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Diplom-Volkswirt Dirk Christian Schilling

aus Oldenburg (Oldb)

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Vorsitzende der Prüfungskommission: Prof. Dr. Jetta Frost
Erstgutachter: Prof. Dr. Wolfgang Drobetz
Zweitgutachter: Prof. Dr. Alexander Bassen

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Meinen Eltern und Großeltern gewidmet.

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Kapitel 1

Zusammenhang und Beitrag der Bestandteile der Dissertation

1.1 Einleitung

Die wissenschaftliche Forschung auf dem Gebiet der Finanzwirtschaft beschäftigt sich mit der Allokation des knappen Gutes Kapital. Dreh- und Angelpunkt der Betrachtungen sind daher die Märkte, auf denen Kapital von den Kapitalgebern zu den Kapitalnehmern transferiert wird. Dieser Transfer kann über einen „Markt" wie die Börse abgewickelt werden oder es können Finanzintermediäre wie Banken und Versicherungen eingeschaltet werden. Kapital ist allerdings kein homogenes Gut. Es existiert in zwei grundlegenden Ausgestaltungen: Eigen- und Fremdkapital. Während Eigenkapital sich durch die Vergütung mit einem Anteil am Gewinnstrom und einer unbegrenzten Laufzeit auszeichnet, ist bei Fremdkapital der zu zahlende Zins pro Periode und die Laufzeit im Vorfeld festgelegt. Die moderne Finanzmarktforschung beschäftigt sich u.a. mit der Allokation von Kapital aus Investorensicht (Asset-Management), dem Verhalten von Kapitalnachfragern (im Fall von Unternehmen Corporate Finance), der Frage wie die Preise der Kapitalüberlassung entstehen (Asset-Pricing) und der Frage wie Kapitalprodukte ausgestaltet werden können (Financal Engineering). Zwischen den Bereichen gibt es große Überschneidungen. Die Beiträge dieser Arbeit bewegen sich an der Schnittstelle der Corporate Finance und des Asset-Pricing, dem Zusammenspiel von Unternehmensentscheidungen und der Preisbildung am Kapitalmarkt.

1.2 Kapitalstruktur

Unternehmen treten als Nachfrager von Kapital auf, um ihrerseits Investitionsprojekte durchzuführen. Kapital ist dann ein Inputfaktor des Produktionsprozesses. Modigliani und Miller (1958) untersuchen die Frage, in welchem Verhältnis Unternehmen Eigen- und Fremdkapital nachfragen, bzw. verwenden. Unter restriktiven Annahmen ergibt sich, dass die Kapitalstruktur, das Verhältnis von Eigen- zu Fremdkapital, irrelevant für den Unternehmenswert ist. Investoren können jeder Veränderung der Kapitalstruktur in ihrem eigenen Portfolio durch Umschichtung entgegenwirken. Die Investoren sind damit in der Lage ihr Portfolio ihrem persönlichen Risikoprofil anzupassen. Die Kapitalstruktur ist in diesem Modell irrelevant für den Unternehmenswert .

In Modigliani und Miller (1963) erweitern die Autoren ihr Modell und führen Steuern als Friktion ein. Fremdkapital dient nun dazu, ein Steuerschild zu bilden und so Gewinne von der Besteuerung abzuschirmen. Mit der Arbeit von Kraus und Litzenberger (1973) werden Kosten finanzieller Anspannung in das Modell eingebracht. Unter dieser Art von Kosten werden u.a. Kosten der Insolvenz, der Vollstreckung aber auch Kosten von Interessenkonflikten zwischen Eigen- und Fremdkapitalgebern subsumiert. Durch einen zu hohen finanziellen Hebel (Leverage) – hoher Anteil von Fremdkapital – steigen diese Kosten an. Aus diesem Modell folgt eine optimale Kapitalstruktur (*Static-Trade-Off-Theorie*). Aufgabe des Unternehmens ist es, Kosten und Nutzen von Fremdkapital gegeneinander abzuwiegen, um die optimale Kapitalstruktur für das jeweilige Unternehmen zu erhalten. Eine weitere Ergänzung erfährt dieser Modellierungsstrang durch Fischer u. a. (1989) mit Anpassungskosten an die Zielkapitalstruktur. Unter diesen Begriff fallen beispielsweise die Kosten einer Kapitalerhöhung, das vorzeitige Kündigen eines Kredits, die Aufnahme eines Kredites und alle weiteren Kosten, die bei Veränderungen der Kapitalstruktur anfallen. Durch diese Veränderung ergibt sich ein dynamischer Aspekt bei der Veränderung der Kapitalstruktur (*Dynamic-Trade-Off-Theorie*): Unternehmen müssen nun die Kosten einer Abweichung von der Zielkapitalstruktur mit den Anpassungskosten in Einklang bringen. Dies führt zu einer langsamen Anpassung an die Zielkapitalstruktur. Eine solche Anpassung kann im Modell von Fischer u. a. (1989) mehrere Jahre in Anspruch nehmen.

Mit dem Beitrag von Akerlof (1970) über den Gebrauchtwagenmarkt hat „Information“ begonnen, eine Rolle in der ökonomischen Modellierung zu spielen. Diese Neuerung wurde auch in der Finanzierungsforschung aufgenommen und ergänzt die Modelle zur Kapitalstruktur um die Frage, welche Informationen unterschiedliche Entscheidungen an den Kapitalmarkt (bzw. Externe) senden, welche Reaktionen diese Informationen hervorrufen und in welcher Weise das Wissen um die Reaktionen die Handlungen der Unternehmen bestimmt. In den Beiträgen von Myers (1984) sowie Myers und Majluf (1984) wird ein Modell entwickelt, dass zu einer Hackordnung (*Pecking-Order*) der Finanzinstrumente führt. Unternehmen bevorzugen interne Finanzierungsquellen, nutzen Fremdkapital, wenn diese aufgebraucht sind, und nutzen Eigenkapital nur dann, wenn kein Fremdkapital mehr zur Verfügung steht. Diese Hackordnung entsteht, weil Manager besser über den Wert des Unternehmens informiert sind als Investoren. Wenn eine Kapitalerhöhung durchgeführt wird, müssen Investoren deshalb davon ausgehen, dass das Unternehmen überbewertet ist. Ist es das nicht, wäre es für Manager irrational eine Kapitalerhöhung durchzuführen. Interne Mittel senden kein Signal an den

Kapitalmarkt, Fremdkapital ein weniger schlechtes als Eigenkapital. Deshalb wird nach dieser Theorie Fremdkapital gegenüber Eigenkapital bevorzugt.

Die Dynamic-Trade-Off-Theorie und die Pecking-Order-Theorie sind die vorherrschenden in der Modellierung der Kapitalstruktur. Beide wurden umfangreich empirisch untersucht (u.a.Trezevant 1992; Frank und Goyal 2003; Lemmon und Zender 2010; De Jong u. a. 2010). Vor allem die Studie von Shyam-Sunder und Myers (1999) stellt einen zentralen Beitrag bei der empirischen Beurteilung der beiden Theorien dar. In dieser Studie werden beide Theorien gleichermaßen untersucht und ein einfaches Testverfahren für die Pecking-Order-Theorie entwickelt. Allerdings beschränkt sich diese Untersuchung auf den Finanzmarkt der USA. Rajan und Zingales (1995) und La Porta u. a. (1998) weisen auf die institutionellen und rechtlichen Unterschiede zwischen den Finanzmärkten hin. Während in den oben zitierten Studien mit Hilfe eines Abstraktionsgrads argumentiert wird, der von institutionellen und rechtlichen Unterschieden absieht, wird nun explizit untersucht, inwieweit diese Unterschiede Einfluss auf die Finanzierungsentscheidungen von Unternehmen haben. Aus der Betrachtung dieser Unterschiede entwickelte sich, vorangetrieben durch Levine (2002), die Unterscheidung in marktorientierte und bankorientierte Kapitalmarktsysteme. Diese Unterscheidung bezieht sich vor allem auf die relative Wichtigkeit und Entwicklung von Banken und Börsen. Daraus ergeben sich ebenfalls Differenzen hinsichtlich der Finanzierung durch Fremd- und Eigenkapital und Unterschiede in der Corporate Governance.

Der Beitrag „Dissecting the Pecking Order – When does it hold?“ schließt an diese beiden Literaturstränge an. Er widmet sich der Frage nach der Evidenz für die Pecking-Order-Theorie im Laufe der Zeit in einer Stichprobe von 1992–2009 und in den Ländern der G7. Genutzt wird dafür die Methodik von Shyam-Sunder und Myers (1999) mit dem Schwerpunkt auf Herausarbeitung des unterschiedlichen Verhaltens von Unternehmen in markt- und bankorientierten Ländern. Weiterhin wird untersucht, ob die Höhe des Finanzdefizits einen Einfluss auf das Verhalten hat, wie weit sich Unternehmen unterscheiden, die nur begrenzten Zugang zu externen Finanzmitteln haben und ob das wirtschaftliche Umfeld Einfluss auf Finanzierungsentscheidungen hat.

Es stellt sich heraus, dass der Erklärungsgehalt der Pecking-Order-Theorie über die Betrachtungsperiode abnimmt. Die anfänglich großen Unterschiede zwischen bankorientierten und marktorientierten Finanzsystemen werden kleiner. Allerdings weist die Pecking-Order-Theorie über den gesamten Zeitraum einen höheren Erklärungsgehalt in bankorientieren Finanzsystemen auf. Unternehmen mit kleinen Defiziten folgen eher einer Pecking Order als Unternehmen mit großen Defiziten. Bei Überschüssen hat die Pecking Order einen hohen Erklärungsgehalt mit Ausnahme sehr großer Überschüsse, bei denen das Verhalten der Unternehmen nicht erklärt werden kann. Hinsichtlich des begrenzten Zugangs zu extrenen Finanzmitteln ist die Pecking-Order-Theorie eher in der Lage das Verhalten von Unternehmen mit begrenztem und unbegrenztem Zugang zu erklären. Hingegen hat die Theorie nur begrenzten Erklärungsgehalt für Unternehmen mit mittlerem Zugang zu externen Quellen. Dies gilt vor allem in Ländern mit bankorientiertem Finanzsystem. Dies deutet auf einen Verhalten nach dem Modell von Bolton und Freixas (2000) hin: kleine, risikoreiche Unternehmen nutzen Bankkapital, Unternehmen mittleren Riskos nutzen den Kapitalmarkt und große, wenig risikoreiche Unternehmen emittieren Anleihen.

Der Beitrag geht außerdem der Frage nach, ob das makroökonomische Umfeld einen Einfluss auf Kapitalstrukturentscheidungen hat. Auch hier schweigt sich die klassische Modellierung aus. Die Ergebnisse zeigen, dass Unternehmen in bankorientierten Ökonomien mit kleinen Defiziten eine prozyklische Fremdkapitalpolitik verfolgen, sich also in Boomphasen verstärkt mit Fremdkapital finanzieren. Insgesamt zeigt dieser Beitrag, dass die Pecking-Order-Theorie nur unzureichend in der Lage ist, Kapitalstrukturentscheidungen zu erklären. Die Theorie ist in der Lage, eine gute Beschreibung für das Verhalten von Unternehmen mit speziellen Charakteristika zu sein, hat aber wenig Erklärungskraft für das allgemeine Verhalten bei Kapitalstrukturentscheidungen.

Der zweite Beitrag „Illuminating the speed of adjustment – Exploring heterogeneity in adjustment behavior“ widmet sich ebenso der Kapitalstrukturpolitik und nimmt den Faden vor allem der Dynamic-Trade-Off-Theorie auf. Die unterschiedlichen Kapitalstrukturtheorien haben Implikationen für die Anpassungsgeschwindigkeit zur Zielkapitalstruktur. Während die Pecking-Order-Theorie eine Anpassungsgeschwindigkeit von 0 impliziert, impliziert die Dynamic-Trade-Off-Theorie eine positive Anpassungsgeschwindigkeit. Modelle wie das von Fischer u. a. (1989) zeigen, dass allerdings schon geringe Anpassungskosten ausreichen, um eine äußerst langsame Anpassung zu erwirken. Zur Anpassungsgeschwindigkeit gibt es zahlreiche Studien, die sich aber vor allem durch die verwendeten Schätzer unterscheiden (u.a. Jalilvand und Harris 1984; Flannery und Rangan 2006; Lemmon u. a. 2008; Huang und Ritter 2009). Ziel dieses Beitrages ist es, die Anpassungsgeschwindigkeiten unter Berücksichtigung der institutionellen und rechtlichen Gegebenheiten zu untersuchen. Es wird weiterhin betrachtet, ob sich die Geschwindigkeit unterscheidet, wenn Unternehmen unterschiedlich hohe Defizite aufweisen, einen beschränkten Zugang zu externen Kapitalmärkten haben und unterschiedliche Abweichungen von der Zielkapitalstruktur auftreten. Außerdem wird der Einfluss des makroökonomischen Umfelds auf die Anpassungsgeschwidigkeit untersucht. Zur Bestimmung der Anpassungsgeschwindigkeit werden verschiedene Panelschätzer eingesetzt und verglichen. Vornehmlich wird das verzerrungsfreie Verfahren von Elsas und Florysiak (2010) genutzt.

Insgesamt zeigt sich eine Anpassungsgeschwindigkeit von im Mittel 20%. Diese ist höher in marktorientierten Ökonomien als in bankorientierten. Es zeigt sich auch, dass Unternehmen große Finanzierungsdefizite nutzen, um schneller ihre Kapitalstruktur anzupassen. Unternehmen mit beschränktem Zugang zum Kapitalmarkt sind gezwungen, sich schneller auf ihre Zielkapitalstruktur hinzubewegen. Dieser Einfluss ist insbesondere in marktorientierten Ökonomien ausgeprägt. Bei der Betrachtung der Abweichung von der Zielkapitalstruktur zeigt sich, dass Unternehmen, die über ihrer Zielkapitalstruktur liegen, sich schneller anpassen, wohingegen ein Unterschreiten der Zielkapitalstruktur nur geringen Einfluss auf die Geschwindigkeit hat. Auch das makroökonomische Umfeld beeinflusst die Anpassung: In Rezessionen erfolgt die Anpassung langsamer. In marktorietierten Ländern nutzen Unternehmen Phasen niedriger Risikoprämien und hoher Inflation für eine schnellere Anpassung.

Insgesamt zeigt der Beitrag, dass die Anpassungsgeschwindigkeit von einer Vielzahl Faktoren beeinflusst wird. Dazu gehören sowohl die Eigenschaften der Unternehmen als auch das makroökonomische Umfeld. Die Anpassung erfolgt zwar teilweise äußerst langsam mit einer mehrjährigen Halbwertszeit, ist allerdings über alle unterschiedlichen Betrachtungen hinweg positiv.

1.3 Directors' Dealings

Die Hackordnung der Finanzinstrumente ergibt sich aus der Informationsasymmetrie zwischen Eigner und Manager. Kapitalstrukturentscheidungen senden ein Signal, dass am Kapitalmarkt verarbeitet wird. Kapitalstrukturentscheidungen sind allerdings nicht das einzige Signal, dass potentiell Einfluss auf die Preisbildung hat. Der dritte Beitrag „Haben Manager Timing-Fähigkeiten? Eine empirische Untersuchung von Directors'-Dealings" untersucht, welches Signal Directors' Dealings an den Kapitalmarkt senden. Unter Directors' Dealings versteht man den Handel eines Managers mit Wertpapieren des „eigenen" Unternehmens. Dieser Handel unterliegt in Deutschland einer Regulierung, die eine Meldepflicht einer solchen Transaktion vorsieht. Die Bundesanstalt für Finanzdienstleistungsaufsicht (BaFin) führt eine Datenbank dieser Transaktionen, die in dem Beitrag ausgewertet wird. Dieser Datensatz ist der bisher umfangreichste in der deutschen Forschung zu Directors' Dealings (u.a. Stotz 2006; Dymke und Walter 2008; Betzer und Theissen 2009a, 2009b; Dickgiesser und Kaserer 2010). Die Auswertung wird in einem ersten Schritt mittels der klassischen Ereignisstudienmethode (u.a. MacKinlay 1997) durchgeführt und die abnormalen Renditen untersucht. Dabei stellt sich heraus, dass Manager in der Lage sind, ihr Insiderwissen zur Erzielung kurzfristiger Renditen zu nutzen. Um die Ergebnisse zu validieren wird im zweiten Schritt der *Generalized-Calender-Time-Ansatz* (GCT) genutzt (Hoechle u. a. 2009). Dieser hat Vorteile hinsichtlich der ökonometrischen Eigenschaften und erlaubt es stetige exogene Variablen in die Analyse einzubeziehen. In dem Beitrag wird darüber hinaus untersucht, ob das Anlegerschutzverbesserungsgesetz (AnSVG) aus dem Jahr 2004 eine Verringerung der Überrenditen mit sich bringt. In diesem Gesetz wurden die Meldepflichten und -fristen enger gefasst.

Die Ergebnisse deuten darauf hin, dass Unternehmensinsider über ausgeprägte Timing-Fähigkeiten verfügen. Insider verhalten sich als Contrarian-Investoren, d.h. sie kaufen eigene Aktien nach Kursverlusten und verkaufen nach Kursanstiegen. Während im Anschluss an Käufe die Kursanstiege zu signifikanten abnormalen Renditen für Insider führen, vermeiden sie signifikante Kursverluste nach Verkäufen. Ein Vergleich mit früheren Studien zeigt, dass die Werthaltigkeit von Insider-Transaktionen im bankorientierten deutschen Finanzsystem nicht höher ausfallen als in den marktorientierten angelsächsischen Finanzsystemen. Für die Information-Hierarchy-Hypothese, wonach die Werthaltigkeit von Informationen mit steigender Hierarchieebene eines Insiders zunimmt, kann keine Evidenz gefunden werden. Hingegen haben die verschärften Regularien des Insiderrechts seit Oktober 2004 zu einem Abbau der Informationsasymmetrien zwischen Unternehmensinsidern und Marktteilnehmern und zur Integrität des Marktes beigetragen. Durch die Verkürzung der Veröffentlichungsfrist gelangen Informationen schneller in den Markt, und die abnormalen Renditen sind im Zeitfenster bis zu 20 Handelstagen nach der Transaktion im Anschluss an die Umsetzung des AnSVG wie erwartet gesunken.

Diese Ergebnisse können durch den GCT-Ansatz im Wesentlichen bestätigt werden. Zusätzlich lassen die Koeffizienten auf die unternehmensspezifischen Variablen darauf schließen, dass größere Insider-Transaktionen zu höheren abnormalen Renditen führen.

1.4 Risikofaktoren

Die Eigenschaften von Unternehmen (Kapitalstruktur, Anpassungsgeschwindigkeit, Managerhandeln) wie sie in den ersten Beiträgen dargestellt werden, sollten sich auch in den Risikoeigenschaften der Aktien widerspiegeln. Zur Charakterisierung von börsengehandelten Titeln wurde von Sharpe (1964) ein Modell entworfen, dass jedem Titel ein idiosynkratisches Maß für das Risiko in einem Marktgleichgewicht zuordnet. Dieses Maß ist als β bekannt und bezeichnet den Koeffizienten einer Regression der jeweiligen Titelrenditen auf die Rendite des Marktes. Anders ausgedrückt: Die mit der quadrierten Varianz des Marktes normalisierte Kovarianz von Unternehmensaktie und Markt. Sharpe (1964) baut auf die Vorarbeiten der Portfolio-Theorie von Markowitz (1952) auf, in der Risikoreduktion durch Diversifikation mathematisch begründet wird. Unter diesen Voraussetzungen entwickelte Sharpe (1964) das *Capital-Asset-Pricing-Modell* (CAPM), ein Modell für den Preis der einzelnen Unternehmensaktie in einem Marktgleichgewicht.

Das Modell wurde in der Folge ausgiebig getestet (u.a. Fama und MacBeth 1973; Fama und French 1996, für eine Zusammenfassung der Literatur siehe Fama und French 2004) mit sehr unterschiedlichen Ergebnissen hinsichtliche der Evidenz. Es zeigt sich allerdings, dass ein Faktor nicht ausreicht, die Renditen der Aktien (und die anderer Wertpapiere) abzubilden. Bei der Schätzung mittels des CAPM zeigen sich systematische Anomalien, die das Modell nicht erklären kann. Aus dem Gedanken, dass die Renditen mit Faktoren zu erklären sein sollten, entwickelten sich in der Folge weitere Modelle. Die *Arbitrage-Pricing-Theorie* (APT) von Ross (1976) geht nur noch von einem arbitragefreien Markt aus. Die Renditen werden nun durch mehrere Faktoren erklärt; jeder Risikofaktor wird durch eine Risikoprämie entschädigt, die im Modell der Faktorladung bzw. dem Regressionskoeffizienten entspricht.

Das *Intertemporal-Capital-Asset-Pricing-Modell* (ICAPM) wurde von Merton (1973) entwickelt und basiert auf dem Gedanken, dass in einem allgemeinen Gleichgewichtsmodell der Diskontfaktor, die Grenzrate des Konsums, der einzige Risikofaktor sein sollte und im einfachen CAPM das Marktportfolio ein Proxy für den Diskontfaktor ist. Cochrane (2001) merkt an, dass aus dem ICAPM die Motivation stammt, makroökonomische Faktoren zu verwenden (siehe auch Campbell (2003) für Preisbildungsmodelle (Asset-Pricing-Modelle), die auf dem Konsum aufbauen). Cochrane (2001) nach handelt sich bei dem *3-Faktor-Modell* von Fama und French (1993) um ein APT-Modell, weil hier Portfolios (Value and Growth) als Faktoren verwendet werden. Ein Modell mit makroökonomischen Faktoren für einen internationalen Aktienmarkt wird von Ferson und Harvey (1994) entwickelt. Es zeigt sich, dass die Profile unterschiedlicher Märkte sich hinsichtlich der Ausprägungen der Faktoren (Risikoladungen) unterscheiden.

Neben Profilen einzelner Märkte ist es aber auch von Interesse, ob unterschiedliche Sektoren jeweils ein eigenes Risikoprofil aufweisen. Fama und French (1997) untersuchen die Risikoprofile von 48 Sektoren und resultierende unterschiedliche Kapitalkosten, die sich für die Unternehmen daraus ergeben. Der vierte Beitrag „Common risk factors in the returns of shipping stocks“ fügt das Risikoprofil eines weiteren Sektors hinzu und untersucht das Risikoprofil des Schifffahrtssektors. Die bisherige Literatur zur Preisbildung von Schifffahrtsaktien (Grammenos und Marcoulis 1996; Kavussanos und Marcoulis 1997, 2000a, 2000b; Grammenos und Arkoulis 2002) wird um eine Auswertung einer umfassenderen Stichprobe, der Verwendung eines ausgereifteren Verfahrens und dem Vergleich mit Länder- und Industrierisikoprofilen erweitert. In den Datensatz gehen alle börsengehandelten Schifffahrtsgesellschaften ein. Aus diesen werden Indizes für Massengutfrachter, Containerfrachter und Öltanker gebildet. Die Schätzungen zeigen ein geringes β für Schifffahrtsaktien; überraschend angesichts des hohen, vor allem zyklischen Risikos in diesem Sektor. Dieses Risiko entsteht, weil die Bestellungen neuer Schiffe in Phasen hoher Frachtraten überschießen und sich in Phasen niedriger Frachtraten dadurch eine Überschusstonnage auf dem Markt befindet, die die Frachtraten weiter nach unten drückt (Stopford 2009). Allerdings kann man aus dem niedrigen β in Kombination mit niedrigem R^2 schließen, dass die Aktien von Seeschifffahrtsgesellschaften vor allem durch unsystematisches Risiko gekennzeichnet sind. Diese Schlussfolgerung legen auch die beobachteten hohen Standardabweichungen der Renditen nahe.

Das Asset-Pricing-Modell zeigt, dass das Risiko von Schifffahrtsaktien mehrdimensional erfasst werden muss. Neben einem Weltmarktaktienindex spielen Wechselkursrisiken des US$, Outputrisiken, wie die Veränderung der Industrieproduktion, und Inputrisiken, wie die Veränderung des Ölpreises, eine große Rolle als Risikofaktoren. Insgesamt zeigt der Beitrag, dass Schifffahrtsaktien ein von anderen Sektoren und Ländern stark abweichendes Risikoprofil aufweisen und daher gut als diversifizierende Portfolioergänzung geeignet sind.

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Chapter 2

Dissecting the pecking order – When does it hold?

Abstract

This paper examines the performance of the pecking order theory in different settings by examining the pecking order coefficient, one of the key evaluators of its strength. We use the coefficient to check for differences in firm behavior across time and under different macroeconomic conditions and firm circumstances. We study differences in firms with large and small deficits and with possible debt constraints. We also study whether financial environment has an impact on firm behavior by performing separate tests for both bank and market-based countries. We find significant differences throughout the various settings. We also find that the explanatory power of the pecking order decreases over time. The different financial systems seem to converge in terms of the magnitude of the pecking order coefficient; however, pecking order-like behavior is more pronounced in bank-based countries. We also find a pro-cyclical debt policy for bank-based firms with small deficits. Furthermore, we find evidence that debt markets have a dual role in bank-based countries, providing funding for both large risk-less firms, and for new risky ones. Our results suggest that the decision whether to use equity or debt is typically clear in market-based systems, but it is less distinct in bank-based. Overall, the pecking order performs poorly in explaining our results, but it provides good results when studying firms with small deficits, and for differences among firms.

Keyword: Capital structure, pecking order, constraints, financial systems

JEL Classification Numbers: G30, G32

2.1 Introduction

"Take on positive net present value projects." This is the succint advise, for how managers can create value operationally on the asset side of the balance sheet. However, the subject of how they can create value operationally on the liability and equity side of the balance sheet is far less obvious, and is at the center of a nearly thirty-year academic debate. During this debate, several theoretical explanations have emerged. The classic Modigliani and Miller (1958) theorem posits that, in a world of perfect capital markets, capital structure is irrelevant to firm value, and whether a project is financed by equity or debt does not matter for firm value. However, Modigliani and Miller (1963) later extended their model to include taxes, which found benefits from using debt as a way to shield profits from taxation. The next extension involved managing bankruptcy costs from excessice amounts of debt. This theory is known as the static trade-off theory: Firms must balance debt and equity according to their respective costs and benefits (Kraus and Litzenberger 1973; Jensen and Meckling 1976).

As asymmetric information modeling (Akerlof 1970) increased in importance, it also spilled over into finance and led to the development of the pecking order theory of capital structure (Myers 1984; Myers and Majluf 1984). This theory claims that firms follow a pecking order in their financing decisions, where equity stands both at the top and the bottom of the hierarchy. Firms prefer to use cash, which results in the lowest costs, followed by debt and equity offerings, which have ascending costs of asymmetric information. And, recently, a third prominent theory has been developed, Baker and Wurgler's (2002) market timing theory. Its main prediction is that the offering behavior of firms depends on the state of the market. Firms will offer equity when the price of equity is low, and they will offer debt otherwise.

In an empirical test of these theories, none emerged as the best explanation for all different data patterns; rather, each theory was best explaining certain patterns. To understand how well a theory really works, we need to explore the explanatory power of every state of a firm or market. By examining its relative strengths and weaknesses, we can gain a deeper understanding of pecking order theory, and determine when its predictions hold. Our first step is to use the G7 countries to check for differences in explanatory power of the theory, as well as examine its development over time. Second, we classify each country as bank- or market-based to further explore its explanatory power under different capital market systems. Our third step is to use firm characteristics to analyze whether pecking order theory performs differently for different firm types. Fourth, we target the macroeconomic environment, and examine how firms generate financing during periods of recessions. Finally, we change perspectives, and look directly at a model of firms' financial decisions, relaxing the assumption that the financial deficit is exogenous.

We find that pecking order theory tends to lose its explanatory power over time. In general, performance is rather weak in market-based financial systems, and it is only slightly better in bank-based systems. However, when we study data subsamples, we find somewhat better explanatory power. If we sort financial deficits by size, we find that only the behavior of firms with very large deficits cannot be explained by pecking order, while the behavior of firms with small deficits is largely explained. Debt constraints also play a role. In market-based countries, firms are forced to use the capital markets even when they are only medium-constrained. In bank-based countries, we find that firms with medium debt constraints also use the capital markets, but constrained firms use banks for financing. Further more, we find evidence of a pro-cyclical debt policy in bank-based countries.

The remainder of the paper is organized as follows: Section 2 provides a literature overview of past research on pecking order theory. In Section 3, we present hypotheses derived from differences in capital market systems. Section 4 gives our data description and summary statistics. Section 5 describes our results in detail.

2.2 Literature overview

Modern academic research on capital structure starts with Modigliani and Miller's (1958) irrelevance theorem. Prior considerations about capital structure were mainly the result of ad hoc reasoning or industry heuristics. Modigliani and Miller's (1958) primary tenet was that a firm's capital structure has no influence on market value. However, this theory comes with strict assumptions.[1] The irrelevance theorem also does not explain, for example, why firms spend so much time on financing decisions, why leverage ratios are remarkably stable in some industries (Bradley et al. 1984), and why IPO activity is cyclical (Ritter and Welch 2002). From the irrelevance theory emerged the static trade-off theory. Modigliani and Miller (1963) provided a

1 In a summary of these assumptions, Frank and Goyal (2008) cite the absence of taxes, transaction costs, bankruptcy costs, agency conflicts, and adverse selection, as well as a separation between financing and operation activities, stable financial market opportunities, and homogeneous investors. In other words, everything that modern finance encompasses was ruled out by the assumption.

model including taxes that leads to relatively cheaper debt. Kraus and Litzenberger (1973) next added bankruptcy costs to create a model of the benefits of using debt as a tax shield and the costs of debt via bankruptcy cost. Decision-makers must evaluate all of these options to come up with an adequate capital structure for each business. The theory implies there is a target capital ratio for each firm to which they gradually move (along with adjustment costs).

The next major theory is the pecking order theory of Myers (1984) and Myers and Majluf (1984). This theory posits a pecking order of capital structure decisions,[2] which is the result of agency conflicts. Firms prefer internal financing; if these sources are depleted, they prefer debt; and only as a last resort will they use equity. Frank and Goyal (2008) note that using various models can lead to pecking order-like behavior, such as adverse selection and agency conflicts. The original derivation works with adverse selection costs, and was developed by Myers (1984) and Myers and Majluf (1984). The primary idea is that owner-managers are better informed by knowing firm value; the estimates of outside investors are subject to errors. When managers sell equity, outside investors tend to assume the firm is undervalued. Hence, firms issue equity only as a last resort, while internal financing is the cheapest option, and debt is in the middle. Another derivation uses agency conflicts, for example, laid out by Jensen and Meckling (1976), who show that the consumption of perks can lead to a pecking order.

Shyam-Sunder and Myers (1999) note a pecking order as well for share repurchases. In this case, they posit that the degree of manager optimism works as the primary mechanism: Optimistic managers (relative to investors) want to buy back shares to reduce supply and thus obtain higher share prices. Pessimistic managers believe their share prices are already too high, and are unlikely to buy back shares. Thus, optimistic managers will drive prices up until their own evaluation matches investor evaluation. In equilibrium, there will be only debt repurchases.

A third theory has also gained attention over the last few years: the market timing theory of capital structure, developed by Baker and Wurgler (2002). Before the formation of this theory, equity markets were not part of the capital structure theories. However, Baker and Wurgler (2002) document that firms tend to issue equity when firm market value is high compared to book value and when the cost of equity is low, and that they buy back shares when it is high. Baker and Wurgler (2002) also find evidence of issues during times of excessive investor “enthusiasm”.

2 The insight that firms prefer internal over external funds dates back to Donaldson (1961).

They note that, in a survey by Graham and Harvey (2001), managers admitted that they tend to time the markets. Baker and Wurgler (2002) find strong evidence of market timing by examining past leverage ratios and market-to-book-values. The influence (or persistence) lasts about ten years. They explicitly state that their findings are consistent to Myers and Majluf's (1984) model with rational managers and investors, as well as with varying adverse selection costs.

The relative merits of each theory have been the subject of intense discussion. However, the empirical success of each theory is mixed. Bradley et al. (1984) document evidence for the static trade-off model by looking at the cross-section of leverage ratios. Trezevant (1992) reports strong evidence for the trade-off model by examining a tax-code change that occurred during the 1980s. The pecking order theory extends the research question of which (only partially) consistent models is more correct? Shyam-Sunder and Myers (1999) evaluate both theories and suggest that the pecking order model performs better in explaining data patterns. They use a fairly simple model that regresses net debt on the financial deficit (see Section 2.5.1). If the coefficient is equal to 1, the variation in debt issues can be explained completely by the pecking order theory. Using a small sample of large firms, they find strong evidence to back up the theory. However, Frank and Goyal (2003) use a larger sample and obtain different results. They document that the pecking order decreases in explanatory power. They also find that net equity issues are better at tracking deficits than net debt issues, as the pecking order theory would predict. Moreover, Chirinko and Singha (2000) note that the Shyam-Sunder and Myers (1999) regression framework is not as powerful because of its empirical weaknesses.[3]

Because Frank and Goyal's (2003) empirical results are not completely satisfactory for some subsamples, however, newer studies have tested the pecking order in different economic environments and for different firm conditions. A central hypothesis states that firms have a limited debt capacity. Hence, firms at their debt limit are financially constrained. These firms are not able to follow a pecking order, and must issue equity when confronted with new investment opportunities. Faulkender and Petersen (2006) evaluate the relationship between the costs and the presence of a debt rating, and find that firms with high information asymmetries also have higher debt costs. Kisgen (2006) further investigates firm behavior during times of rating changes. He finds that ratings directly influence capital structure.

3 They note that the coefficient is biased if 1) the proportion of equity in the issuance is high, 2) equity and debt are reversed in the pecking order, or 3) firms issue in constant proportions.

For example, firms issue less debt if a rating change is expected and they have an unstable outlook. One drawback of these studies is that a credit rating is only a rough proxy for financial conditions, because not every firm relies on a rating and the data coverage on ratings in financial databases is incomplete. To mitigate these problems, Lemmon and Zender (2010) use a logit model to obtain a measure of firm-specific debt capacity. Consistent with pecking order, they find that financially constrained firms tend to use equity, while unconstrained firms tend to use debt. These findings are confirmed by De Jong et al. (2010) when sorting the firms by deficit size. De Jong et al. (2010) also argue that deficit size is a proxy for financially constrained firms. Their results indicate that firms with high deficits, which are generally small firms, do not follow a pecking order. They conclude that smaller firms have larger asymmetric information costs and should thus follow a pecking order, but they are also debt-constrained.

The overall macroeconomic environment is another source of capital issue behavior. Korajczyk and Levy (2003) find that unconstrained firms follow a countercyclical issue policy, while constrained firms have relatively stable debt and equity issues over time. Moreover, unconstrained firms seem to time the market by switching between debt and equity, while constrained firms are not able to follow this active approach.

Fama and French (2002) study both the pecking order and the trade-off theory. They observe that both theories correctly predict that firms with low investments would pay higher dividends. Only the pecking order model correctly predicted that profitable firms have a lower leverage ratio and that short-term variation in leverage is generally caused by debt issues, however.

In contrast, Flannery and Rangan (2006) do not find evidence for pecking order or market timing. Rather, they document a tendency for firms to rapidly converge toward a specific target leverage ratio. Leary and Roberts (2005) also report such a ratio, but they find that only a slow adjustment is possible because of adjustment costs. Hovakimian (2006) argues that these studies suffer from a correlation between historical market-to-book ratios and growth opportunities. In a recent paper Huang and Ritter (2009) overcome this problem by using an implied equity risk premium (ERP).[4] They report market timing and moderate adjustment speeds. They also find that firms finance more of their deficits with equity when the ERP is low.

4 Huang and Ritter (2009) calculate the ERP by using discounted earnings forecasts from firms in the Dow Jones Industrial Average.

In yet another direction, Lemmon et al. (2008) find that firms adjust to largely unobservable targets by examining portfolios of ex ante similarly leveraged firms. They find only a small variation in leverage in the portfolios over time.

However, note that all the studies mentioned above use U.S. accounting data for their research. A notable exception is Rajan and Zingales (1995), who conduct a descriptive analysis for the G7. They suggest applying to financial systems and jurisdiction outside the U.S., in order to obtain a fuller understanding of the theories. They also note that international countries can be considered an independent sample, and could be used as a further check on capital structure theories. Using international data, we can also check for the influence of different legal traditions and institutions on capital structure decisions. For example, La Porta et al. (1998) study various legal traditions, and find differences in the levels of shareholder protection.

Rajan and Zingales (1995) compare the capital structures of the G7 countries, and find they are comparable to the U.S. structure. Bessler, Drobetz, and Pensa (2008) investigate a European sample, and find support for a dynamic trade-off model with firms using market timing in the short run. Drobetz and Wanzenried (2006) use a sample of Swiss firms, and find correlations with the business cycle in their capital structure decisions. On the other hand, Ball et al. (2000) document the importance of international institutional factors for accounting measures. Prior to our work, Antoniou et al. (2009) found evidence for target leverage ratios in the G5, and they also documented some influence of macroeconomic factors and market-related variables on capital structure decisions. We use a much larger dataset and extend the view to firm-specific characteristics such as deficit size.

However, the advantage of considering a broader scope than just the U.S. comes at the cost of data quality. Many countries have 100 or fewer firms in the Compustat database, so the coverage and length of data is much less extensive. We use only G7 countries in this analysis, because they have sufficient data availability and reliable accounting standards. The next section discusses one of the main differences among the G7 countries, the historical development of their financial systems. As per the literature, we consider each system as market- or bank-based, depending on the main source of their external financing and the development of their capital markets and banking systems. We also develop hypotheses for the influence on capital structure.

2.3 Hypotheses

Beck and Levine (2002) were among the first to distinguish between bank- and market-based system, with the primary difference being the source of corporate finance. In market-based countries, the main source of capital is the capital markets, i.e., the stock market and the bond market. In bank-based systems, most capital is raised from banks. This is tied to a lower share of common equity, hence the differences in capital structure. For example, in 2005 the ratio of stock market capitalization to GDP was 1.35 in U.S., while it was only 0.43 in Germany (Beck et al. 2009). The U.S., Canada, and the U.K. are all market-based financial systems, Germany, France, Italy, and Japan are considered typical bank-based systems.

The systemic differences extend also to the implications for corporate governance (Credit Suisse 2005; Rajan and Zingales 2003). The market-based system is characterized by an "arm's-length" control between managers and investors: If managers do not perform, investors sell their shares. The requirements for this type of system are very liquid capital markets and a high degree of free float. The market for corporate control – mergers and acquisitions, as well as leveraged buyouts – also needs to be very active, and option-based payment systems are generally used to align management and shareholder interests. The bank-based system is characterized by high ownership stakes of banks and families, and less liquid capital markets. Bank debt plays a more prominent role in financing new projects, and the market for corporate control is not as active as in market-based countries. However, the insider-based control system also works as a corporate governance mechanism, because banks use their control rights to guarantee cash flows.

There is some discussion about which system has been more effective at providing a foundation for economic growth (Levine 2002). However, when the costs and benefits of both systems were fully evaluated, no clear answer emerged, and the century-old debate fizzled out. Recently, it has started up again, particularly because bank-based countries performed better to some extend during the 2007–2008 financial crisis (Claessens et al. 2010). Another discussion relates to which system provides better investor protection. Common law (market-based) countries generally have stronger shareholders protection, civil law (bank-based) countries tend to protect debtholders more strongly (La Porta et al. 1998). For example, as La Porta et al. (1998) note, the U.S. common law system strongly favors reorganization, with managers keeping their jobs. German civil law, on the other hand, strongly favors liquidation to protect secured creditors. La Porta et al. (2008) also report strong anti-director rights in common law countries, such as strong protection for minority shareholders, voting by mail, and the right for even relatively small shareholders to call shareholder meetings. These differences in corporate governance should result in different costs of equity capital. Because shareholders are less protected in bank-based countries, and incentives for managers are not primarily aligned with shareholder interests, they should demand a higher premium for providing equity (La Porta et al. 2008). Equity should thus be relatively more expensive in bank-based countries, and relatively cheaper in market-based countries. This insight strengthens when we consider the costs of asymmetric information. It is higher for equity providers in bank-based countries, because the disclosure obligations are less severe (Levine 2002).

The differences between the two systems also result in different behavior in capital structure decisions. This leads to our hypotheses:

Hypothesis I: *The proportion of debt used in bank-based countries is higher than in market-based countries.*
The cost of equity capital should be relatively higher in bank-based countries. These higher costs originate from lower investor protection and a governance mechanism that favors debtholders. Firms in bank-based countries should be more likely to use liabilities to finance investments. Hence, they would demonstrate more pecking order-like behavior, as the cost differences between equity and debt are higher than in market-based countries. This behavior should also lead to a higher pecking order coefficient in bank-based countries in the Shyam-Sunder and Myers (1999) framework. It is also documented in Bessler et al. (2011) and in Seifert and Gonenc (2008).

Hypothesis II: *The proportion of equity and debt used to finance financial deficits became closer recent years.*
In a Shyam-Sunder and Myers (1999) world, the pecking order coefficient is not inordinately different between market- and bank-based countries. Levine (2002) reports that high-income countries tend to move to market-based financial systems because of pressure from international markets, and because markets are more efficient at providing corporate governance. The liquidation of the so called "Deutschland AG"

is an example of this view (Höpner and Krempel 2003; Andres et al. 2011; Bessler, Drobetz, and Holler 2008). Therefore, we expect to see a declining pecking order coefficient.

Hypothesis III: *Market timing is more pronounced in market-based countries than in bank-based countries.*
The equity risk premium (similarly to the cost of equity capital) plays a more dominant role in market-based countries, because the capital market is used more heavily to finance firm activities. The risk premium varies (Ferson and Harvey 1991), as does IPO issuing activity (Ritter and Welch 2002). In market-based countries, firms seem to time the market and issue equity if the cost of equity capital is low. Autore and Kovacs (2010) find a correlation between time-varying issuance behavior and time-varying information asymmetries. However, this behavior should be more pronounced in market-based countries, because in bank-based countries the equity markets are not dominant, and banks have privileged access to crucial information. We do not expect to find strong market timing in our bank-based subsample.

Hypothesis IV: *Accounting information (i.e., firm-specific data) should be more important for debt versus equity decisions in market-based countries.*
The capital markets need information provided by firms to value the price of equity. The most important piece of publicly available information is the data from annaul balance sheets. The disclosure rules are stronger in market-based countries (La Porta et al. 1998). But banks are tied more closely to the management, and use other channels to obtain information to monitor firms. Therefore, the influence of balance sheet data should be more pronounced in market-based countries.

To evaluate these hypotheses, we use a comprehensive dataset for the G7 countries that contains firm, market, and macroeconomic data. The next section presents the precise construction.

2.4 Data and summary statistics

We use Standard & Poor's Compustat Global as our basic database. All data on balance sheet items, cash flow items, and market data come from this database. We add indicators for the macroeconomic environment from Thomson Reuters

Datastream.

We use observations from 1991 to 2009 for the G7 countries, and we obtain 125 982 firm-year observations. Frank and Goyal (2008) note that financial databases such as Compustat are subject to outliers and anomalous observations. However, we can manage this problem by using, e.g., rule of thumb truncations, winsorizing, and trimming.

We start with some common rule of thumb cleansing steps. We exclude all utilities (SIC codes 4900–4949) and financial firms (SIC codes 6000–6999).[5] We set any missing capital expenditures or convertible to zero. We also set missing research and development expenditures to zero; however, in this case, we use a dummy to indicate which items were missing and which originally had a zero value.

We further exclude firms with negative leverage ratios or total assets. We only use firms with consolidated balance sheets that have not experienced any changes in accounting method.[6] All firm-level variables are in local currencies,[7] except for sales, which is measured in 2000 US$. We trim our data at the 1%-level.

To construct the variables, we follow Huang and Ritter (2009) and Frank and Goyal (2009) for most definitions. We first look closely look at changes in net debt ($NETD$) and net equity ($NETE$). Net debt is defined as the change in liabilities and preferred stock relative to the beginning-of-year assets (AT). Net equity is the change in equity and convertible debt, minus the change in retained earnings relative to beginning-of-year assets.

Both variables are presented in Table I. The sample is relatively balanced over the years, varying from approximately 8000 to 12 000 observations. As in Huang and Ritter (2009), a firm is defined as issuing debt (equity) if the change in net debt (net equity) is higher than 5%. Looking at columns 2 and 3 of Table I, we note that the proportion of debt and equity issuers is time-varying. For example, in the year 2000, about 50% of firms in the sample issued debt; in 2009, the number was only 21%. Equity issuance is also time-varying. We note that the late 1990s had the highest percentage (up to 36%) of issues, and the late 2000s had the lowest (17% in 2008). This implies a certain amount of market timing on the part of the firms because the years of financial turmoil have low issue proportions. However, most of the firms

5 We exclude financial firms because they have a different balance sheet structure. We also exclude utilities for the sake of comparability, since they are regulated in the U.S.

6 We only use code F of Compustat item $CONSOL$ and drop all mergers ($CSTAT$=AA), new company formation (AB), accounting changes (AC, AN), and combinations.

7 We exclude all firm-years with divergent currencies for accounting and market data.

Table I – Percent of firms in different issuing groups

Year	Number of firms	Debt issuers	Equity issuers
1992	8069	0.399	0.275
1993	8408	0.406	0.295
1994	8815	0.437	0.287
1995	9570	0.478	0.300
1996	10 599	0.471	0.364
1997	10 989	0.454	0.313
1998	11 412	0.453	0.324
1999	11 670	0.488	0.348
2000	11 796	0.501	0.364
2001	11 721	0.349	0.295
2002	11 559	0.321	0.261
2003	11 444	0.359	0.282
2004	11 424	0.382	0.303
2005	11 175	0.429	0.322
2006	10 768	0.407	0.283
2007	10 196	0.354	0.237
2008	9602	0.305	0.175
2009	9063	0.215	0.185

Number of firms corresponds to the number of firm-years in a given year. Debt issuers is the percentage of debt issuers in a year. A firm is defined as issuing debt if the change in net debt $((LT_t + PSTK_t - TXDI_t - DCVT_t)/AT_{t-1})$ is larger than 5%. Equity issuers is the percentage of equity issuers. A firm is defined as issuing equity if the change in net equity $((AT_t - LT_t + PSTK_t - TXDI_t - DCVT_t)/AT_{t-1})$ minus the change in retained earnings (RE_t/AT_{t-1}) is larger than 5%. Note that, because firms can also issue no capital, the percentages need not add up to 100%.

issue debt throughout the sample.

Table II presents the summary statistics of the dependent variables. Overall, we see that leverage in market-based countries, measured as debt relative to total assets, is lower than in bank-based countries. This finding is independent of the definition of leverage. Book leverage and market leverage are lower in market-based countries as well. This finding is also independent of the point in time, as we see from the market leverage graph in Figure I. For book leverage, the ratio is below 0.6 for market-based countries, and generally above 0.6 for bank-based ones. The market leverage picture is even more distinct, as Panel B of Figure I shows. In market-based countries, leverage is below 0.4, while in bank-based countries it is above 0.45.

The central variable of our study is the so-called deficit coefficient (DEF). We define a financial deficit as the change in net debt ($NETD$) plus the change in net equity minus the change in retained earnings ($NETE$) relative to the beginning-of-year assets (see Appendix B for a detailed description).

