Bozdogan's Criterion (CAIC)	374843.951
Schwarz's Bayesian Criterion (BIC)	374805.951

The information criteria are displayed in smaller-is-better form.
Dependent variable: Financial leverage

Type III Tests of Fixed Effects

Source	Numerator df	Denominator df	F	P
Intercept	1	26.891	5.540	.026
Profitability W	1	37303.413	30.764	.000
Profitability B	1	8746.357	43.831	.000
Firm size W	1	23354.006	939.243	.000
Firm size B	1	8687.695	.639	.424
Firm growth W	1	40987.513	849.939	.000
Firm growth B	1	8938.724	12.702	.000
Tangibility W	1	38569.582	22.065	.000
Tangibility B	1	7388.022	896.109	.000
Financial distress	1	9018.428	42.014	.000
Public	1	8672.952	9.214	.002
Uniqueness	1	8757.043	2.814	.093
GDP	1	10917.537	.002	.968
Inflation	1	16904.444	58.460	.000
Tax rate	1	23.342	.483	.494

Dependent variable: Financial leverage

Estimates of Fixed Effects

Source	Estimates	Std. Error	df	t	P	Std. Estimates
Intercept	14.674450	6.234322	26.891	2.354	.026	
Profitability W	-.048718	.008783	37303.413	-5.547	.000	-.008457
Profitability B	-.253430	.038280	8746.357	-6.620	.000	-.059977
Firm size W	17.800548	.580824	23354.006	30.647	.000	.075961
Firm size B	.263695	.329821	8687.695	.800	.424	.007988
Firm growth W	.061626	.002114	40987.513	29.154	.000	.051868
Firm growth B	.070673	.019830	8938.724	3.564	.000	.029758
Tangibility W	.033425	.007116	38569.582	4.697	.000	.008670
Tangibility B	.257721	.008609	7388.022	29.935	.000	.317975
Financial distress	-.425294	.065613	9018.428	-6.482	.000	-.058232
Public	-1.501107	.494533	8672.952	-3.035	.002	-.032337
Uniqueness	-1.402326	.835951	8757.043	-1.678	.093	-.015110
GDP	.000356	.009004	10917.537	.040	.968	.000062
Inflation	.160439	.020984	16904.444	7.646	.000	.013924
Tax rate	.179279	.257932	23.342	.695	.494	.052100

Dependent variable: Financial leverage

Estimates of Covariance Parameters

Parameter		Estimates	Std. Error	Wald Z	P
Repeated Measures	**Var (1)**	356.977663	5.671392	62.944	.000
	Var (2)	358.242883	5.609594	63.863	.000
	Var (3)	363.239511	5.678141	63.972	.000
	Var (4)	346.042109	5.365300	64.496	.000
	Var (5)	334.663167	5.197373	64.391	.000
	Var (6)	335.017596	5.238955	63.947	.000
	Corr (2,1)	.873655	.002663	328.109	.000
	Corr (3,1)	.791482	.004195	188.685	.000
	Corr (3,2)	.869281	.002705	321.360	.000
	Corr (4,1)	.738844	.005084	145.324	.000
	Corr (4,2)	.799824	.003993	200.285	.000
	Corr (4,3)	.877624	.002541	345.368	.000
	Corr (5,1)	.705045	.005619	125.471	.000
	Corr (5,2)	.759715	.004674	162.528	.000
	Corr (5,3)	.822711	.003588	229.302	.000
	Corr (5,4)	.899762	.002097	429.090	.000
	Corr (6,1)	.674167	.006099	110.537	.000
	Corr (6,2)	.715926	.005401	132.549	.000
	Corr (6,3)	.774684	.004429	174.905	.000
	Corr (6,4)	.844070	.003192	264.457	.000
	Corr (6,5)	.913667	.001827	499.987	.000
Intercept (subject = Industry*Country)	**Variance**	43.632566	6.605572	6.605	.000
Intercept (subject = Country)	**Variance**	67.473317	21.555401	3.130	.002

Dependent variable: Financial leverage

Appendix C: Definition of firm size categories

Very large firms. Firms are considered to be very large when they match at least one of the following criteria:

- Operating revenues ≥ €100 million.
- Total Assets ≥ €200 million.
- Employees ≥ 1000.
- Listed.
- Notes: Firms with ratios Operating revenues per employee or Total assets per employee below €100 are excluded. Firms for which Operating revenue, Total assets and Employees are unknown but have a level of capital over €5 million are included.

Large firms. Firms are considered to be large when they match at least one of the following criteria:

- Operating revenues ≥ €10 million.
- Total Assets ≥ €20 million
- Employees ≥ 150.
- Not very large.
- Notes: Firms with ratios Operating revenues per employee or Total assets per employee below €100 are excluded. Firms for which Operating revenue, Total assets and Employees are unknown but have a level of capital over €0.5 million are included.

Medium-sized firms. Firms are considered to be medium-sized when they match at least one of the following criteria:

- Operating revenues ≥ €1 million.
- Total Assets ≥ €2 million.
- Employees ≥ 15.
- Not very large or large.
- Notes: Firms with ratios Operating revenues per employee or Total assets per employee below €100 are excluded. Firms for which Operating revenue, Total assets and Employees are unknown but have a level of capital over €0.05 million are included.

Small firms. Firms not classified as very large, large, or medium-sized.

