An empirical investigation in NPL definitional biases in the EU & US between 1989 and 2019, especially regarding LLP timeliness models.

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Abstract

This thesis aims to empirically measure biases in non-performing loan (NPL) data caused by differing country definitions. Building on the work of Barisitz (2011, 2013b), I identify that Italy has an unambiguous theoretical upwards bias and that the U.K. and U.S. have an unambiguous theoretical downward bias. This thesis adds to the literature by first trying to empirically measure the bias of differing NPL definitions. I attempt to capture these biases by dividing gross charge-offs by lagged NPLs and call this ratio the conversion ratio. I combine a legacy BankScope dataset (1989-2012) with a dataset from Orbis Bank Focus (2012-2019), totalling 35,739 observations for the conversion ratio. The results are in line with the expectations. First, the conversion ratio for Italy is lower than the conversion ratio for the U.K. and U.S. from 2006 to 2019. Second, the conversion ratios for France, Germany and Italy are around 70% lower than the conversion ratios for the U.K. and U.S. between 2012 and 2018, thereby providing evidence of an ongoing bias. This has important implications for the cross-country comparability of NPL data. Finally, this thesis shows that cross-country LLP timeliness models estimating country level timeliness are being impaired by biases in NPL data.

Keywords: Non-performing loans, definitions, cross-country, bias, loan loss provision timeliness

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1. Introduction

The International Monetary Fund defined a non-performing loan (NPL) in 2004 as a loan that has either one of the following two characteristics: (1) 90 days or more past due on interest or principal, or (2) evidence exists that the principal will not be recovered as defined by national supervisors (IMF, 2004a, para. 4.84). However, both parts of this definition vary across countries. In addition, other secondary issues also drive differences in NPL classification. First, loans are classified differently based on the existence of collateral. Second, restructured loans are classified as non-performing for varying amounts of time. Third, varying amounts are recorded as non-performing. Fourth, multiple loans to a single customer are treated differently across countries. Therefore, it is hard to compare NPL data across countries, since the data is based on different definitions and classification systems.

Barisitz conducted several studies between 2011 and 2019 to compare NPL definitions conceptually in several European countries (Barisitz, 2011, 2013a, 2013b, 2017). He finds that, Italy has an unambiguous upwards bias of the NPL data in an international comparison by including loans in "temporary difficulty". Also, he finds that the United Kingdom (U.K.) has an unambiguous downwards bias by only using the '90 days or more past due' rule to classify NPLs (Barisitz, 2013b). However, the European Banking Authority (EBA) harmonized the NPL definitions across Europe (excluding the U.K.) in 2015 by Implementing Technical Standards (ITS), commonly referred to as the EBA ITS (European Commission, 2015).

In addition, the Bank Regulation and Supervision survey (BRS survey) has been conducted five times by the world bank (2001, 2003, 2007, 2011, 2017). This survey shows that there is, theoretically, an ongoing difference between Europe and the U.K. and U.S. (United States) in the treatment of collateral and the treatment of multiple loans to a single customer (World Bank, n.d.).

Barisitz mentioned in the conclusion of the NPL definitional study in Western Europe that further research could attempt to quantitatively measure the biases caused by different definitions (Barisitz, 2013b, p. 45). This thesis aims to do exactly that. The main research question of this thesis is:

"Are the NPL definitional biases empirically observable in France, Germany, Italy, the U.K. and U.S. between 1989 and 2019?"

This question is important to answer for several reasons. First, NPLs are an important asset quality indicator for banks. As such, the NPL ratio (NPLs to gross loans) is used by policymakers, researchers and investors. Biases in the NPL ratio complicate policymaking, academic research and investing. Second, empirically observing biases in NPL ratios caused by definitions would contribute to the literature, because it has not been done yet, as far as I'm aware.

To answer the main research question, I first try to answer the question: What is the difference between NPLs and impaired loans? This is done by comparing NPLs and impaired loans conceptually (comparing definitions and frameworks) and empirically (comparing data sources and variables).

Secondly, I construct a dataset using a legacy BankScope dataset and a current Orbis Bank Focus dataset. The data spans from 1989 to 2019 and includes banks from France, Germany, Italy, the U.K. and U.S., totalling 89,844 bank year observations. To measure the bias caused by definitions I use the ratio of current gross charge-offs (GCOs) divided by lagged NPLs and call this measure the conversion ratio. A lower ratio indicates that less NPLs convert into GCOs the following year and would therefore indicate an upwards NPL bias in an international comparison. Conversely, a higher ratio would indicate a downwards NPL bias in an international comparison. The combined dataset has enough data to calculate the conversion ratio for 35,739 bank years. Lastly, I use the results of the conversion ratio combined with the existing literature to replicate an influential paper that uses NPL data. Namely, I replicate Bushman & Williams (2012) who use future period NPLs to measure current loan loss provision (LLP) timeliness across countries.

First, the data suggest that in the U.S. NPLs are equal to impaired loans. In the EU (European Union) and U.K. this might also be the case, but this study did not find empirical evidence to support that. Second, the conversion ratio is substantially lower for France, Germany and Italy than for the U.K. and U.S. between 2012 and 2018. This indicates an upwards bias of the European NPL data compared to the U.K. and U.S. In addition, the data are mostly in line with the expectation that Italy had an upwards NPL bias prior to 2015 and that the U.K. and U.S. also had a downwards NPL bias prior to 2015. Finally, replicating the LLP timeliness model shows that multiplying NPL data inversely proportionally biases the forward-NPL (timeliness) measure, without changing sign. However, adjusting data upwards doesn't always make countries seem less timely, in fact it makes countries with a negative coefficient seem timelier. Nevertheless, LLP timeliness models and country level timeliness estimators are inaccurate and biased by differing definitions.

This study adds to the literature by empirically observing expected NPL definitional biases. This has important implications for researchers using NPL data in their models, as it could bias their estimations. Furthermore, it has important implications for policymakers comparing cross-country NPL data. Thirdly, it has important implications for investors comparing cross-country asset quality data. Researchers, policymakers and investors should adjust their models and decisions on these biases and should be aware that cross-country comparisons are biased.

This thesis contains the following structure: First, section 2 discusses the existing literature regarding differing NPL definitions and describes the conversion ratio used to measure the bias this might cause in detail. Second, section 3 empirically examines the data for two purposes: (1) to distinguish impaired loans from NPLs, (2) to observe the bias caused by differing NPL definitions. Lastly, section 4 replicates an LLP timeliness model using adjusted NPL data to check the sensitivity of these models to NPL biases.

2. Literature review

This section covers the existing literature regarding NPLs. Section 2.1 discusses the current situation, the current definition of NPLs and the current drivers of differences in the NPL definitions. Section 2.2 provides a brief history of NPL definitions in Europe and the U.S. and describes how definitions have evolved over time. Section 2.3 summarizes the existing literature regarding NPL definitions. Section 2.4 theoretically compares NPLs and impaired loans and details the interaction between these terms. Section 2.5 describes the conversion ratio that I have developed and use in an attempt to empirically observe and measure differences in NPL data due to differing definitions. Finally, section 2.6 summarizes section 2 and describes the expected empirical results based on this literature review.

2.1. Current situation

First, an NPL is a regulatory term used in prudential regulatory frameworks and a popular term and variable in academic research. An impaired loan is an accounting term used in accounting standards, until very recently both in U.S. GAAP and IFRS. Further on, in section 3.1, I will compare NPLs with impaired loans and discuss the most recent developments in accounting standards.