One of our hypotheses states that firms time the market, and that the macroeconomic environment has an important influence on issuance behavior. To proxy for the market directly, we use the equity risk premium (ERP), calculated as the mean of the last 12-month return of the respective country index.[8] The variable is lagged 6 months, as in Huang and Ritter (2009), to account for a lag in managers' decision-making.

To proxy for the state of the economy, we use the real interest rate of every country,[9] the U.S. default spread as a proxy for general risk attitude,[10] the term spread, the TED spread, the GDP growth rate, and the corporate tax rate. Table III shows the correlations between the variables. We note especially low correlations in Panel B. We conclude that each variable is needed to proxy for the economic environment. However, we also use a dummy variable as an overall proxy for recessions, which is equal to 1 if the economy is entering a recession, and 0 otherwise. Here, we follow Halling et al. (2011), and use definitions from the Economic Cycle Research Institute.[11]

Our main goal is to investigate the theories of capital structure under different

8 We use the S&P 500 for the U.S., the FTSE All-Share for the U.K., the Toronto SE 300 for Canada, the SBF 250 for France, the Nikkei 225 for Japan, the BIC ALl Share for Italy, and the MDAX for Germany.

9 REALINT is the nominal interest rate minus inflation, while the nominal interest rate is the yield on three-month Treasury bills or the three-month interbank rate.

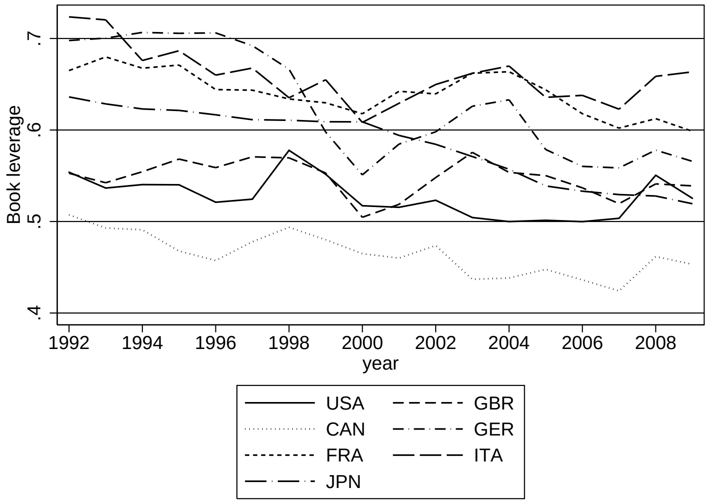
10 CREDIT is the difference between the yield on Moody's Baa-rated and Aaa-rated corporate bonds.

11 The data come from the Economic Cycle Research Institute website (`www.businesscycle.com`).

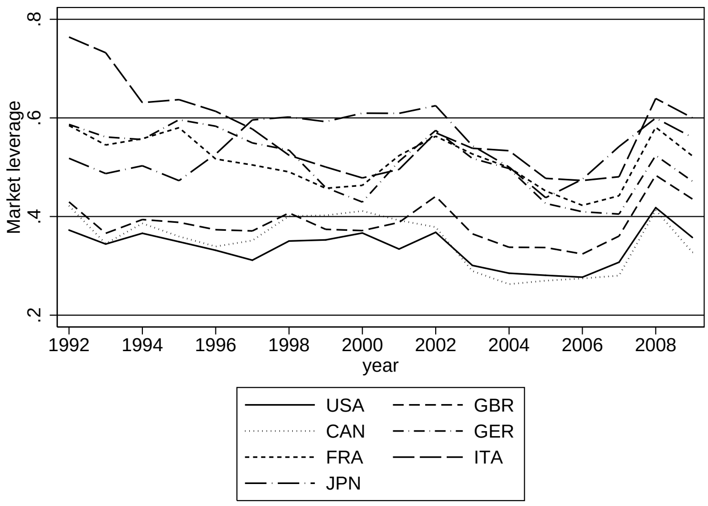
Table II – Summary statistics: Leverage in the G7

Country	Statistic	Book leverage	Market leverage	Net debt	Net equity
CAN	mean	0.465	0.345	5.668	21.183
	s.d.	0.306	0.244	24.531	60.933
GER	mean	0.610	0.494	6.545	12.871
	s.d.	0.246	0.252	27.917	59.316
FRA	mean	0.641	0.507	6.741	7.558
	s.d.	0.245	0.233	24.978	37.927
GBR	mean	0.555	0.383	7.718	19.075
	s.d.	0.333	0.227	28.988	67.053
ITA	mean	0.649	0.549	5.716	4.013
	s.d.	0.204	0.233	23.508	26.327
JPN	mean	0.578	0.549	1.439	1.543
	s.d.	0.221	0.229	14.935	15.492
USA	mean	0.547	0.337	4.530	18.329
	s.d.	0.385	0.246	24.165	68.420
Total	mean	0.567	0.443	4.177	11.231
	s.d.	0.307	0.255	22.560	52.289

This table presents an overview in terms of mean and standard deviation (s.d.) of the different leverage and issue variables. Book leverage (BL) is defined as debt relative to total assets ($(LT_t + PSTK_t - TXDI_t - DCVT_t)/AT_t$), market leverage ($ML$) is defined as debt relative to debt plus the market value of equity ($(LT_t + PSTK_t - TXDI_t - DCVT_t)/(LT_t + MKVAL_t)$). Net debt issues ($NETD$) are long term liabilities plus preferred stock minus deferred taxes and minus convertible debt ($(LT_t + PSTK_t - TXDI_t - DCVT_t)/AT_{t-1}$). Net equity ($NETE$) is total assets minus net debt minus retained earnings ($(AT_t - LT_t + PSTK_t - TXDI_t - DCVT_t - RE_t)/AT_{t-1}$).



(A) Book leverage G7



(B) Market leverage G7

Figure I – Leverage ratios across countries and over time
The two panels show the leverage ratios over time in the G7 countries. Book leverage (BL) is defined as debt relative to total assets ($(LT_t + PSTK_t - TXDI_t - DCVT_t)/AT_t$), market leverage ($ML$) is defined as debt relative to debt plus the market value of equity ($(LT_t + PSTK_t - TXDI_t - DCVT_t)/(LT_t + MKVAL_t)$).

Table III – Summary statistics: Macroeconomic variables

Panel A – Summary Statistics

Financial system	Statistic	ERP	REALINT	CREDIT	TERM	TED	TAX	GDP
Bank	mean	0.634	0.718	1.025	−1.332	0.164	26.429	0.927
	median	−0.522	0.612	0.870	−1.344	0.084	27.178	1.289
	s.d.	26.462	1.064	0.586	0.627	0.373	11.476	2.758
	kurtosis	1.969	9.121	9.989	4.668	15.140	2.596	6.645
	skewness	0.203	1.282	2.683	−0.014	2.612	−0.185	−1.727
	min.	−52.850	−1.691	0.540	−3.533	−1.240	0.595	−8.670
	max.	66.022	10.025	3.380	4.030	4.420	56.426	4.719
Market	mean	4.987	1.541	0.967	−1.340	0.413	18.281	2.616
	median	7.098	2.176	0.850	−1.171	0.268	18.093	2.829
	s.d.	18.141	2.062	0.538	1.421	0.543	3.525	2.062
	kurtosis	2.657	2.753	14.914	1.881	10.982	3.096	5.869
	skewness	−0.449	−0.429	3.388	−0.035	2.584	0.092	−1.341
	min.	−42.952	−3.990	0.540	−4.025	−1.240	9.277	−5.890
	max.	57.303	7.780	3.380	2.182	4.126	29.000	7.073

Panel B – Correlations

		ERP	REALINT	CREDIT	TERM	TED	TAX	GDP
	ERP	1.000						
	REALINT	0.244	1.000					
	CREDIT	−0.506	−0.475	1.000				
	TERM	−0.042	0.585	−0.076	1.000			
	TED	−0.332	−0.251	0.536	0.027	1.000		
	TAX	−0.088	−0.204	−0.119	0.004	−0.084	1.000	
	GDP	0.509	0.542	−0.674	0.167	−0.248	−0.097	1.000

ERP is the excess return of the respective market. *REALINT* is the nominal interest rate minus inflation, and the nominal interest rate is the yield on three-month Treasury bills or the three-month interbank rate. *CREDIT* is the difference between the yield on Moody's Baa-rated and Aaa-rated corporate bonds. *TERM* is the difference between the short- and long-term interest rate. *TED* is defined as the difference between the interbank rate and the nominal interest rate. *TAX* is the corporate tax rate, and *GDP* is the real GDP growth.

capital market systems. However, firm characteristics are also important in determining capital structure, and in evaluating the pecking order theory. Some of the control variables in the literature have had a persistent influence on capital structure decisions (Frank and Goyal 2009). We use a broad set of controls to examine the effects of cash ($CASH$), operating income ($OINC$), capital expenditures ($CAPX$), Tobin's Q (Q), research & development expenditures ($RANDD$), age (AGE), and size ($SIZE$). All variables are scaled by total assets, except for age and size. We construct the size variable as the natural logarithm of sales measured in 2000 US$ in order to be a sufficient proxy for overall firm size in different countries. These variables represent standard capital structure determinants, and are frequently used in corporate finance research(see, e.g., in Frank and Goyal (2009), Huang and Ritter (2009) and Cook and Tang (2010), among others).

2.5 Empirical results

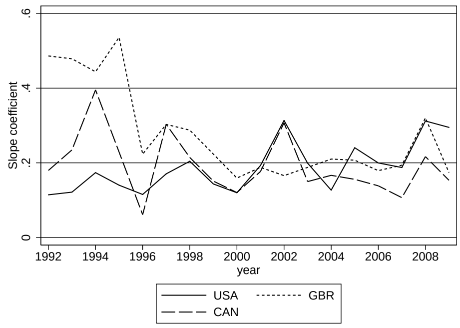
2.5.1 The pecking order over time

We start with the simple model of Shyam-Sunder and Myers (1999) to analyze how the pecking order model performs over time. In our first step, we include only the financial deficit, as follows:

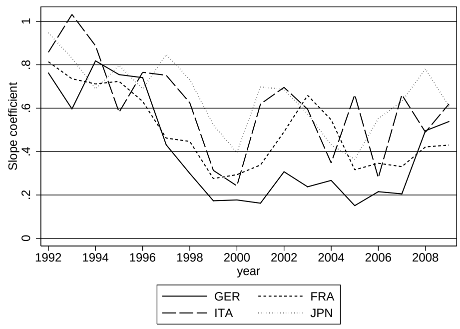
$$\Delta D_{it} = a_t + b_t DEF_{it} + \epsilon_{it} \tag{1}$$

where ΔD_{it} is the net debt issue, and DEF_{it} is the financial deficit. If the pecking order model is correct for describing a firm's capital structure choices, the DEF coefficient (b_t) should equal 1. Firms prefer debt over equity because of the lower costs of asymmetric information. Hence, they should finance their deficits with debt. We perform the regression for all seven countries separately and examine the development of the coefficient. We than divide the sample into bank- and market-based capital markets, and explore the chronological development over time. This provides a first glance at the differences and time series development of the coefficient. According to our Hypotheses I and II, we expect to see a higher pecking order coefficient in bank-based countries, as well as a generally converging pecking order coefficient.

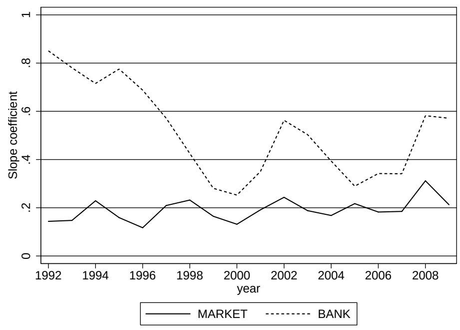
Panel A of Figure II shows that the pecking order coefficient in a market-based system ranges from 0.1 to 0.5 and is relatively stable over time. The same pattern



(A) Market-based



(B) Bank-based



(C) Bank-based vs. market-based

Figure II – Pecking order coefficient across countries and over time
The three panels show the pecking order coefficient over time under different capital market systems. The coefficient is obtained by estimating $\Delta D_{it} = a_t + b_t DEF_{it} + epsilon_{it}$ separately for each year and country. ΔD_{it} is the net debt issue, and DEF_{it} is the financial deficit (net debt issue plus equity issue). Panel A contains the market-based countries the U.S., Canada and the U.K., Panel B contains the bank-based countries: Germany, France, Italy, and Japan. In Panel C the regression is carried out for the two capital market systems.

is observable in all three countries, at least after 1995. The coefficient peaks occur in 1994, 2001 and 2008, which correspond to periods of recession in the respective countries. Firms from market-based countries seem to follow a pecking order more often during times of recession, when the access to equity capital markets is more constrained.

In the second panel, we see that bank-based countries have a much more volatile coefficient that declines over time. This confirms our Hypothesis II, that the proportion of equity and debt used to finance deficits has converged recently. Hence, we see the convergence of the financial systems. The different recessionary times again show the same patterns: The pecking order coefficient seems to be higher during economic downturns, and firms also seem to use more debt in these times. The overall range of the pecking order coefficient in bank-based countries is from about 0.9 to 0.2. The coefficient seems to decline from its high in the early 1990s.

In the third panel, we compare only bank- and market-based systems. While the bank-based coefficient seems to decline during the late 1990s, it is higher than that in market-based countries. This implies that in bank-based systems, firms tend to cover financial deficits with debt more often than in market-based countries. This finding is consistent with our Hypothesis I.

Equity markets in bank-based countries are not as developed as they are in market-based countries, and the legal system tends to be more lender-oriented. Consequently, there is a higher level of information asymmetry between shareholders and management. As we noted earlier, banks have the critical access to information. Equity issues are thus more expensive than in market-based countries, because shareholders demand a higher premium. Firms tend to have extremely close ties to their so-called house banks, and therefore they use more debt for financing because it is relatively cheaper. If we compare our results to Huang and Ritter (2009), we find a somewhat lower coefficient for the U.S. in the years the data overlaps. The DEF coefficient seems stable at around 0.2 in market-based countries, which confirms the findings of Huang and Ritter (2009). The overall picture is also consistent with Shyam-Sunder and Myers (1999), who document strong evidence for the pecking order during the early 1990s, and with Frank and Goyal (2003), who document a declining pecking order coefficient in the 1990s.

However, in both financial systems the coefficient is far from 1 and thus the pecking order theory cannot explain overall firm behavior. There are several possible reasons why firms would not follow a pecking order, or why the simple Shyam-

Sunder and Myers (1999) test does not capture the patterns. The objections of Chirinko and Singha (2000) are one possible explanation, but they are econometric in nature. The authors argue that debt/equity issue policies (issues in constant proportions) can bias the coefficient downwards. However, the focus of our study lies in comparing the pecking order in different financial systems. Even if the problems mentioned by Chirinko and Singha (2000) prevent us from making exact quantitative statements, we can still make qualitative judgments about the importance of the pecking order in different financial systems.

2.5.2 The pecking order and the sign of the deficits

Another reason the pecking order performs so poorly could be that firms behave differently depending on whether they have a positive or negative financial deficit. For example, firms with a surplus might follow a pecking order, but firms with a deficit perhaps do not (or vice versa). Therefore, we differentiate between positive and negative financial deficits in our next step.

It is also possible that the standard DEF coefficient is incorrect because firms behave differently depending on the sign of the financial deficit. In the case of a positive financial deficit (a surplus) firms could use funds to buy back equities or issue dividends, rather than paying debt back first. De Jong et al. (2010) account for these these differences in a study of the pecking order in the U.S. They document a higher pecking order coefficient when firms have a surplus. However, for firms running deficits, the DEF coefficient is low, which is contrary to pecking order predictions. Firms with large deficits have even lower coefficients, indicating that the pecking order model performs poorly for these firms. We extend De Jong et al.'s (2010) tests to our G7 sample, and estimate

$$\Delta D_{it} = a_t + b_t NDEF_{it} + PDEF_{it} + \epsilon_{it}, \tag{2}$$

where $NDEF_{it}$ are negative deficits (financial surpluses), and $PDEF_{it}$ are positive deficits. Shyam-Sunder and Myers (1999) note different implications for deficits and surpluses (see section 2.3). Optimistic managers wish to buy back shares in order to obtain higher prices by reducing the supply of shares. Pessimistic managers tend to evaluate their firms' share prices as too high, and they do not buy back shares. As a result, only optimistic managers will be able to drive up prices until their own evaluation meets investor evaluations. In equilibrium, only debt repurchases will occur. We extend this reasoning to the difference between bank- and market-based systems: We expect to see a lower pecking order coefficient for surpluses in bank-based systems than in market-based systems, because the pressure to buy back shares is less pronounced.

Our first step here is to estimate Equation (2), but with separate positive and negative deficits. This is not exactly De Jong et al.'s (2010) method; they use a dummy variable to capture the effects. Nevertheless, we believe our results are quite comparable to theirs. We find high coefficients in both systems for negative deficits, e.g., surpluses. Both are in the range of 1, and indicate that firms mainly use surpluses to buy back debt, as per Shyam-Sunder and Myers (1999). However, the coefficient on positive financial deficit is much lower than is needed for pecking order behavior. It is higher for banks, but it is below 0.3 in both cases. These results are consistent with De Jong et al. (2010), who find 0.155 for deficits and 0.901 for a surplus in the U.S. The results in Huang and Ritter's (2009) long U.S. sample (from 1961 to 2001) are lower for surpluses and higher for deficits. But the results for their short sample (from 1981 to 2001) are qualitatively similar to ours. For their long sample, they find a 0.5 coefficient on the financial deficit. Overall, Huang and Ritter's (2009) results indicate a declining pecking order coefficient, as they report a higher coefficient for the long-run sample, and a lower coefficient for their short-run sample.

We also need to determine how firm characteristics commonly used in the capital structure literature (Huang and Ritter 2009; De Jong et al. 2010; Frank and Goyal 2008) influence the positive pecking order coefficient. To do this, we include interaction terms with the positive financing deficit ($PDEF$) in Columns 2 and 4. Equation (3) has the definition:

$$\Delta D_{it} = a_t + b_t NDEF_{it} + (c + dCHE_{it} + eCAPX_{it} + fQ_{it} \\ + gRANDD_{it} + hSIZE_{it} + jAGE_{it} + kTANG_{it}) \times PDEF_{it} + \epsilon_{it} \quad (3)$$

Here, we first explore the differences between bank- and market-based systems. A higher cash holdings variable (CHE) has a negative influence on the pecking order coefficient in both financial systems, while capital expenditures ($CAPX$) and Tobin's Q (Q) have a negative influence. The expenditures on research and development ($RAND$) have a positive influence in market-based countries and a

Table IV – Deficit versus surplus

	Market		Bank	
	(1)	(2)	(3)	(4)
VARIABLES	ΔD	ΔD	ΔD	ΔD
NDEF	1.045***	0.881***	0.839***	0.676***
	(0.034)	(0.029)	(0.048)	(0.033)
PDEF	0.137***	0.158***	0.292***	0.186***
	(0.015)	(0.036)	(0.046)	(0.070)
PDEF×CHE		−0.304***		−0.408***
		(0.025)		(0.048)
PDEF×CAPX		−0.255**		−0.324**
		(0.108)		(0.144)
PDEF×Q		−0.005**		−0.011**
		(0.002)		(0.005)
PDEF×RANDDD		0.079***		0.033
		(0.016)		(0.028)
PDEF×RANDD		0.151***		−0.615***
		(0.035)		(0.189)
PDEF×SIZE		0.027***		0.061***
		(0.003)		(0.007)
PDEF×AGE		0.004***		0.005***
		(0.002)		(0.002)
PDEF×TANG		0.204***		0.336***
		(0.064)		(0.116)
Constant	4.976***	1.805***	2.923***	0.431
	(0.489)	(0.282)	(0.647)	(0.375)
Observations	60 311	52 778	61 201	42 053
R-squared	0.262	0.422	0.455	0.657

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The sample period is 1992-2009. We estimate the equation $\Delta D_{it} = a_t + b_t NDEF_{it} + PDEF_{it} + \epsilon_{it}$ in columns 1 and 3, where $NDEF_{it}$ are negative deficits (financial surpluses), and $PDEF_{it}$ is the positive financial deficit. In columns 2 and 4 we add interaction variables with the positive deficit. These are CHE as the cash holding, $CAPX$ as capital expenditures, Q as Tobin's Q, $RANDD$ as research and development expenditures, $RANDDD$ corresponding to 1 if $RANDD$ is missing and 0 otherwise, $SIZE$ as the natural logarithm of sales in 2000 US$, AGE as the number of years a firms is in Compustat, and $TANG$ as tangibility. We correct the p-values for correlations across observations for a given firm and a given year (Rogers 1994).

negative influence in bank-based countries. Size, age and tangibility (*TANG*) all have a positive influence on the pecking order coefficient in both systems.

In our second step, we relate the signs of the coefficients to the pecking order theory. The negative sign on cash holdings is consistent with pecking order theory, because firms generating high levels of cash can use internal financing. Capital expenditures have a negative sign as well. We would expect that the magnitude of expenditures does not influence decisions between equity or debt. However, a negative sign indicates that firms with higher capital expenditures use more equity. This finding contradicts the predictions of the pecking order theory that there would be no influence. Moreover, Tobin's Q has a negative influence: Firms with a high Q tend to be growth firms, and have a lower pecking order coefficient. This is in line with theory, because growth firms have higher costs of financial distress, and higher degrees of asymmetric information. Research and development expenditures lead to a higher pecking order coefficient in market-based systems, which is also consistent with theory. The influence of research and development in bank-based countries may be doubtful, however, as the coefficient indicates a highly significant negative influence. *RANDD* has a very low mean in bank-based countries at 0.012, and has several missing values. An accounting problem in Compustat might be the problem. Size and age have a positive influence on the DEF coefficient. We assume that older and larger firms tend to have higher analyst coverage (Drobetz et al. 2010), and hence lower costs of asymmetric information. This implies they can use more debt. Tangibility has a positive impact on the pecking order coefficient. Firms with a high proportion of property and plants have higher marginal debt issuing activity. These firms have a lower degree of asymmetric information and lower costs of financial distress, because their assets are easy to value and liquidate. This is in line with the predictions of the pecking order theory.

The results indicate that the pecking order predictions hold for most of the influences of firm characteristics; however, the overall performance of the positive financing deficit is still poor. The influence firm characteristics, especially, Tobin's Q, age and tangibility, are somewhat dependent on the extend to which pecking order theory can explain their financing behavior.

2.5.3 The pecking order and the deficit size

The next step is to investigate the magnitude of deficits. From the pecking order theory, we know that the direction of influence is expected to be unclear. Large deficits are normal for small growth firms with many investment opportunities and large information asymmetries. In fact, because of the information asymmetries, we would argue that firms with large deficits direct their financing activities more toward a pecking order. However, banks and the market for corporate debt may not be able (or willing) to grant enough debt. Small firms would therefore have to use equity. Thus, we could argue that firms with large deficits also tend to issue relatively more equity capital. Hypothesis I states that firms in bank-based countries can take on more debt, and therefore the pecking order coefficient for larger deficits should be higher. We divide our sample along the size of deficits and surpluses into four groups (quartiles) and run the regressions separately. We do not use controls because we are only interested in the different DEF coefficients. Table V gives the results.

The highest pecking order coefficient, 0.9, appears for the smallest deficits in bank-based countries. The coefficient in market-based countries is slightly lower. The overall coefficient in bank-based countries is higher, 0.27 to 0.13. However, this is quite low from a pecking order perspective. As the low coefficient shows, the pecking order theory is not a good predictor of the largest deficit in either system. The coefficient is below 0.07 in market-based countries, and it is 0.20 in bank-based countries. Creditors may be more reluctant to lend when deficits are large, and thus firms may need to go to the capital markets. This is consistent with De Jong et al. (2010), who also find very low coefficients for high deficits. The effect is even more pronounced in marked-based countries; hence, in bank-based countries, creditors seem willing to lend more, confirming our Hypothesis I. For medium and larger deficits, the pecking order coefficients range from 0.45 to 0.83. In both cases, the coefficients in bank-based systems are higher than those in market-based systems. This observation provides further evidence for our hypothesis that firms in bank-based system can take on more debt.

In the case of surpluses, the coefficients are – with one exception – above 0.6 and slightly higher in market-based countries. Firms in these countries use surpluses to buy back more debt. However, the results for the largest surpluses are not in line with theory predictions, as they are not fully used to buy back debt. One possible explanation may be that managers tend to smooth dividends (Allen and Michaely 2003), but in years with extremely high surpluses, they buy back shares or pay extra dividends. The pecking order theory does not account for this behavior. Except for very large surpluses, we can confirm the arguments of Shyam-Sunder

Table V – Deficit and surplus size

Panel A – Market

VARIABLES	(1) Overall deficit ΔD	(2) Smallest ΔD	(3) Medium small ΔD	(4) Medium large ΔD	(5) Largest NETD	(6) Overall surplus ΔD	(7) Smallest NETD	(8) Medium small ΔD	(9) Medium large ΔD	(10) Largest ΔD
PDEF	0.127***	0.792***	0.739***	0.449***	0.065***					
	(0.014)	(0.047)	(0.043)	(0.023)	(0.013)					
NDEF						0.722***	0.844***	0.815***	0.913***	0.629***
						(0.026)	(0.113)	(0.089)	(0.076)	(0.042)
Constant	7.253***	−0.788***	−0.639**	2.933***	23.240***	−1.350***	−0.630***	−0.674*	−0.251	−3.891***
	(0.534)	(0.158)	(0.296)	(0.321)	(1.431)	(0.237)	(0.203)	(0.384)	(0.582)	(0.785)
Observations	39713	10074	10069	10064	9496	20608	5161	5156	5154	5126
R-squared	0.144	0.029	0.033	0.042	0.033	0.368	0.008	0.011	0.037	0.209

Panel B – Bank

VARIABLES	Overall deficit ΔD	Smallest ΔD	Medium small ΔD	Medium large ΔD	Largest ΔD	Overall surplus ΔD	Smallest ΔD	Medium small ΔD	Medium large ΔD	Largest ΔD
PDEF	0.272***	0.897***	0.842***	0.754***	0.199***					
	(0.043)	(0.033)	(0.037)	(0.032)	(0.037)					
NDEF						0.584***	0.885***	0.766***	0.774***	0.438***
						(0.031)	(0.078)	(0.052)	(0.044)	(0.042)
Constant	5.545***	−0.314***	−0.222	0.215	18.370***	−1.647***	−0.270*	−0.683***	−0.842**	−5.248***
	(0.831)	(0.104)	(0.204)	(0.346)	(1.925)	(0.233)	(0.154)	(0.211)	(0.330)	(0.619)
Observations	32963	8256	8257	8257	8179	28251	7060	7063	7060	7053
R-squared	0.349	0.041	0.056	0.089	0.208	0.364	0.022	0.024	0.055	0.150

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The sample period is 1992-2009. We estimate the equation $\Delta D_{it} = a_t + b_t DEF_{it} + \epsilon_{it}$, where DEF_{it} is either $NDEF_{it}$ (negative deficits) or $PDEF_{it}$ (positive financial deficits). We sort the firm year observations along the size of the deficits and build quartiles. The regressions are ran separately for positive and negative deficits. The p-values are corrected for correlation across observations for a given firm and a given year (Rogers 1994).

and Myers (1999) that firms in equilibrium should buy back debt, with coefficients slightly below 0.9. With the largest surpluses (0.6 in market-based countries, 0.4 in bank-based) managers seem to follow a different reasoning, and, surprisingly, the coefficient is smaller in bank-based systems. It may be that buying back debt in such large amounts is not possible, because banks do not allow firms to cancel long-term debt contracts.

In summary, we find that pecking order theory does explain the financing behavior of large deficits. Apart from pure size, it may be that some firms are debt-constrained. They may be considered uncreditworthy, and thus can not follow a pecking order. To further investigate this question, our next model uses a more direct measure of debt constraints.

2.5.4 The pecking order and debt constraints

To broaden our understanding of which types of firms follow a pecking order in their financing decisions, we check for the influence of financial constraints. We hypothesize that financially constrained firms do not follow a pecking order because they are not able to borrow. Their creditworthiness may be suspect, or banks and debt markets may have other reasons to decline funding. We further hypothesize that fewer firms in market-based countries will be able (or willing) to follow a pecking order, because equity is relatively cheaper and banks are not as specialized in monitoring highly leveraged firms.

Several approaches exist in the literature to determine, whether a firm is financially constrained. One measure used, Korajczyk and Levy (2003), for example, use dividend distributions. Because many investors look at the credit rating of a firm in their decision-making process, the rating is a natural way to observe any signs of financial constraints. However, as we noted earlier, only a small subsample of firms have ratings, and other solvent firms may have opted not to be rated. This problem is especially severe in an international sample, because ratings are much more common in market-based countries. To overcome this problem, we use Lemmon and Zender's (2010) measure, which estimates the probability that a firm will be able to access public debt markets. In particular, they use a logit regression to estimate the probability of a firm having a bond rating.[12] In our regressions, we use the natural logarithm of total assets, return on assets, tangibility, market-to-book

12 The results of the regression are in Appendix A.

Table VI – Debt constraints

Panel A – Market			
	(1)	(2)	(3)
	Unconstrained	Medium constrained	Constrained
VARIABLES	ΔD	ΔD	ΔD
DEF	0.687***	0.147***	0.187***
	(0.037)	(0.016)	(0.021)
Constant	0.000	2.342***	0.729**
	(0.230)	(0.570)	(0.285)
Observations	9257	36876	14178
R-squared	0.708	0.187	0.231
Panel B – Bank			
	Unconstrained	Medium constrained	Constrained
VARIABLES	ΔD	ΔD	ΔD
DEF	0.762***	0.291***	0.499***
	(0.021)	(0.048)	(0.080)
Constant	0.048	0.847*	0.722**
	(0.181)	(0.490)	(0.337)
Observations	11857	40159	9185
R-squared	0.816	0.383	0.579

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

This table contains regressions of the form $\Delta D_{it} = a_t + b_t DEF_{it} + epsilon_{it}$, where DEF_{it} is the financial deficit. Firms of the years 1992 to 2009 are sorted by the probability of being financially constrained. The measure is the result of logit regression, where the dependent variable is the existence of a debt rating and the independent variables are several firm specific measures (see Appendix A). When firm's probability of having a rating is below 25 % we classify it as constrained. A probability above 75% leads to a classification as unconstrained. We correct the p-values for correlations across observations for a given firm and a given year (Rogers 1994). .

ratio, leverage, firm age, and the standard deviation of earnings as ratings predictors. The dependent variable is a dummy equal to 1 when the firm has a rating, and 0 otherwise. We use the Standard & Poor's RatingExpress database. There are three generally dominant rating agencies, but the resultant probability should capture the financial health of a firm, because they all use roughly the same inputs. We then build three groups: constrained, medium-constrained, and unconstrained, and we perform the pecking order regressions.[13]

The results in Table VI indicate, as in Lemmon and Zender (2010), that the pecking order does not explain the behavior of constrained firms. The coefficients are only 0.187 and 0.147, respectively, for constrained and medium-constrained firms in market-based countries. Unconstrained firms have a 0.687 coefficient. In bank-based countries, the results are somewhat different: The coefficient for unconstrained firms (0.762) is in the same range as for market-based firms (0.687), and it is only slightly higher. So for unconstrained firms, pecking order theory provides a good explanation for firm behavior. But the coefficients on medium (0.291) and constrained (0.499) firms are also higher than in market based countries. This is in line with the observation that firms need lower equity stacks in bank-based countries. It is surprising that the pecking order coefficient on medium constrained firms (0.291) is the lowest for bank-based countries. this implies that unconstrained and constrained firms seem to use debt first when external finance is needed, while medium-constrained firms use the equity market. In bank-based countries, bank debt for firms with high asymmetric information seems to be relatively cheaper than for firms with medium constraints. This corresponds to the findings of Bolton and Freixas's (2000) theoretical model. In equilibrium, riskier firms use bank debt, because banks have the lowest monitoring costs. Medium-risk firms tend to issue bonds and equity, and low-risk firms issue safe bonds.

2.5.5 The pecking order and the macroeconomy

While firms' risk characteristics can be one source of financial constraints, capital shortage can be another. During periods of recession, banks may be unwilling to fund firms. We next test for the influence of the macroeconomic environment.

13 A firm is constrained if the probability of having a rating is below 0.25. It is unconstrained when the probability is higher than 0.75. We use a larger group for medium-constrained firms because we are mainly interested in the behavior of constrained and unconstrained firms. We also expect that the middle body of firms would generally be of medium health.

We also need to test whether firms and the two financial systems behave differently during different businesses cycles. Capital supply and demand could depend on the economic state. Recessions lead to deep declines in cash flows, in line with tighter capital market and bank conditions (Halling et al. 2011). So, on the one hand, banks may be more constrained than capital markets because they have long-lasting lending relationships and may not grant new loan contracts. This should be even more pronounced in bank-based countries, because banks are the main source of funding, and firms will only go to the capital markets as a last resort. On the other hand, capital markets in bank-based countries may run dry faster than banks. The pecking order theory would then be a better description of the behavior during downturns in bank-based countries.

Another hypothesis is that the size of the risk premium impacts a firm's financing behavior: Firms can use equity when the risk premium is low, and debt when it is high. This is the main hypothesis of Baker and Wurgler's (2002) market timing theory, and is in contrast to pecking order. As per our Hypothesis III, we expect this behavior be more pronounced in market-based countries.

Our first step is include a dummy for recessions,[14] in order to test the general influence of economic cycles. We use it as an interaction term to determine its influence on the pecking order coefficient. Column 1 of Table VII gives our results for all countries when a recession dummy is included. The dummy variable is significant at the 5%-level, and is below 0.1. A recession in a country generally leads to a slightly higher pecking order coefficient. However, when we separate bank- and market-based countries (columns 3 and 5), we see that the recession only affects bank-based countries. The coefficient on the recession interaction term in market-based countries is neither large at 0.03, nor significant. In bank-based countries, the coefficient is near 0.2 and quite significant. The behavior in bank-based countries thus seems cyclical. During poor economic times, firms rely more heavily on debt, and capital markets in bank-based countries seem to be hit harder.

In the even columns of Table VII, we further check for the influence of the macroeconomic environment using several indicators of economic health. We use the lagged equity risk premium, calculated as the six-month-lagged twelve-month mean return of the market index, the real interest rate, the U.S. credit spread, the term spread, the corporate tax rate, the TED spread, and the real GDP growth. All variables are interacted with the positive deficit.

14 We use the definition from the Economic Cycle Research Institute (www.businesscycle.com).

Table VII – Pecking order and macroeconomic environment

	All		Market		Bank	
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	ΔD	ΔD	ΔD	ΔD	ΔD	ΔD
NDEF	0.952***	0.898***	1.045***	0.992***	0.822***	0.732***
	(0.037)	(0.034)	(0.033)	(0.032)	(0.046)	(0.031)
PDEF	0.163***	0.346***	0.136***	0.346***	0.272***	0.238*
	(0.017)	(0.084)	(0.015)	(0.078)	(0.043)	(0.132)
PDEF×ERP		0.000		0.000		−0.001
		(0.001)		(0.001)		(0.001)
PDEF×REAL		−0.006		0.003		0.035
		(0.009)		(0.010)		(0.023)
PDEF×CREDIT		−0.067***		−0.039**		0.089
		(0.022)		(0.019)		(0.063)
PDEF×TERM		0.001		−0.006		0.011
		(0.011)		(0.012)		(0.037)
PDEF×TAX		0.002		−0.008***		0.009***
		(0.002)		(0.003)		(0.002)
PDEF×GDP		−0.027***		−0.002		−0.004
		(0.008)		(0.007)		(0.012)
PDEF×TED		−0.039**		0.025*		0.004
		(0.017)		(0.015)		(0.035)
PDEF×REC	0.097**		0.028		0.220***	
	(0.040)		(0.044)		(0.042)	
Constant	4.145***	3.279***	4.963***	4.434***	2.616***	0.845***
	(0.438)	(0.324)	(0.483)	(0.388)	(0.639)	(0.308)
Observations	121 512	94 976	60 311	43 435	61 201	51 541
R-squared	0.314	0.387	0.262	0.328	0.472	0.615

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The sample period lasts from 1992–2009. We estimate the equation $\Delta D_{it} = a_t + b_t NDEF_{it} + PDEF_{it} + PDEFit \times REC_{it} + \epsilon_{it}$ in column 1, 3 and 5 where $NDEF_{it}$ are negative deficits (financial surpluses), and $PDEF_{it}$ are the positive deficits. $PDEF \times REC$ is an interaction term constructed form the positive financial deficit and a dummy for recessions. In columns 2, 4 an 6, we add interaction variables with the positive deficit: the equity risk premium (ERP), the real interest rate ($REALINT$), the term spread ($TERM$), the TED spread (TED), the corporate tax rate (TAX), and real GDP growth (GDP). We correct the p-values for correlations across observations for a given firm and a given year (Rogers 1994).

Contrary to Huang and Ritter (2009), we do not find any significance for the equity risk premium. The real interest rate is also insignificant. In market-based countries, the U.S. credit spread has a significantly negative impact on the pecking order coefficient. During riskier times, firms are thus directed to the capital markets, which indicates that banks are less successful in providing funds than equity markets. The U.S. credit spread also shows no significance in bank-based countries. However, the corporate tax rates are significant, with a negative sign in market-based countries and a positive sign in bank-based ones. This could be explained partially by different taxation rules. A lower corporate-level tax rate would favor debt over equity, in line with findings in bank-based countries. But in market-based countries, a high tax rate drives down the pecking order coefficient, lowering debt issues. This is somewhat puzzling, because some countries have tax legislation on dividends to account for corporate taxation. And interest income, in contrast, is taxed fully. The tax code here appears to favor equity.

In our aggregated sample in Column 2, the real GDP growth rate (with a negative sign) and the TED spread (negative sign) are also significant. A negative sign on GDP growth indicates that during times of high growth opportunities, firms will use slightly more equity. The coefficient on the TED spread suggests that, during risky times, firms use on average more debt. Overall, only a few macroeconomic variables show significance. We find evidence of market timing during recessions in bank-based countries, but not with macroeconomic proxies.

However, until now, we have only checked pecking order theory with observations of the DEF coefficient. Because there is some methodological critique (Chirinko and Singha 2000), we also calculate another model that examines the decision processes of firms. It also serves as a robustness test.

2.5.6 The pecking order and the decision of the firm

A necessary assumption of the pecking order model is that financing decisions are exogenous. But it is possible that firms may decide jointly whether and what kind of securities to issue. To account for this behavior, Huang and Ritter (2009) estimate a nested logit model. The advantage of this type of model is that it can reduce the influence of extreme observations. [15] According to Flannery and Rangan (2006), changing firm characteristics, instead of changing market conditions, can also affect

15 Huang and Ritter (2009) note that, in a nested logit model, the amount of securities being issued is irrelevant, and firms will be assigned the same value.

the pecking order coefficient. Therefore, firm characteristics are also included.

The model has two decision levels: 1) whether to issue securities, and 2) whether to issue debt or equity. A firm is defined as issuing debt (equity) if the change in NETD (NETE) is larger than 5%. We follow Huang and Ritter's (2009) notation and modeling. The probability of security issuance is thus $Pr(i)$, where issuance is $(i = s)$, and no issuance is $(i = n)$. The probability of a security issue is given in Equation (5). The conditional probabilities are $Pr(j|s)$ where $(j = d)$ for debt, and $(j = e)$ for equity. These probabilities are in Equation (4):

$$Pr(j|s) = \frac{exp(x_{sj}\beta)}{exp(x_{se}\beta) + exp(x_{sd}\beta)} \tag{4}$$

and

$$Pr(s) = \frac{exp(y_s\alpha + \eta_s I_s)}{exp(y_s\alpha + \eta_s I_s) + exp(y_n\alpha + \eta_n I_n)}, \tag{5}$$

where $I_i = ln(exp(x_{ie}\beta) + exp(x_{id}\beta))$, and x_{ij} and y_{ij} are vectors with i and j explanatory variables. The numerator is the logistic expression for the occurrence, and the denominator is the combined expression for every occurrence. Non-issuers are the base for the first level, while debt is the base for the second level. The system is estimated by using maximum likelihood.

The results are shown in Table VIII. With a few exceptions, we use the same set of explanatory variables as Huang and Ritter (2009).[16] For the base decision, "Issue or Not", we find results similar to Huang and Ritter (2009) for market-based countries. Thus, cash has a negative impact on the issue decision, consistent with pecking order. But it is not significant in bank-based countries, where the preference for external finance seems lower. Not surprisingly, capital expenditures have a positive impact, along with Tobin's Q and research and development. In this kind of regression, the recession dummy is significant. Note that, in marked-based countries, the dummy has a positive impact on the issuance decision; in bank-based countries, it has is a negative impact. During times of recession, market-based firms have a higher issue probability, and bank-based firms have a lower one. The equity risk premium, however, has a positive impact. Thus, firms tend to issue after periods of high risk premiums. Furthermore, the U.S. credit spread has a negative influence on issue probability. When the price for taking on risk is too high, firms tend not to issue. But the real GDP growth rate has a positive influence. This rate is an indicator

16 Contrary to Huang and Ritter (2009), we excluded the lagged and forwarded market return in order to obtain a more manageable number of observations.

Table VIII – Nested logit model

	Market		Bank	
	(1)	(2)	(3)	(4)
	Issue	Kind	Issue	Kind
VARIABLES	yes	equity	yes	equity
CHE	−0.7840***	−0.0476	−0.1050	−0.0548
	(0.0812)	(0.0540)	(0.1230)	(0.1070)
OIBD	−0.5540***	−0.6620***	−0.0093	0.0735
	(0.1710)	(0.2480)	(0.1920)	(0.1420)
CAPX	4.0470***	−0.4420**	3.6290***	0.3010
	(0.1900)	(0.2130)	(0.3310)	(0.5890)
Q	0.2550***	0.0457***	0.3190***	−0.0087
	(0.0150)	(0.0162)	(0.0235)	(0.0176)
RANDDD	0.0856***	−0.0673**	0.2060***	0.0128
	(0.0273)	(0.0318)	(0.0308)	(0.0249)
RANDD	1.3090***	0.8840**	2.8660***	−0.4210
	(0.3180)	(0.3520)	(0.6150)	(0.8480)
SIZE	−0.0205*	−0.0717***	−0.0256*	0.0191
	(0.0113)	(0.0270)	(0.0141)	(0.0374)
AGE	−0.0134***	−0.0026	−0.0523***	−0.0018
	(0.0027)	(0.0021)	(0.0040)	(0.0036)
BL	0.2070***	0.2900***	0.2740**	−0.1780
	(0.0639)	(0.1040)	(0.1240)	(0.3510)
RATING	−0.0239	−0.0385	−0.0708	−0.0585
	(0.0357)	(0.0284)	(0.0642)	(0.1140)
ERP	0.0033***	−0.0026**	0.0027***	0.0011
	(0.0010)	(0.0012)	(0.0008)	(0.0021)
REAL	−0.0087	−0.0551**	0.0595***	−0.0046
	(0.0127)	(0.0237)	(0.0216)	(0.0105)
CREDIT	−0.0697*	0.0740**	−0.1440***	0.0130
	(0.0393)	(0.0363)	(0.0298)	(0.0255)
TERM	0.0090	0.0219	−0.1160***	0.0260
	(0.0134)	(0.0139)	(0.0345)	(0.0516)
TAX	0.0058	0.0204**	−0.0120***	0.0029
	(0.0048)	(0.0087)	(0.0025)	(0.0058)
GDP	0.0431***	−0.0053	0.0482***	0.0012
	(0.0087)	(0.0059)	(0.0058)	(0.0024)
REC	0.1600***	−0.0619	−0.2540***	0.0454
	(0.0516)	(0.0427)	(0.0425)	(0.0874)
Constant		−0.3040**		0.0816
		(0.1300)		(0.1670)
Observations		104 652		103 368

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The sample is from 1992 to 2001. The probability of a security issue is $Pr(s) = \frac{exp(y_s\alpha+\eta_s I_s)}{exp(y_s\alpha+\eta_s I_s)+exp(y_n\alpha+\eta_n I_n)}$, the conditional probabilities are $Pr(j|s)$ with $(j = d)$ for debt and $(j = e)$ for equity. These probabilities are $Pr(s) = \frac{exp(y_s\alpha+\eta_s I_s)}{exp(y_s\alpha+\eta_s I_s)+exp(y_n\alpha+\eta_n I_n)}$, where $I_i = ln(exp(x_{ie}\beta) + exp(x_{id}\beta))$. In the equation, x_{ij} and y_{ij} are vectors with the explanatory variables according to their category, i and j. The numerator is the logistic expression for the occurrence, the denominator is the combined expression for every occurrence. Non-issuers are the base for the first level and debt is the base for the second level. The system is estimated by means of maximum likelihood.

of investment opportunities. Firms issue capital when there are high investment opportunities.

When it comes to whether to issue equity or debt, in bank-based countries, none of the variables is significant. It seems that the decision is not driven by either firm-specific or macroeconomic variables, which is surprising. However, this finding may be attributable to the fact that equity markets rely on firm disclosures. In bank-based countries, banks are tied more directly to firms, and can monitor by direct intervention (Hypothesis IV). So the data used does not appear to be the same criteria on which firms and investors are relying. We find no evidence for a pecking order with this model.

For market-based countries at this decision level, firm characteristics and the macroeconomic environment are significant. High profitability lowers the probability of issuing equity, while a high Tobin's Q increases the probability, size lowers it, and book leverage also raises it. These findings are all consistent with the pecking order theory. As we discussed earlier, highly profitable firms can access the debt markets. They are also less likely to be debt-constrained, and can follow a pecking order. A high Tobin's Q indicates high growth opportunities. Firms with this characteristic tend to be small and young, with a high degree of asymmetric information. Pecking order theory predicts a higher use of equity as can be found in the data. The same reasoning is valid for research and development expenditures. Book leverage has a positive impact. But as a proxy for risk, an influence toward equity is consistent with the pecking order. The reverse is true for size.

The lagged equity risk premium shows an influence toward debt. Thus, firms use debt more frequently when the equity risk premium is high. Furthermore, the real interest rate drives firms to use debt, while a high credit spread drives them more toward equity. A high corporate tax rate would also be expected to drive them toward equity. This finding indicates at least some market timing in the issuance decisions of firms in market-based countries.

Overall, our results are mixed: Market timing and pecking order both offer partial explanations. However, for market-based firms, the results show that the influence of firm characteristics is consistent with our findings from the regression approach and would be expected from pecking order theory. For bank-based countries, we find no significant results for deciding what type of security to issue. We hypothesize that the criteria for this decision may not be available from balance sheet data.

2.6 Conclusion

This paper evaluates the pecking order theory under different capital market systems and economic states. We check the pecking order across time and across countries, and we added different influences to determine the influence of various settings. We also explore the impact of positive and negative deficits, different deficit sizes, debt constraints, the macroeconomic environment, and firm decisions.

We find evidence of a declining pecking order coefficient. In other words, its explanatory abilities weaken over time. However, the results are driven primarily by large deficits. If we exclude large deficits, we find stronger evidence for the pecking order. We also find evidence for different financing behavior in bank- and market-based capital systems. In bank-based systems, the explanatory power of the pecking order is higher, but it is low in the sample as a whole.