Appendix D: Summary in Slovenian language / Daljši povzetek v slovenskem jeziku

VPLIV ZADOLŽENOSTI NA USPEŠNOST POSLOVANJA PODJETJA: ŠTUDIJA EVROPSKIH DRŽAV

UVOD

Razlaga strukture kapitala podjetja, tj. razmerje med dolgom in lastniškim kapitalom, je že več kot 50 let pomembno raziskovalno vprašanje na področju financ. Leta 1958 sta Modigliani in Miller predstavila teorem, da struktura kapitala ne vpliva na tržno vrednost podjetja, vendar pa so kmalu zatem raziskovalci ob uporabi ustreznejših predpostavk pokazali, da je tržna vrednost podjetja odvisna od virov financiranja. Med najpomembnejšimi teorijami, ki razlagajo strukturo kapitala, sta teorija tehtanja (angl. Trade-off theory) in teorija vrstnega reda (angl. Pecking order hypothesis). Mnoge empirične študije so poskušale razložiti raznolikost kapitalskih struktur podjetij, vendar pa dejavniki ostajajo še vedno nepojasnjeni, kot ugotavljata Frank in Goyal (2009). Odprto namreč ostaja pomembno vprašanje, zakaj so nekatera podjetja visoko zadolžena, druga pa nizko, kljub temu da so si med seboj podobna (Lemmon in drugi, 2008). Ena izmed možnih razlag je naklonjenost vodstva podjetja dolžniškemu financiranju, na kar je opozoril že Donaldson (1961). Trdil je, da je konservativnost menedžmenta glavni dejavnik stopnje zadolženosti podjetja.

Ameriška empirična raziskava, ki so jo izvedli Lemmon in drugi (2008), dokazuje, da sta pri kapitalskih strukturah prisotna tako vztrajnost (bolj zadolžena podjetja ostajajo v povprečju bolj zadolžena daljše časovne obdobje, manj zadolžena podjetja ostajajo v povprečju manj zadolžena) kot približevanje ciljni strukturi kapitala. Graham in Leary (2011) menita, da tudi če približevanje obstaja, ekonomski motivi zanj še vedno niso popolnoma pojasnjeni. Naslednje odprto vprašanje torej ostaja, zakaj se podjetja približujejo ciljni strukturi kapitala, kot to predvideva dinamična različica teorije tehtanja (angl. Dynamic trade-off theory). Lev in Pekelman (1975) sta postavila hipotezo, da v podjetju nastanejo stroški, ko je njegovo razmerje med dolgom in lastniškim kapitalom pod ali nad ciljno strukturo. Veliko raziskovalcev je na primer ugotovilo, da previsoka zadolženost negativno vpliva na uspešnost poslovanja. Opler in Titman (1994) sta pokazala, da v času gospodarskega padca visoko zadolžena podjetja prva izgubijo kupce. Po drugi strani raziskovalci ugotavljajo, da lahko menedžment s premikom od prenizke zadolženosti k ciljni strukturi uspešno poviša tržno vrednost podjetja.

V prvem poglavju doktorskega dela je temeljit pregled strukture kapitala, ki sem ga izvedel s pomočjo analize citatov in kocitatov (angl. Citation and cocitation analysis). V drugem poglavju sem razvil večnivojski linearni model (angl. Multilevel linear model) za pojasnjevanje raznolikosti strukture kapitala evropskih podjetij in za napovedovanje ciljne kapitalske strukture. Ugotovil sem, da je večnivojsko linearno modeliranje možno uporabiti v različnih finančnih študijah, ker ponuja pomembne prednosti pred ostalimi regresijskimi tehnikami. V tretjem poglavju sem preverjal, ali se evropska podjetja podobno kot ameriška približujejo ciljni strukturi. Dodatno sem razvrstil podjetja v različne skupine (npr. v stare in nove članice EU) in primerjal stopnjo približevanja. Preveril sem še, kako je na hitrost približevanja vplivala finančna gospodarska kriza, ki je nastopila konec leta 2008. V četrtem poglavju sem poskušal ugotoviti, kateri dejavniki motivirajo podjetja, da se približujejo ciljni kapitalski strukturi. Analiziral sem razlike v uspešnosti podjetij, ki so blizu ciljne strukture kapitala, s podjetji, ki so močno pod ali nad njo. Primerjal sem tudi podjetja, ki so se v proučevanem obdobju uspešno približevala zmerni zadolženosti, s tistimi, ki so v celotnem obdobju ostala visoko oz. nizko zadolžena.

V doktorski disertaciji sem preveril naslednje štiri osrednje hipoteze:

1. Model za razlaganje heterogenosti strukture kapitala in ocenjevanje ciljne kapitalske strukture se lahko izboljša z večnivojskim linearnim modeliranjem. Takšno modeliranje se lahko uporabi tudi v drugih finančnih študijah. Poleg tega je pomembno razločevati med vplivom pojasnjevalnih spremenljivk znotraj podjetja in vplivom med podjetji.
2. Premiki v strukturi kapitala evropskih podjetij se najlažje opišejo z dinamično teorijo tehtanja.
3. Podjetja, ki so blizu svoji ciljni kapitalski strukturi, poslujejo uspešneje kot podjetja, ki so nad ali pod ciljno strukturo (zadolženost vpliva na uspešnost poslovanja). To pojasni približevanje kapitalske strukture ciljni.
4. Osrednji razlog za zadolževanje je finančna podpora rasti podjetja, medtem ko je osrednji razlog razdolževanja izboljšanje prodaje in učinkovitosti.

