ESSAYS ON BANK INCOME DIVERSIFICATION

Lukas Wyss

ESSAYS ON
BANK INCOME
DIVERSIFICATION

ESSAYS ON BANK INCOME DIVERSIFICATION

Inaugural dissertation

Submitted in fulfilment of the requirements for the degree of
Doctor rerum oeconomicarum at the Faculty of Business, Economics
and Social Sciences of the University of Bern

by

LUKAS CHRISTIAN WYSS

of Wynigen, Canton of Bern

2018

The faculty accepted this work as dissertation on 8 November 2018 at the request of the two advisors Prof. Aymo Brunetti and Prof. Martin Brown, without wishing to take a position on the views presented therein.

Contact: https://www.linkedin.com/in/lukas-wyss-6417171a/
Typeset and designed by the author
Fonts: XCharter and Source Sans Pro
Cover photo: Mohamed Hakim (https://pxhere.com/en/photo/1435081)

Für Nina

Abstract

This thesis investigates the effects of bank income diversification on bank performance and systemic stability in three independent but complementary empirical studies:

Specialized banking systems and financial stability

The first study reviews the Glass–Steagall Act and similar specialized banking systems from a historic and macroeconomic perspective. The goal is to assess whether past specialized banking systems were introduced for financial stability concerns and whether such regimes entailed positive effects on financial stability. The historic analysis of ten countries that formerly had such regimes in place shows that such regulations were not primarily motivated by financial stability. Based on a panel of thirty high-income jurisdictions between 1970 and 2011 the study further provides an assessment of the effects of such regimes on financial stability. The results do not support the popular belief that specialized banking systems are associated with decreased crisis probability. The analysis instead yields limited evidence of a positive relation. However, the results also indicate that specialized banking systems experience less severe banking crises than universal banking regimes.

Meta-analysis of the literature on bank diversification

In contrast to the macro literature, a large body of empirical micro literature on the effects of bank income diversification exists. However, this literature provides mixed results. The second study therefore presents a meta-regression analysis on this literature, including thirty-four studies with a total of 932 regressions. The results indicate some evidence for underlying genuine effects: Diversification is generally associated with reduced risk;

this includes diversification from interest income towards fee income. Diversification towards trading tends to increase profitability but decreases risk-adjusted profitability. However, the clearest result is that the findings of existing studies crucially depend on research design. The discord in the literature can partially be explained by studies not accounting for endogeneity, thus underestimating the riskiness of trading business. Furthermore, studies focusing on countries that used to separate commercial banking from investment banking tend to find a less positive relation between fee-generating activities and profitability and a more positive relation between trading and profitability. Also, samples with larger banks tend to yield more positive effects from fee-generating and trading activities on profits.

Diversification and performance of large banks

The last study analyses the effects of income diversification on large banks. The analysis is based on a panel of ninety large listed international banks from 2005 to 2015. For additional details on banks' income structure, the data set combines information on fee and trading income, assets under management, and investment banking deal volumes. The results indicate that more diversified large banks are generally less risky and more profitable. The detailed analysis of individual bank activities indicates that fee income outside investment banking and asset management (i.e. retail fees) reduces the risk and increases the profitability of banks. The results further provide some evidence that diversification towards trading and syndicated loans underwriting decreases risk and increases profitability. In contrast, equity underwriting increases risk and decreases profitability and risk-adjusted profitability of banks.

No case against universal banks

In combination, these three studies do not support the hypothesis of specialized banking improving financial stability. Instead, the three studies give a slight indication of universal banking improving the stability of individual banks or the financial system. Overall, the results do not support limiting the business model of universal banks by legally separating commercial banking and investment banking.

“And I tell you, sure as I am sitting here, that if banking institutions are protected by the taxpayer and they are given free rein to speculate, I may not live long enough to see the crisis, but my soul is going to come back and haunt you.”

— Paul Volcker, Chairman of the President’s Economic Recovery Advisory Board on 2 February 2010 to the United States Senate Committee on Banking, Housing and Urban Affairs

Contents

Tables

Figures

Preface

Doing a PhD doesn't pay. I remember from an undergrad class in education economics that Swiss PhD holders, on average, earn a lower life income than they would without their degree. Nonetheless, I could just never shed this *idée fixe*. However, when I finally started I remained rational enough to know that I did not want to place my not-so-young life on hold. So I did not: Since my matriculation, five years ago, I have married, managed major projects at FINMA, been blessed with two adorable children, represented FINMA in international working groups, built a home, published my first article in an academic journal, visited weekly swimming lessons with the children, and regularly checked my work e-mail while writing this thesis. I now look forward to going to bed a little earlier.

I would like to thank my beloved wife for the invaluable moral and subject-specific support she has been giving me throughout the course of this project. This thesis is dedicated to her. I am very thankful for her and our children's patience for whenever I have been "writing my book". Special thanks go to Urs Zulauf, former deputy director of FINMA, who helped me initiate my long-postponed dream of a doctorate. I also thank FINMA for the financial support during the coursework stage. I particularly thank my academic advisor Aymo Brunetti for giving the disappearing model of the part-time doctorate another shot. Likewise, I thank my second advisor Martin Brown. I greatly appreciate the guidance and mentoring from both of them. I furthermore thank Klaus Neusser, Ernst Baltensperger and Marc Bellemare for helpful methodical comments.

CHAPTER ONE

Introduction

This thesis investigates the effects of bank income diversification on bank performance and systemic stability. The choice of topic is motivated by the regulatory debate on the implications of universal banking on financial stability following the 2007 Global Financial Crisis: Soon after the start of the crisis many policy makers and economists began to demand a separation of commercial banking and investment banking activities (LaRouche Political Action Committee 2018). The request was initially voiced in the United States but later taken up in other jurisdictions. The rationale is that risky investment banking business of systemically important banks may have negative externalities on society. Proponents of such a regulation refer to the former Glass–Steagall Act that largely separated commercial banks and investment banks in the United States between 1934 and 1999. It is argued that this separation bolstered financial stability for the time it was in place. Therefore, this historic American regulation should serve as a model for a policy response to the Global Financial Crisis. In recent years, several jurisdictions adapted more restrained structural regulations that were partially inspired by the historic American model (Gambacorta and van Rixtel 2013; Viñals et al. 2013; fsb 2014). However, the controversy on reinstating Glass–Steagall or instating similar specialized banking systems has never fully abated.

Limited empirical grounds for debate

Surprisingly, a closer examination of the literature shows that this debate is based on limited and contradicting empirical grounds. The empirical macro literature on the determinants of banking crises ignores the potential influence of specialized banking systems. In contrast, there is an extensive body of empirical micro literature dealing with the relevance of specialization or diversification on the performance of banks. However, this strand of literature yields mixed results. In addition, the literature neglects the relevant nexus to systemic stability by mostly analysing small and medium-sized banks. Analysing diversification of such banks may be relevant from a business perspective but not necessarily for systemic stability and thus for regulation. Regulatory measures can only be justified by stability concerns if the poor performance of such banks generates societal externalities. Such externalities are more likely to occur amongst large banks.

Focus on thus far neglected aspects

This thesis investigates the implicit hypothesis of the post-crisis debate according to which specialized banking is preferable to universal banking from a financial stability perspective. The focus lies on three aspects that have thus far been neglected in the relevant empirical literature: the macro effects on systemic stability, the mixed results in the existing micro literature, and the lack of relevant findings on large and systemically important banks.

1.1 THEORETICAL BACKGROUND ON BANK INCOME DIVERSIFICATION

In addition to the mixed results on the effects of bank diversification in the empirical literature, theoretical expectations for such effects are also ambiguous. This section provides an overview of the major theoretical arguments on this issue.

1.1.1 Individual bank activities and related risks

As a first step to understanding the implications of income diversification, this section individually describes the income streams and risk profiles of different banking activities.

Principal risk versus agent risk

From a risk perspective, the most fundamental categorization of bank income is based on the bank's role as either principal or agent (Saunders and Walter 1994, 167–179). If a bank makes investments on its own accounts, it acts as principal. Principal activities generate interest income, dividend income and gains from asset price movements. If a bank provides services to clients in exchange for fees or commissions, it acts as an agent for its clients. The categorization of principal and agent risks suggests that banks bear higher risks when acting as principals in comparison to when acting as agents: In a bad state of business, a principal may lose all or part of the initially invested amount and earn a negative return. In contrast, an agent should at worst only lose its fee income and earn a zero return.

Commercial and investment banks in both roles

Both, commercial banking and investment banking can entail principal and agency risk. Commercial banks mainly take on principal risks in their traditional business, when giving out mortgage and commercial loans. In asset management, in contrast, commercial banks act as their clients' agents. Investment banks take on principal risk when engaging in proprietary trading and in securities underwriting on a firm-commitment basis (i.e. the bank takes new issues on its books at an agreed price and places them in the market on its own accounts). Other typical investment banking activities are mostly associated with agency risk. Investment banks traditionally take on agency risks through fee generating activities such as trading on behalf of clients (i.e. brokerage), mergers and acquisition services, and best-efforts securities underwriting (i.e. the bank does not take on inventory positions). According to this categorization in principal and agent risks, and contrary to widespread belief, fee-based investment banking activities should be less risky than traditional banking business.

Operational leverage increases agency risk

However, DeYoung and Roland (2001, 81) note that fee-based activities are associated with relatively high fixed-costs for staff and information technology. Owing to this operational leverage in combination with low switching costs for customers, fee-generating activities may be more risky than the traditional lending business. In addition, some fee-based activities may tempt banks to increase their unweighted financial leverage, because these activities tie up only little risk-weighted capital (DeYoung and Roland 2001, 56–57). It is thus not a priori clear whether principal or agent business is riskier.

1.1.2 Theoretical benefits from income diversification

Knowing the riskiness of individual non-interest banking activities is not sufficient to assess the effects of combining such activities with traditional banking business. This becomes clear if we look at different business lines of a universal bank as individual assets in an investment portfolio. Portfolio theory suggests that a bank's risk is a function of the return variances of the individual assets or business lines and the correlation coefficients between each possible pair of business lines:

$$\sigma^2 = \sum_{i=1} \omega_i^2 \sigma_i^2 + \sum_i \sum_{i \neq j} \omega_i \omega_j \sigma_i \sigma_j \rho_{ij} \tag{1.1}$$

where σ^2 is the portfolio return variance, ω_i is the weight of each business line i in terms of invested capital, σ_i is each business line's standard deviation of returns and ρ_{ij} is the correlation coefficient between each possible pair of business lines i and j. If business line returns are negatively correlated, the second term of the formula becomes smaller. At some point, the second term cancels out the first term and the portfolio risk becomes zero.

Portfolio effect reduces risk

So, from a portfolio theory point of view, even if investment banking activities were riskier than commercial banking on a stand-alone basis, a commercial bank could reduce its overall risk or improve its risk-adjusted profitability through diversification if the incomes from investment and commercial banking were weakly or negatively correlated. Diversification of a commercial bank into investment banking would thus only increase risk, if the risks of the two business lines were highly correlated and the investment banking activities were sufficiently riskier than commercial banking (Saunders and Walter 1994, 183–184).

Risk dependent on correlation of returns

Portfolio theory further implies that, by diversifying into a riskier activity, overall risk increases linearly only if the returns of the new activity are perfectly positively correlated with the returns of the bank's other activities. If the correlation coefficient of the returns are between perfectly negative and perfectly positive, a non-linear, quadratic relation results between the proportion of investment bank activities and overall risk, as illustrated in figure 1.1. With a perfectly negative correlation, the relation becomes kinked.

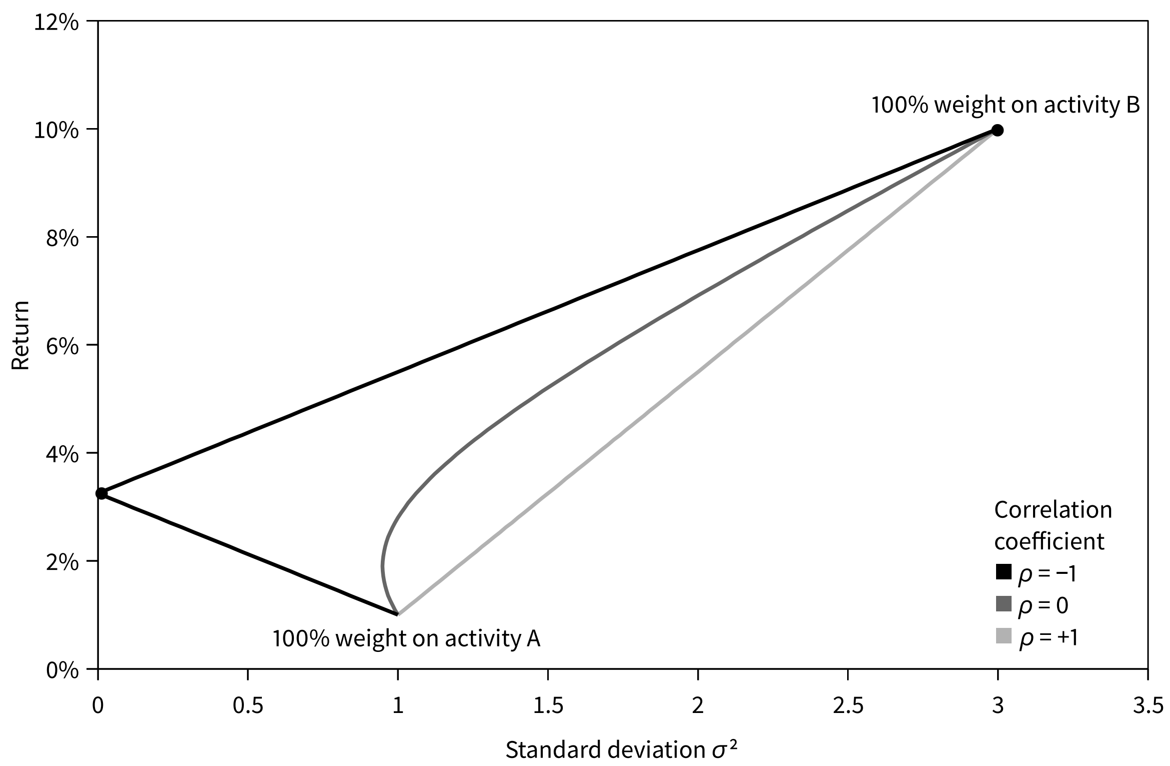

Figure 1.1 Two assets portfolio. If returns of the new activity B are perfectly positively correlated with the returns of the firm's prior activity A, overall risk increases linearly with the share of activity B. If the correlation is between perfectly positive and perfectly negative, a non-linear, quadratic relation results. With a perfectly negative correlation the relation becomes kinked.

In addition to portfolio effects, more diversified banks might benefit from economies of scope. Universal banks could benefit from cross-selling opportunities. Such banks could use information gained on customers from one line of business to provide other services at lower client acquisition or information costs (Demirgüç-Kunt and Huizinga 2010, 627).

Additional benefits from diversification

1.1.3 Theoretical vulnerabilities of universal banks

Other theoretical considerations favour bank specialization over diversification. The literature states several theoretical arguments that could explain more diversified banks having higher risks or lower returns.

De Nicoló et al. (2004, 201) argue that banks do not necessarily diversify to reduce risk but could instead do so to use the improved stability from

Over-compensation of risk reductions

diversification benefits to take on more risk within business lines and increase profitability. If bank risk is associated with negative externalities, bank managers might – in their pursuit of higher profits – choose a risk level that is too high from a societal perspective.

Misaligned incentives of bank managers

For Myers and Rajan (1998, 763) bank diversification may be driven by misaligned incentives between shareholders and managers of banks. Managers may have incentives to build empires or increase risk in expectation of higher bonuses. Managers could even expand into more liquid trading activities to enhance their opportunities to trade against the bank's interests.

Gambling for resurrection

Colvin (1998, 26) argues that universal banks could be more risky because they are more susceptible to gambling for resurrection. A bank that owns shares in a client firm might be tempted to provide further credit financing even if this firm is in distress. In hope of recovering its initial investment, a bank might pour good money after bad.

Maturity mismatch of universal banks

Colvin (1998, 25–26) further considers universal banks to be riskier because they have, in comparison to specialized institutions, a bigger maturity mismatch between assets and liabilities. In contrast, specialized investment banks may provide equally long-term loans but are not financed by short-term deposits. At the same time, specialized commercial banks are less vulnerable to bank runs, because they do not invest in long-term commercial loans.

Higher innovation in specialized systems

Boot and Thakor (1997) explain in a formalized theoretical model that universal banking systems are less efficient than specialized banking systems because of lower financial innovation. The reason is that investment banks aim to lower their clients' costs of capital by broadening the market for their securities through financial innovation. This financial innovation makes capital market financing more attractive to borrowers who would otherwise rely on debt financing by commercial banks. If investment banks and commercial banks are combined to form universal banks, investment banking departments would consider the adverse effect of their financial innovations on their commercial banking departments. Especially in markets with imperfect competition between banks, this would result in a lower overall level of financial innovation and scarcer financing for the economy. Functionally specialized banks would be driven out of the market by universal banks that profit from economies of scope. Internationally, however, investment banks from specialized banking systems would have a competitive edge over the investment banking arms of universal banks because of increased innovation.

Universal banks more systemic?

Several theoretical arguments against universal banks put forward in the literature emphasize an increased moral hazard because of implicit government guarantees (e.g. Benston 1994, 123–124). The rationale is that universal banks tend to be larger than specialized banks. Such arguments thus address the issue of diversification versus specialization only indirectly. In addition, the Global Financial Crisis has demonstrated that specialized investment banks can be sufficiently large to be systemically important.

1.2 STRUCTURE OF THIS THESIS

This thesis is structured into three independent but complementary empirical studies. Each study approaches the issue of universal banking versus specialized banking and of bank diversification versus specialization from a different angle. These three studies form the subsequent chapters 2 to 4.

Specialized banking systems and financial stability

Chapter 2 reviews the Glass–Steagall Act and similar specialized banking systems from a historic and macroeconomic perspective. The goal is to assess whether past specialized banking systems were introduced for financial stability concerns and whether such regimes entailed positive effects on financial stability. In this study, high-income countries are categorized as universal banking or specialized banking systems over an extended period for the first time in the literature. The study is the first to empirically assess the relevance of specialized or universal banking systems as determinants of financial crises. This assessment is based on a panel of thirty high-income countries between 1970 and 2011.

Meta-analysis of the literature on bank diversification

Chapter 3 presents a meta-regression analysis on the micro literature on bank diversification, including thirty-four studies with a total of 932 regressions. This study is one of very few meta-regression analyses in the field of banking and the first one to address the issue of bank diversification. The study identifies underlying genuine effects of diversification on bank performance common to most existing studies. In addition, the analysis explains observed differences in the findings across different empirical studies on this topic.

Diversification and performance of large banks

Chapter 4 analyses the effects of income diversification on large international banks. The analysis is based on a panel of 90 large listed international banks from 2005 to 2015 and includes more granular income data than existing studies on international banks. The data thus allow measuring diversification between commercial banking and investment banking activities in greater detail.

Overall conclusion

Chapter 5 provides an overall summary and identifies possible policy implications. The chapter acknowledges the limitations of the presented work and highlights potentially fruitful avenues for future research.

CHAPTER TWO

Specialized Banking Systems and Financial Stability

The 2007 Global Financial Crisis internationally triggered policy discussions on structurally separating commercial banks from their investment banking activities. Examples of such policy initiatives include the Volcker Rule as part of the American Dodd–Frank Act, the reform in the European Union based on the Liikanen Report and the British reform based on the recommendations of the Vickers commission. All these initiatives entailed some degree of separation between commercial banking and securities activities banking (Lehmann 2016).

The model of the Glass–Steagall Act

The policy discussion was, to a large extent, inspired by the American Glass–Steagall Act (Uchitelle 2009). This act came into force in 1934 as a reaction to the stock market crash of 1929 and the Great Depression. The act prohibited American commercial banks from conducting most securities activities and securities firms from taking deposits (Benston 1990, 7). Financial institutions were thus forced to specialize either on commercial banking or securities business. This specialized banking system was gradually relaxed in the 80s and 90s and eventually abolished in 1999 (Markham 2002, 299–302).

Mixed results from bank-level studies

The effectiveness of separating banking and securities business to improve financial stability appears to be generally accepted in the policy debate after the Global Financial Crisis. However, while a large body of empirical literature on the effects of specialized banking systems exists, the results are contradictory. Most existing studies analyse the stability effects that the combining or separating of commercial banking and securities activities has on individual institutes.[1] An early strand of the literature analyses the co-variances in income of commercial banks and other financial firms (e.g. Johnson and Meinster 1974; Boyd, Graham and Hewitt 1993). Later contributions include event studies of mergers between banks and securities firms (DeLong 2001; Filson and Olfati 2014) or of deregulation steps (e.g. Bhargava and fraser 1998; Cornett, Ors and Tehranian 2002). The largest group of studies, however, includes econometric comparisons of banks with different degrees of involvement in securities business or other non-traditional activities (e.g. Kwast 1989; demirgüç-kunt and Huizinga 2010). Other studies do not explicitly analyse the effects of specialized banking systems but instead analyse the optimal degree of bank activity diversification independently from regulatory restrictions. The existing literature gives an inconsistent verdict on the desirability of specialized or universal banking systems from a financial stability perspective.

Macro studies neglect bank specialization

The aforementioned studies analyse the effects of securities activities on individual institutes. The alternative is a macro-level analysis of the effects from specialized banking systems on the probability and severity of banking crises. The existing literature on the determinants of banking crises analyses various crisis determinants but does not focus on the existence of specialized banking systems as a possible influence. Demirgüç-Kunt and Detragiache (1998) find that low growth, high inflation and high real interest rates are associated with systemic banking sector problems. Demirgüç-Kunt and Detragiache (2002) observe the presence of deposit insurance schemes to increase crisis probability. Beck, Demirgüç-Kunt and Levine (2006) find that more concentrated banking sectors are more stable. Joyce (2011) finds, for emerging economies, that more liberal capital regimes reduce the probability of banking crises, while fixed exchange rate regimes have the opposite effect. Reinhart and Rogoff (2014) show that increased credit growth increases crisis probability. Most closely related to our topic of interest, Demirgüç-Kunt and

1 Another strand of the literature including Kroszner and Rajan (1994) and Drucker and Puri (2005) focuses on implications of universal banking on service quality, rather than on financial stability.

Detragiache (1998) and Iftikhar (2015) find that financial liberalization is associated with increased financial fragility.[2]

Specialized banking systems as crisis determinant

The fame of Glass–Steagall may create the wrong impression that this American regulatory experience was unique and that country comparisons would thus be unfeasible. This is, however, not the case. Several countries had similar restrictions on banks' securities activities in place. But, to my knowledge, Beck, Demirgüç-Kunt and Levine (2006) contribute the only macro study that partially addresses the effect of specialized banking systems on financial stability: They include restrictions on banks' securities activities as a control variable in one single model specification. The control variable yields a positive effect on crisis probability. However, the authors do not discuss the result for this variable. Also, the stated data source for that study only captures specialized banking systems that still existed after 1998. The authors thus seem to incorrectly identify regimes that had been changed to universal banking in sample years before 1998. Also, since the observation period of that pooled regression analysis stretches from 1980 to 1997, the variable on activity restrictions seems to be time-invariant.

Contribution to the literature

The present study assesses whether the Glass–Steagall Act and other historic specialized banking systems can serve as a model to improve financial stability. To do this, I initially conduct a qualitative historic analysis on the relevance of financial stability motives when such specialized banking systems were introduced. I compile a comprehensive dataset on specialized banking systems in high-income countries (and non-sovereign jurisdictions) after 1929. In addition to whether specialized banking systems were motivated by stability concerns, I analyse if such regimes actually had an empirical effect on financial stability. The popular belief that specialized banking regimes increase financial stability by limiting crisis prevalence and severity serves as the main hypothesis for this study. I thus use the compiled data for a macro-level analysis of the effects of specialized banking systems on the probability and severity of banking crises. The quantitative analysis is based on a panel of thirty high-income countries between 1970 and 2011.

2 Papi, Presbitero and Zazzaro (2015, 39) provide an overview on the literature.

Limited relevance of stability concerns for historic regulations

The historic analysis considerably qualifies the relevance of financial stability considerations as a political motive for past specialized banking systems. The literature states financial stability motives only for three out of ten observed specialized banking countries: the United States, Belgium and Italy. However, for all three cases the literature presents alternative explanations that raise questions about the sincerity of the financial stability motive.

Specialization limits crisis severity but not crisis prevalence

Regarding the quantitative analysis, I find no evidence that specialized banking systems lead to fewer banking crises. Limited evidence even suggests that specialized banking systems are associated with increased crisis probability, contrary to popular belief. However, the results also indicate that specialized banking systems experience less severe banking crises.

2.1 QUESTIONABLE STABILITY MOTIVE OF HISTORIC REGULATIONS

This section reviews the motives for the introduction of historic activity restrictions on banks' securities business based on the economic, historic and legal literature. After the Global Financial Crisis of 2007, the policy discussion referred to the Glass–Steagall Act introduced in the United States in 1934 (Uchitelle 2009). The reference implies that this historic separation of commercial and investment banking was motivated by financial stability concerns. However, the analysis of the historic motives for this act and similar activity restrictions in other countries raises doubts about this motivation.

Ten specialized banking countries

To find comparable specialized banking systems, I examine a group of thirty high-income countries. For each country I check whether it had such a regulation in place between 1929 and 2011. The Bank Regulation and Supervision database serves as a starting point (World Bank 2012). Among other things, this database contains information on activity restrictions for banks. The information is based on surveys conducted in irregular intervals since 1998. The last available update was conducted in 2012. The surveys cover a varying sample of 118 to 143 countries, including all high-income countries in the sample of this study. Japan, Taiwan and the United States are reported to have had specialized banking systems in place during the covered period. To check for earlier specialized banking systems in other countries, I search the literature for information on activity restrictions or the presence of universal banks. I initially focus on the period between the Great Depression after 1929 and the start of the era of financial liberalization in 1970. If I find evidence for universal banking activities in a country during this period, I assume that a universal banking regime was maintained until after the Global Financial Crisis. If I find evidence for regulatory restrictions on banks' securities activities, I search the literature to pinpoint the year these restrictions were abolished. I identify ten countries that had specialized banking systems in place: Australia, Belgium, Britain, Canada, France, Italy, Japan, New Zealand, Taiwan and the United States. These countries abolished the restrictions between 1981 and 2001. Table 2.7 in this chapter's appendix lists the individual sources and periods for each country.

Focus on political motives

In the following subsections I analyse these ten countries in greater detail. I focus on the political motivation for introducing such regimes and whether financial stability reasons were important. The focus does not lie on legal differences that existed between the discussed regimes.

2.1.1 United States as model for specialized banking

The United States Banking Act of 1933 was the main historic reference point for post-2007 discussions on separating investment and commercial banking. Dubbed the Glass–Steagall Act, this piece of legislation established the Federal Deposit Insurance Corporation, outlawed interest payments on checking accounts and regulated other aspects of banking (Federal Reserve Bank of New York 1933). Sections 16, 20 and 32 of the Act largely prohibited commercial banks from underwriting, holding and dealing in corporate securities, both directly and through subsidiaries. Also, involvement of commercial bank staff and directors in securities firms was prohibited. In return, Section 21 prohibited securities firms from accepting deposits. These rules established a high degree of separation between the deposit financed loan business of commercial banks and the securities business of investment banks (Kroszner and Rajan 1994).

Pretend concern for financial stability

An initially plausible explanation as to why American lawmakers took this measure can be taken from the congressional hearings conducted after the crash of 1929. The way the United States Senate (1933, 7) described the consequences of the crash amounts to a textbook definition of systemic banking crisis:

> "The wholesale closing of banks and other financial institutions; the loss of deposits and savings; the drastic curtailment of credit; the inability of debtors to meet their obligations; the growth of unemployment; the diminution of the purchasing power of the people to the point where industry and commerce were prostrated; and the increase in bankruptcy, poverty, and distress – all these conditions must be considered in some measure when the ultimate cost to the American public of speculating on the securities exchanges is computed."

This report thus suggests stability concerns as a main motive for the regulation. However, some authors contest the sincerity of this motive. Edwards (1942, 225) criticizes that the commission did not base its conclusions on a statistical analysis of specialized investment banks and securities affiliates of commercial banks. Benston (1990, 220–221) explains the political support for the act with senator Glass' preconceptions about the hazardousness of universal banking. The later sponsor of the Banking Act had warned about the dangers of market speculation throughout the 1920s and believed that recent regulatory changes further encouraged such behaviour (Orbe 1983, 165). His beliefs led the influential senator to misstate the findings from the hearings. Self-interest of specialized commercial banks generated further support for the bill (Benston 1990, 220–222). Tabarrok (1998) emphasizes the support of the Rockefeller family and their National City Bank (later named Citibank) to instate a strict separation of commercial and investment banking to damage its rival J.P. Morgan. As a result of the Glass–Stegall Act, J.P. Morgan had to spin off its investment banking business, which became Morgan Stanley.

Actionism against universal banks

Tabarrok (1998, 7) also describes that an angry American public demanded some action be taken. A resolute legislative response to the crash of 1929 was a major element of the democratic campaign in the election year of 1932 (Benston 1990, 219). Directing this actionism against universal banking seems like an unsurprising choice. Most commercial banks had only started to develop their securities businesses since the First World War. And only since 1927 the McFadden Act had formally recognized the expansion of commercial banks into investment banking (Rahman 2012, 616–617). Accordingly, returning to a system with specialized institutions accommodated a longing for the good old days. In addition, such a financial system corresponded to the model provided by Britain, the world's major power of that time. The United States Senate (1933, 334, 339) refers multiple times to the British system. The separation of commercial and investment banking in the United States thus appears more as the result of political actionism than of economic deliberation.

Erosion of Glass–Steagall

The Glass–Stagall Act was eroded in multiple steps beginning 1986 and eventually abolished with the passage of the Gram–Leach–Bliley Act in 1999 (Cyree 2000, 344; Filson and Olfati 2014, 209–210). Barth, Brumbaugh and Wilcox (2000, 192, 200) state other countries' experience with universal banking, increasing global competition and technological progress facilitating cross-selling as reasons for this development.

2.1.2 Belgium and Italy follow suit

Belgium presents an interesting case on specialized banking regulation. Belgium was the first country in which universal banks evolved in the nineteenth century. Additionally, the Belgian banks were in many aspects more prototypically universal than their much-discussed German neighbours (Ugolini 2010, 7–8). However, after the crash of 1929 and soon after the United States, Belgium took regulatory measures to enforce a division of labour in banking (Weber 1938, 9). The royal decree of 23 August 1934 mandated a separation of banking functions. The *banques mixtes* were separated in *banques de dépôt* and *sociétés de portefeuille.* The *banques de dépôt* were restricted to deposit taking and short-term lending while the *sociétés de portefeuille* were barred from deposit taking (Cassiers et al. 1998, 126).

Separation requested by Belgian banks

As in the case of the United States, the authorities stated crisis prevention as a main reason for the new regulation (Banque Nationale de Belgique 1934, 83). The Belgian reform took place shortly after the enactment of Glass–Steagall, the creation of which the Belgian authorities closely followed (Banque Nationale de Belgique 1933, 81–83). The Banque Nationale de Belgique (1934, 83) explicitly referred to the American model when announcing the new regulation. However, it was not financial stability reasons that led the Belgians to follow the American model. Giddey (2014, 1222–1224) reports that the separation of banking and securities business was added at the last minute to a broader legislative project at the request of major banks. The motive for this lobbying feat was to have the non-depository parts of former universal banks remain out of the scope of the newly instituted banking supervision.

Bank specialization in fascist Italy

In Italy, the first big banks developed as universal banks in the late nineteenth century (Weber 1938, 14–15). As a reaction to the crash of 1929, the Great Depression and major bank failures, fascist Italy enacted the Banking Act of 1936. The act separated the responsibilities of the banking system and the securities markets and stipulated a specialized banking system (La Francesca 2011, 121–123). Banks could neither underwrite shareholdings in industrial companies nor could they be controlled by them (Vozzella, Gabbi and Matthias 2015, 15).

Financial stability or political control?

Draghi (1992, 392) and La Francesca (2011, 122) see financial stability concerns as the main driver for the introduction of this regime. However, as in the cases of the United States and Belgium, the sincerity of this motive is questionable. Forsyth (1991, 201) regards the authorities' desire for control over the credit system and a long-standing conflict with the banks' managements as decisive grounds for the reform.

Liberalization for EU single market

Belgium and Italy both switched to universal banking regimes in 1993 when the two countries implemented directive 92/481 of the European Union (La Francesca 2011, 146). Following this directive, all member countries of the European Union adopted a wide definition of banking activities, inspired by German universal banking, to allow for the European single market (Cassiers et al. 1998, 150).

2.1.3 American influence on Japanese and Taiwanese regulation

The American influence on Japanese and Taiwanese banking regimes was so direct that financial stability considerations can be ruled out as motives. In 1948, American occupation authorities dismantled Japan's dominant industrial groups, the *zaibatsu,* to limit their influence on post-war Japan. To prevent the former *zaibatsu* banks from conducting securities business, the occupation authorities implemented a Glass–Steagall regime (Patrikis 1998, 580). Japan liberalized its banking sector in 1999 in an attempt to render it more internationally competitive. This liberalization entailed the abolishment of the separation between banking and securities business (Patrikis 1998, 583; Flath 2005, 266, 293).

American technical assistance for Taiwan

In Taiwan, after the Chinese civil war, the Kuomintang regime was highly dependent on American aid and technical assistance. To contain communism, such aid and assistance led to strong and institutionalized American influence. For example, the Taiwanese Economic Stabilization Board held its deliberations in English, with American officials participating as de facto full members. Based on American suggestions, Taiwan implemented a package of economic reforms (Haggard and Zheng 2013, 441–446). In 1968 Taiwan enacted its Securities and Exchange Act modelled after the American and Japanese legislation (Ong 2009, 4). The specialized banking system was abolished in 2001 when Taiwan liberalized its banking industry (Huang and Lin 2011, 2–3).

2.1.4 Natural evolution in Britain, its Dominions and France

The Glass–Steagall Act has been a popular subject in the economic literature since the period of financial liberalization in the 1980s and 1990s. This fame of Glass–Steagall obscures the fact that the British financial system specialized long before and had served as the standard counterexample to universal banking during the early twentieth century (Weber 1938).

Evolution towards bank specialization

The British system of specialized banking was based on a complex mixture of statutory and self-regulatory provisions (Pimlott 1985, 142). Clearing banks were the equivalent to commercial banks in today's terms. They were focused on the provision of payment services, deposit-taking activities and short-term corporate lending (Davies et al. 2010, 322). The non-clearing banks comprised of members of the Accepting Houses' Committee that were mainly active in the business of accepting and guaranteeing commercial bills (Grady and Weale 1986, 4, 36). These merchant banks provided trade finance, a limited volume of lending, fund management and conducted corporate finance business. They served as underwriter and priced and placed issues in combination with separate brokers (Bowen, Hoggarth and Pain 1999, 280). Also, at the London Stock Exchange, a division of labour developed in the nineteenth century. Brokers acted only as agents for their clients while so-called jobbers acted as market makers and could not deal directly with the investing public (McMahon 1984, 47).