The different financial market systems come with different sources of financing and costs. Thus, in a market-based country, the cost of using the equity capital markets seems relatively smaller than in bank-based countries. In the case of debt constraints, firms in market-based countries use the capital market with fewer constraints, while bank-based firms can rely longer on debt.

But these findings are only part of the story. We find evidence for an asymmetric cost profile in bank-based countries when it comes to debt capacity. Constrained and unconstrained firms visit the debt market, and follow a pecking order, but medium-constrained firms use equity to finance deficits. This suggests that debt markets in bank-based countries may have a dual role: to finance the small deficits, and to be the lender of last resorts for large deficits.

We also investigated how firms behave during times of recession. For firms in bank-based countries, we find stronger pecking order behavior during recessions, particularly for firms with small deficits. We found that firms with large deficits are excluded from behaving pro-cyclically.

Our paper also sheeds light on firms' decision processes. We find clear determinants for decisions toward equity in market-based countries, while firm-specific and macroeconomic variables in bank based countries are not significant.

However, it is important to note that the financing behavior of firms cannot be explained by one theory alone. Many factors come into play for each form of financing, whether public debt, bank debt, or equity, and each has its own benefits and costs. We identified several influences, such as the development of capital markets and banks, the size of deficits, debt constraints on a firm level, the business cycle, and information asymmetries, characterized indirectly by firm size and age. A theory must account for these influences in order to properly explain the variation in corporate finance decision-making.

Appendix A. Financial constraints estimation

Table IX – Estimation of Debt Capacity

VARIABLES	USA (1)	GBR (2)	CAN (3)	EUR (4)	JPN (5)
AT	0.608***	1.105***	0.817***	1.025***	1.883***
	(0.010)	(0.049)	(0.042)	(0.038)	(0.076)
OIBD	1.075***	−3.560***	−0.285	−2.964***	4.277**
	(0.140)	(0.664)	(0.560)	(1.002)	(1.840)
BL	1.838***	2.548***	2.484***	0.337	−1.691***
	(0.064)	(0.365)	(0.312)	(0.553)	(0.395)
TANG	−0.085	1.406***	0.176	0.774	−0.151
	(0.086)	(0.387)	(0.265)	(0.482)	(0.510)
MTBV	−0.111***	0.314***	0.120*	0.101	−0.183
	(0.019)	(0.085)	(0.067)	(0.098)	(0.133)
AGE	0.074	−0.075	−0.226	1.007***	1.381***
	(0.049)	(0.215)	(0.160)	(0.252)	(0.462)
VOLA	0.003	−0.000	0.012	0.014	0.053**
	(0.004)	(0.028)	(0.014)	(0.020)	(0.022)
Constant	−8.471***	−14.280***	−9.037***	−26.910***	−31.920***
	(0.478)	(1.335)	(0.505)	(0.863)	(1.767)
Observations	45 389	11 503	4937	12 245	39 636

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

This table contains the estimation of the debt capacity. The dependent variable is a dummy equal to 1 if the firm has rating, and 0 otherwise. AT is the natural logarithm of total assets; $OIBD$ is profitability; BL is book leverage; $TANG$ is tangibility; $MTBV$ is the market-to-book ratio; AGE is the number of years a firm is in Compustat; $VOLA$ is the volatility of earnings. The estimation is carried out using a logit regression. The probability of a rating is calculated for each firm after the estimation. A firm is classified as constrained if the probability is below 1/4, as unconstrained if it is higher than 3/4 and as medium-constrained if in between.

Appendix B. Variable definitions

Table X – Data Description

Variable name	Description	Construction	Source
Dependent variables			
NETD	Net debt: change in debt and preferred stock scaled by beginning of year assets	$\Delta(LT_t + PSTK_t - TXDI_t - DCVT_t)/AT_{t-1}$	
NETEQUITY	Change in equity and convertible debt	$\Delta(AT_t - LT_t - PSTK_t + TXDI_t + DCVT_t)/AT_{t-1}$	
NETE	Net equity:change in equity and convertible debt minus change in retained earnings	$nete - \Delta(RE_t)/AT_{t-1}$	
EI	Equity issuer	$= 1\|\Delta NETE/A_{t-1} > 0.05$	
DI	Debt issuer	$= 1\|\Delta NETD/A_{t-1} > 0.05$	
BL	Book leverage	$(LT_t + PSTK_t - TXDI_t - DCVT_t)/AT$	
ML	Market leverage	$(LT_t + PSTK_t - TXDI_t - DCVT_t)/mkvalue + LT_t + PSTK_t - TXDI_t - DCVT_t$	
Explanatory variables			
DEF	Financing deficit	$NETD + NETE$	
NDEF	Negative financing deficit	$= def\|def < 0; 0\|def >= 0$	
PDEF	Positive financing deficit	$= def\|def > 0; 0\|def <= 0$	
ERP	Equity risk premium: stock return of broad market country index t to t-1 minus nominal interest rate matched to fiscal year end	$(marketRET_t - marketRET_{t-1})/marketRET_{t-1} - REAl$	
REALINT	Real country interest rate: 3m or 1m nominal interest rate minus inflation	matched to 6m lag of fical year end	
CREDIT	Default spread: Moody's aaa bond index minus abb bond index	matched to 6m lag of fical year end	
TERM	Term Spread: long-term interest rate minus short term interest rate	matched to 6m lag of fical year end	Datastream
TED	Ted Spread: Euribor return minus nominal 1m gov bond return	matched to 6m lag of fical year end	Datastream
TAX	Statutory corporate tax rate		OECD Tax Database
GDP	Real GDP growth	$GDP_t - GDP_{t-1}/GDP_{t-1}$	
CHE	Cash and Cash Equivalents	CHE/AT	
OIBD	Operating Income before Depreciation	$OIBD/AT$	
Q	Tobin's Q sum of market value of equity and book value of debt divided by book value of assets	$(MKVAL_t + LT_t + PSTK_t - TXDI_t - DCVT_t)/AT$	
RANDD	Research and Development Expense scaled by assets	XRD/AT	
RANDDD	Research and Development Dummy	$= 1\|xrd = ., 0 otherwise$	
SIZE	natural logarithm of net sales in 2000 US$	log(SALE)	Compustat
AGE	Number of years firm is in Compustat		Compustat
RAWRET	Firm return	$(MKVAL_t - MKVAL_{t-1})/MKVAL_{t-1}$	
MARKETRET	Market return of respective market index	$(IND_t - IND_{t-1})IND_{t-1}/$	
MAR	Difference between firm raw return and value weighted market return	$rawRET - marketRET$	
CAPEX	Capital Expenditures	$CAPEX/AT$	
TANG	Net Property, plant, and equipment	$PPENT/AT$	
VOLA	Earnings volatility	$\Delta Earnings - mean(\Delta Earnings)$	

continued

Table X – (continued)

Variables needed for construction			
LT	Total Liabilities		Compustat
AT	Total Assets		Compustat
PSTK	Preferred Stock		Compustat
TXDI	Deferred Taxes		Compustat
DCVT	Convertible Debt		Compustat
RE	Retained Earnings		Compustat
DVT	Dividends - Total		Compustat
CHE	Cash and Equivalents		Compustat
INFLATION	Inflation	$(cpi_t - cpi_{t-12})/cpi_{t-12}$	Compustat
MKVAL	Market value of common equity		Compustat
IND	Respective market index		Compustat
NOM	Nominal short term interest rate		Datastream
XRD	R&D Expenses		Compustat
OPINC	Operating Income		Compustat
GDP	Gross domestic Product		Compustat
CPI	Consumer Price Index		Compustat

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Chapter 3

Illuminating the speed of adjustment – Exploring heterogeneity in adjustment behavior

Abstract

This paper explores heterogeneity in the speed of adjustment. We estimate speed of adjustment using several different econometric methods to ensure robust results against misspecification. The mean speed in our sample is 20%. We compare adjustment speeds in both market- and bank-based economies of the G7 countries and find a higher adjustment speed in market-based countries. Furthermore, we explore heterogeneity in the speed of adjustment induced by different financial circumstances. We find higher speeds for firms with a high financial deficit, medium constrained firms, and highly over-leveraged firms. Finally, we explore how the macroeconomic environment influences the speed of adjustment. Our results indicate a lower speed of adjustment during periods of recession, and reveal market timing in readjustment behavior.

Keywords: Speed of adjustment, constraints, financial systems

JEL Classification Numbers: G30, G32

3.1 Introduction

One of the main questions in modern corporate finance is how fast firms adjust to their target leverage. Huang and Ritter (2009) have called this "the most important issue in capital structure research." This question is important because an estimate of the speed of adjustment is a good guide to the theories underlying capital structure adjustment behavior. A positive speed of adjustment can be interpreted as evidence for a target leverage ratio, or, in other words, a dynamic trade-off model.

Fischer et al. (1989) provide a theoretical formulation of such a model. Their dynamic trade-off model illustrates how even small adjustment costs can lead to large capital structure swings. While a dynamic trade-off model with low or moderate adjustment costs implies a positive speed of adjustment, other capital structure theories find different implications for adjustment speed.

It is interesting to note that the primary competing theory of corporate issue behavior, pecking order theory, predicts no measurable speed of adjustment (Fama and French 2002). Pecking order theory posits that firms prefer internal over external financing and debt over equity, and thus are more likely use the preferred available funding (Myers and Majluf 1984). A negative speed of adjustment is also possible: For example, if firms respond to low equity prices by issuing equity, the measured speed will even be lower than zero (Baker and Wurgler 2002; Dittmar and Thakor 2007). The speed of adjustment is related to every theory of capital structure, and can provide important clues to the soundness of the various theories.

However, when examining the speed of adjustment, it is not only the theoretical implications that are important. All the theories generally state that firms act within the same institutional environment, and generally face the same capital markets, banks and institutional rules. But the global financial environment can have important differences even in developed countries (La Porta et al. 1998; Beck et al. 2009). For example, firms in countries with a more bank-oriented capital market system are often confronted with a less liquid equity market and thus with higher costs of equity. These different institutional environments and macroeconomic conditions may play a role in the differing speeds of adjustment. And a period of recession could lead to a shortage of capital, which could also impact firms' abilities to adjust.

However, besides the extensive U.S. research, there has been relatively little research on the behavior in different countries under different capital market systems.

Notable exceptions are Antoniou et al. (2009), who studies the speed of adjustment in the G5 countries with a focus on cross-country differences, Halling et al. (2011), who uses a set of nineteen countries to study the dynamics over the business cycle, and Dang, Garrett, et al. (2010), who also use G5 countries.

In this paper, we extend and combine the approaches of these three papers, using the G7 as a data set. While the U.S. is still the benchmark for the depth and scope of the data, the G7 have a reliable data structure and enough years to allow the use of different estimators. We explore the heterogeneity in the speed of adjustment in three ways: First, we compare countries to determine whether there are differences between bank- and market-based countries. Second, we examine whether a firm's financial circumstances influence the speed of adjustment. We explore the influence of any financing deficits, financial constraints, or deviations from target leverage. Third, we compare the speed of adjustment through different macroeconomic states, with a broad set of indicators for good and bad states, and for recessions.

But in addition to exploring heterogeneity in the speed of adjustment, we also impose a large set of estimators on our data. This can be seen as an out-of-sample test, because the estimators are tested primarily on U.S. data. Thus, in order to overcome some of the older biases inherent in speed of adjustment research (Iliev and Welch 2010), we use a new estimator for the speed of adjustment developed by Elsas and Florysiak (2010).

We find a 20% speed of adjustment of using all observations and taking the mean of the estimators. However, we find a higher speed of adjustment in market-based countries. Furthermore, we find evidence that firms use high financial deficits to adjust faster. Firms also adjust faster when there is a large deviation from the target capital structure. We also find that the macroeconomic environment influences the speed of adjustment, as firms tend to adjust more slowly during periods of recession. This is especially true for book leverage. Finally, we find evidence of market timing behavior, because firms adjust more quickly when inflation is high and the equity risk premium is low.

This paper proceeds as follows: Section 2 gives an overview of the literature on the speed of adjustment, while Section 3 explores the econometric problems of estimating speed. Section 4 gives the data descriptions and the summary statistics, and Section 5 presents our results and their implications. Section 6 concludes.

3.2 Literature review

The modern formulation of capital structure theory begins with the irrelevance hypothesis of Modigliani and Miller (1958). By studying restrictive assumptions, they conclude that capital structure is irrelevant to a firm's value. In a summary, Frank and Goyal (2008) cite the absence of taxes, transaction costs, bankruptcy costs, agency conflicts and adverse selection, separation between financing and operation activities, stable financial market opportunities, and homogeneous investors as necessary assumptions. This model implies no adjustment to a target capital structure and, therefore, no speed of adjustment. The restrictive assumptions are a major drawback of this model. For example, it cannot explain why certain industries tend to have stable capital structures. Later models investigate the results of relaxing some of the assumptions.

Modigliani and Miller (1963) extend their own model to include corporate income taxes, showing how debt can act to shield the negative effect of income taxes. Bankruptcy costs were later added by Kraus and Litzenberger (1973). Now the model incorporates both the benefits of debt, and the costs of bankruptcy resulting from debt. This leads to an optimal capital structure for each business type, depending on the extent of the bankruptcy costs and the tax shield. However, in this model, firms offset shocks immediately, implying an infinite adjustment speed.

Fischer et al. (1989) extended this model further by adding adjustment costs. They examined the trade-off to firms between the costs of adjustment on the one hand, and the benefits of being at the target capital structure on the other. Even with low adjustment costs, however, Fischer et al.'s (1989) model generates large swings in the debt-to-equity ratio. According to Fama and French (2002), the pecking order theory implies zero adjustment, because firms tend to prefer debt over equity. The capital structure thus depends on a firm's ability to generate internal funds, as well as gain access to debt and equity markets. In market timing theories (Baker and Wurgler 2002; Dittmar and Thakor 2007) the speed of adjustment can even be negative, because firms use high stock prices and a low equity premium to issue equity, thereby increasing the debt-to-equity ratio.

Fischer et al.'s (1989) theoretical model also formulates an explicit speed of adjustment. They build a dynamic capital structure model with adjustment costs, in which firms can have large deviations from their target leverage ratios. In their model, firms with different size, risk, and tax characteristics have different speeds of adjustment, because these measures influence the cost of deviating from the target. Hackbarth et al.'s (2006) model also has important implications for the speed of adjustment. They show that firms should align their financing policies to the state of the economy when macroeconomic conditions have an impact on cash flows. Their model predicts that firms have a higher speed of adjustment during good economic states. There is also survey evidence for a target capital structure. Graham and Harvey (2001) use a sample of 392 surveys and find that 81% of firms have a target debt/equity ratio.[1]

The speed of adjustment has also been measured empirically. Among the first was Marcus (1983), who estimated the adjustment speed for banks. Jalilvand and Harris (1984) investigated industrial firms, and found adjustment speeds as high as 56% for long-term debt. More recent research has found lower adjustment speeds. For example, Fama and French (2002) find a 7%–10% speed for dividend payers and 15%–18% for non-payers. Flannery and Rangan (2006) estimate a partial adjustment model and find a rather high speed of adjustment of 30% per year in the U.S., while Roberts (2002) estimates a half life of about one year by using a state-space framework.

Kayhan and Titman (2007) use OLS regressions and find a 10% speed of adjustment for book leverage, and 8.3% for market leverage. Banerjee et al. (2004) also use an OLS approach. They find adjustment speeds in the U.S. of 50% for book leverage and 25% for market leverage; in the U.K., the speeds are about 20% for book and 22% for market leverage. Lemmon et al. (2008), using GMM estimation, find a 25% speed of adjustment for book leverage. Byoun's (2008) results are also in this range, at about 20% when firms are below their targets and 33% when they are above. Huang and Ritter (2009) estimate a lower adjustment speed in the U.S. of between 11%–23% using a long-difference panel estimator.

Antoniou et al. (2009) find that the speed of adjustment differs among the G5 countries, ranging from 11% in Japan to 40% in France. They find a 32% speed in the U.S. for market leverage. Drobetz and Wanzenried (2006) study Switzerland and find that the influence of macroeconomic factors results in low adjustment speeds of 10% to 20%. An international focus is also used by Getzmann et al. (2010), who investigates large firms in Asia, Europe, and the U.S. Their results indicate a high adjustment speed of 56% for European firms, 31% for Asian firms and 46% for U.S. firms. The past research does not clearly illustrate, whether the adjustment speed

1 See Figure 6 in Graham and Harvey (2001).

is faster in bank- or market-based countries, but this because of influence of Japan. Except for Japan, bank-based countries generally tend to adjust more slowly than market-based countries.

In Halling et al. (2011) the speed of adjustment is studied over the course of the business cycle. The authors find a lower speed of adjustment during recessions, which is more pronounced for financially constrained firms. Cook and Tang (2010) also relate the speed of adjustment to macroeconomic conditions. They find higher speeds during strong economic times. This finding is robust for both constrained and unconstrained firms. They find adjustment speeds ranging from 15% to 50%.

Elsas and Florysiak (2011) investigate whether there is heterogeneity in the speed of adjustment. They find a 26% adjustment speed for their entire U.S. sample. They also find heterogeneity in the speed of adjustment for different industries, which is higher for growth firms and lower for large firms. The financing deficit has also been shown to strongly impact adjustment speed, as firms with large deficits tend to adjust more quickly. This is in line with the findings of Faulkender and Petersen (2006), who also study how cash flows influence the speed of adjustment. They find faster speeds for over-leveraged firms and firms with high cash flows.

Elsas and Florysiak (2011) also note that default risk has an impact, as low-rated firms adjust the fastest, medium-rated firms adjust slowly, and high-rated firms also adjust quickly. Overall, they find evidence that the high opportunity costs of deviating from the target are positively correlated with the speed of adjustment. Thus, a large deviation from the target combined with high default risk will further increase adjustment speed.

Most of the studies noted above work with different versions of dynamic panel estimators. Chang and Dasgupta (2009) have formulated a general critique of this type of estimators using simulated time series. They show that classic dynamic panel estimators generally have a low power to reject the null of no adjustments. However, the simulated time series have only a very low speed of adjustment at 10%, compared to the the estimated speeds in the studies above.

Furthermore, Iliev and Welch (2010) investigate the different estimators, and find a mechanical mean reversion problem that results in a biased estimate of the speed of adjustment (see Section 3.3. Elsas and Florysiak (2010) propose an estimator that considers the fractional nature of the dependent variable and thus does not suffer from these biases.

3.3 Econometric issues

Estimating the speed of adjustment requires the use of a dynamic panel model. In order for firms to make adjustments properly, the leverage of today must be dependent on the lagged leverage. Flannery and Hankins (2011) provide an overview of dynamic panel data models. The econometric specification of the speed of adjustment in the most stylized manner is (Flannery and Hankins 2011; Flannery and Rangan 2006):

$$L_{i,t} - L_{i,t-1} = \lambda(L^*_{i,t} - L_{i,t-1}) + \epsilon_{i,t}. \tag{1}$$

The change in leverage depends on the speed of adjustment λ and the distance between today's leverage and the target leverage ($L^*_{i,t+1}$). Rearranging and substituting $\beta X_{i,t-1}$ for the target leverage ($L^*_{i,t+1}$) results in:

$$L_{i,t} = (1-\lambda)L_{i,t-1} + \lambda\beta X_{i,t-1} + \epsilon_{i,t}, \tag{2}$$

where L is a measure of leverage, X is a vector using firm-specific determinants as proxies for the target leverage ratio, and β is the coefficient vector. However, as Nickell (1981) notes, standard OLS estimation is biased. We can divide the error term $\epsilon_{i,t}$ into a firm fixed effect and a white noise term, as follows:

$$L_{i,t} = (1-\lambda)L_{i,t-1} + \lambda\beta X_{i,t-1} + \mu_i + \delta_{i,t} \tag{3}$$

The lagged leverage is correlated with the firm fixed effect. Baltagi (2005) notes that introducing a dummy variable for the firm fixed effect does not remove the bias in this case, however, because the lagged leverage ($L_{i,t-1}$) is still correlated with the error term (over μ_i). Following Flannery and Hankins (2011), a within transformation to remove the firm fixed (FE) effect (μ_i) yields:

$$L_{i,t} - \overline{L_i} = (1-\lambda)(L_{i,t-1} - \overline{L_{i,}}) + \beta(X_{it} - \overline{X_i}) + (\mu_i - \overline{\mu_i}) + (\delta_{i,t} - \overline{\delta_i}) \tag{4}$$

Now a new bias appears: The transformed lagged leverage ($L_{i,t-1} - \overline{L_{i,}}$) is correlated with the transformed error ($\delta_{i,t} - \overline{\delta_i}$) because the average error ($\overline{\delta} = \sum \delta_{it}$) includes the lagged error (δ_{t-1}). The estimated speed of adjustment λ is still biased downward[2]. Flannery and Hankins (2011) note that the same kind of bias appears when the

2 This type of bias declines with longer panels. However, Monte Carlo evidence presented by Judson and Owen (1999) shows quite a large bias, even in panels containing thirty observations over time.

equation is first-differenced.

One way to remove the biases is to instrument the variables. However, Flannery and Hankins (2011) note that good instruments are rare in practice and that weak instruments can result in worse estimates than biased ones. Arellano and Bond (1991) develop a GMM estimator with valid instruments (AB), which has become known difference GMM estimator. By differentiating (3), we can remove the time-invariant effect:

$$\Delta L_{i,t} = (1-\lambda)\Delta L_{i,t-1} + \lambda\beta\Delta X_{i,t-1} + \Delta\delta_{i,t} \tag{5}$$

The past levels of the lagged depended variable $(L_{i,t-2}, \ldots, L_{i,0})$ can then be used to instrument the first-differenced lagged dependent variable $(\Delta L_{i,t-1})$. The estimator will not be subject to any biases if there is no second-order serial correlation present in the residuals.

However, the estimator can be problematic if there is little information in the instruments, or, in other words, when the lagged leverage ratio contains little information about the change in leverage. This is especially true when the coefficient on the lagged dependent variable is close to 1 (Blundell and Bond 1998), as we would expect for the persistent leverage time series (Huang and Ritter 2009). Blundell and Bond (1998) thus extend the AB-estimator, and develop a system GMM estimator (BB). In addition to the equation in first differences, this estimation uses the following level equations:

$$L_{i,t} = (1-\lambda)L_{i,t-1} + \lambda\beta X_{i,t-1} + \mu_i + \delta_{i,t} \tag{6}$$

$$\Delta L_{i,t} = (1-\lambda)\Delta L_{i,t-1} + \lambda\beta\Delta X_{i,t-1} + \Delta\delta_{i,t} \tag{7}$$

For the equation in first differences (7), the lagged levels $(L_{i,t-2}, \ldots, L_{i,0})$ are still used as instruments. For (6) the lagged first differences $(\Delta L_{i,t-2}, \ldots, \Delta L_{i,1})$ are used. The estimator continues to be problematic when the coefficient on the lagged dependent variable is close to 1 (Huang and Ritter 2009), and in the presence of second-order correlation in the errors (Flannery and Hankins 2011). This problem is addressed by Hahn et al. (2007), who propose a long-difference estimator that uses longer differences (k) on the following equation:

$$\Delta_k L_{i,t} = (1-\lambda)\Delta_k L_{i,t-1} + \lambda\beta\Delta_k X_{i,t-1} + \Delta_k\delta_{i,t}. \tag{8}$$

As Hahn et al. (2007) illustrate, this estimator is much less biased than BB- and

AB-estimators, especially when λ is close to 0, as would be implied in the case of no adjustment. Huang and Ritter (2009) use this estimator with lags of four, eight, eighteen and twenty-eight, and Flannery and Hankins (2011) use it with the maximum available number of lags. The number of firm years in a global sample is somewhat limited (the mean time firms in our sample have been in the Compustat Global database is eight years). So we use four years in our estimation (LD4) as well as the longest available number of lags (LD).

Another approach to correcting for the bias is the Least Squares Dummy Variable Correction (LSDV), developed by Kiviet (1995, 1999) and Bun and Kiviet (2003). They start with Equation (3) and include a dummy for each firm.[3] Afterward, the bias $(1-\lambda)_{LSDV}-(1-\lambda)$ is calculated, and the coefficients are corrected. Bruno (2005a) shows how this technique can also be used in unbalanced panels. Using Monte Carlo analysis Judson and Owen (1999) show that the LSDV-estimator performs better than the GMM pendants in panels with short time dimensions. However, it is not possible to correct standard errors for a potential bias. Therefore, we cannot present standard errors for the LSDV-estimator.

Instead of estimating the target leverage and the speed of adjustment in one step, Hovakimian and Li (2011) use a two-step approach, estimating the target leverage first and the speed of adjustment second. However, this methodology is also biased toward larger adjustment speeds. Hovakimian and Li (2011) find biased estimates in simulated data even when using corrected estimators. They find that the using contemporaneous data to proxy for the target leverage can lead to a look-ahead bias, and can upward-bias the estimates of the speed of adjustment.

As mentioned earlier, mechanical mean reversion can be another reason for biased estimates (Chang and Dasgupta 2009), because debt ratios are bounded between 0 and 1. When only the leverage ratio is under investigation, it is bounded at 0. However, zero debt ratios by definition cannot decrease, and debt ratios already set at 1 cannot increase.

Hovakimian and Li (2011) also report a bias that favors a highly significant speed of adjustment. They suggest overcoming this problem by 1) using a two-step approach, that focuses on the coefficient of the lagged target leverage L^* which results in:

$$L_{i,t} - L_{i,t-1} = \alpha + \lambda_1 L^*_{i,t} + \lambda_2 L_{i,t-1} + \delta_{i,t}, \tag{9}$$

and 2) dropping all debt ratios to above 0.8, which would reduce the upward bias.

3 From this, they obtain the fixed effects regression estimator results (Baltagi 2005).

Iliev and Welch (2010) address the bias for most of the estimators. They find a large bias for all estimators if the underlying process is not a standard dynamic panel process, but rather has a fractional dependent variable (bounded between 0 and 1 in the case of leverage ratios). They use a bias correction for these estimates.

Elsas and Florysiak (2010) also address the problem of mechanical mean reversion by building on the work of Loudermilk (2007). Their method (DPF) takes the fractional nature directly into account. They use a doubly-censored Tobit specification, as follows:

$$L_{i,t} = \begin{cases} 0 & \text{if } L^{+}_{i,t} \leq 0 \\ L^{+}_{i,t} & \text{if } 0 < L_{i,t} < 1 \\ 1 & \text{if } L^{+}_{i,t} \geq 1 \end{cases} \tag{10}$$

where $L^{+}_{i,t}$ is the observed leverage ration, which is set to 0 when it is below 0, and to 1 when it is higher than 1. The replacement primarily corrects data errors because leverage below 0 and above 1 are unusual. The specification can capture corner solutions as well as unobserved heterogeneity, but most importantly it is not subject to mechanical mean reversion. The specification is:

$$L_{i,t} = (1-\lambda)L_{i,t-1} + \lambda\beta X_{i,t-1} + \mu_i + \epsilon_{i,t}, \tag{11}$$

with

$$\mu_i = \alpha_0 + \alpha_1 L_{i,0} + E(X_i)\alpha_2 + \alpha_i \tag{12}$$

for the unobserved firm fixed effect. This effect now depends on the mean of the firm specific variables $E(X_i)$, and on the leverage ratio at the initial period $(\alpha_1 L_{i,0})$. The estimation is carried out by maximum likelihood.

We focus on the DPF estimator because it is relatively simple to implement and has no known biases. We first compare all estimators, and then we explore the differences and the heterogeneity of the speed of adjustment using the DPF estimator.

3.4 Data and summary statistics

We use Standard & Poor's Compustat Global as our basic database, and we obtain data on balance sheet items, cash flow items, and market prices. To ensure that economic indicators are captured as well, we add data from Thomson Reuters

Datastream. Using information for the G7 countries from 1991 to 2009 obtain 125 982 firm year observations. Frank and Goyal (2008) note that financial databases such as Compustat are often subject to outliers and anomalous observations. We can manage such problems by using rule of thumb truncations, winsorizing, and trimming.

We start with some common cleansing steps. We exclude all utilities (SIC codes 4900–4949) and financial firms (SIC 6000–6999)[4]. Missing capital expenditures and missing convertible debt are set to zero. We also set missing research and development expenditures to zero, but we use a dummy variable to indicate which ones were missing and which ones were originally.

We further exclude firm years with negative leverage ratios or negative total assets. We also only use firms with consolidated balance sheets that have not changed their accounting method.[5] All firm-level variables are in local currencies,[6] except for sales, which is measured in 2000 U.S. dollars. We trim our data at a 1% level.

In our study, we use the leverage ratio as the dependent variable, under Huang and Ritter's (2009) definition of leverage. We construct book leverage (*BL*) as total liabilities plus preferred stock, minus deferred taxes, minus convertible debt over total assets $((LT_t + PSTK_t - TXDI_t - DCVT_t)/AT)$.[7] We then construct market levverage as the book value of debt (the same nominator as for book leverage), divided by the market value of equity, plus the book value of debt $(LT_t + PSTK_t - TXDI_t - DCVT_t)/(MKVAL + LT_t + PSTK_t - TXDI_t)$.

Table I gives an overview of the leverage variables. Note from Column 1 that the mean book leverage in market-based countries ranges from 47% in Canada to 55% in Great Britain. In bank-based countries, it is even higher, from 58% in Japan, increasing to 65% in Italy. The standard deviation of book leverage ranges from 20% in Italy to 32% in the U.S., indicating a large variation in leverage. In Column 2, we report the mean of the yearly percentage change of book leverage. While the mean change in total at 4% is rather small, the 45% standard deviation also indicates a large variation.

Columns 3 and 4 give the information on market leverage (*ML*). As with book

4 We exclude financial firms because they have a different balance sheet structure. We also exclude utilities for the sake of comparability, since they are regulated in the US.

5 We use anly code F of Compustat item *CONSOL* and we exclude all mergers (CSTAT=AA), new company formation (AB), accounting changes (AC, AN) and combinations.

6 We exclude all firm years with divergent currencies for accounting and market data.

7 All the data variable abbreviations identify the respective data item in Compustat Global for variables that have not been calculated

Table I – Leverage in the G7 Countries

		BL	ΔBL	ML	ΔML
CAN					
	mean	0.468	0.096	0.341	0.051
	s.d	0.265	0.620	0.250	0.511
	N	5494	3460	4770	2849
DEU					
	mean	0.612	0.046	0.497	0.078
	s.d	0.238	0.494	0.254	0.426
	N	8507	7081	6938	5659
FRA					
	mean	0.636	0.014	0.509	0.028
	s.d	0.223	0.255	0.236	0.243
	N	8049	6489	6606	5233
GBR					
	mean	0.547	0.085	0.382	0.084
	s.d	0.282	0.618	0.229	0.464
	N	18 882	14 625	16 562	12 426
ITA					
	mean	0.651	0.012	0.552	0.033
	s.d	0.202	0.219	0.241	0.234
	N	2446	1904	2038	1570
JPN					
	mean	0.579	0.001	0.549	0.028
	s.d	0.217	0.186	0.229	0.236
	N	45 953	41 859	43 099	39 031
USA					
	mean	0.530	0.069	0.342	0.044
	s.d	0.319	0.603	0.252	0.389
	N	43 266	30 047	39 716	27 124
Total					
	mean	0.561	0.039	0.444	0.044
	s.d	0.270	0.453	0.258	0.345
	N	132 597	105 465	119 729	93 892

This table presents an overview of the different leverage variables and summary statistics in terms of mean, standard deviation (s.d.) and number of observations (N). Book leverage (BL) is defined as book debt relative to total assets ($(LT_t + PSTK_t - TXDI_t - DCVT_t)/AT_t$), and market leverage (ML) is defined as book debt relative to book debt plus the market value of equity ($(LT_t + PSTK_t - TXDI_t - DCVT_t)/(MKVAL + LT_t + PSTK_t - TXDI_t)$). Columns 2 and 4 give the percentage changes. The data cover 1992 through 2009.

leverage, we find that market leverage is lower in market-based countries than in bank-based. For example, the U.S. has a mean market leverage of 34%, while Italy's is 55%. The standard deviation is in a similar range as for book leverage and the total mean of the the yearly percentage change (4%). The standard deviation of the change in market leverage is lower than for book leverage. Thus, firms in bank-based countries have a higher leverage ratio than those in market-based countries.

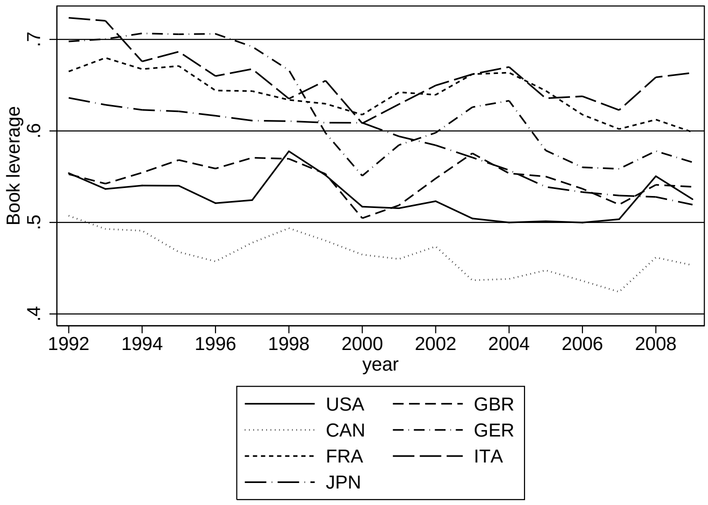
This finding persists when examining the development over time. Panel A of Figure I shows the development for book and market leverage. Firms in bank-based countries are more leveraged than those in market-based countries over the entire period. This may because the laws in bank-based countries are more oriented toward lender protection, and thus firms are able to carry more debt.

We observe some cyclicality in market value in Panel B of Figure I. During economic downturns, such as during the aftermath of the 2008 global financial crisis, leverage tends to rise. The pattern for each country looks quite similar, except for Japan, possibly because of its long economic stagnation. To estimate the target leverage ratio, we use variables introduced by Flannery and Rangan (2006), which have been used extensively to estimate the speed of adjustment by, e.g., Elsas and Florysiak (2011). We use a measure of profitability ($EBIT$), the market-to-book ratio (MB), depreciation (DEP), size ($SIZE$), asset tangibility ($TANG$), research and development expenditures ($R\&D$),[8] and the median industry market leverage.[9] In contrast to Flannery and Rangan (2006), we do not use rating as a control variable for two reasons: 1) Firms outside the U.S. have a shorter rating history, and 2) we will use the rating later to generate a measure for financial constraints. We define the financial deficit (DEF) as the change in net debt ($\Delta(LT+PSTK-TXDI-DCVT)/AT$), plus the change in net equity ($\Delta(AT-LT-PSTK+TXDI+DCVT)/AT$), minus the change in retained earnings ($\Delta RE/AT$). We use this as a conditional variable to estimate adjustment speed.

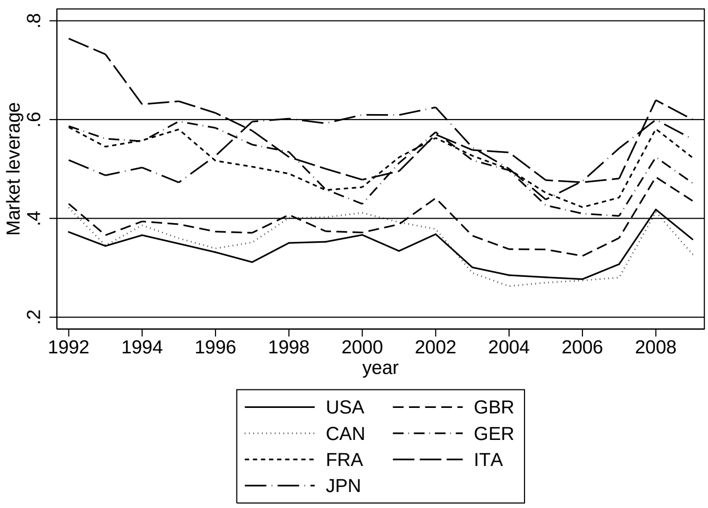
One of our hypotheses states that the macroeconomic environment can strongly impact the speed of adjustment, so we need to establish proxies for the state of

8 $EBIT$ is defined as income before extraordinary items plus interest expenses plus income taxes over total assets ($(IB+XINT+TXT)/AT$); MB is defined as market value over total assets ($MKVAL+LT+PSTK-TXDI)/AT$; DEP is depreciation over total assets (DP/AT); $SIZE$ is the natural logarithm of net sales in 2002 US$ ($ln(SALE)$), and $TANG$ is property, plant, and equipment over total assets ($PPENT/AT$).

9 Our definition of industry classification follows Fama and French (1997), and is obtained from Kenneth French's Homepage (http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html).



(A) Book leverage G7



(B) Market leverage G7

Figure I – Leverage ratios across countries and time frames
This figure illustrates the development over time of the leverage ratios in the G7. Book leverage (BL) is defined as book debt relative to total assets ($(LT_t + PSTK_t - TXDI_t - DCVT_t)/AT_t$), and market leverage ($ML$) is defined as book debt relative to book debt plus the market value of equity ($(LT_t + PSTK_t - TXDI_t - DCVT_t)/(LT_t + PSTK_t - TXDI_t + MKVAL_t)$). The data covers 1992 through 2009.

Table II – Summary statistics – Independent variables

	N	mean	mean	s.d.	min	max
EBIT		0.023	0.038	0.150	−1.198	0.334
MB		1.575	1.197	1.147	0.521	10.911
DEP		0.031	0.025	0.034	0.000	0.209
SIZE		5.670	5.676	1.885	−1.097	10.348
TANG		0.290	0.255	0.208	0.002	0.908
NOR&D		0.494	0.000	0.500	0.000	1.000
R&D		0.025	0.000	0.061	0.000	0.568
INDMED		0.447	0.458	0.160	0.032	0.918
DEF		0.217	0.019	10.623	−37.332	2906.981
N	93 931					

This table contains the summary statistics for the determinants of the target leverage ratio. The data cover 1992 through 2009. ($EBIT$) are earnings before interest and taxes, constructed as income before extraordinary items (IB), plus interest expenses ($XINT$), plus income taxes (TXT) divided by total assets (AT); the market-to-book ratio (MB) is defined as the market value of equity ($MKVAL$), plus the book value of debt ($LT + PSTK - TXDI - DCVT$), divided by total assets; depreciation (DEP) is depreciation expenses divided by total assets; size ($SIZE$) is the natural logarithm of sales measured in U.S. dollars of the year 2000 deflated by the U.S. consumer price index; asset tangibility ($TANG$) is property, plant, and equipment ($PPENT$) divided by total assets; research and development expenditures (*R&D*) are R&D expenditures (XRD) divided by total assets, the $NOR\&D$ is equal to 1 if the firm has no R&D data. The industry median ($INDMED$) of the market leverage follows the definition of Fama and French (1997); (DEF) is the financial deficit, defined as the change in net debt ($\Delta(LT + PSTK - TXDI - DCVT)/AT$), plus the change in net equity ($\Delta(AT - LT - PSTK + TXDI + DCVT)/AT$), minus the change in retained earnings ($\Delta RE/AT$).

the economy. We use the U.S. default spread as a proxy for the general attitude toward risk,[10] the term spread, the TED spread, and the GDP growth rate. Table III shows the correlations between variables. We note especially low correlations in Panel B of Table III. We conclude that each variable is needed to fully capture the economic environment. We also use a dummy variable as an overall proxy for recessions. It is equal to 1 if the economy appears headed toward a recession, and 0 otherwise. In this study, we follow Halling et al. (2011), and use the definitions from the Economic Cycle Research Institute.[11] To examine whether the speed of adjustment follows market timing considerations, we use inflation[12] and the equity risk premium, calculated as the twelve-month mean stock return of a broad market index.[13]

3.5 Results

3.5.1 Comparing the different estimators

Our first step is to investigate the results of the different panel estimators. We examine whether the Monte Carlo and theoretical considerations from earlier papers appear in our sample. For the OLS estimator (OLS), Huang and Ritter (2009) and Iliev and Welch (2010) note it is biased upward: The estimated speed of adjustment is too low. The bias of the fixed effects (FE) model, however, is downward. For the speed of adjustment, this means the estimation is too high. This bias is especially severe if the time dimension is short, which is often the case with firms in the Compustat Global sample.[14]

The GMM estimators also suffer from biases. The Arellano and Bond (1991) estimator (AB) suffers from a small sample bias if the coefficient on the lagged dependent variable is close to 1 in a negative direction (Bruno 2005b). This a reasonable expectation for series as persistent as leverage ratios. The BB estimator, in contrast, is slightly biased upward, as Bruno (2005b) shows in a Monte Carlo study. Hahn et al. (2007) renew the critique of weak instruments for the system estimator

10 CREDIT is the difference between the yield on Moody's Baa-rated and Aaa-rated corporate bonds.
11 Data come from the Economic Cycle Research Institute website, `www.businesscycle.com`.
12 Inflation is calculated as the percentage change in a country's consumer price index.
13 We use the S&P 500 for the U.S., the FTSE All-Share for the U.K., the Toronto SE 300 for Canada, the SBF 250 for France, the Nikkei 225 for Japan, the BIC All-Share for Italy, and the MDAX for Germany.
14 The mean time that firms in our sample have been in the Compustat database is eight years.

Table III – Summary statistics – Macroeconomics

Panel A – Summary Statistics

	REC	CREDIT	TERM	TED	GDP	INF	ERP
Bank							
mean	0.381	1.023	1.322	0.178	0.948	0.534	0.177
median	0.000	0.870	1.336	0.084	1.584	0.299	−0.753
s.d.	0.486	0.580	0.630	0.385	2.734	1.187	26.530
kurtosis	1.238	10.223	4.718	13.323	6.791	3.232	1.962
skewness	0.488	2.718	−0.014	2.419	−1.755	0.600	0.227
min	0.000	0.540	−4.030	−1.240	−8.670	−1.629	−52.850
max	1.000	3.380	3.533	4.420	6.033	6.473	66.022
Market							
mean	0.090	0.967	1.374	0.412	2.529	2.491	4.985
median	0.000	0.850	1.237	0.273	2.727	2.572	7.098
s.d.	0.286	0.527	1.418	0.532	2.076	1.129	18.084
kurtosis	9.204	15.551	1.878	11.426	5.392	19.988	2.667
skewness	2.864	3.459	−0.002	2.637	−1.216	2.007	−0.450
min	0.000	0.540	−2.182	−1.240	−5.890	−0.433	−42.952
max	1.000	3.380	4.054	4.126	7.073	18.742	57.303
Total							
mean	0.228	0.994	1.349	0.299	1.762	1.542	2.621
median	0.000	0.870	1.320	0.201	2.302	1.667	3.233
s.d.	0.420	0.554	1.109	0.481	2.543	1.515	22.760
kurtosis	2.682	12.541	2.832	12.933	7.116	6.097	2.265
skewness	1.297	3.060	0.043	2.653	−1.628	0.494	−0.054
min	0.000	0.540	−4.030	−1.240	−8.670	−1.629	−52.850
max	1.000	3.380	4.054	4.420	7.073	18.742	66.022

Panel B – Correlations

	REC	CREDIT	TERM	TED	GDP	INF	ERP
REC	1						
CREDIT	0.480***	1					
TERM	0.006*	0.075***	1				
TED	0.352***	0.532***	−0.030***	1			
GDP	−0.579***	−0.673***	−0.162***	−0.248***	1		
INF	−0.146***	0.092***	−0.005	0.457***	0.055***	1	
ERP	−0.589***	−0.500***	0.045***	−0.339***	0.505***	−0.102***	1

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

This table presents the summary statistics and correlations between the macroeconomic variables. *REC* is a recession dummy, which is equal to 1 when the ECRI reports a recession. *CREDIT* is the difference between the yield on Moody's Baa-rated and Aaa-rated corporate bonds. *TERM* is the difference between the short- and long-term interest rate. *TED* is defined as the difference between the interbank rate and the nominal interest rate. *GDP* is the real GDP growth rate. *INF* is inflation, and is defined as the percentage change in the consumer price index of each country. The nominal interest rate is the yield on three-month government bonds, or, if not available, on one-year government bonds. The lower part of the table shows the correlations. The asterisks denote a significant difference from zero. The statistic is calculated as $2 * \tilde{t}(n-2, |\hat{\rho}|\sqrt{(n-2)}/\sqrt{(1-\hat{\rho}^2)})$.

(BB) first proposed by Blundell and Bond (1998), and instead focus on using longer lags as instruments (LD). They perform a simulation, and show that when the true parameter is 0.9, the system GMM (BB) produces a biased estimate of 0.664, while the long-differencing estimator (LD) produces an estimate of 0.902. Huang and Ritter (2009) use this estimator with a lag of four (LD4), and Flannery and Hankins (2011) use it with the longest available lag (LD). Flannery and Hankins (2011) show that the GMM estimators and the Least Squares Dummy Variable correction perform. Elsas and Florysiak (2010) and Iliev and Welch (2010) note that the leverage ratio is a bounded variable, and therefore all estimators assuming a standard dynamic panel process are biased. Elsas and Florysiak (2010) propose using a fractional dependent variable estimator instead, and arguing that it is bias-free.

We expect FE to yield the lowest estimate, followed by AB, the LD, the LD4, the LSDVC, and the DPF estimators. The BB and OLS estimators should yield the highest estimates.

Tables IV (for book leverage) and V (for market leverage) give our results for all estimators. As expected, the OLS estimate for book leverage is relatively high with a ρ of 0.911, implying a slow adjustment of only 0.09% per year. We observe the lowest coefficient, 0.62, using the fixed effects estimator. This implies a 38% adjustment per year. The coefficient for the AB estimator is 0.856, and the system GMM generates a 1.015 estimate, implying a negative speed of adjustment. The bias corrected estimator produces a 0.762 coefficient, and the remaining coefficients are 0.791 (DPF), 0.843 (LD4), and 0.587 (LD). However, the high number of lags for instrumenting means the long-difference estimators losing many observations, and, therefore, information. The mean speed is 20% per annum, which equates to a half live of about three years.[15]

For market leverage, Welch (2004) finds that firms do not adjust to changes in the leverage ratio caused by stock price changes. So we expect to see a lower speed of adjustment for market leverage ratios. Table V presents the results for the estimation with market leverage. However, it is not clear on average whether the speed of adjustment is higher or lower than with the book leverage estimation. For example, the OLS estimator has a slightly lower coefficient (BL:0.911 to ML:0.895), implying a higher speed of adjustment. But the fractional dependent estimator exhibits a higher coefficient (BL:0.843 to ML:0.880), implying a lower speed of adjustment. Huang and Ritter (2009) argue that the effect described by Welch

15 The half life can be calculated as: $halflife = ln(2)/ln(\lambda)$.

(2004) can be offset by the fact that, after stock price decreases, the leverage ratio sharply increases. There are two possibilities: The firm may declare bankruptcy and be dropped from the sample, or the stock price will increase again, and the leverage ratio will decrease. We only capture the second alternative here, which might overestimate the market leverage speed of adjustment.

Quantitatively, our findings fall in the middle of the range found by newer studies. For example, Huang and Ritter (2009) obtain a 0.789 coefficient for book leverage and 0.777 for market leverage using their four-lag difference estimator on U.S. data. Elsas and Florysiak (2011) obtain 0.737 for market leverage.