1 TEORIJA STRUKTURE KAPITALA

Analiza citatov in kocitatov je močno statistično orodje, ki omogoča preprost vpogled v najpomembnejša dela na izbranem raziskovalnem področju. Z njeno pomočjo sem pripravil kronološki pregled najpomembnejših del s področja strukture kapitala (glej *Graf 1*). Analiza je pokazala, da se je sodobna teorija strukture kapitala razvila iz neoklasične teorije podjetja, ki ima začetke v 30. letih 20. stoletja. Berle in Means (1932) sta v svoji knjigi *Modern Corporation and Private Property* med prvimi opredelila različne oblike podjetij, medtem ko je Coase (1937) v svojem delu *The Nature of the Firm* razlagal, zakaj podjetje obstaja. Iz Coasove opredelitve podjetja sta se razvili dve teoriji (*Agency cost theory* in *Property rights theory*), ki sta močno vplivali na razvoj sodobne teorije strukture kapitala. Leta 1958 sta Modigliani in Miller objavila delo *The cost of capital, corporation finance and the theory of investment*, v katerem sta predstavila teorem, da ob množici nerealnih predpostavk struktura kapitala ne vpliva na tržno vrednost podjetja. Frank in Goyal (2008) sta ugotovila, da pred njunim delom ni bilo splošno sprejete teorije strukture kapitala. Teorem je bil kasneje dopolnjen z vključitvijo obrestnega davčnega ščita

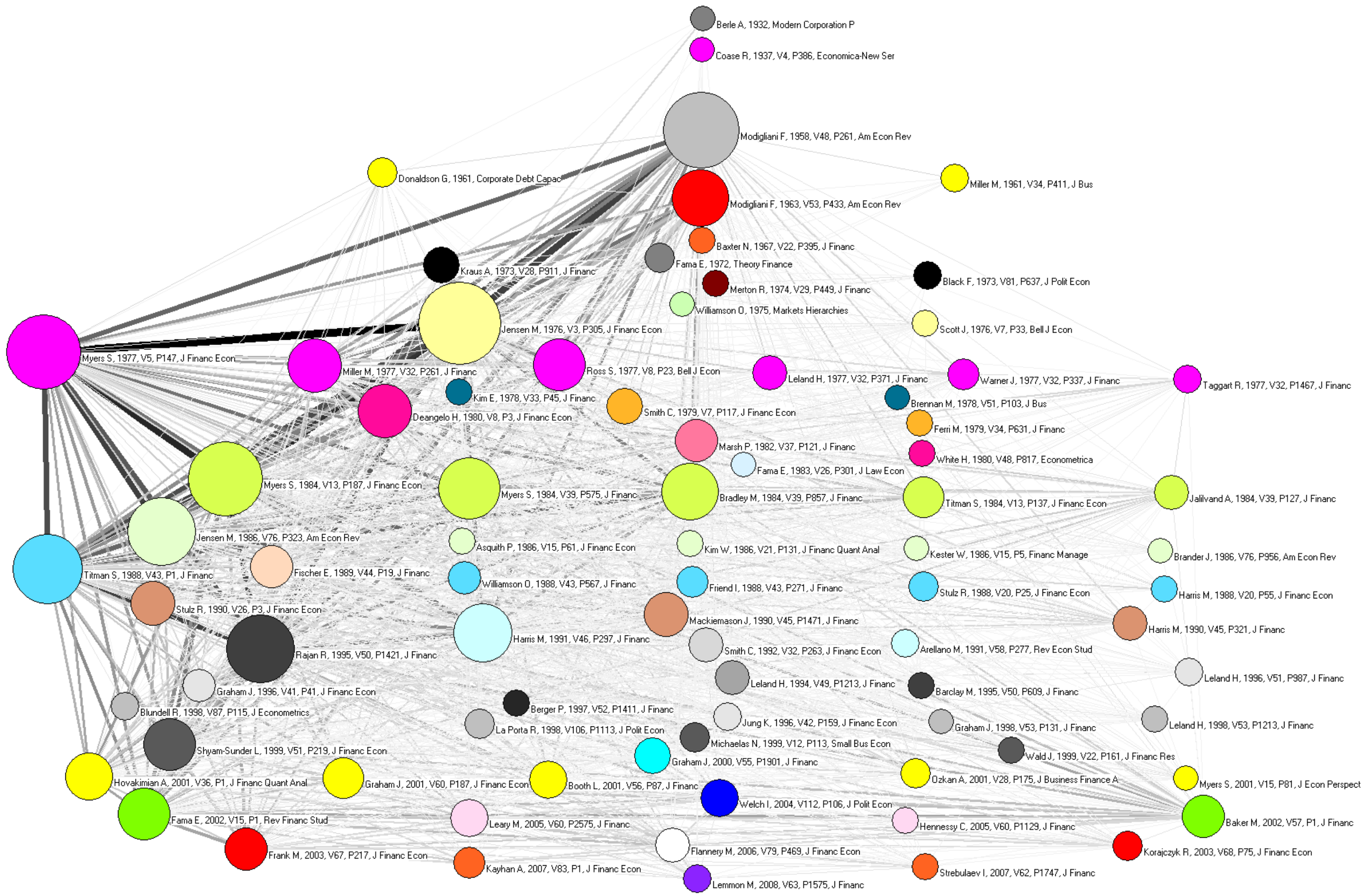
(Modligliani in Miller, 1963), iz česar je sledilo, da je vrednost podjetja maksimirana pri 100-odstotnem dolžniškem financiranju. Vendar pa je že v 70. letih 20. stoletja postalo jasno, da ima dolg poleg pozitivnih učinkov tudi negativne. Donaldson (1961) je trdil, da mora biti verjetnost dogodka insolventnosti osrednji dejavnik pri izbiri stopnje dolžniškega financiranja. Podobno sta menila tudi Kraus in Litzenberger (1973), in sicer da je treba koristi dolžniškega financiranja tehtati s stroški, ki nastanejo pri stečaju podjetja. Raziskovalci so tako kmalu ugotovili, da struktura kapitala vpliva na tržno vrednost podjetja. DeAngelo in Masulis (1980) sta bila med prvimi, ki sta jasno pokazala, da ima vsako podjetje enolično določeno optimalno strukturo kapitala.