Specialization agreed among banks

The specialization in British banking was largely non-statutory, evolved through distinct self-regulating clubs or associations and was encouraged by the Bank of England (Peeters 1988, 371). Thomas (2004, 117–118) argues that this specialization was the result of rationalization and served as a defensive reaction to the increasing complexity of finance. D'Have and Quentyn (1987, 98) regard the self-interests of an oligopolistic banking cartel as the reason for the development of this division of labour. With regard to the division of labour at the stock exchange, Neal and Davis (2006) sees path-dependency in combination with the initial membership structure as crucial.

Implausible stability motive

In summary, there is no evidence suggesting the specialized banking system in Britain was deliberately implemented to safeguard financial stability. Such a motive even seems implausible as the specialization evolved over time and as a result of interacting stakeholders, rather than a centralized decision. The specialization requirement between banking and securities business was lifted in the course of the *big bang* liberalization of 1986 (Hebb and Fraser 2003, 82–83).

Specialization in British dominions

Similar specialized systems had evolved in the British Dominions, although not because of interference by the homeland. As in Britain, there is no evidence that the development of specialized banking systems in the Dominions was driven by financial stability concerns. Canadian banks were restricted in their involvement in the securities industry by custom and tradition (Hebb and Fraser 2002, 1937). Securities dealers were involved with the underwriting and selling of bond and stock issues under a legislative framework established by provincial governments (Freedman 1992, 373). Universal banking became permissible with the Banking Act of 1987 (Hebb and Fraser 2002, 1938). In Australia, Edey and Gray (1996, 7) argue that a division of labour between banking and securities business evolved naturally and that competition across the two sectors was limited. Banking controls implemented to counter inflation during the Second World War formally established this segmentation. The controls were maintained after the war and constrained bank lending. As a result, an increasing proportion of corporate investment was intermediated through non-bank financial institutions and financed through the issuance of bonds (Black et al. 2012, 7–10). The distinction between so called *trading banks* and *savings banks* was removed in 1988 (Battellino and McMillan 1989, 28). Similar to Australia, New Zealand introduced monetary controls during the Second World War. These measures included, among other things, the regulation of asset portfolios (Hunt 2009, 34). Owing to stock exchange regulations, banks were also prohibited to incorporate stockbrokers (Davis 1998, 21). These regulations were liberalized in 1986 (Tanndal and Waldenström 2016, 56).

Similar evolution in France

Also in France, some degree of specialization in the banking system developed right up to the First World War, initially without explicit regulatory guidance. Denizet (1970, 450) explains the division of labour between *banques d'affaires* and *banques de dépôts* simply with tradition. Brambilla (2010, 103, 106) explains this development with the importance of Paris as an international financial centre. Paris had a comparatively deep and liquid securities market that lessened needs for banks' direct industrial investments. While Denizet (1970, 450) regards specialization in interwar France as comparable to Britain, Weber (1938, 11) describes it as middle ground between specialized and universal banking. However, in 1941 Vichy France implemented a statutory and stricter specialization (Gourio 1984, 6). Also for this case, financial stability concerns do not seem to have been the driver of bank activity restrictions. Bouvier (1973, 186) judges this reform to be more politically than economically motivated. France abandoned its specialized banking system in 1984 for competitiveness reasons, during a period of international liberalization (Gourio 1984, 6–7).

2.2 DATA

The econometric analysis aims to determine the effects of specialized banking systems on financial stability. I therefore collect data on banking crises and specialized banking systems for a macro panel of high-income countries. This data is complemented by an array of control variables commonly used in the empirical literature on the determinants of banking crises.

2.2.1 Country sample

The sample includes thirty countries (and non-sovereign jurisdictions) with 1196 yearly observations from 1970 to 2011. I include countries that qualify as high-income according to the World Bank's World Development Indicators database since 2000 or prior. I exclude countries with populations below a hundred thousand and non-sovereign jurisdictions with populations below one million because available information on banking crises appears incomplete (e.g. Bermuda, Liechtenstein, Macau, Monaco). I further exclude member countries of the Organisation of Islamic Cooperation because Islamic banking systems differ fundamentally from conventional banking systems.

Data overview

Table 2.1 lists all included countries, the years when specialized banking systems were in place and the years when banking crises were observed. Owing to missing data, some countries are not included for the entire sample period.

2.2.2 Prevalence and severity of banking crises

I use multiple separate dependent variables to analyse the impact of specialized banking systems on the prevalence and severity of banking crises.

Crisis prevalence

Crisis prevalence is a dummy variable that indicates the presence of banking crises for each country and year. Crisis years are compiled from the exist-

Table 2.1 Included countries and banking crises

Country	Sample years	Specialized banking	Banking crises
Australia	1970–2011	1970–1988	1989–1991
Austria	1970–2011		2008–2010
Belgium	1970–2011	1970–1983	2008–2009
Canada	1970–2011	1970–1987	1983–1985
Cyprus	1987–2011		2000–2001, 2009–2011
Denmark	1970–2011		1987–1992, 2008–2009
Finland	1970–2011		1991–1994
France	1970–2011	1970–1984	1991–1995, 2008–2010
Germany	1970–2011		1974–1975, 2008–2010
Greece	1995–2011		2008–2011
Hong Kong	1990–2011		1998–1999
Iceland	1970–2011		1985, 1993, 2007–2011
Ireland	1970–2011		1985, 2007–2011
Israel	1970–2011		1977–1978, 1983–1985
Italy	1970–2011	1970–1994	1991–1993, 2008–2011
Japan	1970–2011	1970–1999	1992–1999
Luxembourg	1990–2011		2008–2011
Netherlands	1970–2011		1975, 2008–2011
New Zealand	1970–2010	1970–1986	1987–1990
Norway	1970–2011		1987–1989, 2008–2011
Portugal	1993–2011		2008–2009
Singapore	1970–2011		1982–1983
Slovenia	1995–2011		2008–2011
South Korea	1971–2011		1980, 1997–1998
Spain	1970–2011		1977, 1980–1987, 2008–2011
Sweden	1970–2011		1990–1994, 2008–2010
Switzerland	1970–2011		1991–1993, 2008–2010
Taiwan	1977–2011	1970–2001	1983, 1995
United Kingdom	1970–2011	1970–1986	1973–1976, 1981–1982, 1991–1992, 2007–2011
United States	1970–2011	1970–1999	1984, 2007–2011

ing literature on banking crises. Table 2.1 lists all identified crisis episodes per country. There is a total of 160 crisis years spread over fifty-one crisis episodes. Figure 2.1 shows the yearly number of countries in crisis over the sample period.

Crisis severity, depth and duration

Crisis severity, crisis depth and *crisis duration* are constructed according to the severity index of Reinhart and Rogoff (2014, 51). *Crisis depth* is defined as the absolute value of the maximum percentage decline in real

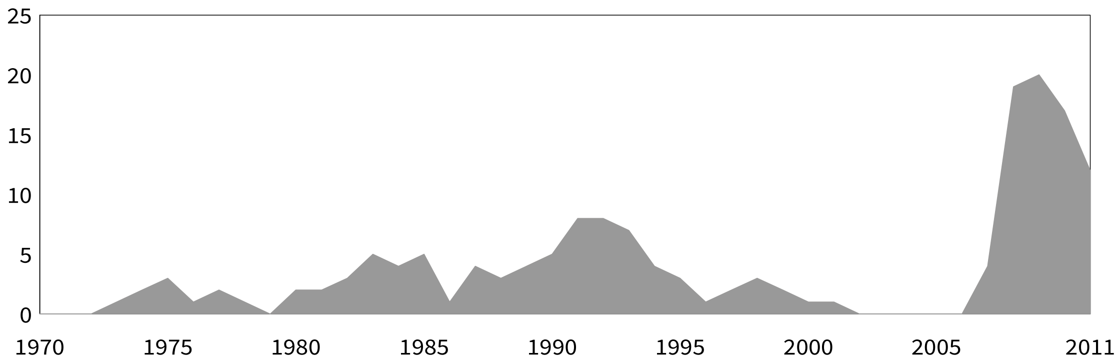

Figure 2.1 Number of sample countries in banking crises over time

GDP per capita during a crisis, based on GDP and population data from the Penn World Table (Feenstra, Inklaar and Timmer 2015). There is some discretion in choosing the exact reference point for this decline because the sources only state the starting year of each crisis and not a specific starting day. If the initial crisis year already exhibits a decline in real GDP per capita, *crisis depth* describes the maximum decline relative to the year preceding the beginning of the crisis. If the downturn starts later, the variable describes the maximum decline relative to the initial crisis year. *Crisis duration* is defined as the number of years it takes for real GDP per capita to recover to pre-crisis level. If no decline in GDP per capita is observed for a crisis episode, the duration is based on the crisis years stated in the sources for *crisis prevalence*. Any renewed downturn is considered part of the same crisis if the second downturn takes place before the economy has reached its prior peak. For countries that were still in a crisis in 2011, I consider GDP development beyond the end of the sample period. The available GDP data from Penn World Table stretches until 2014. For countries still in crisis in that year, I estimate *crisis duration* based on reported and estimated growth rates for the years after 2014 (IMF 2017a; 2017b).[3] *Crisis severity* is constructed by simply adding the two components *crisis depth* and *crisis duration*.

3 These countries are Cyprus, Greece, Iceland, Italy and Spain.

2.2.3 Specialized banking

The variable of interest for this analysis is *specialized banking*. This dummy variable is derived from the historical analysis in section 2.1. The variable indicates years during which a country had regulations in place that restricted banks' securities business, similar to the American Glass–Steagall Act.

2.2.4 Control variables

I include several control variables that are correlated with my dependent variables and my variable of interest so that their omission could bias the estimated coefficient of the variable of interest. I also include controls that are uncorrelated with the variable of interest and serve to increase the precision of the estimate. The included controls are commonly applied in the existing literature on crisis determinants (Demirgüç-Kunt and Detragiache 1998; 2002; Beck, Demirgüç-Kunt and Levine 2006; Joyce 2011; Gourinchas and Obstfeld 2012).

Output gap is constructed as the percentage deviation of output-side real GDP from its Hodrick-Prescott trend. *Output gap* is not significantly correlated to the variable of interest and its omission would thus not bias the estimate. However, the variable captures macroeconomic shocks that can be a major driver of banking crises by increasing the share of non-performing loans. *Output gap* is thus included to reduce the error variance and increase the precision of the estimate (Wooldridge 2008, 205). Based on the findings of Gourinchas and Obstfeld (2012) we can expect *output gap* to be positively correlated with *crisis prevalence* and *crisis severity*. Output gap

Inflation measures the annual percentage change in price level in local currency. Controlling for *inflation* seems appropriate because *inflation* serves as a proxy for macroeconomic mismanagement and may thus be associated with the prevalence and severity of banking crises (Demirgüç-Kunt and Detragiache 1998, 93). At the same time, *inflation* correlates with the variable of interest because inflation levels were generally higher in earlier sample years, when *specialized banking* systems were more prevalent. Not Inflation controlling for *inflation* could thus bias the estimate by incorrectly attributing effects of *inflation* to *specialized banking* systems.

Trade and financial openness

Existing studies frequently control for countries' economic openness. More open and interconnected economies might be more prone to financial contagion and might thus be more likely to experience banking crises. Within this study's sample period, openness is closely linked to the emergence and spread of neo-liberalism. This political trend emerged in Anglo-Saxon countries and later spread to other developed economies (Konzelmann, Fovargue-Davies and Schnyder 2012, 499–502). As established in section 2.1, Anglo-Saxon countries were historically more disposed to have specialized banking systems. Controlling for economic openness is thus necessary to distinguish between the effects of (declining) specialized banking systems and more general economic liberalism. The literature applies various approaches to measure economic openness. I include *trade openness* and *financial openness*. *Trade openness* measures the sum of merchandise exports and imports per GDP. *Financial openness* is constructed as the sum of total foreign assets and total foreign liabilities divided by GDP. Both variables are also applied in the existing literature by Joyce (2011).

Credit

Credit measures domestic credit to the private sector as percentage of the GDP. The variable not only serves to capture credit bubbles; in the longer run, the variable exhibits an increasing trend and thus captures the level of development of a financial sector. Svirydzenka (2016, 21) shows that *credit* correlates with more sophisticated indicators for financial sector development but offers longer time series. However, financial sector development also coincides to some extent with a decrease in the prevalence of specialized banking systems. It is thus necessary to control for *credit* to compare financial sectors that, apart from specialized banking regulation, have a similar level of development. Demirgüç-Kunt and Detragiache (1998, 92) and Gourinchas and Obstfeld (2012) find *credit* to be positively associated with the probability of banking crises.

Deposit insurance

Deposit insurance is a dummy variable indicating the availability of an explicit deposit insurance scheme. Controlling for *deposit insurance* seems prudent because its widespread introduction among sample countries falls in the same period as the decline of specialized banking systems: In 1970

Table 2.2 Summary statistics

	Mean	Median	Min.	Max.	Within std. dev.	Between std. dev.	Overall std. dev.
Crisis prevalence	0.143	0.000	0.000	1.000	0.347	0.071	0.350
Crisis severity	1.547	0.000	0.000	34.227	4.524	1.742	4.702
Crisis depth	0.825	0.000	0.000	18.227	2.692	1.017	2.802
Crisis duration	0.722	0.000	0.000	16.000	2.036	0.792	2.116
Specialized banking	0.188	0.000	0.000	1.000	0.296	0.260	0.391
Output gap	−0.141	0.215	−33.819	24.574	6.648	0.988	6.615
Inflation	0.670	0.044	−3.917	20.440	1.554	1.439	2.134
Trade openness	13.766	0.748	0.102	286.303	12.407	35.421	38.660
Financial openness	6.259	1.617	0.179	240.749	6.597	31.165	24.550
Domestic credit	82.836	75.260	0.059	312.120	34.542	31.604	45.257
Deposit insurance	0.666	1.000	0.000	1.000	0.372	0.299	0.472
Global Financial Crisis	0.133	0.000	0.000	1.000	0.340	0.000	0.340

only four sample countries had deposit insurance schemes in place while in 2011 only one country did not have such a scheme. While explicit deposit insurance is intended to reduce the incidence of bank runs, it may increase moral hazard. Demirgüç-Kunt and Detragiache (2002) find a positive association of explicit deposit insurance with crisis probability and severity.

Global Financial Crisis

Global Financial Crisis is a dummy variable indicating the period from the Global Financial Crisis to the end of the sample period, i.e. the years 2007 to 2011. During these years the variable is positive for every country, whether the country is experiencing a crisis or not. The dummy serves to account for factors that are not observed by other explanatory variables but influence crisis prevalence across all countries. This variable therefore serves as a substitute for year dummies that are not included in the subsequent regression due to collinearity issues. *Global Financial Crisis* accounts for the – in intertemporal comparison – particularly pronounced contagion in the years after 2007 and should thus capture the most important time fixed effects.

Table 2.2 shows the summary statistics for each variable, table 2.3 an overview of the definitions and sources.

Table 2.3 Definitions and sources of variables

Variable	Description and sources
Dependent variables	
Crisis prevalence	Dummy indicating banking crisis years for each country, compiled from Lindgren, Garcia and Saal (1996, 21–35), Demirgüç-Kunt and Detragiache (1998, 92), Bordo et al. (2001, 37–41), Glick and Hutchison (2001, 64–67), Caprio and Klingebiel (2003), Atkinson and Morelli (2011, 66), Valencia and Laeven (2012, 24–26), Reinhart and Rogoff (2014, online appendix), Jordà, Schularick and Taylor (2017, online appendix) and Lo Duca et al. (2017, 53–54)
Crisis severity	Index constructed as the sum of *crisis depth* and *crisis duration*
Crisis depth	Maximum decrease of real GDP per capita in percent, based on Penn World Table (Feenstra, Inklaar and Timmer 2015)
Crisis duration	Duration in years until pre-crisis level in real GDP per capita is reached, based on Penn World Table (Feenstra, Inklaar and Timmer 2015); if real GDP per capita does not decline, duration is derived from sources on *crisis prevalence*
Variables of interest	
Specialized banking	Dummy indicating years in which the respective country had activity restrictions for banks' securities business in place; compiled from various secondary sources from the economic, history and legal literature, see table 2.7 in appendix for detailed sources
Control variables	
Output gap	Percentage deviation of output-side real GDP from its Hodrick-Prescott trend, based on data from Penn World Table (Feenstra, Inklaar and Timmer 2015)
Inflation	Annual percentage change of price level from Penn World Table (Feenstra, Inklaar and Timmer 2015)
Trade openness	Sum of merchandise exports and imports divided by GDP, all from Penn World Table (Feenstra, Inklaar and Timmer 2015)
Financial openness	Sum of total foreign assets and total foreign liabilities divided by GDP, all from the updated External Wealth of Nations Mark II database (Lane and Milesi-Ferretti 2007)
Credit	Domestic credit to private sector as percentage of GDP, from the World Bank' World Development Indicators and, for Taiwan, Datastream
Deposit insurance	Dummy indicating availability of an explicit deposit insurance scheme, compiled from Demirgüç-Kunt, Karacaovali and Laeven (2005, 20), Demirgüç-Kunt, Kane and Laeven (2014, 32) and Bank of Israel (2015)
Global Financial Crisis	Dummy indicating the years 2007 to 2011

2.3 METHODS

Country fixed effects

I follow the approach of JOYCE (2011) by estimating the prevalence of banking crises with multivariate conditional fixed-effects logistic regression. The inclusion of country fixed effects allows to account for time-invariant differences among sample countries, such as cultural or lasting institutional aspects. The *F*-tests on the joint significance of the fixed-effects dummies indicate that a fixed-effects specification is preferable to pooled regression.

Thanks to a relatively long sample period and a comprehensive list of banking crises, every sample country includes at least one crisis episode. The inclusion of country fixed effects therefore does not lead to a loss of observations by excluding countries without variation in the dependent variable. Several other studies such as DEMIRGÜÇ-KUNT and DETRAGIACHE (1998), DEMIRGÜÇ-KUNT and DETRAGIACHE (2002) and BECK, DEMIRGÜÇ-KUNT and LEVINE (2006) resort to pooled regression for this reason. However, these authors also acknowledge the advantages of fixed-effects regression (DEMIRGÜÇ-KUNT and DETRAGIACHE 1998, 90).

No year dummies due to collinearity issues

While a long and narrow panel is advantageous for the inclusion of country fixed effects, it causes collinearity issues when including time fixed effects. I thus cannot include year dummies. However, other control variables should capture cross-sectionally similar developments over time. In addition, the dummy variable for the *Global Financial Crisis* constitutes a multi-year fixed-effects variable that can be assumed to capture the most relevant time fixed effects.

Addressing feedback effects on controls

I include separate analyses where the years after the initial crisis year are excluded for every multi-year crisis episode. This accounts for possible feedback effects from banking crises on included macroeconomic control variables (DEMIRGÜÇ-KUNT and DETRAGIACHE 1998, 89; JOYCE 2011, 881).

Pooled regression for crisis severity

When analysing the effects of *specialized banking* on *crisis severity,* I follow the approach of DEMIRGÜÇ-KUNT and DETRAGIACHE (1998, 101–103) and limit the sample to observations during crisis episodes. In addition, I analyse the individual additive components of the *crisis severity* index – *crisis depth* and crisis *duration* – as alternative dependent variables. In contrast to the analysis of *crisis prevalence,* I use pooled ordinary least square estimation when analysing the effects on *crisis severity* and its components. This is preferable for two reasons: First, subsampling for crisis observations reduces the available degrees of freedom necessary to include country dummies. Second, the subsample of crisis episodes is highly imbalanced and consequently barely resembles a panel. Banking crises happen at different points in time across countries and there are long gaps of non-crisis periods between crisis episodes. Country fixed effects would thus be of little use. *F*-tests on the joint significance of fixed-effects dummies support the omission of country fixed effects. To account for multi-year crisis episodes, I cluster standard errors by crisis episode. For this purpose, simultaneous banking crises in different countries constitute separate crisis episodes.

Subsample analyses to avoid feedback

As in the analysis of *crisis prevalence,* I account for possible feedback effects by analysing variants where observations after each initial crisis year are excluded. Since clustering standard errors by crisis episode is not possible in these cases, I report heteroskedasticity-consistent standard errors for these results.

2.4 RESULTS

The results of the empirical analysis indicate that *specialized banking* is not associated with a decrease in the prevalence of banking crises. The analysis even yields limited evidence for specialized banking systems being more susceptible to banking crises than universal banking systems. However, the results indicate that in the case of a banking crisis, *specialized banking* systems endure less severe and less deep crises than universal banking systems.

2.4.1 Limited evidence for specialization leading to more crises

Table 2.4 reports four conditional fixed-effects logistic regressions on the determinants of *crisis prevalence.* Model (1) is the standard model including all available observations but excluding the dummy variable for the *Global Financial Crisis.* Model (2) includes the dummy for observations after 2007 to limit the effect of the *Global Financial Crisis* on the relation between *specialized banking* and *crisis prevalence.* The dummy accounts for the particularly

Table 2.4 Conditional fixed-effects logistic regression analysis of crisis prevalence

	Crisis prevalence			
	(1)	(2)	(3)	(4)
Specialized banking	0.706*	0.873**	0.676	0.776
	(0.373)	(0.375)	(0.619)	(0.611)
Output gap	–0.032**	–0.042***	0.066**	0.048*
	(0.015)	(0.016)	(0.027)	(0.028)
Inflation	–0.006	–0.018	0.122	0.109
	(0.113)	(0.110)	(0.149)	(0.149)
Trade openness	0.025*	0.010	0.050*	0.029
	(0.013)	(0.012)	(0.030)	(0.024)
Financial openness	0.068**	0.024	0.023	–0.001
	(0.028)	(0.020)	(0.023)	(0.024)
Credit	0.015***	0.006*	0.010**	0.002
	(0.003)	(0.003)	(0.004)	(0.005)
Deposit insurance	0.423	0.319	0.355	0.207
	(0.323)	(0.324)	(0.481)	(0.495)
Global Financial Crisis		2.009***		1.878***
		(0.282)		(0.437)
Observations	1121	1121	1012	1012
Chi-squared	89.347***	142.676***	26.412***	45.236***
Pseudo *R*-squared	0.115	0.184	0.082	0.140

Results are estimated with conditional fixed-effects logistic regression. Models (2) and (4) include a dummy for the years 2007–2011 to account for unobserved common factors contributing to the Global Financial Crisis. Models (3) and (4) include only the initial year of each crisis to reduce potential feedback effects. Standard errors are in parentheses. Levels of significance at 10%, 5% and 1% are denoted by *, ** and ***.

widespread contagion during that period. Model (3) equals model (1) but, to reduce feedback effects, excludes all crisis observation after the initial year of each crisis episode. Model (4) combines the inclusion of the *Global Financial Crisis* dummy from model (2) and the reduced sample from model (3).

More crises in specialized regimes

Model (1) indicates a weakly significant positive effect of *specialized banking* on *crisis prevalence.* When including a dummy variable for the period of the *Global Financial Crisis* in model (2), this effect becomes stronger and more significant. In models (3) and (4) the relation becomes insignificant. However, models (3) and (4) use a reduced sample size. It is thus unclear whether this lack of statistical robustness is caused by the reduction in observations or whether it is the result of model uncertainty (Neumayer and Plümper 2017, 47). It is common practice in the existing literature to check variants that exclude crisis years after the initial years of each crisis episode. However, the historic analysis in section 2.1 indicates that the maintenance or abolishment of specialized banking systems between 1970 and 2011 was not endogenous to the prevalence of banking crises. It thus appears probable that the reduced effect sizes for *specialized banking* in models (3) and (4) are just the result of the reduced sample size. We should therefore not discard the evidence for positive effects of *specialized banking* on *crisis prevalence* from models (1) and (2). Universal banking systems could accordingly benefit from diversification to reduce the probability of banking crises. In any case, the results do not support our initial hypothesis that *specialized banking* reduces the prevalence of banking crises.

Odds ratios facilitate result interpretation

A closer look at effect sizes helps to assess economic significance. However, because logistic regression is a non-linear model, only the signs of the estimated coefficients are directly interpretable, but not the size of the coefficients. Odds ratios are more helpful in this regard. Table 2.5 reports the odds ratios for the variable of interest and the related 95% confidence intervals. The results suggest that the odds of *specialized banking* countries experiencing a banking crisis are approximately twice as high as for universal banking countries.

Table 2.5 Odds ratios for the effect of specialized banking on crisis prevalence

	(1)	(2)	(3)	(4)
Odds ratio	2.026*	2.394**	1.967	2.174
95% confidence interval	0.976–4.206	1.148–4.993	0.585–6.618	0.656–7.199

Columns (1) to (4) show the odds ratios and the 95% confidence intervals for the models presented in Table 2.4. Models (3) and (4) include only the initial year of each crisis to reduce potential feedback effects. Standard errors are in parentheses. Levels of significance at 10%, 5% and 1% are denoted by *, ** and ***.

To obtain more intelligible results, we can convert the odds ratio to changes in probability. However, because the coefficients for the fixed effects are unknown in logistic fixed-effects regressions, there is no standard approach to specify the effect size in terms of probability (Kitazawa 2012, 192; Pforr 2013; Santos Silva and Kemp 2016, 4–13). Zhang and Yu (1998) provide a popular approach for such a conversion. Under this approach, the odds ratio can be converted to the risk ratio based on an assumption regarding the initial probability of individuals that have not been exposed to the treatment, so that:

Interpreting effect size in logistic results

$$Risk\ ratio = \frac{P_{exposed}}{P_{non\text{-}exposed}} = \frac{odds\ ratio}{1 - P_{non\text{-}exposed} + P_{non\text{-}exposed} \times odds\ ratio} \qquad (2.1)$$

where $P_{non\text{-}exposed}$ describes the initial crisis probability of universal banking countries and $P_{exposed}$ the crisis probability of specialized banking countries.

To obtain a meaningful initial crisis probability we can observe the prevalence of banking crises among universal banking countries. In our sample, there are 137 crisis years during 910 observations of universal banking jurisdictions. This implies a non-exposed crisis probability of 15%. Using this reference point, an odds ratio of 1.967 results in a risk ratio of 1.718. Thus replacing all universal banking observations in the sample with specialized banking systems would increase these countries' crisis probability from 15% to 26%. If, instead, we only take the year 2008 for reference, we obtain a non-exposed probability of 63% and thus a risk ratio of 1.222. Switching all countries to specialized banking systems would thus increase their crisis probability in 2008 from 63% to 77%. Given these increases in probability, we can conclude that the observed positive relation between *specialized banking* and *crisis prevalence* is economically significant.

Economically significant effects

2.4.2 Less severe banking crises in specialized systems

Table 2.6 reports pooled ordinary least squares regression results for the determinants of *crisis severity* and its components. The sample is reduced to only crisis years. Models (6) and (7) report the results on *crisis severity*.

Models (8) and (9) report the results on *crisis depth* and models (10) and (11) report the results on *crisis duration*. While models (6), (8) and (10) include all crisis years, models (7), (9) and (11) exclude years after the initial year of each crisis episode.

Less severe and less deep crises

Model (6) indicates a significant negative relation between *specialized banking* and *crisis severity*. However, the effect becomes smaller and insignificant in model (7), which includes only the first observation of each crisis episode. The separate analysis of *crisis depth* and *crisis duration,* the two additive components of *crisis severity,* clarifies this picture. No effect is observed for *specialized banking* on *crisis duration* in models (10) and (11). However, we observe a significant negative effect of *specialized banking* on *crisis depth* in models (8) and (9). Universal banking countries thus

Table 2.6 Pooled analysis of crisis severity, depth and duration

	Crisis severity		*Crisis depth*		*Crisis duration*	
	(6)	(7)	(8)	(9)	(10)	(11)
Specialized banking	–3.699**	–2.051	–3.349**	–2.007*	–0.351	–0.044
	(1.817)	(1.483)	(1.396)	(1.089)	(0.757)	(0.734)
Output gap	–0.016	0.376**	–0.055	0.235**	0.039	0.141**
	(0.118)	(0.161)	(0.086)	(0.114)	(0.047)	(0.065)
Inflation	–0.902***	–0.313	–0.644**	–0.285*	–0.259**	–0.027
	(0.287)	(0.225)	(0.249)	(0.163)	(0.103)	(0.109)
Trade openness	–0.028**	–0.010*	–0.014*	–0.004	–0.015***	–0.007**
	(0.011)	(0.006)	(0.008)	(0.004)	(0.004)	(0.003)
Financial openness	0.009	0.034***	0.013	0.030***	–0.005	0.004
	(0.011)	(0.009)	(0.008)	(0.007)	(0.003)	(0.003)
Credit	0.029	0.036*	0.016	0.020	0.013*	0.016*
	(0.018)	(0.019)	(0.014)	(0.013)	(0.007)	(0.009)
Deposit insurance	3.564	0.848	1.990	0.240	1.574*	0.608
	(2.416)	(2.048)	(1.888)	(1.496)	(0.914)	(0.895)
Constant	5.628***	3.779**	2.992*	2.101*	2.636***	1.678*
	(1.978)	(1.818)	(1.531)	(1.205)	(0.816)	(0.839)
Observations	160	51	160	51	160	51
F-test	12.784***	16.706***	12.913***	21.798***	7.558***	9.497***
Adjusted *R*-squared	0.175	0.263	0.156	0.224	0.167	0.182

Models (7), (9) and (11) include only the initial year of each crisis to reduce potential feedback effects. Results are estimated with ordinary least squares regression. Standard errors are in parentheses. Levels of significance at 10%, 5% and 1% are denoted by *, ** and ***.

experience on average 2 to 3.3 percentage points stronger declines in GDP during banking crises than countries with specialized banking systems. This effect size appears economically significant.

Alternative financing from capital markets?

A possible explanation for deeper banking crises in universal banking countries could be due to the higher dependence of such countries on bank financing (Demirgüç-Kunt and Levine 1999). This dependence leaves such economies with little financing alternatives in the case of a banking crisis, as the capital market remains underdeveloped.[4] The results are deeper crises.

2.4.3 Discussion of control variables

This subsection discusses the results regarding control variables' effects on *crisis probability, crisis severity* and its components, as presented in tables 2.4 and 2.6.

Strong feedback effects on output gap

Output gap exhibits a negative relation with crisis prevalence in models (1) and (2), a result that contradicts our theoretical expectations. However, when we exclude crisis observations after the initial year of each crisis episode, this result is reversed to a significant positive relation. A similar feedback effect is also observed for the relation between *output gap* and *crisis severity* and its components. While these relations are insignificant when analysing the whole sample, they become significantly positive in models (7), (9) and (11). The effects from *output gap* on all analysed dependent variables are thus as expected when we account for feedback effects.

Inflation less relevant for rich countries

Inflation yields no significant effects on *crisis prevalence*. Also with regard to *crisis severity* and its components, the observed relations are only significant when we do not account for feedback effects. These results suggest that inflation is irrelevant as indicator for macroeconomic mismanagement in high-income countries. Different findings in the existing literature

4 I cannot effectively control for the development level of capital markets because data on volumes of debt securities are only available starting from the 1990s, which would leave insufficient degrees of freedom for statistical inference (BIS 2018).

are most likely owed to these studies including emerging market economies in their samples (Demirgüç-Kunt and Detragiache 1998; Joyce 2011).

More severe crises in financially open economies

Trade openness and *financial openness* do not yield robust results on effects on *crisis prevalence.* With regard to *crisis severity* we observe evidence of a negative effect from *trade openness.* This robust negative relation is also observed between *trade openness* and *crisis duration* but not between *trade openness* and *crisis depth.* These findings suggest that more developed international trade might help economies to recover more quickly after banking crises. Increased *financial openness,* however, appears to render banking crises deeper and thus more severe.

More crises in more developed financial systems

The results for *credit* indicate a significant positive relation with crisis prevalence, except for model (4). The results suggest, as expected, that more leveraged economies with more developed financial systems are more prone to banking crises. In models (7), (10) and (11) we further observe some evidence that more developed financial systems experience longer and more severe banking crises.

Insignificant results for deposit insurance

Regarding *deposit insurance* we observe no significant effects on *crisis prevalence* and *crisis severity* or its components, except for a weakly significant positive effect on crisis duration in model (10). The lack of a robust significant effect does not correspond to the findings of Demirgüç-Kunt and Detragiache (2002). These authors report a positive association of deposit insurance and banking crises and attribute this finding to moral hazard stemming from deposit insurance. A possible explanation could be that Demirgüç-Kunt and Detragiache (2002) include high-income and emerging economies in their sample. Future research would have to indicate whether moral hazard from deposit insurance is stronger in emerging economies with weaker institutions.

More crises after 2007

The dummy variable for the years of the *Global Financial Crisis* unsurprisingly yields a significant positive association with *crisis prevalence.* This finding reflects the relevance of contagion during these crisis years and does not qualitatively change the effect of the variable of interest.

2.5 CONCLUSION

In the policy discussion, after the Global Financial Crisis, reference was made to the potentially beneficial effects the American Glass–Steagall Act may have had on financial stability. This study reviews how far the Glass–Steagall Act and other historic specialized banking systems can serve as a model to address financial stability issues. To this end, I compile a comprehensive dataset on specialized banking systems in high-income countries after 1929. In total, I identify ten high-income countries that at one point had specialized banking systems in place after that year. I conduct a qualitative historic assessment on how regulatory restrictions on banks' securities business have emerged in each affected country and whether these regimes were motivated by financial stability considerations. Further, I review the actual effects these regimes had on financial stability. I use a panel of thirty high-income countries between 1970 and 2011 to assess the effects of specialized banking systems on crisis probability and severity.

Financial stability not relevant for past specialized regimes

The results from the historic analysis considerably qualify the relevance of financial stability consideration as a political motive for past specialized banking systems. Out of ten high-income countries with specialized banking systems, the literature states financial stability considerations as political motive for only three: the United States, Belgium and Italy. However, for these three countries the literature presents alternative explanations that raise questions about the sincerity of the financial stability motive. In the cases of the United States and Belgium, the literature reports financial institutions lobbying for the separation of banking and securities business. In the case of Italy, the literature suggests that this break-up was part of government efforts to increase political control over the credit system.

More but less severe crises in specialized regimes

Regarding the quantitative analysis, the results provide no support for the popular belief that specialized banking systems are associated with decreased crisis probability. The analysis even yields non-robust evidence of an opposite relation. However, regarding the severity of banking crises, the results correspond to the notion that specialized banking systems are beneficial to financial stability. The results indicate that specialized banking systems experience less deep banking crises in terms of losses in GDP per capita.

Higher dependence on banks in universal banking systems

A probable explanation for these results is that universal banks benefit from diversification to some extent. These diversification benefits allow the banks to better cope with minor shocks in comparison to specialized banks. On the other side of the coin, the real economy tends to rely more on bank financing in universal banking systems. In case of a banking crisis, this leaves relatively little financing alternatives for the real economy, as the capital market remains underdeveloped.

Development of capital markets as alternative policy

Despite evidence for beneficial effects in times of banking crises, Glass–Steagall-like regulation generally does not appear to be an effective answer to financial stability concerns. Such regimes do not reduce the probability of banking crises and there is even some evidence that specialized banking systems increase crisis probability. To reduce the severity of banking crises other policy measures to develop capital market financing should be pursued.