We can also interpret the signs of the variables determining the target leverage ratios. Because the coefficients interact with the speed of adjustment, the value can not be interpreted. Profitability has a negative effect on leverage: Firms with high profits the previous year have a lower leverage. This is consistent with pecking order theory, since firms have a preference for internal funds. MB also has a negative sign in most of the regressions. A high market-to-book ratio lowers leverage. This is consistent with the trade-off-theory, because a high MB ratio is associated with higher bankruptcy costs. Depreciation also lowers leverage, which is consistent with the trade-off theory, size, tangibility, R&D, and the median industry leverage all have a positive influence as well.

3.5.2 Heterogeneity

3.5.2.1 Countries

We next present the results for the speed of adjustment in the G7 countries. We perform this regression with the DPF estimator separately for each country, followed by estimations for market- and bank-based countries. We expect to find a lower speed of adjustment in bank-based countries. Speed of adjustment depends on two concepts: the cost of deviating from the target capital structure, and adjustment costs. Firms must middle ground between these two costs after external shocks to the capital structure, caused, for example, by unexpected decline in product demand. We expect the costs of deviating from target leverage to be lower in bank-based countries than in market-based ones. Because the banking sector is the main source of capital, the corporate governance system does not operate at arm's length as in a market-based systems. Rather banks can exert much more control, and deviations from the target can be negotiated with house banks, instead of being

Table IV – Different estimators of adjustment speed – Book leverage

	OLS	FE	AB	BB	LSDV	DPF	LD4	LD
LBL	0.911***	0.619***	0.856***	1.015***	0.762	0.791***	0.843***	0.587***
	(115.381)	(175.230)	(39.853)	(59.995)		(210.761)	(70.891)	(27.219)
SOA (in %)	8.9	38.1	14.4	−1.5	2.38	20.9	15.7	41.3
EBIT	−0.093***	−0.095***	0.240***	0.266***	−0.073	−0.016***	−0.085***	−0.191***
	(−9.306)	(−20.904)	(25.497)	(18.194)		(−3.869)	(−5.497)	(−6.798)
MB	−0.002	−0.007***	−0.012***	−0.010***	−0.007	−0.007***	−0.004**	0.009**
	(−1.697)	(−11.908)	(−15.606)	(−6.755)		(−14.418)	(−3.161)	(2.961)
DEP	0.095**	−0.051	−0.074	−0.047	−0.113	−0.199***	−0.028	0.726***
	(3.028)	(−1.752)	(−1.606)	(−0.659)		(−7.450)	(−0.341)	(10.343)
SIZE	0.001*	0.006***	−0.039***	−0.042***	0.003	−0.000	−0.001	−0.003**
	(2.080)	(6.640)	(−16.109)	(−11.625)		(−0.041)	(−0.294)	(−2.596)
TANG	−0.003	0.030***	0.022	0.026	0.022	0.032***	0.029*	−0.011
	(−0.967)	(4.862)	(1.863)	(1.467)		(5.805)	(2.426)	(−1.279)
NO_R&D	0.009***	0.004*	−0.001	0.003	0.004	0.004**	−0.001	−0.004
	(5.366)	(2.349)	(−0.377)	(0.789)		(2.722)	(−0.487)	(−1.200)
R&D	0.001	0.090***	0.099***	0.057	0.076	0.016	−0.030	0.043
	(0.070)	(5.607)	(3.986)	(1.129)		(1.073)	(−0.621)	(0.630)
INDMED	0.011**	0.025**	−0.011	−0.025	0.016	0.008	−0.003	−0.018
	(2.729)	(3.099)	(−0.798)	(−1.739)		(1.120)	(−0.288)	(−1.582)
Observations	74482	74482	56949	74482	74482	71660	26943	33507

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

All estimators are described in Section II. The dependent variable is book leverage, as described in Table I. Table II contains an explanation of the independent variables. OLS is the ordinary least squares estimator; FE is the fixed effects estimator; AB is the Arellano-Bond difference GMM estimator; BB is the Blundell-Bond system GMM; LSDV is the least squares dummy variable correction, for whom standard errors cannot be calculated; DPF is the dynamic panel with fractional dependent variable estimator; LD4 is the longest lag estimator using lag 4, and LD is the longest difference estimator with the longest lag. Time dummies, constants, initial leverage, and mean exogenous variables are omitted. SOA is 1 minus the coefficient on lagged book leverage (BL).

Table V – Different estimators of adjustment speed – Market leverage

	OLS	FE	AB	BB	LSDV	DPF	LD4	LD
LML	0.895***	0.562***	0.873***	1.062***	0.717	0.880***	0.932***	0.439***
	(233.067)	(149.992)	(44.702)	(77.996)		(277.834)	(105.789)	(27.631)
SOA (in %)	10.5	33.8	12.7	-6.2	28.3	12.0	6.8	56.1
EBIT	−0.029	−0.056***	0.181***	0.174***	−0.032	0.051***	−0.026	−0.144***
	(−1.690)	(−13.246)	(23.689)	(14.765)		(8.442)	(−1.828)	(−5.144)
MB	0.004**	−0.002***	0.043***	0.049***	0.004	0.017***	0.015***	−0.065***
	(3.082)	(−4.015)	(32.389)	(27.465)		(21.205)	(10.312)	(−13.814)
DEP	−0.204*	−0.216***	−0.116*	−0.585***	−0.224	−0.271***	−0.086	−0.147
	(−2.156)	(−7.866)	(−2.485)	(−9.633)		(−6.637)	(−1.117)	(−1.441)
SIZE	0.000	0.023***	0.015***	0.006*	0.018	0.012***	0.012***	−0.009***
	(0.285)	(26.683)	(6.900)	(2.231)		(10.600)	(3.627)	(−6.048)
TANG	0.005	0.014*	−0.033**	−0.035*	0.001	−0.013	−0.013	−0.006
	(0.581)	(2.402)	(−2.776)	(−2.303)		(−1.757)	(−1.111)	(−0.454)
NO_R&D	0.010***	0.005**	0.002	−0.005	0.008	0.010***	0.011***	−0.003
	(4.356)	(2.993)	(0.774)	(−1.141)		(4.735)	(4.387)	(−0.651)
R&D	−0.113***	−0.011	0.148***	0.098**	0.012	0.014	0.014	0.187**
	(−4.991)	(−0.739)	(5.912)	(2.750)		(0.586)	(0.320)	(2.603)
INDMED	0.024*	0.021**	−0.140***	−0.167***	0.001	−0.031**	−0.057***	0.140***
	(2.366)	(2.652)	(−9.448)	(−10.076)		(−3.139)	(−4.744)	(7.735)
Observations	74919	74919	57284	74919	74919	41516	27052	20576

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

All estimators are described in Section II. The dependent variable is book leverage, as described in Table I. Table II contains an explanation of the independent variables. OLS is the ordinary least squares estimator; FE is the fixed effects estimator; AB is the Arellano-Bond difference GMM estimator; BB is the Blundell-Bond system GMM; LSDV is the least squares dummy variable correction for whom standard errors cannot be calculated; DPF is the dynamic panel with fractional dependent variable estimator; LD4 is the longest lag estimator using lag 4, and LD is the longest difference estimator with the longest lag. Time dummies, constants, initial leverage, and mean exogenous variables are omitted. SOA is 1 minus the coefficient on lagged market leverage (ML).

punished immediately by the market. We also expect the adjustment costs to be higher, primarily because equity markets are less developed and thus less liquid. Therefore, seasoned equity offerings (SEOs) should be more expensive. Long-term debt contracts may also have to be renegotiated at more costly rates.

The findings in Tables VI and VII confirm our hypothesis. We find a 26% adjustment speed Canada and the U.K., and 21% for the U.S. The bank-based countries have slightly lower speeds of adjustment: Germany 21%, France 8%, Japan 14%, and Italy 22%. The average speed of adjustment for the market-based countries is 22%, and it is 18% for bank-based countries. In the last column of Table VI, we examine whether the difference is significant by including a dummy variable for the financial system interacting with the lagged leverage ratio. It is highly significant, and shows a lower adjustment speed of 3 percentage points. Although difference is not quite large, it is in terms of half life. For market-based countries, we find that it takes 2.8 years for half of a shock to be adjusted, for bank-based countries, it is 3.5 years.

When comparing the results for book leverage to those for market leverage, we note form Table VII that it is unclear which adjusts more quickly. In Canada, the adjustment speeds are nearly the same; in the U.K. and in the U.S., the speed for book leverage is 7 percentage points lower. In Germany, Italy, and Japan, the speed for market leverage shocks is lower, while in France it is 3 percentage points higher. If we examine the aggregated market and bank samples, we find that, in market-based countries, the adjustment speed of the market leverage is 8 percentage points lower than the speed of book leverage (Column 9, Tables VI and VII); in bank-based countries, the difference is also 8 points (Column 10, Tables VI and VII). This difference is again significant, and at 2.6% it is in the same range as for book leverage.

The finding that book leverage adjusts more quickly than market leverage is consistent with Welch's (2004) finding that firms do not adjust to stock price-induced changes in leverage. But it is contrary to Huang and Ritter (2009), who estimate a higher adjustment speed for market leverage. This difference might be the result of Huang and Ritter's (2009) longer time horizon.

Overall, we find a lower adjustment speed for bank-based countries, in line with Halling et al. (2011) and Antoniou et al. (2009), whose findings are in the 40%–50% range. By using an unbiased estimator, we believe our results are more reliable. Dang, Garrett, et al.'s (2010) results are also much higher, and provide no conclusive evidence for higher speed in market- or bank-based countries. Our empirical find-

Table VI – Speed of adjustment – Book leverage G7

	CAN	GBR	USA	GER	FRA	ITA	JPN	MARKET	BANK	DIFF
LBL	0.739***	0.743***	0.787***	0.789***	0.920***	0.774***	0.855***	0.776***	0.825***	0.776***
	(35.589)	(75.772)	(128.811)	(55.032)	(41.600)	(64.021)	(105.652)	(153.912)	(149.698)	(199.623)
SOA (in %)	26.1	25.7	21.3	21.1	8.0	22.6	14.5	22.4	17.5	22.4
EBIT	0.003	−0.003	−0.047***	−0.052**	0.170***	−0.022	0.065***	−0.027***	0.019**	−0.018***
	(0.092)	(−0.277)	(−5.874)	(−3.134)	(4.060)	(−1.238)	(8.228)	(−4.425)	(3.161)	(−4.190)
MB	−0.003	−0.009***	−0.010***	−0.000	0.006	−0.003	−0.008***	−0.010***	−0.004***	−0.007***
	(−1.052)	(−6.175)	(−10.304)	(−0.178)	(1.223)	(−1.519)	(−9.926)	(−12.522)	(−5.861)	(−14.549)
DEP	−0.143	−0.214**	−0.348***	−0.118	0.020	0.021	-90.408*	−0.254***	−0.064	−0.191***
	(−0.971)	(−3.287)	(−6.194)	(−1.608)	(0.120)	(0.277)	(−2.515)	(−6.265)	(−1.759)	(−7.157)
SIZE	0.000	0.002	0.002	0.003	−0.015*	0.007*	−0.012***	0.000	−0.004***	0.001
	(0.014)	(1.063)	(1.298)	(1.041)	(−2.536)	(2.498)	(−7.761)	(0.324)	(−3.346)	(0.864)
TANG	−0.007	−0.005	0.061***	0.017	0.006	0.029	0.058***	0.027**	0.047***	0.029***
	(−0.209)	(−0.323)	(4.975)	(0.784)	(0.154)	(1.179)	(7.897)	(3.005)	(7.079)	(5.323)
NO_R&D	−0.007	0.014**	−0.010	−0.015**	0.011	−0.007	0.005**	0.002	0.001	0.004**
	(−0.466)	(2.640)	(−1.686)	(−2.598)	(1.056)	(−1.346)	(2.948)	(0.507)	(0.681)	(2.792)
R&D	−0.339***	0.076	0.031	−0.167*	0.142	−0.115	0.211***	0.026	0.015	0.020
	(−4.003)	(1.875)	(1.226)	(−2.504)	(0.744)	(−1.822)	(5.383)	(1.238)	(0.555)	(1.358)
INDMED	0.172***	−0.018	0.049**	−0.040	0.035	−0.085**	0.007	0.038**	−0.017*	0.011
	(3.398)	(−0.753)	(2.986)	(−1.500)	(0.906)	(−3.265)	(0.810)	(2.947)	(−2.318)	(1.488)
LBL×BANK										0.030***
										(15.315)
Observations	1814	10075	19609	4780	1469	4564	29349	31498	40162	71660

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

This table gives the speed of adjustment for different countries and capital market systems. All estimations are obtained by using the DPF estimator: $L_{i,t} = (1-\lambda)L_{i,t-1} + \lambda\beta X_{i,t-1} + \mu_i + \epsilon_{i,t}$, with $mu_i = \alpha_0 + \alpha_1 L_{i,0} + E(X_i)\alpha_2 + \alpha_i$. The dependent variable is book leverage as described in Table I. Table II contains a explanation of the independent variables. $LBL \times BANK$ is an interaction variable for lagged book leverage and the financial system. The $BANK$ variable is equal to 1 when the financial system is bank-based. Time dummies, constants, initial leverage, and mean exogenous variables are omitted. SOA is 1 minus the coefficient on lagged book leverage.

Table VII – Speed of adjustment – Market leverage G7

	CAN	GBR	USA	GER	FRA	ITA	JPN	MARKET	BANK	DIFF
LML	0.744***	0.815***	0.858***	0.838***	0.880***	0.899***	0.911***	0.847***	0.907***	0.861***
	(23.182)	(76.745)	(130.971)	(30.577)	(60.737)	(38.373)	(220.948)	(155.668)	(239.571)	(240.862)
SOA (in %)	25.6	18.5	14.2	16.2	12.0	10.1	8.9	15.3	9.3	13.9
EBIT	−0.009	0.052***	0.009	−0.104**	0.084*	0.035	0.152***	0.027**	0.104***	0.046***
	(−0.267)	(3.535)	(0.849)	(−3.173)	(2.570)	(0.623)	(13.905)	(3.248)	(10.889)	(7.695)
MB	0.010*	0.011***	0.011***	0.015***	0.025***	0.060***	0.024***	0.011***	0.026***	0.016***
	(2.146)	(4.750)	(8.641)	(3.355)	(6.274)	(6.234)	(17.071)	(10.073)	(20.807)	(20.419)
DEP	−0.032	−0.489***	−0.516***	−0.002	−0.323*	−0.256	12.353	−0.440***	0.053	−0.265***
	(−0.186)	(−5.114)	(−7.166)	(−0.016)	(−2.466)	(−0.843)	(0.222)	(−8.093)	(0.743)	(−6.487)
SIZE	0.004	0.015***	0.013***	0.006	0.012**	0.001	0.011***	0.010***	0.012***	0.013***
	(0.735)	(4.647)	(6.192)	(1.271)	(2.853)	(0.141)	(4.687)	(6.061)	(6.651)	(11.499)
TANG	−0.042	0.036	0.044**	0.021	0.002	−0.064	−0.027*	0.023*	−0.039***	−0.016*
	(−1.095)	(1.909)	(2.859)	(0.584)	(0.046)	(−1.412)	(−2.406)	(2.057)	(−3.930)	(−2.153)
NO_R&D	0.027	0.004	−0.011	−0.019*	0.002	0.026	0.007**	−0.006	0.010***	0.010***
	(1.497)	(0.527)	(−1.615)	(−2.106)	(0.230)	(1.313)	(3.044)	(−1.145)	(4.618)	(5.040)
R&D	−0.318*	0.047	−0.027	−0.028	0.016	0.829	0.229***	−0.012	0.163***	0.014
	(−2.513)	(0.718)	(−0.790)	(−0.254)	(0.141)	(1.347)	(3.656)	(−0.395)	(3.469)	(0.627)
INDMED	0.172**	0.017	−0.013	−0.004	−0.012	0.117	−0.034**	0.014	−0.029*	−0.027**
	(2.693)	(0.566)	(−0.654)	(−0.085)	(−0.275)	(1.917)	(−2.736)	(0.846)	(−2.513)	(−2.777)
LML×BANK										0.026***
										(11.854)
Observations	1256	5246	11 076	1832	1968	861	19 277	17 578	23 938	41 516

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

This table gives the speed of adjustment for different countries and capital market systems. All estimations are obtained by using the DPF estimator: $L_{i,t} = (1-\lambda)L_{i,t-1} + \lambda\beta X_{i,t-1} + \mu_i + \epsilon_{i,t}$, with $mu_i = \alpha_0 + \alpha_1 L_{i,0} + E(X_i)\alpha_2 + \alpha_i$. The dependent variable is market leverage as described in Table I. Table II contains a explanation of the independent variables. $LBL \times BANK$ is an interaction variable for lagged market leverage and the financial system. The $BANK$ variable is equal to 1 when the financial system is bank-based. Time dummies, constants, initial leverage, and mean exogenous variables are omitted. SOA is 1 minus the coefficient on lagged market leverage.

ings imply either higher adjustment costs or lower costs of deviating from the target in bank-based countries. Although our estimation cannot discriminate between these two concepts, we find evidence of different behavior between the two capital market systems.

3.5.2.2 Financial circumstances

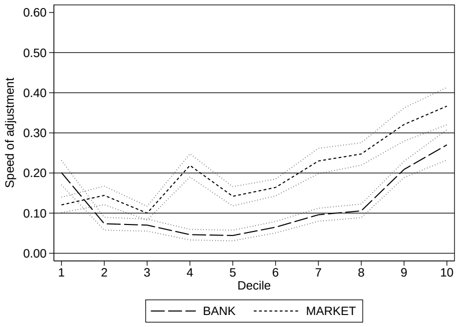
Differing legal environments and financial systems can be one source of heterogeneity in the speed of adjustment; different firm financial circumstances can be another. In this section, we investigate the heterogeneity resulting form differences in magnitude of financial deficits, health, and distance from target.

Financial deficit. The financial deficit refers to the amount of capital a firm issues on the financial markets or generates as net profits. If a firm has high profits, it can easily adjust its capital structure by either buying back shares or renegotiating and lowering its long-term debt. The reasoning also works the other way: Firms that have investment opportunities and need to raise capital can easily adjust using either debt or equity, depending on leverage status. As Faulkender et al. (2011) mentions, this would lower the cost of adjustment, because the firm needed to go to the market anyway.

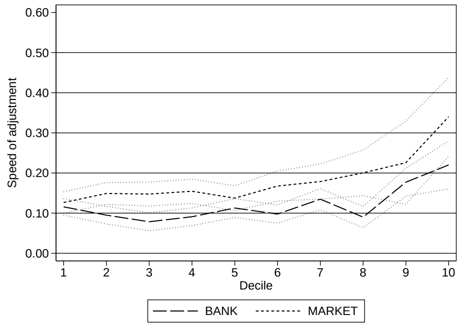
In contrast, if the firm has no financing deficit, it would either lack profits or investment opportunities. Thus, any capital structure activity would be done for readjustment only and would be subject to the full costs. We expect firms with a high financing deficit, whether positive or negative, to adjust faster than firms with a low deficit.

We tackle this question by grouping the firms in deciles according to their mean financial deficit.[16] The financial deficit is defined, as in Huang and Ritter (2009), as change in net debt ($\Delta(LT + PSTK - TXDI - DCVT)/AT$), plus change in net equity ($\Delta(AT - LT - PSTK + TXDI + DCVT)/AT$), minus change in retained earnings ($\Delta RE/AT$). The results for different definitions of the financial deficit can be seen in Figure II. We group the first two panels by the absolute value of the magnitude of the deficit. The adjustment of firms with very small deficits is 2% in bank-based countries and 10% in market-based countries. The speed remains relatively constant

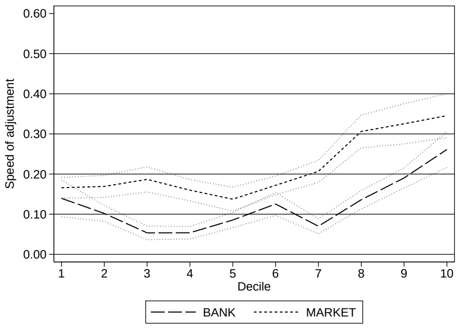
16 If we use firm years, we would lose vast amounts of data and destroy the panel structure. We performed a robustness test using firm years as grouping variable; the results were qualitatively the same.



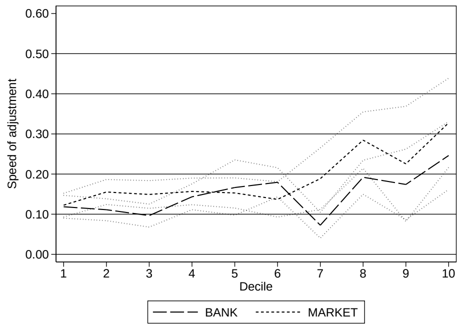
(A) Absolute financial deficit – Book leverage



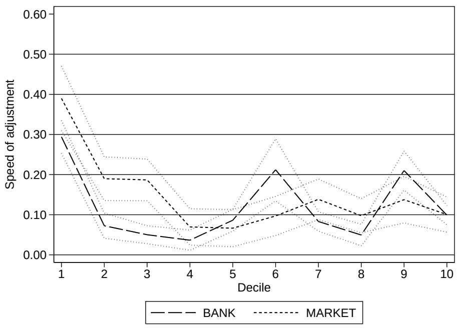
(B) Absolute financial deficit – Market leverage



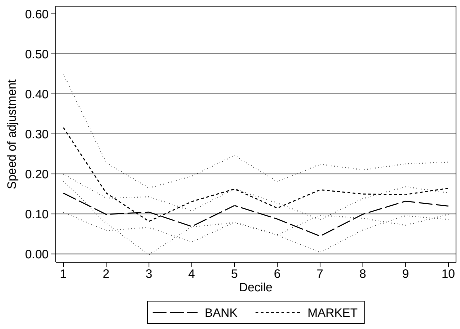
(C) Positive financial deficit – Book leverage



(D) Positive financial deficit – Market leverage



(E) Negative financial deficit – Book leverage



(F) Negative financial deficit – Market leverage

Figure II – Speed of adjustment with different financial deficits
These figures show the speed of adjustment conditional on the mean financial deficit, which is calculated as the change in net debt ($\Delta(LT+PSTK-TXDI-DCVT)/AT$), plus the change in net equity ($\Delta(AT-LT-PSTK+TXDI+DCVT)/AT$), minus the change in retained earnings ($\Delta RE/AT$). The two top panels use the mean of the absolute value of deficit size, the middle panels use only firm years with positive deficits, and the lower panels use the years with negative financial deficits. The firms are sorted and the estimation is performed decile-wise, where 1 is the decile with the lowest financial deficit, and 10 is the highest decile. All estimations are done by means of the DPF estimator: $L_{i,t} = (1-\lambda)L_{i,t-1} + \lambda\beta X_{i,t-1} + \mu_i + \epsilon_{i,t}$, with $mu_i = \alpha_0 + \alpha_1 L_{i,0} + E(X_i)\alpha_2 + \alpha_i$. The solid line gives the estimate of the speed of adjustment; the dashed line gives the 95% interval.

up to decile 5, and then increases to 25%–35% by decile 10. Firms with a large financial deficit seem to use it to effect a faster adjustment. This effect is also visible for market leverage in Panel B of Figure II, but is less pronounced.

If we examine only positive deficits, we also note that the speed of adjustment increases with the financial deficit. It is at 10%–20% in the lower and mid deciles, and increases to 25%–33% in the deciles with the highest financial deficits.

Firms with negative financial deficits (surpluses) can use these funds to adjust capital structure by buying back shares or debt. For some firms, however, considerations such as dividend payments may have a higher priority. As Panels E and F of II show, the speed of adjustment is relatively stable at 10% over the deciles, except for the lowest decile (which shows the firms with the highest profits), where it is between 30% and 40%.

Our findings of a U-shaped pattern for the magnitude of the financial deficit confirm Faulkender et al.'s (2011) results. They also find larger adjustment speeds for U.S. firms with large positive or negative financing deficits.

For the absolute value of financing deficits, we can compare our results directly to those of Elsas and Florysiak (2011). For the deciles with large financing deficits, we find the same speeds of adjustment, up to 30% for market-based firms at the top range of absolute deficits, and up to 10% at the bottom range. However, the speed of adjustment is higher in market-based countries than in bank-based countries. This might be attributable to the more frequent use of share repurchases and SEOs, which make the leverage more flexible and cheaper to adjust in market-based countries.

Financial constraints. Our next step is to examine how the financial health influences adjustment speed. As Dang, Kim, et al. (2010) argue, financial health can have an important influence on the costs of deviating from the target leverage ratio. They note that over-leveraged firms face debt constraints and tend to have higher bankruptcy and liquidation costs. Therefore, their costs of deviating from the target are higher than for unconstrained firms. We thus believe constrained firms will adjust more quickly. Gilson (1997) notes that, under Chapter 11, debt restructuring is rather cheap. Therefore, the costs of adjustment should also be lower for constrained firms, which is another reason they adjust adjust faster.

In the literature, several approaches exist to determine whether a firm is financially constrained. For example, Korajczyk and Levy (2003) use dividend distributions. Because many investors look at a firm's rating during their decision process,

Table VIII – Speed of adjustment – Financial constraints

Panel A – Book Leverage

	Market-based				Bank-based			
	Constrained	Medium-constrained	Unconstrained	Difference	Constrained	Medium-constrained	Unconstrained	Difference
LagBL	0.815***	0.730***	0.847	0.865***	0.844***	0.808***	0.938***	0.873***
	(79.631)	(111.731)	(90.684)	(130.616)	(82.428)	(131.356)	(205.042)	(113.393)
SOA (in %)	18.5	27.0	15.3	13.5	15.6	19.2	6.2	12.7
LagBL×CON				−0.049***				−0.004
				(−7.493)				(−0.945)
N	6970	18421	6107	13077	6538	24545	9079	15617

Panel B – Market Leverage

	Market-based				Bank-based			
	Constrained	Medium constrained	Unconstrained	Difference	Constrained	Medium constrained	Unconstrained	Difference
LagML	0.784***	0.847***	0.870***	0.856***	0.847***	0.899***	0.904***	0.923***
	(44.698)	(116.828)	(77.135)	(100.889)	(38.514)	(179.151)	(132.367)	(149.484)
SOA (in %)	21.6	15.3	23.0	25.2	25.3	10.1	9.6	9.3
LagBL×CON				−0.043***				−0.014**
				(−5.038)				(−3.021)
N	3191	10225	4162	7353	2793	13810	7335	10128

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

This table gives the speed of adjustment conditional on financial health. All estimations are obtained using the DPF estimator: $L_{i,t} = (1-\lambda)L_{i,t-1} + \lambda\beta X_{i,t-1} + \mu_i + \epsilon_{i,t}$, with $mu_i = \alpha_0 + \alpha_1 L_{i,0} + E(X_i)\alpha_2 + \alpha_i$. The dependent variable is book/market leverage as described in Table I. Table II contains an explanation for the independent variables. Details on the estimation of financial constraints can be found in Appendix A. SOA is 1 minus the coefficient on lagged market leverage. The variable $LagBL/ML \times CON$ is an interaction term between the lagged leverage and the financial constraint dummy, which is equal to 1 for financially constrained firms. The difference sample is consistent for all firms, except medium constrained ones. Time dummies, constants, initial leverage, and mean exogenous variables are omitted.

the rating is a natural means to determine financial constraints. However, only a small subsample of firms are rated, and some perfectly solvent firms have foregone a rating. This problem can be especially severe in an international sample, because ratings are more common in market-based countries. To overcome this problem, we use Lemmon and Zender's (2010) method, which estimates the probability that a firm will be able to access public debt markets. In particular, they use a logit regression to estimate the probability of a firm having a bond rating.[17] In our regressions, we use the log of total assets, return on assets, tangibility, market-to-book ratio, leverage, firm age, and the standard deviation of earnings as predictors for rating probability. The dependent variable is a dummy equal to 1 if the firm has a rating, and 0 otherwise. We use Standard and Poor's RatingExpress database. Although there are three dominant rating agencies, the resulting probability should capture the financial health of a firm because the rating methods use roughly the same inputs. We then build three groups: constrained, medium-constrained and unconstrained, and perform the speed of adjustment estimation.[18]

The results are in Table VIII. For book leverage, we find the highest adjustment speed for medium-constrained firms in both market- and bank-based countries. The speed of adjustment is higher for constrained firms, however, by only 3 percentage points for market-based countries and by 9 for bank-based countries. Constrained firms also adjust faster than unconstrained firms, but not as fast as medium-constrained ones. Moreover, the costs of deviating from the target drive medium-constrained firms to a faster adjustment. For constrained firms, these costs are even higher, but here also the costs of adjustment seem to be higher, resulting in a lower adjustment speed. We note that the accounting data available in Compustat Global for bankrupt firms is often somewhat murky. Therefore, our cleansing steps could have led to their deletion. This would explain why Gilson's (1997) argument of a faster adjustment in bankruptcy does not seem to apply to our data.

Firms with debt constraints also face higher costs of equity issuing, and, therefore, they can not adjust as quickly as desired. Unconstrained firms in bank-based countries have only have an adjustment speed of 6.2%. For them, the cost of deviating from their target capital levels seems very low.

17 The results of the regression are in Appendix A.

18 A firm is considered constrained if the probability of it being rated is below 0.25; when the probability is higher than 0.75, it is considered unconstrained. We use a larger group for medium-constrained firms, because we are primarily interested in constrained and unconstrained firms. It is also natural that the main group of firms would be of medium health.

For market leverage (Panel B of Table VIII) in market-based countries, we find the highest speed of adjustment (21%) for constrained firms. This may be attributable to the fact that the market is the main source of capital in these countries. This arm's length drives them more quickly to their targets, forcing them to issue equity or buy back debt. We also find the highest speed of adjustment (25.3%) in bank-based countries for constrained firms. Here, market leverage seems to be a more dominant measure than for unconstrained firms. Furthermore, as Welch (2004) notes, unconstrained firms do not adjust market leverage, as constrained firms do. We could conclude that these firms thus face higher costs from deviating from the market leverage ratio. For financially distressed firms, market valuation might be a faster and more direct indicator of financial health than book leverage, because it reacts faster to restructuring announcements and might be more easily adjusted.

Elsas and Florysiak (2011) investigate the influence of the rating on the speed of adjustment. Because our measure of financial deficits is derived from bond ratings, it is somewhat comparable. They find the highest speed of adjustment to market leverage targets at 51% for CCC+ to D-rated firms, which are clearly financially constrained. Here, Gilson's (1997) findings can explain the results: Firms in distress have low adjustment costs, because restructuring debt is fairly simple under Chapter 11. The speed of adjustment for BB+ and B-rated firms is 14%, which is rather low, as we find for our constrained sample. And Elsas and Florysiak (2011) find that unconstrained firms (AAA to AA-rated firms) adjust rather quickly at 30%, but we cannot confirm this. Our sample of unconstrained firms is larger, with a broader definition of what constitutes unconstrained. Therefore, we don't focus on this effect.

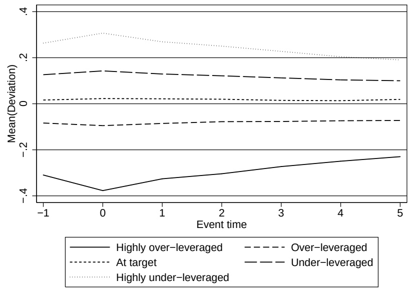
We find that financial constraints have a larger impact in market-based countries, with a 4.9% faster adjustment of constrained firms for book leverage, and 4.3% for market leverage. For bank-based countries, the differences are only 0.4% for book leverage and 1.4% for market leverage. Easier access to capital markets for constrained firms also seems to result in lower adjustment costs in market-based countries. The lower costs of deviating from the target may be another source of influence, because banks use insider-oriented corporate governance mechanisms.

Distance from target. Another determinant of the speed of adjustment might be the distance of a firm from its target. The costs of deviating from the target should increase with this distance, because bankruptcy costs increase for over-leveraged firms, and, free cash flow problems increase for under-leveraged firms (Jensen 1986). Therefore, these firms should adjust more quickly than those near or at their targets.

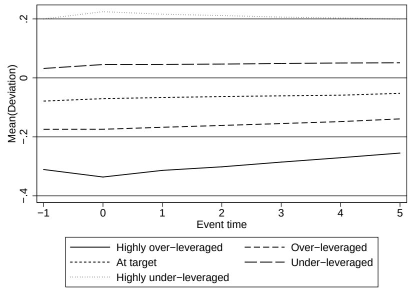
To explore this issue more fully we follow Elsas and Florysiak's (2011) and use an event approach. We calculate target leverage at each firm year by using the results of the FE regression in Table IV for book leverage and Table V for market leverage. We then calculate the distance from the target leverage by subtracting the actual leverage. We sort the firms into quintiles according to distance from target and look at the development of leverage over time after a leverage shock. Figure III shows the development of the mean of the deviation in years t_{-1} to t_5.

Panel A shows the reaction after a book leverage shock in market-based countries. Note that highly over- or under-leveraged firms adjust the fastest (the slope is the steepest). For bank-based countries, Panel B shows the adjustment is slower and the shocks also seem smaller in magnitude. Panels C and D show the results for market leverage. Here, the results provide some evidence of asymmetry in adjustment behavior. Firms that are highly over-leveraged after the shock tend to adjust quickly; highly under-leveraged firms, on the other hand, adjust more slowly. Also, for market leverage, positive shocks have a larger impact on adjustment than negative shocks, as can be seen by the steeper slope of the green line.

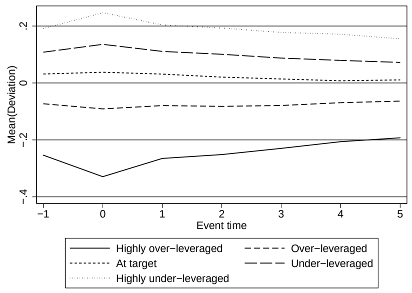
We illustrate the speed of adjustments after shocks in Table IX. We find high speed of adjustment for book leverage for highly over-leveraged firms: 54% in market-based countries and 38 % in bank-based ones. For highly under-leveraged firms, we find a 25% adjustment speed in market-based countries, and 19% in bank-based ones. The speed of under-leveraged firms is lower than that of firms at their targets (31%), over-leveraged firms (38%), and under-leveraged firms (40%) in market-based countries. We also find in bank-based countries that the speed of highly under-leveraged firms is only slightly higher than the speed of firms at target (19%), over-leveraged (24%), or under-leveraged. Examining market leverage, we find a similar pattern for market-based countries: a high speed of adjustment for highly over-leveraged firms (37%) and a moderate speed for highly under-leveraged firms (23%), while the other speeds fall somewhere in between. For bank-based countries, there is one difference: Highly over-leveraged firms adjust more slowly (24%) than over-leveraged firms (40%). The highly over-leveraged firms in terms of market leverage seem to face higher adjustment costs. So to adjust, firms must either issue equity, which might be harder to place in the less developed capital markets of bank-based countries, or buy back debt.



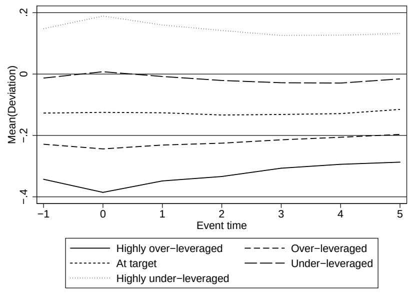
(A) Book leverage – Market-based



(B) Book leverage – Bank-based



(C) Market leverage – Market-based



(D) Market leverage – Bank-based

Figure III – Speed of adjustment after leverage shocks
This figure presents the leverage after a financial shock with the method of Elsas and Florysiak (2011). We sort firm years according to their difference from the target leverage in t_0, and build quintiles from highly over-leveraged firms to highly under-leveraged firms. We than plot the mean deviation in each quintile from t_{-1} to t_5.

Table IX – Speed of adjustment after shocks

	Book-leverage		Market-leverage	
	Market	Bank	Market	Bank
Panel A – Highly over-leveraged				
LBL/LML	0.463***	0.617***	0.628***	0.759***
	(17.087)	(21.814)	(16.315)	(13.654)
SOA (in %)	53.7	38.3	37.2	24.1
N	1131	1635	1064	1647
Panel B – Over-leveraged				
LBL/LML	0.620***	0.759***	0.704***	0.597***
	(20.040)	(20.845)	(21.580)	(21.540)
SOA (in %)	38.0	24.1	29.6	40.3
N	1022	1498	979	1670
Panel C – At target				
LBL/LML	0.688***	0.811***	0.752***	0.782***
	(19.214)	(32.008)	(19.341)	(33.397)
SOA (in %)	31.2	18.9	24.8	21.8
N	796	1217	904	1257
Panel D – Under-leveraged				
LBL/LML	0.603***	0.723***	0.663***	0.811***
	(14.646)	(21.228)	(19.196)	(15.646)
SOA (in %)	39.7	27.7	33.7	28.9
N	762	1257	902	1180
Panel E – Highly under-leveraged				
LBL/LML	0.655***	0.801***	0.770***	0.834***
	(15.890)	(21.065)	(17.609)	(29.161)
SOA (in %)	24.5	19.1	23.0	16.6
N	561	1151	589	1030

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

This table shows the speed of adjustment conditional on the difference from target leverage. We sort firm years according to their difference from the target leverage in t_0, and build quintiles from highly over-leveraged to highly under-leveraged firms. We then estimate the speed of adjustment using the firm years from t_{-1} to t_5 to estimate the after-shock speed. All estimations are done by means of the DPF estimator: $L_{i,t} = (1-\lambda)L_{i,t-1} + \lambda\beta X_{i,t-1} + \mu_i + \epsilon_{i,t}$, with $mu_i = \alpha_0 + \alpha_1 L_{i,0} + E(X_i)\alpha_2 + \alpha_i$. SOA is 1 minus the coefficient on lagged market leverage. Time dummies, constants, initial leverage, and mean exogenous variables are omitted.

Contrary to Elsas and Florysiak (2011), we do not find extremely high speeds of adjustment for under-leveraged firms, and we cannot confirm their U-shaped pattern. However, our results are consistent with those of Faulkender et al. (2011), who find high adjustment speeds for over-leveraged firms. We find that firms tend to deleverage quickly after large positive shocks, but do not releverage after large negative shocks in the same speed. We thus find evidence for asymmetric behavior in terms of higher adjustment speeds for over-leveraged firms, and only moderate adjustment speeds for under-leveraged firms. This confirms the asymmetry in the costs of deviating from the target (Faulkender et al. 2011): Bankruptcy costs from over leveraging seems to be more expensive than the costs of having too little debt (e.g., agency conflicts and free cash flow problems).

3.5.2.3 Macroeconomic environment

In addition to a firm's overall financial health, we posit that the speed of adjustment, may also be impacted by macroeconomic events and the state of the market. We investigate the influence of recessions to determine whether firms react to market state by market timing.

Recession indicators. During a recession, capital markets are often less liquid and banks tend to tighten credit, which results in higher adjustment costs. Therefore, we expect a lower speed of adjustment during recessions. We test this hypothesis by using several measures. As a broad indicator of recessions, we use the classification of the Economic Cycle Research Institute.[19] Approximately 1% of the years are classified as recessionary in market based countries, while 38% are in bank-based countries. The reason for the low number of recession years in market-based countries is that the data comes monthly and we only classify a firm year as recessionary if the financial year end is in a recession month. The high number in bank-based countries is attributable to the long lasting Japanese recession. In fact, according to the ECRI, more than 40% of the months in the database are classified as recessionary in Japan.

To further classify recessions, we use a broad set of macroeconomic indicators, such as the U.S. credit spread, to obtain a broad indicator of risk, the TED spread, the term spread, and the GDP growth rate. We then build quintiles, and compare the high-performing states (the quintile with the best observations) with the poor-

19 The data come form the Economic Cycle Research Institute website (`www.businesscycle.com`).

performing states (the quintile with the worst observations), as in Cook and Tang (2010). Using an interaction term, we examine the differences between the different periods of recession and the normal adjustment rates.

Table X gives our results for book leverage, and Table XI for market leverage. First, by looking at the recession dummy for book leverage, we observe a higher speed of adjustment during good states of the economy than during bad states. In market-based countries, we find a 23% speed for good states; during bad states, it slows down to just 16%. The difference in speed for the bad state is significant, at 2.5 percentage points lower. In bank-based countries, we observe the same pattern: 14% during good states, 9% during bad states, and a significant difference of 5.6%.

Next, by looking at the credit spread in Panel B of Table X, we see that market-based firms do not appear to be sensible to this measure. For bank-based countries, it also shows that, during bad states, firms adjust more slowly. Note that the credit spread is an international measure of risk attitude and pricing of risk, and is thus more critical to firms that rely more heavily on debt. It is not surprising that this measure has an impact on the speed of adjustment in bank-based countries.

For the TED-spread, we find only a small significant difference between the good and bad states. For bank-based countries, it is 6.5% higher, and exhibits a highly significant coefficient on the difference dummy. The term spread shows significantly different behavior only in market-based countries: The speed of adjustment is higher in times of an inverse term structure. As an inverse term structure is leading recession indicator, we conclude that the speed is higher if a recession is on the horizon. indicating a higher speed at a . However, the GDP growth rate has a strong influence on the speed of adjustment. During times of high GDP growth, the speeds of adjustment are 20% and 10%, respectively; but during poorer-performing times, they are only 13% and 5%. Firms seem to use periods of strong economic growth and investment opportunities to adjust their capital structure.

For market leverage in Table X, we can confirm the overall finding that the speed of adjustment is generally slower than for book leverage. The reaction of the speed of adjustment is not as dependent on the state of the economy as for book leverage. However, there are some differences: The recession dummy shows about a 9% influence in market-based countries, and only 1% in bank-based countries. This implies the speed of adjustment of market leverage reacts more strongly during recessions in market-based countries. For the credit spread, we find no differences . The TED spread shows different behavior for both states, with an 8.2% lower speed for bad states in market-based countries, and 3.3% in bank-based ones. However, note that the term spread also has an unexpected influence: In market-based countries, the speed of adjustment is 5.3% lower, but in bank-based countries, firms adjust faster when there is an inverse time structure of interest rates. Firms may use that time to restructure long-standing credit contracts. Finally, the GDP growth rate has only a small impact.

Overall, our evidence suggests higher speeds of adjustment during positive economic states, and low speeds during times of recession. We confirm this finding with several measures. We compare our results to Cook and Tang (2010), and we also find generally lower estimates. We can confirm that firms adjust faster during positive economic states.

Market timing. Using the equity risk premium and inflation, we can determine whether the speed of adjustment is influenced by the state of the equity market. Inflation and the equity risk premium impact the price of risk, and, therefore, the costs of adjustment. During high-inflation periods (we call them “bad”), firms adjust more quickly than during low-inflation (“good”) periods. This observation holds for book leverage in market- and bank-based countries, and for market leverage in market-based countries. In bank-based countries, market leverage adjustment speed does not appear to be influenced by market variables. However, for book leverage, this is a first indicator of market timing. High inflation favors borrowers, resulting in lower adjustment costs. Furthermore, larger amounts of debt tend to lose value during periods of high inflation.

In the last Panel (G) of Tables X and XI, we investigate the influence of the equity risk premium, which is defined as the mean of the last twelve-month stock return in excess of a market return. “Bad” states are defined as states with a high mean return, indicating a low risk premium. “Bad” for states with a low risk premium is somewhat unintuitive, but we take the view of investors here and secure uniform appellation. We find that firms adjust more quickly after periods of rising stock prices. This indicates that the speed of adjustment is also influenced by market timing considerations. After periods of rising stock prices, the equity risk premium is lower, which also lowers the costs of adjustment with equity. Firms use this opportunity to issue capital. Furthermore, except for market leverage in bank-based countries, this behavior is equally pronounced for both book and market leverage in market-based countries. In bank-based countries, however, markets are not as

Table X – Speed of adjustment and macroeconomics - Book leverage

	Market-based			Bank-based		
	Good	Bad	G.vs.B.	Good	Bad	G.vs.B.
Panel A – States determined by recession indicator						
LBL	0.772***	0.842***	0.774***	0.861***	0.914***	0.805***
	(145.373)	(74.804)	(151.299)	(180.570)	(168.987)	(144.488)
SOA (in %)	22.8	15.8	22.6	13.9	8.6	19.5
LBL×REC			0.024**			0.056***
			(2.707)			(16.553)
REC			−0.004			−0.031***
			(−0.657)			(−13.311)
N	28 092	3406	31 498	22 966	17 196	40 162
Panel B – States determined by spread on Moody's AAA to BBB bond index						
LBL	0.833***	0.842***	0.840***	0.867***	0.933***	0.875***
	(107.442)	(105.093)	(122.563)	(119.515)	(165.773)	(147.570)
SOA (in %)	16.7	15.8	16.0	13.3	6.7	12.5
LBL×BADDUMCREDIT			0.008			0.045***
			(1.039)			(8.140)
BADDUMCREDIT			−0.011			−0.024***
			(−0.521)			(−4.925)
N	7980	6493	14 473	6525	9796	16 321
Panel C – States determined by TED spread						
LBL	0.837***	0.859***	0.835***	0.860***	0.918***	0.857***
	(119.022)	(109.795)	(121.976)	(156.453)	(115.872)	(154.300)
SOA (in %)	16.3	14.1	16.5	14.0	8.2	14.3
LBL×BADDUMTED			0.019*			0.065***
			(2.186)			(9.345)
BADDUMTED			0.000			−0.037***
			(0.013)			(−6.298)
N	7031	5875	12 906	8651	4052	12 703
Panel D – States determined by term spread						
LBL	0.853***	0.814***	0.854***	0.911***	0.916***	0.915***
	(101.167)	(106.438)	(115.637)	(122.802)	(158.318)	(144.631)
SOA (in %)	14.7	18.6	14.6	8.9	8.4	8.5
LBL×BADDUMTERM			−0.034***			0.004
			(−3.692)			(0.689)
BADDUMTERM			−0.018			−0.011
			(−0.828)			(−1.787)
N	5556	6160	11 716	4617	9214	13 831

continued

Table X – (continued)

	Market-based			Bank-based		
	Good	Bad	G.vs.B.	Good	Bad	G.vs.B.
Panel E – States determined by GDP growth rate						
LBL	0.795***	0.871***	0.805***	0.893***	0.954***	0.883***
	(88.040)	(102.935)	(105.794)	(164.666)	(168.278)	(168.628)
SOA (in %)	20.5	22.9	19.5	10.7	4.6	11.7
LBL×BADDUMGDP			0.054***			0.064***
			(5.961)			(13.220)
BADDUMGDP			−0.023**			−0.039***
			(−2.982)			(−11.314)
N	7224	5192	12 416	9445	8632	18 077
Panel F – States determined by inflation						
LBL	0.846***	0.823***	0.841***	0.940***	0.928***	0.940***
	(103.391)	(104.020)	(104.850)	(145.263)	(189.869)	(172.440)
SOA (in %)	15.4	17.7	15.9	6.0	7.2	6.0
LBL×BADDUMINF			−0.029**			−0.021***
			(−3.225)			(−3.858)
BADDUMINF			0.013*			0.015*
			(2.146)			(2.269)
N	5606	6326	11 932	6298	9277	15 575
Panel G – States determined by equity risk premium						
LBL	0.844***	0.818***	0.844***	0.918***	0.890***	0.908***
	(105.544)	(109.565)	(114.689)	(172.137)	(154.719)	(164.753)
SOA (in %)	15.6	18.2	15.6	8.2	11.0	9.2
LBL×BADDUMERP			−0.034***			−0.043***
			(−3.840)			(−8.985)
BADDUMERP			−0.021*			0.003
			(−2.387)			(0.475)
N	6254	6405	12 659	11 048	8370	19 418

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

This table shows the speed of adjustment conditional on the macroeconomic environment. The column *Good* refers to good macroeconomic states. We classify states as good if the recession indicator is zero, the credit spread is low, the TED spread is low, the term spread is low, the GDP growth rate is high, the inflation rate is low, and the equity risk premium is low. The classification for *Bad* is the opposite. The *G.vs.B* column estimates whether the difference between good and poor states is significant. *BADDUM* is a dummy variable equal to 1 in bad states. *LBL×BADDUM* is an interaction term between lagged leverage and the bad dummy. All estimations are done by the DPF estimator: $L_{i,t} = (1-\lambda)L_{i,t-1} + \lambda\beta X_{i,t-1} + \mu_i + \epsilon_{i,t}$, with $mu_i = \alpha_0 + \alpha_1 L_{i,0} + E(X_i)\alpha_2 + \alpha_i$. SOA is 1 minus the coefficient on lagged book leverage. Time dummies, constants, initial leverage, and mean exogenous variables are omitted.