There are many definitions of an NPL by many different international institutions and even more national regulators. The most straightforward description would be a loan that is 90 days or more past due on its interest or principal payment. However, in practice there are many factors that complicate defining an NPL. In 2004, the IMF made some recommendations concerning the definition of an NPL specifically to improve cross-country comparability. The IMF suggested to define an NPL as a loan that has either (IMF, 2004a, para. 4.84):

1) Interest or principal that is 90 or more days past due
2) A serious probability of not recovering the principal in full as specified under national supervisory guidance.

This internationally influential and leading definition of NPLs by the IMF consists of 2 parts. The first part, '90+ days past due' is a relatively objective measure (quantitative) and easy to compare across countries. Internationally most countries have converged towards this '90+ days past due criteria' over the last two decades. However, the second part of the definition is a much more subjective measure (qualitative) and has varied much more from country to country. This variation has significantly decreased over the last two decades as well but is still significant. More about this in section 2.3.1.

Lastly, there are even more issues that drive differences in NPL definitions besides the two criteria mentioned in the IMF definition. Barisitz (2011) fittingly named them secondary elements and listed a few:

1) The amount recorded as NPLs: (a) the gross value of the loan or (b) part of it.
2) The classification of restructured loans: (a) as non-performing or (b) as performing.

3) The classification of loans with collateral: (a) disregard the collateral or (b) let the collateral influence the classification.
4) The classification of multiple loans to a single customer X when loan Y is classified as nonperforming: (a) classify all loans of customer X as nonperforming (customer view), classify only loan Y as nonperforming (product view).

2.2. History

In this section I will further detail the history of the term NPL. Only in the last two to three decades the term NPL has become more prominent and formerly defined. For example, the Bank Regulation and Supervision Survey (BRS survey) of 2001 shows that almost 1/3rd of the countries participating don't have a formal definition for NPLs (World Bank, n.d.). Among these countries are major economies such as Germany, the United Kingdom (UK) and the United States (US).

However, the history of the closely related accounting term 'impaired loans' does go back further. In 1975 the Financial Accounting Standards Board (FASB) introduced Financial Accounting Standard 5 (FAS 5) in the U.S. FAS 5 states that from then on, all companies must make provisions for contingent losses if two conditions are met (FASB, 1975, para. 8). (a) It is probable (=likely) that an asset has been impaired, or a liability incurred at the reporting date. (b) "*The amount of loss can be reasonably estimated*". As Bholat et al. (2018) mention, this was likely the first formal definition of impaired loans in the accounting standards. Furthermore, Bloem & Freeman (2005) mention that in 1993 the System of National Accounts (SNA) provided a non-binding principle for defining NPLs internationally. The principle is to classify loans likely not to make all contractual payments as NPLs. According to this principle NPLs would be identical to impaired loans following the relevant accounting standards: FAS 5 (1975 onwards), FAS 114 (adopted in 1993) and International Account Standard 39 (adopted in 2004) standards. More about all the relevant accounting standards and their relationship to NPLs is detailed in section 2.4.

As mentioned before, the first significant step to international convergence was made by the IMF in 2004. That year the IMF made some non-binding recommendations concerning the NPL definition. Defining an NPL as a loan that has either: (1) interest or principal 90+ days past due or (2) a serious probability of not recovering at least part of the loan, as specified under national guidance (IMF, 2004a). However, it is important to note that there weren't even international guidelines concerning secondary elements such as the treatment of collateral or the classification of restructured loans.

According to the BRS survey the U.S. adopted a formal definition of NPLs only after 2003 and before 2007 (World Bank, n.d.). However, before 2007 the definition was already used informally. Despite that, it's very hard to find this formal definition defined. However, both the St. Louis FED (Federal Reserve Bank of St. Louis) and the New York FED (Federal Reserve Bank of New York) define NPLs this way in their timeseries reported online (FRED, 2019; Federal Reserve Bank of New

York, 2019). According to their timeseries, the definition of an NPL in the U.S. is the sum of: (1) 90+ days past due loans and (2) non-accrual loans.

In Europe national NPL definitions have varied widely up until 2013 when the EBA first introduced a binding technical standard that was fully implemented in 2015 (EBA, 2014; European Commission, 2015). This new harmonized EU wide definition is often referred to as the EBA ITS (European Banking Authority, Implementing Technical Standards). This standard is likely the biggest and most comprehensive international harmonization effort of NPL definitions so far. This effort was triggered by the European debt crisis which led to the creation of a European Banking Union. Under this Banking Union, all European banks fall under the authority of the EBA and ECB (European Central Bank) through the Single Supervisory Mechanism (SSM). Underlying all of this is the adoption of a 'single rulebook' aimed at providing an equal regulatory reporting framework across the Banking Union. Part of this single rulebook is the EBA ITS defining NPLs across Europe.

The EBA ITS uses the term non-performing exposures (NPE) which includes all NPLs plus possibly some other items, such as financial guarantees likely to be called in. The EBA defines exposures as nonperforming that satisfy at least one of the following two conditions (European Commission, 2015): (a) material exposures more than 90 days past due, or (b) the borrower is unlikely to pay back the principal without realization of collateral. Also, all impaired loans as classified under accounting frameworks are considered nonperforming, as well as all loans classified as default under the Capital Requirement Regulation (CRR). Furthermore, all secondary elements mentioned by Barisitz are covered and defined in the EBA ITS, summarized below.

1. The amount recorded: The entire gross amount.
2. Classification of restructured loans: Mostly classified as nonperforming when forbearance measures are taken out of necessity, i.e., when the borrower experiences financial difficulty. Only when very strict rules are met not classified as nonperforming.
3. Classification of loans with collateral: collateral is not considered when classifying loans as nonperforming.
4. Classification of multiple loans to a single customer: If more than 20% of all gross loans to a customer are considered nonperforming, all loans to this customer will be classified nonperforming (pulling effect).

Furthermore, the exit criteria are clearly defined. Exposures can be reconsidered as performing when: (a) an exposure meets the company's exit criteria considering impaired loans/default classification, (b) full repayment is likely, (c) the borrower doesn't have any exposures that are 90+ days past due (European Commission, 2015, p. 606).

Besides the adoption of the EBA ITS no major binding international regulations have been implemented after 2015. However, both the Basel Committee on Banking Supervision (BCBS) and the Financial Stability Institute (FSI) have pushed for further international harmonization of NPL definitions

since then (BCBS, 2017; Baudino, Orlandi, & Zamil, 2018). So, Europe has a harmonized NPL definition, however, there are still differences between Europe, UK and US.

2.3. Literature review NPL definitions

Various studies and surveys have been conducted to compare different NPL definitions, mostly in the last two decades. It is notable that almost all these studies are either written by employees of international institutions and national banks or are published at the request of international institutions and policymakers. In addition, it is noteworthy that all studies so far have been theoretical studies in the different NPL definitions. In other words, no study has yet tried to quantify the bias these different definitions introduce, at least to my knowledge.

In this section, the existing literature is summarized and broadly categorized into 2 different categories. First, academic studies not directly linked to institutions. Second, studies linked to institutions, often with the direct aim of policy implementation or policy monitoring. In addition, some academic empirical research papers noted the difficulty of using cross-country NPL data and have subsequently adjusted their research accordingly. I will name a few at the end of the literature review of academic studies, especially those that have suggested ways to deal with this bias.

2.3.1. Academic studies

One of the very first academic studies that explores the deviation between NPL definitions worldwide is by Cortavarria, Dziobek, and Kanaya (2000). They conclude that there is neither a worldwide NPL definition nor a worldwide loan classification system. On the contrary, regulators all use their own system, weakening cross-country comparisons of credit risk/NPL data. Furthermore, they recommend some practices that could be included in a worldwide loan classification system. Lastly, they detail how both primary and secondary elements of the NPL definition vary significantly across countries worldwide. This includes a huge variation in past due criteria, treatment of restructured loans and the treatment of collateral (Cortavarria et al., 2000).