APPENDIX

Table 2.7 Coding of and sources for the specialized banking variable

Country	Specialized banking	Sources
Australia	1938–1988	Battellino and McMillan (1989, 25, 28)
Austria		Weber (1938, 12), Teichova (1994, 25), Collins (1998, 8)
Belgium	1935–1993	Weber (1938, 9), Cassiers et al. (1998, 126)
Canada	<1929–1987	Thomas and Walter (1991, 110–113), Hebb and Fraser (2002, 1938)
Cyprus		Pafitou (2010, 83)
Denmark		Weber (1938, 12–13), Lindblom and Andersson (1997, 181–184), Honkapohja (2012, 8)
Finland		Lindblom and Andersson (1997, 181–184), Honkapohja (2012, 8)
France	1941–1984	Gourio (1984), Cassis (2017, 18–19)
Germany		Tilly (1994, 308), Collins (1998, 8)
Greece		Barth, Nolle and Prabja (2014, 17)
Hong Kong		Jao (1974, 47, 111), Schenk (2003, 144–146), Chan (2011)
Iceland		Pálmason (1994, 533–536)
Ireland		Doherty (1994, 557)
Israel		Ber, Yafeh and Yosha (1997, 1–6), Ribon and Yosha (1999)
Italy	1936–1993	Weber (1938, 14–15), Hertner (1994, 561–592), Panetta (2003, 15–16), De Bonis, Pozzolo and Stacchini (2012, 4)
Japan	1948–1999	Bank of Japan (1973, 48–49), Patrikis (1998, 583), (Flath 2005, 239, 266)
Luxembourg		Lehners (1994, 689, 693, 701)
Netherlands		Weber (1938, 13), Collins (1998, 8)
New Zealand	1938–1986	Grimes (1998, 294), Tanndal and Waldenström (2016, 56)
Norway		Weber (1938, 13), Lindblom and Andersson (1997, 181–184), Honkapohja (2012, 8)
Portugal		Barth, Nolle and Prabja (2014, 19)
Singapore		Lee (1990, 243, 257, 288), Giap and Kang (1999, 89–91), Brown (2006, 8)
Slovenia		World Bank (2012)
South Korea		Park (1996, 249)
Spain		Weber (1938, 15), Collins (1998, 8)
Sweden		Weber (1938, 12–13), Lindblom and Andersson (1997, 181–184), Collins (1998, 8), Honkapohja (2012, 8),
Switzerland		Weber (1938, 13–14), Saunders and Walter (1994, 104–105)
Taiwan	1968–2001	Lin (2009, 1), Huang and Lin (2011, 1111–1112)
United Kingdom	<1929–1986	Hablutzel (1992, 371), Collins (1998, 20–21), Hebb and Fraser (2003, 81–82), Shabani et al. (2015, 85)
United States	1934–1999	Kroszner and Rajan (1994, 810), Barth, Brumbaugh and Wilcox (2000, 191)

CHAPTER THREE

Meta-Analysis of the Literature on Bank Diversification

After the Global Financial Crisis of 2007, the idea of limiting banks' securities business regained popularity in many jurisdictions. Advocates for and against such regulation claimed that the existing empirical literature on bank income diversification supported their position. A closer look at the empirical literature reveals that neither evidence for nor against beneficial effects of bank income diversification clearly dominates. These heterogeneous results can be attributed to the wide range of methodical approaches applied. However, the literature not only provides mixed results across different approaches but also presents varying results of studies with similar approaches.

Technique to investigate discord in literature

This study investigates the discord in the literature by means of meta-regression analysis. Meta-regression analysis helps infer genuine effects and causes for differing results of existing studies that are heterogeneous in sample, approach and results. The technique stems from medical research but has gained increasing popularity in economics in recent years.

Existing meta-regression analyses

Existing meta-regression analyses in economics cover a wide range of topics. They range from employment effects of minimum wages (Card and Krueger 1995; Doucouliagos and Stanley 2009) over aggregating estimates for demand elasticities (Gallet and List 2003; Knell and Stix 2005; Gallet 2010; Gallet and Doucouliagos 2014) to drivers of foreign direct investments (Feld and Heckemeyer 2011; Iamsiraroj and Doucouliagos 2015). To my knowledge, there are currently only two meta-regression analyses in banking: one on frontier efficiency measurement (Iršová and Havranek 2010) and one on relationship lending (Kysucky and Norden 2016).

Contribution to the literature

The study at hand follows the predominant approach in economic meta-regression analysis as developed by Stanley and Jarrell (1989), Stanley (2008) and Stanley and Doucouliagos (2012). This study is based on 932 regression results from thirty-four primary studies examining the effects of bank income diversification towards non-interest activities. The study contributes to the literature by exploring whether, and how, bank income diversification has a genuine effect on banks' performances. It exploits the limited existing research on fee and trading income to generate more solid evidence on the effects of these types of income. Further, this study explains the heterogeneity of the existing literature by examining the conditions under which beneficial or detrimental effects are observed.

Overview of results

The results from this meta-regression analysis illustrate the high degree of heterogeneity in the existing literature. Whether empirical studies find positive or negative effects of diversification on bank performance depends on the studies' research design. The evidence for underlying genuine effects observable across the body of empirical literature is mixed and for no type of diversification perfectly robust. The most solid evidence observed indicates that diversification towards trading decreases risk-adjusted profitability. Less robust evidence suggests that diversification towards trading increases both profitability and risk. There is also some evidence that diversification towards fee generating activities decreases risk. However, the meta-regression analysis is inconclusive regarding the effects of increased reliance on fee generating activities on profitability and risk-adjusted profitability.

3.1 QUALITATIVE LITERATURE REVIEW

Bank income diversification has been the object of economic research since the beginning of the gradual repeal of the American Glass–Steagall Act in the 1980s. Consequently, a large body of empirical literature investigating the topic has developed. The following literature review illustrates the heterogeneity in the existing literature in terms of, both, methods and findings. It also identifies the main strands of literature that are used for the subsequent quantitative meta-regression analysis. Like the subsequent meta-regression analysis, this review focuses on the risk and profitability implications of bank diversification towards investment banking. Studies focusing on diversification into non-banking industries such as insurance are thus excluded.

3.1.1 Bank activities and related types of income

The empirical literature mostly assesses the relative importance of different banking activities by measuring the proportion of different types of income related to these activities. The most traditional banking activity is characterized by interest income. It results from the difference between the bank's interests generated from loans and mortgages and the interests paid out for customer deposits and debt.

Trading income is not interest income

Interest income does not include the revenue generated from investments in securities. The literature and data providers generally categorize such income as trading income, without further distinguishing whether it derives from proprietary trading and investing or from market making.

Various fee income generating activities

The other main subset of non-interest income includes fees and commissions (hereinafter: fees). This type of income combines very different activities from banking segments such as retail, private, commercial or investment banking. Fee generating activities include deposit services, payment transactions, credit cards, investment management, investment advisory, securities underwriting, loan syndication, and merger and acquisitions advisory.

Limited granularity of available data

Statistically exploitable information from data providers and financial reports are generally limited to differentiating interest, fee and trading income.

3.1.2 Non-interest income

Most studies measure diversification based on accounting figures by distinguishing traditional interest income from non-interest income or measuring assets related to such income. Since non-interest income usually makes up the smaller component, banks are considered more diversified, the more they rely on non-interest income.

Is non-interest income beneficial?

Brewer (1989) finds that a higher proportion of non-loan assets reduces the standard deviation of daily stock market returns of American bank holding companies. Similarly, Li and Zhang (2013) and Köhler (2015) find for Chinese and European banks that higher shares of non-interest income reduce accounting return volatilities.

Or is it detrimental?

In contrast, Lepetit et al. (2008) and Gambacorta and van Rixtel (2013) find increased shares of non-interest income increase accounting return and risk of international banks. But these studies do not present results on risk-adjusted profitability. For American banks, Demirgüç-Kunt and Huizinga (2010) find risk reducing effects only at very low levels of non-interest income. The authors conclude that non-interest income mostly increases risk without any clear benefits for profitability. For Canadian banks, Calmès and Théoret (2012) find higher shares of non-interest income to be associated with both higher risk and higher risk-adjusted profitability. They also find these results when splitting non-traditional activities in various fee-generating activities and trading. Hidayat, Kakinaka and Miyamoto (2012) conclude that Indian banks that rely more on non-interest income are riskier. Ji et al. (2012) find increased shares in non-interest income decrease risk-adjusted profitability for Taiwanese banks.

3.1.3 Specific types of non-interest income

While many studies analyse combined non-interest income, some differentiate between fees and trading income. Demirgüç-Kunt and Huizinga (2010) find trading to increase both risk and profitability, while fees increase risk without associated increase of profitability. Meslier, Tacneng and Tarazi (2014) find beneficial effects of increased non-interest income on risk, profitability and risk-adjusted profitability from non-interest income, particularly from trading.

Are fees preferable to trading?

In contrast, DeYoung and Roland (2001) find for an American sample that increased fee and trading income shares increase accounting return volatility. They also find that fee income increases profitability while trading income decreases it. Matching this result, Stiroh (2004a) finds that increased trading income reduces risk-adjusted profitability while fee income increases risk-adjusted profitability.

Few studies on more granular income data

Only a few studies are able to exploit more granular data that allow analysing the effects of more granular income subtypes. Kwast (1989) finds that trading activity as a primary dealer tends to reduce banks' overall risk, while engagement as a non-primary dealer increases risk. These studies are too few and too heterogeneous to be included in detail in the subsequent meta-regression analysis. Only their results regarding fees and trading income are included. Stiroh (2004b) finds that commercial and industrial lending, in contrast to mortgage and consumer lending, is associated with lower profitability and higher risk of community banks. Stiroh (2004a) finds that fiduciary income from managing trusts is associated with higher risk-adjusted profitability. DeYoung and Torna (2013) find that investment banking and venture capital investments increase banks' default risk while loan servicing and securities brokerage reduce it.

More contradicting evidence

Overall, the literature does not agree in regard to the effects of diversification, neither towards non-interest income in general nor towards fee or trading income individually.

3.1.4 Constructed diversification indices

Several authors construct diversification variables based on a reversed Herfindahl concentration index. In its basic version, this diversification index is:

$$Diversification = 1 - \left(\frac{interest\ income}{operating\ income}\right)^2 - \left(\frac{non\text{-}interest\ income}{operating\ income}\right)^2 \qquad (3.1)$$

where *operating income* is defined as the sum of *interest income* and *non-interest income.*

Is more diversification better?

Applying this or similar diversification measures, Stiroh (2004b) and Stiroh and Rumble (2006) find that increased diversification reduces risk-adjusted profitability for American banks. Altunbas, Manganelli and Marques-Ibanez (2011) observe increased risk for more diversified

European and American Banks, based on occurrence of public support during the Global Financial Crisis. Ben Gamra and Plihon (2011) find the same for banks in emerging market economies, despite increased profitability. Goddard, McKillop and Wilson (2008) also find reduced risk-adjusted profitability for American banks in general but observe a positive correlation for the largest banks.

Or is diversification disadvantageous?

In contrast, Mercieca, Schaeck and Wolfe (2007) find increased risk but also increased risk-adjusted profitability for more diversified banks in the European Union. Busch and Kick (2009) find the same for German banks. Brighi and Venturelli (2013) find beneficial effects of diversification on both risk and risk-adjusted profitability of Italian banks. Lee, Hsieh and Yang (2014) obtain the same results for a group of Asian countries and Sanya and Wolfe (2011) for emerging markets.

Pros and cons of indices

Applying such an index allows measuring diversification with one single variable. The approach also has the advantage that it models a non-linear relation between diversification and risk, as expected from a portfolio theory perspective. However, blending multiple forms of income in one index unnecessarily reduces available information. Also, such indices imply that equal shares from all types of income constitute the maximum level of diversification, which is not necessarily true.

3.1.5 Qualitative industry classifications

Some studies measure diversification through qualitative industry classifications. Geyfman (2005) finds American banks with subsidiaries for securities business from 1985 to 1999 to be less risky than other banks. Hryckiewicz (2014) constructs her own industry classification from banks' income and asset structure. She finds universal banks to have a higher risk-adjusted profitability than focused commercial banks or trading houses.

Contradicting evidence yet again

In contrast, Schmid and Walter (2009) identify diversified and focused financial firms based on the North American Industry Classification System. They find that stocks of more diversified firms are traded at a discount. In summary, the group of studies measuring diversification through industry classification does not provide a uniform picture of the desirability of bank income diversification.

3.1.6 Approaches not based on regression analysis

Counterfactual merger studies are a noteworthy alternative approach to regression analysis. This approach is mainly observed in the early empirical literature, when bank diversification was legally limited in America. Counterfactual merger studies combine accounting income streams or stock returns of commercial banks with securities firms or other financial service providers, accounting for observed covariances. A lower income volatility of the combined hypothetical firms compared to stand-alone banks would prove the existence of diversification benefits. Such a situation occurs, for instance, if securities business is more profitable than commercial banking and the correlation of profits is sufficiently low.

Also discord among counterfactual merger studies

Examples for this strand of literature include Johnson and Meinster (1974) and Saunders and Walter (1994) who find beneficial effects of securities business on risk and profitability. In contrast, Boyd, Graham and Hewitt (1993) find such diversification increases bank risk. Furthermore, Estrella (2001) finds these increases in risk to overcompensate for increases in profitability. So, counterfactual merger studies also provide ambiguous evidence on the desirability of bank diversification into securities business.

Drawbacks of counterfactual merger studies

Counterfactual merger studies have their drawbacks. This type of study ignores benefits from economies of scope and scale. Equally, such studies cannot account for potentially increased agency costs, conflicting business cultures and endogeneity of business strategies. Counterfactual merger studies are not based on regression analysis and are consequently difficult to compare with other discussed approaches. They are therefore excluded from this meta-regression analysis.

3.1.7 Dealing with endogeneity

It is not only diversification that affects bank performance. The relation is most likely reciprocal: bank managers also consider current risk and profitability levels when choosing the degree of diversification (Stiroh 2010, 155–156). This endogeneity may lead to biased and inconsistent estimates of the effects of diversification on bank performance.

Instrumental variables

Some authors apply statistical techniques to correct for endogeneity. Demirgüç-Kunt and Huizinga (2010) use qualitative business model categories as instrumental variable for the share of non-interest income. The authors argue that business model categories are strictly exogenous as they remain constant for all banks during the observation period.

System generalized method of moments

Because strictly exogenous instruments are often unavailable, many recent studies favour the system generalized method of moments (system GMM) by Arellano and Bond (1991). In contrast to the traditional instrumental variable approach, system GMM allows using predetermined instruments. Predetermined instruments are only exogenous for the respective period, but not strictly exogenous over the whole sample period. System GMM thus simplifies the search for instruments because variables can be instrumented with their own lags. The approach allows controlling for endogeneity under conditions where traditional instrumental variables are not available (Greene 2012, 442). This approach is, for instance, applied by Sanya and Wolfe (2011), Gürbüz, Yanik and Aytürk (2013), Lee, Yang and Chang (2014), Meslier, Tacneng and Tarazi (2014) and Köhler (2015).

3.2 DATA FOR SIMPLE AND MULTIPLE META-REGRESSION ANALYSIS

Statistically exploitable meta-data on the economic literature is not readily available. In addition, existing studies on bank income diversification differ from one another in many properties. This situation confronts meta-analysts with a nearly continuous quality space in terms of applied approaches, observed populations and obtained results. Mapping these characteristics requires categorization and thus judgement. Researchers must exercise this judgement in a foreseeable and consistent manner to arrive at replicable findings. This section therefore describes how I select studies to be included in this meta-regression analysis, explains how I construct the data set and provides descriptive statistics.

3.2.1 Identification of relevant primary studies

The first step in carrying out a meta-regression analysis is to create a data set that includes all available and relevant empirical studies. To sample these studies, I first searched the Ideas, ScienceDirect and SSRN databases and Google for the terms "bank income diversification" and "universal banking". Second, I checked the references from the studies found in the initial search. Here, the literature reviews by Gambacorta and van Rixtel (2013), Stiroh (2010), Sanya (2009) and DeYoung and Roland (2001) proved particularly helpful. Third, I used the RePEc-database to search for studies citing hits from the first and second rounds. In each round, I made a preselection based on the information provided in the title and summaries. The search ended February 2016.

Included and excluded studies

The final data set includes published scientific articles, books and unpublished working papers that apply regression analysis to the topic of bank income diversification. As recommended by Stanley and Doucouliagos (2012, 35), if studies present more than one regression result, I include every regression individually unless it does not address the research questions of this meta-regression analysis. In consequence, I exclude observations that focus exclusively on bank income diversification toward insurance activities. Also, purely qualitative studies and merger simulations are excluded as they cannot be aggregated with the predominant methods of meta-regression analysis. For the same reason, some deregulation event and merger studies are excluded.[5] The final data set consists of thirty-four studies, each

5 Despite being based on regression analysis, event studies are too different to be compared with other regression analyses. For instance, there is no non-arbitrary way to summarize or otherwise include individual regressions for multiple periods after the studied event into a meta-regression analysis.

including between one and 168 regressions. In total, the sample includes 932 observations. This chapter's appendix, on page 85, lists the included primary studies.

3.2.2 Subsamples for diversification and performance measures

The literature review shows that existing studies can be categorized according to how they measure diversification and the kind of performance they assess. I categorize each sampled regression based on four non-exclusive categories of diversification measures: the proportion of non-interest income, the proportion of fee income, the proportion of trading income and constructed diversification indices. Regarding measures of bank performance, I group each regression into three mutually exclusive categories depending on whether effects on profitability, risk or risk-adjusted profitability are analysed.

Categories lack comparability

This meta-regression analysis seeks insights on how the four categories of diversification measures affect the three categories of bank performance. Depending on what type of diversification is measured, we can expect to find different effects on bank performance. Likewise, it is expected that risk, profitability and risk-adjusted profitability are affected differently by a given type of diversification measure. It is therefore inadequate to aggregate these categories and subject them to a combined meta-regression analysis. Instead, I create subsamples for each pairing of the four and three categories and analyse these twelve subsamples individually for the remainder of this study.

Opportunities for consistency checks

Having twelve conceptually related measures of diversification effects on bank performance provides opportunities for consistency checks that are unavailable to other meta-regression analyses. Such consistency checks may compare the effects of fee and trading income to the effects of aggregated non-interest income. Additionally, we can check whether effects on risk-adjusted profitability are consistent with the individual effects on risk and profitability.

3.2.3 Construction of effect variables

Comparing the literature through meta-regression analysis requires a partial and comparable measure of effect size and direction. A measure of effect is partial if it captures the effect of one variable on another, with other factors remaining constant. It is comparable if it uses the same unit of measure across different studies and regressions (Stanley and Doucouliagos 2012, 23). No variable that meets these conditions is directly included in the sampled primary studies. In contrast to medical research, where many studies use the same dependent variable (e.g. mortality), dependent variables in social sciences are more diverse. To obtain a suitable effect variable, I thus construct the partial correlation coefficient *r* for each pairing of explanatory and dependent primary study variables:

$$r = \frac{t}{\sqrt{t^2 + df}} \tag{3.2}$$

where t denotes the t-statistic and df the degrees of freedom of each sampled regression. Where the t-statistic is not reported, I calculate it based on available information on regression coefficients and standard errors. Where the degrees of freedom are not reported, I calculate or estimate them based on sample size and model specification. Resorting to the partial correlation coefficient is common among economic meta-regression analyses because it allows compiling the most comprehensive data set. This advantage counteracts the fact that partial correlation is not an economic measure but a statistical one that cannot be used to assess economic significance (Stanley and Doucouliagos 2012, 25–26).

Four individual effect variables

Constructing partial correlation results in four approximately normally distributed, unitless effect variables ranging from -1 to $+1$. The *non-interest income effects* variable summarizes the effects that primary studies find from non-interest income on risk, profitability or risk-adjusted profitability of banks. The specific kind of effect can be isolated by subsampling for regressions that focus on either risk, profitability or risk-adjusted profitability. Likewise, the *fee effects* and *trading effects* variables summarize effects from the shares of fees and trading income on bank performance. The *index* *effects* variable summarizes the effects found by primary studies using some form of diversification index as an explanatory variable.

3.2.4 Moderator variable for study quality

In the context of meta-regression analysis, control variables are called moderator variables. Simple meta-regression analysis only includes a single moderator variable to capture the quality of studies and regressions included. A variable measuring study quality can be used to account for possible publication biases, a well-known phenomenon in social sciences. In economics, Card and Krueger (1995, 139) identify three sources of publication bias: First, reviewers may be more likely to accept papers that correspond to prevalent theoretical presumptions. Second, researchers may use the presence of expected empirical effects as a guide for further model specifications. And third, researchers may favour model specifications that lead to high levels of significance, despite small sample sizes. Publication bias can severely distort the results of meta-regression analysis, typically by inflating the estimated effect. Identifying publication bias is thus one of the most important contributions meta-regression analysis can make to empirical research.

Standard error as quality indicator

To identify publication bias and following Stanley (2005), I include for each subsample the *standard error* of the partial correlation between diversification and performance. The rationale is that standard errors are larger for studies with small samples. Additionally, these studies are also more prone to publication bias because the significant effects needed for successful publication are harder to achieve. As a measure of study quality, standard errors have several advantages over other conceivable measures like dummies for peer-reviewed publication or journal impact factors. Standard errors can be calculated for all sampled studies, including unpublished ones, and they allow individually determining the quality of each regression within a study (Stanley and Doucouliagos 2012, 34).

Table 3.1 Description of variables for simple meta-regression analysis

Variable	Description
Dependent effect variables	
Non-interest income effects	Partial correlation coefficient between primary studies' non-interest income variables and bank performance
Fee effects	Partial correlation coefficient between primary studies' fee income variables and bank performance
Trading effects	Partial correlation coefficient between primary studies' trading income variables and bank performances
Index effects	Partial correlation coefficient between primary studies' diversification indices and bank performance
Independent moderator variable for publication bias	
Standard error	Standard error of the effect variable

3.2.5 Descriptive analysis

Table 3.1 presents an overview of definitions of the variables included in the subsequent simple meta-regression analysis. Table 3.2 presents the arithmetic means of all effect and moderator variables for the overall sample and all analysed subsamples. The table also indicates the number of papers and regressions included in each subsample.

Comparing arithmetic means

A preliminary analysis of the arithmetic means of the effect variables does not provide any clarity on the effects of bank income diversification. Although, on average, *non-interest income effects* and *index effects* decrease risk and increase profitability, they nonetheless appear to decrease risk-adjusted profitability. In addition, negative *non-interest income effects* on risk seem implausible in comparison with positive *fee effects* and *trading effects* on risk. After all, fees and trading income almost exclusively make up non-interest income. So the analysis of the arithmetic means of effects provides inconsistent results.

3.2.6 Visual analysis of publication bias

Figure 3.1 shows scatter plots of the effect sizes sampled from existing empirical estimates against the precision of these estimates. Precision is

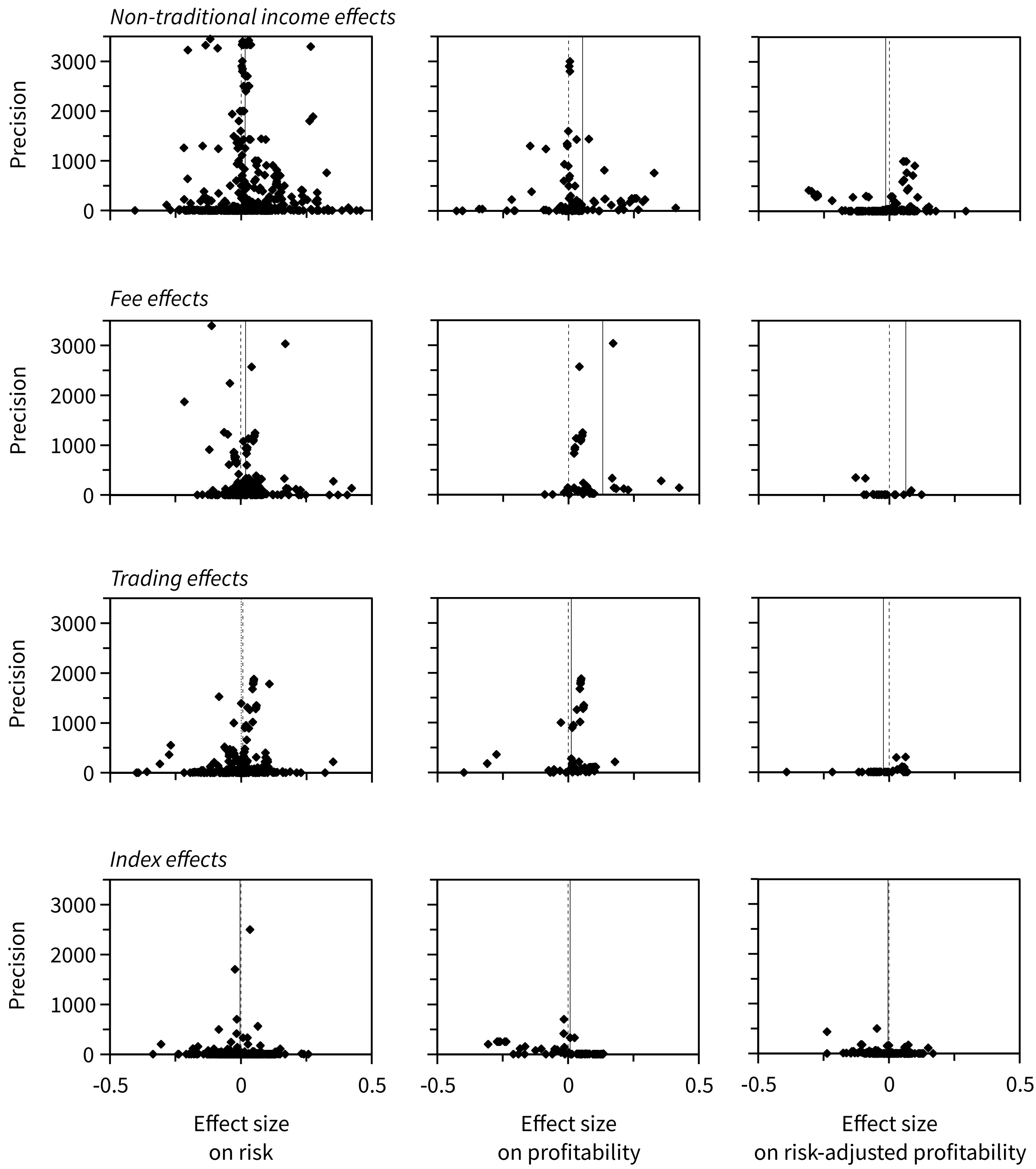

Figure 3.1 Funnel graphs of partial correlations and precision. The *X*-axes indicate the partial correlations of *non-interest income effects, fee effects, trading effects* and *diversification effects* with the bank performance in regard to risk, profitability and risk-adjusted profitability; the *Y*-axes indicate the precision of each regression estimate as the inverse of its standard error. The solid vertical lines indicate the precision-weighted average effects.

Table 3.2 Summary statistics of variables for simple meta-regression analysis

	Subsample												
	Risk				Profitability				Risk-adj. profitability				
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	Full
Non-interest income effects	−0.02				0.05				−0.02				
Fee effects		0.01				0.01				−0.02			
Trading effects			0.01				0.11				0.05		
Index effects				−0.01				0.01				0.00	
Standard error	0.05	0.05	0.05	0.04	0.05	0.04	0.04	0.04	0.04	0.04	0.03	0.03	
Number of papers and regressions included in subsamples													
Papers	26	14	12	13	15	7	5	8	16	9	8	13	34
Regressions	309	227	218	227	109	63	57	87	150	28	24	146	932

Columns (1) to (4) refer to the subsamples for *non-interest income effects*, *fee effects*, *trading effects* and *index effects*. For effect variables, full sample means are not reported because they cannot be aggregated across the subsamples for risk, profitability and risk-adjusted profitability. The same is true for the *standard error* variable because it relates to the effect variables.

measured by the inverse of an estimate's standard error. These scatter plots are called funnel graphs because, in the absence of publication bias, they should take the shape of a reversed funnel. This shape is due to random sampling errors, small samples, noisy data and misspecified models that cause estimates to disperse symmetrically around the true effect. Estimates with higher precision cluster closely around the true effect size while less precise estimates disperse more widely. Funnel graphs illustrate the average and dispersion of effects. Their symmetry, or lack thereof, allows for the visual identification of publication biases (Stanley and Doucouliagos 2012, 53–60).

Precision-weighted average effects

The solid vertical lines in the funnel graphs indicate the precision-weighted average effects for each dependent variable (Costa-Font, De-Albuquerque and Doucouliagos 2015, 493). Since they account for study and regression quality, weighted means are more helpful than arithmetic means to gain an impression of the effects of income diversification. The weighted means mostly show the same signs as the arithmetic means.

However, the signs of *non-interest income effects* and *fee effects* on risk and of *fee effects* and *trading effects* on risk-adjusted profitability are reversed. The comparison of precision-weighted means leads to contradicting observations: trading decreases risk and increases profitability but has negative effects on risk-adjusted profitability. The same contradicting results are found for *index effects.*

Initial evidence for publication bias

A possible source for inconsistencies is publication bias. Stanley and Doucouliagos (2012, 53–60) recommend conducting an initial visual analysis of publication bias with the help of funnel graphs. If publication bias is present, this results in an asymmetric funnel graph. The funnel graphs in figure 3.1 mostly show the expected funnel shape, except for those with a low number of observations. The three graphs on the effects of *non-interest income* may appear to bias towards the positive. Such a conclusion seems plausible since researchers' hypothesis would usually be that non-interest banking business buys higher profitability with higher risks. The risk and profitability graphs for *fee effects* and *trading effects* also depict a bias to the positive. However, the presence of publication bias is difficult to visually determine in graphs with a low number of observations. Section 3.6 more formally addresses the issue of publication bias.

3.3 METHODS FOR SIMPLE META-REGRESSION ANALYSIS

Simple meta-regression analysis allows estimating the underlying genuine effect common to all primary studies and corrected for publication bias. To achieve this, I follow the approach developed by Stanley and Jarrell (1989), Stanley (2008), and Stanley and Doucouliagos (2012).

3.3.1 Basic principle of meta-regression analysis

The most basic estimation of the genuine effects involves regressing comparable effect variables against a constant and an error term:

$$r_{ij} = \beta_0 + v_{ij} \tag{3.3}$$

where r_{ij} is the i-th partial correlation reported in the j-th study and υ_{ij} is the random error. This model is based on the assumption that the reported effects vary randomly around a central effect, β_0. Hence, β_0 is the estimate of the genuine effect.

3.3.2 Funnel-asymmetry precision-effect test

To detect and correct publication bias, I conduct funnel-asymmetry and precision-effect tests. These tests detect publication bias as a significant relationship between an effect and its standard error. To conduct these tests, I expand the basic meta-regression model from equation 3.3 to:

$$r_{ij} = \beta_0 + \beta_{se} SE_{ij} + \varepsilon_{ij} \tag{3.4}$$

where SE denotes the standard error of the partial correlation (i.e. not the standard error of the original regression coefficient) and ε_{ij} is the error term. The funnel-asymmetry test provides an analytical version of the visual examination of a funnel graph and tests if β_{se} is significantly different from zero. In this case, publication bias is present. The precision-effect test identifies a genuine empirical effect corrected for publication bias by testing if β_0 is significantly different from zero.

3.3.3 Precision-effect estimate with standard error

The precision-effect test may mistakenly indicate a genuine non-zero effect in the case of excess unexplained heterogeneity in the meta-regression model (Stanley 2008, 123). This bias can be reduced by adopting a non-linear estimator that replaces the standard error of the partial correlation SE_{ij} with its variance SE_{ij}^2:

$$r_{ij} = \beta_0 + \beta_{se} SE_{ij}^2 + \upsilon_{ij} \tag{3.5}$$

Stanley and Doucouliagos (2012, 65–67) call this procedure the precision-effect estimate with standard error. Their simulations show that this approach provides the best estimate of the underlying genuine effect if such an effect is present. So if the precision-effect test yields significant results, the precision-effect estimate with standard error is recommended to confirm the genuine effect.

3.4 ADDITIONAL DATA FOR MULTIPLE META-REGRESSION ANALYSIS

In multiple meta-regression analysis, moderator variables not only measure the quality of the primary studies included, but also the main methodical and sampling differences. Sampling differences can occur in terms of geography, time period or other criteria (Stanley and Doucouliagos 2012, 86). Table 3.3 presents an overview of the definitions of the additional moderator variables; table 3.4 presents the arithmetic means for each analysed subsample as summary statistics.

Table 3.3 Description of additional variables for multiple meta-regression analysis

Variable	Description
Independent moderators for sample heterogeneity	
Global Financial Crisis	Dummy indicating inclusion of sample years 2007, 2008 or 2009
Legal history	Dummy indicating focus on countries with legal history of separating banking and securities business (CA, JP, PH, US)
Big banks	Dummy for focus on big banks
Commercial banks	Dummy for focus on commercial banks (i.e. not universal banks)
Independent moderator variables for methodical heterogeneity	
Industry classifications	Dummy indicating business models identification through qualitative industry classifications instead of accounting measures
Multiple incomes	Dummy indicating distinction of more than two kinds of income
Real effects	Dummy indicating usage of real effect measures like market reactions or default frequencies instead of accounting effects
Static risk measure	Dummy indicating if a panel data analysis uses risk measure without risk-driven longitudinal variability
Cross-sectional	Dummy for purely cross-sectional studies
Endogeneity-controlled	Dummy indicating usage of instrumental variables or generalized method of moments to control for endogeneity

I use four moderator variables to describe the samples of primary studies. For sample periods, I include the dummy variable *Global Financial Crisis,* which is positive if the sample period includes years 2007, 2008 or 2009. For sample regions, I add a dummy identifying studies that focus on countries with a *legal history* of separating banking and securities businesses. Countries that have such a *legal history* and are a focus area of sampled studies are Canada, Japan, the Philippines and the United States. To describe whether primary studies or individual regressions focus on specific groups of banks, I include dummy variables for *big banks* and *commercial banks*. Many studies report separate regressions for half the banks above and below the median size of the respective overall sample. The *big banks* variable reflects this subsampling and is thus not based on an objective threshold such as total assets. This variable also indicates studies focusing on the largest banks in a given geographic area. The *commercial banks* variable applies if primary samples exclude universal and pure investment banks or concentrate on co-operatives or credit unions.