Table XI – Speed of adjustment and macroeconomics - Market leverage

	Market-based			Bank-based		
	Good	Bad	G.vs.B.	Good	Bad	G.vs.B.
Panel A – States determined by recession indicator						
LML	0.838***	0.905***	0.838***	0.897***	0.882***	0.902***
	(148.539)	(44.383)	(150.435)	(131.760)	(106.534)	(207.158)
SOA (in %)	16.2	9.5	16.2	10.3	11.8	9.8
LML×REC			0.086***			0.010*
			(6.923)			(2.237)
REC			−0.033***			0.021***
			(−4.659)			(6.594)
N	16 056	1522	17 578	13 133	10 805	23 938
Panel B – States determined by spread on Moody's AAA to BBB bond index						
LML	0.847***	0.860***	0.846***	0.956***	0.906***	0.930***
	(76.727)	(66.942)	(86.847)	(99.066)	(109.069)	(123.256)
SOA (in %)	15.3	14.0	15.4	4.4	9.4	7.0
LML×BADDUMCREDIT			0.014			−0.002
			(1.320)			(−0.233)
BADDUMCREDIT			−0.007			0.020**
			(−0.278)			(2.766)
N	5115	3109	8224	4311	5595	9906
Panel C – States determined by TED spread						
LML	0.825***	0.913***	0.828***	0.947***	0.942***	0.939***
	(74.714)	(61.694)	(83.387)	(112.239)	(69.481)	(122.470)
SOA (in %)	17.5	8.7	17.2	5.3	5.8	6.1
LML×BADDUMTED			0.082***			0.033***
			(7.116)			(3.370)
BADDUMTED			−0.026**			−0.011
			(−2.636)			(−1.186)
N	3640	3126	6766	4958	2240	7198
Panel D – States determined by term spread						
LML	0.816***	0.868***	0.817***	0.927***	0.895***	0.943***
	(64.687)	(66.002)	(81.287)	(76.195)	(102.442)	(94.363)
SOA (in %)	18.5	13.2	18.3	7.3	10.5	5.7
LML×BADDUMTERM			0.053***			−0.058***
			(4.476)			(−6.311)
BADDUMTERM			0.055			0.014
			(0.987)			(1.386)
N	3036	3532	6568	2549	5513	8062

continued

Table XI – (continued)

	Market-based			Bank-based		
	Good	Bad	G.vs.B.	Good	Bad	G.vs.B.
Panel E – States determined by GDP growth rate						
LML	0.852***	0.869***	0.850***	0.886***	0.899***	0.897***
	(72.378)	(64.946)	(82.012)	(103.377)	(100.034)	(138.224)
SOA (in %)	14.8	13.1	15.0	11.4	10.1	10.3
LML×BADDUMGDP			0.024*			0.009
			(2.066)			(1.312)
BADDUMGDP			−0.019*			0.021***
			(−2.161)			(3.939)
N	4572	2609	7181	6077	4953	11 030
Panel F – States determined by inflation						
LML	0.893***	0.812***	0.877***	0.894***	0.887***	0.893***
	(63.243)	(66.335)	(74.988)	(82.396)	(124.966)	(115.406)
SOA (in %)	10.7	18.8	12.3	10.6	11.3	10.7
LML×BADDUMINF			−0.055***			−0.002
			(−4.388)			(−0.319)
BADDUMINF			0.031***			−0.004
			(3.980)			(−0.338)
N	2845	3361	6206	3481	5737	9218
Panel G – States determined by equity risk premium						
LML	0.860***	0.831***	0.880***	0.865***	0.871***	0.887***
	(61.131)	(76.622)	(86.120)	(102.381)	(98.656)	(146.410)
SOA (in %)	14.0	16.9	12.0	13.5	12.9	11.3
LML×BADDUMERP			−0.067***			−0.007
			(−5.995)			(−0.978)
BADDUMERP			−0.061***			−0.066*
			(−3.463)			(−2.572)
N	3234	4013	7247	6555	5308	11 863

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

This table shows the speed of adjustment conditional on the macroeconomic environment. The column *Good* refers to good macroeconomic states. We classify states as good if the recession indicator is zero, the credit spread is low, the TED spread is low, the term spread is low, the GDP growth rate is high, the inflation rate is low, and the equity risk premium is low. The classification for *Bad* is the opposite. The *G.vs.B* column estimates whether the difference between good and poor states is significant. *BADDUM* is a dummy variable equal to 1 in bad states. $LML \times BADDUM$ is an interaction term between lagged leverage and the bad dummy. All estimations are done by the DPF estimator: $L_{i,t} = (1-\lambda)L_{i,t-1} + \lambda\beta X_{i,t-1} + \mu_i + \epsilon_{i,t}$, with $mu_i = \alpha_0 + \alpha_1 L_{i,0} + E(X_i)\alpha_2 + \alpha_i$. SOA is 1 minus the coefficient on lagged market leverage. Time dummies, constants, initial leverage, and mean exogenous variables are omitted.

important for financing, so an equity risk premium-induced difference in market leverage is not measurable.

Overall, we find that firms in market-based countries have higher adjustment speeds, which are induced by high inflation and a low equity risk premium. This indicates market timing behavior. In bank-based countries, only the adjustment speed of book leverage is affected by inflation and the equity risk premium.

3.6 Conclusion

Adjustment speed varies for firms and during different economic states. To explore what causes the differences, we perform an in-depth investigation of adjustment speed and look for differences according to firms' financial systems, financial conditions, and the macroeconomic environments. We use an estimator that accounts for the fractional nature of the dependent variable leading to unbiased estimates.

We find a 20% mean speed of adjustment, which is lower than in most historical studies, but is well within the range of studies using advanced estimators that do not suffer from a priori known biases. We find a higher speed of adjustment in market-based countries than in bank-based countries. This is further evidence that there are in fact two different financial systems, and firms face different adjustment costs and different costs of deviating from their targets within these two systems. Future articles may want to explore this concept further, in an effort to shed more light on the different mechanisms of determining of the capital structure.

Furthermore, we find that firms tend to use periods of high financial deficits to adjust faster. Financially constrained firms can adjust faster than unconstrained firms, but they are slower than medium-constrained firms. Even if they desire to adjust more quickly, we find they face higher costs of deviating from their targets, and will thus be prevented by the concurrent high costs of adjustment. Highly over-leveraged firms also adjust faster than highly under-leveraged firms. There seems to be some asymmetry in the costs of deviating from targets here: the costs appear to be higher for over-leveraged firms.

The speed of adjustment is also dependent on the state of the economy. We find a lower adjustment speed during times of recession. This phenomenon is more pronounced for book leverage. Market leverage speeds do not react as strongly to the economic environment, particularly in bank-based countries. Moreover, we find evidence of market timing, as firms adjust faster during periods of high inflation and low equity risk premiums.

Our results are helpful in judging capital structure models, and they can provide evidence for a target leverage over the medium and long term. However, as we note, the speed of adjustment is not greatly affected by short-run deviations from the target. We would suggest that future research on this topic focus on the differences even more strongly, and illuminate how the institutional environment and the macroeconomy impact the speed of adjustment. As our results show, firm behavior is ultimately conditional on these factors.

Appendix A. Financial constraints estimation

Table XII – Estimation of debt capacity

VARIABLES	USA (1)	GBR (2)	CAN (3)	EUR (4)	JPN (5)
AT	0.608***	1.105***	0.817***	1.025***	1.883***
	(0.010)	(0.049)	(0.042)	(0.038)	(0.076)
OIBD	1.075***	−3.560***	−0.285	−2.964***	4.277**
	(0.140)	(0.664)	(0.560)	(1.002)	(1.840)
BL	1.838***	2.548***	2.484***	0.337	−1.691***
	(0.064)	(0.365)	(0.312)	(0.553)	(0.395)
TANG	−0.085	1.406***	0.176	0.774	−0.151
	(0.086)	(0.387)	(0.265)	(0.482)	(0.510)
MTBV	−0.111***	0.314***	0.120*	0.101	−0.183
	(0.019)	(0.085)	(0.067)	(0.098)	(0.133)
AGE	0.074	−0.075	−0.226	1.007***	1.381***
	(0.049)	(0.215)	(0.160)	(0.252)	(0.462)
VOLA	0.003	−0.000	0.012	0.014	0.053**
	(0.004)	(0.028)	(0.014)	(0.020)	(0.022)
Constant	−8.471***	−14.280***	−9.037***	−26.910***	−31.921***
	(0.478)	(1.335)	(0.505)	(0.863)	(1.767)
Observations	45 389	11 503	4937	12 245	39 636

Robust standard errors are in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

This table shows the estimation of debt capacity. The dependent variable is a dummy equal to 1 if the firm has a rating, and 0 otherwise. *AT* is the log of total assets; *OIBD* is profitability; *BL* is book leverage; *TANG* is tangibility; *MTBV* is the market-to-book ratio; *AGE* is years the firm is in Compustat; *VOLA* is the volatility of earnings. The estimation is carried out using a logit regression. The probability of a rating is calculated for each firm after the estimation. A firm is classified as constrained if the probability is below 1/4, unconstrained if it is higher than 3/4, and as medium constrained if it falls in between.

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Kapitel 4

Haben Manager Timing-Fähigkeiten? Eine empirische Untersuchung von Directors'-Dealings

mit Wolfgang Drobetz[a] und Sven Lindner[b]

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[a] Wolfgang Drobetz, Lehrstuhl für Unternehmens- und Schiffsfinanzierung, Universität Hamburg, Von-Melle-Park 5, 20146 Hamburg, Tel.: +49-40-42838-5506, Mail: wolfgang.drobetz@wiso.uni-hamburg.de.

[b] Sven Lindner, NRS Norddeutsche Retail-Service AG, Börsenbrücke 2a, 20457 Hamburg, Mail: sven.lindner@ nrs-ag.de.

Zusammenfassung

In dieser Untersuchung wird die Performance deutscher Unternehmensinsider bei Transaktionen in Aktien ihrer „eigenen“ Unternehmen analysiert. Grundlage sind die Mitteilungen der BaFin-Datenbank für Directors’ Dealings über den Zeitraum vom 1. Juli 2002 bis 17. März 2009. Die Ergebnisse deuten darauf hin, dass Unternehmensinsider über ausgeprägte Timing-Fähigkeiten verfügen. Insider verhalten sich als Contrarian-Investoren, d.h. sie kaufen Aktien nach Kursverlusten und verkaufen nach Kursanstiegen. Während im Anschluss an Käufe die Kursanstiege zu signifikanten abnormalen Renditen für die Insider führen, vermeiden sie signifikante Kursverluste nach Verkäufen. Für die Information-Hierarchy-Hypothese, wonach die Werthaltigkeit von Informationen mit steigender Hierarchieebene eines Insiders zunimmt, gibt es keine empirische Evidenz. Hingegen haben die verschärften Regularien des Insiderrechts seit Oktober 2004 zu einem Abbau der Informationssymmetrien zwischen Unternehmensinsidern und Marktteilnehmern und damit zur Integrität des Marktes beigetragen. Daneben enthält die Untersuchung auch einen zentralen methodischen Beitrag. Die empirischen Ergebnisse sind robust und können sowohl durch eine klassische Ereignisstudie als auch in Panelregressionen im Rahmen eines generalisierten Kalenderzeitansatzes bestätigt werden.

Stichwörter: Insidertransaktionen, Directors’ Dealings, Markteffizienz, Ereignisstudie, Kalenderzeitverfahren

JEL Klassifikation: G11, G12, G14, G23

4.1 Einleitung

Das Informationsgefälle zwischen Unternehmensinsidern und allen anderen Marktteilnehmern (Outsidern) ist ein zentrales Element der Finanzierungslehre.[1] Unternehmensinsider, also insbesondere Vorstände und Aufsichtsratsmitglieder börsennotierter Gesellschaften, besitzen wertvollere Informationen über den wahren Zustand ihres „eigenen" Unternehmens als Kleinaktionäre. Es erstaunt daher nicht, dass die Handelsaktivitäten von Unternehmensinsidern in zahlreichen Studien untersucht wurden (Jaffe 1974; Seyhun 1986; Lakonishok und Lee 2001; Fidrmuc u. a. 2006). Im Mittelpunkt steht dabei die Frage nach der Profitabilität von Insider-Transaktionen vor dem Hintergrund der Informationseffizienz der Kapitalmärkte (Fama 1970). Eine Analyse der Profitabilität von Insider-Transaktionen stellt einen Test der starken Form der Markteffizienz dar. Im Gegensatz dazu ermöglicht die Analyse der Profitabilität von Mimicking-Strategien (d.h. Käufe und Verkäufe von Marktteilnehmern im Anschluss an die Veröffentlichung von Insider-Käufen bzw. Insider-Verkäufen) einen Test der mittelstarken Form der Markteffizienz.

In der Regulierungsliteratur werden Insider-Transaktionen sehr ambivalent beurteilt. Insider-Transaktionen können einerseits einen Beitrag zur verbesserten Wertpapierpreisbildung und damit zur effizienten Ressourcenallokation liefern, sie bergen jedoch anderseits auch die Gefahr eines opportunistischen Verhaltens der Insider. Leland (1992) argumentiert, dass die Aktienkurse einen höheren Informationsgehalt aufweisen und das allgemeine Bewertungsniveau höher ausfällt, wenn Unternehmensinsider Wertpapiere des eigenen Unternehmens handeln dürfen. Nach Manne (1966a, 1966b) stellt der Handel mit Unternehmensaktien einen effizienten Vergütungsmechanismus für die Leistungen der Insider dar, weil der Vertrag zwischen Managern und Anteilseignern nicht ständig den sich wandelnden Umweltbedingungen angepasst werden muss. Insider könnten ihren Informationsvorteil aber auch opportunistisch ausnutzen. Bereits Lin und Howe (1990) dokumentieren, dass die abnormalen Renditen der Outsider im Rahmen von Mimicking-Strategien geringer ausfallen als jene der Insider. Auch wenn dieses Ergebnis aufgrund der asymmetrischen Informationsverteilung nicht grundsätzlich überrascht, ist aus eben diesem Grund Insider-Trading auf entwickelten Kapitalmärkten einer starken Regulierung durch den Gesetzgeber unterworfen. Ziel der gesetzlichen Regelung ist es, zu ver-

1 Im Rahmen dieser Arbeit werden unter dem Begriff „Outsider" alle Kapitalmarktteilnehmer verstanden, die keine Insider nach der Definition des Wertpapierhandelsgesetzes (WpHG) sind.

meiden, dass die Marktintegrität durch Missbrauch in Form von Insiderhandel und Marktmanipulation in Zweifel gezogen wird, was wiederum zum Vertrauensverlust der Anleger führen könnte (Seyhun 1986). Entsprechend liegt in Deutschland nach dem Wertpapierhandelsgesetz (WpHG) ein gesetzeswidriges Insider-Geschäft dann vor, wenn die der Transaktion zugrunde liegende Insiderinformation konkret ist und einen Tatsachenkern enthält. Die Information muss zusätzlich das Potential haben, den Kurs des Insiderpapiers zu beeinflussen.

Ein zentrales Ergebnis früherer empirischer Studien ist, dass Unternehmensinsider über ausgeprägte Timing-Fähigkeiten beim Handel eigener Aktien besitzen. Zu den ersten Studien zählen Jaffe (1974) und Finnerty (1976), die beide für den US-Markt kurzfristige abnormale Renditen für Insider dokumentieren. Beispielsweise misst Finnerty (1976) im Handelsmonat abnormale Renditen für Insider-Käufe in Höhe von 3,68% und für Insider-Verkäufe in Höhe von -0,90%. Seyhun (1986) dokumentiert, dass die abnormalen Renditen in den 100 Tagen nach einer Insider-Transaktion 3,00% bei Käufen und -1,78% bei Verkäufen betragen. Während abnormale Renditen am Ereignistag selbst nicht überraschen, deuten die langfristigen Bewertungseffekte darauf hin, dass der Markt die Insiderinformation nur langsam verarbeitet. Neben diesen Beobachtungen zur Kapitalmarkteffizienz weisen viele Studien auf Handelsmuster der Insider hin. Ein regelmäßig dokumentiertes Muster ist die Fähigkeit der Insider, die kurzfristige Wertentwicklung des Unternehmens prognostizieren zu können. Insider kaufen Aktien, wenn das Unternehmen aus ihrer Sicht unterbewertet ist und verkaufen Aktien, wenn sie das Unternehmen als überbewertet erachten. Da sich die Insider gegenläufig zur beobachteten Preisentwicklung verhalten, verfolgen sie eine „Contrarian-Investment-Strategie“ (Givoly und Palmon 1985; Seyhun 1986; Rozeff und Zaman 1998). Ob sich daraus allerdings profitable „Mimicking-Strategien“ auch für andere Marktteilnehmer ergeben, wird in der empirischen Literatur mit teilweise widersprüchlichen Befunden diskutiert (Lin und Howe 1990; Bettis u. a. 1997; Lakonishok und Lee 2001; Jeng u. a. 2003).[2]

Die Determinanten der Profitabilität von Insider-Transaktionen stellen einen weiteren wichtigen Aspekt in den früheren Studien dar. Potentielle Einflussfaktoren sind die Unternehmensgröße (Seyhun 1986; Chari u. a. 1988; Lakonishok und Lee

2 Auch für andere nationale Kapitalmärkte außerhalb der USA liegen empirische Ergebnisse zum Insider-Trading vor. Die Studien von Pope u. a. (1990) und Friederich u. a. (2002) für Großbritannien, Bajo und Petracci (2006) für Italien, Biesta u. a. (2003) für die Niederlande, Fowler und Rorke (1988) für Kanada und Zhu u. a. (2002) für China bestätigen die US-amerikanischen Ergebnisse. Im Gegensatz dazu scheinen die Timing-Fähigkeiten der Insider in Spanien (Del Brio u. a. 2002) und Norwegen (Eckbo und Smith 1998) weniger stark ausgeprägt zu sein.

2001; Jeng u. a. 2003), die Nähe des Insiders zum operativen Geschäft (Seyhun 1986), das Transaktionsvolumen und deren Frequenz (Barclay und Warner 1993; Friederich u. a. 2002; Jeng u. a. 2003), die finanzielle Situation des Unternehmens (Gosnell u. a. 1992; Fidrmuc u. a. 2006), die Branche (Aboody und Lev 2000) sowie die Anleger- und Eigentümerstruktur (Fidrmuc u. a. 2006). Ein zentraler Gegenstand der empirischen Forschung ist schließlich die Frage, ob Insider ihren Informationsvorteil opportunistisch nutzen, oder ob die Profitabilität der Unternehmensinsider auf Preisdruckeffekte zurückzuführen ist, die durch Mimicking-Strategien der Outsider erzeugt werden. Die empirischen Befunde zeigen, dass Insider regelmäßig im Vorfeld von wichtigen Finanzierungsentscheidungen stattfinden, also etwa vor Dividendenerhöhungen (John und Lang 1991), Kapitalerhöhungen (Karpoff und Lee 1991), Aktienrückkäufen (Lee u. a. 1992), Gewinnankündigungen (Elliott u. a. 1984; Noe 1999; Ke u. a. 2003) oder vor einem Konkurs (Seyhun und Bradley 1997). Diese Ergebnisse deuten darauf hin, dass Insider ihren Informationsvorsprung aktiv zu ihrem eigenen Vorteil ausnutzen. Im Gegensatz dazu können Givoly und Palmon (1985) keinen systematischen Zusammenhang zwischen der Profitabilität von Insider-Transaktionen und der Veröffentlichung wichtiger und sehr breit gefasster Unternehmensnachrichten (d.h. nicht ausschließlich aus dem Finanzierungsbereich) messen.

Die Anzahl wissenschaftlicher Studien zum Insider-Trading in Deutschland ist bedingt durch die relativ späte Implementierung zwingender Gesetzesnormen und der damit verbundenen Datenverfügbarkeit gering. Zu den prominentesten Arbeiten zählen die Studien von Stotz (2006), Dymke und Walter (2008), Betzer und Theissen (2009a, 2009b) sowie Dickgiesser und Kaserer (2010).[3] Stotz (2006) weist über die 25 Handelstage nach dem Ereignistag abnormale Renditen von insgesamt 2,73% bei Käufen und -2,85% bei Verkäufen aus. Dabei verhalten sich Insider als „Contrarian-Investors", d.h. sie kaufen Wertpapiere des Unternehmens, nachdem der Aktienkurs gesunken ist, und sie verkaufen Wertpapiere nach einem Kursanstieg. Von diesen Timing-Fähigkeiten der Insider können auch Outsider profitieren, weil selbst im Anschluss an die Veröffentlichung der Transaktion signifikante abnormale Renditen zu beobachten sind. Betzer und Theissen (2009a) dokumentieren ähnliche Handelsmuster und untersuchen zusätzlich den Einfluss der Corporate-Governance auf die Profitabilität von Insider-Transaktionen. Aus ihren Ergebnissen leiten sie

3 Frühere Studien mit kleineren Stichproben für Deutschland stammen von Rau (2004), Heidorn u. a. (2004) sowie Tebroke und Wollin (2005).

die Wirksamkeit von Handelssperren für Insider vor Gewinnveröffentlichungen ab („Blackout-Perioden"). In Bezug auf die Anteilsstruktur finden sie höhere abnormale Renditen bei Unternehmen mit atomistischer Aktionärsstruktur. Die Position des Insiders im Unternehmen (also Vorstand bzw. Aufsichtsrat; Information-Hierarchy-Hypothese) scheint hingegen keine systematische Determinante für die Werthaltigkeit von privaten Informationen zu sein.[4] Dymke und Walter (2008) dokumentieren, dass Insider ihren Informationsvorsprung aktiv ausnutzen und systematisch vor der Veröffentlichung von Unternehmensnachrichten handeln. Diese Art des als rechtlich problematisch einzustufenden „Front-Running" äußert sich darin, dass jene Insider-Transaktionen am profitabelsten sind, die unmittelbar vor einer Veröffentlichung im Rahmen der ad-hoc Publizitätspflichten erfolgen. Dickgiesser und Kaserer (2010) untersuchen die Profitabilität von Mimicking-Strategien. Ihre Ergebnisse deuten darauf hin, dass Mimicking-Strategien nach Berücksichtigung der Transaktionskosten keine signifikanten Überrenditen erzeugen. Die Unterreaktion des Marktes im Anschluss an die Veröffentlichung von Insider-Transaktionen ist nach Dickgiesser und Kaserer (2010) durch die Kosten von „Risky-Arbitrage" (Shleifer und Vishny 1997) zu erklären. Damit kann der Markt als effizient in Sinne von Jensen (1978) interpretiert werden.

Die vorliegende Studie ergänzt die bisherigen Ergebnisse für Deutschland in mehrfacher Hinsicht. Erstens liegt unserer Untersuchung die mit Abstand größte Strichprobe von Insider-Transaktionen zugrunde. Gegenstand unserer empirischen Analyse sind sämtliche Mitteilungen über Transaktionen, deren Handelstag zwischen dem 1. Juli 2002 und dem 17. März 2009 liegt. [5] Damit können die Ergebnisse der früheren Studien auf ihre Stabilität überprüft werden. Eine zweite Besonderheit unserer Stichprobe ist, dass der Beobachtungszeitraum die Anpassungen im deutschen Insiderrecht umfasst, die im Oktober 2004 durch das Anlegerschutzverbesserungsgesetzes (AnSVG) hervorgerufen wurden. Die wichtigste Änderung ist die gesetzliche Pflicht zur Veröffentlichung einer Transaktion innerhalb von fünf Werktagen (anstatt „ohne schuldhaftes Verzögern" unter der vorhergehenden Rechtslage). Man würde vermuten, dass durch die Einführung einer kürzeren Veröf-

4 Betzer und Theissen (2009b) untersuchen die zeitliche Verzögerung zwischen dem Handelstag und der Veröffentlichung einer Insider-Transaktion. Die Höhe der abnormalen Rendite nach dem Veröffentlichungstag ist unabhängig von der zeitlichen Verzögerung. Es ist daher zu vermuten, dass es zu Verzerrungen der Aktienpreise zwischen dem Handels- und dem Veröffentlichungstag kommt.
5 Beispielsweise analysieren Stotz (2006) sowie Betzer und Theissen (2009a) Insider-Transaktionen, die zwischen dem 1. Juli 2002 und der letzten Gesetzesänderung im Oktober 2004 liegen. Die bislang aktuellste Untersuchung von Dickgiesser und Kaserer (2010) verwendet Daten bis Oktober 2007.

fentlichungsfrist die Wahrscheinlichkeit erhöht wurde, verbotenen Insiderhandel aufzudecken. Beim Auftreten eines meldepflichtigen Ereignisses unmittelbar nach einer Transaktion liegt der Verdacht auf einen regelwidrigen Insiderhandel nahe, der auf einem Tatsachenkern beruht (Dymke und Walter 2008). Im Vergleich zur Regelung vor der Gesetzesänderung im Oktober 2004 sollten demnach geringere abnormale Renditen zu beobachten sein, weil der diskretionäre Spielraum der Insider verringert wurde und eine Transaktion, die auf einer langfristigen Einschätzung statt auf einer eindeutigen Information beruht, weniger profitabel sein dürfte.

Ein dritter zentraler Beitrag unserer Studie liegt im methodischen Bereich. Das Standardverfahren in allen bisherigen empirischen Untersuchungen stellt die traditionelle Ereignisstudie („Event-Study“) dar. Im Anschluss an die Schätzung der abnormalen Renditen werden diese im Rahmen von Querschnittregressionen auf deren Einflussfaktoren untersucht (z.B. Unternehmensgröße, Transaktionsgröße oder Stellung des Insiders im Unternehmen). Diese zweistufige Methode ist allerdings nicht in der Lage, im Rahmen der Querschnittregressionen Schätzkoeffizienten zu messen, die stabil gegenüber Abhängigkeiten der untersuchten Einheiten (Insider) im Querschnitt sind. Gerade dieses Problem der „Cross-Sectional-Dependence“ dürfte in unserem Panel-Datensatz auftreten, in dem nur wenige Beobachtungen über die Zeit aber viele Beobachtungen über die Einheiten (Insider) enthalten sind (Fama 1998; Lyon u. a. 1999; Mitchell und Stafford 2000). Die Performance der Insider-Trades wird daher zunächst im Rahmen der klassischen Ereignisstudie ermittelt. Im Anschluss kommt auch der Generalized-Calendar-Time-Ansatz (GCT-Ansatz) nach Hoechle u. a. (2009) zum Einsatz. Anders als das klassische Kalenderzeitverfahren erlaubt es der GCT-Ansatz, die Ereignisrenditen zu messen und neben den systematischen Renditetreibern auch unternehmensspezifische Erklärungsvariablen in das Modell aufzunehmen. Damit ist dieses alternative Verfahren in der Modellspezifikation ebenso flexibel wie eine Querschnittregression. Die Korrektur um die systematischen Renditetreiber und die firmenspezifischen Erklärungsvariablen erfolgt dabei nicht in zwei getrennten Schritten, sondern simultan in einem Panelmodell. Ein weiterer methodischer Vorteil ist, dass im GCT-Ansatz – im Gegensatz zum traditionellen Kalenderzeitverfahren – auf eine Portfoliobildung am Beginn jeder Periode verzichtet werden kann. Loughran und Ritter (2000) kritisieren den klassischen Kalenderzeitansatz, weil jeder Zeitpunkt und nicht jede Beobachtung eine Gleichgewichtung erfährt, was zu Verzerrungen in den geschätzten abnormalen Renditen führen kann. Da der GCT-Ansatz ein Panelverfahren darstellt, kommt es durch die Kleinst-Quadrat-Schätzung automatisch zu einer Gleichgewichtung aller Beobachtungen. Insgesamt liegt mit dem GCT-Ansatz ein ökonometrisch geeignetes Schätzverfahren vor, das eine umfassende Überprüfung der Ergebnisse der früheren Studien in einem einheitlichen Schätzmodell erlaubt.

Unsere Ergebnisse deuten darauf hin, dass Unternehmensinsider über ausgeprägte Timing-Fähigkeiten verfügen. Insider verhalten sich als Contrarian-Investoren, d.h. sie kaufen eigene Aktien nach Kursverlusten und verkaufen nach Kursanstiegen. Während im Anschluss an Käufe die Kursanstiege zu signifikanten abnormalen Renditen für Insider führen, vermeiden sie signifikante Kursverluste nach Verkäufen. Ein Vergleich mit früheren Studien zeigt, dass die Werthaltigkeit von Insider-Transaktionen im bankbasierten deutschen Finanzsystem nicht höher ausfallen als in den marktbasierten angelsächsischen Finanzsystemen. Für die Information-Hierarchy-Hypothese, wonach die Werthaltigkeit von Informationen mit steigender Hierarchieebene eines Insiders zunimmt, kann ebenfalls keine Evidenz gefunden werden. Hingegen haben die verschärften Regularien des Insiderrechts seit Oktober 2004 zu einem Abbau der Informationssymmetrien zwischen Unternehmensinsidern und Marktteilnehmern und zur Integrität des Marktes beigetragen. Durch die Verkürzung der Veröffentlichungsfrist gelangen Informationen schneller in den Markt, und die abnormalen Renditen sind im Zeitfenster bis zu 20 Handelstagen nach der Transaktion im Anschluss an die Umsetzung des Anlegerverbessrungsschutzgesetzes wie erwartet gesunken. Diese Ergebnisse können durch den GCT-Ansatz im Wesentlichen bestätigt werden. Zusätzlich lassen die Koeffizienten auf die firmenspezifischen Variablen darauf schließen, dass größere Insider-Transaktionen zu höheren abnormalen Renditen führen.

Die weiteren Ausführungen gliedern sich wie folgt. Zunächst werden in Abschnitt 2 das regulatorische Umfeld und die Daten beschrieben. In Abschnitt 3 werden die empirischen Ergebnisse der Ereignisstudie und des GCT-Ansatzes dargestellt und ausführlich diskutiert. Abschnitt 4 fasst die Ergebnisse zusammen und gibt einen Ausblick auf die künftige Forschung.

4.2 Regulatorisches Umfeld und Datenbeschreibung

4.2.1 Gesetzliche Bestimmungen zum Insider-Trading in Deutschland

Im Vergleich zu anderen Rechtskulturen hat sich das deutsche Insiderrecht relativ spät entwickelt und gilt daher als neues Rechtsgebiet. Als Vorbild bei der Regulierung von Insidergeschäften dient insbesondere das US-amerikanische Recht, in dem der Eingriff in die Transaktionsaktivitäten von Insidern seit dem „Securities Exchange Act of 1934“ besteht.[6] Die Insiderüberwachung ist im deutschen Recht im WpHG festgeschrieben. In der ursprünglichen Fassung, die per 1. Januar 1995 in Kraft getreten ist, hatte das Verbot des Insiderhandels noch keinen allgemein verpflichtenden Charakter.[7] Erst durch die Rechtsfortbildung des WpHG per 1. Januar 2002 wurde eine Meldepflicht von Insidergeschäften im Rahmen der sogenannten „Directors’ Dealings“ umgesetzt. Die gesetzliche Verpflichtung zur Mitteilung von Geschäften in eigenen Aktien und anderen Finanzinstrumenten verfolgt die Zielsetzung der verbesserten Publizität. Allgemein wird Regelungen dieser Art eine Erhöhung der Markttransparenz, eine Verringerung der Informationsasymmetrie zwischen Insidern und Anteilseignern, eine Gleichbehandlung der Anleger sowie eine Erhöhung der Aufdeckungswahrscheinlichkeit von regelwidrigem Insiderhandel zugeschrieben.

Vor der Einführung der gesetzlichen Meldepflicht gab es in Deutschland privatrechtliche Vorschriften. Ein Beispiel war das Regelwerk am Börsensegment Neuer Markt, das Vorstands- und Aufsichtsratsmitglieder verpflichtet, jedes Geschäft in Finanzinstrumenten des eigenen Unternehmens anzuzeigen. Seit 1. Januar 2002 muss die Veröffentlichung unverzüglich (ohne schuldhaftes Verzögern) erfolgen, eine genaue Definition des Handlungsspielraums ist allerdings nicht gegeben.[8] Darüber hinaus ist die Meldung nur erforderlich, wenn die Wertpapiertransaktionen innerhalb von 30 Tagen die Bagatellgrenze in Höhe von 25 000€ übersteigen. Eine weitere Verschärfung erfuhr das deutsche Insiderrecht durch die Vorgaben der Marktmissbrauchsrichtline, die von der Europäischen Kommission am 30. Mai 2001

6 Der Securities Exchange Act of 1934 regelt den Wertpapierhandel auf dem Sekundärmarkt in den USA. Das Gesetz trat am 6. Juni 1934 in Kraft (48 Stat. 881, 15 U.S.C. § 78a). Bainbridge (2000) liefert eine ausführliche Beschreibung der Entwicklung der Insiderüberwachung in den USA.

7 Vgl. hierzu WpHG, BGBl. I S. 1749 vom 26.07.1994, zuletzt geändert durch Artikel 4 des Gesetzes vom 31. Juli 2009 (BGB1. I S. 2512).

8 Die folgenden Ausführungen basieren auf Hower-Knobloch (2007).

vorgelegt wurden. Zweck dieser Richtlinie soll eine weitere Vereinheitlichung des europäischen Rechtsrahmens zum Schutz der Kapitalmarktintegrität sein. Deren Leitgedanke ist, dass die Marktintegrität durch Marktmissbrauch in Form von Insiderhandel und Marktmanipulation gefährdet wird, was zum Vertrauensverlust der Anleger führen könnte. Wenn eine Veröffentlichung der Wertpapiergeschäfte von Unternehmensinsidern unterbleibt, dann erhöht sich die Informationsasymmetrie zwischen den Insidern und den Anlegern noch zusätzlich, die von den Insidern opportunistisch ausgenutzt werden könnte.

Die Marktmissbrauchsrichtline wurde durch das Anlegerschutzverbesserungsgesetz (AnSVG) vom 28. Oktober 2004 in deutsches Recht umgesetzt.[9] Die wichtigsten Änderungen beziehen sich auf die Reduzierung der Bagatellgrenze auf nunmehr 5000€ pro Jahr und die Pflicht zur Veröffentlichung der Transaktion innerhalb von fünf Werktagen. Darüber hinaus erfasst die Regelung nach der gesetzlichen Änderung nicht mehr nur Organmitglieder, sondern alle Personen mit Zugang zu Insiderinformationen und sämtliche sich auf die Unternehmensaktie beziehenden Finanzinstrumente[10]. Außerdem wurde mit §15b die Pflicht zur Führung von Insiderverzeichnissen eingeführt, in denen sämtliche Personen, die Zugang zu Insiderinformation haben, geführt werden müssen.[11]

Aktuell beruht die deutsche Insiderüberwachung auf dem WpHG in der Fassung vom 31. Juli 2009.[12] Die zentrale Norm des Insiderrechts stellt das Verbot von Insidergeschäften nach §14 WpHG dar. Demnach sind der Erwerb oder die Veräußerung von Insiderpapieren unter Verwendung einer Insiderinformation, die unbefugte Weitergabe oder Zugänglichmachung einer Insiderinformation und die auf den Kauf oder Verkauf gerichtete Empfehlung auf der Grundlage einer Insiderinformation verboten. Eine Insiderinformation liegt vor, wenn die Information konkret ist (diese also einen Tatsachenkern enthält und keine bloße Bewertung darstellt), wenn die Information nicht öffentlich ist, wenn sich die Information auf einen Emittenten oder ein Wertpapier bezieht, und wenn die Information das Potenzial hat, den Kurs des Insiderpapiers zu beeinflussen (§13 WpHG). Eine weitere Voraussetzung für ein Insidergeschäft ist die Börsenzulassung des betroffenen Finanzinstruments (§2 Abs. 2a WpHG) an einer inländischen oder europäischen Börse (§12 S. 1 Nr. 1 und

9 Für umfassende Ausführungen siehe auch das AnSVG, BGBl. I 2004, S. 2630.
10 Siehe Assmann und Schneider (1999).
11 Für eine Diskussion über die Reichweite der Insiderverzeichnisse siehe von Neumann-Cosel (2008).
12 Siller (2006) liefert eine grundsätzliche Darstellung des WpHG.

2 WpHG). Insider im Sinne des Gesetzes sind persönlich haftende Gesellschafter oder Mitglieder eines Leitungs-, Verwaltungs- oder Aufsichtsorgans des Emittenten sowie sonstige Personen, die regelmäßig Zugang zu Insiderinformationen haben und zu wesentlichen unternehmerischen Entscheidungen ermächtigt sind (§15a Abs. 2 WpHG). Diese Definition umfasst ebenfalls die den Insidern nahe stehenden Personen (z.B. Ehepartner oder Kinder) als auch juristische Personen. Somit werden gleichermaßen Primärinsider als auch Sekundärinsider von dem Gesetz angesprochen.

Als Konsequenz aus dem Verbot des Insidergeschäfts sind Finanztransaktionen von Insidern mitteilungspflichtig. Die Mitteilungspflicht erstreckt sich auf alle eigene Geschäfte, die Insider mit Finanzinstrumenten des Emittenten durchführen. Die Mitteilung hat innerhalb von fünf Werktagen an den Emittenten sowie die Bundesanstalt für Finanzdienstleistungsaufsicht (BaFin) zu erfolgen (§15a Abs. 1 WpHG). Die Meldepflicht besteht nicht, wenn Insider Finanzinstrumente im Rahmen von Vergütungsplänen erhalten (z.B. Aktienoptionen), wenn die oben erwähnte Bagatellgrenze nicht überschritten wird, oder wenn die Finanzinstrumente im Freiverkehr gehandelt werden.[13] Auch ehemalige Unternehmensinsider sind von der Regelung ausgenommen. Ein Verstoß gegen das Insiderrecht kann sowohl eine Ordnungswidrigkeit als auch eine Straftat darstellen. Eine wichtige Besonderheit des deutschen Insiderrechtes ist schließlich, dass es keine „Blackout-Perioden" gibt. Während in den USA oder in Großbritannien Insider-Geschäfte 1-2 Monate vor einer Gewinnankündigung untersagt sind, liegt eine ähnliche Regelung in Deutschland nicht vor (Betzer und Theissen 2009a).

4.2.2 Datenbeschreibung

Die Grundlage für die empirische Untersuchung bildet die Datenbank für Directors' Dealings der Bundesanstalt für Finanzdienstleistungsaufsicht (BaFin). Die Datenbank umfasst neben den Mitteilungen über Wertpapiergeschäfte, die aus der gesetzlichen Verpflichtung entstehen, auch solche, für die keine Verpflichtung besteht. Der zweiten Kategorie können beispielsweise auf freiwilliger Basis übermittelte Meldungen zugeordnet werden, die unterhalb der gesetzlichen Mitteilungsschwelle liegen. Gegenstand der empirischen Analysen sind die Mitteilungen über Direc-

13 Der Freiverkehr ist (neben dem regulierten Markt) ein gesetzliches Marktsegment, das durch relativ niedrige Zulassungs- sowie Zulassungsfolgepflichten gekennzeichnet ist. Der Freiverkehr soll den Kapitalmarkt auch für kleine und mittelständische Unternehmen zugänglichen machen.

tors' Dealings von deutschen Emittenten, deren Handelstag zwischen dem 1. Juli 2002 und dem 17. März 2009 liegt. Bis einschließlich 31. März 2008 wurden die Meldungen in anonymisierter Form, d.h. unter Angabe der beruflichen Rolle aber ohne Nennung des Namens des Insiders, durch die BaFin zur Verfügung gestellt. Ab dem 1. April 2008 stammen die Meldungen aus der öffentlich zugänglichen Internet-Datenbank der BaFin, welche die Mitteilungen mit Informationen über die Identität des Insiders enthält. Insgesamt liegt ein Datensatz bestehend aus 21 527 Mitteilungen nach §15a WpHG vor, der im Folgenden einem Selektionsprozess anhand verschiedener Kriterien unterzogen wird. Die Selektion hat eine Minimierung möglicher Verzerrung zum Ziel und orientiert sich an der Vorgehensweise von Stotz (2006), Dymke und Walter (2008) sowie Betzer und Theissen (2009a).

Im ersten Schritt werden alle Mitteilungen entfernt, die auf eine für die Untersuchung nicht ausreichende Datenqualität der Datenbank hindeuten. In diese Kategorie fallen unvollständige Mitteilungen – also solche ohne Angabe des Handelskurses, der beruflichen Rolle (Primär- oder Sekundärinsider) oder des gehandelten Volumens – und unrichtige Mitteilungen. Unter unrichtigen Mitteilungen werden in diesem Zusammenhang zum Beispiel Mitteilungen mit einem Veröffentlichungstag vor dem Handelstag, Mitteilungen mit einem Handelstag, an dem die Börse nicht offiziell geöffnet ist, und Mitteilungen von nicht meldepflichtigen Emittenten (Emittent ist kein börsennotiertes Unternehmen, sondern wird als Personengesellschaft geführt) verstanden. Insgesamt werden durch diesen Bereinigungsschritt 1158 Mitteilungen (inklusive 64 Duplikate) eliminiert. Da der Untersuchungsgegenstand lediglich Aktientransaktionen umfasst, werden im zweiten Schritt Mitteilungen über den Wertpapierhandel im Rahmen von Vergütungssystemen, den Handel mit Options- oder Bezugsrechten, den Tausch von Aktien in eine andere Gattung sowie die Leihe oder Schenkung von Wertpapieren aus der Datenbank entfernt. Der Grund für dieses Vorgehen ist die Annahme, dass sich die Motive dieser Transaktionen von denen einer „normalen" Transaktion unterscheiden. Beispielsweise erfolgt der Bezug von Aktien oder Optionsrechten als Bestandteil der anreizkompatiblen Vergütung auf Basis des Arbeitsvertrages und nicht aufgrund von Unternehmensinformationen. Der Datensatz wurde dabei um weitere 1578 Mitteilungen reduziert. Der dritte Bereinigungsschritt zielt auf die Kausalbeziehung zwischen Informationen und Wertpapiertransaktionen ab. Mitteilungen ohne erkennbaren Informationsgehalt fließen demnach nicht in die weitere Analyse ein. Dieser Kategorie sind Intra-Insider Trades (also der taggleiche Wertpapierhandel zwischen zwei unterschiedlichen Insidern zum identischen Kurs) zuzuordnen. Man kann vermuten, dass Intra-Insider Transaktion steuerrechtlich motiviert sind und damit keine Signalwirkung auf den Markt haben. Auf diese Weise werden 529 Mitteilungen über Intra-Insider Geschäfte aus dem Datensatz entfernt. Der vierte Bereinigungsschritt konzentriert sich auf die gesetzlichen Bestimmungen. Einerseits werden Mitteilungen, die unterhalb der gesetzlichen Meldefrist – also auf freiwilliger Basis – erfolgt sind, eliminiert. Andererseits werden alle Mitteilungen entfernt, die außerhalb der gesetzlichen Veröffentlichungsfrist erfolgt sind. Für den Zeitraum vom 1. Juli 2002 bis 28. Oktober 2004 wurde aufgrund der nicht eindeutigen Regulierung eine Frist von 30 Werktagen gesetzt, innerhalb der die Veröffentlichung als „unverzüglich“ angesehen wird. Im darauffolgenden Zeitraum vom 29. Oktober 2004 bis 17. März 2009 hat die Veröffentlichung innerhalb der gesetzlichen Frist von 5 Werktagen zu erfolgen. Insgesamt genügen 2233 Mitteilungen nicht den beschriebenen Kriterien. Der fünfte Bereinigungsschritt ist durch den Handelsmechanismus begründet. Bedingt durch das Angebots- und Nachfrageverhalten auf dem Markt, werden Wertpapiergeschäfte, und insbesondere solche mit großen Volumina, in Teiltransaktionen durchgeführt. Da diesen Teiltransaktionen die gleiche Insiderinformation zugrunde liegt, werden taggleiche Transaktionen desselben Insiders unter Bildung eines gewichteten Mischkurses verdichtet. Dadurch werden weitere 4384 Mitteilungen aus dem Datensatz zusammengefügt. Anschließend werden die verbleibenden Mitteilungen auf die Verfügbarkeit von Preisinformationen der gehandelten Aktien geprüft. Die Quelle für Preisinformationen ist Thomson Reuters Datastream. Für 326 Mitteilungen konnten die notwendigen Informationen nicht ermittelt werden. Nach allen Bereinigungsschritten umfasst der Datensatz schließlich 11 135 Mitteilungen über Directors’ Dealings. Tabelle I gibt einen Überblick der deskriptiven Statistiken für die Mitteilungen (aufgeteilt in Käufe und Verkäufe) nach der Anwendung aller Selektionskriterien.

Die täglichen Preisinformationen aus Thomson Reuters Datastream wurden für die empirische Analyse der Korrektur von Ince und Porter (2006) unterzogen. Beispielsweise wurden die konstanten Preisinformationen von nicht mehr börsennotierten Unternehmen durch den Wert Null ersetzt. Ebenso wurden tägliche Renditen von mehr als 300% manuell auf Richtigkeit geprüft und gegebenenfalls aus der Analyse entfernt.