Barisitz has studied NPL definitions in Europe extensively. He has written three papers about NPL definitions in ten different Central, Eastern and Southeastern European countries (so called: CESEE countries). These were published in 2011, 2013 and 2019 (Barisitz, 2011, 2013a, 2013b, 2019). Furthermore, Barisitz has written a paper about NPLs in Western Europe in 2013, just before the European Banking Authority took a major step in harmonizing the NPL definitions across Europe in 2014 (Barisitz, 2013b).

In the first study Barisitz (2011) found that there is an international definition of NPLs as issued by the IMF in 2004 and subsequently adjusted in 2006 (IMF, 2004a). Besides, the IMF has timeseries of NPLs available through their Financial Soundness indicators website. However, there were multiple problems with these data. For example, timeseries were limited, there were breaks in the data and different sources within the database weren't always consistent with each other. Therefore, he decided

to compare the different national definitions conceptually. He finds that the definitions are relatively similar. Most countries use the 90+ days past due measure complemented by an additional measure to capture loans that are very likely to default despite not being 90+ days past due. This last measure is often called a "well-defined weakness" or "serious weakness". Furthermore, he finds that countries use different approaches in what he later in 2013 fittingly would call "secondary elements". For example, Croatia and Hungary take the product view, while the other 8 countries use the customer view. That means, that if a loan to a customer in Croatia is classified as non-performing, other loans to the same customer are not necessarily classified non-performing (Barisitz, 2011).

Two years later, Barisitz followed up his first research by making a selective comparison of NPLs in Western Europe (Barisitz, 2013b). He compared the primary and secondary elements of the NPL definition of 9 Western European countries. Primary elements are the 90+ days past due feature accompanied by the commonly referred to "well-defined weakness". Secondary elements are the amount recorded as NPL, classification of restructured loans, classification of collateral and classification of multiple loans to a single customer. He found that the United Kingdom only used the 90+ days past due feature without a second measure to capture for example imminent bankruptcy. In addition, the U.K. also used more lenient restructuring classification and was less strict in recording the full gross amount. Therefore, the U.K. has a downward bias both in primary and secondary elements. In an international comparison, the U.K. would be expected to have a clear unambiguous downwards bias of the NPL data and subsequently NPL ratio. Contrary, he found that Italy categorized 4 out of 5 loan categories as nonperforming, including substandard loans. However, substandard loans are loans to customers currently experiencing difficulties that are expected to improve reasonable soon (IMF, 2004b, p 42). Moreover, all 4 secondary elements were strict resulting in an unambiguous upwards bias. Therefore, in an international context, Italy is expected to have an upwards bias of the NPL data and NPL ratio (Barisitz, 2013b).

The same year Barisitz conducted a follow up research in the same fashion concerning the ten CESEE countries. That is, he compared the primary and secondary elements of each country in a table and drew a conclusion about the overall bias in an international comparison. He concluded, that the primary elements were very much aligned and that only Russia diverged slightly. That is, the Russian central bank defined a "well-defined weakness" in slightly more lenient wording. Furthermore, the secondary elements diverged moderately across countries. However, no unambiguous bias would be expected in an international setting (Barisitz, 2013a).

In 2019 Barisitz published a brief update on the NPL definitions in the 10 CESEE countries. In this update he compares the recent developments in the CESEE countries to the new European definition implemented in 2015 as mentioned before. He concludes that these countries are comparable with only marginal differences. Russia is presumed to have a slightly softer primary definition; it doesn't explicitly mention 90+days past due. Croatia's regulatory guidelines imply a more lenient approach to the

secondary aspects. Overall, the countries have converged towards the international/EBA definition since Barisitz's previous 2013 study (Barisitz, 2019).

D'Hulster, Salomao-Garcia, and Letelier (2014) published a paper comparing loan classification and provisioning in 26 Eastern and Central Asian (ECA) countries. This paper builds on Barisitz's work prior to 2014. Their conclusions are similar to Barisitz's conclusions: It's difficult to compare NPL data cross-country because of different supervisory definitions. Furthermore, most countries rely on the 90+ days past due benchmark as a primary element. Nevertheless, regarding more subjective criteria and secondary elements there is a wide divergence in definitions and practices. They provide a selection of tables comparing elements that comprise the NPL definition for the ECA countries. These tables are based on the questions asked in the BRS survey by the world bank, I will cover this survey in more detail for selected countries in section 2.3.2.1.

Bholat, Markose, Miglionico, and Sen wrote a paper analyzing the current situation regarding NPLs (2018), building on the work of Barisitz. Their paper takes on a broader scope than Barisitz's research, they also include the accounting treatment of NPLs in addition to the regulatory treatment. First, they conclude that since definitions differ and are partly discretionary it is very hard to compare across firms and it's even more difficult to compare across regulatory frameworks. Even after all the recent international harmonization initiatives (European Commission, 2015; Baudino et al., 2018; EBA, 2018), the differences are still far from negligible. Second, they conclude that accounting standards deal with impaired loans instead of NPLs. Furthermore, the new accounting standards going into effect in the EU (IFRS 9) & U.S. (ASC 326) could increase divergence. Therefore, the need for comparable asset quality measures increases (Bholat et al., 2018). Lastly, they provide a useful theoretical summary of NPL definitions across "group of 20" (G20) countries. They supplement this with a table summarizing the NPL definitions of all global systemically important banks (GSBIs). The first table of country definitions shows that all EBA member countries adopted the same definition in 2014. Besides, it shows the diverse definitions among other countries worldwide, including a different definition for the U.S. The second table shows that even banks from the same country (U.S.) can have slightly different practices, for example in classifying credit card debt.

2.3.1.1. Studies adjusting NPL data

Various researchers are aware of the different NPL definitions across countries. Often it is mentioned that because of the different definitions it is hard to make cross-country comparisons (Beck, Jakubík, & Poloiu, 2013; Jakubík & Reininger, 2013; Disarò, 2017; Fraccaroli, 2019). However, some researchers have tried to mitigate the possible bias introduced by different definitions. Firstly, Jakubík & Reininger (2013) mention using Barisitz's (2011, 2013b) work to adjust NPL data for a better comparison. They mention reconstructing different national credit classification classes to enhance the comparability. However, they don't specify in detail what that entails.

Secondly, earlier that year Beck et al. (2013) mention using logarithmic differences to nihilate the effect of different NPL definitions across countries. Therefore, Jakubík has used two different methodologies to combat cross-country NPL differences. Following Beck et al., Fraccaroli (2019) also uses the logarithmic differences, however he uses them as a robustness check and finds that it doesn't change his results.

2.3.2. Institutional studies

Besides the previously mentioned studies there isn't any academic research specifically concerning differing NPL definitions that the author is currently aware of. However, more has been written by international institutions and policymakers. Often with the intent of policy making and subsequently policy monitoring. Nevertheless, these reports provide a valuable insight into the different NPL definitions and practices. A lot has been published by the EBA/ECB after the creation of the SSM and the subsequent harmonization of regulatory frameworks. The most important developments are covered.

One of the first studies that covers NPL definitions is by Bloem & Freeman (2005). Their study was prepared to inform and facilitate a meeting by an IMF committee. They conclude that NPL definitions differ significantly among countries. They recognize there is a difference between impaired loans and NPLs caused by different country definitions. However, they also recognize that accounting rules form the basis for classifying loans as impaired and therefore as nonperforming for most banks (Bloem & Freeman, 2005).