Moderator variables for primary samples

Table 3.4 Summary statistics of additional variables for multiple meta-regression analysis

	Subsample												
	Risk				Profitability				Risk-adj. profitability				
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	Full
Global Financial Crisis	0.41	0.67	0.65	0.63	0.56	0.76	0.84	0.54	0.37	0.32	0.38	0.24	0.50
Legal history	0.33	0.20	0.18	0.34	0.46	0.14	0.19	0.44	0.53	0.50	0.67	0.60	0.35
Big banks	0.44	0.19	0.18	0.25	0.38	0.13	0.11	0.25	0.25	0.14	0.08	0.20	0.29
Commercial banks	0.11	0.19	0.19	0.19	0.15	0.22	0.25	0.16	0.07	0.00	0.00	0.04	0.13
Industry classifications	0.03	0.00	0.03	0.05	0.02	0.00	0.00	0.02	0.08	0.00	0.08	0.30	0.07
Multiple incomes	0.04	0.97	1.00	0.69	0.03	0.87	0.96	0.54	0.10	0.79	1.00	0.10	0.34
Real effects	0.40	0.21	0.22	0.23	0.21	0.00	0.00	0.21	0.26	0.18	0.21	0.16	0.27
Static risk measure	0.60	0.33	0.30	0.41	0.08	0.05	0.04	0.02	0.86	0.82	0.79	0.77	0.46
Cross-sectional	0.25	0.17	0.18	0.06	0.04	0.00	0.00	0.05	0.13	0.00	0.08	0.14	0.15
Endogeneity-controlled	0.18	0.63	0.66	0.67	0.42	0.76	0.86	0.60	0.07	0.11	0.17	0.09	0.35

Columns (1) to (4) refer to the subsamples for *non-interest income effects*, *fee effects*, *trading effects* and *index effects*.

Moderator variables for methods

Another group of moderator variables describes the methodical approaches of primary studies. The first two variables of this group specify more closely how diversification is measured. I include a moderator variable to distinguish studies based on *industry classifications* from those based on accounting measures of diversification. The dummy variable *multiple incomes* indicates studies that distinguish more than two types of income, which are most often traditional interest income and non-interest income.

Moderators for effect measurement

Two dummy variables describe how effects are measured. The *real effects* variable distinguishes studies using price reactions, bail-outs and defaults from studies measuring accounting effects. The dummy variable *static risk measure* indicates studies that include the *Z*-score or similar measures as dependent variable. The *Z*-score is an indicator for default risk and is frequently included in panel data studies on bank diversification (e.g. STIROH 2004b; SANYA and WOLFE 2011). The indicator measures the number of standard deviations that *net income* must fall to wipe out *equity:*

$$Z = \frac{net\ income + equity}{\sigma_{net\ income}} \tag{3.6}$$

Despite its popularity, the *Z*-score can be criticized (LEPETIT and STROBEL 2013). Almost all authors applying this measure calculate the standard deviation of *net income* over the entire sampling period. This causes the longitudinal variability of the *Z*-score to solely depend on leverage and it could thus impede the identification of risk effects from income diversification. To account for this possible problem, the *static risk measure* variable is included.

Cross-sectional and endogeneity

Further methodical study characteristics are captured by a dummy variable indicating purely *cross-sectional* studies and the dummy variable *endogeneity-controlled.* The latter identifies studies that apply modern techniques to account for endogeneity, such as instrumental variables or system GMM.

Excluded moderators

I exclude several other available moderator variables because they yield insignificant results in general-to-specific model selection (STANLEY and DOUCOULIAGOS 2012, 91). These excluded variables are dummy variables for geographic focus on North America, Europe, the Asia-Pacific region and emerging market economies. Also excluded are dummies for authors contributing to multiple studies because no author fixed effects are observed.

3.4.1 Data dependence

Estimating the discussed meta-regression analysis models with ordinary least squares requires the reported estimates r to be statistically independent. Such an approach would be based on the assumption that the error terms are independently and identically distributed. This assumption might be too strong when sampling several regressions per study because using similar data and methods can shrink standard errors. I thus account for within study data dependency by applying cluster-robust precision-weighted least squares and clustering regressions from the same study (Iamsiraroj and Doucouliagos 2015).

3.5 METHODS FOR MULTIPLE META-REGRESSION ANALYSIS

The expected value of a reported estimate often depends on many characteristics of the analysed primary studies. Leaving this heterogeneity unaccounted may lead to omitted variable bias. The variance of effects can then dominate the average effect so that simple meta-regression analysis yields no significant results, even if a genuine effect is present. Multiple meta-regression analysis is the tool to account for such heterogeneity. As for simple meta-regression analysis, I follow the approach developed by Stanley and Jarrell (1989), Stanley (2008) and Stanley and Doucouliagos (2012, 91). Bel and Fageda (2009), Costa-Font, De-Albuquerque and Doucouliagos (2015), and Iamsiraroj and Doucouliagos (2015) provide illustrative applications.

3.5.1 Multiple meta-regression model

Multiple meta-regression analysis can be used to account for heterogeneity by explicitly modelling any research characteristics with a potential effect on observed results. Doing so not only reduces the danger of omitted variable bias, but it also provides additional insight on the aspects of research design driving the observed results. I thus expand equation 3.4 to:

$$r_{ij} = \beta_0 + \beta_{se} SE_{ij} + \gamma Z_{ij} + \varepsilon_{ij} \tag{3.7}$$

where Z is a vector of moderator variables that describe sample characteristics and methodical differences. This equation represents the main model used for subsequent multiple meta-regression analysis.

3.5.2 General-to-specific model selection

To determine which moderator variables to include in Z, Stanley and Doucouliagos (2012, 91) recommend the general-to-specific approach of model selection. They recommend coding a broad range of moderator variables that could influence the effect measure or that are commonly included in meta-regression analyses. Starting by including all available moderators, the variable with the lowest p-value is dropped in each regression run until only statistically significant variables remain. In this study I adapt this approach because the different measures of diversification and performance are conceptionally closely related. For instance, a variable that is insignificant regarding risk-adjusted profitability should not be dropped if it significantly contributes to the effects on risk or profitability. I thus separately follow the general-to-specific approach for all twelve combinations of diversification and performance measures. The variables that are significant in at least one model are then applied to all models.

3.5.3 Robustness checks

As an alternative to cluster-robust precision-weighted least squares and following Stanley (2008) and Iamsiraroj and Doucouliagos (2015), I use degrees of freedoms as weights. As a second robustness test, I use a multilevel mixed effects model with restricted maximum likelihood estimation (Doucouliagos and Stanley 2009; Costa-Font, De-Albuquerque and DOUCOULIAGOS 2015). This approach is an alternative to correct for within study dependencies. To do so, I interpret the data set as an unbalanced panel: individual studies make up the cross-sectional dimension and their regressions the longitudinal.

Squared standard errors sub-variants

For each of these three variants I include sub-variants with *squared standard errors,* instead of *standard errors,* as moderator for study quality. The inclusion of *squared standard errors* provides an analogy to the precision-effect estimate with standard errors from simple meta-regression analysis. In total, this set-up results in six different model specifications for the multiple meta-regression analysis.

3.6 RESULTS

The following section presents and discusses the results from applying the discussed methods to the presented data. The main question is if there are underlying genuine effects of diversification on bank performance present in the empirical literature. If such effects are present, the two simple and six multiple meta-regression model specifications should all yield concurrent significant results. However, excess heterogeneity in the literature may inhibit simple meta-regression analysis. Multiple meta-regression analysis can account for such heterogeneity. Thus, simple meta-regression analysis yielding no clear results does not necessarily preclude the existence of genuine effects if multiple meta-regression analysis indicates otherwise.

Criteria for results interpretation

I interpret results as evidence for genuine effects, if both simple meta-regression models yield concurrent significant results that are not contradicted by any of the six extended models. If the results from simple meta-regression analysis are unclear, I still accept them as evidence for genuine effects if at least five of the six extended models yield concurrent significant results without any contradicting results. If evidence for two performance measures fulfil these criteria, I accept matching but weaker evidence for the third.

3.6.1 Genuine effects and publication bias in the simple model

Table 3.5 provides the formal equivalent to the visual funnel graph analysis presented in figure 3.1. For each of the four effect variables, the table presents three models: The weighted average columns display the results for the precision-weighted intercept-only regression model as previously described in equation 3.3. This naive form of meta-regression analysis is only included as a reference to illustrate the influence of publication bias. The FAT-PET columns display the results for the funnel-asymmetry precision-effect test of equation 3.4. The *standard error* coefficient of this model provides the funnel-asymmetry test and the intercept provides the precision-effect test. The PEESE columns show the results for the precision-effect estimate with standard errors as described by equation 3.5. Its intercept is less likely to overstate the absolute value of the genuine effect than the precision-effect test.

No clear evidence for non-interest income effects

The results indicate a significant positive precision-effect estimate with standard errors for *non-interest income effects* on profitability. However, the purpose of this test is to provide a confirmation for a significant precision-effect test, which we cannot observe in this case. Evidence of genuine positive *non-interest income effects* on profitability is therefore weak and non-robust. In addition, non-zero *non-interest income effects* on profitability would be inconsistent with the lack of evidence against zero effects on risk and risk-adjusted profitability. As for publication bias, there is no evidence for such bias for *non-interest income effects* on risk, profitability or on risk-adjusted profitability.

Fees increase profitability

For *fee effects,* the naive aggregation of the intercept-only precision-weighted least squares model yields a significantly positive effect on profitability. The funnel-asymmetry test indicates the presence of a negative publication bias. Corrected for this publication bias, the observed genuine effect, as provided by the precision-effect test, is even more significant and positive. The precision-effect estimate with standard errors confirms this positive genuine effect. Nonetheless, this per se solid evidence is not complemented with consistent results for *fee effects* on risk or risk-adjusted profitability. In both cases, the results indicate no evidence of non-zero genuine effects. For *fee effects* on risk and risk-adjusted profitability, there is also no evidence of publication bias.

Trading decreases risk-adjusted profitability

For *trading effects*, the results of the precision estimate test indicate a significant genuine negative effect on risk-adjusted profitability. The precision-effect estimate with standard errors confirms this finding. The funnel-asymmetry test indicates a significant positive publication bias. This observation means that, on average, publication bias causes the existing empirical literature to falsely report less negative *trading effects* on risk-adjusted profitability. Consistent with this finding, there is evidence of positive *trading effects* on risk: the precision-effect estimate with standard errors is significantly positive. However, because the precision estimate test is insignificant, this evidence is weak. With regard to *trading effects* on profitability, evidence suggests that the mostly positive effects reported in the literature can be entirely attributed to publication bias. If controlled for publication bias, the results show no genuine non-zero *trading effect* on profitability. So, in summary, trading increases risk and decreases risk-adjusted profitability without having an observable effect on profitability. Therefore, if bank managers decide to diversify towards trading activities, this might be because of miss-aligned incentives with disproportionate upside potential for managers, as suggested by Demirgüç-Kunt and Huizinga (2010, 637).

No evidence for index effects

For *index effects,* there is neither evidence for non-zero genuine effects on risk, profitability and risk-adjusted profitability nor for the presence of publication bias.

Inconsistencies due to sample heterogeneity

In summary, simple meta-regression analysis yields evidence that fee income increases profitability if corrected for publication bias. Also, trading income increases risk and decreases risk-adjusted profitability. The results also exhibit some inconsistencies. Namely, the observed evidence for positive *fee effects* on profitability lacks matching evidence for effects on risk or risk-adjusted profitability. A possible explanation for such inconsistencies could lie in differing subsamples of the primary studies included in the twelve individual meta-regression analyses. Table 3.2 shows that the subsamples resulting from observing different effect variables and bank performance measures differ considerably. And in table 3.5, the low adjusted R-squared measures indicate that the simple meta-regression analysis leaves

Table 3.5 Simple meta-regression analysis

	Non-interest income effects on risk						*Non-interest income*	
	Weighted average		FAT-PET		PEESE		Weighted average	
Constant	−0.034	(0.050)	−0.054	(0.071)	−0.039	(0.053)	0.031*	(0.016)
Standard error			0.783	(0.834)				
Squared standard error					3.898	(2.629)		
Adjusted *R*-squared			0.004		0.013			
Observations	309		309		309		109	

	Fee effects on risk						*Fee effects* on	
	Weighted average		FAT-PET		PEESE		Weighted average	
Constant	0.005	(0.006)	−0.007	(0.011)	0.002	(0.007)	0.031*	(0.015)
Standard error			0.381	(0.347)				
Squared standard error					0.002	(1.117)		
Adjusted *R*-squared			0.013		0.012			
Observations	227		227		227		63	

	Trading effects on risk						*Trading effects* on	
	Weighted average		FAT-PET		PEESE		Weighted average	
Constant	0.006	(0.005)	0.002	(0.015)	0.008*	(0.004)	0.064**	(0.022)
Standard error			0.110	(0.552)				
Squared standard error					−1.369	(3.618)		
Adjusted *R*-squared			−0.004		−0.003			
Observations	218		218		218		57	

	Index effects on risk						*Index effects* on	
	Weighted average		FAT-PET		PEESE		Weighted average	
Constant	−0.007	(0.021)	0.013	(0.025)	−0.005	(0.022)	0.016	(0.033)
Standard error			−0.692	(0.492)				
Squared standard error					−2.223	(2.569)		
Adjusted *R*-squared			0.031		0.002			
Observations	227		227		227		87	

Estimates are precision-weighted least squares. Weighted averages illustrate naive effects if publication bias is ignored. Significant standard errors in funnel-asymmetry tests (FAT) indicate publication bias. Significant constants in precision estimate tests (PET) and precision-effect estimate with standard errors (PEESE) indicate genuine effects. Cluster-robust standard errors are in parentheses. Levels of significance at 10%, 5% and 1% are denoted by *, ** and ***.

effects on profitability				*Non-interest income effects* on risk-adjusted profitability					
FAT-PET		PEESE		Weighted average		FAT-PET		PEESE	
0.012	(0.016)	0.031*	(0.016)	−0.008	(0.021)	0.006	(0.031)	−0.006	(0.022)
0.833	(0.595)					−0.629	(1.132)		
		0.620	(3.431)					−1.668	83.370)
0.025		−0.009				0.007		−0.003	
109		109		150		150		150	

profitability				*Fee effects* on risk-adjusted profitability					
FAT-PET		PEESE		Weighted average		FAT-PET		PEESE	
0.060**	(0.018)	0.035*	(0.015)	−0.006	(0.021)	0.007	(0.027)	−0.004	(0.022)
−1.185**	(0.384)					−0.719	(0.541)		
		−5.047***	(0.846)					−2.597***	(0.334)
0.097		0.094				0.019		0.038	
63		63		28		28		28	

profitability				*Trading effects* on risk-adjusted profitability					
FAT-PET		PEESE		Weighted average		FAT-PET		PEESE	
−0.073	(0.042)	0.017	(0.016)	−0.008	(0.022)	−0.112*	(0.050)	−0.055***	(0.013)
5.014*	(1.878)					4.819*	(2.458)		
		46.719*	(20.828)					63.546***	(7.034)
0.421		0.376				0.449		0.754	
57		57		24		24		24	

profitability				*Index effects* on risk-adjusted profitability					
FAT-PET		PEESE		Weighted average		FAT-PET		PEESE	
0.036	(0.040)	0.022	(0.035)	−0.003	(0.013)	−0.001	(0.020)	−0.002	(0.015)
−0.726	(0.513)					−0.121	(0.694)		
		−5.427	(3.193)					−1.690	(8.098)
0.005		0.002				−0.006		−0.006	
87		87		146		146		146	

much of the heterogeneity among primary studies unexplained. Adding more moderator variables to account for this heterogeneity therefore seems necessary (Stanley and Doucouliagos 2012, 81).

3.6.2 Combined effects predicted by the extended model

In multiple meta-regression analysis, unlike simple meta-regression analysis, the genuine effect observed over all primary studies cannot be directly read from the intercept. Instead, we must calculate a combined effect based on assumed moderator variable values.

Varying assumptions as robustness checks

Stanley and Doucouliagos (2012, 98) argue that in order to calculate a combined effect, the assumed moderator values should represent best practice research design. If it is unclear which research design represents best practice, these authors recommend the use of sample means as moderator values. Accordingly, when calculating the combined effects I generally assume the full sample's arithmetic means, as reported in table 3.2, as moderator values. As exceptions to this rule, best practice seems to be a clear choice for the moderator variables *Global Financial Crisis* and *endogeneity-controlled*. For these variables I assume the value one. Including the years 2007 to 2009 in the sample period seems appropriate because the effects on bank performance under such adverse conditions are most relevant for policy implications. Also, setting the *Global Financial Crisis* variable to one gives a higher weight to newer studies that are, in general, methodically more advanced. For the same reason, it is also appropriate to assume a positive value for the *endogeneity-controlled* variable. To filter out potential effects from publication bias, I set the variables *standard error* and *squared standard error* to zero. Following common practice in forecasting, I calculate the 95% prediction interval for each point estimate.

Comparison of results

Table 3.6 summarizes the predicted combined effects for this best practice research design and the multiple meta-regression model described by equation 3.7. For comparison, the table also summarizes the results from the simple meta-regression analysis. To illustrate the robustness of the estimated prediction intervals, the two columns for positive and negative genuine effects state the proportion of the six model specifications that yield

Table 3.6 Overview of empirical evidence for genuine effects

	Simple model		Extended model: Best practice design		Extended model: Good practice designs		Extended model: All potential designs	
	+	–	+	–	+	–	+	–
Non-interest income effects on								
Risk	0%	0%	0%	100%	5%	60%	12%	51%
Profitability	50%	0%	66.00%	0%	39%	4%	22%	28%
Risk-adjusted profitability	0%	0%	0%	0%	21%	49%	27%	35%
Fee effects on								
Risk	0%	0%	0%	17%	0%	18%	7%	24%
Profitability	100%	0%	17%	33%	13%	25%	20%	28%
Risk-adjusted profitability	0%	0%	50%	0%	38%	0%	45%	4%
Trading effects on								
Risk	50%	0%	33%	0%	23%	2%	16%	15%
Profitability	0%	0%	100%	0%	66%	6%	40%	38%
Risk-adjusted profitability	0%	100%	0%	83%	0%	88%	0%	66%
Index effects on								
Risk	0%	0%	0%	100%	1%	75%	38%	31%
Profitability	0%	0%	0%	50%	40%	16%	46%	11%
Risk-adjusted profitability	0%	0%	0%	33%	2%	58%	20%	37%

The columns for the simple model summarize the results from simple meta-regression analysis. The percentages describe the proportion of the two model specifications (precision estimate test and precision-effect estimate with standard errors) that yield positive or negative results significant at the 10% level. The columns for the extended model summarize the results from multiple meta-regression analysis. The best practice design assumes that publication bias is absent, the Global Financial Crisis is included in the sample period, endogeneity is controlled and all other moderator variables are equal to their arithmetic mean in the full sample. The percentages for best practice design describe the proportion of six model specifications that yield positive or negative prediction intervals at the 95% level of confidence. Under good practice designs, all moderator variables previously set to sample means are allowed to take any binary value. All potential research designs include the combinations of all binary values of all moderator dummy variables. Publication bias is always assumed to be absent. For good practice designs and all potential designs, the percentages describe the proportion of research designs with positive or negative prediction intervals for at least four of six regression models at the 95% level of confidence.

significant positive or negative predictions. The individual point estimates and prediction intervals are reported in tables 3.7 to 3.10 in section 3.6.6, where I also discuss the influence of individual moderator variables.

Non-interest income reduces risk

The best practice combined *non-interest income effects* on risk are significantly negative over all six models. Overall, the existing empirical literature thus finds diversification towards more non-interest income helps banks to reduce their risks. There is also some evidence for significant positive combined *non-interest income effects* on profitability. However, this evidence is not robust as only two of six models yield significant results. The evidence for positive effects on profitability is further limited by the lack of evidence for positive *non-interest income effects* on risk-adjusted profitability. All results for positive *non-interest income effects* on risk-adjusted profitability are insignificant.

Fees increase risk-adjusted profitability by reducing risk

The best practice combined *fee effects* on risk-adjusted profitability are positive for three of the six models. One of the six models indicates that this relation is driven by negative effects on risk. While simple meta-regression analysis suggests positive *fee effects* on profitability, multiple meta-regression cannot confirm this relation. Two of the six models indicate significant negative *fee effects* on profitability and one indicates positive effects. The results are thus inconsistent.

Trading increases profitability but decreases risk-adjusted profitability

Five of the six models indicate significant negative combined *trading effects* on risk-adjusted profitability. This finding is consistent with the results from the simple meta-regression analysis. The relation appears to be driven by a positive effect on risk, albeit evidence for this is only robust over two of the six models. Nonetheless, this evidence for positive effects on risk gains additional credibility from significant positive *trading effects* on profitability observed over all six models. Also, positive *trading effects* on risk are consistent with the non-robust evidence from the simple meta-regression analysis.

Negative index effects match negative fee effects on risk

Consistent with the results for *non-interest income effects,* the results indicate significant negative combined *index effects* on risk over all six models. This result also supports the evidence for negative *fee effects* on risk. Since trading positively affects risk, yet *index effects* and *non-interest income effects* on risk are negative, negative *fee effects* on risk overcompensate positive *trading* effects.

3.6.3 Sensitivity analysis of predicted combined effects

The existing empirical literature on the effects of bank income diversification uses a wide range of research designs. What constitutes best practice for each moderator variable is, therefore, unclear. For this reason, this section analyses how sensitive predicted combined effects react to changes in research design, that is, to changes in assumptions regarding moderator parameter values.

Varying assumptions as robustness check

For a first sensitivity analysis I define *standard error* and *squared standard error* as zero while *Global Financial Crisis* and *endogeneity-controlled* are set to one. These assumptions are identical to those made for the best practice research design. In contrast to the best practice assumptions, I allow all other dummy variables to take any binary value. This specification results in $2^8 = 256$ possible good practice research designs. I then calculate the point estimates and 95% prediction intervals for all 256 combinations times the six multiple meta-regression models. I count combinations as evidence for positive or negative effects if at least four of the six models consistently yield significantly positive or negative predictions without significant results of the opposite sign. In a second sensitivity analysis I relax the restriction of *Global Financial Crisis* and *endogeneity-controlled* to one. This new specification expands the analysis to $2^{10} = 1024$ possible research designs.

No effects fully robust to research design

The columns for "good practice designs" and "all potential designs" in table 3.6 report the results of the two sensitivity analyses. The results show that all combined effect predictions are, to some extent, sensitive to assumed parameter values. Given the discord in the relevant empirical literature, this observation is no surprise. Robust predicted combined effects over all possible research designs could only be reasonably expected if the empirical literature was mostly in consensus. However, in such a situation, meta-regression analysis adds no value. I thus accept results if there is a gap of at least fifty percentage points between positive and negative good practice research designs.

Some mostly robust effect predictions

Generally, the clearer the results from best practice predictions, the less sensitive these predictions are to assumed parameter values. The good practice sensitivity analysis shows fairly clear support for negative *trading effects*

Table 3.7 Multiple meta-regression analysis for non-interest income effects

	Effects on risk						Effects on profitability	
	Precision WLS		DF WLS		Mixed-effects		Precision WLS	
Standard error	2.222		−0.161		1.039		−0.011	
	(1.391)		(0.652)		(0.540)		(0.403)	
Squared standard error		7.718		2.145		0.957		1.549
		(4.307)		(3.270)		(2.932)		(2.780)
Global Financial Crisis	−0.145**	−0.130	−0.064	−0.067	−0.048	−0.037	−0.057***	−0.054**
	(0.066)	(0.065)	(0.037)	(0.036)	(0.056)	(0.055)	(0.017)	(0.018)
Legal history	0.081	0.098	0.042	0.042	0.106	0.117**	−0.074***	−0.076***
	(0.047)	(0.048)	(0.025)	(0.026)	(0.057)	(0.056)	(0.014)	(0.017)
Big banks	−0.003	0.006	0.024	0.023	0.016	0.021	0.029	0.031
	(0.027)	(0.026)	(0.015)	(0.014)	(0.028)	(0.028)	(0.020)	(0.019)
Commercial banks	−0.034**	−0.036	−0.022**	−0.022**	−0.035	−0.033	0.009**	0.010**
	(0.016)	(0.018)	(0.009)	(0.009)	(0.041)	(0.041)	(0.004)	(0.004)
Industry classifications	0.179**	0.206**	0.096***	0.093**	0.152	0.206	−0.016	−0.015
	(0.076)	(0.093)	(0.033)	(0.034)	(0.126)	(0.128)	(0.022)	(0.024)
Multiple incomes	−0.150***	−0.171***	−0.095***	−0.094***	−0.127	−0.136	−0.005	−0.004
	(0.038)	(0.040)	(0.024)	(0.025)	(0.070)	(0.071)	(0.011)	(0.011)
Real effects	−0.127**	−0.123**	−0.038	−0.041	−0.137***	−0.140***	0.034**	0.031**
	(0.050)	(0.048)	(0.032)	(0.032)	(0.046)	(0.046)	(0.012)	(0.011)
Static risk measure	−0.001	0.008	−0.021	−0.022	−0.048	−0.044	−0.046	−0.050
	(0.062)	(0.054)	(0.043)	(0.043)	(0.045)	(0.045)	(0.028)	(0.029)
Cross-sectional	−0.263***	−0.241**	−0.088**	−0.094**	−0.169***	−0.197***	−0.001	−0.002
	(0.087)	(0.089)	(0.039)	(0.036)	(0.064)	(0.062)	(0.031)	(0.031)
Endogeneity-controlled	0.039	0.043	0.004	0.005	−0.071	−0.073	−0.100**	−0.111**
	(0.056)	(0.051)	(0.022)	(0.023)	(0.049)	(0.049)	(0.036)	(0.039)
Constant	0.024	0.046	0.050	0.049	0.045	0.064	0.120***	0.124***
	(0.069)	(0.063)	(0.043)	(0.045)	(0.072)	(0.070)	(0.027)	(0.032)
Observations	309	309	309	309	309	309	227	227
Adjusted *R*-squared	0.422	0.389	0.181	0.182			0.424	0.426
Combined effect	−0.170**	−0.118**	−0.050**	−0.055**	−0.154**	−0.122**	0.051**	0.091**
95% prediction interval	±0.067	±0.040	±0.031	±0.023	±0.059	±0.055	±0.076	±0.070

Standard errors are in parentheses (cluster-robust for WLS). Levels of significance at 10%, 5% and 1% are denoted by *, ** and ***.

				Effects on risk-adjusted profitability					
DF WLS		Mixed-effects		Weighted average		DF WLS		Mixed-effects	
–0.293		–0.140		0.113		–1.200		–1.589**	
(0.362)		(0.494)		(1.058)		(0.941)		(0.788)	
	–0.777		3.683		0.565		–1.81		–5.965
	(3.069)		(3.362)		(4.027)		(7.173)		(4.174)
–0.057***	–0.056***	–0.036	–0.038	–0.115**	–0.114	–0.113***	–0.136***	–0.072	–0.075
(0.017)	(0.017)	(0.037)	(0.036)	(0.048)	(0.057)	(0.037)	(0.045)	(0.078)	(0.080)
–0.074***	–0.072***	–0.097***	–0.093***	–0.069	–0.069	–0.094***	–0.100***	0.098	0.100
(0.011)	(0.012)	(0.035)	(0.034)	(0.035)	(0.037)	(0.008)	(0.009)	(0.137)	(0.128)
0.016	0.018	0.054**	0.050**	0.006	0.006	0.013	0.009	0.009	0.001
(0.012)	(0.012)	(0.022)	(0.023)	(0.015)	(0.013)	(0.008)	(0.006)	(0.021)	(0.021)
0.008**	0.008**	0.01	0.011	–0.008	–0.008	–0.021***	–0.021***	–0.009	–0.004
(0.003)	(0.003)	(0.011)	(0.011)	(0.015)	(0.011)	(0.005)	(0.005)	(0.029)	(0.029)
–0.01	–0.011	–0.017	–0.019	–0.184***	–0.181***	–0.191***	–0.224***	–0.067	–0.072
(0.018)	(0.018)	(0.043)	(0.042)	(0.030)	(0.040)	(0.029)	(0.015)	(0.349)	(0.321)
–0.007	–0.006	0.026	0.028	–0.025	–0.025	0.003	0.008	–0.028	–0.025
(0.010)	(0.010)	(0.016)	(0.015)	(0.041)	(0.042)	(0.018)	(0.017)	(0.031)	(0.032)
0.036***	0.033***	0.033	0.028	0.016	0.016	0.035***	0.030**	0.052	0.045
(0.007)	(0.006)	(0.021)	(0.021)	(0.028)	(0.027)	(0.010)	(0.010)	(0.054)	(0.055)
–0.033	–0.034	–0.076***	–0.074***	–0.202***	–0.202***	–0.229***	–0.237***	0.004	0.007
(0.018)	(0.020)	(0.026)	(0.026)	(0.061)	(0.066)	(0.043)	(0.050)	(0.262)	(0.244)
–0.015	–0.015	0.03	0.025	0.038	0.038	0.059***	0.055***	–0.103	–0.099
(0.030)	(0.029)	(0.030)	(0.029)	(0.030)	(0.030)	(0.009)	(0.009)	(0.249)	(0.229)
–0.090***	–0.094***	–0.158***	–0.154***	0.000	0.000	–0.029	–0.028	0.010	0.009
(0.016)	(0.021)	(0.027)	(0.027)	(0.022)	(0.021)	(0.018)	(0.018)	(0.030)	(0.031)
0.121***	0.116***	0.141***	0.135***	0.240**	0.241***	0.298***	0.295***	0.043	0.007
(0.028)	(0.027)	(0.048)	(0.047)	(0.082)	(0.077)	(0.048)	(0.051)	(0.293)	(0.274)
227	227	227	227	150	150	150	150	150	150
0.486	0.484			0.283	0.283	0.596	0.579		
–0.013	0.040	0.249**	0.229**	–0.003	–0.0002	0.024	–0.010	0.004	–0.036
±0.081	±0.071	±0.086	±0.080	±0.039	±0.033	±0.029	±0.026	±0.142	±0.129

Table 3.8 Multiple meta-regression analysis for fee effects

	Effects on risk						Effects on profitability	
	Precision WLS		DF WLS		Mixed-effects		Precision WLS	
Standard error	0.617**		0.460		1.126***		−1.491**	
	(0.248)		(0.559)		(0.388)		(0.408)	
Squared standard error		2.054		3.085		−11.748***		−4.628***
		(1.027)		(2.096)		(3.846)		(0.627)
Global Financial Crisis	0.031	0.023	0.038	0.034	−0.004	−0.006	−0.064	−0.041
	(0.055)	(0.057)	(0.023)	(0.021)	(0.065)	(0.059)	(0.036)	(0.037)
Legal history	−0.06	−0.072	−0.044	−0.050	0.001	0.067	−0.079**	−0.094
	(0.048)	(0.048)	(0.052)	(0.046)	(0.068)	(0.061)	(0.029)	(0.039)
Big banks	0.038	0.038	0.037	0.037	−0.001	−0.019	0.095**	0.072
	(0.035)	(0.035)	(0.019)	(0.019)	(0.026)	(0.028)	(0.034)	(0.035)
Commercial banks	0.003	0.001	0.005	0.005	−0.002	0.000	0.009	0.012
	(0.003)	(0.003)	(0.003)	(0.003)	(0.017)	(0.016)	(0.008)	(0.008)
Industry classifications								
Multiple incomes	0.007	0.010	0.008	0.009	−0.057	−0.029	0.02	0.019
	(0.051)	(0.052)	(0.050)	(0.048)	(0.105)	(0.096)	(0.033)	(0.036)
Real effects	0.007	0.013	0.004	0.006	−0.041	−0.001		
	(0.022)	(0.026)	(0.017)	(0.016)	(0.038)	(0.041)		
Static risk measure	−0.033	−0.031	−0.004	−0.004	−0.129***	−0.124***	−0.154	−0.171
	(0.038)	(0.039)	(0.004)	(0.004)	(0.028)	(0.027)	(0.081)	(0.097)
Cross-sectional	−0.085	−0.079	−0.063	−0.059	−0.001	−0.032		
	(0.060)	(0.062)	(0.056)	(0.056)	(0.058)	(0.052)		
Endogeneity-controlled	−0.091***	−0.082***	−0.061	−0.056	−0.102**	−0.083**	0.076	0.032
	(0.026)	(0.027)	(0.040)	(0.041)	(0.041)	(0.042)	(0.076)	(0.071)
Constant	0.039	0.055	0.005	0.014***	0.134	0.046	0.049***	0.034***
	(0.041)	(0.042)	(0.014)	(0.004)	(0.087)	(0.076)	(0.004)	(0.005)
Observations	227	227	227	227	227	227	63	63
Adjusted R-squared	0.122	0.107	0.101	0.099			0.493	0.449
Combined effect	−0.054	−0.038	−0.030	−0.020	−0.062	−0.097**	−0.002	−0.058
95% prediction interval	±0.067	±0.068	±0.054	±0.055	±0.086	±0.079	±0.069	±0.063

Standard errors are in parentheses (cluster-robust for WLS). Levels of significance at 10%, 5% and 1% are denoted by *, ** and ***. Some variables are dropped because of collinearity issues.