Jensen in Mecklinga (1976) sta razvila teorijo tehtanja (angl. Trade-off theory), s pomočjo katere so raziskovalci določili dejavnike, ki vplivajo na optimalno strukturo kapitala. Osrednja ideja te teorije je, da je optimalna struktura kapitala določena s tehtanjem med koristmi in stroški dolžniškega financiranja. Navskrižje med lastniki in menedžerji (angl. principal-agent problem) se lahko učinkovito zmanjša z dolžniškim financiranjem, medtem ko navskrižje med lastniki in kreditodajalci narašča z dodatnim zadolževanjem. Lemmon in Zender (2010) sta povzela, da teorija tehtanja opisuje optimalno strukturo kapitala kot mešanico financiranja, ki izenači mejne stroške dolžniškega financiranja z njegovimi mejnimi koristmi. Teorija opisuje vrsto dejavnikov (stopnja oprijemljivih sredstev, dobičkonosnost, velikost podjetja ipd.), ki naj bi vplivali na ciljno strukturo kapitala. Frank in Goyal (2008) sta ugotovila, da hipoteza postopnega prilagajanja (angl. Target adjustment hypothesis), ki se je razvila iz dinamične različice teorije tehtanja (angl. Dynamic trade-off theory), najuspešneje pojasnjuje dejansko obnašanje podjetij. Osrednja ideja te hipoteze je, da se podjetja postopoma približujejo svoji ciljni strukturi kapitala, kar pomeni, da so odstopanja pričakovana, vendar postopoma odpravljena.

Vzporedno sta Myers in Majluf (1984) razvila hipotezo vrstnega reda (angl. Pecking order hypothesis). Njuna ideja je bila, da podjetje sledi hipotezi vrstnega reda, če daje prednost notranjim virom financiranja pred zunanjimi, in dolžniškemu financiranju pred lastniškim, če je zunanje financiranje dejansko uporabljeno. Po tej hipotezi so koristi in stroški dolžniškega financiranja, ki so osrednjega pomena pri teoriji tehtanja, nepomembni v primerjavi s stroški, ki nastanejo ob izdaji novih lastniških vrednostnih papirjev v pogojih visoke stopnje nesimetričnosti informacij (Shyam-Sunder in Myers, 1999), saj novo izdajo lastniških delnic vlagatelji povezujejo s precenjenostjo vrednosti podjetja, kar posledično privede do močnega padca cene delnice. Hipoteza predpisuje vrstni red financiranja, ki naj bi maksimiral vrednost podjetja, in opisuje dejavnike, ki povečujejo stopnjo nesimetričnosti informacij in dajejo prednost dolžniškemu zadolževanju.

Graf 1: Kronološki pregled najpogosteje citiranih člankov s področja strukture kapitala in povezave med njimi

Velikost kroga predstavlja število citatov, debelina črte pa moč povezanosti med članki glede na št. kocitatov. Članki so predstavljeni v kronološkem redu, z najstarejšimi članki na vrhu in novejšimi spodaj (barva označuje leto).



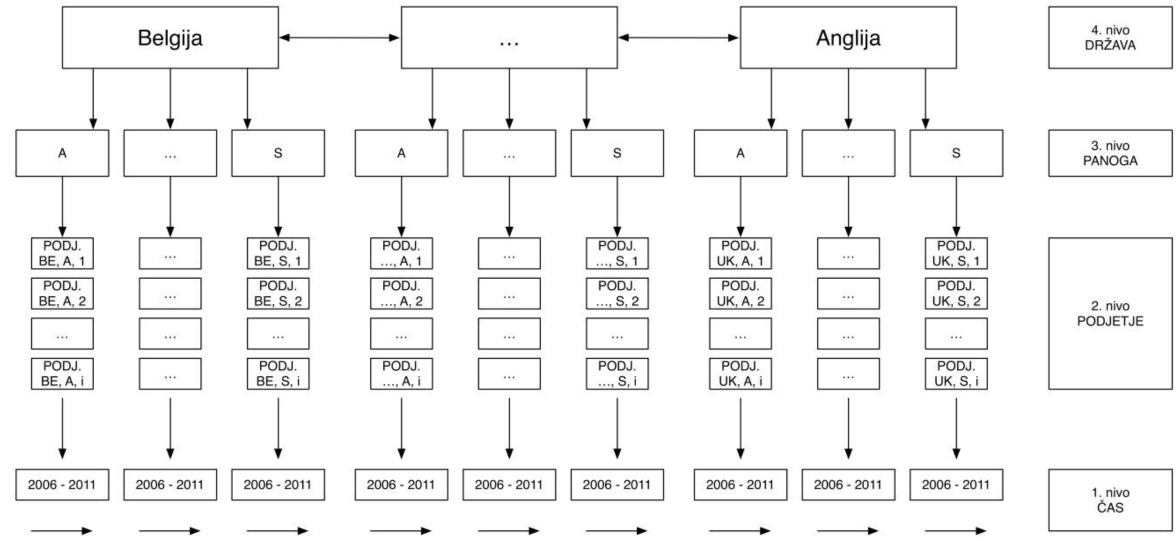
Vir: ISI Web of Science, 2013.

Poleg omenjenih dveh teorij strukture kapitala je veliko zanimanja doživela tudi teorija tržnega načrtovanja (angl. Market timing theory), ki sta jo leta 2002 predstavila Baker in Wurgler. Struktura kapitala je po njunem mnenju samo rezultat preteklih tržnih vrednosti delnice podjetja. Menedžment naj bi namreč analiziral razmere na trgu lastniških in dolžniških vrednostnih papirjev in se odločil za tisti način financiranja, ki je v danem trenutku ugodnejši. Osrednja pomanjkljivost te teorije je, da je ni mogoče povezati s tradicionalnimi dejavniki strukture kapitala.