In 2017 the BCBS issued a new set of guidelines for the *"prudential treatment of problem assets – definitions of non-performing exposures and forbearance*. In these guidelines the BCBS recognizes that even though a lot has been done to harmonize NPE definitions, there still is a fair amount of divergence. For example, a handful of regulatory jurisdictions don't even have an NPL definition/category. Furthermore, the classification practices regarding secondary elements (amount recorded, collateral, customer vs product view, restructuring) vary widely. Therefore, this set of guidelines promotes a unified definition to categorize NPE's to improve comparability.

Also in 2017, the ECB published a non-binding guidance to banks classified as Significant Institutions (SI's) directly supervised under the SSM (ECB, 2017a). This guidance provides strategies and best practices to reduce NPL levels. For example, expected practices regarding forbearance (restructuring), write-offs and provisioning. Banks are expected to comply, especially those with above average NPL levels, and should explain differences upon supervisory request. Approximately a year later, the ECB published an addendum to the initial guidance (ECB, 2018). This document specified some additional best practices that were expected, mainly focusing on the treatment of collateral.

The same year the ECB published a *"stocktake of national supervisory practices and legal frameworks related to NPLs"* (ECB, 2017b). This stocktake is aimed at the Less Significant Institutions (LSI's), contrary to the "*guidance to banks on non-performing loans*" earlier in 2017 which was aimed

at SI's. In this stocktake the ECB analyzes the situation regarding NPLs in all SSM member countries from a broad perspective (legal, supervisory, accounting). They find that all national authorities have adopted the common definition implemented by the EBA. Therefore, the divergence in NPL definitions and practices has greatly been reduced. However, some minor differences still exist. For example, regarding very specific practices, write-off practices and differences caused by different legal frameworks.

Lastly, the Financial Stability Institute (FSI) of the Bank for International Settlements (BIS) published a report on the identification and measurement of NPLs across countries (Baudino et al., 2018). This paper compares the identification and measurement of NPLs worldwide. It considers the impact of differing and changing accounting frameworks as well as the existing varying regulatory policies. Mostly it reiterates the conclusions from the 2017 BCBS guidelines on problem assets. Ultimately, it concludes that different and changing accounting standards are problematic when making cross-country NPL comparisons. Furthermore, varying regulatory policies only worsen the situation. Therefore, it recommends further harmonization of regulatory treatment by incorporating the 2017 BCBS guidelines worldwide (BCBS, 2017).

2.3.2.1. Survey

The World Bank periodically conducts a survey among bank supervisors globally. The survey consists of a broad set of questions surrounding the supervision and regulation of banks. In this survey 15 topics are covered and the 9th topic is 'provisioning'. This 9th topic includes questions such as: "after how many days is a loan classified under a certain category?" and "Which criteria are used to determine if a loan is non-performing?" (World Bank, n.d.). The survey has been conducted 5 times so far and has been published in: 2001, 2003, 2007, 2011 and 2017. I made a selective comparison covering 6 countries over all 5 editions, these countries are: France, Germany, Italy, the Netherlands, the United Kingdom and the United States. The survey shows a couple of interesting observations and interesting trends over time.

Foremost, the survey shows a converging trend in NPL definitions over the last 18 years. In the first survey only France and Italy (2/6) reported to have a formal definition of NPLs and in 2019 only the United Kingdom (5/6) doesn't seem to have a formal definition of NPLs. In addition, the differences in secondary elements have been reduced. The 2013 harmonization effort by the EBA is observable among the member countries (France, Germany, Italy and the Netherlands). In the first surveys two countries didn't have a formal definition and both primary and secondary elements were differing significantly. In the last survey all criteria were exactly alike (World Bank, n.d.).

Second, in the 2011 survey, France and Germany explicitly mention relying on accounting frameworks and rules to classify NPLs. Italy and the U.S. explicitly mention relying on a supervisory framework, distinct from the accounting framework to determine NPLs. The Netherlands implicitly

mention relying on the relevant accounting framework to determine NPLs and explicitly mention not to use a distinct supervisory framework "like the U.S.". For the U.K. it's unclear.

Thirdly, it's interesting to note that Italy in 2007/2011 seems to have a very strict definition of NPLs (which implies an upwards bias). Italy is the only country to take the customer view regarding multiple loans to a single customer and the only country not to allow immediate reclassification of restructured loans. Furthermore, Italy doesn't take collateral into account, unlike the U.K., U.S. and the Netherlands. This is in line with the findings of Barisitz (2013), who also finds that Italy has an unambiguous upwards bias in an international comparison.

Lastly, regarding the current situation, all EBA member countries seem to have the exact same criteria/definition, as expected. Furthermore, the U.K./U.S. differ from Europe in several aspects. Both allow collateral to classify loans in a better category and both take the product view instead of the customer view regarding multiple loans to a single customer. Also, the U.K. is the only country that allows immediate reclassification of restructured loans. The secondary elements would suggest an ongoing bias of NPLs in the U.K. and U.S. compared to Europe (EBA members).

2.4. Comparison between NPLs and impaired loans

In this section I will describe and detail the differences, similarities and interaction effects between NPLs and impaired loans. An NPL is a regulatory term used in prudential regulatory frameworks. An impaired loan is an accounting term used in accounting frameworks. There is no formal conceptual relation between NPLs and impaired loans. However, in practice the two terms cover much of the same ground, they often refer to the exact same loans. For example, the items that comprise NPL data are often obtained from accounting data and are therefore influenced by the relevant accounting standards. Contrarily, the classification of loans under the accounting framework is often influenced by the relevant regulatory guidance. These two factors together create a complex dynamic that makes it hard to disentangle NPLs from impaired loans and creates another layer of complexity in making cross-country comparisons.

Therefore, in this section I will cover both the accounting standards and regulatory guidelines of the EU & US. Furthermore, section 3.1 will go beyond theoretical concepts and explore some of the practical challenges when selecting NPL data. For example, that section includes a comparison between data from different databases, regulatory filings and annual reports.

2.4.1. Accounting standards

First, in this section the accounting standards used in the EU & US are compared. In Europe a lot of banks are required to report using International Financial Reporting Standards (IFRS) and the accompanying older standards: International Accounting Standards (IAS) issued by the International Accounting Standards Board (IASB). Contrarily, in the U.S. the Financial Accounting Standards Board

(FASB) sets the U.S. GAAP (generally Accepted accounting Principles). These two major accounting frameworks differ in several ways and are not expected to converge in the near term.

In Europe many banks report using IFRS. Previously IAS 39 "*Financial instruments: Recognition and measurement*" was applicable. Currently IFRS 9 "*Financial instruments*" is effective. IAS 39 was used from 2001 till 2017. Annual periods beginning after the 1st of January 2018 use IFRS 9. Therefore, banks had to apply IFRS 9 first in the 2018 annual reports. (IASB, 2014).

Both IAS 39 and IFRS 9 ultimately deal with credit impairment and the collectability of loans. First, IAS 39 made a distinction between impaired and unimpaired loans. Loans were classified as impaired if (IASB, 1998, para. 59): "*There is objective evidence of impairment as a result of one or more events that occurred after the initial recognition of the asset ... and that loss event has an impact on the estimated future cash flows of the financial asset*." Furthermore, several examples of such a loss event are provided: Significant financial difficulty, a breach of contract, forbearance out of necessity and probable bankruptcy. Subsequently the impairment on loans classified as impaired is measured. The impairment is measured as the difference between the book value and the present value of future cash flows. Consequently, the carrying value will be reduced directly or through crediting an allowance account (IASB, 1993, para. 63). So, the impairment of loans under IAS 39 follows an incurred loss approach, because only loans that have already incurred a loss are impaired.