Tabelle I – Datenbeschreibung

	Käufe	**Verkäufe**
Mitteilungen:		
Vorstand	4131	2061
Primärinsider	3403	1656
Sekundärinsider	728	405
Aufsichtsrat	3242	1701
Primärinsider	1897	1184
Sekundärinsider	1345	517
bis 28. Oktober 2004	1176	935
ab 29. Oktober 2004	6197	2827
Gesamt	7373	3762
Emittenten:		
Anzahl	528	445
Mittleres Transaktionsvolumen (in €):		
Gesamt	679 274,17	2 456 181,22
Vorstand	208 411,37	1 617 722,00
Primärinsider	119 299,72	1 283 177,05
Sekundärinsider	624 959,35	2 985 639,44
Aufsichtsrat	1 279 253,88	3 472 092,14
Primärinsider	408 240,73	1 329 098,79
Sekundärinsider	2 507 738,60	8 379 837,05
Median Transaktionsvolumen (in €):		
Gesamt	24 990,00	98 760,00
Vorstand	24 000,00	138 875,00
Primärinsider	23 400,00	125 500,00
Sekundärinsider	26 628,50	184 826,44
Aufsichtsrat	26 498,53	65 380,26
Primärinsider	21 462,00	55 072,83
Sekundärinsider	41 200,00	124 231,82
Werktage zwischen Handelstag und Veröffentlichungstag:		
bis 28. Oktober 2004		
Minimum	0	0
Maximum	56*	29
Mittelwert	5,31	3,77
Standardabweichung	6,28	4,37
ab 29. Oktober 2004		
Minimum	0	0
Maximum	5	5
Mittelwert	1,99	2,44
Standardabweichung	1,39	1,43

Die Tabelle fasst die Beschreibung der Stichprobe nach Anwendung aller Selektionskriterien zusammen. Unterteilt nach Käufen und Verkäufen werden die Anzahl der Mitteilungen nach der Position des Insiders im bzw. zum Unternehmen sowie den rechtlichen Rahmenbedingungen ausgewiesen. Zusätzlich werden die Anzahl der Emittenten, das mittlere Transaktionsvolumen (in €) sowie statistische Maße für die Verzögerung zwischen dem Zeitpunkt der Transaktion und der Veröffentlichung der Insider-Transaktion dargestellt.
* Obwohl die maximale Differenz zwischen dem Handelstag und dem Tag der Veröffentlichung 30 Werktage beträgt, kann das Maximum einen höheren Wert annehmen. Grund ist das Überschreiten der Bagatellgrenze zu einem späteren Zeitpunkt. Die Bagatellgrenze hat vor dem Anlegerschutzverbesserungsgesetz (AnSVG) eine zeitliche Dimension von einem Jahr.

4.3 Empirische Ergebnisse

Dieser Abschnitt untersucht die Kursentwicklung rund um Kauf- und Verkaufsentscheidungen von Insidern. Abschnitt 4.3.1 stellt die Ergebnisse einer klassischen Ereignisstudie dar. Dabei wird die Stichprobe anhand verschiedener Kriterien differenziert. Abschnitt 4.3.2 beschreibt die Ergebnisse, die sich auf der Basis des von Hoechle et al. (2009) entwickelten Generalized-Calendar-Time-Ansatz (GCT-Ansatz) ergeben. Aus der empirischen Analyse können Rückschlüsse auf die Timing-Fähigkeiten der Insider und die Werthaltigkeit von Insider-Trades für die Anleger gezogen werden.

4.3.1 Ergebnisse der Ereignisstudie

Um den Informationsgehalt von Insider Transaktionen zu analysieren, wird im ersten Schritt eine Ereignisstudie durchgeführt. Die Vorgehensweise orientiert sich an der Darstellung von MacKinlay (1997). Zunächst wird für jede Beobachtung der Achsenabschnitt α und der Steigungsparameter β eines Marktmodells mit Hilfe einer Kleinst-Quadrat-Schätzung ermittelt. Dabei wird ein Schätzfenster mit einer Länge von 180 Handelstagen vor dem Tag -20 relativ zum Ereignistag, der als Handelstag des Insiders definiert ist, verwendet. Anschließend erfolgt die Berechnung der abnormalen Rendite:

$$AR_{i,t} = R_{i,t} - \hat{\alpha}_i - \hat{\beta}_i R_{m,t}, \qquad (1)$$

wobei $AR_{i,t}$ die abnormale Rendite einer Aktie i am Tag t darstellt. $R_{i,t}$ und $R_{m,t}$ bezeichnen die Rendite des Wertpapiers i bzw. des Marktportfolios am Tag t. $\hat{\alpha}_i$ und $\hat{\beta}_i$ sind die firmenspezifischen Parameter aus der Marktmodellregression, die während des zeitlich vorhergehenden Zeitfensters [-200;-20] geschätzt werden. Als Stellvertreter für das Markportfolio wird der CDAX der Deutsche Börse AG verwendet. Die täglichen abnormalen Renditen werden über das Ereigniszeitfenster $T - \tau$ und alle Ereignisse i (mit $i = 1, \ldots, N$) zur durchschnittlichen kumulierten abnormalen Rendite ($\overline{CAR}$) aggregiert:

$$\overline{CAR_{\tau,T}} = \frac{1}{T-\tau} \sum_{t=\tau}^{T} \left[\frac{1}{N} \sum_{i=1}^{N} AR_{i,\tau} \right]. \qquad (2)$$

Von den 11 135 in der Stichprobe verbliebenen Mitteilungen werden zusätzlich die 465 Mitteilungen sogenannter „Penny-Stocks“ entfernt. Dabei handelt es sich um

Aktien, deren Handelskurs 1€ oder einen geringeren Wert beträgt. Nach Conrad und Kaul (1993) erhöhen die Renditen von „Penny-Stocks" die Stichprobenvarianz, was zu verzerrten Schätzern in der Marktmodellregression und damit zu Messfehlern bei den abnormalen Renditen führen kann. In einem weiteren Bereinigungsschritt werden sämtliche 498 Mitteilungen jener Unternehmen ausgeschlossen, für die nicht ausreichende Preisinformationen zur Schätzung der Marktmodellparameter verfügbar sind. Der endgültige Datensatz für die Ereignisstudie besteht somit aus 10172 Mitteilungen über Directors' Dealings.

Die Ergebnisse der Ereignisstudie werden in Tabelle II dargestellt. Unternehmensinsider erzielen signifikante abnormale Renditen nach Käufen und vermeiden Verluste nach Verkäufen, womit die Werthaltigkeit von privaten Informationen der Insider bestätigt werden kann. Betrachtet man das Ereigniszeitfenster [0;5] in der letzten Zeile der Tabelle, dann sind Käufe insgesamt mit einer kumulierten abnormalen Rendite von 1,05% verbunden. Für den gleichen Zeitraum ist die abnormale Performance nach Verkäufen negativ und beträgt -0,68%. Insider vermeiden durch den Verkauf von Wertpapieren Kursrückgänge und damit Verluste in ihren Portfolios. In beiden Fällen sind die kumulierten abnormalen Renditen statistisch signifikant am 1%-Niveau. Eine ähnliche Interpretation lässt sich auch aus den längeren Ereignisfenstern ableiten. Beispielsweise betragen die kumulierten abnormalen Renditen im Ereigniszeitfenster [0;20] rund 1,80% für Insider-Käufe und -3,50% für Insider-Verkäufe. Demnach werden private Informationen nicht sofort eingepreist, sondern durch den Markt erst im Laufe der Zeit verarbeitet. Dies gilt insbesondere für Insider-Verkäufe; in diesem Fall ergibt sich eine kumulative abnormale Rendite in Höhe von -2,82% über das spätere Zeitfenster [6;20], was einen großen Teil der abnormalen Rendite von -3,50% über das gesamte Zeitfenster [0;20] ausmacht. Positive Unternehmensinformationen, die zu Insider-Käufen führen dürften, werden hingegen durch den Markt schneller verarbeitet und führen im folgenden Zeitfenster [6;20] zu einer abnormalen Rendite von nur 0,73%.

Eine gegenläufige Entwicklung zeigt sich für das Zeitfenster vor dem Ereignistag (Transaktionstag). Die kumulierten abnormalen Renditen der Insider-Käufe weisen ein negatives Vorzeichen auf, die der Insider-Verkäufe hingegen ein positives. Die absolute Höhe der kumulierten abnormalen Renditen steigt mit zunehmender Länge des Zeitintervalls vor dem Ereignis. Insider kaufen Wertpapiere nach einer kumulierten abnormalen Rendite im Ereigniszeitfenster [-20;-1] in der Höhe von -3,35%, und sie verkaufen Wertpapiere während des gleichen Zeitraums nach einer kumulierten

Tabelle II – Kumulierte abnormale Renditen im Ereignisfenster

Panel A – Käufe

	CAR[-20;20]	CAR[-20;-1]	CAR[-5;-1]	CAR[0;5]	CAR[0;20]	CAR[6;20]
Vorstand	−0,028***	−0,044***	−0,018***	−0,008***	−0,017***	−0,009***
Primärinsider	(−7,771)	(−16,992)	(−11,969)	(5,372)	(7,019)	(4,463)
Vorstand	−0,012***	−0,012***	−0,007***	−0,023***	−0,025***	−0,002***
Sekundärinsider	(1,521)	(−1,869)	(−1,958)	(6,441)	(4,571)	(0,415)
Aufsichtsrat	−0,011***	−0,038***	−0,015***	−0,011***	−0,027***	−0,016***
Primärinsider	(−2,422)	(−10,787)	(−6,675)	(5,774)	(8,618)	(6,106)
Aufsichtsrat	−0,005***	−0,010***	−0,003***	−0,010***	−0,005***	−0,004***
Sekundärinsider	(−0,953)	(−2,771)	(−1,415)	(4,803)	(1,457)	(−1,425)
Vor AnSVG	−0,007***	−0,013***	−0,003***	−0,006***	−0,021***	−0,015***
	(1,049)	(−2,659)	(−1,062)	(2,030)	(4,591)	(4,213)
Nach AnSVG	−0,020***	−0,037***	−0,015***	−0,011***	−0,017***	−0,006***
	(−7,979)	(−19,955)	(−14,193)	(10,883)	(10,179)	(4,167)
Δ AnSVG	0,027***	0,024***	0,012***	−0,006***	0,003***	0,009***
	(4,241)***	(5,025)***	(4,399)***	(−2,143)***	(0,765)***	(2,563)***
Gesamt	−0,016***	−0,033***	−0,013***	−0,011***	−0,018***	−0,007***
	(−6,525)	(−18,836)	(−12,957)	(10,567)	(11,149)	(5,605)

Panel B – Verkäufe

	CAR[-20;20]	CAR[-20;-1]	CAR[-5;-1]	CAR[0;5]	CAR[0;20]	CAR[6;20]
Vorstand	−0,007***	−0,042***	−0,017***	−0,008***	−0,035***	−0,027***
Primärinsider	(1,273)	(9,055)	(7,069)	(−3,836)	(−10,163)	(−10,490)
Vorstand	−0,036***	−0,072***	−0,038***	−0,005***	−0,036***	−0,040***
Sekundärinsider	(3,005)	(6,759)	(6,461)	(0,817)	(−4,000)	(−5,555)
Aufsichtsrat	−0,000***	−0,033***	−0,013***	−0,006***	−0,033***	−0,027***
Primärinsider	(−0,035)	(6,233)	(5,230)	(−2,167)	(−7,662)	(−7,940)
Aufsichtsrat	−0,021***	−0,061***	−0,025***	−0,012***	−0,039***	−0,027***
Sekundärinsider	(2,280)	(7,155)	(6,034)	(−2,799)	(−5,576)	(−5,599)
Vor AnSVG	−0,018***	−0,061***	−0,028***	−0,004***	−0,043***	−0,038***
	(2,178)	(8,693)	(7,370)	(−1,246)	(−8,490)	(−10,119)
Nach AnSVG	−0,007***	−0,039***	−0,016***	−0,008***	−0,032***	−0,025***
	(1,604)	(11,511)	(9,555)	(−4,678)	(−11,612)	(−11,648)
Δ AnSVG	0,011***	0,022***	0,012***	0,003***	−0,011***	−0,014***
	(1,356)***	(3,133)***	(3,223)***	(0,891)***	(−1,903)***	(−3,241)***
Gesamt	−0,010***	−0,045***	−0,019***	−0,007***	−0,035***	−0,028***
	(2,578)	(14,407)	(12,049)	(−4,431)	(−14,358)	(−15,247)

Die Tabelle gibt eine Übersicht der kumulierten abnornmalen Renditen (CARs) in verschiedenen Ereigniszeitfenstern für Insider-Käufe und Insider-Verkäufe. Die CARs werden gemäß dem bei MacKinlay (1997) beschriebenen Vorgehen durch Aggregation der abnormalen Renditen über die Zeit sowie die einzelnen Wertpapiere ermittelt:

$$CAR_{\tau,T} = \frac{1}{T-\tau} \sum_{t=\tau}^{T} \left[\frac{1}{N} \sum_{i=1}^{N} R_{i,\tau} - \alpha_i - \beta_i R_{m,\tau} \right].$$

Ausgangspunkt für die Schätzung der Normalrendite ist das Marktmodell mit dem Achsenabschnitt α und dem Sensitivitätskoeffizienten β. Die Darstellung differenziert die Ergebnisse nach der Position des Insiders im bzw. zum Unternehmen und den rechtlichen Rahmenbedingungen (vor bzw. nach dem Anlegerschutzverbesserungsgesetz; AnSVG). Der Wert in runder Kammer stellt das Ergebnis eines zweiseitigen t-Tests dar. *** / ** / * deuten auf eine signifikant von Null verschiedene kumulierte abnormale Rendite mit einer Irrtumswahrscheinlichkeit von 1% / 5% / 10% hin.

abnormalen Rendite in Höhe von 4,46%. Insgesamt deuten die abnormalen Renditen vor und nach dem Ereignistag auf ausgeprägte Timing-Fähigkeiten der Insider hin. Diese Timing-Fähigkeiten werden in Abbildung I dargestellt, in der die kumulierten abnormalen Renditen über das gesamte Ereigniszeitfenster [-20;20] abgetragen sind. Unternehmensinsider verhalten sich als Contrarian-Investoren. Sie kaufen „eigene“ Aktien nach Kursverlusten und verkaufen nach Kursanstiegen. Im Anschluss an Käufe führen die signifikanten Kursanstiege zu signifikanten abnormalen Renditen für die Insider. Gleichzeitig sind Insider in der Lage, signifikante Kursverluste nach Verkäufen zu vermeiden. Zudem sind in beiden Fällen die kumulierten abnormalen Renditen über das gesamte Ereigniszeitfenster [-20;20] statistisch signifikant von Null verschieden.

In Abbildung II wird die gleiche Analyse durchgeführt, allerdings dient als Ereignistag alternativ zum Handelstag der Veröffentlichungstag. Aus Sicht der Anleger scheint diese Betrachtungsweise geeigneter, weil erst mit einer Verzögerung von einigen Tagen gehandelt werden kann (siehe Tabelle I). Die Ergebnisse deuten darauf hin, dass die abnormalen Renditen nach der Veröffentlichung von Insider-Käufen (Insider-Verkäufen) weiter steigen (sinken). Allerdings dokumentieren Dickgiesser und Kaserer (2010), dass Anleger zu diesem späteren Zeitpunkt nicht mehr von den Timing-Fähigkeiten der Insider profitieren und die abnormalen Renditen nach Berücksichtigung von Transaktionskosten verschwinden.

Vergleich mit früheren nationalen und internationalen Studien: Insgesamt sind diese Ergebnisse mit denen in den früheren Studien von Stotz (2006) sowie Betzer und Theissen (2009a) für Deutschland vergleichbar. Es ist zudem keine Evidenz für die Hypothese zu beobachten, dass die Werthaltigkeit von Insider-Transkationen in Deutschland, das von Allen und Michaely (2003) als Prototyp eines bankbasierten Finanzsystems charakterisiert wird, signifikant höher ist als in marktbasierten Finanzsystemen. Fidrmuc u. a. (2006) weisen für einen englischen Datensatz abnormale Renditen in ähnlicher Höhe aus. Vergleicht man allerdings die absolute Höhe der abnormalen Renditen zwischen Käufen und Verkäufen, sind diese anders als bei Betzer und Theissen (2009a) in der hier verwendeten deutlich umfangreicheren Stichprobe im Ereigniszeitfenster [0;5] statistisch signifikant voneinander verschieden. Die Ereignisrendite von 1,05% für Käufe ist im Betrag signifikant höher als die 0,68% für Verkäufe; ein Test auf Gleichheit der Mittelwerte liefert einen t-Wert von 13,81, was auf Signifikanz am 1%-Niveau hindeutet. Mit zunehmen-

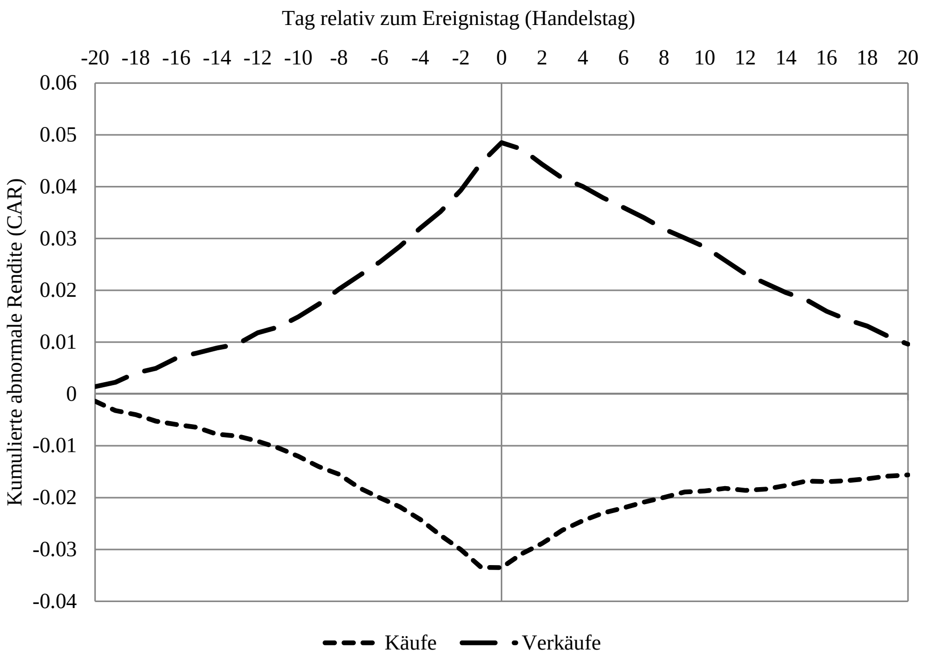

Abbildung I – Kumulierte abnormale Renditen rund um den Ereignistag (Handelstag) Die Abbildung stellt die zeitliche Entwicklung der kumulierten abnormalen Renditen (CARs) für Käufe und Verkäufe von Insiderpapieren im Ereigniszeitfenster [-20;20] dar. Das zugrunde liegende Ereignis ist der Handelstag.

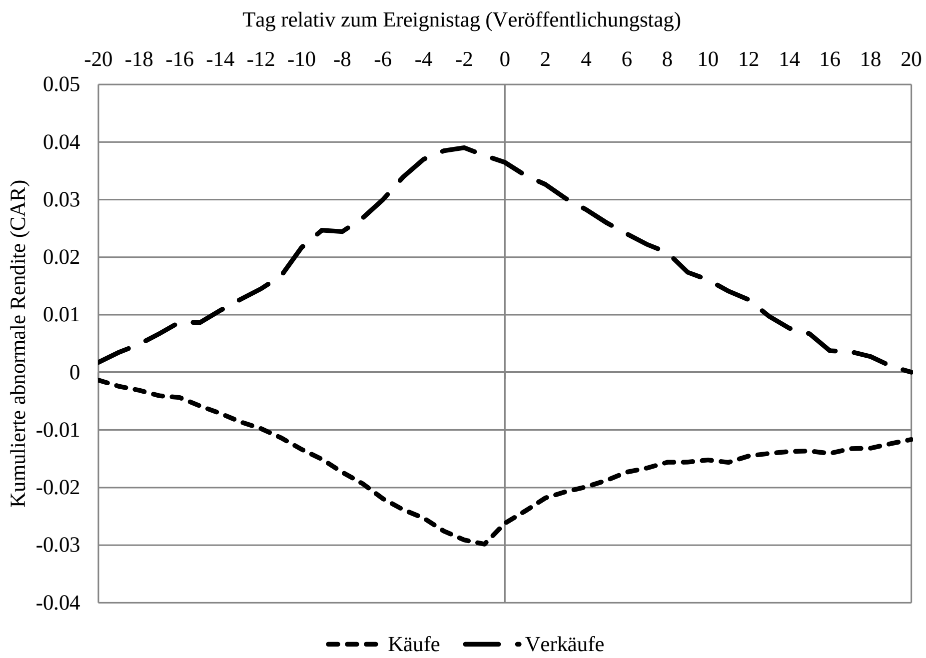

Abbildung II – Kumulierte abnormale Renditen rund um den Ereignistag (Veröffentlichungstag)
Die Abbildung stellt die zeitliche Entwicklung der kumulierten abnormalen Renditen (CARs) für Käufe und Verkäufe von Insiderpapieren im Ereigniszeitfenster [-20;20] dar. Das zugrunde liegende Ereignis ist der Tag der Veröffentlichung.

dem Zeithorizont steigen allerdings die abnormalen Renditen der Insider-Verkäufe deutlich stärker an als die der Insider-Käufe. Im längeren Ereigniszeitfenster [0;20] beträgt die kumulative abnormale Rendite nach Insider-Käufen 1,79% und nach Insider-Verkäufen -3,50%. Ein t-Test auf Gleichheit der Mittelwerte (im Betrag) zeigt, dass die Nullhypothese mit einem t-Wert von 21,11 am 1%-Niveau verworfen werden muss. Diese Ergebnisse deuten darauf hin, dass negative Unternehmensinformationen höhere Auswirkungen auf den Kurswert haben als positive, die im Markt jedoch erst mit erheblicher Verzögerung verarbeitet werden. Sie widersprechen der Beobachtung von Fidrmuc u. a. (2006), die höhere abnormale Renditen bei Insider-Käufen im Vergleich zu Insider-Verkäufen dokumentieren. Die geringere Werthaltigkeit von Insider-Verkäufen wird darauf zurückgeführt, dass Verkäufe häufig durch das Liquiditätsbedürfnis der Insider, also ohne weiteren Informationsgehalt über die zukünftigen Cashflows des Unternehmens, ausgelöst werden. Gleichzeitig stellt der Kauf eigener Aktien durch Insider ein glaubwürdiges Signal dar, weil mit der Kaufentscheidung erhebliche Kosten einer suboptimalen Diversifikation auf privater Ebene verbunden sind. Im Gegensatz dazu könnte die höhere Werthaltigkeit von Insider-Verkäufen im Vergleich zu Insider-Käufen, wie sie in Tabelle II zumindest für das längere Ereigniszeitfenster dokumentiert wird, durch die Verlustaversion der Unternehmensinsider erklärt werden (Tversky und Kahneman 1992; Thaler u. a. 1997). Da Verluste mehr schmerzen als Gewinne erfreuen, werden Insider ihren Informationsvorsprung nutzen, um Verluste auf die eigene Aktie zu vermeiden. Die Untersuchung von Chan (2003) stützt diese Hypothese. Seine empirischen Ergebnisse für den US-Aktienmarkt deuten ebenfalls darauf hin, dass negative Unternehmensnachrichten zu einer stärkeren Preisreaktion führen als gute Nachrichten. Demnach unterreagieren Anleger insbesondere auf schlechte Nachrichten, was auf Marktfriktionen zurückzuführen sein könnte. Als Beispiel nennt Chan (2003) Leerverkaufsrestriktionen, die eine schnelle Preisanpassung nach dem Ereignis verhindern.[14]

Information-Hierarchy-Hypothese: Gemäß der Information-Hierarchy-Hypothese von Seyhun (1986) und Lin und Howe (1990) nimmt die Werthaltigkeit von Informationen mit steigender Hierarchieebene eines Insiders zu. In der Führungsstruktur

14 Hong u. a. (2000) argumentieren ebenfalls, dass Anleger langsam auf negative Nachrichten reagieren. Kleine Unternehmen mit einer geringen Anzahl von Analysten weisen das höchste Renditemomentum auf, wobei dieser Effekt bei Unternehmen mit negativen Renditen über die letzten Monate am stärksten ausgeprägt ist.

deutscher Unternehmen ist dabei zwischen Mitgliedern des Vorstandes und Mitgliedern des Aufsichtsrates zu unterscheiden. Man würde erwarten, dass die abnormalen Renditen nach Käufen und Verkäufen der Vorstandmitglieder, die das Unternehmen operativ leiten, höher ausfallen als bei Aufsichtsratsmitgliedern, denen lediglich eine Kontrollfunktion zukommt. Auf beiden Ebenen ist außerdem zwischen Primärinsidern und Sekundärinsidern zu unterscheiden. Primärinsider umfassen die Mitglieder des Vorstandes oder des Aufsichtsrates, während Sekundärinsider (also Lebensgefährten oder Nachkommen von Vorstands- und Aufsichtsratsmitgliedern) nicht im Unternehmen beschäftigt sind. Man würde vermuten, dass zwischen Primär- und Sekundärinsider wiederum ein Informationsgefälle vorherrscht, das zu einer Abnahme der abnormalen Renditen führt.

Die Ergebnisse in Tabelle II lassen, ähnlich wie bei Fidrmuc u. a. (2006) sowie Betzer und Theissen (2009a), keine Evidenz für die Information-Hierarchy-Hypothese erkennen. Überraschend ist das Ergebnis, dass die Sekundärinsider des Vorstandes im Ereigniszeitfenster [0;5] nach einem Kauf eine sehr hohe abnormale Rendite von 2,28% erzielen. Die abnormalen Renditen nach Käufen der übrigen Personenkreise fallen im gleichen Zeitfenster deutlich geringer aus und liegen bei rund 1%. Die abnormalen Renditen steigen mit zunehmender Länge des betrachteten Zeitintervalls. Lediglich für Sekundärinsider des Aufsichtsrates sind die abnormalen Renditen im Ereignisfenster [0;20] nicht signifikant von Null verschieden. Basierend auf der Renditeentwicklung in diesem Zeitintervall ergibt sich folgende Reihenfolge der Werthaltigkeit der verfügbaren Information bei Wertpapierkäufen: (1) Primärinsider des Aufsichtsrates, (2) Sekundärinsider des Vorstandes, (3) Primärinsider des Vorstandes und (4) Sekundärinsider des Aufsichtsrates. Diese Reihenfolge widerspricht der Information-Hierarchy-Hypothese.

Die Betrachtung der Insider-Verkäufe führt zu ebenso unerwarteten Ergebnissen. Im Ereigniszeitfenster [0;5] sind die abnormalen Renditen sehr gering. Wiederum steigen die abnormalen Renditen mit zunehmender Länge des Intervalls an. Im Ereigniszeitfenster [0;20] vermeiden alle Insidergruppen durch einen Verkauf einen abnormalen Verlust von über 3%. Es ergibt sich folgende Reihenfolge der Werthaltigkeit der Informationen bei Verkäufen: (1) Sekundärinsider des Aufsichtsrates, (2) Sekundärinsider des Vorstandes, (3) Primärinsider des Vorstandes und (4) Primärinsider des Aufsichtsrates. Auch diese Reihenfolge widerspricht der Information-Hierarchy-Hypothese.

Höhere abnormale Renditen nach Käufen von Aufsichtsratsmitgliedern könnten gemäß Jeng u. a. (2003) dadurch erklärt werden, dass Vorstandsmitglieder zwar über bessere Informationen verfügen, gleichzeitig aber auch unter stärkerer Kontrolle durch Aktionäre und Regulatoren stehen. Deshalb sind Vorstandmitglieder zurückhaltend, auf Basis ihres Informationsvorsprungs Aktien zu kaufen. Die Art der Kommunikation zwischen Vorstand und Aufsichtsrat könnte eine schlechtere Performance (d.h. eine geringere Verlustvermeidung) der Aufsichtsratsmitglieder nach Verkäufen erklären. Vorstandsmitglieder haben keinen Anreiz, den Aufsichtsratsmitgliedern schlechte Informationen sofort weiterzuleiten, und damit sind sie lange vor dem Aufsichtsrat über negative Informationen informiert. Eine stärker ausgeprägte Preisentwicklung nach Transaktionen von Sekundärinsidern im Vergleich zu Primärinsidern könnte auf das individuell wahrgenommene Risiko einer Transaktion zurückzuführen sein. Wenn Primärinsider private Informationen nicht auf eigene Rechnung nutzen, werden sie an Sekundärinsider nur gut abgesicherte Informationen weitergeben, die sich dann in einer höheren abnormalen Rendite niederschlagen. Außerdem könnten Primärinsider durch Übertragung werthaltiger Informationen auf Sekundärinsider Insidergewinne strategisch verschleiern.

Auswirkungen des Anlegerschutzverbesserungsgesetz: Als Folge des Verbotes des Handels aufgrund von Insiderinformation (§15 WpHG) im Zusammenspiel mit der Veröffentlichungspflicht (§15a WpHG) ergibt sich, dass Insider nur solche Geschäfte durchführen dürfen, die nicht auf Insiderinformation beruhen, also keinen Tatsachenkern enthalten, sondern die aufgrund einer langfristigen Erfolgseinschätzung getätigt werden. Man würde daher vermuten, dass durch die Einführung der 5-tägigen Veröffentlichungsfrist im Anlegerschutzverbesserungsgesetz (AnSVG) die Wahrscheinlichkeit erhöht wurde, regelwidrigen Insiderhandel aufzudecken. Beim Auftreten eines meldepflichtigen Ereignisses unmittelbar nach einer Transaktion liegt der Verdacht auf einen Insiderhandel nahe, der auf einem Tatsachenkern beruht (Dymke und Walter 2008). Im Vergleich zur Regelung vor der Gesetzesänderung am 29. Oktober 2004 sollten demnach geringere abnormale Renditen zu beobachten sein, weil der diskretionäre Spielraum der Insider verringert wurde und eine Transaktion, die auf einer langfristigen Einschätzung statt auf einer eindeutigen Information beruht, lediglich ein Signal darstellt und weniger profitabel sein dürfte. Die grundsätzliche Forderung nach einer kürzeren Veröffentlichungsfrist ergibt sich auch aus den Ergebnissen von Betzer und Theissen (2009b), wonach es zu einer ineffizienten Kursbildung zwischen dem Handels- und dem Veröffentlichungstag kommt.

Die empirischen Ergebnisse in Tabelle II geben Hinweise auf eine negative Wirkung des Anlegerschutzverbesserungsgesetzes (AnSVG) auf die Ereignisrenditen. Vor der Gesetzesänderung 2004 (vor AnSVG) zeigen sich bei Insider-Käufen nur geringe abnormale Renditen in den kürzeren Ereigniszeitfenstern, die allerdings im längeren Zeitfenster [0;20] auf 2,06% ansteigen. Nach der Gesetzesänderung (nach AnSVG) steigen die anormalen Renditen im Ereigniszeitfenster [0;5] auf 1,15% an. Dies ist darauf zurückzuführen, dass sich – wie das Gesetz auch vorsieht – die Anzahl Handelstage zwischen Transaktion und Veröffentlichung von 5,31 Tage auf 3,77 Tage verkürzt hat (siehe Tabelle I). Dadurch werden die Geschwindigkeit der Informationsverarbeitung und die Werthaltigkeit der Informationen im kürzeren Ereigniszeitfenster [0;5] erhöht. Bei Insider-Käufen ist allerdings im Anschluss nur noch ein geringer Renditeeffekt zu beobachten. Im Ereigniszeitfester [6;20] steigen die abnormalen Renditen nochmals um rund 60 Basispunkte. Somit ist die abnormale Rendite während des Ereignisfensters [0;20] im Anschluss an Insider-Käufe mit 1,73% nach der Einführung des AnSVG geringer als zuvor mit 2,06%; allerdings ist die Differenz statistisch nicht signifikant.

Bei einer Betrachtung der Insider-Verkäufe scheint die Wirkung des Anlegerschutzverbesserungsgesetzes (AnSVG) stärker ausgeprägt zu sein. Erwartungsgemäß sind wiederum die (negativen) abnormalen Renditen im kurzen Ereigniszeitfenster [0;5] nach der Gesetzesänderung stärker ausgeprägt als vorher. Wichtiger ist die Beobachtung, dass die abnormalen Renditen im Ereigniszeitfenster [0;20] vor und nach der Gesetzesänderung unterschiedlich sind; die Differenz zwischen den -4,27% vor und den -3,22% nach der Einführung des AnSVG ist mit einem t-Wert von 1,90 am 10%-Niveau statistisch signifikant. Insgesamt scheinen damit die verschärften Regularien des Insiderrechts zum Abbau der Informationssymmetrien zwischen Insidern und Marktteilnehmern und zur Integrität des Marktes beizutragen. Durch die Verkürzung der Veröffentlichungsfrist gelangen Informationen schneller in den Markt und werden insbesondere bei Insider-Käufen aber auch bei Verkäufen schneller verarbeitet. Es scheint schwieriger geworden zu sein, regelwidrige Insider-Trades auf Basis publikationspflichtiger Ereignisse durchzuführen. Man würde deshalb vermuten, dass die Stichprobe nach der Gesetzesänderung einen höheren Anteil an Transaktionen enthält, die lediglich ein Signal an den Markt über die langfristigen Erwartungen der Insider senden. Diese Hypothese wird durch die geringeren abormalen Renditen im längeren Ereigniszeitfenster [0;20] unterstützt.

4.3.2 Ergebnisse des Generalized-Calender-Time-Ansatzes

Um die empirischen Ergebnisse in Abschnitt 4.3.1 auf ihre Stabilität zu überprüfen, wird in diesem Abschnitt der Generalized-Calender-Time-Ansatz (GCT-Ansatz) verwendet, der bei Hoechle u. a. (2009) ausführlich beschrieben wird. Beim traditionellen Kalenderzeitverfahren werden die Renditen von Portfolios gemessen, die zu jedem Zeitpunkt t aus Ereignisunternehmen bestehen, und danach im Rahmen einer Multifaktorenregression hinsichtlich ihrer Faktorsensitivitäten („Exposures“) untersucht. Die Vorgehensweise ist in zwei Schritte unterteilt (Kothari und Warner 2007). Zunächst wird zu jedem Zeitpunkt t ein Portfolio jener Unternehmen gebildet, für die in der vorherigen Zeitperiode t-k das zu analysierende Ereignis vorliegt. Die Länge der Verzögerung k kann frei gewählt werden.[15] Anschließend wird die Zeitreihe der Überschussrenditen des Kalenderzeitportfolios auf systematische Risikofaktoren regressiert, um die risikoadjustierte Rendite zu bestimmen. Häufig wird das 3-Faktorenmodell von Fama und French (1993) verwendet:[16]

$$R_{pt} - R_{ft} = a_p + b_p(R_{mt} - R_{ft}) + s_p SMB_t + h_p HML_t + e_{pt}, \qquad (3)$$

wobei R_{pt} die Rendite des gleich- oder wertgewichteten Portfolios der Ereignisunternehmen zum Zeitpunkt t bezeichnet. R_{ft} und R_{mt} sind der risikofreie Zinssatz bzw. die Rendite des Marktportfolios zum Zeitpunkt t. Das Faktorportfolio SMB stellt die Renditedifferenz zwischen einem Portfolio mit kleinen Unternehmen und einem Portfolio mit großen Unternehmen dar, wobei die Größe basierend auf der Marktkapitalisierung gemessen wird. HML misst die Renditedifferenz zwischen einem Portfolio mit Unternehmen, die ein hohes Buch-Markt-Verhältnis aufweisen, und einem Portfolio mit Unternehmen, die durch ein geringes Buch-Markt-Verhältnis gekennzeichnet sind. Beide Faktorportfolios stellen selbstfinanzierende Strategien dar und können nach Fama und French (1993) als Stellvertreter für die nicht beobachtbaren systematischen Risikofaktoren interpretiert werden. Der Achsenabschnitt der Regression, a_p, misst die durchschnittliche abnormale Rendite (Jensen's Alpha) des Ereignisportfolios. b_p, s_p und h_p stellen Sensitivitätskoeffizien-

15 Da das Ereignisportfolio in jeder Periode neu gebildet wird, schwankt die Anzahl der Unternehmen je nach Häufigkeit des Ereignisses, dem Beobachtungszeitpunkt und der Verzögerung k. Das Portfolio kann gleich- oder wertgewichtet sein, wobei die Rendite gleichgewichteter Portfolios aufgrund der Übergewichtung kleiner Unternehmen höher ist als die wertgewichteter Portfolios (Fama 1998).

16 Alternativ kann auch das 4-Faktorenmodell von Carhart (1997) verwendet werden.

ten (Exposures) dar, und e_{pt} ist weißes Rauschen.

Ein wesentlicher Nachteil des traditionellen Kalenderzeitverfahrens ist, dass unternehmensspezifische Erklärungsvariablen nicht in die Regressionsgleichung (3) integriert werden können. Um diesen Schwachpunkt in der Modellspezifikation zu beheben, stellen Hoechle u. a. (2009) ein erweitertes Kalenderzeitverfahren, den Generalized-Calendar-Time-Ansatz (GCT-Ansatz), vor. Anders als das klassische Kalenderzeitverfahren erlaubt es diese alternative Methode, neben den systematischen Renditetreibern auch unternehmensspezifische Erklärungsvariablen in das Modell aufzunehmen. Damit ist der GCT-Ansatz ebenso flexibel in der Modellspezifikation wie eine klassische Querschnittregression. Die Korrektur um systematische Renditetreiber und firmenspezifische Erklärungsvariablens erfolgt dabei aber nicht in zwei getrennten Schritten sondern simultan in einem Panelmodell. Ausgangspunkt ist zunächst folgendes Panelmodell:

$$y_{it} = (z_{it} \otimes x_t)d + v_{it}, \tag{4}$$

wobei y_{it} die Überschussrendite des Unternehmens i in Periode t bezeichnet. d ist ein Vektor mit Schätzkoeffizienten, v_{it} ist der Fehlerterm der Regression, und die erklärenden Variablen ergeben sich als Kronecker-Produkt ($\otimes$) der Vektoren z_{it} und x_t. Dabei enthält x_t die Risikofaktoren, die in der zeitlichen Dimension variabel aber im Querschnitt der Unternehmen konstant sind. Wie beim traditionellen Kalenderzeitverfahren wird der Vektor x_t auf der Grundlage des 3-Faktorenmodells nach Fama und French (1993) spezifiziert:

$$x_t = [1 \quad RMRF_t \quad SMB_t \quad HML_t]. \tag{5}$$

Der Vektor z_{it} enthält unternehmensspezifische Erklärungsvariablen $z_{m,it}$ ($m = 1,\ldots,M$). In der hier verwendeten Modellspezifikation werden auch mitteilungsspezifische Variablen berücksichtigt. Im Gegensatz zu den Risikofaktoren variieren die unternehmensspezifischen Variablen sowohl über die Zeit als auch den Querschnitt der Unternehmen. Der Vektor z_{it} hat somit folgende Struktur:

$$z_{it} = [1 \quad z_{1,it} \quad \ldots \quad z_{M,it}]. \tag{6}$$

Um den Informationsgehalt der gesamten Panelstichprobe zu nutzen und die Ereignisunternehmen von den restlichen Unternehmen („Matching-Firms“) der

Stichprobe zu trennen, wird das Modell noch zusätzlich um den Vektor p_{it} erweitert. Der Vektor p_{it} enthält eine Konstante sowie eine mitteilungsspezifische Dummy-Variable:

$$p_{it} = [1 \quad D_{it}], \tag{7}$$

wobei die Dummy-Variable D_{it} den Handelstag t für ein Ereignisunternehmen i kennzeichnet; sie wird im weiter unten dargestellten im Grundmodell mit Event bezeichnet. Die Dummy-Variable nimmt für Ereignisunternehmen am Tag einer Insider-Transaktion den Wert 1 und an allen anderen Tagen den Wert 0 an. Für alle Matching-Unternehmen aus dem CDAX nimmt die Dummy-Variable über die gesamte Stichprobenperiode den Wert 0 an. Das erweiterte Panelmodell ist dann wie folgt spezifiziert:

$$y_{it} = ((p_{it} \otimes z_{it}) \otimes x_t)d + v_{it}. \tag{8}$$

Der Vektor x_t umfasst die Risikofaktoren des Fama und French (1993) 3-Faktorenmodells. Hierfür wird der Marktfaktor *RMRF* als Differenz zwischen der Rendite des CDAX Total Return Index und der 1-Monats Frankfurt-Interbank-Offered-Rate (FIBOR) ermittelt. Die beiden Faktorportfolios *SMB* und *HML* werden durch die Differenzrenditen der MSCI Style-Indizes für Deutschland approximiert.

Der Vektor z_{it} im Regressionsmodell (8) enthält unternehmens- und mitteilungsspezifische (Kontroll-) Variablen, die sowohl über die Zeit als auch über den Unternehmensquerschnitt variieren. Die beiden wichtigsten mitteilungsspezifischen Variablen werden als Dummy-Variablen kodiert, um die Perioden vor einem Ereignis (Runup) und nach einem Ereignis (Drift) zu identifizieren. Diese Variablen nehmen für die Ereignisunternehmen im GCT-Grundmodell während der 10 Handelstage vor bzw. 10 Handelstage nach dem Ereignis den Wert 1 und an allen anderen Tagen den Wert 0 an. In einer alternativen Modellspezifikation kennzeichnen mitteilungsspezifische Dummy-Variablen Käufe und Verkäufe von Vorstands-Primärinsidern (VsPrim), Vorstands-Sekundärinsidern (VsSek), Aufsichtsrats-Primärinsidern (AsrPrim) und Aufsichtsrats-Sekundärinsidern (AsrSek). In einer weiteren Modellvariante wird mit dem relativen Transaktionsvolumen des Insider-Geschäfts (TradeValue) eine zusätzliche mitteilungsspezifische Erklärungsvariable in das Modell aufgenommen. Diese Variable wird als Quotient des Transaktionswertes und dem Marktwert der ausstehenden Aktien berechnet. Als unternehmensspezifische Kontrollvariablen werden in allen Modellvarianten der Bid-Ask-Spread (Bid/Ask), die Marktkapitalisierung (MV), eine Maßzahl für die Liquidität der gehandelten Aktie (TV), der

Verschuldungsgrad (LEV), das Markt-Buch-Verhältnis (MB), die Ausschüttungsquote (POR), der Freefloat der Aktie (Freefloat), der Gewinn pro Aktie (EPS) sowie die Dividendenrendite (DY) verwendet. Tabelle III gibt eine Übersicht aller Variablen, die in der Panelregression verwendet werden.

Das im Folgenden zu schätzende Grundmodell des GCT-Verfahrens enthält die mitteilungsspezifischen Dummy-Variablen Event, Runup und Drift sowie aller unternehmensspezifischen Kontrollvariablen. Die Spezifikation dieser Panelregression ist daher:

$$\begin{aligned} y_{it} = &\alpha + \beta_1 RMRF_t + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 Event_{it} + \beta_5 Runup_{it} \\ &+ \beta_6 Drift_{it} + \beta_7 RMRF_t \times Event_{it} + \beta_8 SMB_t \times Event_{it} \\ &+ \beta_9 HML_t \times Event_{it} + \beta_{10} Bid/Ask_{it} + \beta_{11} MV_{it} + \beta_{12} TV_{it} + \beta_{13} LEV_{it} \\ &+ \beta_{14} MB_{it} + \beta_{15} POR_{it} + \beta_{16} Freefloat_{it} + \beta_{17} EPS_{it} + \beta_{18} DY_{it} + v_{it}. \end{aligned} \quad (9)$$

Dabei beschreibt der Achsenabschnitt α die risikoajdustierte Rendite für den Fall, dass keine Insider-Transaktion stattfindet. Die Koeffizienten β_1 bis β_3 messen den Einfluss der systematischen Risikofaktoren.[17] Im Mittelpunkt stehen die Koeffizienten β_4 bis β_9, mit denen der Informationsgehalt und die Performance von Insider-Transaktionen gemessen werden können. Der Koeffizient β_4 auf die Event-Dummy misst den Unterschied in der risikoadjustierten Rendite am Handelstag im Vergleich zu allen CDAX Matching-Unternehmen ohne Insider-Transaktionen. Die Risikoadjustierung erfolgt durch die geschätzten Koeffizienten β_7 bis β_9 auf die Interaktionsterme zwischen der Marktrisikoprämie und den beiden Faktorportfolios mit der Event-Dummy-Variable. Die Koeffizienten β_5 und β_6 messen den Unterschied in der risikoadjustierten Rendite während der Runup-Periode bzw. der Drift-Periode im Vergleich zu allen CDAX Matching-Unternehmen ohne Insider-Transaktionen.

Anders als die Event-Study-Methodik ist der CGT-Ansatz in der Lage, Schätzkoeffizienten zu generieren, die robust gegenüber möglichen Abhängigkeiten der untersuchten Einheiten (Insider) im Querschnitt (Cross-Sectional-Dependency) sind. Dieses Problem könnte in unserem Datensatz auftreten, der nur wenige Beobachtungen über die Zeit aber viele Beobachtungen über die Einheiten (Insider) enthält (Fama 1998; Lyon u. a. 1999; Mitchell und Stafford 2000). Ein weiterer methodischer

17 Die geschätzten Koeffizienten α, β_1, β_2 und β_3 werden in den Ergebnistabellen nicht ausgewiesen. α ist in jeder Regression negativ und beträgt bei Käufen -0,64% und bei Verkäufen -0,70%. β_1 (0,74) sowie β_2 (0,59) sind in allen Regressionen positiv, während β_3 (-0,06) durchgängig negativ ist. Alle genannten Koeffizienten sind mindestens auf dem 10% Niveau statistisch signifikant. Der Erklärungsgehalt (R^2) beträgt modellunabhängig rund 11%.

Tabelle III – Variablen im GCT-Ansatz

Variable	Kennzeichnung	Berechnungsmethode	Quelle
Überschussrendite	—	Rendite des Wertpapiers abzüglich des risikofreien Zinses (FIBOR, 1 Monate)	DataStream
Ereignis	Event	Zeitpunkt des Events	BAFin
Periode vor dem Ereignis	Runup	binär; 1 im Zeitraum von 10 Tagen vor Event, 0 sonst	./.
Periode nach dem Ereignis	Drift	binär; 1 im Zeitraum von 10 Tagen nach Event, 0 sonst	./.
Vorstand - Primärinsider	VsPrim	binär; 1 bei Transaktion durch Vorstandsmitglied, 0 sonst	BAFin
Vorstand - Sekundärinsider	VsSek	binär; 1 bei Transaktion durch Vorstand nahestehende Person, 0 sonst	BAFin
Aufsichtsrat - Primärinsider	AsrPrim	binär; 1 bei Transaktion durch Aufsichtsratsmitglied, 0 sonst	BAFin
Aufsichtsrat - Sekundärinsider	AsrSek	binär; 1 bei Transaktion durch Aufsichtsrat nahestehende Person, 0 sonst	BAFin
Vor Anleger-verbesserungsschutzgesetz	Vor AnSVG	binär; 1 bei Transaktion vor 29.10.2004, 0 sonst	./.
Nach Anleger-verbesserungsschutzgesetz	Nach AnSVG	binär; 1 bei Transaktion nach 28.10.2004, 0 sonst	./.
Transaktionsvolumen	TradeValue	(Anzahl gehandelte Aktien * Kurs) / Marktkapitalisierung	BAFin / DataStream
Bid-Ask-Spread	Bid/Ask	(Ask + Bid) / (0,5 * (Ask - Bid))	DataStream
Marktkapitalisierung	MV	log(Marktkapitalisierung)	DataStream
Liquidität	TV	(Anzahl gehandelter Aktien * Kurs) / Marktkapitalisierung	DataStream
Verschuldungsgrad	LEV	Nettoverschuldung / Marktkapitalisierung	DataStream
Ausschüttungsquote	POR	Ausschüttungsquote in %	DataStream
Markt-Buch-Verhältnis	MB	Markt-Buch-Verhältnis in %	DataStream
Freefloat	Freefloat	Streubesitz in %	DataStream
Gewinn pro Aktie	EPS	Gewinn pro Aktie in EUR	DataStream
Dividendenrendite	DY	Dividendenrendite in %	DataStream
RMRF	RMRF	Fama-French-Faktor (Marktfaktor)	DataStream
SMB	SMB	Fama-French-Faktor (Größenfaktor)	DataStream
HML	HML	Fama-French-Faktor(Wachstums-/Substanzfaktor)	DataStream

Die Tabelle fasst die in der Panelregression im Rahmen des GCT-Ansatzes verwendeten Variablen, deren Kennzeichnung im Text und die Berechnungsmethode zusammen.