2 VEČNIVOJSKI LINEARNI MODEL ZA RAZLAGANJE RAZNOLIKOSTI STRUKTURE KAPITALA

Teorija strukture kapitala predpostavlja, da ima podjetje ciljno zadolženost, ki je opredeljena s tehtanjem med koristmi in stroški dolžniškega oz. lastniškega financiranja (Kayhan in Titman, 2007). Kapitalsko strukturo podjetij v obdobju 2005–2011 sem analiziral na vzorcu 8.777 podjetij iz 18 panog in 25 evropskih držav (Belgija, Bolgarija, Hrvaška, Češka, Estonija, Finska, Francija, Nemčija, Grčija, Madžarska, Islandija, Irska, Italija, Latvija, Litva, Luksemburg, Norveška, Poljska, Portugalska, Slovaška, Slovenija, Španija, Švedska, Švica in Anglija). Ker veliko podjetij posluje v isti panogi oz. državi, so si takšna podjetja do neke mere podobna. Zato sem uporabil večnivojsko linearno modeliranje (angl. Multilevel linear modeling) in pokazal, da je ustreznejše statistično orodje za analizo strukture kapitala v primerjavi z regresijskimi tehnikami, ki se najpogosteje uporabljajo v finančnih študijah. V doktorskem delu sem tako razvil štirinivojski linearni model za ocenjevanje ciljne zadolženosti podjetja (prvi nivo je posamično opazovanje podjetja, drugi nivo je podjetje, tretji nivo je panoga in četrti nivo je država), ki je prikazan na *Grafu 2*. Stopnja medsebojne odvisnosti med podjetji, ki poslujejo v isti panogi/državi, je namreč pokazala, da obstaja med njimi visoka stopnja presečne odvisnosti (angl. Cross-sectional dependency), ki jo je treba ustrezno modelirati s hierarhično strukturo. Poleg tega je večnivojsko linearno modeliranje učinkovito razrešilo tudi longitudinalno odvisnost (angl. Time-series dependency) med posameznimi opazovanji (vsako podjetje je bilo opazovano več zaporednih let), obstajajo pa tudi druge prednosti, ki so lahko zelo uporabne pri analizi različnih finančnih študij (omogoča uporabo informacij celotne podatkovne baze za sklepanje o skupinah z majhnim številom opazovanj, pomembno izboljša napovedovalno moč modela, omogoča modeliranje spremenljivk na različnih nivojih, izboljša natančnost ocenjevanja standardnih napak, primerno je za analize z manjkajočimi podatki ipd.).

Graf 2: Grafična predstavitev hierarhije modela



Poleg slučajnih vplivov na nivoju panoge in države sem za pojasnjevanje zadolženosti uporabil 10 spremenljivk z močno teoretično podlago za razlago strukture kapitala, merjenih na različnih nivojih. Pokazal sem, da je pri pojasnjevalnih spremenljivkah na prvem nivoju treba ločiti dva vpliva: vpliv znotraj podjetja in vpliv med podjetji (angl. Cluster confounding). Odvisna spremenljivka je opredeljena kot odstotek celotnega finančnega dolga v celotnih sredstvih podjetja, pojasnjevalne spremenljivke, ki so merjene z enoletnim odlogom, pa so naslednje: na prvem nivoju sem uporabil dobičkonosnost, velikost podjetja, stopnjo rasti podjetja in stopnjo oprijemljivih sredstev. Na drugem nivoju sem uporabil verjetnost nastopa finančnih težav, status podjetja (javno oz. zasebno podjetje) in slamnato spremenljivko za podjetja, ki proizvajajo trajne izdelke. Na četrtem nivoju sem uporabil rast bruto domačega proizvoda, stopnjo inflacije in nominalno stopnjo davka na dobiček. Frank in Goyal (2009) sta naštela spremenljivke z visoko pojasnjevalno močjo pri analizi strukture kapitala ameriških podjetij. To so mediana zadolženosti panoge, stopnja otipljivih sredstev, dobičkonosnost, velikost podjetja in inflacija. Ugotovil sem, da vsi navedeni dejavniki statistično značilno pojasnjujejo tudi razlike v strukturi kapitala evropskih podjetij. Močno izboljšanje modela ob vključitvi slučajnih vplivov na tretjem in četrtem nivoju kaže na pomembnost razlik med panogami in državami pri analizi strukture kapitala. Ugotovil sem, da ima dobičkonosnost močnejši vpliv med podjetji, kar kaže na dejstvo, da bolj dobičkonosna podjetja potrebujejo manj zunanjih virov financiranja. Velikost podjetja pokaže, da je vpliv velikosti med podjetji mnogo manjši kot vpliv znotraj podjetja. Razlike med zadolženostjo manjših in večjih podjetij so zelo majhne, medtem ko je povečanje velikosti podjetja v času povezano z visoko stopnjo dodatnega zadolževanja. Ugotovil sem še, da je povečanje stopnje rasti povezano z dodatnim zadolževanjem in da ima stopnja otipljivih sredstev močnejši vpliv med podjetji, kar kaže na pomembnost povprečne stopnje oprijemljivih sredstev: podjetja, ki poslujejo z višjo stopnjo oprijemljivih sredstev, lažje pridobijo dolžniško financiranje. Rezultati so razkrili, da imajo podjetja z višjo razpršenostjo operativnega dobička nižjo stopnjo zadolženosti in da so javna podjetja in podjetja, ki proizvajajo trajne izdelke, manj zadolžena. Večnivojski linearni model je razkril, da se podjetja bolj zadolžujejo v času višje rasti BDP-ja in v času visoke inflacije. V nasprotju z ugotovitvami multiple regresijske funkcije, večnivojski linearni model pokaže, da nominalna stopnja davka na dobiček ne pojasnjuje razlik v zadolženosti evropskih podjetij. V tretjem poglavju sem poskušal preveriti, ali podjetja sledijo ideji o ciljni strukturi kapitala.