IFRS 9 divides loans into 3 categories: stage 1, stage 2 and stage 3. Impaired loans under IAS 39 are approximately the same as stage 3 loans under IFRS 9. Stage 1 and stage 2 loans approximately correspond to the previously unimpaired loans. Stage 2 loans are loans with increased credit risk. Furthermore, under IFRS 9 provisions are also made for stage 1/stage 2 loans based on respectively the 12-month expected credit loss and the lifetime expected credit loss. So, contrary to IAS 39, IFRS 9 uses an expected credit loss (ECL) model that is more forward looking by also incorporating possible losses on previously unimpaired loans. The impairment is still calculated as the difference between the book value and the present value of future cash flows (IASB, 2014).

In the U.S the FASB sets the U.S. GAAP, practically all the American banks and financial institutions use U.S. GAAP. In 1975 FAS 5 regarding accounting for contingencies, first covered impaired loans. In 1993 FAS 5 was amended by FAS 114 "*accounting by creditors for impairment of a loan*". FAS 114 paragraph 8 (FASB, 1993) states: "*A loan is impaired when, based on current information and events, it is probably that a creditor will be unable to collect all amounts due according to the contractual terms of the loan agreement*." Once again, impairment is measured as the difference between the present value of future cash flows and the book value. Contrary to IFRS, under U.S. GAAP the direct write-off method is not allowed, an allowance account is always used as a contra-asset account to gross loans, this is called the allowance method (FASB, 1993, paras 8, 13).

Effective for fiscal years starting 15-12-2019 accounting standards codification (ASC) 26 supersedes large parts of FAS 114. Under ASC 326 the FAS 114 definition of an impaired loan is removed. Under ASC 326 there is no minimum threshold or event that triggers the impairment of a loan.

Instead, for every loan the current estimate of all expected future credit losses should be incorporated. Therefore, ASC 326 replaces the old incurred loss model and replaces it with a current expected credit loss (CECL) model (FASB, 2016).

In conclusion, both the EU and U.S. have moved from an incurred loss model to an expected credit loss model. Therefore, provisions might be set up even before loss events take place or before it is probable that not all amounts due will be collected. So, from a theoretical perspective there is little difference between the approaches in the EU and the US. However, in practice, there are some important differences in implementation. Furthermore, in Europe the new accounting rules have gone into effect approximately 2 years earlier.

2.4.2. Regulatory frameworks

Second, this section examines the regulatory frameworks that officially define the term NPL. First, the regulatory definition in Europe is described. Second, the regulatory definition in the U.S. is covered.

In Europe the EBA ITS harmonized the NPL definitions in 2015, as covered before in section 2.2. This binding definition classifies loans as nonperforming if: (a) material exposures are more than 90 days past due, or (b) the borrower is unlikely to pay back. Besides all impaired loans as classified under accounting frameworks and all loans classified as default under the CRR are also considered nonperforming. Furthermore, all secondary elements are covered in a relatively strict way. That means, the gross amount is recorded as nonperforming, restructured loans are mostly classified nonperforming, collateral is disregarded, and if more than 20% of a single customer's loans are classified as nonperforming all loans to this customer will be classified as non-performing (European Commission, 2015). However, it is important to note that the harmonized NPE definition is binding for supervisory reporting, but not for financial reporting. Therefore, it's not guaranteed that the amounts reported for supervisory purposes are also published in public financial reporting, although it is encouraged (ECB, 2017b, para. 5.1). Before the EBA ITS every European regulator used its very own definition. Sometimes based on the accounting framework (Germany), sometimes on a separate definition (Italy). Barisitz has researched this extensively as covered before in the literature review.

For the U.S. it is harder to find an NPL definition, it seems that the US NPL definition is not reported anywhere formally. However, both the St. Louis Fed research department and the New York FED quarterly trend reports mention the same definition in their reports (FRED, 2019; Federal Reserve Bank of New York, 2019). Namely, NPLs consist of (1) loans 90+ days past due or (2) non-accrual loans. Furthermore, the BRS survey gives the same definition, informally in 2001 and 2003 and formally in 2007, 2011 and 2017 (World Bank, n.d.). Besides, the St. Louis Fed mentions that '90+ days and still accruing' equals the regulatory call item RCFD1407. Non-accrual loans match the call item RCFD1403. Those call items are part of a mandatory regulatory call report that U.S. banks must publish. More specifically, most banks must also file a FR-Y9C report. In this report in schedule HC-N banks report

item RCFD1407 and RCFD1403 (FED, 2020). Those reports are publicly accessible on the Federal Financial Institutions Examination Council's (FFIEC) website (FFIEC, 2020).

In conclusion, before 2015 the EU had a broad range of diverse NPL definitions. Since 2015 there is one relatively strict definition. The US has a formal definition since at least 2007. All those definitions consist of two parts and secondary elements. First, mostly 90+ days past due or another quantitative measurement of days past due. Second, a more qualitative measurement that means to check if the payment of the contractual payments is under threat. This is called many different names like nonaccrual status or a well-defined weakness. The IMF said about the second criteria (IMF, 2004a, paragraph 4.84): *"... Evidence exists to classify a loan as nonperforming even in the absence of a 90 days past due payment, such as when the debtor files for bankruptcy."* Lastly, secondary elements also differ significantly between the EU & US. So, most variation between NPL definition is naturally caused by the second qualitative part of the definition and by the secondary elements.

2.4.3. Interaction accounting and regulatory frameworks

In theory NPLs and impaired loans could coexist with different definitions used in different contexts. However, the NPE definition by the EBA mentions that all loans classified as impaired under accounting are also nonperforming (ECB, 2017b, para. 5.1). Therefore, the NPL definition is theoretically possibly broader than the impaired loan definition. And in this way the accounting framework would influence the NPL definition.

However, there is also anecdotal evidence that the regulatory NPL definition influences the accounting framework and financial reporting. For example, UniCredit Spa mentions that their stage 3 exposures from IFRS 9 are measured using the NPE definition from the EBA ITS (UniCredit Spa, 2019, p. 300). In that case, the accounting term exactly matches the regulatory term. In the US banks are obligated to file regulatory reports including total loans and leases (1) 90+ days past due still accruing (RCFD1407) and (2) non-accruing (RCFD1403). However, the regulatory definitions are applied when filing regulatory reports and are not necessarily reported in annual reports.

2.5. Measuring NPL definitional biases

There are differences in NPL definitions as shown by the existing research. Furthermore, Barisitz (2013a) has explicitly recommended for further research to attempt a quantitative estimation of national upwards and downwards biases. However, no one has tried to quantify these biases yet, as far as I'm aware. In this thesis I will try to estimate cross-country biases in NPL data caused by differing NPL definitions. To do this I have come up with an intuitive ratio of gross charge-offs divided by lagged NPLs. The gross charge-offs are the amount banks write-off on their loans. Net charge-offs are the gross charge-offs minus recoveries, the amounts previously written off recovered. The ratio off gross charge-offs to lagged NPLs could measure the percentage of NPLs in a certain year, that convert into gross

charge-offs (GCO) the following year. Therefore, I will refer to this ratio as the conversion ratio, as shown in (1).

$$conversion\ ratio_t = \frac{GCO_t}{NPL_{t-1}} \quad (1)$$

The lower limit is 0, this will be the case if a bank has no charge-offs in a particular year. The upper limit is theoretically infinite, since NPLs can become very small and GCOs could be as large as the banks entire loan portfolio. However, in practice a ratio of 1.0 would be high and I would assume the conversion ratio won't be larger than 2.0 for prolonged periods of time.

The conversion ratio tries to estimate the percentage of NPLs that convert into gross charge-offs in the following year. Therefore, if a country has an internationally downwards biased NPL definition the conversion ratio is expected to be comparatively higher. Vice versa, if a country has an internationally upwards biased NPL definition the conversion ratio is expected to be comparatively lower.