Vorteil des CGT-Ansatzes ist, dass es nicht notwendig ist, zu jedem Zeitpunkt ein Portfolio aus Ereignisunternehmen zu bilden. Loughran und Ritter (2000) kritisieren den Kalenderzeitansatz, weil jeder Zeitpunkt und nicht jede Beobachtung eine Gleichgewichtung erfährt, was zu Verzerrungen in den geschätzten abnormalen Renditen führen kann. Da der CGT-Ansatz ein Panelverfahren darstellt, kommt es durch die Kleinst-Quadrat-Schätzung automatisch zu einer Gleichgewichtung aller Beobachtungen. Das Panelmodell in Gleichung (9) wird mittels gepoolter Regression geschätzt, wobei die Standardfehler basierend auf der Methode von Driscoll und Kraay (1998) ermittelt werden. Hoechle u. a. (2009) dokumentieren, dass sich damit heteroskedastie-konsistente Standardfehler ergeben, die stabil gegenüber allgemeinen Formen der Abhängigkeit in den Residuen sowohl über den Querschnitt als auch über die Zeit sind.[18]

Die Verwendung eines Paneldatensatzes erfordert eine weitere Bereinigung der zu analysierenden Mitteilungen. Erstens sind von den verbleibenden 11 135 Mitteilungen (siehe Abschnitt 4.2.2) diejenigen zu entfernen, für deren Emittenten die ausgewählten Kontrollvariablen nicht vorliegen. Dadurch fallen 1031 Mitteilungen aus der Stichprobe. Zweitens können taggleiche Ereignisse aufgrund der unterschiedlichen mitteilungsspezifischen Variablen nicht zusammengefügt werden, weshalb diese eliminiert werden müssen. Hierdurch werden 798 weitere Mitteilungen von der Analyse ausgeschlossen. Damit verbleiben 9306 Mitteilungen für die Analyse auf Basis des GCT-Verfahrens. Wie bei der klassischen Ereignisstudie erfolgt eine getrennte Betrachtung der Insider-Käufe und der Insider-Verkäufe. Die Ergebnisse sind in den Tabellen IV (Käufe) und V (Verkäufe) dargestellt.

Die Ergebnisse des Grundmodells in Gleichung (9) für Insider-Käufe werden im Modell 1 in der Tabelle IV ausgewiesen. Am Tag eines Insider-Kaufes reagiert der Markt positiv. Der Koeffizient auf die *Event*-Dummy-Variable macht deutlich, dass die risikoadjustierte Rendite um 0,49%-Punkte höher ausfällt als an Tagen ohne Insider-Transaktionen. Zudem lassen die positiven Sensitivitäten der Interaktionsterme jeweils zwischen den beiden Faktorportfolios *RMRF* und *HML* mit der *Event*-Dummy-Variable vermuten, dass Insider tendenziell in steigenden Märkten kaufen und dabei Aktien von Substanzunternehmen (d.h. mit hohen Buch-Markt-Verhältnissen) erwerben. Die Unternehmensgröße scheint keinen Einfluss auf Insider-Käufe zu haben, was aus dem nicht signifikanten Koeffizienten auf das

18 Hoechle u. a. (2009) beschreiben den genauen Zusammenhang zwischen dem traditionellen Kalenderzeitverfahren, dem GCT-Ansatz und dem Querschnittregressionsansatz.

Tabelle IV – Regressionsergebnisse des GCT-Ansatzes für Käufe am Handelstag

	Modell 1		**Modell 2**		**Modell 3**		**Modell 4**	
	Koeffizient	**t-Wert**	**Koeffizient**	**t-Wert**	**Koeffizient**	**t-Wert**	**Koeffizient**	**t-Wert**
Event	0,004 93***	4,31	0,005 89***	3,56	0,004 88***	4,27	0,005 81***	3,51
Runup	−0,003 88***	−15,47	−0,003 89***	−15,41	−0,003 87***	−15,43	−0,003 88***	−15,38
Drift	0,000 70***	2,85	0,000 69***	2,82	0,000 63***	2,57	0,000 62***	2,55
RMRF x Event	0,000 99***	3,58	0,001 00***	3,66	0,000 98***	3,57	0,001 00***	3,64
SMB x Event	0,000 91***	1,50	0,000 87***	1,44	0,000 90***	1,49	0,000 86***	1,42
HML x Event	0,001 66***	3,20	0,001 67***	3,19	0,001 66***	3,20	0,001 67***	3,19
VsPrim			−0,003 09***	−2,01			−0,003 04***	−1,98
VsSek			0,005 30***	2,16			0,005 27***	2,14
AsrPrim			0,000 17***	0,10			0,000 21***	−0,12
Transaktionsvolumen					0,012 41***	2,83	0,012 00***	2,77
Marktkapitalisierung	0,000 01***	0,14	0,000 02***	0,16	0,000 02***	0,15	0,000 02***	0,17
Bid-Ask-Spread	−0,000 51***	−0,22	−0,000 51***	−0,22	−0,000 51***	−0,22	−0,000 50***	−0,22
Liquidität	0,000 10***	2,50	0,000 10***	2,50	0,000 10***	2,50	0,000 10***	2,50
Verschuldungsgrad	0,000 00***	−1,87	0,000 00***	−1,87	0,000 00***	−1,87	0,000 00***	−1,86
Ausschüttungsquote	0,000 00***	0,46	0,000 00***	0,47	0,000 00***	0,47	0,000 00***	0,48
Markt-Buch-Verhältnis	0,000 00***	0,24	0,000 00***	0,24	0,000 00***	0,24	0,000 00***	0,24
Freefloat	−0,000 01***	−4,88	−0,000 01***	−4,86	−0,000 01***	−4,87	−0,000 01***	−4,84
Gewinn pro Aktie	−0,000 01***	−1,77	−0,000 01***	−1,79	−0,000 01***	−1,79	−0,000 01***	−1,81
Dividendenrendite	−0,000 07***	−4,00	−0,000 07***	−3,99	−0,000 07***	−4,00	−0,000 07***	−3,99

Die Tabelle stellt die Ergebnisse des GCT-Ansatzes nach Hoechle u. a. (2009) dar. Die Panelregression hat folgende Struktur:

$$y_{it} = ((p_{it} \otimes z_{it}) \otimes x_t)d + v_{it}.$$

Die Abhängige Variable y_{it} ist die Überschussrendite der Käufe am Handelstag. Der Vektor p_{it} kennzeichnet ein Ereignis, z_{it} die unternehmens- und mitteilungsspezifischen Kontrollvariablen, x_t die Fama-French-Risikofaktoren und d die Regressionskoeffizienten. Modelle 1 bis 3 unterscheiden sich in Bezug auf die verwendeten mitteilungsspezifischen Variablen. Modell 4 enthält alle Variablen. Für alle Modelle nehmen die Dummy-Variablen Runup und Drift den Wert eins im Zeitraum von zehn Handelstagen vor bzw. nach dem Ereignis (Handelstag des Insiders) an. Die t-Werte basieren auf den Standardfehlern von Driscoll und Kraay (1998). *** / ** / * deuten auf eine signifikant von Null verschiedene Rendite mit einer Irrtumswahrscheinlichkeit von 1% / 5% / 10% hin.

Tabelle V – Regressionsergebnisse des GCT-Ansatzes für Verkäufe am Handelstag

	Modell 1		Modell 2		Modell 3		Modell 4	
	Koeffizient	**t-Wert**	**Koeffizient**	**t-Wert**	**Koeffizient**	**t-Wert**	**Koeffizient**	**t-Wert**
Event	−0,009 72***	−4,71	−0,010 06***	−3,17	−0,009 70***	−4,70	−0,010 01***	−3,15
Runup	0,002 96***	10,88	0,002 95***	10,87	0,002 96***	10,89	0,002 95***	10,88
Drift	−0,001 07***	−4,23	−0,001 07***	−4,22	−0,001 09***	−4,28	−0,001 08***	−4,26
RMRF x Event	−0,002 48***	−3,94	−0,002 53***	−4,01	−0,002 47***	−3,93	−0,002 53***	−4,00
SMB x Event	−0,000 36***	−0,30	−0,000 38***	−0,32	−0,000 35***	−0,29	−0,000 37***	−0,31
HML x Event	0,002 22***	1,83	0,002 33***	1,92	0,002 22***	1,83	0,002 33***	1,91
VsPrim			−0,001 28***	−0,48			−0,001 23***	−0,47
VsSek			0,006 77***	1,52			0,006 82***	1,53
AsrPrim			−0,000 83***	−0,29			−0,000 79***	−0,28
Transaktionsvolumen					0,000 28***	0,61	0,000 28***	0,61
Marktkapitalisierung	0,000 06***	0,56	0,000 06***	0,57	0,000 06***	0,57	0,000 06***	0,58
Bid-Ask-Spread	−0,000 29***	−0,10	−0,000 28***	−0,10	−0,000 28***	−0,10	−0,000 28***	−0,10
Liquidität	0,000 07***	2,41	0,000 07***	2,41	0,000 07***	2,41	0,000 07***	2,41
Verschuldungsgrad	0,000 00***	−3,58	0,000 00***	−3,58	0,000 00***	−3,63	0,000 00***	−3,63
Ausschüttungsquote	0,000 00***	1,23	0,000 00***	1,23	0,000 00***	1,23	0,000 00***	1,22
Markt-Buch-Verhältnis	0,000 00***	0,38	0,000 00***	0,38	0,000 00***	0,38	0,000 00***	0,37
Freefloat	−0,000 01***	−3,99	−0,000 01***	−3,99	−0,000 01***	−3,99	−0,000 01***	−3,98
Gewinn pro Aktie	−0,000 10***	−7,02	−0,000 10***	−7,01	−0,000 10***	−7,02	−0,000 10***	−7,02
Dividendenrendite	−0,000 12***	−4,55	−0,000 12***	−4,55	−0,000 12***	−4,55	−0,000 12***	−4,55

Die Tabelle stellt die Ergebnisse des GCT-Ansatzes nach Hoechle u. a. (2009) dar. Die Panelregression hat folgende Struktur:

$$y_{it} = ((p_{it} \otimes z_{it}) \otimes x_t)d + v_{it}.$$

Die Abhängige Variable y_{it} ist die Überschussrendite der Verkäufe am Handelstag. Der Vektor p_{it} kennzeichnet ein Ereignis, z_{it} die unternehmens- und mitteilungsspezifischen Kontrollvariablen, x_t die Fama-French-Risikofaktoren und d die Regressionskoeffizienten. Modelle 1 bis 3 unterscheiden sich in Bezug auf die verwendeten mitteilungsspezifischen Variablen. Modell 4 enthält alle Variablen. Für alle Modelle nehmen die Dummy-Variablen Runup und Drift den Wert eins im Zeitraum von zehn Handelstagen vor bzw. nach dem Ereignis (Handelstag des Insiders) an. Die t-Werte basieren auf den Standardfehlern von Driscoll und Kraay (1998). *** / ** / * deuten auf eine signifikant von Null verschiedene Rendite mit einer Irrtumswahrscheinlichkeit von 1% / 5% / 10% hin.

Faktorportfolio *SMB* geschlossen werden kann. Die Koeffizienten auf die Dummy-Variablen *Runup* und *Drift* deuten wie bei der Ereignisstudie wiederum darauf hin, dass Insider den Kauf eigener Aktien strategisch steuern. Insider kaufen Wertpapiere nach einer Periode mit negativer Kursentwicklung. Die abnormale Rendite während der 10 Tage vor einem Kauf beträgt -0,38%. Im Anschluss profitieren Insider allerdings von einer positiven Wertentwicklung der eigenen Aktie; die abnormale Rendite während der 10 Tage nach einem Kauf beträgt 0,69%. Auch wenn die Höhe der Timing-Effekte in der multivariaten Analyse damit geringer ausfällt als in der Ereignisstudie, deuten diese Ergebnisse darauf hin, dass Insider über private kursrelevante Informationen verfügen, die für Outsider aufgrund asymmetrischer Informationsverteilung nicht zugänglich sind.[19] Der Einfluss der unternehmensspezifischen Kontrollvariablen ist relativ gering. Lediglich die Kontrollvariablen *TV*, *LEV*, *Freefloat*, *EPS* und *DY* haben einen signifikanten Einfluss auf die Überschussrendite. Die Überschussrendite sinkt mit zunehmendem Verschuldungsgrad, höherem Streubesitz, einem höheren Gewinn pro Aktie und einer höheren Dividendenrendite. Sie steigt hingegen mit zunehmender Liquidität der Aktie.

Bei Verkäufen ist die abnormale Rendite am Handelstag im Grundmodell des GCT-Ansatzes betragsmäßig höher als bei Käufen. Der Koeffizient auf die Event-Dummy-Variable im Modell 1 in der Tabelle V weist einen Wert von -0,97%-Punkten auf. Wie bei Insider-Käufen lassen sich auch bei Insider-Verkäufen Timing-Fähigkeiten messen. Insider verkaufen nach einer Periode positiver Kursentwicklung, und die abnormale Rendite 10 Tage vor einem Insider-Verkauf beträgt 0,29%. Die abnormale Rendite in den 10 Tagen nach einem Insider-Verkauf beträgt hingegen -1,10%, d.h. Unternehmensinsider vermeiden eine negative Wertentwicklung relativ zu den CDAX Matching-Unternehmen.

Zur Analyse der Werthaltigkeit der Informationen in Abhängigkeit von der Position des Insiders wird das Grundmodell durch die mitteilungsspezifischen Erklärungsvariablen VsPrim, VsSek und AsrPrim im Vektor z_{it} ergänzt. Die Variable AsrSek dient als Referenzkategorie und wird nicht in die Regression aufgenommen. Die Ergebnisse werden jeweils im Modell 2 in den Tabellen IV und V dargestellt. Bei den Insider-Käufen ergeben sich signifikante Koeffizienten lediglich für Primär- und Sekundärinsider des Vorstandes. Demnach erzielen Primärinsider des Vorstandes eine um 0,30%-Punkte geringere abnormale Rendite im Vergleich

19 Abweichungen in den Ergebnissen der beiden Methoden sind darauf zurückzuführen, dass beim GCT-Ansatz neben der Aufnahme der firmenspezifischen Variablen auch eine umfassendere Risikokorrektur durch den Einbezug der *SMB*- und *HML*-Faktoren erfolgt.

zu Sekundärinsidern des Aufsichtsrates. Hingegen erzielen Sekundärinsider des Vorstandes eine um 0,53%-Punkte höhere abnormale Rendite als Sekundärinsider des Aufsichtsrates. Daraus ergibt sich folgende Reihenfolge für die Werthaltigkeit der Informationen bei Käufen: (1) Sekundärinsider des Vorstandes, (2) Primär- und Sekundärinsider des Aufsichtsrates, (3) Primärinsider des Vorstandes. Damit kann auch im GCT-Ansatz – ebenso wie in der Ereignisstudie – keine Bestätigung für die Information-Hierarchy-Hypothese bei Insider-Käufen festgestellt werden. Für Insider-Verkäufe ist überhaupt keine Beziehung zwischen Werthaltigkeit der Information und der Position des Unternehmensinsiders auszumachen. Keiner der drei Schätzkoeffizienten der Dummy-Variablen, die auf die Position des Insiders im Unternehmen abstellen, ist statistisch signifikant.

Im Modell 3 in den beiden Tabellen IV und V wird der Transaktionswert des Insider-Geschäfts ($TradeValue$) als eine weitere mitteilungsspezifische Erklärungsvariable in das Modell aufgenommen. Man würde erwarten, dass größere Transaktionen aufgrund der asymmetrischen Informationsverteilung zwischen Insidern und Outsidern ein stärkeres Signal an den Markt senden und daher zu höheren abnormalen Renditen führen (Jeng u. a. 2003). Anders als bei Betzer und Theissen (2009a) wird diese Vermutung durch den signifikant positiven Koeffizienten auf $TradeValue$ bei Insider-Käufen bestätigt.[20] Für Insider-Verkäufe scheint die Größe der Transaktion hingegen keinen Einfluss auf die abnormalen Renditen zu haben. Dies könnte nach Jeng u. a. (2003) damit begründet werden, dass die Beziehung zwischen der Transaktionsgröße und der abnormalen Rendite verschwindet, wenn die betragsmäßig größten Insider-Verkäufe aus Überlegungen hinsichtlich der optimalen Diversifikation oder aufgrund von Liquiditätsbedürfnissen der Manager durchgeführt werden.

Um den Einfluss des Anlegerschutzverbesserungsgesetzes zu untersuchen, könnte man eine weitere mitteilungsspezifische Dummy-Variable in das GCT-Regressionsmodell aufnehmen, die Insider-Transaktionen vor bzw. nach der Umsetzung des Anlegerschutzverbesserungsgesetzes identifiziert. Entsprechend würde diese Variable den Wert 1 für Ereignisse vor und 0 nach dem 28. Oktober 2004 annehmen.

20 Im Gegensatz dazu berichten Barclay und Warner (1993) sowie Chakravarty (2001), dass Insider-Trades mittleren Volumens die größten Preisbewegungen nach sich ziehen. Dieser empirische Befund ist mit der Hypothese des „Stealth-Trading“ konsistent. Demnach werden Insider ihre Transaktionen in mehrere (nicht zu kleine und nicht zu große) Pakete aufteilen, um bereits zu profitieren, bevor der Markt die zugrundeliegenden Informationen verarbeitet (Kyle 1985; Admati und Pfleiderer 1988). Auch Friederich u. a. (2002) dokumentieren, dass zeitlich aufeinanderfolgende Transaktionen ein stärkeres Signal darstellen als großvolumige Transkationen.

Allerdings ergibt sich dabei möglicherweise ein Problem der Multikollinearität, das durch die hohe Korrelation mit den beiden Runup- und Drift-Variablen hervorgerufen wird. Es ist daher schwierig, die separate Wirkung der Gesetzesänderung eindeutig zu messen. Dies könnte erklären, weshalb der Koeffizient auf eine AnSVG-Dummy-Variable nicht signifikant gemessen wird und daher in den Tabellen nicht ausgewiesen ist. Um die Robustheit des Modells zu überprüfen, werden zunächst im Modell 4 in den Tabellen IV und V sämtliche Erklärungsvariablen in einer gemeinsamen Spezifikation verwendet. Alle Ergebnisse der GCT-Schätzung bleiben qualitativ unverändert. Zusätzlich werden die Ergebnisse auf Robustheit hinsichtlich von „Thin-Trading-Effekten“ bei der Berechnung der abnormalen Renditen überprüft, die als abhängige Variable dienen.[21] Hierzu wird das Verfahren von Dimson (1979) zur Adjustierung des Marktbetas mit zwei Leads und Lags verwendet. Da sich aber kein Hinweis auf Thin-Trading-Probleme ergibt, werden die Ergebnisse nicht ausgewiesen.

4.4 Zusammenfassung

In dieser Untersuchung wird die Performance deutscher Unternehmensinsider bei Transaktionen in Aktien ihrer „eigenen“ Unternehmen analysiert. Grundlage sind die Mitteilungen der BaFin-Datenbank für Directors’ Dealings nach §15 a WpHG im Zeitraum vom 1. Juli 2002 bis 17. März 2009. Die empirische Analyse erfolgt auf der Basis zweier Bewertungsmodelle: (1) der klassischen Ereignisstudie (1997) und (2) dem Generalized-Calender-Time-Ansatz (GCT-Ansatz). Die empirischen Ergebnisse belegen, dass Unternehmensinsider im Vergleich zu anderen Marktteilnehmern über werthaltigere Informationen verfügen und diese im Rahmen von Insider-Transaktionen nutzen. Die kumulierten abnormalen Renditen in der klassischen Ereignisstudie betragen im Intervall von 20 Tagen nach dem Handelstag 1,79% bei Käufen und -3,50% bei Verkäufen. Anhand der Ergebnisse des GCT-Ansatzes erzielen Insider am Handelstag bei Käufen eine Rendite von maximal 0,59%; bei Verkäufen vermeiden sie maximal einen Verlust von 1,01%. In den darauffolgenden zehn Börsentagen führen Käufe (Verkäufe) zu einer abnormalen Rendite in Höhe von 0,70% (-1,09%). Damit führen beide Methoden qualitativ zu sehr ähnlichen Ergebnissen. Die Höhe der Schätzkoeffizienten ist allerdings nur bedingt vergleichbar,

21 Thin-Trading bezeichnet nach Dimson (1979) die geringe Handelsfrequenz von Wertpapieren. Die hieraus resultierende positive Autokorrelation und die negativ verzerrten Beta-Schätzungen können zu Messproblemen bei den abnormalen Renditen führen.

weil der GCT-Ansatz eine umfangreichere Korrektur der Renditen rund um den Ereignistag vornimmt als die Ereignisstudie (z.B. durch die Interaktion der Runup- und Drift-Variablen mit den Fama-French Faktoren).

Zudem ermöglichen die Ergebnisse Rückschlüsse auf strategisches Verhalten der Insider bei Wertpapiertransaktionen. Insider haben auf Basis ihrer privaten Informationen die Fähigkeit, die Wertentwicklung des Unternehmens zu prognostizieren. Diese Timing-Fähigkeiten der Insider kommen durch negative (positive) CARs vor Käufen (Verkäufen) sowie durch den negativen (positiven) Regressionskoeffizienten der Variable Runup bei Käufen (Verkäufen) im GCT-Ansatz zum Ausdruck. Renditeunterschiede zwischen Käufen und Verkäufen sind bei kurzfristiger Betrachtung durch die Geschwindigkeit der Informationsverarbeitung des Kapitalmarktes erklärbar. Während bei positiven Informationen eine schnelle Preisanpassung erfolgt, sind bei negativen Informationen Preisreaktionen über einen längeren Zeitraum messbar. Negative Informationen bzw. Verkäufe von Insiderpapieren scheinen insgesamt eine höhere Werthaltigkeit für den Kapitalmarkt zu besitzen.

Einheitliche Aussagen zum Zusammenhang zwischen der Position des Insiders und der Werthaltigkeit der verfügbaren Informationen gemäß der Information-Hierarchy-Hypothese sind nicht möglich. In Bezug auf die Auswirkungen der Implementierung des Anlegerverbesserungsschutzgesetzes liefert die Ereignisstudie neue Ergebnisse. Die CARs im Ereigniszeitfenster [0;20] weisen einen Rückgang der Insidergewinne um 0,3%-Punkte bei Käufen und rund 1%-Punkt bei Verkäufen auf. Die Anpassung der gesetzlichen Rahmenbedingungen für Insidergeschäfte – und insbesondere die kürzere Veröffentlichungsfrist von Insider-Transaktionen – reduziert die Dauer des Informationsgefälles zwischen Insidern und Outsidern und fördert insgesamt die Gleichberechtigung aller Marktteilnehmer.

Angesichts der Ergebnisse in dieser Arbeit bleiben allerdings Zweifel, ob die gegenwärtigen rechtlichen Rahmenbedingungen die Absichten des Gesetzgebers umfassend erfüllen. Die Timing-Fähigkeiten der Insider könnten als Hinweise auf ein Umgehen der gesetzlichen Vorschriften interpretiert werden, woraus die Forderung nach differenzierteren Mechanismen zur Eindämmung von Insidergewinnen erwächst. Da ein generelles Verbot von Insider-Trades schon aufgrund der Gewährung von Aktienoptionen im Rahmen von anreizkompatiblen Vergütungssystemen nicht sachgerecht ist, und der Nachweis von Insiderinformationen im Einzelfall nur unter prohibitiv hohen Kosten zu erbringen sein dürfte, sollte zumindest eine Durchführung von Insider-Transaktionen im Vorfeld von planbaren Informationsveröffentlichungen (z.B. Quartals- oder Jahresberichte) verboten sein. Diese Forderung wird bereits durch die früheren Ergebnisse von Dymke und Walter (2008) sowie Betzer und Theissen (2009a) unterstützt und könnte eine effizientere Regulierung des Insider-Tradings in Deutschland bewirken.

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Chapter 5

Common risk factors in the returns of shipping stocks

mit Wolfgang Drobetz[a] und Lars Tegtmeier[b]
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[a] Wolfgang Drobetz, Lehrstuhl für Unternehmens- und Schiffsfinanzierung, Universität Hamburg, Von-Melle-Park 5, 20146 Hamburg, Tel.: +49-40-42838-5506, Mail: wolfgang.drobetz@wiso.uni-hamburg.de.
[b] Lars Tegtmeier, TKL.Fonds Gesellschaft für Fondsconception und -analyse mbH, Neuer Wall 18, 20354 Hamburg, Germany

Abstract

The knowledge of risk factors that determine an industry's expected stock returns is important to assess whether this industry serves as a separate asset class. This study analyses the macroeconomic risk factors that drive expected stock returns in the shipping industry and its three sectors: container, tanker, and bulker shipping. Our sample consists of the monthly returns of 48 publicly-listed shipping companies over the period from January 1999 to December 2007. We use shipping stocks together with a set of country or other industry indices to estimate the macroeconomic risk profiles and the corresponding factor risk premiums. Using a Seemingly Unrelated Regressions (SUR) model to estimate factor sensitivities, we document that shipping stocks exhibit remarkably low stock market betas. We also provide evidence that a multidimensional definition of risk is necessary to capture the risk-return spectrum of shipping stocks. A one-factor model produces large pricing errors, and hence it must be rejected based on tests of the model's orthogonality conditions using the Generalized Method of Moments (GMM). In contrast, when the change in the trade-weighted value of the US$, the change in G-7 industrial production, and the change in the oil price are added as additional risk factors, the resulting multifactor model is able to explain the cross-section of expected stock returns. The risk-return profile of shipping stocks differs from country and other industry indices. However, the sensitivities to global systematic risk factors are similar across all three sectors of the shipping industry. Overall, our results suggest that shipping stocks have the potential to serve as a separate asset class. Our findings also have important implications for computing the cost of equity capital in the shipping industry.

Keyword: Risk factors, shipping stocks, asset pricing, GMM

JEL Classification: G12, G11

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5.1 Introduction

An asset class can be determined by its sensitivities to and its co-movements with underlying risk factors. A specific industry may be viewed as a separate asset class if its risk-return profile based on factor sensitivities (or exposures) to common risk factors is sufficiently different from those of other industries. In this study, we investigate whether the shipping industry has the potential to serve as a separate asset class that enhances the risk-return spectrum of an already diversified investor. We also examine which risk factors are important for the pricing of publicly listed shipping stocks. Knowing both the sensitivities to systematic risk factors and the associated risk premiums, there are implications for the cost of equity capital of shipping companies.

Analyzing ship markets has a long tradition in economics. Already Koopmans (1939) studied the relationship between freight rates and the construction of oil tankers. Nevertheless, the shipping industry has never received the attention in the literature it deserves given its economic importance. The shipping industry is responsible for the carriage of about 75% of world trade by volume (Lloyd's List 2009). Without shipping, it would be impossible to conduct international trade, the bulk transport of raw materials as well as the import and export of food or manufactured goods. The operation of ships generates an estimated annual income of almost US$ 500 billion in freight rates, representing about 5% of the total global economy (International Maritime Organization 2006). The relatively low cost and the efficiency of maritime transport supported globalization and enabled the shift of industrial production to emerging countries. With growing world trade and increasing international division of labor, the shipping industry has enjoyed the longest sustained period of buoyant markets until late 2007. The industry has responded by building new ships, thereby generating new investment opportunities and attracting the interest of investors. Presumably, this cyclical behavior has contributed to the severity of the current crises in the shipping markets.

In spite of the economic importance of the shipping industry, there is only limited research that examines shipping stocks in an asset pricing context. For example, Grammenos and Marcoulis (1996) use the stock market beta and firm-specific factors to explain the cross-section of shipping stock returns. They report a market beta lower than unity in a small sample of 11 shipping companies over the sample period from 1989 to 1993. Similarly, Kavussanos and Marcoulis (1997a) analyze the market risk of shipping stocks and compare the average beta to the overall U.S. stock market. They cannot detect a significant difference between the average betas of the shipping industry and Standard & Poors (S&P) 500 stocks during their sample period from 1985 to 1995. In another empirical study, Kavussanos and Marcoulis (1997b) compare the return structure of different transportation sectors. They report a stock market beta lower than unity in the water transportation sector and low explanatory power of accounting data for shipping stock returns (e.g., the assets-to-book ratio). Kavussanos and Marcoulis (1998) emphasize the observation that the systematic risk of the shipping industry is low, as measured by the explanatory power of market model regressions over the period from 1984 to 1995. In related studies, Kavussanos and Marcoulis (2000a, 2000b) use macro-and micro-factors to explain the cross-section of U.S. transport industry returns. For example, their results reveal some explanatory power of the changes in industrial production and the changes in the oil price for stock returns. Grammenos and Arkoulis (2002) relate international shipping stock returns to a set of macroeconomic factors. They report that oil prices and laid-up tonnage are negatively related to shipping stock returns, whereas a US$ depreciation implies higher shipping stock returns. No significant relationship can be detected between shipping stock returns and global measures of inflation as well as industrial production. Kavussanos et al. (2003) look at a sample of international shipping stocks in order to compare the return structure of different sectors in the shipping industry. They cannot detect notable differences in the systematic (market) risk across sectors, but they report a stock market beta smaller than unity for most sectors. In many instances, the estimated alpha indicates mispricing in the shipping industry. Most recently, Gong et al. (2006) examine the stability of the beta estimates in the shipping industry using different estimation techniques. For example, they use the Scholes and Williams (1977) approach to account for a potential thin-trading bias. The estimated betas vary considerably depending on the estimation technique over their sample period from 1984 to 1995. In contrast to what one would expect, they also report betas lower than unity in the water transportation sector. Finally, Kavussanos and Marcoulis (2005) review this strand of the empirical literature. The current consensus seems to be that the returns on shipping stocks are related to both firm-specific and common macroeconomic factors. These results from the previous empirical literature are practically important because investors will be concerned about the risk-return profile of shipping stocks in their asset allocation decisions. The risk-return profile of shipping stocks indicates how returns react to contemporaneous changes in macroeconomic risk factors, e.g., exchange rate changes, changes in interest rates, and changes in the oil price. More specifically, knowledge of the risk factors and the factor sensitivities is important for the following applications:

Fundamental analysis: Factor sensitivities (or exposures) and the explanatory power of factor models provide information about the economic determinants of stock return volatility. This information enables an efficient allocation of resources in the data gathering and transformation process of financial analysis.

Diversification: The cross-sectional patterns of factor risk profiles provide valuable information about the diversification effects across industries. A well-diversified portfolio not only incorporates the idiosyncratic risks of individual stocks or entire industries, but also the various risk factors and the factor exposures provide the necessary information.

Pricing potential: Cross-sectional differences in expected returns can be related to common risk factors if the respective factor exposures differ across stocks and are different from zero.

Hedging: Because the factor sensitivities incorporate the correlation between stocks and the underlying risk factors, factor exposures are also the basis for minimum-variance hedging strategies.

In this article, we address the first three issues. In a first step, we examine the risk-return profile of stocks from the three sectors of the shipping industry: bulker, tanker, and container shipping. In the spirit of international asset pricing tests (Harvey 1991; Ferson and Harvey 1993; Dumas and Solnik 1995), we consistently use aggregate information about global sources of systematic risk. This choice assumes that global stock markets are integrated, i.e., stocks denominated in different currencies or from different countries exhibit the same risk-adjusted expected rate of return (Bekaert and Harvey 1995). If shipping stocks exhibit different factor sensitivities than the aggregate stock market or other industry indices, they presumably offer diversification benefits for an investor by enhancing the available risk-return spectrum. In this case, shipping stocks constitute a separate asset class.

A caveat is that shipping stocks are only one out of several investment vehicles that allow an investor to participate in the economic cycles of the shipping industry.

One prominent example for an alternative way to take on exposure to ships is a closed-end ship fund, e.g., under the German KG model (Bessler et al. 2008). In fact, the investment opportunities into ships are broad: in the risk-return spectrum they range from the Schiffspfandbrief and corporate bonds, managed trusts and closed-end ship funds to freight derivatives and shipping hedge funds. Based on their risk-adjusted performance potential, shipping stocks are presumably in the middle of this range.

The main advantage of using shipping stocks in our empirical analysis is that reliable price data are available on a daily basis. In a second step, we extend the previous empirical shipping literature and conduct an asset pricing test. Following Ferson and Harvey (1994), we examine the pricing potential of predefined risk factors and simultaneously estimate the factor sensitivities and the corresponding factor risk premiums. The underlying notion is that if the common factors represent sources of systematic risk, an investor earns a premium for taking on these types of risk. The empirical results are important for two reasons. First, from an investor's perspective they indicate the performance attributes of shipping stocks and the sources of expected returns. Second, from a company's perspective, the results have implications for the cost of equity capital, which is a required input parameter for the valuation of ships and, more generally, any project in the shipping industry.

We use a sample of 48 listed shipping companies that are classified into the three main sectors of the shipping industry. The sample period ranges from January 1999 to December 2007. To estimate the risk-return profile of the shipping industry and compare it with other industries, we construct indices of these single stocks. Country and other industry indices are used as spanning assets for pricing; they are assumed to constitute separate asset classes. In a first step, we run regressions of portfolio returns on a broad market factor and test for differences in the market betas. In a second step, we extend our regression analysis to include a set of global risk factors that presumably have a pricing impact. The estimated factor sensitivities (or exposures) indicate the risk-return profile of ships as a potential asset class. In a final step, we estimate the factor sensitivities and the corresponding risk premiums simultaneously in a system of equations using Hansen's (1982) generalized method of moments (GMM). This approach allows us to examine the attributes of expected shipping stock returns. To our knowledge, this is the first study that uses a full-fledged asset pricing model – where factor sensitivities and risk premiums are estimated simultaneously – to price shipping stocks within a broad asset universe.

The article closest to ours is Grammenos and Arkoulis (2002). They also estimate the risk-return profile of shipping stocks by relating macroeconomic factors that contain global information to stock returns. However, they do not test whether their set of macroeconomic factors represent systematic sources of risk. We simultaneously estimate the sensitivities of shipping stocks on global risk factors and the associated risk premiums given the cross-sectional pricing restrictions (which are incorporated in a set of orthogonality conditions). Therefore, our results also provide the basis to compute the cost of equity capital, and hence they have important implications for financing and investment decisions in the shipping industry in general.

In line with former research, we document that shipping stocks have remarkably low stock market betas. We also report that shipping stocks exhibit a unique risk-return spectrum compared to other equity investments. For the set of spanning assets that consists of shipping stocks and country or sector indices, the one-factor model leads to large pricing errors and is rejected based on the GMM orthogonality conditions. In contrast, when the change in industrial production, the change in the trade-weighted value of the US$, and the change in the oil price are added as additional risk factors, the resulting multifactor model is able to price the cross-section of expected stock returns. The sensitivities (or exposures) of shipping stocks to global systematic risk factors are different than those of country and other industry indices. However, the risk-return profiles are similar across all three sectors of the shipping industry. The remainder of this article is structured as follows. Section 2 describes our empirical methodology and Section 3 presents our data set. Section 4 contains a discussion of our empirical findings. Finally, Section 5 provides a conclusion and an outlook for further research.

5.2 Empirical methodology

According to the capital asset pricing model (CAPM) of Sharpe (1964); Lintner (1965) and Mossin (1966), the expected return on a firm's equity can be explained as a linear function of a single risk factor, i.e., the expected return on the market portfolio. In the empirical asset pricing literature, a broad index of stocks must be chosen to represent the market portfolio. Multifactor extensions of this model use either portfolio returns, such as the returns on size, value, or momentum portfolios (Fama and French 1993; Carhart 1997), or macroeconomic variables (Ferson and Harvey 1994; Chen et al. 1986 as proxies for additional sources of priced risk. We follow the latter approach and examine the multidimensional risk-return structure of global shipping stocks. Specifically, we expect that in addition to the world stock market factor, a set of macroeconomic risk factors impact the cross-section of expected shipping stock returns. Macroeconomic factors describe the current and future economic environment, which in turn determines the stream of expected freight earnings, and hence these factors will affect shipping stock returns. Therefore, our analysis leads to a deeper understanding of the risk-return profile of shipping stocks.

Ultimately, we are interested in whether the risk-return profile of shipping stocks is different from country and other industry indices. The shipping industry exhibits several peculiar characteristics. Most important, it is characterized by very high cyclicality (Stopford 2009). Due to choppy revenue streams, shipping companies usually have some years of abnormal profits followed by some years of losses. The vessels constitute almost 90% of the fixed assets of shipping companies. Since the cost of vessels can range between US$ 20 – 300 million, the industry in addition to being cyclical is also highly capital intensive. The standardized nature of the shipping services and the fragmentation of the industry make it difficult for any single company to gain significant pricing power, leading to severe international competition and low profit margins. Grammenos and Arkoulis (2002) argue that this international nature of the shipping industry and the complex mechanism through which freight rates – which are the most important source of income of shipping companies – are determined by the interaction of supply and demand makes the influence of macroeconomic factors on shipping stock returns particularly interesting. Stopford (2009) identifies five factors that determine the demand and supply of shipping transport. The demand factors are: the world economy; seaborne commodity trades; average haul; random shocks; and transport cost. The supply factors are: the world fleet; fleet productivity; shipbuilding production; scrapping and losses; and freight revenues. This set of influence factors depends strongly on the macroeconomic environment, and hence it presumably generates a distinct risk return-profile of shipping stocks in comparison to different country and other industry indices. We interpret the latter sets of indices as traditional asset classes that span the global risk-return spectrum of equity investments.

In our empirical analysis, we use an unconditional beta pricing model to examine the structure of stock returns in the shipping industry. Analyzing the pricing potential of global risk factors in an unconditional framework is particularly useful from the viewpoint of investors who think in terms of constant long-run compensations for taking on multidimensional risks. Our valuation framework is consistent with the Arbitrage Pricing Theory (APT) developed by Ross (1976); Huberman (1982); Chamberlain (1983); Chamberlain and Rothschild (1983) and Ingersoll (1984) among others. A theoretical foundation for using the APT in an international context is provided by Solnik (1983) and Ikeda (1991). Their models suggest that multiple international risk factors have an impact on expected returns and standard deviations of international assets. Moreover, only global factors represent sources of systematic risk, and hence a set of observable global risk factors serves as a representation of the true (but unobservable) factor structure that drives stock returns. The assumptions that are required to use an international beta pricing model are rather strong. Most important, one has to assume that national equity markets (and the sector markets aggregated over the national barriers) are perfectly integrated and that there are no distorting taxes or transaction costs. Only under these assumptions is a set of global risk factors sufficient to capture the pricing restrictions; otherwise local risk factors must also be included. However, our approach is justified based on previous empirical findings. For example, Bekaert and Harvey (1995) report evidence that the degree of integration on international stock markets is rising. De De Santis and Gerard (1997) deny the pricing potential of national risk factors in an international context. Their results strongly emphasize the importance of global risk factors.

In order to examine the risk-return profile of shipping stocks, we use a standard factor model structure. Specifically, the excess return on asset i is determined by K risk factors:

$$r_{it} = \alpha_i + \sum_{j=1}^{K} \beta_{ij} F_{jt} + u_{it}, \tag{1}$$

where r_{it} denotes the continuously compounded excess return on stock i over the risk-free rate in period $t-1$ to t. The β_{ij}'s are the sensitivities or betas of stock i to the K global macroeconomic risk factors, denoted as F_{jt} (with $j = 1, \ldots, K$). The factor betas relate to the systematic sources of risk, which are assumed to earn a risk premium. In contrast, the error term u_{it} represents unsystematic risk that is not rewarded in an asset pricing context. The CAPM posits that pricing over the cross-section of stock returns implies that the intercept term, labelled α_i, is zero for each asset i. A negative (positive) indicates that a stock is overpriced (underpriced), and hence its return is higher (lower) than expected on the basis of securities market line (SML) analysis. In theory, this notion also applies for multifactor asset pricing models.

In a first step, we estimate the market model and only use a broad stock market factor in order to examine if the market betas are different across the three sectors of the shipping industry and to compare them with the market betas of country and other industry indices. We test the null hypothesis that all beta coefficients are equal across the shipping sectors as well as across all equity indices using a Wald test. In general, the market beta is a measure of a stock's sensitivity to changes in the market portfolio. A stock with a market beta greater than one carries above average covariance risk, implying that an investor would require a higher expected return to hold it, and vice versa. Given the peculiar characteristics of the shipping industry, one would clearly expect a market beta above unity for shipping stocks. The shipping industry is highly cyclical and capital intensive, and it is well known that operating and financial leverage add up and further reinforce cyclicality (Ross et al. 2006). Therefore, in contrast to previous empirical evidence, we hypothesize to observe high covariance risk and a market beta greater than one for shipping stocks.

In a second step, we examine additional global risk factors that are described in more detail in Section 3. Specifically, we regress excess stock returns on a set of global macroeconomic risk factors F_{jt} (with $j = 1, \ldots, K$) and examine the resulting risk-return profiles (defined as the set of factor sensitivities). There is no consensus about the choice of risk factors in the asset pricing literature, and for most potential risk factors the direction of impact on returns can be ambiguous. Kavussanos and Marcoulis (2000a) argue that there are no theoretical a priori expectations as to what the effect of macroeconomic risk factors on stock returns might be. Therefore, in contrast to the market beta, we abstain from formulating detailed hypotheses for the factor sensitivities of shipping stocks and simply let the question be answered empirically. Nevertheless, we provide detailed explanations for the signs of the estimated coefficients when we discuss our empirical results in Section 4. In all time-series regressions, we use Zellner's (1962) seemingly unrelated regressions (SUR) technique that allows for contemporaneous shocks across equations. In our setup, the resulting coefficients are the same as in a simple ordinary least squares (OLS) framework, but the standard errors are more efficient.

In a third step, we estimate a full-fledged asset pricing model in order to analyze the cross-section of expected stock returns. We follow the framework proposed in Ferson and Harvey (1994), which is able to extract the factor sensitivities (betas) and the risk premiums simultaneously. The model for expected returns is:

$$E(r_i) = \sum_{j=1}^{K} \beta_{ij}\lambda_j \quad i = 1,\ldots,N \tag{2}$$

where λ_j is the risk premium of factor j (with $j = 1,\ldots,K$). The interpretation of the factor betas is economically the same as in Equation (1). We estimate the specification in Equation (2) as follows:

$$r_{it} = \sum_{j=1}^{K} \beta_{ij}(f_{it} + \lambda_j) + u_{it} \quad i = 1,\ldots,N \tag{3}$$

where f_{jt} denotes the demeaned risk factor F_{jt}. We implicitly assume that the intercept term is equal to zero[1]. Hansen's (1982) GMM is used to estimate the system of equations in Equation (3). This technique does not require strong assumptions on the data generating process. The data has to follow a strictly stationary and ergodic stochastic process, but the error terms do not have to be normally distributed.

The system of equations in Equation (3) implies the following two moment conditions: $E(u_{it}) = 0$ and $E(u_{it}F_{it}) = 0$. While the first moment condition is well known from linear regression models, the second expectation (a covariance term) captures the asset pricing condition for the cross-section of expected stock returns. Intuitively, this restriction requires that all information in a specific risk factor F_{jt} that is pricing relevant is fully exploited in a simultaneous estimation of factor sensitivities and risk premiums using GMM, and hence there is no remaining information that correlates with the error terms. We use a vector of ones and the contemporaneous values of the risk factors as instruments. The weighting matrix in the quadratic form that is being minimized in the GMM estimation accounts for heteroskedasticity and serial correlation. Following Cochrane (2001), we use a two-step GMM iteration procedure.

1 Using the demeaned factors, we do not need to assume that the factor means are related to the risk premiums.

5.3 Data

5.3.1 Shipping stocks and spanning assets

Our empirical work focuses on the container, tanker, and bulker sector of the shipping industry. These three sectors represent approximately 90% of the world fleet measured by dead weight. Our sample is based on the stocks of container, tanker, and bulker companies that are included in the following indices or stock lists: the Clarksons liner share price index, the Clarksons tanker share price index, and dry bulk insight, a monthly report published by Drewry Publications. In addition, we consulted the shipping news service, Trade Winds. We identify a sample of 48 stocks with a minimum of 36 monthly observations over the period from January 1999 to December 2007. From these 48 companies, six are represented in two or all three subsectors. The Appendix presents a list of the shipping companies. Stock prices are taken from Thomson Financial Datastream; they are denominated on a US$ basis and adjusted for capital actions and dividends. While we cannot make sure to include all listed shipping stocks, our sample of traded stocks is collected from prominent sources in the shipping industry and seems comprehensive. As a comparison, Grammenos and Arkoulis (2002) examine 36 shipping stocks, and the numbers of stocks that are directly classified into the three shipping sectors in the Kavussanos et al. (2003) study are also slightly lower.[2] Therefore, to the best of our knowledge, our results should not suffer from any sample selection bias. Nevertheless, we cannot rule out that the results are partly driven by the fact that our sample firms in the different sectors represent different fractions of total worldwide tonnage capacity. Estimation biases could arise if our subsamples are not representative and the return drivers identified from our regression analysis are different from the underlying factors that impact the aggregate sector. Presumably, the container stocks in our sample represent a larger proportion of the total existing container fleet than the tanker and bulker stocks in their respective sectors.[3] Unfortunately, without return

2 However, they also use a larger number of stocks that they classify as "diversified", i.e., these firms are simultaneously active in different sectors of the maritime industry.

3 In fact, the restriction that we require a minimum of 36 monthly return observations is responsible for the fact that our sample does not contain some of the largest shipping companies in terms of market capitalization that did not go public before the end of 2004 (the latest possible IPO date in our sample). This is particularly the case for companies in the tanker sector (e.g., General Maritime and Teekay) and the bulker sector (e.g., Diana Shipping, Dry Ships, Genco Shipping & Trading, and Navios Maritime Holding).

data from other privately held shipping companies, it is impossible to assess the degree of potential biases in our results.

We calculate continuously compounded returns on a monthly basis for each company and the Morgan Stanley Capital International (MSCI) world stock market index as our proxy for the global market portfolio. Rather than using single stocks, we form portfolios. For each sector of the shipping industry, we construct a value-weighted and an equally-weighted portfolio. While value-weighted portfolios are more in line with the predictions of the CAPM about market equilibrium, equally-weighted portfolios give more weight to smaller stocks. Sercu et al. (2008) report that beta estimations of portfolios are more reliable than those of single stocks. Building portfolios avoids the problem of thin-trading biases, which may arise when stocks are not traded continuously (Gong et al. 2006; Scholes and Williams 1977; Dimson 1979). This problem is particularly severe for smaller and illiquid stocks, and hence it may be present in our sample of mainly small-cap shipping stocks. However, using monthly returns of portfolios of shipping stocks in our empirical analysis alleviates this problem.