3 DINAMIKA ZADOLŽEVANJA PODJETIJ V EVROPSKIH DRŽAVAH

Razčlenitev variance dolga na štiri nivoje je pokazala, da je bila raznolikost v obdobju 2006–2011 veliko večja med podjetji kot znotraj podjetja (*Tabela 1*). To pomeni, da je bila v obdobju šestih let prisotna močna vztrajnost dolga, pa tudi določena stopnja sprememb znotraj podjetja. Zanimalo me je, ali so te spremembe usmerjene k ciljni kapitalski strukturi.

Tabela 1: Razčlenitev variance dolga v obdobju 2006–2011

	Razčlenitev variance dolga v %	
	Dolgoročni dolg	Celotni finančni dolg
Znotraj podjetja	14,8	15,2
Med podjetji znotraj panoge	51,8	59,6
Med panogami znotraj države	24,2	15,4
Med državami	9,2	9,8

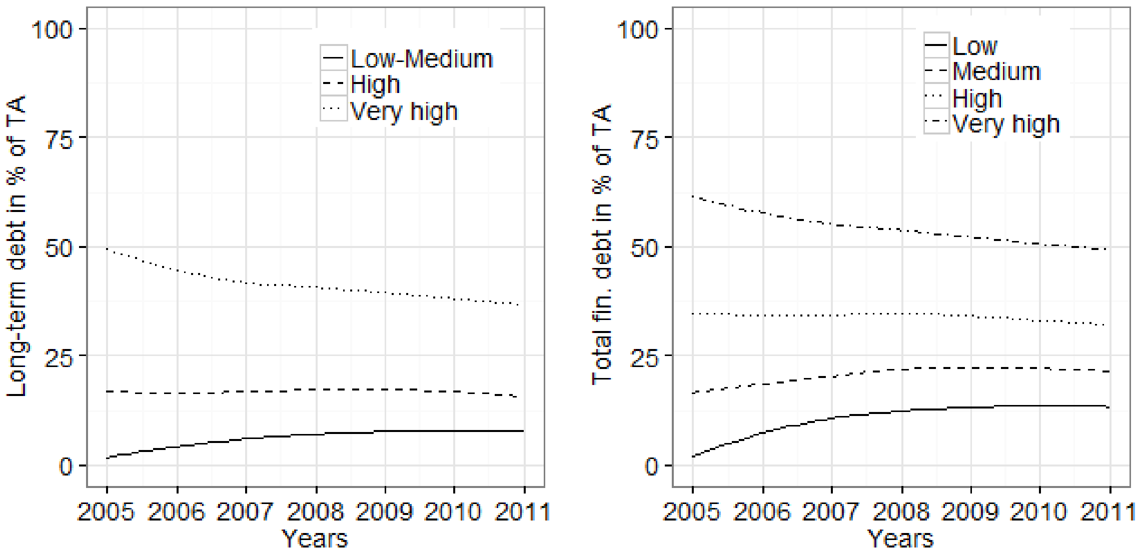
Vir: Amadeus, 2013.

Kayhan in Titman (2007) sta ugotovila, da obstaja visoka stopnja nesoglasja o pomembnosti koncepta ciljne strukture kapitala. Menila sta, da je intuitivno razmišljati o tem, kako tehtanje med koristmi in stroški dolžniškega financiranja vodi k ciljni strukturi, vendar pa je možno, da je blizu ciljne strukture povezava med stopnjo dolžniškega financiranja in tržno vrednostjo podjetja šibka, kar pomeni, da bodo stroški odstopanja dejanske strukture kapitala od ciljne, relativno majhni. V tem primeru je ideja o ciljni strukturi kapitala veliko manj pomembna, dejanska struktura pa bo odvisna od transakcijskih stroškov in tržnih razmer, ki začasno vplivajo na stroške dolžniškega financiranja.

Grafična analiza mikroravni podjetij, ki je prikazana v *Grafu 3*, dokazuje, da obstaja splošna usmeritev gibanja strukture kapitala k ciljni strukturi, ne glede na to, ali je zadolženost opredeljena kot dolgoročni dolg ali kot celotni finančni dolg v deležu celotnih sredstev podjetja. Kljub različnim razdelitvam podjetij v skupine sta tako vztrajnost zadolženosti na eni strani kot tudi približevanje ciljni strukturi na drugi strani jasno izraženi, enako, kot je bilo ugotovljeno za ameriška podjetja. Še več, enak vzorec sprememb v strukturi kapitala se pojavlja tudi med manjšimi, zasebnimi podjetji. Razdelitev podjetij v skupine je razkrila, da se v nasprotju z ugotovitvijo Leva (1969) srednje velika podjetja približujejo hitreje kot večja podjetja. Hitrost zadolževanja in razdolževanja je v času krize upadla, vendar pa je kljub temu iz analize razvidno, da obstaja enaka oblika približevanja v obeh obdobjih, kar je skladno z dinamično različico teorije tehtanja. Podjetja iz novih članic EU in podjetja iz južnoevropskih držav so se v analiziranem obdobju hitreje zadolževala kot preostala podjetja. Dokazal sem še, da obstaja statistično značilna povezanost med dejanskim in napovedanim premikom proti ciljni strukturi kapitala, ocenjeni s pomočjo večnivojskega linearnega modela. Analiza hitrosti približevanja je razkrila, da se celotni finančni dolg prilagaja ciljni strukturi hitreje kot samo dolgoročni dolg, kar je skladno z ugotovitvami Taggarta (1977), ki je trdil, da ima kratkoročni dolg pomembno vlogo pri kratkoročnih nihanjih finančnega primanjkljaja. V celotnem vzorcu evropskih podjetij se prezadolžena podjetja približujejo ciljni strukturi hitreje kot podzadolžena podjetja, enako, kot je pokazal Byoun (2008) za ameriška podjetja.