There are several implicit assumptions that must hold true for the conversion ratio to measure the extent of definitional biases in NPL data accurately. First, there are different write off practices across banks and countries (ECB, 2017b). However, I assume that loans are written off when the prospects of recovery are very slim and that this criterion is uniformly used across countries. Furthermore, I assume that this criterion has less room for discretion than the criteria used to define NPLs across countries.

Secondly, there are multiple variables that influence the gross charge-offs. However, this ratio assumes that NPLs are the biggest driver and will capture most of the variation. Thirdly, the amount of NPLs and subsequently gross charge-offs in countries differ. Nevertheless, the ratio already adjusts for these variations and can therefore capture the differences in definitions.

In conclusion, the conversion ratio is a crude measure with two big assumptions. Despite that, it could be useful to measure and identify possible biases in NPL data due to definitional differences.

2.6. Summary and expectations

The theoretical comparison of NPLs and impaired loans shows that in the U.S. both the regulatory data and accounting data is published and publicly available. In addition, the definition of impaired loans seems theoretically similar to the definition of NPLs. Therefore, I expect that in the U.S. NPLs are equal to impaired loans. Also, I expect that both NPLs and impaired loans consist of loans (1) + 90 days past due, and (2) on nonaccrual status.

Furthermore, Barisitz (2013b) concludes that Italy has an unambiguous internationally upwards biased NPL definition, driven by their classification of loans in temporary difficulties as non-

performing. He also concludes that the U.K. has an unambiguous internationally downwards biased NPL definition, driven by the lenient approach to restructuring and customers with multiple loans. Moreover, comparing the BRS survey and the EBA ITS suggests that this bias persists after 2015. Also, it suggests that the U.S. has an internationally downwards biased NPL definition, driven by their lenient treatment of collateral and their lenient treatment of customers with multiple loans. Based on all the above, it is expected that the U.K. and U.S. have a higher conversion ratio than Italy for the entire timespan. In addition, the EBA ITS is relatively strict in defining NPLs compared to the U.K. and U.S. Therefore, it is expected that France and Germany have a lower conversion ratio than the U.K. and U.S. after 2014.

3. Empirical analysis

This section of the thesis presents the findings from empirically analysing the data. First, section 3.1 compares NPLs and impaired loans empirically building on the theoretical comparison from section 2.4. Second, section 3.2 describes how the sample is selected that is used for the main analysis. Third, Section 3.3 provides descriptive statistics of the selected sample. Fourth, Section 3.4 gives an overview of the NPL ratios in France, Germany, Italy, the U.K. and U.S. Fifth, Section 3.5 presents detailed tables and figures of the mean and median of the conversion ratio in the above mentioned 5 selected countries over time. Lastly, Section 3.6 summarizes the entire section and draws conclusions based on the findings.

3.1. Empirical comparison of NPLs and impaired loans

Many researchers are using an NPL variable in their models, such as in LLP timeliness models. However, the exact data that compromises this NPL variable differs. For example, Bushman & Williams (2012) report they use bank financial statement data from Bankscope, covering an international sample from 1995 to 2006. Contrarily, Beatty & Liao (2011) report using the COMPUSTAT item '*npatq*' (nonperforming assets – total, quarterly) in a model that spans from the 3rd quarter of 1993 to the 2nd quarter of 2009 for U.S. banks. Both these databases use bank financial statement data. As covered in section 2.4, NPL data is in theory not covered by annual reports and therefore by databases containing annual report data. Financial statements are comprised of accounting data and would therefore contain items like impaired loans. Furthermore, while searching for NPL data for this thesis I struggled to find 'true' NPL data. In other words, find an NPL item in the available databases that was different from impaired loans. Therefore, this section is meant as an explorative study comparing different items in a few databases relating to NPL data. In particular to empirically differentiate between NPL data and impaired loan data, however, the comparison is not comprehensive.

For this comparative study I use data from five different sources. First, a dataset from Orbis Bank Focus spanning from 2012 to 2019 and a legacy download from its predecessor BankScope

spanning from 1985 to 2012. Second, the WRDS bank regulatory database. Third, Compustat Capital IQ fundamentals quarterly/yearly. Fourth, annual reports, and lastly, the FRY-9C reports from the FFIEC website. The data from Orbis and Compustat contains annual report data and the data from the WRDS bank regulatory database should contain the data from the FRY-9C regulatory filings. I used the annual reports and regulatory filings to double check my findings and to see which exact item was being reported in the database. I also use the dataset from Orbis Bank Focus and the legacy dataset from BankScope for my main analyses in the next sections, more information about my sample selection can be found in section 3.2, for the purpose of the analysis in this section I don't drop any observations after the initial download.

In table 1 on page 18, I have provided a selected overview of all the variables from the different data sources relating to NPLs. In addition, in table A1 in appendix A is a more extensive version of table 1. This includes the variable name, label as provided initially and the source or name of the dataset. Also, the number of non-missing observations for each variable is reported as a percentage of the total dataset. Table 1 shows that Orbis Bank Focus has at least 4 variables that might include NPL data, however, it is ambiguous as the description provided by Orbis says: "Impaired/Non-Performing loans". Furthermore, the legacy dataset only includes 3 variables that should include impaired loan data and in 1 case it is again named "Impaired loans(/NPLS)/Gross Loans".

Table 2 on page 19 provides a comparison of the main NPL related variables from Orbis Bank Focus between 2012 and 2019. The similarity between the descriptive statistics of the four variables shows that for most banks the values of these variables are equal. Annual reports show that 'timpnpa' usually contains some extra minor items compared to total impaired loans. Furthermore, impaired loans seem to be slightly different, but the variable 'difference' highlights that this is only the case for a small percentage of observations.

Table 3 on page 19 compares a variable from Orbis that directly reports the NPL ratio to the '*impnpl*' variable divided by gross loans in percentages. The table shows that the NPL ratio variable is often just the same as the impaired loan ratio (benchmark). For some banks the NPL ratio variable from Orbis differs from the impaired loan ratio, I haven't been able to determine what number is reported in those cases.

Banks that report using IFRS are required to use IFRS 9 since 2018. Therefore, instead of reporting impaired loans they now (also) report stage 3 loans. Table 4 on page 19 shows that if both variables are present, they are very identical. Almost always is the exact same value reported, as shown by the matching values for all percentiles except for the 25^{th} percentile.

In addition, table 5 on page 19 shows that from 2012 to 2019 in the US impaired loans were equal to nonaccrual loans plus 90+ days past due still accruing loans. NPLs in the U.S. are defined as nonaccrual loans plus loans 90 plus days past due and still accruing. Therefore, for the U.S. both theory and practice suggest that impaired loans are equal to NPLs. This is line with the expectation that in the

U.S. NPLs equal impaired loans. Table 5 confirms that this is the case from 2012 onwards, by showing that the difference between the terms is 0 in the U.S. from 2012 onwards.