				Effects on risk-adjusted profitability					
DF WLS		Mixed-effects		Weighted average		DF WLS		Mixed-effects	
−1.746**		−0.624		−1.422**		−2.998**		−2.288	
(0.667)		(1.526)		(0.468)		(0.943)		(1.551)	
	−9.685		−0.862		−2.637***	−4.824		−3.420	
	(5.001)		(6.395)		(0.607)	(2.974)		(6.982)	
−0.090	−0.074	−0.049	−0.056	−0.046	−0.056	−0.026	−0.038	−0.061	−0.076
(0.041)	(0.040)	(0.271)	(0.283)	(0.078)	(0.086)	(0.057)	(0.069)	(0.103)	(0.129)
−0.055**	−0.056**	−0.128	−0.138	−0.125***	−0.092***	−0.161***	−0.089***	−0.146	−0.089
(0.018)	(0.022)	(0.287)	(0.300)	(0.016)	(0.012)	(0.025)	(0.010)	(0.090)	(0.101)
0.099	0.075	0.121**	0.112**	0.040***	0.036**	0.039***	0.034***	0.043*	0.039*
(0.042)	(0.039)	(0.049)	(0.044)	(0.007)	(0.014)	(0.006)	(0.010)	(0.023)	(0.023)
0.005	0.005	0.007	0.007						
(0.003)	(0.004)	(0.014)	(0.014)						
0.006	0.006	−0.001	−0.001	0.031**	−0.001	0.071**	−0.002	0.057	−0.010
(0.015)	(0.017)	(0.041)	(0.041)	(0.012)	(0.002)	(0.025)	(0.004)	(0.094)	(0.102)
						0.125*	0.078	0.138	0.102
						(0.062)	(0.069)	(0.127)	(0.156)
−0.103**	−0.109**	−0.089**	−0.089**	−0.117	−0.101				
(0.029)	(0.035)	(0.041)	(0.041)	(0.076)	(0.086)				
0.124	0.086	−0.194***	−0.194***	0.030***	0.028***	0.031***	0.028***	0.031	0.029
(0.063)	(0.060)	(0.035)	(0.035)	(0.001)	(0.000)	(0.001)	(0.000)	(0.029)	(0.029)
0.050***	0.035***	0.04	0.034	0.173*	0.140	0.074***	0.044***	0.064**	0.051*
(0.005)	(0.002)	(0.230)	(0.240)	(0.075)	(0.086)	(0.010)	(0.001)	(0.027)	(0.027)
63	63	63	63	28	28	28	28	28	28
0.528	0.491			0.589	0.506	0.819	0.715		
0.048**	0.002	−0.253**	−0.272**	0.081**	0.043**	0.093**	0.033	0.052	0.008
±0.045	±0.038	±0.176	±0.178	±0.041	±0.040	±0.042	±0.049	±0.089	±0.101

Table 3.9 Multiple meta-regression analysis for trading effects

	Effect on risk						Effects on profitability	
	Precision WLS		DF WLS		Mixed-effects		Precision WLS	
Standard error	0.265		0.764		0.569		1.936***	
	(0.457)		(0.628)		(1.098)		(0.331)	
Squared standard error		−0.866		2.958		−4.286		14.859**
		(2.487)		(4.914)		(7.761)		(4.795)
Global Financial Crisis	0.024	0.014	−0.028	−0.027	0.199	0.219	0.685***	0.704***
	(0.076)	(0.069)	(0.065)	(0.059)	(0.156)	(0.153)	(0.021)	(0.023)
Legal history	−0.022	−0.032	−0.017	−0.026	0.173	0.173	0.779***	0.805***
	(0.050)	(0.052)	(0.033)	(0.033)	(0.153)	(0.148)	(0.023)	(0.022)
Big banks	−0.024	−0.029	−0.015	−0.017	0.038	0.035	0.057	0.061
	(0.020)	(0.020)	(0.017)	(0.017)	(0.036)	(0.036)	(0.046)	(0.046)
Commercial banks	−0.012***	−0.014***	−0.008***	−0.008***	−0.012	−0.012	−0.041***	−0.043***
	(0.002)	(0.001)	(0.001)	(0.001)	(0.021)	(0.021)	(0.002)	(0.004)
Industry classifications	0.140	0.133	0.070	0.074	0.285	0.295		
	(0.131)	(0.133)	(0.108)	(0.110)	(0.206)	(0.202)		
Multiple incomes							−0.030	−0.033
							(0.023)	(0.028)
Real effects	0.015	0.027	0.020	0.028	−0.115	−0.095		
	(0.038)	(0.038)	(0.018)	(0.017)	(0.062)	(0.064)		
Static risk measure	0.143	0.145	0.071	0.070	0.236***	0.241***	−0.098**	−0.094**
	(0.074)	(0.069)	(0.073)	(0.070)	(0.040)	(0.040)	(0.023)	(0.027)
Cross-sectional	−0.043	−0.040	−0.040	−0.029	−0.014	−0.011		
	(0.055)	(0.055)	(0.044)	(0.041)	(0.080)	(0.080)		
Endogeneity-controlled	0.093***	0.101***	0.077**	0.080**	−0.004	0.003	0.101**	0.122***
	(0.030)	(0.026)	(0.028)	(0.029)	(0.060)	(0.060)	(0.023)	(0.018)
Constant	−0.114	−0.101	−0.065	−0.049	−0.341**	−0.342**	−0.738***	−0.735***
	(0.090)	(0.088)	(0.083)	(0.084)	(0.155)	(0.151)	(0.056)	(0.057)
Observations	218	218	218	218	218	218	57	57
Adjusted *R*-squared	0.097	0.094	0.073	0.049			0.847	0.829
Combined effect	0.061**	0.070**	0.009	0.030	0.020	0.054	0.279**	0.333**
95% prediction interval	±0.051	±0.048	±0.053	±0.046	±0.111	±0.102	±0.020	±0.024

Standard errors are in parentheses (cluster-robust for WLS). Levels of significance at 10%, 5% and 1% are denoted by *, ** and ***. Some variables are dropped because of collinearity issues.

				Effect on risk-adjusted profitability					
DF WLS		Mixed-effects		Weighted average		DF WLS		Mixed-effects	
2.134***		0.567		8.534***		2.927		5.759	
(0.367)		(0.961)		(1.430)		(3.842)		(3.648)	
	23.348***		0.537		79.278***		69.262***		81.195***
	(3.018)		(10.305)		(1.674)		(13.500)		(4.412)
0.689***	0.693***	0.708***	0.728***	–0.11	–0.144***	–0.103	–0.139***	–0.066	–0.146***
(0.016)	(0.009)	(0.134)	(0.155)	(0.050)	(0.005)	(0.049)	(0.010)	(0.198)	(0.036)
0.764***	0.743***	0.805***	0.837***	0.151***	0.027**	0.024	0.022	0.129	0.021
(0.032)	(0.024)	(0.146)	(0.176)	(0.040)	(0.010)	(0.105)	(0.019)	(0.150)	(0.024)
0.078**	0.064**	–0.021	–0.007	0.042	0.028**	0.021	0.021	0.037	0.035
(0.024)	(0.014)	(0.061)	(0.087)	(0.025)	(0.011)	(0.015)	(0.012)	(0.036)	(0.033)
–0.040***	–0.039***	–0.045**	–0.047**						
(0.001)	(0.001)	(0.022)	(0.022)						
				–0.108***	–0.121***	–0.109***	–0.120***	–0.083	–0.121***
				(0.020)	(0.002)	(0.020)	(0.004)	(0.199)	(0.036)
–0.017**	–0.018	–0.022	–0.018						
(0.005)	(0.006)	(0.064)	(0.064)						
				–0.012	0.130***			–0.041	0.148***
				(0.042)	(0.013)			(0.224)	(0.045)
–0.111***	–0.109***	–0.105	–0.108			–0.077	–0.121***		
(0.004)	(0.006)	(0.064)	(0.064)			(0.107)	(0.016)		
0.099**	0.095***	0.091**	0.089	0.049	0.035**	0.061**	0.045***	0.023	0.019
(0.023)	(0.016)	(0.044)	(0.045)	(0.021)	(0.015)	(0.023)	(0.005)	(0.032)	(0.032)
–0.759***	–0.721***	–0.689***	–0.703***	–0.297***	–0.078***	–0.014	0.055	–0.221	–0.080***
(0.033)	(0.021)	(0.162)	(0.193)	(0.049)	(0.003)	(0.248)	(0.028)	(0.169)	(0.019)
57	57	57	57	24	24	24	24	24	24
0.752	0.725			0.773	0.905	0.186	0.551		
0.259**	0.286**	0.326**	0.345**	–0.303**	–0.142**	–0.084	–0.090**	–0.224**	–0.158**
±0.024	±0.017	±0.081	±0.082	±0.082	±0.014	±0.146	±0.023	±0.190	±0.039

Table 3.10 Multiple meta-regression analysis for index effects

	Effect on risk						Effects on profitability	
	Precision WLS		DF WLS		Mixed-effects		Precision WLS	
Standard error	−0.011		−0.293		−0.140		−1.572	
	(0.403)		(0.362)		(0.494)		(0.723)	
Squared standard error		1.549		−0.777		3.683		−10.015
		(2.780)		(3.069)		(3.362)		(6.016)
Global Financial Crisis	−0.057***	−0.054**	−0.057***	−0.056***	−0.036	−0.038	−0.099	−0.067
	(0.017)	(0.018)	(0.017)	(0.017)	(0.037)	(0.036)	(0.093)	(0.102)
Legal history	−0.074***	−0.076***	−0.074***	−0.072***	−0.097***	−0.093***	0.075***	0.099***
	(0.014)	(0.017)	(0.011)	(0.012)	(0.035)	(0.034)	(0.017)	(0.007)
Big banks	0.029	0.031	0.016	0.018	0.054**	0.050**	0.013	0.018
	(0.020)	(0.019)	(0.012)	(0.012)	(0.022)	(0.023)	(0.015)	(0.017)
Commercial banks	0.009**	0.010**	0.008**	0.008**	0.01	0.011	0.077***	0.080***
	(0.004)	(0.004)	(0.003)	(0.003)	(0.011)	(0.011)	(0.013)	(0.016)
Industry classifications	−0.016	−0.015	−0.01	−0.011	−0.017	−0.019		
	(0.022)	(0.024)	(0.018)	(0.018)	(0.043)	(0.042)		
Multiple incomes	−0.005	−0.004	−0.007	−0.006	0.026	0.028	0.221***	0.227***
	(0.011)	(0.011)	(0.010)	(0.010)	(0.016)	(0.015)	(0.049)	(0.043)
Real effects	0.034**	0.031**	0.036***	0.033***	0.033	0.028	0.062**	0.06
	(0.012)	(0.011)	(0.007)	(0.006)	(0.021)	(0.021)	(0.024)	(0.031)
Static risk measure	−0.046	−0.050	−0.033	−0.034	−0.076***	−0.074***		
	(0.028)	(0.029)	(0.018)	(0.020)	(0.026)	(0.026)		
Cross-sectional	−0.001	−0.002	−0.015	−0.015	0.03	0.025	−0.021	−0.007
	(0.031)	(0.031)	(0.030)	(0.029)	(0.030)	(0.029)	(0.035)	(0.042)
Endogeneity-controlled	−0.100**	−0.111**	−0.090***	−0.094***	−0.158***	−0.154***	0.018	0.001
	(0.036)	(0.039)	(0.016)	(0.021)	(0.027)	(0.027)	(0.037)	(0.039)
Constant	0.120***	0.124***	0.121***	0.116***	0.141***	0.135***	−0.068	−0.126**
	(0.027)	(0.032)	(0.028)	(0.027)	(0.048)	(0.047)	(0.058)	(0.049)
Observations	227	227	227	227	227	227	87	87
Adjusted *R*-squared	0.424	0.426	0.486	0.484			0.654	0.633
Combined effect	−0.069**	−0.075**	−0.056**	−0.065**	−0.084**	−0.089**	−0.021	−0.049**
95% prediction interval	±0.030	±0.023	±0.017	±0.014	±0.027	±0.024	±0.028	±0.030

Standard errors are in parentheses (cluster-robust for WLS). Levels of significance at 10%, 5% and 1% are denoted by *, ** and ***. Some variables are dropped because of collinearity issues.

				Effects on risk-adjusted profitability					
DF WLS		Mixed-effects		Weighted average		DF WLS		Mixed-effects	
−1.676		−0.677		0.467		0.703		−0.191	
(1.062)		(2.667)		(1.113)		(1.099)		(1.119)	
	−15.558**		3.682		4.441		7.29		−3.21
	(4.779)		(12.359)		(12.324)		(13.916)		(10.345)
		0.092	0.095	−0.093***	−0.094***	−0.098***	−0.100***	−0.214***	−0.209**
		(0.371)	(0.352)	(0.023)	(0.023)	(0.022)	(0.022)	(0.082)	(0.082)
0.224***	0.228***	0.119	0.134	−0.039	−0.043	−0.040	−0.046	−0.123	−0.117
(0.031)	(0.034)	(0.329)	(0.309)	(0.031)	(0.024)	(0.030)	(0.025)	(0.074)	(0.075)
0.009	0.012	−0.009	−0.008	−0.001	−0.001	0.009	0.009	−0.009	−0.009
(0.007)	(0.010)	(0.022)	(0.022)	(0.016)	(0.016)	(0.011)	(0.012)	(0.016)	(0.016)
0.075***	0.074***	0.078***	0.079***	0.042	0.043	0.038	0.04	0.072***	0.072***
(0.004)	(0.005)	(0.013)	(0.013)	(0.039)	(0.038)	(0.037)	(0.036)	(0.019)	(0.019)
				−0.085***	−0.085***	−0.086***	−0.086***	−0.103***	−0.103***
				(0.012)	(0.011)	(0.010)	(0.010)	(0.022)	(0.022)
0.267***	0.259***	0.039	0.039	0.011	0.01	0.006	0.005	0.007	0.007
(0.055)	(0.031)	(0.022)	(0.022)	(0.008)	(0.008)	(0.006)	(0.006)	(0.016)	(0.016)
0.048***	0.042***	0.095***	0.095***	0.036**	0.037**	0.033**	0.035**	0.048**	0.048**
(0.008)	(0.007)	(0.022)	(0.022)	(0.014)	(0.015)	(0.015)	(0.016)	(0.021)	(0.021)
				−0.015	−0.015	−0.024	−0.026	−0.048	−0.045
				(0.021)	(0.020)	(0.016)	(0.014)	(0.090)	(0.090)
0.110***	0.100***	0.008	−0.006	−0.029**	−0.029**	−0.031***	−0.030***	−0.114	−0.114
(0.027)	(0.026)	(0.222)	(0.217)	(0.012)	(0.011)	(0.009)	(0.008)	(0.080)	(0.079)
0.001	0.008	−0.125***	−0.125***	0.022	0.022	0.001	0.002	−0.003	−0.002
(0.048)	(0.026)	(0.026)	(0.026)	(0.031)	(0.032)	(0.022)	(0.023)	(0.019)	(0.019)
−0.195***	−0.225***	−0.153	−0.164	0.058	0.070	0.063	0.079**	0.227**	0.216
(0.034)	(0.024)	(0.349)	(0.324)	(0.059)	(0.037)	(0.053)	(0.034)	(0.116)	(0.119)
87	87	87	87	146	146	146	146	146	146
0.81	0.807			0.374	0.372	0.477	0.474		
−0.054**	−0.072**	−0.097	−0.101	−0.025	−0.016	−0.051**	−0.038**	−0.057	−0.060
±0.050	±0.019	±0.191	±0.184	±0.036	±0.027	±0.034	±0.025	±0.070	±0.066

on risk-adjusted profitability, negative *non-interest income effects* on risk and positive *fee effects* on risk adjusted profitability. The good practice sensitivity analysis further supports the evidence for positive *non-interest effects* and *trading effects* on profitability and for negative *index effects* on risk and risk adjusted profitability.

3.6.4 Bonferroni adjustment for multiple hypothesis testing

Since existing studies differ in methods and scope, this meta-analysis presents its results separately for twelve kinds of genuine effects. Assessing the significance of these twelve effects requires testing for twelve individual hypotheses. Such multiple hypotheses testing entails an increased risk of type I errors. This risk is especially relevant for exploratory analyses without clear a priori hypotheses, as is the case for meta-regression analyses. However, in the present meta-regression analysis, validating results over multiple models mitigates the risk of type I errors. Nonetheless, formally accounting for multiple hypothesis testing may be informative.

Higher significance threshold if more hypotheses

Perhaps the simplest and most widely used way to account for multiple hypothesis testing is the Bonferroni adjustment: For a significance threshold of α and n separate tests, the Bonferroni adjustment deems a score significant only if the corresponding p-value is $\leq \alpha/n$ (Noble 2009, 1136). However, the downside is that Bonferroni adjusted levels of significance may be overly conservative regarding type I errors at the cost of inflated type II errors (Perneger 1998).

Reduced significance of simple model

Applying the Bonferroni adjustment to the simple meta-regression analysis renders those results insignificant that are previously only significant at the 10% level. All simple meta-regression results previously significant at the 5% or 1% level remain significant on at least the 5% level. The adjustment thus affects both occurrences where the precision estimate test and the precision-effect estimate with standard errors correspond. Only corresponding test results would provide robust evidence for genuine effects. Thus, after the adjustment, all results from simple meta-regression analysis are non-robust. The evidence for positive *fee effects* on profitability and negative *trading effects* on risk-adjusted profitability is thus weakened.

In contrast, regarding the results from the multiple meta-regression analysis, the Bonferroni adjustment has little effect. Most predictions would also pass a higher threshold than the reported 95% level of confidence. All but one of the previously significant best practice combined effects remain significant at the 95% level of confidence for at least four of the six model specifications. The exception is the prediction for *non-interest income effects* on profitability. Without adjustment, four of the six model specifications yield significant positive results; with adjustment this is only the case for three specifications.

Little effect on extended model

3.6.5 Overall appreciation of evidence for genuine effects

When considering the Bonferroni adjustment, there remains evidence for genuine negative *trading effects* on risk-adjusted profitability and for positive *trading effects* on profitability. These two effects in combination support the otherwise weak evidence for positive *trading effects* on risk. Further, there is evidence for negative *non-interest income effects* and *index effects* on risk. In combination with the evidence on positive *trading effects* on risk, these observations support the otherwise weak evidence for negative *fee effects* on risk. For the remaining combinations of effects and performance measures, the meta-regression analysis yields, in summary, no clear evidence.

The results for genuine effects are generally less clear for fee income than for trading income. This lack of clarity could be due to the wider area of business activities contributing to fee income in contrast to trading income. The range of activities captured by fee income increases the unaccounted heterogeneity of observed *fee effects*.

Clearer evidence on trading than on fees

3.6.6 Moderators driving business model effects on performance

The sensitivity of combined effect predictions on assumed moderator parameter values raises the question of how individual moderator variables affect the relations between diversification and bank performance. Tables 3.7 to 3.10 present the detailed results for the multiple meta-regressions. It includes several moderator variables to explicitly model the heterogeneity among primary studies regarding samples and methods.

Mixed evidence on moderator influence

The coefficients of moderator variables generally describe how research design can lead to different observed effects. However, the robustness of the observed results is limited for most combinations of diversification and performance measures. Tables 3.7 to 3.10 show that only few moderator variables are significantly and robustly correlated with the effect variable over all six models. However, in combination with a check for consistent effects, it seems plausible that some moderators contribute to the effects of diversification. I thus interpret as evidence for moderator influence results that are significant over at least three of the six specifications and consistent across different performance and diversification measures.

Publication bias regarding fee and trading effects

The clearest evidence is observed for publication bias. The results show a negative publication bias for *fee effects* on profitability. *Standard error* or *squared standard error* are significantly negatively correlated with the effect variable for three of the six models. In addition, three of the six multiple meta-regression models show consistent evidence for a negative publication bias regarding *fee effects* on risk-adjusted profitability. Regarding *trading effects,* the results indicate positive publication bias on profitability and risk-adjusted profitability. In both cases, the evidence is robust over four of the six models. In addition, the results from the multiple meta-regression analysis match the findings that the simple meta-regression analysis provides on publication bias. This observation indicates that the existing empirical literature, on average, judges fees too critically and trading too favourably regarding effects on profitability and risk-adjusted profitability.

Endogeneity understates effects of fees and trading

A consistent pattern is also observable for the *endogeneity-controlled* variable. It contributes negatively to *non-interest income effects* on profitability in all six specifications. However, while evidence for influences on *fee effects* and *index effects* on profitability tend in the same direction, these results are both only significant over two of the six specifications. *Endogeneity-controlled* further contributes negatively to *fee effects* and *index effects* on risk in four and six specifications. In contrast, this moderator's contributions to *trading effects* on profitability and risk are positive in four and three specifications. These results suggest that studies not accounting for endogeneity underestimate the riskiness and profitability of trading business. Also, the results indicate that studies not accounting for endogeneity overestimate, both, the profitability and riskiness of fee generating business. In combination, these observations lead to the counter-intuitive conclusion that not controlling for endogeneity understates effect sizes. An explanation for this observation could be that only authors who find clear effects can "afford" instrumental variable approaches and maintain their significant results.

Specialized banking tradition harms fees and helps trading

The results further provide some evidence that banks' ability to benefit from diversification depends on the *legal history* of their home country. Studies focusing on countries with a *legal history* of separating banking and securities business are shown to find less positive *non-interest income effects* on profitability in all six specifications. This relation could be driven by fees, as suggested by the negative contribution of *legal history* to *fee effects* on profitability. However, this connection is only observed for two model specifications. The contribution to *trading effects* on profitability is, in contrast, positively affected by a *legal history* of separating banking from securities business over all six models. So banks from countries with a *legal history* of separating banking and securities business have more difficulties building a profitable fee-based business. For trading activities, banks from such countries appear to be in a better position. A possible explanation might be that in countries that used to restrict banks' securities business, a more market-based (in contrast to bank-based) financial system has developed.

Big banks benefit from fees and trading

Finally, studies focusing on *big banks* tend to find more positive *fee effects* on profitability in three of the models and on risk-adjusted profitability in six of them. Similarly, but with more limited robustness, two models indicate positive *trading effects* on profitability and one model shows positive *trading effects* on risk-adjusted profitability. These results suggest that larger banks can more easily profit from diversification than smaller institutions. However, the results for *non-interest income effects* and *index effects* do not confirm this observation.

No clear evidence for other moderators

For the remaining moderator variables some significant contributions to effects can be observed, but they do not provide a consistent picture. Clearer patterns might become observable once the body of empirical literature has grown further.

3.7 CONCLUSION

The idea of legally limiting banks' engagement in securities business has regained popularity after the Global Financial Crisis. However, the existing empirical literature on bank income diversification provides no clear support for such regulations. Neither evidence for nor against diversification clearly dominates. The meta-regression analysis presented in this study investigates this discord. The analysed literature includes thirty-four studies with a total of 932 regressions. Based on this data set, the analysis aims at detecting the genuine effects of income diversification and explaining the discord in the literature.

Consistency checks over multiple effects

The existing literature applies various approaches to measure diversification and its effects. For diversification, most authors simply use the banks' dependence on non-interest income as opposed to interest income. Other authors separately measure the dependence on fees and trading income, and yet others construct diversification indices assuming that equal shares across all types of income correspond to maximum diversification. To measure effects on bank performance, existing studies assess risk, profitability or risk-adjusted profitability. For the meta-regression analysis presented here, the four measures of diversification and three measures of performance provide twelve conceptually related measures of diversification effects. This set-up allows consistency checks that are not possible for existing meta-regression analyses in economics.

Trading lowers risk-adjusted profitability

The results illustrate that whether empirical studies find positive or negative effects of diversification on performance depends critically on the studies' research design. The evidence for underlying genuine effects observable across the body of empirical literature is mixed. None of the results from this meta-regression analysis is perfectly robust. The most solid evidence indicates that diversification towards trading decreases risk-adjusted profitability. Less robust evidence suggests that diversification towards trading increases both profitability and risk. There is also evidence that diversification as measured by the share of non-interest income and by constructed diversification indices reduces risk. Since fee income is the main component of such diversification measures, these results support the otherwise weak evidence that diversification towards fee-generating activities decreases risk. However, the results are inconclusive regarding the effects of fee generating activities on profitability and risk-adjusted profitability.

Fees judged too critically and trading too favourably

Meta-regression analysis suggests that the existing empirical literature, on average, underestimates the beneficial effects of fee income on profitability and risk-adjusted profitability because of publication bias. For the same reason, the literature overestimates the positive effects of trading income on profitability and underestimates the negative effects on risk-adjusted profitability. Regarding profitability and risk-adjusted profitability, the literature thus tends to judge fees too critically and trading too favourably.

Explanations for discord in literature

The results provide some explanations for the discord in the existing empirical literature. Studies not accounting for endogeneity underestimate the riskiness of trading business. Larger banks are more successful in increasing profits by expanding fee-generating activities and trading. Furthermore, the legal history of some countries to separate banking and securities business negatively affects the profitability of fee-generating activities but positively affects the profitability of trading.

Policy implications

Overall, the meta-regression analysis provides some support for the general political argument that trading business increases the risk of banks. However, whether this observation calls for regulatory limitations to trading activities remains questionable because some evidence suggests that larger banks are more likely to profit from increased trading business. The results further provide support for the popular strategy to expand fee-generating activities, especially for large banks.

Future research to analyse specific fee income types

Future research should analyse individual types of fee income to capture the sources of the heterogeneity present in existing empirical results. Doing so could be helpful to gain more clarity on the effects of fee income on bank performance.

APPENDIX

Table 3.11 Literature included in the meta-regression analysis

ALTUNBAS, Yener, Simone MANGANELLI and David MARQUES-IBANEZ. 2011. *Bank Risk During the Financial Crisis: Do Business Models Matter?* Working Paper Series No. 1394, European Central Bank. https://www.ecb.europa.eu/pub/pdf/scpwps/ecbwp1394.pdf.

BAELE, Lieven, Olivier DE JONGHE and Rudi VANDER VENNET. 2007. "Does the Stock Market Value Bank Diversification?" *Journal of Bank-ing & Finance* 31 (7): 1999–2023. doi: 10.2139/ssrn.883593.

BEN GAMRA, Saoussen and Dominique PLIHON. 2011. *Revenue Diversification in Emerging Market Banks: Implications for Financial Performance.* Working paper, CEPN Centre d'Économie de l'Université Paris-Nord. https://arxiv.org/abs/1107.0170.

BREWER, Elijah III. 1989. "Relationship between Bank Holding Company Risk and Nonbank Activity." *Journal of Economics and Business* 41 (4): 337–353. doi: 10.1016/0148-6195(89)90030-1.

BRIGHI, Paola and Valeria VENTURELLI. 2013. *The Effect of Revenue and Geographic Diversification on Bank Performance.* Working Paper No. 43, CEFIN Centro Studi Banca e Finanza, Università di Modena e Reggio Emilia. http://morgana.unimo.it/campusone/web_dep/CefinPaper/CEFIN-WP43.pdf.

BUSCH, Ramona and Thomas KICK. 2009. *Income Diversification in the German Banking Industry.* Discussion Paper Series No. 2, Banking and Financial Studies, Deutsche Bundesbank. doi: 10.2139/ssrn.1342282.

CALMÈS, Christian P. A. and Raymond THÉORET. 2012. *The Change in Banks' Product Mix, Diversification and Performance: An Application of Multivariate GARCH to Canadian Data.* RePAd Working Paper Series, University of Quebec. doi: 10.2139/ssrn.2380711.

CHIORAZZO, Vincenzo, Carlo MILANI and Francesca SALVINI. 2008. "Income Diversification and Bank Performance: Evidence from Italian Banks." *Journal of Financial Services Research* 33 (3): 181–203. doi: 10.1007/s10693-008-0029-4.

DEMIRGÜÇ-KUNT, Asli and Harry HUIZINGA. 2010. "Bank Activity and Funding Strategies: The Impact on Risk and Returns." *Journal of Financial Economics* 98 (3): 626–650. doi: 10.1596/1813-9450-4837.

DEMIRGÜÇ-KUNT, Asli, Edward KANE and Luc LAEVEN. 2014. *Deposit Insurance Database.* Working Paper No. 14/118, International Monetary Fund. https://www.imf.org/en/Publications/WP/Issues/2016/12/31/Deposit-Insurance-Database-41710.

DEMSETZ, Rebecca S. and Philip E. STRAHAN. 1997. "Diversification, Size and Risk at Bank Holding Companies." *Journal of Money, Credit and Banking* 29 (3): 300–313. doi: 10.2307/2953695.

DEYOUNG, Robert and Gökhan TORNA. 2013. "Nontraditional Banking Activities and Bank Failures during the Financial Crisis." *Journal of Financial Intermediation* 22 (3): 397–421. doi: 10.1016/j.jfi.2013.01.001.

GAMBACORTA, Leonardo and Adrian VAN RIXTEL. 2013. *Structural Bank Regulation Initiatives: Approaches and Implications.* Working Paper No. 412, Bank for International Settlements. http://www.bis.org/publ/work412.pdf.

GODDARD, John, Donal MCKILLOP and John O. S. WILSON. 2008. "The Diversification and Financial Performance of US Credit Unions." *Journal of Banking & Finance* 32 (9): 1836–1849. doi: 10.1016/j.jbankfin.2007.12.015.

GÜRBÜZ, Ali O., Serhat YANIK and Yusuf AYTÜRK. 2013. "Income Diversification and Bank Performance: Evidence from Turkish Banking

Table 3.11 (*continued*)

Sector." *Journal of BRSA Banking and Financial Markets* 7 (1): 9–29. http://www.bddk.org.tr/websitesi/turkce/raporlar/bddk_dergi/12248makale1.pdf.

HIDAYAT, Wahyu Y., Makoto KAKINAKA and Hiroaki MIYAMOTO. 2012. "Bank Risk and Non-Interest Income Activities in the Indonesian Banking Industry." *Journal of Asian Economics* 23 (4): 335–343. doi: 10.1016/j.asieco.2012.03.008.

HIRTLE, Beverly J. and Kevin J. STIROH. 2007. "The Return to Retail and the Performance of US Banks." *Journal of Banking & Finance* 31 (4): 1101–1133. doi: 10.1016/j.jbankfin.2006.10.004.

HRYCKIEWICZ, Aneta. 2014. *Originators, Traders, Neutrals and Traditioners – Various Banking Business Models across the Globe. Does the Business Model Matter for Financial Stability?* Working paper, Chair of International Banking and Finance, Goethe University Frankfurt. doi: 10.2139/ssrn.2412171.

JI, Yueh-Er, Ming-Chang CHENG, Chien-Chi LEE and I-Ju CHEN. 2012. "Diversification in Banking: Is Non-Interest Income the Answer? The Case of Taiwan Banking Industry." *Journal of Business and Policy Research* 7 (1): 1–29. http://www.jbprpapers.com/page/2012/april.

KÖHLER, Matthias. 2015. "Which Banks Are More Risky? The Impact of Business Models on Bank Stability." *Journal of Financial Stability* 16: 195–212. doi: 10.2139/ssrn.2180688.

LEE, Chien-Chiang, Meng-Fen HSIEH and Shih-Jui YANG. 2014. "The Relationship between Revenue Diversification and Bank Performance: Do Financial Structures and Financial Reforms Matter?" *Japan and the World Economy* 29 (C): 18–35. doi: 10.1016/j.japwor.2013.11.002.

LEPETIT, Laetitia, Emmanuelle NYS, Philippe ROUS and Amine TARAZI. 2008. "Bank Income Structure and Risk: An Empirical Analysis of European Banks." *Journal of Banking & Finance* 32 (8): 1452–1467. doi: 10.1016/j.jbankfin.2007.12.002.

LI, Li and Yu ZHANG. 2013. "Are There Diversification Benefits of Increasing Noninterest Income in the Chinese Banking Industry?" *Journal of Empirical Finance* 24 (C): 151–165. doi: 10.1016/j.jempfin.2013.10.004.

MERCIECA, Steve, Klaus SCHAECK and Simon WOLFE. 2007. "Small European Banks: Benefits from Diversification?" *Journal of Banking & Finance* 31 (7): 1975–1998. doi: 10.1016/j.jbankfin.2007.01.004.

MESLIER, Céline, Ruth TACNENG and Amine TARAZI. 2014. "Is Bank Income Diversification Beneficial? Evidence from an Emerging Economy." *Journal of International Financial Markets, Institutions and Money* 31 (C): 97–126. doi: 10.1016/j.intfin.2014.03.007.

SANYA, Sarah O. and Simon WOLFE. 2011. "Can Banks in Emerging Economies Benefit from Revenue Diversification?" *Journal of Financial Services Research* 40 (1): 79–101. doi: 10.2139/ssrn.1077842.

SAWADA, Michiru. 2013. "How Does the Stock Market Value Bank Diversification? Empirical Evidence from Japanese Banks." *Pacific-Basin Finance Journal* 25 (C): 40–61. doi: 10.1016/j.pacfin.2013.08.001.

SCHMID, Markus M. and Ingo WALTER. 2009. "Do Financial Conglomerates Create or Destroy Economic Value?" *Journal of Financial Intermediation* 18 (2): 193–216. doi: 10.1016/j.jfi.2008.07.002.

STIROH, Kevin J. 2004. "Diversification in Banking: Is Noninterest Income the Answer?" *Journal of Money, Credit and Banking* 36 (5): 853–82. doi: 10.1353/mcb.2004.0076.

———. 2004. "Do Community Banks Benefit from Diversification?" *Journal of Financial Services*

Table 3.11 (*continued*)

Research 25 (2): 135–160. doi: 10.1023/b:fina.0000020657.59334.76.

———. 2006. "New Evidence on the Determinants of Bank Risk." *Journal of Financial Services Research* 30 (3): 237–263. doi: 10.1007/s10693-006-0418-5.

———. 2006. "A Portfolio View of Banking with Interest and Noninterest Activities." *Journal of Money, Credit and Banking* 38 (5): 1351–1361. doi: 10.1353/mcb.2006.0075.

Stiroh, Kevin J. and Adrienne Rumble. 2006. "The Dark Side of Diversification: The Case of US Financial Holding Companies." *Journal of Banking & Finance* 30 (8): 2131–2161. doi: 10.1016/j.jbankfin.2005.04.030.

Templeton, William K. and Jacobus T. Severiens. 1992. "The Effect of Nonbank Diversification on Bank Holding Company Risk." *Quarterly Journal of Business and Economics* 41 (4): 3–17. http://www.jstor.org/stable/40473066.

CHAPTER FOUR

Diversification and Performance of Large Banks

In international policy debates after the Global Financial Crisis, proponents of regulatory limits to banks' investment banking activities referred to the American Glass–Steagall Act (UCHITELLE 2009). However, this still ongoing policy debate is based on limited empirical grounds. Policy makers are mainly concerned about the resilience of the largest banks because it is these institutes that generate externalities when balancing their risk-return profile. Nonetheless, existing studies on the effects of income diversification do not focus on such banks but instead analyse heterogeneous samples. It is thus unclear to what extent existing findings can be conferred to large banks.

Discordant findings in existing literature

In addition, there is discord in the existing literature on the effects of bank income diversification. While some existing studies find trading activities to increase risks and decrease risk-adjusted profitability (e.g. DEYOUNG and ROLAND 2001; STIROH 2004b), there are also notable reports of negative effects on risk and positive effects on risk-adjusted profits (e.g. LEPETIT et al. 2008; MESLIER, TACNENG and TARAZI 2014). Regarding the effects from fee-generating activities, available empirical evidence draws an even less conclusive picture (e.g. KWAN 1998 vs. DEMIRGÜÇ-KUNT and HUIZINGA 2010).

Need for more granular analysis

This study examines the effects of income diversification on the performance of large international banks, arguably the most relevant institutes for the post-crisis policy debate. The study provides new insights by breaking up fee income into detailed types of business activities. Only few existing studies are able to break up non-interest income in more categories than just fee and trading income (e.g. Calmès and Théoret 2012; DeYoung and Torna 2013). To obtain this level of detail, these studies utilize regulatory data sets; however, available regulatory data are country-specific and thus prevent international comparisons. Such data limitations force existing studies to include smaller banks in their samples to obtain sufficiently large samples. Yet, findings from such heterogeneous samples are not necessarily conferrable to large international banks.

Novel data set

The present study focuses on large banks with over USD 100 billion in total assets. Similar to the existing literature, I use income statement data on fee and trading income for my analysis. To obtain more detailed information on non-interest income, I combine this data with investment banking deal volumes and assets under management. From annual reports and secondary sources, I compile the most comprehensive panel of assets under management data in the literature. The resulting sample consists of ninety international banks over the years 2005 to 2015. As an additional improvement in comparison to the existing literature I use the daily available Bloomberg Default Risk indicator as dependent variable. This indicator has the advantage that it is not based on return volatility and can thus exploit longitudinal changes in risk.

More diversified large banks are less risky and more profitable

The results indicate that banks with a more diversified income structure generally have a lower default risk and higher profitability. Retail fee income, trading income and income from syndicated loan underwriting reduce banks' default risk and increase their profitability. Equity underwriting, in contrast, increases default risk and decreases profitability and risk-adjusted profitability. For diversification towards debt underwriting, merger and acquisition services (M&A), and asset management, the analysis yields no conclusive effects on bank performance. These findings provide support for bank strategies to increase fee income. However, the results cast doubts on the effectiveness of limiting banks trading and investment banking activities as a mean to make large banks more resilient.

4.1 DATA

This study is more focused on large banks and includes more detailed information on bank income than existing studies with international samples. The following section discusses the sampled data and its sources.

4.1.1 Sample selection and data collection

Large and systemically important banks are arguably the most relevant institutes for the post-crisis policy debate. To balance focusing on large banks and adequate sample size, this study includes banks with more than USD 100 billion in total assets. This criterion serves as an approximation for banks' systemic importance, which is not officially defined for the whole sample period. Also, official definitions of systemic importance vary between countries. The size criterion combined with data availability results in an unbalanced panel of ninety listed banks with 979 annual data points from 2003 to 2015. The length of individual time series varies from four to thirteen years. However, because of the applied dynamic panel data analysis with incorporated lags, the actual number of observations decreases to 799. Table 4.9 in this chapter's appendix on page 119 lists the included banks.