Graf 3: Dinamika zadolževanja evropskih podjetij v obdobju 2005–2011

Vzorec sestavlja 8.777 podjetij s povprečnimi celotnimi sredstvi nad 5 milijonov evrov. V letu 2005 so podjetja razvrščena po stopnji dolga (odstotek dolgoročnega finančni dolga v celotnih sredstvih – levi graf in odstotek celotnega finančnega dolga v celotnih sredstvih – desni graf) v enega izmed štirih kvartilnih portfeljev, poimenovanih nizka zadolženost (low), srednja zadolženost (medium), visoka zadolženost (high) in zelo visoka zadolženost (very high). Pri dolgoročnem finančnem dolgu sta prva dva portfelja združena. Ko je podjetje razvrščeno v enega izmed portfeljev, ostane v njem šest let, v tem času pa se opazuje spreminjanje njegove strukture kapitala. Za vsak portfelj posebej predstavlja krivulja povprečno spreminjanje zadolženosti podjetij, ki so vanj razvrščeni.



Source: Amadeus, 2013.

Graham in Leary (2011) sta menila, da tudi če približevanje obstaja, ekonomski motivi zanj še vedno niso popolnoma pojasnjeni. V zadnjem poglavju disertacije sem raziskal, ali so uspešnejša tista podjetja, ki poslujejo blizu ciljne kapitalske strukture (imajo ustrezno zadolženost).

4 VPLIV ZADOLŽENOSTI NA USPEŠNOST POSLOVANJA PODJETJA

V tretjem poglavju sem pokazal, da obstaja splošno gibanje k ciljni strukturi kapitala, v četrtem poglavju pa ugotavljal, kateri so možni razlogi. Uporabil sem hipotezo Leva in Pekelmana (1975), ki sta trdila, da v podjetju nastanejo stroški, kadar je dejansko razmerje med dolžniškim in lastniškim kapitalom nad ali pod ciljno strukturo, in da se strošek povečuje s stopnjo oddaljenosti od ciljne strukture. Za vsako podjetje sem ocenil ciljno zadolženost s pomočjo večnivojskega modela iz drugega poglavja in nato podjetja razdelil v tri skupine: 25 % podjetij, ki so najbolj podzadolžena, 25 % podjetij, ki so najbolj prezadolžena, in preostalih 50 % podjetij, ki so najbližje ocenjeni ciljni strukturi. Za vsako skupino sem nato ocenil prvi, drugi in tretji kvartil za povprečni donos na lastniški kapital (angl. ROE) in povprečni donos na celotni investirani kapital (angl. ROCE), izračunan za vsako podjetje posebej za obdobje 2006–2011. Rezultati so prikazani v *Tabeli 2*.

Tabela 2: Kazalnika dobičkonosnosti za tri skupine podjetij

Vzorec sestavlja 8.777 podjetij. Za obdobje 2006–2011 je dejanska povprečna zadolženost podjetja primerjana s povprečno ciljno zadolženostjo, ocenjeno s pomočjo večnivojskega linearnega modela. Za vsako podjetje je ocenjena razlika, na podlagi katere so podjetja razvrščena v tri skupine: 25 % podjetij, ki so najbolj prezadolžena, 50 % podjetij, ki so najbližje ciljni strukturi, in 25 % podjetij, ki so najbolj podzadolžena. Za vsako skupino posebej so ocenjeni prvi kvartil (p25), mediana (p50) in tretji kvartil (p75) za dva kazalnika dobičkonosnosti: povprečni donos na lastniški kapital (ROE) in povprečni donos na celotni investirani kapital (ROCE), izračunan za vsako podjetje posebej za obdobje 2006–2011.

	ROE			ROCE		
	p25	p50	p75	p25	p50	p75
Prezadolžena podjetja	1,90	**9,84**	21,00	5,61	**11,11**	19,56
Podjetja blizu ciljne strukture	3,39	**10,22**	20,00	6,12	**12,42**	21,75
Podzadolžena podjetja	4,77	**12,23**	22,81	7,22	**14,88**	26,53

Vir: Amadeus, 2013.

Ugotovil sem, da dosegajo podjetja, ki poslujejo blizu svoje ciljne strukture kapitala, višjo mediano povprečnega donosa na lastniški kapital in višjo mediano povprečnega donos na celotni investirani kapital, kot prezadolžena podjetja. Podjetja, ki so podzadolžena, dosegajo najvišjo dobičkonosnost. Razlike so statistično značilne. Višja dobičkonosnost je lahko močan motiv, da se prezadolžena podjetja približujejo ciljni strukturi kapitala. Nadalje sem raziskal, na katere kategorije bilance stanja in izkaza uspeha vpliva približevanje ciljni strukturi. V letu 2005 sem podjetja razdelil v tri skupine, in sicer 25 % najmanj zadolženih podjetij, 25 % najbolj zadolženih podjetij, in preostalih 50 % podjetij na sredini (enak način sem uporabil v letu 2011). Glede na vsa možna prehajanja med skupinami sem podjetja razvrstil v eno izmed devetih skupin (primer: v letu 2005 je bilo podjetje med 25 % najmanj zadolženih, v letu 2011 je med 50 % podjetij na sredini). Za vsako izmed skupin sem analiziral izbrane postavke bilance stanja in izkaza uspeha in jih primerjal med seboj. Ugotovil sem, da zmerna zadolženost omogoča hitrejšo rast osnovnih sredstev – podjetja ne zmorejo vedno sama financirati hitre rasti, zato potrebujejo zunanja finančna sredstva, dolžniški kapital pa ima po hipotezi vrstnega reda prednost pred novimi izdajami lastniškega kapitala. Hitrejša rast osnovnih sredstev omogoča podjetjem povečanje prodaje. Nadalje sem ugotovil, da visoko zadolžena podjetja dosegajo najpočasnejšo rast prihodkov, kar ima teoretično podlago v razpravi Oplerja in Titmana (1994). Podjetja, ki zmanjšajo zadolženost in se s tem približajo svoji ciljni strukturi, bistveno izboljšajo tako rast prodaje kot koeficient obračanja sredstev (učinkovitost), kar se odrazi v izboljšanju uspešnosti poslovanja.