Table 1

Selected variables from 4 databases related to NPLs

Variable name	Label	Observations	Source
impnpl	Impaired / Non Performing Loans	59%	Orbis Bank Focus
timpnpl	Total impaired / Non-performing loans	35%	Orbis Bank Focus
timpnpa	Total impaired / Non-performing assets	30%	Orbis Bank Focus
imploans	Impaired loans (as reported)	49%	Orbis Bank Focus
NPLratio	NPL ratio (as reported) %	3%	Orbis Bank Focus
Nonaccrualloans	Non-accrual loans	23%	Orbis Bank Focus
P90DPD	+ 90 days past due	37%	Orbis Bank Focus
stage1customers	Gross loans & advances to customers - Stage 1	1%	Orbis Bank Focus
stage2customers	Gross loans & advances to customers - Stage 2	1%	Orbis Bank Focus
stage3customers	Gross loans & advances to customers - Stage 3	1%	Orbis Bank Focus
pastduenotimp	Past due but not impaired	31%	Orbis Bank Focus
restructuredloans	Rescheduled/restructured loans	29%	Orbis Bank Focus
data2170	Impaired loans (memo)	63%	Legacy Bankscope
data11110	Memo: Impaired Loans included above	63%	Legacy Bankscope
data18200	Impaired Loans(NPLs)/ Gross Loans	62%	Legacy Bankscope
data30250	Nonaccrual Loans	42%	Legacy Bankscope
data30240	+90 Days past due	41%	Legacy Bankscope
RCFD1403	TOTAL LOANS AND LEASE FINANCE RECEIVABLES: NONACCRUAL	n.a.	WRDS Bank Regulatory
RCFD1407	TOTAL LOANS AND LEASE FINANCING RECEIVABLES: PAST DUE 90 DAYS OR MORE AND STILL ACCRUING	n.a.	WRDS Bank Regulatory
npatq	Nonperforming Assets - Total, quarterly	n.a.	Compustat Capital IQ

Note: Variable name is the name of the variable when I first acquired the dataset, label is the label provided by the source without altering it, observations is the percentage of observations that include the specific variable divided by the percentage of observations that have a non-missing value for total assets and source is the relevant source of the data. N.a. means not applicable.

Table 2

Comparison of the main NPL related variables from Orbis Bank Focus from 2012 to 2019

	Mean	Median	p1	p25	p75	p99	N
impnpl	345,198	12,668	163	4,576	43,531	6,697,274	14,756
timpnpl	333,886	12,668	164	4,576	43,467	6,735,694	14,756
timpnpa	339,438	12,811	173	4,665	43,963	6,749,587	14,756
imploans	338,688	12,634	162	4,539	43,374	6,735,694	14,756
difference	6,510	0	-4	0	0	5	14,756

Note: An empirical comparison of the main NPL and impaired loans variables in Orbis Bank focus from 2012 to 2019 as described in table 1. Only observations that were neither missing nor zero for all variables, excluding difference are included. All amounts are in thousands of US dollars. P1 through p99 indicate the values of these variables at the respective different percentiles. N is the number of observations included. The variable *difference* indicates the difference between *'impnpl'* and *'imploans'*.

Table 3

Comparison of the NPL ratio reported in Orbis Bank Focus to a benchmark from 2012 to 2019

	Mean	Median	p1	p25	p75	p99	N
NPLratio	5.53%	2.90%	0.07%	1.55%	6.14%	40.00%	1,528
Benchmark	5.57%	3.07%	0.06%	1.66%	6.25%	47.30%	1,528

Note: An empirical comparison of the variable *'NPLratio'* directly from Orbis compared to a benchmark variable, both from Orbis Bank Focus from 2012 to 2019. Benchmark is the *'impnpl'* variable divided by gross loans in percentages. Only observations that were neither missing nor zero for all variables. All amounts are in thousands of US dollars. P1 through p99 indicate the values of these variables at the respective different percentiles. N is the number of observations included.

Table 4

Comparison of variable 'impnpl' to variable 'stage3customers' for 2018 and 2019 only

	Mean	Median	p1	p25	p75	p99	N
impnpl	1,394,508	192,846	214	36,754	654,199	26,400,000	705
stage3customers	1,394,662	192,846	214	37,238	654,199	26,400,000	705

Note: An empirical comparison between the variable *'impnpl'* and *'stage3customers'* from Orbis Bank Focus for 2018 and 2019. Only observations that were neither missing nor zero for all variables. All amounts are in thousands of US dollars. P1 through p99 indicate the values of these variables at the respective different percentiles. N is the number of observations included.

Table 5

Comparison of the composition of impaired loans in the US and EU between 2012 and 2019

	Mean	Median	p1	p25	p75	p99	N
Difference US	-41	0	0	0	0	0	7,467
Difference non-US	184,035	15,517	-4,688,864	1,187	53,938	6,703,891	332

Note: An empirical comparison between the composition of impaired loans in the US and outside the US, variables are from Orbis bank focus between 2012 and 2019. *Difference* is the difference between *'impnpl'* and the sum of nonaccrual loans and +90days past due loans. *Difference US* is the difference for banks in the U.S., *difference non-US* is the difference for all banks that are not from the U.S. All amounts are in thousands of US dollars. P1 through p99 indicate the values of these variables at different percentiles. N is the number of observations included.

Table 6 below contains a comparison between the 3 main impaired loan variables from the BankScope legacy dataset. The variable data18200 was "Impaired Loans(NPLs)/ Gross Loans" therefore I have multiplied it again by gross loans and divided by 100 to make it comparable to the other 2 variables. The statistics in table 6 show that those 3 variables contain the same data. The differences in "data18200imp" are because of rounding differences.

Table 6

Comparison of the main NPL related variables from Legacy BankFocus dataset

	Mean	Median	p1	p25	p75	p99	N
data2170	3402	10	1	2	88	29679	146089
data11110	3402	10	1	2	88	29679	146089
data18200imp	3403	10	1	2	88	29705	146089

Note: An empirical comparison of the main NPL/impaired loan variables in the BankScope legacy dataset between 1985 and 2012. All three variables are impaired loans. Only observations for which all three variables have a non-missing value are included. *Data18200* is multiplied by gross loans to translate it to impaired loans again. Variables are in different units and currencies on a bank level. P1 through p99 indicate the values of these variables at different percentiles. N is the number of observations included.

Table 7 below compares the composition of the impaired loans in the US and outside the US. In the first row is the distribution of the variable difference (impaired loans minus 'nonaccrual loans' minus '90days past due still accruing loans'). The first row indicates that impaired loans are not exactly equal to the sum of nonaccrual loans and 90days past due still accruing loans. However, the third row shows that before 2009 impaired loans were equal to nonaccrual loans in the U.S. In addition, the fifth row shows that in 2010 and 2011 impaired loans were empirically equal to nonaccrual loans and restructured loans in the U.S. Therefore, the legacy dataset doesn't empirically confirm the hypothesis that in the U.S. NPLs are equal to impaired loans for the period before 2012. In addition, the second, fourth and sixth row show that outside the U.S. none of these equations seem to be satisfied.

Table 7

Comparison of the composition of impaired loans in and outside the US for 1985-2012

	Mean	Median	p1	p25	p75	p99	N
Difference US	-6	0	-64	0	0	19	136836
Difference non-US	-813	-27	-23752	-161	-5	2724	1217
Difference 2 US	1	0	0	0	0	1	101158
Difference 2 non-US	101	0	-28	0	4	3179	2843
Difference 3 US	-5	0	-1	0	0	1	18155
Difference 3 non-US	-1950	0	-76200	-35	22	5487	333

Note: *Difference* is the sum of impaired loans (*data2170*) minus both nonaccrual loans (*data30250*) and 90+ days past due loans (*data30240*). *Difference 2* is the sum of impaired loans (*data2170*) minus nonaccrual loans (*data30250*) before 2009. Difference 3 is the sum of impaired loans (*data2170*) minus both nonaccrual loans (*data30250*) and restructured loans (*data30260*) in 2010 and 2011. Difference *US* is the difference for banks in the U.S., *difference non-US* is the difference for all banks that are not from the U.S. P1 through p99 indicate the values of these variables at different percentiles. N is the number of observations included.

Besides Orbis I also downloaded a dataset from the WRDS Bank Regulatory database and a dataset from the COMPUSTAT Capital IQ database. First, the WRDS Bank Regulatory database contains regulatory filings such as call reports and FRY-9C reports for banks in the U.S.