Data sources

I mainly construct the panel from balance sheets and income statements from Thomson Reuters' Eikon. From this source I obtain data on fee and trading income and investment banking deal volumes. In addition, I collect data on assets under management from Pension & Investments' annual asset manager rankings and from banks' annual reports. Data on default risk is gathered from Bloomberg. Bank-specific control variables are obtained from Thomson Reuters' Eikon, macroeconomic control variables from Thomson Reuters' Datastream.

More detailed income data than literature

The collected data set provides more detailed insights on international banks' income generating activities than available from the existing literature. The focus on large international banks increases the relevance for recent and ongoing policy debates and improves the availability of detailed data. Such a focus also reduces potentially unobservable heterogeneity in

Table 4.1 Description of variables

Variable	Description	Source
Dependent variables		
Default risk	Natural logarithm of the annual maximum of the daily available one-year default probability from Bloomberg Default Risk (ranging from 0 to 1 before logarithmization)	Bloomberg
Profitability	Annual return on assets	Eikon
Risk-adjusted profitability	Annual return on assets times annual maximum of one-year default probability	Eikon, Bloomberg
Variables of interest		
Non-interest diversification	Index of diversification between interest income and combined non-interest income (i.e. fees and trading) based on each bank's deviations from average reliance on each income type, scaled from 0 (minimum observed diversification) to 1 (market diversification, defined as maximum diversification)	Eikon
Detailed diversification	Analogously constructed index of diversification between interest income and all individual non-interest activities as listed below, scaled from 0 to 1	Eikon, P&I, annual reports
Fees	Ratio of annual fee and commission income per total assets	Eikon
Trading	Ratio of annual trading income per total assets	Eikon
Equity	Ratio of annual volume of equity deals per total assets	Eikon
Debt	Ratio of annual volume of debt deals per total assets	Eikon
Syndicated Loans	Ratio of annual volume of syndicated loan deals per total assets	Eikon
M&A	Ratio of annual volume of M&A deals per total assets	Eikon
Asset management	End-of-year assets under management per total assets	P&I, annual reports
Control variables		
Size	Total assets in trillion USD	Eikon
Leverage	Ratio of total assets over total equity	Eikon
Economic growth	Annual GDP growth in bank's home country in percent	Datastream
Interest rate	End-of-year three-month treasury rate in bank's home country in percent	Datastream

Where no unit is stated the variable is measured in units of one.

business models. Table 4.1 provides an overview of all used variables, their definitions and sources. Table 4.2 presents the summary statistics.

4.1.2 Measures of bank performance

I measure bank performance in terms of *default risk, profitability* and *risk-adjusted profitability.* To measure *default risk,* I use the natural logarithm of the Bloomberg Default Risk indicator. This indicator estimates the probability of a default over the next year. It is based on proprietary, non-public risk models incorporating market and fundamental data. The indicator offers default risk estimates for public and private companies alike, which implies that, in terms of market data, not only stock price volatility but also bond spreads and spreads on credit default swaps (CDS spreads) are factored in.

Natural logarithm of annual risk maxima

The index provides daily data. To convert this index to an annual frequency like the rest of the data, I select the maximum index values of each bank and year. Doing so allows exploiting the index's intra-year variance, while simply using end-of-year values would forgo available information. I

Table 4.2 Summary statistics

	Mean	Median	Min.	Max.	Within std. dev.	Between std. dev.	Overall std. dev.
Risk	−3.712	−3.840	−4.935	−0.412	0.425	0.437	0.579
Profitability	0.009	0.009	−0.041	0.068	0.006	0.007	0.009
Risk-adjusted profitability	0.009	0.009	−0.039	0.067	0.006	0.007	0.009
Non-interest diversification	0.976	0.995	0.000	1.000	0.062	0.070	0.096
Detailed diversification	0.996	0.999	0.802	1.000	0.008	0.012	0.014
Fees	0.010	0.008	−0.011	0.051	0.003	0.007	0.007
Trading	0.012	0.007	−0.011	0.127	0.010	0.015	0.018
Debt	0.036	0.016	0.000	0.907	0.025	0.065	0.065
Equity	0.005	0.001	0.000	0.100	0.006	0.009	0.011
Syndicated Loans	0.029	0.010	0.000	0.596	0.031	0.043	0.050
M&A	0.086	0.008	0.000	1.790	0.096	0.189	0.215
Asset management	0.584	0.265	0.000	16.289	0.419	1.260	1.435
Size	0.808	0.469	0.062	3.675	0.239	0.733	0.763
Leverage	19.166	17.267	6.722	71.733	5.015	7.342	8.944
Economic growth	2.173	2.010	−5.620	26.280	2.367	2.540	3.089
Interest rate	3.764	3.570	−0.069	16.490	1.241	2.029	2.407

use the natural logarithm to obtain a more normally distributed *default risk* variable.

More responsive risk indicator

The chosen *default risk* indicator is more responsive to changes in risk than alternative indicators measuring risk based on income volatility. The most popular risk indicator in the literature is the *Z*-score, which measures the number of standard deviations that profits must fall to wipe out a bank's equity (e.g. Lown et al. 2000; Stiroh 2004b; Sanya and Wolfe 2011). This indicator is defined as:

$$Z = \frac{net\ income + equity}{\sigma_{net\ income}} \tag{4.1}$$

with the standard deviation $\sigma_{net\ income}$ being calculated over the whole sample period. However, using the standard deviation of net income over the sample period is, in my opinion, problematic for longitudinal analyses and it is also criticized in the literature (Lepetit and Strobel 2013). Measured this way, income volatility remains constant over time. Any longitudinal changes in the *Z*-score are thus driven by changes in leverage or profitability. Since the *Z*-score does not capture changes in income volatility, this index is ill-suited for assessing the risk effects of income diversification. Using Bloomberg Default Risk avoids this problem.

Preferable to market-based indicators

The selected *default risk* variable is preferable to purely market-based risk indicators. It offers a better measurement of default probability than stock price volatility and is available for more banks and over more years than CDS or bond spreads.

Other dependent variables

As a second dependent variable, I use *profitability,* defined as pre-tax return on assets, as reported by Thompson Reuter's Eikon. Furthermore, I include *risk-adjusted profitability* as the dependent variable. This variable is constructed as the product of pre-tax return on assets and the converse probability of a default over the next year as estimated by the Bloomberg Default Risk indicator (which is not logarithmized here).

4.1.3 Measures of diversification in individual income types

In the existing empirical literature, there are two general approaches to measure income diversification of banks: through a comprehensive index (e.g. ALTUNBAS, MANGANELLI and MARQUES-IBANEZ 2011) or by separately assessing a bank's reliance on individual income types other than traditional interest income (e.g. KÖHLER 2015). Thereby, diversification indices usually include multiple measures of individual income types as building blocks. In a first step I therefore discuss the measures of individual income types included in this study.

Fees and trading per total assets

I follow DEYOUNG and TORNA (2013) to construct the variables *fees* and *trading* by normalizing the respective income statement figures by total assets. Dividing by total assets serves as a proportional approximation for the actual return on assets of each business activity. This exact measure cannot be calculated due to the divisor being unknown. Other authors (e.g. SANYA and WOLFE 2011; KÖHLER 2015) normalize individual income streams by total operating income. However, this approach causes troubles if the income becomes zero or negative. Dividing by total assets avoids such problems and seems more intuitive.

Different activities contribute to fees

Fees and *trading* in combination are only an unsatisfactory proxy for investment banking activities. In particular, the *fees* variable not only measures income that stems from various investment banking activities but also from other banking areas. DEYOUNG and RICE (2004, 47) show for American banks with over USD 25 billion of total assets that, apart from fee income related to investment banking business, the major proportion of fee income is related to asset management: Investment banking and securitization fees together account for 40% of attributable fee income, and fiduciary and deposit fees for 54%.[6] More information on fee income is thus necessary to identify the share of fee income that is related to investment banking.

6 The source lists subtypes of fee income together with other types of non-interest income. To calculate the stated percentages, venture capital income, gains on asset sales and insurance related income were excluded because they are not included in the fee income data used in the present study.

Investment banking volumes as proxies

To analyse bank income in more detail than found in the existing literature, I include data to individually measure five subcategories of fee income. Namely, I include investment banking fees from *equity, debt, syndicated loans,* and *M&A* deals, and fees from *asset management.* For investment banking, I use data on deal volumes from Eikon's League Tables, normalized by total assets, to approximate individual types of investment banking fee income.

Compiling assets under management

For *asset management* activities, assets under management data, normalized by total assets, serve as a proxy for the related fee income. Since assets under management are not on banks' balance sheets, accounting standards do not require banks to report this data. Consequently, availability of data on assets under management is patchy and varies between banks and years. Assembling a substantial data set of assets under management information thus requires compiling data from various sources. I collect most assets under management data from Pensions & Investments' survey-based annual asset manager rankings. Further data are collected from banks' voluntary disclosures in annual reports. If data from Pensions & Investment and from annual reports only yield incomplete time series for an individual bank, I combine the time series if they overlap and match during the overlapping periods. If the overlapping time series for a bank diverge, I scale the shorter segment to match the longer segment. Banks change their reporting format considerably over time. If combining assets under management from annual reports results in inexplicable jumps, I drop the suspicious observations. Since assets under management usually evolve relatively steadily over time, I fill missing values between available years from consistent sources with linear interpolation. This concerns 12 of 799 data points. I do not, however, extrapolate any missing values.

4.1.4 Diversification indices

Measuring banks' reliance on certain activities does not directly enable conclusions on the effects of diversification. If a bank has a very low share of non-interest income, we could argue that expanding non-interest income activities constitutes an increase in diversification. But large international banks tend to generate relatively high shares of non-interest income. For such banks it is not a priori clear if increasing non-interest income activities reflects increasing or decreasing diversification. Also, it is unclear how shifts between non-interest income activities affect the level of diversification. Constructing a diversification index solves this problem. In the literature (e.g. Stiroh 2006; Goddard, McKillop and Wilson 2008), a popular approach for constructing diversification indices is based on a reversed Herfindahl concentration index:

$$diversification = 1 - \left(\frac{interest\ income}{operating\ income}\right)^2 - \left(\frac{non\text{-}interest\ income}{operating\ income}\right)^2 \quad (4.2)$$

where *operating income* is defined as the sum of *interest income* and *non-interest income*. An analogous index can be derived for more than two income types (e.g. Mercieca, Schaeck and Wolfe 2007; Sanya and Wolfe 2011).

Naive diversification indices have arbitrary maximum level

In my opinion, this approach bears two disadvantages: First, the approach implies that under maximum diversification each income type has the same size. This assumption is not necessarily true from a portfolio theory perspective. And assuming so becomes more problematic if, like in this study, multiple income categories and subcategories are analysed. Second, the approach implies an arbitrary maximum level of diversification if different income types are measured in different units. By using business volumes as proxies for related fee income, I assume that fees from each business line are the product of a constant but unknown multiplier and the respective business volume. However, this constant and unknown multiplier is different for each income type. Defining maximum diversification as an even split of income types would thus be arbitrary because the unknown units of measurement are different across income types. Herfindahl indices thus bear serious disadvantages for measuring diversification.

Adapted industry concentration index as alternative

To avoid these disadvantages, I construct my indices borrowing from the approach of Kacperczyk, Sialm and Zheng (2005) for measuring industry concentration of investment portfolios. I construct two indices to measure diversification between interest and non-interest income (*non-interest diversification*) and to measure diversification between all available individual types of income (*detailed diversification*). For measuring *detailed diversification,* the described disadvantages of Herfindahl indices are particularly relevant. So this index is discussed first. Applying an index for industry concentration of investment portfolios to the concentration within fee income results in:

$$\begin{aligned} \textit{detailed concentration}_{b,t} = &\; bias^2_{\textit{interest income},b,t} + bias^2_{\textit{fees},b,t} + bias^2_{\textit{trading},b,t} \\ &+ bias^2_{\textit{equity},b,t} + bias^2_{\textit{debt},b,t} + bias^2_{\textit{loans},b,t} \\ &+ bias^2_{\textit{M\&A},b,t} + bias^2_{\textit{asset management},b,t} \end{aligned} \tag{4.3}$$

where each bias describes the difference between the actual value of the income subtype and its expected value, that is, its arithmetic mean. To prevent arbitrary weighting of the different income types, I standardize the different *bias*-components to a common scale by dividing them by their standard deviation. In the example of income from *interests,* the *bias* is thus constructed as:

$$bias_{\textit{interest income},b,t} = \frac{\textit{interest income}_{b,t} - \overline{\textit{interest income}}}{\sigma_{\textit{interest income}}} \tag{4.4}$$

where $\textit{interest income}_{b,t}$ is the volume of debt investment banking deals of bank *b* at time *t*, normalized by the bank's total assets in the same year, and $\overline{\textit{interest income}}$ is the arithmetic mean of the normalized volume over all banks and periods. The devisor $\sigma_{\textit{interest income}}$ is the standard deviation of the normalized volume of interest income. The other income subcategory biases are constructed analogously.

Conversion to diversification index

Following the usage of the Herfindahl indices in the literature, I convert the concentration index into a diversification index which results in:

$$\textit{detailed diversification}_{b,t} = 1 - \frac{\textit{detailed concentration}_{b,t}}{\textit{detailed concentration}_{max}} \tag{4.5}$$

where dividing by the sample maximum rescales *detailed diversification* to lie within a 0 to 1 range. The resulting index now has the same range like reversed Herfindahl indices but avoids their disadvantages.

Interest income vs. non-interest income

A second index measures *non-interest diversification,* that is, diversification between *interest income* and *non-interest income,* the latter comprising *fees* and *trading* income. These components all have the same unit of measure. Constructing a reversed Herfindahl index would therefore be possible. Nonetheless, a traditionally constructed index would still have the disadvantage that it assumes equally sized income types as maximum diversification. Thus, and for the sake of consistency, I construct *non-interest diversification* in the same way as *detailed diversification.* A diversification index constructed this way corresponds to a reversed Herfindahl index if the arithmetic means of the two income types were each 50% of total operating income.

4.1.5 Control variables

I include several bank-specific and macroeconomic control variables that can be expected to affect, both, performance and income diversification of banks. Their omission could lead to omitted variable bias. The included variables are frequently controlled for in the existing literature (e.g. Demirgüç-Kunt and Huizinga 2010; Sanya and Wolfe 2011; DeYoung and Torna 2013).

Size

Size is measured as total assets in trillion USD. A bank's *size* might affect the extent to which a bank decides to diversify its income. Certain business areas might require a certain minimum volume and thus minimum bank size in order to be viable. At the same time, the *size* variable can affect bank performance. Larger banks may face reduced default probability because government support preventing bankruptcy is more likely (Penas and Unal 2004). Possible economies of scale may also cause larger banks to be more profitable. We thus expect size to have a negative effect on *default risk* and a positive effect on profitability and risk-adjusted profitability.

Leverage

Leverage describes the leverage ratio, that is, total assets per total equity. A high *leverage* can constrain a bank's diversification options for regulatory reasons. Leverage also affects a bank's *default risk* because a higher proportion of equity capital better absorbs shocks from declining asset values (LEHAR 2005, 2579). *Leverage* should thus be positively correlated with *default risk*. In addition, poorly capitalized banks need to operate more prudently which can decrease *profitability* (i.e. return on assets).

Economic growth

I further include macroeconomic variables to control for influences stemming from the economic situation in a bank's home country.[7] *Economic growth* describes the growth in GDP over the previous year in percent. A growing economy offers more attractive diversification options to banks than a contracting economy, in which banks and other firms might have to focus on what they do best. In contrast, a growing economy creates larger business volumes and lowers default rates on investments. We can thus expect banks to have lower *default risk* and higher *profitability* if *economic growth* is higher.

Interest rate

As another macroeconomic control I include *interest rate,* measured as the home country's end-of-year three-month treasury rate in percent. As experienced after the Global Financial Crisis, an expansionary monetary policy may depress banks' interest margins. Depressed interest margins may negatively affect bank profitability. However, not all bank activities are affected equally. Namely fee income should be less affected. Accordingly, the *interest rate* can have an effect on banks' decision to engage more in fee-generating activities. *Interest rate* is thus a confounding factor for bank performance and income diversification and must be controlled.

Fixed effects

In addition to the above discussed control variables, global macroeconomic developments are accounted for through the inclusion of year dummies. Bank dummies, in contrast, are unnecessary because unobserved time-invariant effects are cancelled out with the selected estimation method, as described in the next section.

7 Because of the low number of sample banks per country, the inclusion of country-year fixed effects would be an inefficient alternative to address the macroeconomic influences.

4.2 METHODS

The choice of method for this study is largely driven by the need to account for possible endogeneity of a bank's diversification decision. Diversification may not only influence bank performance; bank performance may also be a relevant factor for the management decision whether to diversify more or less. Existing studies identify the need to control for such endogeneity (Stiroh and Rumble 2006, 2145–2146; Baele, De Jonghe and Vander Vennet 2007, 2009). When using an ordinary least squares estimator in the presence of endogeneity, past shocks to the dependent variable can cause a correlation between the dependent variable and the error term. Such a correlation leads to dynamic panel bias (Nickell 1981). Also, if shocks are not explicitly modelled, they remain embedded in the error term and influence subsequent observations. Such autocorrelation is a violation of the assumptions for consistent ordinary least squares estimators.

4.2.1 System Generalized Method of Moments

In the recent empirical literature on bank activity diversification it has become standard practice to account for endogeneity by applying system generalized method of moments (GMM) estimation (e.g. Sanya and Wolfe 2011; Meslier, Tacneng and Tarazi 2014; Köhler 2015). This approach has been developed by Arellano and Bond (1991) and explicitly incorporates dynamic effects from the dependent variable from one period to another.

Facilitates search for instruments

System GMM is suitable for panels with fewer periods than individuals and with endogenous explanatory variables, such as the dataset of this study. The approach facilitates the search for instrumental variables since it allows for the use of internal instruments that are built from past observations of regressors and the dependent variable (Roodman 2009a, 100).

Differences equation

System GMM combines two equations. The first is expressed in differences to the previous period:

$$\Delta y_{i,t} = \alpha \Delta y_{i,t-1} + \Delta x'_{i,t}\beta + \Delta v_{i,t} \tag{4.6}$$

where suitable lags of the dependent variable and of explanatory variables are used as instruments. The term $y_{i,t}$ is the dependent variable *default risk, profitability* or *risk-adjusted profitability* for each bank i in period t. The lagged variable $y_{i,t-1}$ is the same measure observed in the previous period. The vector $x'_{i,t}$ represents all additional explanatory variables, including the variables of interest, control variables and year dummies. The error term $v_{i,t}$ is independent across banks (Roodman 2009a, 104).

Levels equation

The second equation is specified in levels:

$$y_{i,t} = \alpha y_{i,t-1} + x'_{i,t}\beta + \eta_i + v_{i,t} \tag{4.7}$$

where η_i describes unobserved bank specific effects (Roodman 2009a, 100; Sanya and Wolfe 2011, 82).

Bank fixed effects unnecessary

Under system GMM, unobserved time-invariant effects need not be accounted for by including fixed-effects dummies. Under this estimation method, all instruments for the levels equation are assumed to be orthogonal to fixed effects and other time-invariant variables. Including bank fixed-effects dummies, and thus removing fixed effects from the error terms, does not affect the moments that are the basis for identification. Bank fixed effects therefore do not affect the coefficient estimates for other regressors (Roodman 2009a, 115).

4.2.2 Specification choices

System GMM offers many specification choices. Following Roodman (2009a, 129), I report all specification choices. General specification choices are reported in the following subsection; specification choices for individual model variants are reported in the result tables.

One-step estimator for small panels

I apply a one-step estimator because evidence suggests this estimator to be more reliable than the two-step version for panels with fewer than hundred individuals (Soto 2009, 9). The reported standard errors are cluster-robust to heteroskedasticity and to arbitrary patterns of autocorrelation within individuals. I include year dummies to account for global economic developments. Including year dummies is also recommended by Roodman (2009a,

128) because doing so reduces the probability of correlation in idiosyncratic differences, which would violate a basic assumption of system GMM.

All regressors in instrument matrix

Following Roodman (2009a, 128), I include every regressor into the instrument matrix. In accordance with Köhler (2015), I thereby treat all bank-specific variables as potentially endogenous and other variables as strictly exogenous. Potentially endogenous variables are included in the instrument matrix as GMM-style instruments; strictly exogenous variables are included as standard instrumental variables.

Avoiding instrument proliferation

There is a danger in system GMM of including too many instrumental variables. Including too many instruments can overfit endogenous variables, weaken the power of diagnostic tests to detect invalid instruments and bias regression coefficients. While a strict rule does not exist, Roodman (2009a, 99) proposes, as a rule of thumb, that the instrument count should not exceed the number of individuals. To keep the instrument count sufficiently low I use a combination of instrument lag truncation and collapsing of the instrument matrix to one column. Subject to this condition, I select the combination that yields the best overall diagnostic test results for each regression.

4.2.3 Diagnostic tests

Roodman (2009b) warns of the risk of system GMM leading to invalid results that appear valid. He consequently emphasizes the importance of thorough diagnostic tests. I follow his recommendation as to which tests to perform.

Test for second order autocorrelation

The most important diagnostic is the Arellano and Bond (1991) test for autocorrelation in the residuals. It allows checking for first-order serial correlation in the levels equation (i.e. equation 4.7) by looking for second-order serial correlation in the differenced equation (i.e. equation 4.6). If the null hypothesis of no second-order correlation cannot be rejected, a higher lag of the dependent variable must be included. In this case, a test for second-order serial correlation in the levels equation and third-order serial correlation in the differenced equation is needed. The lag structure may be further increased until auto correlation in the residuals can be ruled out.

Hansen *J*-test for full instrument set

I also report the HANSEN (1982) *J*-test to avoid endogenous instruments. The tests' null hypothesis of exogenous instruments refers to all instruments collectively. A low *p*-value means that the instruments are not exogenous and do not satisfy the orthogonality condition. Here, ROODMAN (2007, 10–11) recommends not to be complacent with rejecting the null hypotheses at conventional significance levels of 5% or 10%. While these thresholds are conservative when deciding on the significance of a coefficient, they are liberal when ruling out correlation between instruments and the error term. ROODMAN recommends a minimum *p*-value of 25% instead.

Hansen *C*-test for instrument subsets

Closely related to the *J*-test for validity of the full instrument set is the *C*-test, also called difference-in-Hansen test. This test checks the exogeneity of instrument subsets by computing the increase in the *J*-test if a subset is added to the estimation. Following ROODMAN (2009b, 158), I perform the Hansen *C*-tests for the full set of instruments for the levels equation and for the subset based on the dependent variable.

4.2.4 Robustness checks

Researchers have considerable discretion regarding the specification choices of system GMM. If diagnostics are not convincing, ROODMAN (2009b, 140) therefore recommends testing the estimates for robustness to reducing the instrument set.

Limits of traditional instrument reduction

Regarding robustness checks for an analysis that initially includes the full instrument set, this recommendation is relatively clear: The researcher should limit the instrument range or collapse the instrument matrix to a single column. However, for the data set used in this study, ROODMAN's recommendation is less clear. The panel is relatively long, which causes the number of unrestricted instruments to be large in comparison to the number of banks. I thus truncate the lag range and collapse the instrument matrix to limit the number of instruments to the number of banks (see subsection 4.2.2 on specification choices). The only traditional way to further and meaningfully reduce instruments would be to collapse all lagged instruments and truncate them to only one period. Doing so would forgo a considerable amount of information.

Bontempi and Mammi (2015) present a way for more compelling robustness checks. The authors propose a principal component analysis of the instrument matrix to shrink the instruments into a set of linear combinations of the original variables. The weights used in such orthogonal combinations reflect the contribution of each variable to the observed total variability. The resulting principal component analysis scores (pca scores) are then used as instruments. In comparison to lag truncation and collapsing the instrument matrix, principal component analysis has the advantage of exploiting information from the whole set of instruments to select the lags that contribute most to total variability. The instrument count can be reduced while less available information is lost than in the case of traditional lag truncation and collapsing of the instrument matrix.

Fewer instruments through principal component analysis

For each presented regression, I conduct a principal component analysis on the set of included variables. When computing the score, I retain the principal components that, in sum, account for at least 90% of the variability in the original data. This value is the default criterion suggested by Bontempi and Mammi (2015, 1081). I include the scores as instruments in the initial system gmm model, in place of the lagged bank-specific variables. For reference, I include for each regression a variant with principal component analysis where I keep a similar instrument count. Subsequently and to check the results' robustness to reduced instrument counts, I include variants where the instrument count is reduced as much as possible: The scores are collapsed and truncated to just the second lag. The dependent variable instrument is collapsed and truncated to the first lag. The exogenous regressors remain as traditional instrumental variables. This procedure nearly halves the instrument count.

Settings for principal component analysis

4.3 RESULTS

The results indicate that banks with a more diversified income structure tend to have a lower *default risk,* higher *profitability* and higher *risk-adjusted profitability.* Evidence suggests that the average sample bank could reduce its *default risk* and increase *profitability* by increasing fee-generating business other than investment banking and asset management. Also by increasing trading activities, the average sample bank could improve *profitability* and *risk-adjusted profitability.* Note that the results for the control variables are synoptically discussed at the end of this section, in subsection 4.3.3.

4.3.1 Diversification lowers risk and increases profitability

The regression results for the effects of diversification on *default risk* are presented in Table 4.3. Columns (1) to (3) show the results for *non-interest diversification.* Columns (4) to (6) use the *detailed diversification* index, which includes diversification towards investment banking and asset management activities. The results consistently indicate that, both, *non-interest diversification* and *detailed diversification* lower *default risk.*

Economically significant effects

To interpret the economic significance of the estimated coefficients we have to remember how the diversification indices are constructed: Index value 1 describes the average income structure off all banks and index value 0 describes the income structure of the least diversified observed bank. A one-unit increase in diversification describes a bank moving from the very bottom of the diversification ranking to the very top. A one-unit increase would be an exceptional, but nonetheless plausible, increase in diversification. It would decrease the bank's log-probability of default by –1.533, based on the estimate from column (1). This equals a reduction in default probability by 88%. We can thus regard the decrease in *default risk* associated to diversification as economically significant.

Diagnostics and robustness checks

Columns (1) and (4) show the main results with the standard approach to instrument selection where the lags of potentially endogenous regressors serve as instruments. Their lag ranges are limited and matrices collapsed to the extent necessary to push the instrument count below the number of banks. While all Hansen tests yield insignificant results, some do not pass Roodman's (2007, 10–11) rule of thumb threshold of a 0.25 p-value. So, checking the coefficients' robustness to reducing the instrument count appears recommendable. To preserve available information while reducing the instrument count I use PCA scores as instruments. As an intermediate

Table 4.3 Effects of diversification on risk

	Risk					
	(1)	(2)	(3)	(4)	(5)	(6)
1st lag of regressand	0.849***	0.833***	0.546***	0.712***	0.761***	0.279**
	(0.115)	(0.081)	(0.146)	(0.098)	(0.091)	(0.120)
2nd lag of regressand	–0.414***	–0.163***	–0.387***	–0.472***	–0.170***	–0.450***
	(0.098)	(0.038)	(0.088)	(0.109)	(0.037)	(0.118)
Non-interest diversification	–1.533***	–0.845***	–2.658***			
	(0.403)	(0.234)	(0.641)			
Detailed diversification				–2.413***	–1.278***	–4.236***
				(0.309)	(0.256)	(0.469)
Size	–0.068	–0.008	–0.058	–0.096*	–0.018	–0.104
	(0.054)	(0.043)	(0.052)	(0.058)	(0.044)	(0.063)
Leverage	–0.012	–0.012	–0.007	–0.007	–0.008	0.006
	(0.010)	(0.008)	(0.007)	(0.010)	(0.008)	(0.007)
Economic growth	–0.044***	–0.035***	–0.057***	–0.049***	–0.037***	–0.066***
	(0.008)	(0.006)	(0.011)	(0.009)	(0.006)	(0.012)
Interest rate	–0.052***	–0.027*	–0.066***	–0.022	–0.006	–0.006
	(0.016)	(0.015)	(0.022)	(0.015)	(0.012)	(0.019)
Chi-squared	570***	1046***	380***	464***	746***	352***
Number of instruments	88	87	48	88	87	48
Lag range of regressand	1–1	1–3	1–1	1–1	1–3	1–1
Collapsed	No	No	Yes	No	No	Yes
Lag range of bank variables	2–5			2–5		
Collapsed	Yes			Yes		
Lag range of PCA scores		2–2	2–2		2–2	2–2
Collapsed		Yes	Yes		Yes	Yes
P-value AR(3)	0.468	0.290	0.779	0.550	0.291	0.674
Hansen's *J*-test	0.128	0.145	0.022	0.131	0.156	0.009
Hansen's *C*-test levels	0.074	0.014	0.008	0.143	0.011	0.028
Hansen's *C*-test *risk*	0.477	0.188	0.213	0.631	0.298	0.278

All regressions include 799 observations over ninety banks. Year dummies are included. Robust standard errors are in parentheses. Levels of significance at 10%, 5% and 1% are denoted by *, ** and ***.

step for reference, columns (2) and (5) present the results based on such instruments without significantly reducing the instrument count. Columns (3) and (6) present the results for fully truncated and collapsed instruments to lower the instrument count. Columns (3) and (6) expectedly perform poorly in the Hansen tests. However, the estimated coefficients qualitatively match the results from the standard system GMM model. The robustness check of reducing the instrument count thus supports the observed results.

Observed second-order autocorrelation

Note that all models include two lags of the dependent variable as explanatory variables. The additional lag addresses second-order serial correlation observed in several single-lag versions of these models and in models including other dependent variables (not reported). Third-order autocorrelation can be ruled out for all models. Including two lags of the dependent variable reduces the number of observations to 799, since two sample years are lost to lagging.

Positive effects on profitability

In table 4.4, we see the effects of diversification on *profitability.* Analogously to the results on *default risk,* columns (7) to (9) show the results for *non-interest diversification* and columns (10) to (12) those for *detailed diversification.* Columns (7) and (10) show the main results for standard system GMM. Columns (8) and (11) show the variant with PCA scores but without significantly reduced instrument count. The instrument counts are significantly reduced in columns (9) and (12). All results except for column (9) indicate significant positive diversification effects on *profitability.* The estimated coefficients may appear rather small. However, the summary statistics in table 4.2 indicate that the median bank has return on assets of less than 1%. If an exceptional but plausible one-unit increase in diversification increases return on assets by 1 percentage point, we must regard this result as economically significant.

Robustness checks support findings

Hansen diagnostics are insignificant for the two system GMM models in columns (7) and (10), but do not satisfy the 0.25 p-value rule of thumb. However, except for the aforementioned column (9), the robustness checks with PCA scores instrumentation and reduced instrument counts confirm the initial result. Third-order autocorrelation can be ruled out for all results.

Table 4.5 shows the effects of diversification on *risk-adjusted profitability.* Similar to the previously discussed tables, columns (13) to (15) show the results for *non-interest diversification* and columns (16) to (18) for *detailed diversification.* Columns (13) and (16) show the main results for standard system GMM, the other columns robustness checks with PCA scores instrumentation and reduced instrument count.

Table 4.4 Effects of diversification on profitability

	Profitability					
	(7)	(8)	(9)	(10)	(11)	(12)
1st lag of regressand	−0.247***	0.098*	−0.328***	−0.291***	−0.025	−0.361***
	(0.071)	(0.054)	(0.085)	(0.064)	(0.061)	(0.073)
2nd lag of regressand	−0.075	−0.023	−0.354**	−0.114	−0.122*	−0.380***
	(0.096)	(0.062)	(0.148)	(0.082)	(0.068)	(0.140)
Non-interest diversification	0.010***	0.003	0.010***			
	(0.004)	(0.003)	(0.003)			
Detailed diversification				0.016***	0.015***	0.018***
				(0.003)	(0.003)	(0.004)
Size	0.003***	0.001	0.004***	0.003***	0.003***	0.004***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Leverage	−0.0006***	−0.0001	−0.0006***	−0.0008***	−0.0008***	−0.0009***
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
Economic growth	0.0013***	0.0011***	0.0016***	0.0013***	0.0011***	0.0015***
	(0.0002)	(0.0002)	(0.0003)	(0.0002)	(0.0002)	(0.0003)
Interest rate	0.0014***	0.0011***	0.0022***	0.0010***	0.0007***	0.0016***
	(0.0003)	(0.0002)	(0.0003)	(0.0002)	(0.0003)	(0.0004)
Chi-squared	570***	1046***	380***	464***	746***	352***
Number of instruments	90	87	48	84	87	48
Lag range of regressand	1–11	1–3	1–1	1–5	1–6	1–1
Collapsed	Yes	No	Yes	Yes	Yes	Yes
Lag range of bank variables	2–6			2–6		
Collapsed	Yes			Yes		
Lag range of PCA scores		2–2	2–2		2–4	2–2
Collapsed		Yes	Yes		Yes	Yes
P-value AR(3)	0.970	0.669	0.238	0.970	0.786	0.312
Hansen's *J*-test	0.207	0.205	0.015	0.133	0.200	0.014
Hansen's *C*-test levels	0.136	0.053	0.000	0.113	0.033	0.000
Hansen's *C*-test *risk*	0.191	0.102	0.220	0.193	0.153	0.194

All regressions include 799 observations over ninety banks. Year dummies are included. Robust standard errors are in parentheses. Levels of significance at 10%, 5% and 1% are denoted by *, ** and ***.

Corresponding effects on risk-adjusted profitability

Analysing the effects on *risk-adjusted profitability* mainly serves to double-check the previous results on *default risk* and *profitability*. The results on *risk-adjusted profitability* are consistent with previous results and indicate a robust positive association with diversification.

Supportive robustness checks

The main results from columns (13) and (16) exhibit insignificant Hansen diagnostics. However, as before, these tests do not fulfil the 0.25 *p*-value rule

Table 4.5 Effects of diversification on risk-adjusted profitability

	Risk-adjusted profitability					
	(13)	(14)	(15)	(16)	(17)	(18)
1st lag of regressand	–0.184**	0.080	–0.313***	–0.218***	0.042	–0.350***
	(0.074)	(0.063)	(0.092)	(0.067)	(0.064)	(0.080)
2nd lag of regressand	–0.101	–0.052	–0.419***	–0.136	–0.093	–0.458***
	(0.112)	(0.093)	(0.145)	(0.093)	(0.079)	(0.120)
Non-interest diversification	0.009**	0.007**	0.010***			
	(0.004)	(0.003)	(0.003)			
Detailed diversification				0.014***	0.014***	0.017***
				(0.003)	(0.002)	(0.003)
Size	0.003***	0.002**	0.003***	0.003***	0.002**	0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Leverage	–0.0005***	–0.0004***	–0.0005***	–0.0007***	–0.0007***	–0.0008***
	(0.0002)	(0.0001)	(0.0001)	(0.0002)	(0.0001)	(0.0002)
Economic growth	0.0013***	0.0011***	0.0015***	0.0012***	0.0010***	0.0015***
	(0.0002)	(0.0002)	(0.0003)	(0.0002)	(0.0002)	(0.0003)
Interest rate	0.0014***	0.0009***	0.0022***	0.0010***	0.0006***	0.0017***
	(0.0002)	(0.0002)	(0.0003)	(0.0002)	(0.0002)	(0.0003)
Chi-squared	581***	1232***	440***	504***	966***	416***
Number of instruments	90	89	46	90	89	46
Lag range of regressand	1–11	1–11	1–1	1–11	1–11	1–1
Collapsed	Yes	Yes	Yes	Yes	Yes	Yes
Lag range of bank variables	2–6			2–6		
Collapsed	Yes			Yes		
Lag range of PCA scores		2–4	2–2		2–4	2–2
Collapsed		Yes	Yes		Yes	Yes
P-value AR(3)	0.591	0.995	0.083	0.639	0.985	0.113
Hansen's *J*-test	0.213	0.161	0.010	0.203	0.149	0.010
Hansen's *C*-test levels	0.149	0.066	0.001	0.169	0.083	0.001
Hansen's *C*-test *risk*	0.205	0.067	0.154	0.169	0.215	0.119

All regressions include 799 observations over ninety banks. Year dummies are included. Robust standard errors are in parentheses. Levels of significance at 10%, 5% and 1% are denoted by *, ** and ***.

of thumb. But the conducted robustness checks lead to qualitatively identical coefficients. Third-level autocorrelation is ruled out for all results.