SKLEP

Raziskave na področju strukture kapitala so najpogosteje izvedene z regresijskimi tehnikami, ki uporabijo različne popravke standardnih napak. Vendar pa struktura podatkov kaže, da je uporaba večnivojskega linearnega modeliranja primernejša, saj podjetja poslujejo v istih panogah in državah, kar povzroča presečno odvisnost. Poleg tega se podjetje opazuje daljše obdobje, kar povzroči longitudinalno odvisnost. Obe obliki odvisnosti se lahko uspešno modelirata s štirinivojskim linearnim modelom, ki je razvit v drugem poglavju. Takšen model se lahko prenese tudi na vrsto drugih finančnih študij, saj večnivojsko linearno modeliranje ponuja vrsto prednosti pred ostalimi regresijskimi tehnikami. Pokazal sem, da je za pravilno razumevanje dejavnikov strukture kapitala treba ločiti med vplivom znotraj podjetja in vplivom med podjetji. S tem sem potrdil prvo hipotezo, da se model za razlaganje heterogenosti strukture kapitala in ocenjevanje ciljne kapitalske strukture lahko izboljša z večnivojskim linearnim modeliranjem, ki se ga lahko uporabi tudi v drugih finančnih študijah, pomembno pa je tudi ločiti med vplivom pojasnjevalnih spremenljivk znotraj podjetja in vplivom med podjetji. Ugotovil sem, da so razlike med zadolženostjo manjših in večjih podjetij zelo majhne, medtem ko je povečanje velikosti podjetja v času povezano z visoko stopnjo dodatnega zadolževanja. Rezultati kažejo, da je pri analizi strukture kapitala pomembno upoštevati razlike med panogami in državami, ter da so najpomembnejše pojasnjevalne spremenljivke stopnja otipljivih sredstev med podjetji, velikost znotraj podjetja, dobičkonosnost med podjetji, razpršenost operativnega dobička in rast znotraj podjetja.

S pomočjo grafične analize mikroravni podjetij sem dokazal, da obstaja splošna usmeritev gibanja strukture kapitala k ciljni strukturi ne glede na to, ali je zadolženost opredeljena kot dolgoročni dolg ali kot celotni finančni dolg v deležu celotnih sredstev podjetja. Kljub različni razvrstitvi podjetij v skupine sta tako vztrajnost zadolženosti na eni strani kot tudi približevanje ciljni strukturi na drugi strani jasno izraženi, enako, kot je bilo ugotovljeno za ameriška podjetja. Ker se takšno obnašanje najlažje opiše z dinamično teorijo tehtanja, to potrjuje drugo hipotezo. Še več, pokazal sem, da je enak vzorec sprememb v strukturi kapitala prisoten tudi med manjšimi, zasebnimi podjetji. Ugotovil sem, da je hitrost zadolževanja in razdolževanja v času krize upadla, vendar pa je kljub temu iz analize razvidno, da obstaja enaka oblika približevanja v obeh obdobjih, kar je skladno z dinamično različico teorije tehtanja in še dodatno potrjuje idejo o ciljni kapitalski strukturi. Izkazalo se je tudi, da so se podjetja iz novih članic EU in podjetja iz južnoevropskih držav v analiziranem obdobju hitreje zadolževala kot preostala podjetja.

Na koncu sem ugotovil, da dosegajo podjetja, ki poslujejo blizu svoje ciljne strukture kapitala, višjo mediano povprečnega donosa na lastniški kapital in višjo mediano povprečnega donosa na celotni investirani kapital, kot prezadolžena podjetja. Podjetja, ki so podzadolžena, dosegajo najvišjo dobičkonosnost. Nadalje sem pokazal, da zmerna zadolženost omogoča hitrejšo rast osnovnih sredstev – podjetja ne zmorejo vedno sama financirati svoje rasti, zato potrebujejo zunanja finančna sredstva, dolžniški kapital pa ima po hipotezi vrstnega reda prednost pred novimi izdajami lastniškega kapitala. Tem podjetjem je hitrejša rast omogočila povečanje prodaje. Na drugi strani pa visoko zadolžena podjetja dosegajo najpočasnejšo rast prihodkov, kar ima teoretično podlago v razpravi Oplerja in Titmana (1994). Podjetja, ki zmanjšajo zadolženost in se s tem premaknejo proti svoji ciljni strukturi, bistveno izboljšajo tako rast prodaje kot koeficient obračanja sredstev, kar se odrazi v izboljšanju uspešnosti poslovanja. S tem potrjujem tretjo in četrto hipotezo. Podjetja, ki so blizu svoje ciljne kapitalske strukture, poslujejo uspešneje kot podjetja, ki so nad ali pod ciljno strukturo – zadolženost vpliva na uspešnost poslovanja. To pojasni približevanje kapitalske strukture ciljni. Osrednji razlog za zadolževanje je finančna podpora rasti podjetja, medtem ko je osrednji razlog razdolževanja izboljšanje prodaje in učinkovitosti.

To doktorsko delo zaključujem z ugotovitvijo, da izbrana kapitalska struktura, tj. stopnja zadolženosti, vpliva na uspešnost poslovanja podjetja, kar se pokaže v tržni vrednosti podjetja, kot so ugotavljali že drugi raziskovalci. V skladu s Frankom in Goyalom (2008) sem ugotovil, da se premiki v strukturi kapitala evropskih podjetij najlažje opišejo z dinamično teorijo tehtanja, kar pomeni, da večina podjetij sledi ciljni strukturi kapitala in se njej dejavno približuje, s čimer izboljšajo uspešnost poslovanja.