In order to compare the results for shipping stocks with other asset classes and to have sufficient spanning assets in estimating factor risk premiums, we use two sets of equity indices: (1) the MSCI country indices for the United States, Germany, the United Kingdom, and Japan, and (2) the 10 MSCI industry indices for energy, materials, industrials, consumer discretionary, consumer staples, healthcare, financials, information technology, telecommunication services, and utilities (all measured in US$). To calculate excess stock returns, we subtract the short-term country interest rate.[4] The sector indices contain stocks from outside the United States, Germany, the United Kingdom, and Japan, and hence it draws from a larger universe of stocks. Nevertheless, given that these four markets account for a large part of total world stock market capitalization and that their stock market indices constitute well-diversified portfolios, it is reasonable to assume that both sets of country and industry indices contains similar pricing information.[5] Therefore, one

4 We use the yield on 3-month Treasury Bills for the United States, the shipping indices, and the other industry indices, while we apply a local short-term interest rate for the other country indices.
5 Our sample is restricted to the four country indices of the United States, Germany, the United Kingdom, and Japan. Taken together, these countries accounted for more than 60% of world stock market capitalization during all the sample period. Adopting the framework of Hansen and Jagannathan's volatility bounds for stochastic discount factors (SDF) (Hansen and Jagannathan 1991), Drobetz (2003) documents that a small number of country indices is sufficient to span the global risk-return spectrum in unconditional asset pricing tests.

Table I – Summary statistics of stock returns

Equity index	Observations	Mean	SD	Minimum	Maximum
Container	107	0.0216	0.071	−0.162	0.212
Tanker	107	0.0289	0.068	−0.112	0.217
Bulker	107	0.0430	0.095	−0.204	0.356
United States	107	−0.0003	0.040	−0.097	0.104
United Kingdom	107	0.0024	0.039	−0.124	0.083
Japan	107	0.0011	0.053	−0.120	0.135
Germany	107	0.0037	0.065	−0.205	0.237
Energy	107	0.0116	0.053	−0.162	0.154
Materials	107	0.0123	0.054	−0.136	0.183
Industrials	107	0.0057	0.041	−0.126	0.116
Consumer discretionary	107	0.0019	0.048	−0.148	0.131
Consumer staples	107	0.0031	0.030	−0.084	0.061
Health care	107	0.0008	0.033	−0.087	0.083
Financials	107	0.0045	0.042	−0.112	0.118
Information technology	107	0.0016	0.087	−0.254	0.232
Telecommunication services	107	0.0007	0.059	−0.180	0.208
Utilities	107	0.0061	0.036	−0.115	0.085

This table shows summary statistics (number of observations, mean excess return, standard deviation, minimum return, and maximum return) of the stock indices that are used as dependent variables in the empirical analysis. All figures are on a monthly basis. The three shipping indices contain the stocks in the Clarksons liner share price index (container), the Clarksons tanker index (tanker), and the Baltic dry bulk report (bulker). The four country and 10 industry indices are taken from MSCI. All equity indices are value-weighted. The sample period is from January 1999 to December 2007. Excess returns are computed using the yield on the 3-month U.S. Treasury Bill for the United States, the shipping indices, and the other industry indices. For the remaining country indices the LIBOR rates in the respective currencies are used to compute excess returns.

would expect that the estimated factor risk premiums using two different sets of spanning assets do not strongly differ; i.e., they should not be affected by the way the information contained in the underlying stocks is being bundled into indices.[6]

Summary statistics of the equity indices are presented in Table I. The mean return on shipping stocks during the sample period from January 1999 to December 2007 (using month-end stock prices) is remarkably high compared to the returns of both the country and other industry indices. For example, the monthly average excess return of 2.16% in the container sector corresponds to a return of roughly 24% per year, while the yearly excess return on the U.S. stock market was -0.36% during the sample period. As one would expect for a highly cyclical industry with mainly smaller firms, the higher mean return in the shipping industry is accompanied by a higher volatility as compared to most other indices.

5.3.2 Global risk factors

The global risk factors must represent pervasive sources of risk for international investments. We consistently apply aggregate information on potential global sources of systematic risk. Three of the nine global factors are constructed by aggregating economic data from the G-7 countries. These major industrialized countries are Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States. The remaining six risk factors are derived from economic and financial time-series and represent information on global aggregates. All time series are taken from Datastream. Since there is no commonly accepted asset pricing model, the choice of risk factors is not straightforward and ultimately requires economic intuition. We use risk factors that are common in the asset pricing literature (Ferson and Harvey 1994; Zimmermann et al. 2003). Standard models of international asset pricing theory motivate some of these risk factors (Adler and Dumas 1983; Sercu 1980; Solnik 1974; Stulz 1981a). Earlier empirical studies on multibeta asset pricing models in an international environment provide further guidelines for our model (Ferson and Harvey 1993; Harvey 1995; Dumas and Solnik 1995; Brown and Otsuki 1993). Finally, empirical studies on the pricing of risks on national stock and bond markets influence our selection of risk factors (Fama and French 1993; Chen et al. 1986; Elton et al. 1995; Ferson and Korajczyk 1995).

We use the MSCI world stock market index as a proxy for the global market

6 Cavaglia et al. (2000) and Gerard et al. (2006) provide a discussion of the benefits of country versus sector indices for asset allocation.

portfolio. The monthly log changes of this variable are denoted as dWRLDE. The MSCI world stock market index is a broad equity index of 22 developed countries, whose stock market capitalization represents roughly 80% of the total world stock market capitalization.

The monthly log changes of a weighted currency basket, labeled dCURB, consist of the exchange rates between the US$ and the Euro, Canadian dollar, Japanese yen, British pound, Swiss franc, Australian dollar, and Swedish krona (defined as foreign currency/US$). The weights are derived from the relative trade position of the United States against the corresponding country. The monthly log changes of this currency basket mirror changes in the external value of the US$, which is still the lead currency in the shipping industry. Dumas and Solnik (1995) and De Santis and Gerard (1998) document that currency risk is pricing relevant in international factor models. Ferson and Harvey (1994) note that one implicitly assumes that relative purchasing power parity holds if currency risk is excluded.[7] Shipping markets are heavily oriented toward international trade, and hence exchange rate changes may have a large impact on shipping stock returns. The problem arises from the imposition of a volatile foreign exchange market on a freight market structure which fixes revenues in US$. Leggate (1999) documents that operating profits in the shipping industry can rise and fall dramatically simple because of exchange rate movements.

We expect that shipping stocks are sensitive to variations in international economic activity and global trade. According to Stopford (2009), industrial production is a main parameter that affects the demand for sea transport through world trade. To proxy for these influences, we incorporate two additional risk factors: the change in industrial production in the G-7 countries and the change in industrial production in China. The change in the G-7 industrial production (dIPG7) is the weighted average of the contemporaneous log changes of monthly industrial production in these countries. The change in the Chinese industrial production (dIPChina) is the contemporaneous monthly log change of industrial production in this largest emerging country.

Previous studies in the asset pricing literature document that stock returns are sensitive to risk factors that are condensed out of interest rates (Harvey 1991; Ferson and Harvey 1994). We use measures for the short-term interest rate, the long-term interest rate, and the TED spread (i.e., the difference between the interbank lending

7 For a theoretical derivation, see Stulz (1981b).

rate and the risk-free rate). The short-and long-term G-7 interest rates (d3MIG7 and d10YIG7) are proxied by the yields on 3-month and 10-year government bonds, respectively. We weigh the interest rates of the G-7 countries according to their share of the G-7 gross domestic product (GDP) in the previous quarter. The TED spread is defined as the difference between the 3-months Eurodollar rate and the yield on the 90-day U.S. Treasury Bill. We use the monthly log changes of the TED spread (dTED). The TED spread is affected by three factors: (1) world political stability, (2) balance of trade, and (3) fiscal policy of the United States (Ferson and Harvey 1993). When political uncertainty is high and the risk of disruption in the global financial system increases, the yield differential widens. When the balance of trade is decreasing, the TED spread also rises. Presumably, the TED spread is an indicator of the current health of the economy. The yield differential should be higher during phases of economic recessions (when investors are seeking safer assets), and it decreases during expansionary phases.

Inflation is another factor that is related to interest rates. We use a measure derived from the G-7 producer price index (INFLG7). In general, higher inflation may signal higher levels of economic uncertainty, which makes investors worse off. More specifically, many products transported by ships are preproducts that are finished at the place of destination. Prices determine the demand for these products, and hence inflation presumably will have an influence on returns in the shipping industry.

Finally, the oil price could be a potential return driver of shipping stock returns for two reasons. First, oil is the main input factor for producing carriage service. Second, oil is the main product of carriage of tankers. The demand for tanker freight is a derived demand from oil; if oil prices are high, the demand for oil will be high, and the demand for tanker transport tends to be high as well. Therefore, the oil price can have a negative or a positive impact on shipping stock returns. We use the changes in the price of Brent crude oil (dOIL).

Panel A of Table II shows summary statistics of our global risk factors. The mean excess return on the world stock market portfolio is 0.2% per month. Surprisingly, the mean of the changes in industrial production in China is lower than in the G-7 countries, while the standard deviation of Chinese industrial production is higher than in the G-7 countries. The mean change in G-7 interest rates indicates that our sample period covers an environment of declining interest rates. The rise in the oil price during our sample period leads to a high mean return on oil, accompanied by a

Table II – Macroeconomic risk factor

Panel A. Summary statistics

Variable	**Observations**	**Mean**	**SD**	**Minimum**	**Maximum**
dWRLDE	107	0.0020	0.039	−0.102	0.097
dCURB	107	−0.0024	0.019	−0.050	0.045
dOIL	107	0.0199	0.111	−0.327	0.332
dIPG7	107	0.0013	0.005	−0.013	0.011
dIPChina	107	0.0005	0.039	−0.144	0.151
INFLG7	107	0.0019	0.005	−0.013	0.013
dTED	107	0.0131	0.407	−0.865	1.194
d3MIG7	107	−0.0007	0.045	−0.236	0.085
d10YIG7	107	−0.0007	0.045	−0.101	0.164

continued

Table II – (continued)

Panel B: Correlation structure

	dWRLDE	**dCURB**	**dOIL**	**dIPG7**	**dIPChina**	**INFLG7**	**dTED**	**d3MIG7**	**d10YIG7**
DCURB	−0.345***	1.000							
	(0.000)								
dOIL	0.122	−0.114	1.000						
	(0.210)	(0.243)							
DIPG7	0.059	−0.007	0.104	1.000					
	(0.547)	(0.946)	(0.286)						
DIPChina	−0.098	0.036	0.070	−0.061	1.000				
	(0.316)	(0.714)	(0.475)	(0.533)					
INFLG7	−0.047	−0.014	0.544***	−0.006	0.002	1.000			
	(0.631)	(0.887)	(0.000)	(0.949)	(0.981)				
dTED	−0.083	0.054	−0.092	0.061	0.136	0.023	1.000		
	(0.394)	(0.582)	(0.345)	(0.531)	(0.163)	(0.816)			
d3MIG7	0.157	−0.026	0.131	0.349***	−0.013	0.084	−0.258***	1.000	
	(0.105)	(0.791)	(0.179)	(0.000)	(0.891)	(0.388)	(0.007)		
d10YIG7	0.219**	0.283***	0.008	0.076	−0.158	0.036	−0.048	0.242**	1.000
	(0.026)	(0.003)	(0.939)	(0.436)	(0.104)	(0.502)	(0.626)	(0.012)	

Panel A of this table shows summary statistics (number of observations, mean change, SD, minimum change, and maximum change) for the macroeconomic risk factors that are used as independent variables in the empirical analysis. All figures are on a monthly basis. The global risk factors are the excess return on the MSCI world stock market index (dWRLDE), the change in a weighted currency basket (dCURB), the change in the oil price (dOIL), the changes in the industrial production of the G-7 countries (dIPG7) and China (dIPChina), the inflation rate (INFLG7), the change in the TED spread (dTED), and the changes in the short-term (d3MIG7) and the long-term interest rate (d10YIG7). The sample period is from January 1999 to December 2007. Panel B shows the correlation matrix of the macroeconomic factors. The p-values are reported underneath the correlation coefficients. With n being the number of observations and $\hat{\rho}$ the sample correlation, the corresponding t-test statistic is $2 * \tilde{t}(n-2, |\hat{\rho}|\sqrt{(n-2)}/\sqrt{(1-\hat{\rho}^2)})$.
***, ** and * denotes statistical significance at the 1, 5 and 10% levels.

high standard deviation. The sharp increase in the TED spread due to the beginning of the financial crises in the last months of 2007 leads to a high mean and a high standard deviation of this variable.

The correlation structure of our global risk factors is shown in Panel B of Table II. The highest correlation (0.48) is measured between G-7 inflation and oil price changes. In fact, some of the correlation coefficients are significant, implying potential multicollinearity problems and unstable coefficients depending on the variables included in the model. However, an examination of the variance inflation factors (VIFs) indicates that all of them are well below 5 (and the mean VIF is only 1.32), which is usually interpreted as low multicollinearity.

5.4 Empirical results

5.4.1 Market model regressions

Given that firm-specific risk can be diversified through portfolio formation, one should consider market or systematic risk (captured by the stock market beta) rather than total risk (return volatility) as the appropriate risk measure. Table III shows the results of market model regressions, i.e., the model in Equation (1) with the world stock market index as the single source of risk. The market betas of the three shipping sectors (container, tanker, and bulker shipping) are all around one, and none of them is distinguishable from unity in a statistical sense.[8] Moreover, according to a Wald test based on the SUR estimates, the three sector betas in the shipping industry are not distinguishable from each other. Compared to previous empirical studies (Kavussanos and Marcoulis 2000a; Kavussanos et al. 2003), we document slightly higher market betas. Nevertheless, market betas around one are against our hypothesis and clearly surprising for the highly cyclical shipping industry that additionally exhibits high operating and high financial leverage (Stopford 2009). It is well known that these risks add up and reinforce covariance risk (Ross et al. 2006). Therefore, one would expect a market beta greater than one for an industry with these risk characteristics. The observation that the betas of the three shipping sectors are not different from each other is also in line with the findings in Kavussanos et al. (2003).

8 We compute a Wald test to test the null hypothesis that the shipping betas are equal to one. In all three cases, the null hypothesis cannot be rejected.

All beta coefficients shown in Table III are significant at the 1% level. Compared to the country indices, the market betas of shipping stocks are similar to the beta of the United States (0.982). They are higher than the betas of the United Kingdom (0.881) and Japan (0.827), but lower than the beta of Germany (1.441). A Wald test rejects the null hypothesis that all shipping and country betas are equal at the 1% level. Moreover, the shipping stock betas are in the middle of the 10 industry betas. The information technology industry exhibits the highest (1.909) and the health-care industry the lowest (0.334) beta. The water transportation sector is part of the industrials sector, which has a world market beta of 0.969. As one would expect, the shipping betas are very similar to this beta of the industrials sector.

The constant (intercept) terms in the market model regressions of the three shipping sectors are all positive and strongly significant. Given that returns are in excess of the risk-free rate, this observation indicates that the shipping industry is systematically underpriced in a securities market line (SML) analysis. A similar result has been reported in Grammenos and Arkoulis (2002) and Kavussanos et al. (2003). One explanation for potential mispricing is high asset specificity coupled with pronounced information asymmetry in the shipping industry, and hence investors do not have access to the information that is required to price shipping stocks correctly. Low liquidity of the mainly small-cap shipping stocks could be another explanation.

The R-squares of the market model regressions for the shipping sectors fall into the range between 0.16 and 0.32. These values are very low compared to the market model regressions involving country and most industry indices, but they are still in the upper range of previous studies. For example, Kavussanos et al. (2003) document market model R-squares in the range between 0.02 and 0.35 for different subsectors of the water transportation industry in an earlier sample period. Our results may indicate that the systematic part of total risk in the shipping industry has increased over the recent years. Nevertheless, even in our more recent sample period a low proportion of the variance of shipping stocks is attributable to a single stock market factor. This observation indicates that a multifactor model may be better able to describe the risk-return spectrum of shipping stocks than a one-factor model.

5.4.2 Multifactor model regressions

In this section, we use a multifactor model to estimate the relationship between stock returns and the set of macroeconomic risk factors described in Section 2. The regression results using the SUR method are shown in Table IV. A first observation is that the market betas of the three shipping sectors are smaller than in the market model; they fall into the range between 0.80 (for bulkers) and 0.87 (for tankers) and are significant at the 1% level. These figures are more in line with the market beta estimates in Kavussanos and Marcoulis (2000a). Given the high cyclicality of the shipping industry coupled with high operating and high financial leverage, these results are again against our initial hypothesis. Moreover, the market betas of the three shipping sectors are lower than those of the country indices (except Japan). Using a Wald test, we reject the null hypotheses that all market betas are equal to zero and that they are all equal among each other. In contrast, the null hypothesis of equality of market betas across the three shipping sectors again cannot be rejected (not reported in Table IV).

The coefficient on changes in the trade-weighted value of the US$ (dCURB) is statically significant in all three shipping sectors. The negative sign indicates that a stronger US$ has a negative effect on shipping stock returns; this result confirms previous findings by Grammenos and Arkoulis (2002). An explanation could be that most shipping related contracts are denominated in US$. A stronger dollar implies higher operating costs for non-U.S. shipping firms and a lower income in the home currency (Stopford 2009). At the same time, the income side of a shipping company (e.g., the freight contracts) is denominated in US$, and hence a company can buy more units of the home currency (Leggate 1999). The estimated coefficient indicates that the first effect outweighs the second in our sample. The country indices also exhibit a negative exposure to the currency factor.

The coefficient on changes in industrial production in the G-7 countries (dIPG7) is marginally significant only in the container sector. The coefficient implies that a 1% increase in industrial production leads to a 2.2% increase in monthly returns in the container sector. Only the Japanese stock market benefits even stronger from an increase in G-7 industrial production than the container sector. This high exposure is consistent with the general notion that the demand for sea transport is derived from the growth of the global economy and international trade. The negative (albeit insignificant) coefficient on industrial production in the tanker sector is clearly surprising. One would expect that with rising output the demand for oil as an input factor increases as well. It is also against expectations that the coefficient on changes in industrial production in China (dIPChina) is not estimated significantly in any sector of the shipping industry. Grammenos and Arkoulis (2002) also cannot detect a significant relationship between shipping stock returns and

Table III – Results of market model regressions

	dWRLDE	Constant	R^2		dWRLDE	Constant	R^2
Container	1.004***	0.022***	0.30	Energy	0.832***	0.010**	0.36
	(0.150)	(0.006)			(0.110)	(0.004)	
Tanker	0.966***	0.029***	0.32	Materials	1.068***	0.010***	0.59
	(0.140)	(0.005)			(0.086)	(0.003)	
Bulker	0.923***	0.045***	0.16	Industrials	0.969***	0.003*	0.82
	(0.220)	(0.008)			(0.043)	(0.002)	
United States	0.982***	−0.002*	0.91	Consumer discretionary	1.147***	−0.001	0.87
	(0.030)	(0.001)			(0.043)	(0.002)	
United Kingdom	0.881***	0.001	0.75	Consumer staples	0.353***	0.002	0.20
	(0.049)	(0.002)			(0.068)	(0.002)	
Japan	0.827***	0.000	0.37	Health care	0.334***	0.000	0.15
	(0.100)	(0.004)			(0.077)	(0.003)	
Germany	1.441***	0.002	0.73	Financials	0.941***	0.002	0.74
	(0.085)	(0.003)			(0.054)	(0.002)	
				Information technology	1.909***	−0.004	0.72
					(0.120)	(0.005)	
Wald test on equality of betas		188.83		Telecommunication services	1.171***	−0.003	0.58
		(0.000)			(0.096)	(0.003)	
Wald test on equality of shipping betas		0.22		Utilities	0.498***	0.005	0.29
		(0.895)			(0.075)	(0.003)	

This table shows the results of market model regressions using the world stock market as the single source of risk. The three shipping indices contain the stocks in the Clarksons liner share price index (container), the Clarksons tanker index (tanker), and the Baltic dry bulk report (bulker). The four country and ten sector indices are from MSCI. The MSCI world stock market index is used as the market portfolio. All equity indices are value-weighted. The sample period is from January 1999 to December 2007. The estimation uses SUR technique (Zellner 1962). The standard errors of the estimated coefficients are presented in parentheses. R2 indicates the explanatory power of a regression model. ***,** and * denotes statistical significance at the 1, 5 and 10% levels. For the Wald tests the p-values are shown in parentheses.

Table IV – Results of multifactor model regressions

	dWRLDE	dCURB	dIPG7	dIPChnia	d3MIG7	d10YIG7	dTED	INFLG7	dOIL	Constant	Adjusted R^2
Container	0.851***	−0.720**	2.238*	0.054	−0.123	0.050	−0.021	−0.801	0.095*	0.017***	0.38
	(0.160)	(0.340)	(1.320)	(0.140)	(0.140)	(0.140)	(0.014)	(1.410)	(0.057)	(0.006)	
Tanker	0.872***	−0.597*	−0.505	0.093	0.101	0.028	0.004	0.697	0.070	0.026***	0.38
	(0.150)	(0.320)	(1.270)	(0.140)	(0.140)	(0.130)	(0.014)	(1.360)	(0.055)	(0.006)	
Bulker	0.796***	−1.223**	1.340	0.070	−0.014	−0.142	0.012	0.393	0.078	0.039***	0.25
	(0.240)	(0.490)	(1.930)	(0.210)	(0.210)	(0.200)	(0.021)	(2.060)	(0.084)	(0.009)	
United States	1.060***	0.368***	0.065	−0.004	−0.025	−0.041*	0.000	−0.671***	0.000	0.000	0.94
	(0.027)	(0.056)	(0.220)	(0.024)	(0.024)	(0.023)	(0.002)	(0.240)	(0.010)	(0.001)	
United Kingdom	0.827***	−0.329***	−1.460***	−0.003	0.102**	−0.026	−0.005	0.634	−0.030*	0.002	0.82
	(0.048)	(0.100)	(0.390)	(0.043)	(0.043)	(0.042)	(0.004)	(0.420)	(0.017)	(0.003)	
Japan	0.735***	−0.375*	2.563***	−0.076	−0.111	0.015	0.004	1.360	0.056	−0.008*	0.48
	(0.110)	(0.230)	(0.890)	(0.097)	(0.096)	(0.094)	(0.010)	(0.950)	(0.038)	(0.004)	
Germany	1.351***	−0.415**	−0.017	0.120	0.008	0.207***	−0.002	0.304	−0.066**	0.002	0.76
	(0.091)	(0.190)	(0.750)	(0.082)	(0.081)	(0.079)	(0.008)	(0.800)	(0.032)	(0.004)	
Wald test on equality	37.19	46.67	24.42	2.84	9.11	10.44	6.35	9.47	7.99		
of betas	(0.000)	(0.000)	(0.000)	(0.829)	(0.168)	(0.108)	(0.385)	(0.149)	(0.239)		
Wald test on	13720.97	54.83	25.92	3.21	10.40	10.62	6.88	10.28	13.90		
zero betas	(0.000)	(0.000)	(0.001)	(0.865)	(0.167)	(0.156)	(0.442)	(0.173)	(0.053)		

This table shows the results of multifactor model regressions shown in Equation (1) using global macroeconomic factors as multiple sources of risk. The three shipping indices contain the stocks in the Clarksons liner share price index (container), the Clarksons tanker index (tanker), and the Baltic dry bulk report (bulker). The four country indices are from MSCI. All equity indices are value-weighted. The global risk factors are the return of the MSCI world stock market index (dWRLDE), the change of a weighted currency basket (dCURB), the changes in industrial production of the G-7 countries (dIPG7) and China (dIPChina), the change in the TED-spread (dTED), the changes in the short-term (d3MIG7) and the long-term (d10YIG7) interest rates, the G-7 inflation rate (INFLG7), and the change in the oil price (dOIL). The sample period is from January 1999 to December 2007. The estimation uses SUR technique (Zellner 1962). The standard errors of the coefficients are presented in parentheses. Adjusted R2 indicates the adjusted explanatory power of a regression model.

***, ** and * denotes statistical significance at the 1, 5 and 10% levels. For the Wald tests the p-values are shown in parentheses.

changes in industrial production. They argue that the influence changes in industrial production may have on shipping stock returns is already captured by the remaining macroeconomic factors.[9] Another explanation for our results may be that the sample of listed tanker and bulker companies (in contrast to our container sample) may not capture a representative fraction of total worldwide tonnage capacity in these sectors, and hence our coefficient estimates may not reflect all underlying macroeconomic relationships. However, without additional public data, we cannot address this potential problem. Finally, problems related to the accuracy and reliability of Chinese industrial production data could drive our results (Chow 2006).

The term structure of interest rates (d3MIG7 and d10YIG7), the TED spread (dTED), and the inflation rate (INFLG7) also do not exert a significant impact on shipping stock returns. Given that interest rates are related to the state of the economy, it is clearly surprising that none of the factors related to interest rates shows up significantly in regressions with shipping stock returns as the dependent variables. Our final risk factor, the change in the oil price (dOIL), is estimated significantly for the container sector, but it shows no significance in the other shipping sectors. The direction of influence tends to be positive: a higher oil price leads to an increase in the returns on shipping stocks. Given that oil is one of the main input factors in the production of freight services, one could expect a negative influence. Grammenos and Arkoulis (2002) are able to confirm this notion for shipping stocks in their earlier sample period. However, the oil price also serves as a proxy for the state of the world economy, and hence it may exert a positive influence on shipping stock returns in particular. This notion is reasonable for our sample period, which covers a long phase of economic prosperity. In contrast, the sensitivities of the country indices to oil price changes tend to be negative, presumably because oil is a major input factor. The high coefficient (in absolute terms) for Germany could be explained by the export orientation of the German economy.

In results not reported here, we use several alternative explanatory variables to check the robustness of our results. An exclusion of the MSCI world stock market index does not qualitatively alter our findings. We also include a direct measure of international trade, such as the International Monetary Fund (IMF) export index, but it does not enter significantly into the regressions. One would further expect

9 However, our sample changes in G-7 industrial production are only significantly correlated with changes in the short-term interest rate (see Table II), and the latter is also insignificant in multifactor regressions that involve the three shipping sectors (see Table IV).

that measures of stock market volatility (e.g., the VIX index, which is a measure of the implied volatility of S&P 500 index options) and a down-market dummy variable that account for an asymmetric perception of risk have explanatory power for stock returns. However, both measures turn out to be insignificant. Finally, we replace the changes in the oil price with the changes in the Dow Jones commodity spot index. The significance levels of the corresponding coefficients decrease and the regression R-squares are also slightly lower. Looking at the intercept terms (alphas), we get similar results in the multifactor model in Table IV as in the market model in Table III. Most important, the estimated alphas for shipping stocks are significantly positive at the 1% level. Although these results need to be interpreted with due care because there is no general consensus on what constitutes the correct asset pricing model, they again indicate that shipping stocks tend to be underpriced. However, the abnormal returns are smaller in the multifactor model than in the market model, implying that part of the alpha is captured by the additional macroeconomic factors. This notion is strengthened by the observation that the multifactor R-squares (albeit still relatively low) are higher compared to the market model.[10] Most important, the inclusion of macroeconomic factors increases the fraction of explained variance between 6 and 9 percentage points in the multifactor model for the shipping sectors.

Finally, we report the results of two Wald tests. First, we test the null hypothesis that the beta coefficients are equal across all assets for a given factor. We reject this hypothesis for the coefficients on the world stock market index, the currency basket against the US$, and G-7 industrial production. Second, we test the null hypothesis that the beta coefficients are simultaneously equal to zero across all assets for a given factor. This null hypothesis is rejected for the coefficients on the world stock market index, the currency basket against the US$, G-7 industrial production, and the oil price. From these results, we hypothesize that the latter four factors are not only drivers of stock return volatility, but that they also have the potential to represent sources of systematic risk. Exposure to the common risk factors should be rewarded with a risk premium. To validate this hypothesis, it is necessary to include a cross-sectional pricing restriction into the model. Accordingly, in the final step of our analysis, we test a full-fledged asset pricing model by exploiting the moment conditions imposed by full information processing.

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10 Cochrane (2001) argues that the regressions of returns on factors can have low R-squares in the context of Merton's (1973) intertemporal capital asset pricing model (ICAPM). In fact, factor pricing (as examined in Section 5.4.3) does not necessarily require a factor structure (as assumed in Equation (1)).

5.4.3 Testing the pricing restrictions

In our asset pricing model, we use those global risk factors from the multifactor regressions for which the null hypothesis that the coefficients are simultaneously equal to zero across all assets can be rejected. Specifically, our four macroeconomic risk factors (in changes) are: the world stock market index (dWRLDE), the trade-weighted value of the US$ dollar (dCURB), G-7 industrial production (dIPG7), and the oil price (dOIL). We use country and sector indices as spanning assets in two separated factor pricing models. The results from estimating the system of equations in Equation (3) using the GMM with country and industry indices as spanning assets are shown in Tables V and VI respectively.

In a first step, we use the MSCI world stock market index as the only risk factor. Using country indices as spanning assets in Table V, the market betas for the shipping sectors are between 0.67 for bulker and 0.96 for container. This reinforces our previous finding that the covariance risk of shipping stocks is lower than the risk of the overall stock market. The world market betas of the four countries are also similar to those in the multifactor model in Table IV. The estimated market risk premium is 0.01% per month, which is much smaller than the historical stock market excess return of 0.20% per month, as reported in Table II. One explanation for this result is that the US stock market earned a negative mean excess return during our sample period, which was coupled with a relatively low standard deviation. The GMM estimator puts a heavy weight on those assets with low standard deviations (Cochrane 2001), and hence the world stock market risk premium may be underestimated. Given this very low estimate for the world stock market risk premium, one expects that the one-factor model is not powerful in explaining the cross-section of expected stock returns. In fact, as indicated by the chi-square test of over-identification (a test for the goodness of fit; Hamilton 1994), the model violates the moment conditions that capture the cross-sectional pricing restriction. Our findings are strengthened on the basis of the average pricing error, which is similar in magnitude to the average monthly excess return. Overall, we conclude that the world stock market index alone is not able to price all assets in the system of equations with sufficient accuracy.

The four-factor asset pricing model with the additional macroeconomic risk factors again generates lower market betas for the shipping sectors, while the country betas remain virtually unchanged. The market risk premium is now 0.52% per month. Surprisingly, this is much higher than the mean market excess return during our

Table V – Long-run risks with country indices as spanning assets

	One-factor model			Four-factor model				
	dWRLDE beta	Mean excess return (%)	Average pricing error (%)	dWRLDE beta	dCURB beta	dIPG7 beta	dOIL beta	Average pricing error (%)
Container	0.966	0.0216	0.0234	0.814	−0.763	1.572	0.075	0.0010
	(0.129)		(0.008)	(0.104)	(0.229)	(0.648)	(0.023)	(0.008)
Tanker	0.864	0.0289	0.0303	0.853	−0.536	0.373	0.062	−0.0005
	(0.119)		(0.008)	(0.054)	(0.163)	(0.715)	(0.023)	(0.007)
Bulker	0.680	0.0430	0.0483	0.616	−1.363	0.546	0.090	−0.0015
	(0.195)		(0.012)	(0.134)	(0.291)	(0.943)	(0.029)	(0.010)
United States	0.875	−0.0003	−0.0009	1.036	0.319	−0.187	−0.013	−0.0001
	(0.032)		(0.001)	(0.016)	(0.034)	(0.158)	(0.006)	(0.001)
United Kingdom	0.846	0.0024	0.0023	0.856	−0.273	−0.580	−0.033	−0.0002
	(0.038)		(0.002)	(0.021)	(0.072)	(0.211)	(0.012)	(0.002)
Japan	0.891	0.0011	0.0014	0.731	−0.385	2.253	0.055	0.0015
	(0.081)		(0.005)	(0.062)	(0.165)	(0.587)	(0.023)	(0.004)
Germany	1.378	0.0037	0.0042	1.410	−0.247	−0.137	−0.023	0.0004
	(0.080)		(0.003)	(0.071)	(0.098)	(0.340)	(0.015)	(0.003)
Mean pricing error (%)			0.0156					0.0001
			χ^2-test on over-identification					χ^2-test on over-identification
Risk premium	0.0001		37.39	0.0052	−0.0116	−0.0131	0.3759	12.85
	(0.000)		(0.000)	(0.002)	(0.010)	(0.010)	(0.219)	(0.998)

This table shows the results from estimations of the system of equations in Equation (3), where factor sensitivities and risk premiums are determined simultaneously. Country indices are used as spanning assets. The three shipping indices contain the stocks in the Clarksons liner share Price index (container), the Clarksons tanker index (tanker), and the Baltic dry bulk report (bulker). The four country indices are from MSCI. All equity indices are value-weighted. In the one-factor model, the world stock market is the single source of risk. The MSCI world stock market index, whose returns are denoted as dWRLDE, is used as a proxy for the market portfolio. The four-factor model incorporates three additional global macroeconomic factors that have been identified in the SUR model in Table IV: the change in a weighted currency basket (dCURB), the change in industrial production of the G-7 countries (dIPG7), and the change in the oil price (dOIL). The sample period is from January 1999 to December 2007. In order to capture the cross-sectional asset pricing conditions, the factor sensitivities are asset-specific, but the risk premiums apply for all assets. The model's orthogonality conditions are estimated using Hansen's (1982) GMM. Returns and pricing errors are in percent per month. Standard errors are given in parentheses. For the χ^2-tests on over-identification the p-values are shown in parentheses.

sample period, but it is similar to the figures reported in Dimson et al. (2007) based on very long-run averages. The currency risk premium on the US$ is negative with -1.2% per month. However, all sensitivities on the currency factor apart from the United States are negative, which implies a positive total return contribution from taking on currency risk. The U.S. market itself exhibits a positive exposure to currency risk, and hence a stronger US$ induces a lower expected rate of return on U.S. firms. A stronger US$ weakens exports and strengthens imports, which has an adverse impact on the cash flow of U.S. firms. With respect to changes in industrial production, we find notable differences across assets. The strongest impact of this factor is observable in the container sector, while the impact on the other shipping sectors is smaller (albeit still positive). In contrast, industrial production has a negative impact on three of the four country indices. In this respect, shipping stocks tend to differ fundamentally from country indices. Shipping stocks profit from higher contemporaneous production in the G-7 countries, whereas the coefficients on the country indices are mixed (as in Table IV) potentially because the stock market also serves as a leading indicator of the business cycle. However, the risk premium is negative with -1.3% per month during our sample period, which implies that the total return attribution for shipping stocks from industrial production risk is negative. There are similar differences with respect to changes in the oil price, also suggesting that shipping stocks are different in their risk characteristics from stocks overall. The change in the oil price has a positive impact on shipping stock returns (as in Table IV). In contrast, all country indices (except Japan) exhibit negative exposures to oil price changes. As in Ferson and Harvey (1994), taking on one unit of risk related to oil price changes earns a huge risk premium during our sample period.[11]

Most important from an asset pricing perspective, the average pricing error of the four-factor model is much smaller than that of the one-factor model (50.001 versus 0.015). Obviously, the multifactor model is better able to explain the cross-section of expected stock returns. This conclusion is also justified by looking at the chi-squared test of over-identification (test for the goodness of fit). The orthogonality conditions cannot be rejected, indicating that the model no longer violates the cross-sectional pricing conditions. Therefore, we conclude that a multidimensional definition of systematic risk is necessary to correctly price shipping stocks when country indices

11 The effect of this high-risk premium on expected returns is mitigated by the low-sensitivity coefficients.

Table VI – Long-run risks with industry indices as spanning assets.

	One-factor model			Four-factor model				
	dWRLDE beta	**Mean excess return (%)**	**Average pricing error (%)**	**dWRLDE beta**	**dCURB beta**	**dIPG7 beta**	**dOIL beta**	**Average pricing error (%)**
Container	0.915	0.0216	0.0206	0.886	−0.500	1.020	0.074	−0.0022
	(0.121)		(0.008)	(0.252)	(0.430)	(1.567)	(0.056)	(0.002)
Tanker	0.992	0.0289	0.0273	0.818	−0.703	0.228	0.090	0.0018
	(0.093)		(0.007)	(0.226)	(0.375)	(1.713)	(0.068)	(0.002)
Bulker	0.890	0.0430	0.0429	0.682	−1.304	0.982	0.082	0.0003
	(0.160)		(0.011)	(0.323)	(0.578)	(1.984)	(0.072)	(0.001)
Energy	0.982	0.0116	0.0096	0.750	−0.227	−1.598	0.153	−0.0007
	(0.076)		(0.004)	(0.144)	(0.177)	(1.049)	(0.066)	(0.001)
Materials	1.119	0.0123	0.0096	0.998	−0.378	−1.016	0.030	0.0008
	(0.060)		(0.004)	(0.132)	(0.219)	(1.156)	(0.056)	(0.002)
Industrials	0.937	0.0057	0.0035	0.966	0.033	0.449	0.005	0.0006
	(0.032)		(0.001)	(0.091)	(0.160)	(0.480)	(0.022)	(0.002)
Consumer discretionary	1.124	0.0019	−0.0011	1.185	0.228	0.355	0.002	0.0010
	(0.030)		(0.002)	(0.091)	(0.162)	(0.488)	(0.026)	(0.002)
Consumer staples	0.499	0.0031	0.0023	0.329	−0.292	−0.291	−0.046	−0.0011
	(0.058)		(0.003)	(0.121)	(0.130)	(0.847)	(0.037)	(0.002)
Health care	0.404	0.0008	−0.0002	0.348	−0.060	0.325	−0.072	0.0012
	(0.057)		(0.003)	(0.138)	(0.212)	(0.616)	(0.037)	(0.002)
Financials	0.968	0.0045	0.0024	0.943	−0.130	0.108	−0.054	0.0007
	(0.042)		(0.002)	(0.100)	(0.112)	(0.536)	(0.035)	(0.001)
Information technology	1.521	−0.0016	−0.0056	1.996	0.624	−0.007	0.091	0.0000
	(0.109)		(0.005)	(0.231)	(0.263)	(1.180)	(0.069)	(0.002)
Telecommunication	1.041	−0.0007	−0.0033	1.198	0.094	0.502	−0.055	−0.0016
services		(0.063)	(0.004)	(0.171)	(0.238)	(1.041)	(0.072)	(0.003)
Utilities	0.709	0.0061	0.0048	0.452	−0.419	−0.653	−0.036	−0.0011
	(0.076)		(0.003)	(0.160)	(0.172)	(0.867)	(0.049)	(0.001)
Mean pricing error (%)			0.0087					0.0000

continued

Table VI – (continued)

	One-factor model			Four-factor model				
	dWRLDE beta	**Mean excess return (%)**	**Average pricing error (%)**	**dWRLDE beta**	**dCURB beta**	**dIPG7 beta**	**dOIL beta**	**Average pricing error (%)**
			χ^2-test on over-identification					χ^2-test on over-identification
Risk premium	0.0014		60.69	0.0031	−0.0249	0.0040	0.0658	19.25
	(0.000)		(0.000)	(0.001)	(0.014)	(0.006)	(0.054)	(0.999)

This table shows the results from estimations of the system of equations in Equation (3), where factor sensitivities and risk premiums are determined simultaneously. Industry indices are used as spanning assets. The three shipping indices contain the stocks in the Clarksons liner share price index (container), the Clarksons tanker index (tanker), and the Baltic dry bulk report (bulker). The ten industry indices are from MSCI. All equity indices are value-weighted. In the one-factor model, the world stock market is the single source of risk. The MSCI world stock market index, whose returns are denoted as dWRLDE, is used as a proxy for the market portfolio. The four-factor model incorporates three additional global macroeconomic factors that have been identified in the SUR model in Table IV: the change in a weighted currency basket (dCURB), the change in industrial production of the G-7 countries (dIPG7), and the change in the oil price (dOIL). The sample period is from January 1999 to December 2007. In order to capture the cross-sectional asset pricing conditions, the factor sensitivities are asset-specific, but the risk premiums apply for all assets. The model's orthogonality conditions are estimated using Hansen's (1982) GMM. Returns and pricing errors are in percent per month. Standard errors are given in parentheses. For the χ^2-tests on over-identification the p-values are shown in parentheses.***, ** and * denotes statistical significance at the 1, 5 and 10% levels.

are used as spanning assets. The four risk factors shown in Table V seem to be systematic sources of risk, and the risk-return profile of shipping stocks differs from those of country indices.

To check the robustness of our results, we alternatively estimate the model using sector indices as the spanning assets. The results are shown in Table VI. If the system of equations in Equation (3) represents a valid asset pricing model, the estimated risk premiums should be independent of the choice of spanning assets as long as they represent sufficiently diversified portfolios. In fact, the estimated risk premiums on the world stock market index and on the currency basket are of similar magnitude in Table VI as those in Table V, while the risk premium on industrial production is now positive (and the sensitivities being mixed again). The risk premium on oil decreases substantially, but it is still positive. Overall, we observe lower standard errors and conclude that the model with sector indices rather than country indices as spanning assets is better in explaining the cross-section of expected stock returns. Explanations for the differences between Tables V and VI may be that we analyze a relatively short sample period with peculiar risk-return characteristics and that the industry indices cover a broader set of stocks than the country indices. However, similar to the country index model, the moment conditions of the one-factor model using sector indices as the spanning assets are rejected using the chi-square test of over-identification. In contrast, the four-factor model is again able to capture the cross-sectional pricing restrictions.

Looking at shipping stocks, the market betas remain quite stable in Table VI and are well below unity. Again, shipping stocks exhibit low covariance risk with the overall market. Their sensitivities to the currency basket and the oil price remain negative and positive, respectively, while they carry a positive exposure to industrial production risk. Most important, the risk-return profile of shipping stocks seems to be specific, as none of the other 10 industry indices exhibits the same factor loadings on the four macroeconomic risk factors. Even the broad industrials sector, which contains water transportation as a subsector, exhibits a different risk-return profile with a positive exposure to currency risk. This observation clearly supports our notion that ships represent a distinct investment and have the potential to serve as a unique and distinguishable asset class.

5.5 Conclusions

This study investigates the risk-return profile of listed companies from the shipping industry and its three sectors: container, tanker, and bulker shipping. Our empirical findings suggest that the shipping industry exhibits lower (covariance) risk in terms of beta than the overall stock market. Similar to previous studies that investigate the risk characteristics of the shipping industry, we document that shipping stocks exhibit a beta lower than one and a high proportion of unsystematic risk. Moreover, the results from our asset pricing tests indicate that market risk alone is not sufficient to price an equity universe that includes shipping stocks. One implication is that the decision to invest in the shipping industry cannot be made from looking at the market beta alone. Instead, risk is multidimensional and additional macroeconomic risk factors must be taken in consideration. Specifically, we identify the world stock market index, currency fluctuations against the US$, changes in industrial production, and changes in the oil price as long-run systematic risk factors that drive expected stock returns. The sensitivities to these global risk factors have a significant contribution in explaining the expected stock return differential in the cross-section of asset. The pricing error is small enough that a GMM-based test cannot reject the moment conditions imposed by full information processing.

The different global risk-return profile of the shipping industry compared to country and other industry indices suggest that shipping stocks should be regarded as a separate asset class. The distinct risk-return profile of the shipping industry is of utmost importance for investors whose goal is to achieve maximal diversification. While a look at the market beta indicates a nearly average-risk profile, the sensitivities (or exposures) to the macroeconomic risk factors suggest that an investor who has already invested in country or other industry indices could further enhance the risk-return spectrum by investing in shipping stocks.

Finally, our results also have important implications for estimating the cost of equity capital in the shipping industry. In practice, the cost of capital in the industry is often based on simple heuristics. Having estimates for the exposures of different subsectors of the shipping industry to the macroeconomic risk factors and the associated risk premiums, an obvious extension would be to calculate the cost of equity capital. We leave this task for future research.

Appendix A. List of shipping stocks

Table VII – List of shipping stocks

Container	Time Period
Alexander & Baldwin	January 1999–December 2007
AP Moeller Maersk A	January 1999–December 2007
AP Moeller Maersk B	January 1999–December 2007
China Shipping Container Lines (CSCL)	June 2004–December 2007
Compania Sud Americana De Vapores S.A. (CSAV)	January 1999–December 2007
Evergreen Marine	January 1999–December 2007
Finnlines	January 1999–December 2007
Hanjin Shipping Co. Ltd.	January 1999–December 2007
Heung–A Shipping Co. Ltd.	January 1999–December 2007
Hyundai Merchant Marine Co. Ltd.	January 1999–December 2007
Kawasaki Kisen (K–Line)	January 1999–December 2007
MISC Berhad	January 1999–December 2007
Mitsui OSK Lines (MOL)	January 1999–December 2007
Neptune Orient Lines (NOL)	January 1999–December 2007
Nippon Yusen Kabushiki Kaisha (NYK)	January 1999–December 2007
Orient Overseas Intl.	January 1999–December 2007
Regional Container Line (RCL)	January 1999–December 2007
Samudera Shipping Line	January 1999–December 2007
Sinotrans Ltd.	February 2003–December 2007
Trailer Bridge Inc.	January 1999–December 2007
Wan Hai Lines	January 1999–December 2007
Wilh. Wilhelmsen ASA	January 1999–December 2007
Yang Ming Marine Transport Corp.	January 1999–December 2007
Tanker	
Brostrom January 1999–December 2007	
Concordia Maritime	January 1999–December 2007
Dampskibsselskabet "NORDEN" A/S (D/S Norden)	January 1999–December 2007
Dampskibsselskabet "Torm" A/S (D/S Torm)	January 1999–December 2007
Euronav	December 2004–December 2007
Frontline Ltd.	January 1999–December 2007
Great Eastern Shipping	January 1999–December 2007
I.M. Skaugen ASA	January 1999–December 2007
James Fisher & Sons	January 1999–December 2007
Jinhui Shipping & Transportation Ltd.	January 1999–December 2007
Knightsbridge Tankers Ltd.	January 1999–December 2007
Mitsui OSK Lines (MOL)	January 1999–December 2007
Neptune Orient Lines (NOL)	January 1999–December 2007
Nordic American Tanker Shipping	January 1999–December 2007
Odfjell "A"	January 1999–December 2007
Overseas Shipholding Group (OSG)	January 1999–December 2007
Shinwa Kaiun	January 1999–December 2007

continued

Table VII – (continued)

Ship Finance Intl.	June 2004–December 2007
Stolt Nielsen	January 1999–December 2007
Teekay Corporation	January 1999–December 2007
Tsakos Energy Navigation	March 2002–December 2007
Bulker	
Cosco Corp.	January 1999–December 2007
Dampskibsselskabet "NORDEN" A/S (D/S Norden)	January 1999–December 2007
Dampskibsselskabet "Torm" A/S (D/S Torm)	January 1999–December 2007
Excel Maritime Carriers	August 2000–December 2007
Golden Ocean Group	December 2004–December 2007
Great Eastern Shipping	January 1999–December 2007
Mitsui OSK Lines (MOL)	January 1999–December 2007
Pacific Basin Shipping	June 2004–December 2007
Percious Shipping	January 1999–December 2007
U-Ming Marine Transport	January 1999–December 2007

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