Table 4.6 Effects of individual business activities on risk

	Risk					
	(19)		(20)		(21)	
1st lag of regressand	0.907***	(0.123)	0.844***	(0.067)	0.668***	(0.096)
2nd lag of regressand	−0.242**	(0.112)	−0.088*	(0.052)	−0.135	(0.082)
Fees	−28.043***	(8.160)	−12.809*	(7.751)	−45.506***	(17.567)
Trading	−2.498	(2.113)	−6.873**	(3.090)	0.768	(4.507)
Debt	0.102	(0.435)	0.554	(1.000)	−0.705	(1.510)
Equity	6.220*	(3.237)	4.442	(4.544)	15.647	(10.382)
Syndicated loans	−1.841**	(0.842)	−2.232	(1.549)	−5.348	(4.185)
M&A	0.038	(0.222)	0.051	(0.251)	0.867	(0.687)
Asset management	−0.038	(0.098)	−0.065	(0.075)	−0.143	(0.240)
Size	−0.005	(0.062)	0.005	(0.059)	0.048	(0.084)
Leverage	−0.040***	(0.012)	−0.032***	(0.011)	−0.058***	(0.013)
Economic growth	−0.043***	(0.009)	−0.031***	(0.008)	−0.061***	(0.013)
Interest rate	−0.009	(0.013)	0.004	(0.013)	−0.017	(0.020)
Chi-squared	25856***		40779***		16316***	
Number of instruments	88		87		48	
Lag range of regressand	1–1		1–3		1–1	
Collapsed	No		No		Yes	
Lag range of bank variables	2–5					
Collapsed	Yes					
Lag range of PCA scores			2–2		2–2	
Collapsed			Yes		Yes	
P-value AR(3)	0.221		0.269		0.554	
Hansen's *J*-test	0.212		0.184		0.003	
Hansen's *C*-test levels	0.205		0.032		0.001	
Hansen's *C*-test *risk*	0.444		0.471		0.837	

All regressions include 799 observations over ninety banks. Year dummies are included. Robust standard errors are in parentheses. Levels of significance at 10%, 5% and 1% are denoted by *, ** and ***.

4.3.2 Results on individual bank activities

The discussed indices measure diversification in a non-linear way and based on the assumption that the average portfolio of income generating activities represents maximum diversification. This raises the question whether the average sample bank could improve its performance by deviating from the average mix of bank activities. As in the previous result tables, the subsequent tables first present the main results with standard system GMM instrumentation and then the robustness checks with PCA scores instrumentation with and without reduced instrument count.

Fee income lowers risk

Table 4.6 presents the effects of individual non-interest bank activities on *default risk*. We observe a robust negative effect of *fees* on *default risk*. The coefficient of –28.043 suggests that a 1% increase in fee income per total assets decreases the average sample bank's default probability by 12%. Note that this effect is controlled for fee generating activities in investment banking and asset management. We can thus conclude that the observed risk-reducing effects stem from other fee-generating activities such as retail fees.

Limited evidence for syndicated loans and trading to lower risk

For other bank activities, the evidence is less clear. We observe some evidence that *trading* and *syndicated loans* business decrease default risk. These findings are non-robust but we can at least conclude that there is no evidence for the hypothesis that *trading* or *syndicated loans* increase risk. Also for *debt* and *M&A* deals we observe no evidence of increased *default risk* as all coefficients are insignificant. Likewise, the results are insignificant for *asset management* activities and therefore do not support the hypothesis that asset management fees reduce the *default risk* of banks.

Equity deals may increase risk

For *equity* deals we find some non-robust evidence of positive effects on *default risk*. While these non-robust results must be interpreted with care, they could be explained by equity generally being a riskier asset class than debt securities. This difference could affect banks' default risk if they conduct securities underwriting on a firm-commitment basis. For this business, instead of earning fees, banks accept securities for an agreed price and place them on the market at their own risk (SAUNDERS and CORNETT 2011, 109).

Diagnostics

As in previous results, the Hansen test diagnostics are insignificant and relatively good for the main results in column (19). Third-order autocorrelation is ruled out for all results.

Fees and syndicated loans increase profitability

Table 4.7 presents the effects of individual non-interest bank activities on *profitability*. We observe robust evidence of positive effects from *fees* and from *syndicated loans* deals on *profitability*. A 1% increase in fee income per total assets is associated with a 0.97% increase in return on assets. This effect size appears economically significant. Regarding *syndicated loans,* a 1%

Table 4.7 Effects of individual business activities on profitability

	Profitability					
	(22)		(23)		(24)	
1st lag of regressand	−0.335***	(0.063)	−0.035	(0.062)	−0.371***	(0.065)
2nd lag of regressand	−0.124*	(0.066)	−0.092*	(0.050)	−0.346***	(0.125)
Fees	0.973***	(0.163)	0.602***	(0.128)	0.740***	(0.194)
Trading	0.022	(0.055)	0.170***	(0.054)	0.199**	(0.089)
Debt	−0.013	(0.017)	−0.035	(0.026)	−0.050*	(0.028)
Equity	−0.147*	(0.088)	−0.129	(0.082)	−0.102	(0.249)
Syndicated loans	0.055**	(0.025)	0.091**	(0.046)	0.144**	(0.057)
M&A	0.002	(0.004)	−0.003	(0.003)	−0.010	(0.008)
Asset management	−0.001	(0.001)	−0.001	(0.001)	−0.003*	(0.002)
Size	0.003**	(0.001)	0.002*	(0.001)	0.003*	(0.002)
Leverage	−0.0004***	(0.0001)	−0.0003***	(0.0001)	−0.0003***	(0.0001)
Economic growth	0.0017***	(0.0003)	0.0012***	(0.0002)	0.0016***	(0.0003)
Interest rate	0.0005	(0.0003)	0.0001	(0.0003)	0.0010**	(0.0004)
Chi-squared	718***		1168***		557***	
Number of instruments	90		90		48	
Lag range of regressand	1–11		1–9		1–1	
Collapsed	Yes		Yes		Yes	
Lag range of bank variables	2–6					
Collapsed	Yes					
Lag range of PCA scores			2–4		2–2	
Collapsed			Yes		Yes	
P-value AR(3)	0.941		0.835		0.033	
Hansen's *J*-test	0.194		0.165		0.043	
Hansen's *C*-test levels	0.062		0.079		0.000	
Hansen's *C*-test *risk*	0.189		0.293		0.474	

All regressions include 799 observations over ninety banks. Year dummies are included. Robust standard errors are in parentheses. Levels of significance at 10%, 5% and 1% are denoted by *, ** and ***.

increase in volume per total assets is associated with a 0.055% increase in return on assets. This initially appears economically insignificant because we compare fee income and deal volumes. However, for a better comparison, we can look at the effects of a 1 standard deviation increase of each explanatory variable, as reported in table 4.2. A 1 standard deviation increase in fee income (i.e. 0.7%) leads to an increase in profitability of 0.68%. A 1 standard deviation increase in syndicate loans deals (i.e. 5%) amounts to an increase in profitability of 0.29%. Although the effect of *syndicated loans* remains smaller than that of *fees,* the two effects are of a roughly similar and economically significant magnitude.

Trading may also increase profitability

We also observe evidence of positive effects from *trading* on *profitability.* However, this effect is only observed in two out of three models. Further, we observe non-robust and weakly significant negative effects from *debt* and *equity* investment banking deals and from *asset management* on *profitability.*

Consistent results for risk-adjusted profitability

As previously discussed for the results on diversification indices, analysing the effects on *risk-adjusted profitability* provides a consistency test for the estimated coefficients. Table 4.8 presents the effects from individual banking activities on *risk-adjusted profitability.*

Fees increase risk-adjusted profitability

Consistent with the observed negative effects from *fees* on *default risk* and positive effects on *profitability,* we observe significant and robust positive effects on *risk-adjusted profitability.*

Support for non-robust findings

Equally, we find robust positive effects from *trading* on *risk-adjusted profitability.* This increases the credibility of the previously reported non-robust negative effects on *default risk* and positive effects on *profitability.* Further, negative effects from *equity* deals on *risk-adjusted profitability* are observed in column (19) but are non-robust in subsequent columns. However, this effect is consistent with the signs of the previously observed non-robust effects on *default risk* and *profitability.* This adds to the credibility of this non-robust evidence. Similarly, we see positive effects from *syndicated loans* business on *risk-adjusted profitability* in column (20). This result is consistent with the previously observed non-robust evidence of negative effects on *default risk* and the robust evidence of positive effects on *profitability.*

No support for some non-robust findings

In contrast, previously observed non-robust negative effects from *debt* and *asset management* business on *profitability* are not supported by corresponding evidence on *risk-adjusted profitability.*

4.3.3 Control variables

The results for the control variables in tables 4.3 to 4.8 mostly have the expected signs and otherwise yield insignificant effects, the results on *leverage* being the exception. We observe no inconsistencies between significant

Table 4.8 Effects of individual business activities on risk-adjusted profitability

	Risk-adjusted profitability					
	(25)		(26)		(27)	
1st lag of regressand	−0.215***	(0.076)	−0.069	(0.069)	−0.609***	(0.075)
2nd lag of regressand	0.160	(0.129)	−0.042	(0.063)	0.468***	(0.132)
Fees	0.436***	(0.143)	0.716***	(0.151)	0.735***	(0.141)
Trading	0.092**	(0.038)	0.138***	(0.050)	0.211***	(0.078)
Debt	0.010	(0.011)	−0.036	(0.026)	−0.018	(0.028)
Equity	−0.156*	(0.083)	−0.119	(0.083)	−0.198	(0.218)
Syndicated loans	0.021	(0.015)	0.094**	(0.046)	0.074	(0.047)
M&A	−0.001	(0.004)	−0.004	(0.006)	−0.001	(0.007)
Asset management	0.000	(0.001)	−0.001	(0.001)	−0.001	(0.001)
Size	0.0007	(0.0007)	0.0016	(0.0010)	0.0014	(0.0011)
Leverage	−0.0001	(0.0001)	−0.0003***	(0.0001)	−0.0003***	(0.0001)
Economic growth	0.0012***	(0.0002)	0.0012***	(0.0002)	0.0012***	(0.0002)
Interest rate	0.0004	(0.0003)	−0.0001	(0.0003)	−0.0004	(0.0004)
Chi-squared	634***		992***		890***	
Number of instruments	88		91		48	
Lag range of regressand	1–1		1–10		1–1	
Collapsed	No		Yes		Yes	
Lag range of bank variables	2–5					
Collapsed	Yes					
Lag range of PCA scores			2–4		2–2	
Collapsed			Yes		Yes	
P-value AR(3)	0.272		0.673		0.038	
Hansen's *J*-test	0.222		0.162		0.170	
Hansen's *C*-test levels	0.087		0.124		0.020	
Hansen's *C*-test *risk*	0.147		0.380		0.366	

All regressions include 799 observations over ninety banks. Year dummies are included. Robust standard errors are in parentheses. Levels of significance at 10%, 5% and 1% are denoted by *, ** and ***.

effects on *default risk, profitability* and *risk-adjusted profitability.* Likewise, models with different variables of interest are consistent with each other in terms of significant results on control variables.

Economies of scale for bigger banks

Size has a non-robust negative effect on *default risk* in only one model, in column (4) in table 4.3. However, this observation is consistent with the predominantly positive effects on *profitability* and the mostly positive effects on *risk-adjusted profitability.* In contrast to the models for diversification indices, the models including individual banking activities only yield weakly significant effects of *size* on *profitability*. These effects become insignificant when adjusted to risk. The effects of *size* on *default risk* are equally insignificant. These findings can thus be regarded as limited evidence for a "too big to fail" risk discount for larger banks and strong evidence of economies of scale.

Counter-intuitive results for leverage

For *leverage,* we observe a significant negative effect on *default risk,* albeit only in the models including individual banking activities. The effects from *leverage* on *profitability* and *risk-adjusted profitability* are significantly negative in most models. A negative association of *leverage* with *default risk* and a positive association with *profitability* and *risk-adjusted profitability* appear counter-intuitive. For a possible explanation we must bear in mind that *profitability* is defined as return on assets, not return on equity: After the Global Financial Crisis, banks possibly compensated stricter regulatory constraints on leverage by otherwise taking on more risk (Sarin and Summers 2016). If banks keep their pre-crisis risk level to maintain the return for equity holders, lower leverage and shorter balance sheets might become correlated with higher return on assets.

Expected effects from economic growth

Economic growth has a negative effect on *default risk* and positive effects on *profitability* and *risk-adjusted profitability.* These effects are robust across all models.

Low interest rates increase default risk and decrease returns

Interest rate yields non-robust negative significant effects on *default risk* in the models for diversification indices. No significant effects are observed for the models including individual banking activities. *Interest rate* effects on *profitability* are mostly significant and positive across all models. The effects on *risk-adjusted profitability* are significantly positive and robust across all models that include diversification indices. However, for the models including individual banking activities we observe no significant effects. The observed *interest rate* effects are overall consistent with our theoretical expectations.

4.4 CONCLUSION

The post-crisis policy debate on regulatory limits to banks' trading and investment banking activities stands on limited empirical grounds. Large banks are arguably the most relevant group of institutes for this debate. However, existing studies on the effects of bank income diversification do not focus on such banks but instead include more heterogeneous samples. It is thus unclear to what extent existing findings can be conferred to large banks. In addition, existing studies cannot measure banks' income structure in great detail and the literature is in disagreement regarding the effects of bank income diversification. This study therefore focuses on the effects of income diversification on the performance of the largest international banks, based on more detailed income structure data.

Detailed analysis of bank income

The data set includes ninety large listed international banks from 2005 to 2015. It provides information on the performance effects of general diversification indices and of individual bank activities. In contrast to the existing literature, the applied diversification indices do not assume equal shares of different income types to constitute maximum diversification. Instead, the indices used in this study assume the market portfolio of bank activities, namely the average income structure, as the maximum level of diversification. This allows incorporating more individual bank activities in the diversification indices. Specifically, I analyse the effects of investment banking and asset management activities in greater detail than the existing literature. The used data set combines information on fee and trading income with assets under management and investment banking deal volumes. Assets under management and volumes of debt, equity, syndicated loans and M&A deals thereby serve as proxies for the related subtypes of fee income.

Diversified banks are safer and more profitable

The results indicate that banks with a more diversified income structure generally have a lower default risk and a higher profitability. This finding holds for diversification between interest and non-interest income and for diversification between various individual incomes including investment banking activities and asset management.

Benefits from retail fees, trading and syndicated loans

The analysis of individual bank activities indicates that fee income outside investment banking and asset management (i.e. retail fees) reduces banks' default risk and increases their profitability. We also observe limited evidence of negative effects on risk and positive effects on profitability from diversification towards trading income and towards syndicated loans underwriting. In contrast, we find equity underwriting to increase banks' default risk and decrease their profitability and risk-adjusted profitability. For diversification towards debt underwriting, M&A services and asset management, we observe no conclusive effects on bank performance.

No support for regulatory limits on bank activities

The results provide support for bank strategies aiming to increase the share of non-interest income. Trading income and fee income from retail banking and from syndicated loan underwriting appear preferable to income from other investment banking activities and asset management. In terms of policy implications, these findings cast doubts on the effectiveness of limiting large banks' trading activities as a means to make these banks more robust.

APPENDIX

Table 4.9 List of banks included

Agricultural Bank of China	CN	CTBC Financial Holding	TW
Allied Irish Banks	IE	Danske Bank	DK
Australia and New Zealand Banking Group	AU	DBS Bank	SG
Banca Monte dei Paschi di Siena	IT	Deutsche Bank	DE
Banca Popolare di Milano	IT	Deutsche Postbank	DE
Banco Bilbao Vizcaya Argentaria	ES	DNB	NO
Banco Bradesco	BR	Erste Group	AT
Banco de Sabadell	ES	Fifth Third Bancorp	US
Banco do Brasil	BR	Goldman Sachs	US
Banco Santander	ES	Hana Financial Group	KR
Bank of America	US	HSBC	GB
Bank of Beijing	CN	Huaxia Bank	CN
Bank of China	CN	Industrial and Commercial Bank of China	CN
Bank of Ireland	IE	Industrial Bank	CN
Bank of New York Mellon	US	Industrial Bank of Korea	KR
Bank of Shanghai	CN	ING	NL
Bankia	ES	Intesa Sanpaolo	ES
Barclays	GB	Itau Unibanco	IT
BB&T	US	JPMorgan Chase	US
BNP Paribas	FR	KBC Bank	BE
CaixaBank	ES	Lloyds Banking Group	GB
Canadian Imperial Bank of Commerce	CA	Macquarie Group	AU
China Construction Bank	CN	Mitsubishi UFJ Financial Group	JP
China Everbright Bank	CN	Mizuho Financial Group	JP
China Merchants Bank	CN	Morgan Stanley	US
China Minsheng Banking Corporation	CN	National Australia Bank	AU
CITIC Group	CN	National Bank of Canada	CA
Citigroup	US	Natixis	FR
Commerzbank	DE	Nordea	SE
Commonwealth Bank of Australia	AU	Oversea-Chinese Banking Corporation	SG
Crédit Agricole	FR	PNC Financial Services	US
Credit Suisse	CH	Raiffeisen Bank International	AT

Table 4.9 (*continued*)

Regions Financial Corporation	US	Sumitomo Mitsui Trust Holdings	JP
Resona Holdings	JP	SunTrust Banks	US
Royal Bank of Canada	CA	Svenska Handelsbanken	SE
Royal Bank of Scotland	GB	Swedbank	SE
Sberbank of Russia	RU	Toronto-Dominion Bank	CA
Scotiabank	CA	UBI Banca	IT
Shanghai Pudong Development Bank	CN	UBS	CH
Shinhan Bank	KO	UniCredit	IT
Skandinaviska Enskilda Banken	SE	United Overseas Bank	SG
Société Générale	FR	US Bancorp	US
Standard Chartered	GB	VTB Bank	RU
State Street	US	Wells Fargo	US
Sumitomo Mitsui Financial Group	JP	Westpac Banking Corporation	US

CHAPTER FIVE

Overall Conclusion

The existing empirical literature is in discord over the desirability of bank income diversification from a financial stability perspective. In light of the recent and ongoing policy debate of separating commercial banking from investment banking, the literature provides an unsatisfying basis for policy decisions. This thesis offers several contributions to the empirical literature by focusing on aspects that have so far been neglected.

Contributions to the literature

In chapter 2, this thesis presents the literature's first categorization of high-income countries as universal banking or specialized banking systems over an extended period and reviews the historical political motives for introducing such regulatory regimes. Based on the categorization as universal banking or specialized banking systems, chapter 2 further assesses the relevance of regulatory regimes as determinants of financial crises. Chapter 3 presents the first meta-regression analysis on the micro literature on bank diversification. The chapter illustrates the possibilities and limitations of modern meta-regression techniques as an increasingly popular tool for economics. Finally, chapter 4 analyses the effects of income diversification on those financial institutions that are most relevant for the post-crisis regulatory debate: large international banks. This is the first study in this field to focus on large international banks. The analysis includes more granular income data than existing studies and measures bank income diversification in greater detail. In addition, chapter 4 suggests a risk indicator and diversification indices that are new to the literature on bank income diversification.

Main results and limitations

What can we learn from the results of this thesis? As previously discussed, the post-crisis policy debate implicitly establishes the hypothesis that specialized banking is preferable to universal banking from a financial stability perspective. The main result from this thesis is that evidence, overall, does not support this hypothesis. However, not all results are fully consistent across the three studies. Some results do speak in favour of specialized banking systems: We observe more severe banking crises in universal banking systems and the meta-regression analysis indicates trading income to be mostly associated with higher bank risk. Yet, the evidence in favour of specialized banking in no way dominates. In contrast, the meta-regression analysis indicates that larger banks are more likely than smaller banks to increase risk-adjusted profitability when diversifying towards fee and trading income. Consistent with this finding, the analysis of large international banks finds risk-reducing effects from diversification. On the macro level, the evidence suggests that universal banking systems have a lower likelihood of banking crises. Furthermore, the historic analysis shows that the establishment of previous specialized banking systems around the world was not primarily motivated by financial stability concerns.

No case against universal banks

Given the discord in the existing empirical literature, it would be quite a surprise if the results of this thesis were unanimous. However, to justify a regulatory separation of commercial banking from investment banking, we would at least expect a clear overweight of evidence against universal banking. After all, such a regulation constitutes considerable interference with freedom of commerce. In the absence of sufficiently clear evidence for the social benefits of specialized banking, limitations to universal banking cannot be justified. The widely accepted idea that specialized banking systems increase financial stability largely appears to be a perpetuation of a biased belief without a convincing empirical basis.

Avenues for future research

This thesis furthermore shows that the empirical literature on bank diversification uses a wide range of approaches. Future contributions to this field should be welcomed to develop a clearer set of commonly accepted research designs. For instance, research should more closely analyse the relevance of bank size as a precondition for successful bank diversification. Also, using generalizing indices to measure diversification might only be helpful from a policy perspective. To produce results that are relevant for the management of individual financial institutions, future studies should be based on more detailed data on bank diversification.

References

ALTUNBAS, Yener, Simone MANGANELLI and David MARQUES-IBANEZ. 2011. *Bank Risk During the Financial Crisis: Do Business Models Matter?* Working Paper Series No. 1394, European Central Bank. https://www.ecb.europa.eu/pub/pdf/scpwps/ecbwp1394.pdf.

ARELLANO, Manuel and Stephen BOND. 1991. "Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations." *The Review of Economic Studies* 58 (2): 277–297. doi: 10.2307/2297968.

ATKINSON, Anthony B. and Salvatore MORELLI. 2011. *Economic Crises and Inequality.* Human Development Research Paper 2011/06, United Nations Development Programme. http://hdr.undp.org/sites/default/files/hdrp_2011_06.pdf.

BAELE, Lieven, Olivier DE JONGHE and Rudi VANDER VENNET. 2007. "Does the Stock Market Value Bank Diversification?" *Journal of Banking & Finance* 31 (7): 1999–2023. doi: 10.2139/ssrn.883593.

BANK OF ISRAEL. 2015. *Issues in the Application of Deposit Insurance.* http://www.boi.org.il/en/NewsAndPublications/PressReleases/Pages/16-06-2015-ApplicationDepositInsurance.aspx.

BANK OF JAPAN. 1973. *Money and Banking in Japan: The Bank of Japan Economic Research Department.* Palgrave Macmillan.

BANQUE NATIONALE DE BELGIQUE. 1933. *Bulletin d'information et de documentation,* 10 August. https://www.nbb.be/doc/ts/publications/economicreview/1933/1933.08.10-bull.pdf.

———. 1934. *Bulletin d'information et de documentation,* 25 August. https://www.nbb.be/doc/ts/publications/economicreview/1934/1934.08.25-bull.pdf.

BARTH, James R., R. Dan BRUMBAUGH and James A. WILCOX. 2000. "Policy Watch: The Repeal of Glass–Steagall and the Advent of Broad Banking." *Journal of Economic Perspectives* 14 (2): 191–204. doi: 10.1257/jep.14.2.191

BARTH, James R., Daniel E. NOLLE and Apanard PRABJA. 2014. *Banking Structure and Regulation in 1993 and 2013 – A Cross-Country Comparison.* Research report, Milken Institute. http://www.milkeninstitute.org/publications/view/651.

BATTELLINO, Ric and Nola MCMILLAN. 1989. *Changes in the Behaviour of Banks and Their Implications for Financial Aggregates.* Research Discussion Paper No. 8904, Reserve

Bank of Australia. https://www.rba.gov.au/publications/rdp/1989/8904.html.

Beck, Thorsten, Asli Demirgüç-Kunt and Ross Levine. 2006. "Bank Concentration, Competition, and Crises: First Results." *Journal of Banking & Finance* 30 (5): 1581–1603. doi: 10.1016/j.jbankfin.2005.05.010.

Bel, Germà and Xavier Fageda. 2009. "Factors Explaining Local Privatization: A Meta-Regression Analysis." *Public Choice* 139 (1): 105–119. doi: 10.1007/s11127-008-9381-z.

Ben Gamra, Saoussen and Dominique Plihon. 2011. *Revenue Diversification in Emerging Market Banks: Implications for Financial Performance.* Working paper, CEPN Centre d'Économie de l'Université Paris-Nord. https://arxiv.org/abs/1107.0170

Benston, George J. 1990. *The Separation of Commercial and Investment Banking: The Glass–Steagall Act Revisited and Reconsidered.* London: Macmillan.

——. 1994. "Universal Banking." *Journal of Economic Perspectives* 8 (3): 1211–143. doi: 10.1257/jep.8.3.121.

Ber, Hedva, Yishay Yafeh and Oved Yosha. 1997. *Conflict of Interest in Universal Banking: Evidence from the Post-Issue Performance of IPO Firms.* Discussion Paper No. 97.05, Bank of Israel. http://www.boi.org.il/en/Research/Pages/papers-dp9705.aspx.

Bhargava, Rahul and Donald R. Fraser. 1998. "On the Wealth and Risk Effects of Commercial Bank Expansion into Securities Underwriting: An Analysis of Section 20 Subsidiaries." *Journal of Banking & Finance* 22 (4): 447–465. doi: 10.1016/s0378-4266(98)00022-3.

BIS (Bank for International Settlements). 2018. *Reporting Practices for Domestic and Total Debt Securities.* https://www.bis.org/statistics/coverage.pdf.

Black, Susan, Joshua Kirkwood, Alan Rai and Thomas Williams. 2012. *A History of Australian Corporate Bonds.* Research Discussion Paper 2012-09, Reserve Bank of Australia. https://www.rba.gov.au/publications/rdp/2012/pdf/rdp2012-09.pdf.

Bontempi, Maria E. and Irene Mammi. 2015. "Implementing a Strategy to Reduce the Instrument Count in Panel GMM." *Stata Journal* 15 (4): 1075–1097. http://www.stata-journal.com/article.html?article=st0414.

Boot, Arnoud W. A. and Anjan V. Thakor. 1997. "Banking Scope and Financial Innovation." *The Review of Financial Studies* 10 (4): 1099–1131. doi: 10.1093/rfs/10.4.1099.

Bordo, Michael, Barry Eichengreen, Daniela Klingebiel and Maria Soledad Martinez-Peria. 2001. "Is the Crisis Problem Growing More Severe?" *Economic Policy* 16 (32): 52–82. doi: 10.1111/1468-0327.00070.

Bouvier, Jean. 1973. *Un siècle de banque française – Les contraintes de l'État, et les incertitudes des marchés.* Paris: Hachette.

Bowen, Alex, Glenn Hoggarth and Darren Pain. 1999. *The Recent Evolution of the UK Banking Industry and Some Implications for Financial Stability.* Conference Papers No. 7, Bank for International Settlements. https://www.bis.org/publ/confp07l.pdf.

Boyd, John H., Stanley L. Graham and R. Shawn Hewitt. 1993. "Bank Holding Company Mergers with Nonbank Financial Firms: Effects on the Risk of Failure." *Journal of Banking & Finance* 17 (1): 43–63. doi: 10.1016/0378-4266(93)90079-s.

Brambilla, Carlo. 2010. "Assessing Convergence in European Investment Banking Patterns Until 1914." In *Convergence and Divergence of National Financial Systems: Evidence from the Gold Standards, 1871–1971,* edited by Patrice Baubeau and Anders Ögren, 89–108. London: Pickering & Chatto.

Brewer, Elijah III. 1989. "Relationship between Bank Holding Company Risk and Nonbank

Activity." *Journal of Economics and Business* 41 (4): 337–353. doi: 10.1016/0148-6195(89)90030-1.

Brighi, Paola and Valeria Venturelli. 2013. *The Effect of Revenue and Geographic Diversification on Bank Performance.* Working Paper No. 43, CEFIN Centro Studi Banca e Finanza, Università di Modena e Reggio Emilia. http://morgana.unimo.it/campusone/web_dep/CefinPaper/CEFIN-WP43.pdf.

Brown, Raj. 2006. *The Emergence and Development of Singapore as a Regional/International Financial Centre.* XIV International Economic History Congress Helsinki, Session 31. http://www.helsinki.fi/iehc2006/papers1/Brown.pdf.

Busch, Ramona and Thomas Kick. 2009. *Income Diversification in the German Banking Industry.* Discussion Paper Series No. 2, Banking and Financial Studies, Deutsche Bundesbank. doi: 10.2139/ssrn.1342282.

Calmès, Christian P. A. and Raymond Théoret. 2012. *The Change in Banks' Product Mix, Diversification and Performance: An Application of Multivariate GARCH to Canadian Data.* RePAd Working Paper Series, University of Quebec. doi: 10.2139/ssrn.2380711.

Caprio, Gerard and Daniela Klingebiel. 2003. *Episodes of Systemic and Borderline Financial Crises.* Working paper, World Bank. http://siteresources.worldbank.org/INTRES/Resources/469232-1107449512766/648083-1108140788422/23456_Table_on_systemic_and_non-systemic_banking_crises_January_21_2003.pdf.

Card, David and Alan Krueger. 1995. "Time-Series Minimum-Wage Studies: A Meta-Analysis." *American Economic Review* 85 (2): 238-43. http://davidcard.berkeley.edu/papers/ts-min-wage.pdf.

Cassiers, Isabelle, Valérie de Briey, Florence Degavre and Anne-Catherine Provost. 1998. "Les banques belges face à l'État: une rétrospective (1935–1993)." *Revue d'économie financière* 48 (4): 125–155. doi: 10.3406/ecofi.1998.4588.

Cassis, Youssef. 2017. "Regulatory Responses to the Financial Crises of the Great Depression." In *Recalibrating Risk and Regulation after Oil Spills, Nuclear Accidents and Financial Crises,* edited by Edward J. Balleisen, 349–370. Cambridge: Cambridge University Press.

Chan, Norman T. L. 2011. *Universal Banking – Hong Kong' Perspective.* Keynote address at the Asian Banker Summit, Hong Kong Monetary Authority. http://www.hkma.gov.hk/eng/key-information/speech-speakers/ntlchan/20110407-1.shtml.

Collins, Michael. 1998. "English Bank Development within a European Context, 1870–1939." *The Economic History Review* 51 (1): 1–24. doi: 10.1111/1468-0289.00081.

Colvin, Christopher L. 1998. *Universal Banking Failure? An Analysis of the Contrasting Responses of the Amsterdamsche Bank and the Rotterdamsche Bankvereeniging to the Dutch Financial Crisis of the 1920s.* Working Paper No. 89/07, London School of Economics. http://eprints.lse.ac.uk/22320/1/wp98.pdf.

Cornett, Marcia M., Evren Ors and Hassan Tehranian. 2002. "Bank Performance around the Introduction of a Section 20 Subsidiary." *Journal of Finance* 57 (1): 501–521. doi: 10.1111/1540-6261.00430.

Costa-Font, Joan, Filipe De-Albuquerque and Hristos Doucouliagos. 2015. "Does Inter-Jurisdictional Competition Engender a 'Race to the Bottom'? A Meta-Regression Analysis." *Economics & Politics* 27 (3): 488–508. doi: 10.1111/ecpo.12066.

Cyree, Ken B. 2000. "The Erosion of the Glass–Steagall Act: Winners and Losers in the Banking Industry." *Journal of Economics and Business* 52 (4): 343–363. doi: 10.1016/s0148-6195(00)00023-0.

Davies, Richard, Peter Richardson, Vaiva Katinaite and Mark Manning. 2010. "Evolution of the UK banking system." *Bank of England Quarterly Bulletin* 50 (4): 321–332. https://www.bankofengland.co.uk/-/media/boe/files/quarterly-bulletin/2010/evolution-of-the-uk-banking-system.pdf.

Davis, Kevin. 1998. *Reform of Australian and New Zealand Financial Markets.* Conference paper for the 24th Pacific Trade and Development Conference, Department of Accounting and Finance, University of Melbourne. https://kevindavis.com.au/secondpages/acadpubs/pre2002/Reform%20of%20Aust%20and%20NZ%20Financial%20Markets.pdf.

De Bonis, Rissardo, Alberto Franco Pozzolo and Massimiliano Stacchini. 2012. *The Italian Banking System: Facts and Interpretations.* Economics & Statistics Discussion Paper No. 068/12, University of Molise. http://web.unimol.it/progetti/repec/mol/ecsdps/ESDP12068.pdf.

De Nicoló, Gianni, Philip Bartholomew, Jahanara Zaman and Mary Zephirin. 2004. "Bank Consolidation, Internationalization and Conglomeration: Trends and Implications for Financial Risk." *Financial Markets, Institutions & Instruments* 13 (4): 173–217. doi: 10.1111/j.0963-8008.2004.00076.x.

DeLong, Gayle L. 2001. "Stockholder Gains from Focusing versus Diversifying Bank Mergers." *Journal of Financial Economics* 59 (2): 221–252. doi: 10.1016/s0304-405x(00)00086-6.

Demirgüç-Kunt, Asli and Enrica Detragiache. 1998. *Financial Liberalization and Financial Fragility.* Working Paper 98/83, Policy Research Working Paper Series, International Monetary Fund. https://www.imf.org/external/pubs/ft/wp/wp9883.pdf.

———. 1998. "The Determinants of Banking Crises in Developing and Developed Countries." *IMF Staff Papers* 45 (1): 81–109. https://www.imf.org/external/Pubs/FT/staffp/1998/03-98/demirguc.htm.

———. 2002. "Does Deposit Insurance Increase Banking System Stability? An Empirical Investigation." *Journal of Monetary Economics* 49 (7): 1373–1406. doi: 10.1016/S0304-3932(02)00171-X.

Demirgüç-Kunt, Asli and Harry Huizinga. 2010. "Bank Activity and Funding Strategies: The Impact on Risk and Returns." *Journal of Financial Economics* 98 (3): 626–650. doi: 10.1596/1813-9450-4837.

Demirgüç-Kunt, Asli, Edward Kane and Luc Laeven. 2014. *Deposit Insurance Database.* Working Paper No. 14/118, International Monetary Fund. https://www.imf.org/en/Publications/WP/Issues/2016/12/31/Deposit-Insurance-Database-41710.

Demirgüç-Kunt, Asli, Baybars Karacaovali and Luc Laeven. 2005. *Deposit Insurance around the World: A Comprehensive Database.* Policy Research Working Paper No. 3628, World Bank. http://documents.worldbank.org/curated/en/593131468330040612/pdf/wps36280rev.pdf.

Demirgüç-Kunt, Asli and Ross Levine. 1999. *Bank-Based and Market-Based Financial Systems: Cross-Country Comparisons.* Policy Working Paper No. 2143, World Bank. Doi: 10.1596/1813-9450-2143.

Denizet, Jean. 1970. "Évolution récente et future de la banque." *Revue d'économie politique* 80 (3): 448–474. http://www.jstor.org/stable/24694661.

DeYoung, Robert and Tara Rice. 2004. "How do Banks Make Money? The Fallacies of Fee Income." *Economic Perspectives* 28 (4): 34–51. https://www.chicagofed.org/publications/economic-perspectives/2004/4qtr2004-part3-deyoung-rice.

DeYoung, Robert and Karin P. Roland. 2001. "Product Mix and Earnings Volatility at Commercial Banks: Evidence from a Degree of Total Leverage Model." *Journal of Financial Intermediation* 10 (1): 54–84. doi: 10.2139/ssrn.251356.

DeYoung, Robert and Gökhan Torna. 2013. "Nontraditional Banking Activities and Bank Failures during the Financial Crisis." *Journal of Financial Intermediation* 22 (3): 397–421. doi: 10.1016/j.jfi.2013.01.001.

Doherty, Joseph. 1994. "Ireland." In *Handbook on the History of European Banks,* edited by Manfred Pohl and Sabine Freitag, 543–558. Frankfurt: Edward Elgar Publishing.

Doucouliagos, Hristos and Tom D. Stanley. 2009. "Publication Selection Bias in Minimum-Wage Research? A Meta-Regression Analysis." *British Journal of Industrial Relations* 47 (2): 406–428. doi: 10.1111/j.1467-8543.2009.00723.x.

Draghi, Mario. 1992. "The Case for and against Financial Conglomarate Groups: The Italian Debate on the Eve of the European Banking Integration." In *Financial Regulation – Changing the Rules of the Game,* edited by Dimitri Vittas, 391–417. Washington: World Bank.

Drucker, Steven and Manju Puri. 2005. "On the Benefits of Concurrent Lending and Underwriting." *Journal of Finance* 60 (6): 2763–2799. doi: 10.1111/j.1540-6261.2005.00816.x.

D'Have, Piet and Marc Quentyn. 1987. "Regulering en deregulering van de financiële sector in het Verenigd Koninkrijk." *Revue de la Banque* 51 (4): 97–104.

Edey, Malcolm and Brian Gray. 1996. *The Evolving Structure of the Australian Financial System.* Conference volume 8–9 July 1996, Reserve Bank of Australia. https://www.rba.gov.au/publications/confs/1996/pdf/edey-gray.pdf.

Edwards, George W. 1942. "The Myth of the Security Affiliate." *Journal of the American Statistical Association* 37 (218): 225–232. doi: 10.2307/2279217.

Estrella, Arturo. 2001. "Mixing and Matching: Prospective Financial Sector Mergers and Market Valuation." *Journal of Banking & Finance* 25 (12): 2367–2392. doi: 10.1016/S0378-4266(01)00195-9.

Federal Reserve Bank of New York. 1933. *Banking Act of 1933.* Circular No. 1248. https://archive.org/stream/FullTextTheGlass-steagallActA.k.a.TheBankingActOf1933/1933_01248_djvu.txt.

Feenstra, Robert C., Robert Inklaar and Marcel P. Timmer. 2015. "The Next Generation of the Penn World Table." *American Economic Review* 105 (10): 3150–3182. doi: 10.15141/S5J01T.

Feld, Lars P. and Jost H. Heckemeyer. 2011. "FDI and Taxation: A Meta-Study." *Journal of Economic Surveys* 25 (2): 233–272. doi: 10.1111/j.1467-6419.2010.00674.x.

Filson, Darren and Saman Olfati. 2014. "The Impacts of Gramm–Leach–Bliley Bank Diversification on Value and Risk." *Journal of Banking & Finance* 41 (C): 209–221. doi: 10.1016/j.jbankfin.2014.01.019.

Flath, David. 2005. *The Japanese Economy.* Second edition. Oxford: Oxford University Press.

Forsyth, Douglas L. 1991. "The Rise and Fall of German-inspired Mixed Banking in Italy, 1894–1936." In *The Role of Banks in the Interwar Economy,* edited by Harold James, Hekan Lindgren and Alice Teichova, 179–204. Cambridge: Cambridge University Press.

Freedman, Charles. 1992. "Universal Banking: The Canadian Review – Changing the Rules of the Game." In *Financial Regulation,* edited by Dimitri Vittas, 369–390. Washington: Economic Development Institute of the World Bank.

FSB (Financial Stability Board). 2014. *Structural Banking Reforms: Cross-border Consistencies and Global Financial Stability Implications.* Report to G20 leaders for the November 2014 summit. http://www.financialstabilityboard.org/wp-content/uploads/r_141027.pdf.

Gallet, Craig A. 2010. "The Income Elasticity of Meat: A Meta-Analysis." *Australian Journal of Agricultural and Resource Economics* 54 (4): 477-490. doi: 10.1111/j.1467-8489.2010.00505.x.

Gallet, Craig A. and Hristos Doucouliagos. 2014. "The Income Elasticity of Air Travel: A Meta-Analysis." *Annals of Tourism Research* 49: 141–155. doi: 10.1016/j.annals.2014.09.006.

Gallet, Craig A. and John A. List. 2003. "Cigarette Demand: A Meta-Analysis of Elasticities." *Health Economics* 12 (10): 821–835. doi: 10.1002/hec.765.

Gambacorta, Leonardo and Adrian van Rixtel. 2013. *Structural Bank Regulation Initiatives: Approaches and Implications.* Working Paper No. 412, Bank for International Settlements. http://www.bis.org/publ/work412.pdf.

Geyfman, Victoria. 2005. *Banks in the Securities Business: Market-Based Risk Implications of Section 20 Subsidiaries.* Working Paper 05-17, Federal Reserve Bank of Philadelphia. doi: 10.2139/ssrn.796126.

Giap, Tan K. and Chen Kang. 1999. "Singapore's Dichotomized Financial System." In *Rising to the Challenge in Asia: A Study of Financial Markets,* 81–140. Manila: Asian Development Bank.

Giddey, Thibaud. 2014. "La surveillance bancaire belge de 1935 façonnée sur le modèle suisse: un discret transfert de politique publique?" *Revue belge de Philologie et d'Histoire* 92 (4): 1211–1243. http://www.persee.fr/doc/rbph_0035-0818_2014_num_92_4_8608.

Glick, Reuven and Michael M. Hutchison. 2001. "Banking and Currency Crises: How Common Are Twins?" In *Financial Crises in Emerging Markets,* edited by Reuven Glick, Ramon Moreno and Mark M. Spiegel, 35–69. Cambridge: Cambridge University Press.

Goddard, John, Donal McKillop and John O. S. Wilson. 2008. "The Diversification and Financial Performance of US Credit Unions." *Journal of Banking & Finance* 32 (9): 1836–1849. doi: 10.1016/j.jbankfin.2007.12.015.

Gourinchas, Pierre-Olivier and Maurice Obstfeld. 2012. "Stories of the Twentieth Century for the Twenty-First." *American Economic Journal: Macroeconomics* 4 (1): 226–265. doi: 10.1257/mac.4.1.226.

Gourio, Alain. 1984. "L'adaption de la loi du 24 janvier 1984." *Banque & Droit* (special issue): 6–7. http://m.revue-banque.fr/medias/content/users/christine/1395832229273.pdf.

Grady, John and Martin Weale. 1986. *British Banking, 1960–85.* New York: Palgrave Macmillan.

Greene, William H. 2012. *Econometric Analysis.* Seventh edition. Boston: Prentice Hall.

Grimes, Arthur. 1998. "Liberalisation of Financial Markets in New Zealand." *Reserve Bank of New Zealand Bulletin* 61 (4): 291–306. https://www.rbnz.govt.nz/-/media/ReserveBank/Files/Publications/Bulletins/1998/1998dec61-4grimes.pdf.

Gürbüz, Ali O., Serhat Yanik and Yusuf Aytürk. 2013. "Income Diversification and Bank Performance: Evidence from Turkish Banking Sector." *Journal of BRSA Banking and Financial Markets* 7 (1): 9–29. http://www.bddk.org.tr/websitesi/turkce/raporlar/bddk_dergi/12248makale1.pdf.

Hablutzel, Philip N. 1992. "British Bank's Role in UK Capital Markets since the Big Bang." *Chicago-Kent Law Review* 68: 365–376. https://scholarship.kentlaw.iit.edu/cklawreview/vol68/iss1/27.

Haggard, Stephan and Yu Zheng. 2013. "Institutional Innovation and Investment in Taiwan:

the Micro-Foundations of the Developmental State." *Business and Politics* 15 (4): 435–466. doi: 10.1515/bap-2012-0010.

Hansen, Lars Peter. 1982. "Large Sample Properties of Generalized Method of Moments Estimators." *Econometrica* 50 (4): 1029–1054. doi: 10.2307/1912775.

Hebb, Gregory M. and Donald R. Fraser. 2002. "Conflict of Interest in Commercial Bank Security Underwritings: Canadian Evidence." *Journal of Banking & Finance* 26 (10): 1935–1949. doi: 10.1016/S0378-4266(01)00176-5.

——. 2003. "Conflict of Interest in Commercial Bank Security Underwritings: United Kingdom Evidence." *Quarterly Journal of Business and Economics* 42 (1/2): 79–95. https://www.jstor.org/stable/40473365.

Hertner, Peter. 1994. "Italy." In *Handbook on the History of European Banks,* edited by Manfred Pohl and Sabine Freitag, 559–672. Frankfurt: Edward Elgar Publishing.

Hidayat, Wahyu Y., Makoto Kakinaka and Hiroaki Miyamoto. 2012. "Bank Risk and Non-interest Income Activities in the Indonesian Banking Industry." *Journal of Asian Economics* 23 (4): 335–343. doi: 10.1016/j.asieco.2012.03.008.

Honkapohja, Seppo. 2012. *The 1980s Financial Liberalization in the Nordic Countries.* Research Discussion Papers 36, Bank of Finland. https://www.suomenpankki.fi/globalassets/fi/media-ja-julkaisut/julkaisut/tutkimusjulkaisut/keskustelualoitteet/documents/bof_dp_1236.pdf.

Hryckiewicz, Aneta. 2014. *Originators, Traders, Neutrals and Traditioners – Various Banking Business Models across the Globe. Does the Business Model Matter for Financial Stability?* Working paper, Chair of International Banking and Finance, Goethe University Frankfurt. doi: 10.2139/ssrn.2412171.

Huang, Chen-Jui and Jwu-Rong Lin. 2011. "Financial Liberalization and Banking Performance: An Analysis of Taiwan's Former 'Top 10 Banks'." *Applied Economics Letters* 18 (12): 1111–1120. doi: 10.1080/13504851.2010.526566.

Hunt, Chris. 2009. "Banking Crises in New Zealand – An Historical Perspective." *Reserve Bank of New Zealand Bulletin* 72 (4): 26–41. https://www.rbnz.govt.nz/-/media/ReserveBank/Files/Publications/Bulletins/2009/2009dec72-4hunt.pdf.

Iamsiraroj, Sasi and Hristos Doucouliagos. 2015. "Does Growth Attract FDI?" *Economics: The Open-Access, Open-Assessment E-Journal* 9 (2015-19). doi: 10.5018/economics-ejournal.ja.2015-19.

Iftikhar, Syed Faizan. 2015. "Financial Reforms and Financial Fragility: A Panel Data Analysis." *International Journal of Financial Studies* 3 (2): 1–18. doi: 10.3390/ijfs3020084.

IMF (International Monetary Fund). 2017a. *World Economic Outlook, April 2017: Gaining Momentum?* http://www.imf.org/en/Publications/WEO/Issues/2017/04/04/world-economic-outlook-april-2017.

——. 2017b. *World Economic Outlook, October 2017: Seeking Sustainable Growth.* https://www.imf.org/en/Publications/WEO/Issues/2017/09/19/world-economic-outlook-october-2017.

Iršová, Zuzana and Tomas Havranek. 2010. "Measuring Bank Efficiency: A Meta-Regression Analysis." *Prague Economic Papers* 2010 (4): 307–328. doi: 10.18267/j.pep.379.

Jao, Yu Ching. 1974. *Banking and Currency in Hong Kong – A Study of Postwar Financial Development.* London: Palgrave Macmillan.

Ji, Yueh-Er, Ming-Chang Cheng, Chien-Chi Lee and I-Ju Chen. 2012. "Diversification in Banking: Is Non-Interest Income the Answer? The Case of Taiwan Banking Industry." *Journal of*

Business and Policy Research 7 (1): 1–29. http://www.jbprpapers.com/page/2012/april.

Johnson, Rodney N. and David R. Meinster. 1974. "Bank Holding Companies: Diversification Opportunities in Nonbank Activities." *Eastern Economic Journal* 1 (4): 316–323. http://www.jstor.org/stable/40324628.

Jordà, Òscar, Moritz Schularick and Alan M. Taylor. 2017. "Macrofinancial History and the New Business Cycle Facts." In *NBER Macroeconomics Annual 2016,* edited by Martin Eichenbaum and Jonathan A. Parker, 213–263. Chicago: University of Chicago Press.

Joyce, Joseph P. 2011. "Financial Globalization and Banking Crises in Emerging Markets." *Open Economies Review* 22 (5). doi: 10.2139/ssrn.1339948.

Kacperczyk, Marcin, Clemens Sialm and Lu Zheng. 2005. "On the Industry Concentration of Actively Managed Equity Mutual Funds." *The Journal of Finance* 60 (4): 1983-2011. doi: 10.1111/j.1540-6261.2005.00785.x.

Kitazawa, Yoshitsugu. 2012. "Hyperbolic Transformation and Average Elasticity in the Framework of the Fixed Effects Logit Model." *Theoretical Economics Letters* 2: 192–199. doi: 10.4236/tel.2012.22034.

Knell, Markus and Helmut Stix. 2005. "The Income Elasticity of Money Demand: A Meta-Analysis of Empirical Results." *Journal of Economic Surveys* 19 (3): 513–533. doi: 10.1111/j.0950-0804.2005.00257.x.

Köhler, Matthias. 2015. "Which Banks Are More Risky? The Impact of Business Models on Bank Stability." *Journal of Financial Stability* 16: 195–212. doi: 10.2139/ssrn.2180688.

Konzelmann, Sue, Marc Fovargue-Davies and Gerhard Schnyder. 2012. "The Faces of Liberal Capitalism: Anglo-Saxon Banking Systems in Crisis?" *Cambridge Journal of Economics* 36: 495–524. doi: 10.1093/cje/ber049.

Kroszner, Randall S. and Raghuram G. Rajan. 1994. "Is the Glass–Steagall Act Justified? A Study of the US Experience with Universal Banking before 1933." *The American Economic Review* 84 (4): 810–832. http://www.jstor.org/stable/2118032.

Kwan, Simon. 1998. *Securities Activities by Commercial Banking Firms' Section 20 Subsidiaries: Risk, Return and Diversification Benefits.* Working Papers in Applied Economic Theory 98-10, Federal Reserve Bank of San Francisco. http://www.frbsf.org/economic-research/files/wp98-10.pdf.

Kwast, Myron L. 1989. "The Impact of Underwriting and Dealing on Bank Returns and Risks." *Journal of Banking & Finance* 13 (1): 101–125. doi: 10.1016/0378-4266(89)90022-8.

Kysucky, Vlado and Lars Norden. 2016. "The Benefits of Relationship Lending in a Cross-Country Context: A Meta-Analysis." *Management Science* 62 (1): 90–110. doi: 10.1287/mnsc.2014.2088.

La Francesca, Salvatore. 2011. "Il sistema bancario italiano: Dalla crisi del 1929 alla fine del novecento." In *Lezioni sulla formazione del Sistema bancario italiano,* 115–153. Rome: Associazione per lo Sviluppo degli Studi di Banca e Borsa, Università Cattolica del Sacro Cuore. http://www.assbb.it/contenuti/news/files/Quaderno_258.pdf.

Lane, Philip R. and Gian Maria Milesi-Ferretti. 2007. "The External Wealth of Nations Mark II: Revised and Extended Estimates of Foreign Assets and Liabilities, 1970–2004." *Journal of International Economics* 73: 223–250. doi: 10.1016/j.jinteco.2007.02.003.

LaRouche Political Action Committee. 2018. *Documented Support for Glass-Steagall.* https://larouchepac.com/hr129support.

Lee, Chien-Chiang, Meng-Fen Hsieh and Shih-Jui Yang. 2014. "The Relationship between

Revenue Diversification and Bank Performance: Do Financial Structures and Financial Reforms Matter?" *Japan and the World Economy* 29 (C): 18–35. doi: 10.1016/j.japwor.2013.11.002.

LEE, Chien-Chiang, Shih-Jui YANG and Chi-Hung CHANG. 2014. "Non-Interest Income, Profitability, and Risk in Banking Industry: A Cross-Country Analysis." *The North American Journal of Economics and Finance* 27 (C): 48–67. doi: 10.1016/j.najef.2013.11.002.

LEE, Sheng-Yi. 1990. *The Monetary and Banking Development of Singapore and Malaysia.* Third edition. Singapore: Singapore University Press.

LEHAR, Alfred. 2005. "Measuring Systemic Risk: A Risk Management Approach." *Journal of Banking & Finance* 29 (10): 2577–2603. doi: 10.1016/j.jbankfin.2004.09.007.

LEHMANN, Matthias. 2016. "Volcker Rule, Ring-fencing or Separation of Bank Activities – Comparison of Structural Reform Acts around the World." *Journal of Banking Regulation* 17. doi: 10.1057/jbr.2015.3.

LEHNERS, Jean-Paul. 1994. "Luxemburg." In *Handbook on the History of European Banks,* edited by Manfred Pohl and Sabine Freitag, 675–716. Frankfurt: Edward Elgar Publishing.

LEPETIT, Laetitia, Emmanuelle NYS, Philippe ROUS and Amine TARAZI. 2008. "Bank Income Structure and Risk: An Empirical Analysis of European Banks." *Journal of Banking & Finance* 32 (8): 1452–1467. doi: 10.1016/j.jbankfin.2007.12.002.

LEPETIT, Laetitia and Frank STROBEL. 2013. "Bank Insolvency Risk and Time-Varying Z-score Measures." *Journal of International Financial Markets, Institutions and Money* 25: 73–87. doi: doi: 10.1016/j.intfin.2013.01.004.

LI, Li and Yu ZHANG. 2013. "Are There Diversification Benefits of Increasing Noninterest Income in the Chinese Banking Industry?" *Journal of Empirical Finance* 24 (C): 151–165. doi: 10.1016/j.jempfin.2013.10.004.

LIN, Chih-Pin. 2009. "Universal Banking in an Emerging Economy: The Conflict-of-Interest Hypothesis." *Journal of Global Business Management* 5 (2). http://www.jgbm.org/page/8%20Chih-Pin%20Lin.pdf.

LINDBLOM, Ted and Martin ANDERSSON. 1997. "Recent Developments in Retail Banking in Scandinavia: Narrow v. Unversal Banking." In *The Recent Evolution of Financial Systems,* edited by Jack Revell, 181–202. London: Macmillan Press.

LINDGREN, Carl-Johan, Gillian GARCIA and Matthew I. SAAL. 1996. *Bank Soundness and Macroeconomic Policy.* Washington: International Monetary Fund.

LO DUCA, Marco, Anne KOBAN, Marisa BASTEN, Elias BENGTSSON, Benjamin KLAUS, Piotr KUSMIERCZYK and Jan H. LANG. 2017. *A New Database for Financial Crises in European Countries.* Occasional Paper Series No. 194, European Central Bank. https://www.ecb.europa.eu/pub/pdf/scpops/ecb.op194.en.pdf.

LOWN, Cara S., Carol L. OSLER, Philip E. STRAHAN and Amir SUFI. 2000. "The Changing Landscape of the Financial Services Industry: What Lies Ahead?" *Economic Policy Review* 6 (4): 39–54. https://www.newyorkfed.org/medialibrary/media/research/epr/00v06n4/0010lown.pdf

MARKHAM, Jerry W. 2002. *A Financial History of the United States: From the Age of Derivatives into the New Millennium (1970–2001).* Armonk: M. E. Sharpe.

MCMAHON, Christopher. 1984. "The Business of Financial Supervision." *Bank of England Quarterly Bulletin* 24 (1): 46–50. https://www.bankofengland.co.uk/-/media/boe/files/quarterly-bulletin/1984/the-business-of-financial-supervision.pdf.

Mercieca, Steve, Klaus Schaeck and Simon Wolfe. 2007. "Small European Banks: Benefits from Diversification?" *Journal of Banking & Finance* 31 (7): 1975–1998. doi: 10.1016/j.jbankfin.2007.01.004.

Meslier, Céline, Ruth Tacneng and Amine Tarazi. 2014. "Is Bank Income Diversification Beneficial? Evidence from an Emerging Economy." *Journal of International Financial Markets, Institutions and Money* 31 (C): 97–126. doi: 10.1016/j.intfin.2014.03.007.

Myers, Stewart C. and Raghuram G. Rajan. 1998. "The Paradox of Liquidity." *The Quarterly Journal of Economics* 113 (3): 733–771. doi: 10.1162/003355398555739.

Neal, Larry and Lance Davis. 2006. "The Evolution of the Structure and Performance of the London Stock Exchange in the first Global Financial Market, 1812–1914." *European Review of Economic History* 10: 279–300. doi: 10.1017/S1361491606001766.

Neumayer, Eric and Thomas Plümper. 2017. *Robustness Tests for Quantitative Research.* Cambridge: Cambridge University Press.

Nickell, Stephen. 1981. "Biases in Dynamic Models with Fixed Effects." *Econometrica* 49 (6): 1417–1426. http://www.jstor.org/stable/1911408.

Noble, William S. 2009. "How does multiple testing correction work?" *Nature Biotechnology* 27: 1135–1137. doi: 10.1038/nbt1209-1135.

Ong, Lawrence. 2009. "International Securities Exchange Law in Taiwan." In *The Comparative Law Yearbook of International Business,* edited by Dennis Campbell and Antonida Netzer, 3–90. Alphen aan den Rijn: Kluwer Law International.

Orbe, Lawrence F. III. 1983. "Glass–Steagall: Lest We Forget." *Florida State University Law Review* 11 (1). https://ir.law.fsu.edu/lr/vol11/iss1/5.

Pafitou, Nadina. 2010. *Bank of Cyprus Chronicle 1899–2009.* Bank of Cyprus. http://www.bankofcyprus.com.cy/globalassets/cyprus/istoriko-arhio/history/boc-chronicle_english-allagi.pdf.

Pálmason, Ólafur. 1994. "Iceland." In *Handbook on the History of European Banks,* edited by Manfred Pohl and Sabine Freitag, 533–540. Frankfurt: Edward Elgar Publishing.

Panetta, Fabio. 2003. "L'evoluzione strutturale del sistema bancario." In *Struttura e operatività del sistema bancario italiano a dieci anni dal testo unico,* 15–29. Rome: Associazione per lo Sviluppo degli Studi di Banca e Borsa, Università Cattolica del Sacro Cuore. http://www.assbb.it/wp-content/uploads/2014/10/QR_208.pdf.

Papi, Luca, Andrea F. Presbitero and Alberto Zazzaro. 2015. *IMF Lending and Banking Crises.* Working Paper No. 15/19, International Monetary Fund. https://www.imf.org/external/pubs/ft/wp/2015/wp1519.pdf.

Park, Won-Am. 1996. "Financial Liberalization: The Korean Experience." In *Financial Deregulation and Integration in East Asia,* edited by Takatoshi Ito and Anne O. Krueger, 247–276. Chicago: University of Chicago Press.

Patrikis, Ernest T. 1998. "Japan's Big Bang Fin-ancial Reforms." *Brooklyn Journal of International Law* 24 (2): 577–592. https://brooklynworks.brooklaw.edu/bjil/vol24/iss2/6.

Peeters, Jan. 1988. "Re-Regulation of the Financial Services Industry in the United Kingdom." *University of Pennsylvania Journal of International Business Law* 10 (3). https://www.law.upenn.edu/journals/jil/articles/volume10/issue3/Peeters10U.Pa.J.Int'lBus.L.371(1988).pdf.

Penas, María Fabiana and Haluk Unal. 2004. "Gains in Bank Mergers: Evidence from the Bond Markets." *Journal of Financial Economics*

74 (1): 149–179. doi: 10.1016/j.jfineco.2003.05.004.

Perneger, Thomas V. 1998. "What's Wrong with Bonferroni Adjustments." *British Medical Journal* 316: 1236–1238. doi: 10.1136/bmj.316.7139.1236.

Pforr, Klaus. 2013. *How to Interpret the Logistic Regression with Fixed Effects.* 5th ESRA Conference, GESIS Leibniz Institute for the Social Sciences. https://www.europeansurveyresearch.org/conf/uploads/174/103/128/pforr_ESRA2013_interpretation_fixed_effects_logit.pdf.

Pimlott, Graham F. 1985. "The Reform of Investor Protection in the UK – An Examination of the Proposals of the Gower Report and the UK Government's White Paper of January, 1985." *Journal of Comparative Business and Capital Market Law* 7: 141–172. https://www.law.upenn.edu/journals/jil/articles/volume7/issue2/Pimlott7J.Comp.Bus.%26Cap.MarketL.141(1985).pdf.

Rahman, K. Sabeel. 2012. "Democracy and Productivity: The Glass–Steagall Act and the Shifting Discourse of Financial Regulation." *The Journal of Policy History* 24 (4): 612–643. doi: 10.1017/S089803061200022X.

Reinhart, Carmen M. and Kenneth S. Rogoff. 2014. "Recovery from Financial Crises: Evidence from 100 Episodes." *American Economic Review* 104 (5): 50–55. doi: 10.1257/aer.104.5.50.

Ribon, Sigal and Oved Yosha. 1999. *Financial Liberalization and Competition in Banking: An Empirical Investigation.* Discussion Paper No. 99.05, Bank of Israel. http://www.boi.org.il/en/Research/Pages/papers_dp9905e.aspx.

Roodman, David. 2009a. "How to Do Xtabond2: An Introduction to Difference and System GMM in Stata." *Stata Journal* 9 (1): 86–136. http://www.stata-journal.com/article.html?article=st0159.

———. 2009b. "A Note on the Theme of Too Many Instruments." *Oxford Bulletin of Economics and Statistics* 71 (1): 135–158. doi: 10.1111/j.1468-0084.2008.00542.x.

———. 2007. *A Note on the Theme of Too Many Instruments.* Working paper, Center for Global Development. https://www.cgdev.org/publication/note-theme-too-many-instruments-working-paper-125.

Santos Silva, João and Gordon C. R. Kemp. 2016. *Partial Effects in Fixed Effects Models.* 22nd London Stata Users Group Meeting. https://www.stata.com/meeting/uk16/slides/santos_uk16.pdf.

Sanya, Sarah O. 2009. *Intermediation Patterns in Banks: Three Empirical Essays.* Doctoral thesis, Faculty of Law, Arts and Social Sciences, School of Management, University of Southhampton. http://eprints.soton.ac.uk/167479.

Sanya, Sarah O. and Simon Wolfe. 2011. "Can Banks in Emerging Economies Benefit from Revenue Diversification?" *Journal of Financial Services Research* 40 (1): 79–101. doi: 10.2139/ssrn.1077842.

Sarin, Natasha and Lawrence H. Summers. 2016. *Have Big Banks Gotten Safer?* Brookings Papers on Economic Activity, Harvard University. https://www.brookings.edu/wp-content/uploads/2016/09/2_sarinsummers.pdf.

Saunders, Anthony and Marcia M. Cornett. 2011. *Financial Institutions Management: A Risk Management Approach.* Seventh edition. New York: McGraw-Hill.

Saunders, Anthony and Ingo Walter. 1994. *Universal Banking in the United States: What Could We Gain? What Could We Lose?* New York: Oxford University Press.

Schenk, Catherine R. 2003. "Banking Crises and the Evolution of the Regulatory Framework in Hong Kong 1945–1970." *Australian Economic*

History Review 43 (2): 140–154. doi: 10.1111/1467-8446.t01-1-00047.

Schmid, Markus M. and Ingo Walter. 2009. "Do Financial Conglomerates Create or Destroy Economic Value?" *Journal of Financial Intermediation* 18 (2): 193–216. doi: 10.1016/j.jfi.2008.07.002.

Shabani, Mimoza, Judith Tyson, Jan Toporowski and Terry McKinley. 2015. *The Financial System in the UK.* fessud Studies in Financial Systems No. 14. http://fessud.eu/wp-content/uploads/2012/08/UK-Country-Report-revised-August-2014-final-study-14.pdf.

Soto, Marcelo. 2009. *System GMM Estimation with a Small Sample.* Barcelona Economics Working Paper Series No. 395, Barcelona Graduate School of Economics. http://www.iae.csic.es/investigatorsMaterial/a111411124703archivoPdf29632.pdf.

Stanley, Tom D. 2005. "Integrating the Empirical Tests of the Natural Rate Hypothesis: A Meta-Regression Analysis." *Kyklos* 58 (4): 611–634. doi: 10.1111/j.0023-5962.2005.00305.x.

———. 2008. "Meta-Regression Methods for Detecting and Estimating Empirical Effects in the Presence of Publication Selection." *Oxford Bulletin of Economics and Statistics* 70 (1): 103-127. doi: 10.1111/j.1468-0084.2007.00487.x.

Stanley, Tom D. and Hristos Doucouliagos. 2012. *Meta-Regression Analysis in Economics and Business.* London: Routledge.

Stanley, Tom D. and Stephen B. Jarrell. 1989. "Meta-Regression Analysis: A Quantitative Method of Literature Surveys." *Journal of Economic Surveys* 3 (2): 161-70. doi: 10.1111/j.1467-6419.1989.tb00064.x.

Stiroh, Kevin J. 2004a. "Diversification in Banking: Is Noninterest Income the Answer?" *Journal of Money, Credit and Banking* 36 (5): 853–82. doi: 10.1353/mcb.2004.0076.

———. 2004b. "Do Community Banks Benefit from Diversification?" *Journal of Financial Services Research* 25 (2): 135–160. doi: 10.1023/b:fina.0000020657.59334.76.

———. 2006. "A Portfolio View of Banking with Interest and Noninterest Activities." *Journal of Money, Credit and Banking* 38 (5): 1351–1361. doi: 10.1353/mcb.2006.0075.

———. 2010. "Diversification in Banking." In *The Oxford Handbook of Banking,* edited by Allen N. Berger, Philip Molyneux and John Wilson, 146–170. Oxford: Oxford University Press.

Stiroh, Kevin J. and Adrienne Rumble. 2006. "The Dark Side of Diversification: The Case of US Financial Holding Companies." *Journal of Banking & Finance* 30 (8): 2131–2161. doi: 10.1016/j.jbankfin.2005.04.030.

Svirydzenka, Katsiaryna. 2016. *Introducing a New Broad-based Index of Financial Development.* Working Paper 16/5, International Monetary Fund. https://www.imf.org/en/Publications/WP/Issues/2016/12/31/Introducing-a-New-Broad-based-Index-of-Financial-Development-43621.

Tabarrok, Alexander. 1998. "Separation of Commercial and Investment Banking: The Morgans vs. The Rockefellers." *Quarterly Journal of Austrian Economics* 1 (1): 1–18. https://mises.org/library/separation-commercial-and-investment-banking-morgans-vs-rockefellers.

Tanndal, Julia and Daniel Waldenström. 2016. *Does Financial Deregulation Boost Top Incomes? Evidence from the Big Bang.* iza Discussion Paper No. 9684, Institute for the Study of Labor. http://ftp.iza.org/dp9684.pdf.

Teichova, Alice. 1994. "Austria." In *Handbook on the History of European Banks,* edited by Manfred Pohl and Sabine Freitag, 3–27. Frankfurt: Edward Elgar Publishing.

Thomas, Hugh and Ingo Walter. 1991. "The Introduction of Universal Banking in Canada:

An Event Study." *Journal of International Financial Management & Accounting* 3 (2): 110–132. doi: 10.1111/j.1467-646X.1991.tb00100.x.

Thomas, Mark. 2004. "The Service Sector." In *The Cambridge Economic History of Modern Britain,* edited by Roderick Floud and Paul Johnson, Cambridge: Cambridge University Press.

Tilly, Richard. 1994. "Germany." In *Handbook on the History of European Banks,* edited by Manfred Pohl and Sabine Freitag, 299–488. Frankfurt: Edward Elgar Publishing.

Uchitelle, Louis. 2009. "Volcker Fails to Sell a Bank Strategy." *New York Times* 20 October. https://www.nytimes.com/2009/10/21/business/21volcker.html.

Ugolini, Stefano. 2010. *Universal Banking and* the Development of Secondary Corporate Debt Markets: Lessons from 1830s Belgium. Working paper, Norges Bank. https://static.norges-bank.no/globalassets/upload/english/publications/working-papers/2010/norges_bank_working_paper_2010_21.pdf.

United States Senate. 1933. *Stock Exchange Practices.* Committee on Banking and Currency. https://www.senate.gov/artandhistory/history/common/investigations/pdf/Pecora_FinalReport.pdf.

Valencia, Fabián and Luc Laeven. 2012. *Systemic Banking Crises Database: An Update.* Working Paper 12/163, International Monetary Fund. https://www.imf.org/external/Pubs/FT/staffp/1998/03-98/demirguc.htm.

Viñals, José, Ceyla Pazarbasioglu, Jay Surti, Aditya Narain, Michaela Erbenova and Julian Chow. 2013. *Creating a Safer Financial System: Will the Volcker, Vickers and Liikanen Structural Measures Help?* Staff Discussion Note, International Monetary Fund. doi: 10.5089/9781484340943.006.

Vozzella, Pietro, Giampaolo Gabbi and Massimo Matthias. 2015. *Financial Regulation in Italy.* FESSUD Working Paper Series No. 60. http://fessud.eu/wp-content/uploads/2015/03/Financial-Regulation-in-Italy_April-2015_working-paper-60-.pdf.

Weber, Adolf. 1938. *Depositenbanken und Spekulationsbanken: Ein Vergleich des deutschen und englischen Bankwesens.* Fourth edition. Munich: Duncker & Humblot.

Wooldridge, Jeffrey M. 2008. *Introductory Econometrics: A Modern Approach.* Mason: South-Western Cengage Learning.

World Bank. 2012. *Bank Regulation and Supervision Survey.* http://www.worldbank.org/en/research/brief/BRSS.

Zhang, Jun and Kai F. Yu. 1998. "What's the Relative Risk? A Method of Correcting the Odds Ratio in Cohort Studies of Common Outcomes." *Journal of the American Medical Association* 280 (19): 1690–1691. doi: 10.1001/jama.280.19.1690.