I downloaded a dataset from the WRDS bank Regulatory database spanning from 2009 to 2019 and download mainly two variables: *RCFD1403* and *RCFD1407*. *RCFD1403* is 'total nonaccrual loans' and leases and *RCFD1407* is the 'total loans and leases 90 days past due and still accruing'. As a first check, I also download two call reports directly from the website of the FFIEC (FFIEC, 2020) for "Wells Fargo Bank National Association" (at 31/12/2018) as well as "JPMorgan Chase Bank National association" (at 31/12/2017). The items from the database exactly matched the items from the call reports, as expected, since the call reports are the source of the database. Furthermore, they also matched with the Orbis Bank Focus items 'non-accrual loans' and '+ 90 days past due'. Therefore, it looks like the Orbis item '+ 90 days past due' is actually '+ 90 days past due and still accruing', at least for U.S. banks. In addition, it seems that for US banks impaired loans are equal to NPLs both in theory and in practice. Impaired loans are empirically observed to consist of nonaccrual loans and '+ 90 days past due' loans. Simultaneously, it is known that the definition of NPLs in the U.S. is: nonaccrual loans plus '+ 90 days past due still accruing' loans.

Contrarily, for the EU-countries, regulatory filings on the bank level are not publicly published. To my knowledge, central banks in European countries and the ECB/EBA only publish regulatory data on an aggregated level. Therefore, it is not possible to compare the regulatory values to the accounting values empirically.

Lastly, the WRDS Capital IQ database reports an item called '*npatq*' (Nonperforming Assets – Total, quarterly). I compare '*npatq*' values from the Capital IQ database to Orbis and annual reports. For example, for Wells Fargo & Company the 2018 annual report shows on page 85 that 'npatq' matches total nonperforming assets, which consists of total nonaccrual loans and foreclosed assets. However, Orbis generally shows a value that is much closer to total nonaccrual loans (although, not exactly because there have been some restatements that seem not to be incorporated in Orbis). In addition, the 2018 annual report of JPMorgan Chase & Co shows on page 287 that nonperforming assets exactly match '*npatq*' from the Capital IQ database. Also, in the annual report it is stated that nonperforming assets include nonaccrual loans, nonperforming derivatives and assets acquired in foreclosures. Although, the values of nonaccrual loans in Orbis are close to the '*npatq*' values, oddly enough they are sometimes lower.

3.1.1. Conclusion empirical comparison NPLs and impaired loans

There are many variables reported in databases regarding NPLs and impaired loans. However, it seems that all the variables in Orbis Bank Focus and the legacy dataset from BankScope report the value of impaired loans from the accounting framework and not necessarily NPL data.

However, the WRDS Bank Regulatory database reports items from regulatory filings for U.S. banks. Both nonaccrual loans (*RCFD1403*) and loans 90 days past due but still accruing (*RCFD1407*) match with the Orbis items 'non-accrual loans' and '+90 days past due'. In addition, for U.S. banks impaired loans consist of nonaccrual loans and '+90 days past due still accruing' loans. Therefore, in the U.S. impaired loans are both in theory and in practice equal to NPLs. There seems to be no difference between the terms, at least for the period 2012 to 2019. Therefore, mostly confirming the expectation that in the U.S. NPLs are equal to impaired loans. Contrarily, in Europe there is no regulatory data publicly published on the bank level.

Lastly, in COMPUSTAT Capital IQ an item called '*npatq*' (Nonperforming Assets – Total, quarterly) is reported. Nonperforming assets are in theory a superset of nonaccrual loans and should therefore always be equal to or larger than nonaccrual loans. However, the data shows that '*npatq*' is roughly the same as nonaccrual loans, sometimes larger, sometimes smaller.

In conclusion, for the U.S. it seems that NPLs are equal to impaired loans, for the EU, it is unclear. Either way, Orbis only seems to report impaired loans. For the next two sections of this thesis the Orbis item '*impnpl*' will be used as the variable to represent NPLs, even though this section shows that it might be impaired loans for banks outside the U.S.

3.2. Sample selection

The sample consist of three different datasets. First, a legacy download from Bankscope with data from 1985 to 2012 containing 545 variables and 346,580 bank year observations. Second, a download from Orbis Bank Focus for banks with more than 1 billion US dollars in assets in the last available year. The data spans from 2012 to 2019 including all 27 European member states plus all Organisation for Economic Co-operation and Development (OECD) countries. This gives a sample containing 41 countries over 8 years resulting in 57,897 bank year observations. Third, a dataset from the World Bank; 'World Development Indicators' containing year average currency exchange rates from 1989 to 2011 for the Euro/Dollar and the Pound Sterling/US Dollar.

For the first dataset I only keep observations between 1989 and 2011. Furthermore, I drop all bank years that don't compromise a full year (months not equal to 12), all banks don't that use the Euro, Pound Sterling or US Dollar as their reporting currencies, all banks that don't use millions as their reporting unit and all bank-year duplicate observations. In addition, I merge the exchange rates and translate all variables into US dollars, therefore all variables are in millions of US dollars. The second dataset is downloaded in thousands of US dollars, therefore all the variables are divided by a thousand, so they are all in millions of US dollars. Lastly, the two datasets are appended. Banks with less than 750 million US dollars in assets are dropped. In addition, 4 categories of banks are dropped based on their specialization (central banks, specialized governmental credit institutions, clearing institutions & custody and Islamic banks). Furthermore, I only keep observations for banks from France, Germany, Italy, the United Kingdom and the United States. These are the only countries within the scope of this

study with a sizable amount of observations for the conversion ratio (>300), as can be seen in table A2 in appendix A. All variables are winsorized at the 1st and 99th percentile, except for the conversion ratio variable, which is winsorized at the 5th and 95th percentile. In addition, the conversion ratio is only calculated if GCOs are not equal to zero and the NPL ratio is only calculated if NPLs are not equal to zero.

The resulting final sample consists of 89,844 bank year observations from 5 countries spanning 31 years. Besides, 35,739 bank year observations have available data to compute the conversion ratio. The variables I use are: Conversion ratio, NPL ratio, GCO ratio, total assets, ROA and capital ratio. Table A3 in Appendix A describes the components and construction of these variables in detail.

3.3. Descriptive statistics

Table A2, also in Appendix A shows the total number of observations for the conversion ratio per country before and after keeping only the selected 5 countries. This table shows two important things. First, the countries that are selected all have more than 1000 available observations for the conversion ratio. It is very fortunate that those countries that are expected to have the largest biases in NPL definitions according to Barisitz (2013b), namely Italy and the U.K., also have a sizable number of observations. Second, the U.S. has by far the most observations, 77% of the selected sample's available observations.

Table 8 on page 24 shows the descriptive statistics. In panel A are the descriptive statistics concerning the entire dataset and in panel B are the descriptive statistics for observations with a non-missing conversion ratio. The conversion ratio shows the exact same statistics in both panels, since panel B shows descriptive statistics for the other variables when the conversion ratio is not missing. The mean of the conversion ratio is 0.537 while the median is 0.281, this indicates that the distribution of the conversion ratio is skewed to the right. Further, in panel A, the NPL ratio has a mean of 2.8% and a median of 1.3%. The GCO ratio has a mean of 0.7% and a median of 0.3%. So, both those variables also have a right-tailed distribution. Further, the minimum value of total assets is 770 million US dollars, this is because I filtered on a minimum of 750 million US dollars. The mean and median of return on Assets is just under 1%. The capital ratio has a mean of 9.2% and a median of 7.8%.

Panel B shows that the descriptive statistics for observations with a non-missing conversion ratio are mostly like the descriptive statistics of the entire sample. It also shows that banks with a non-missing conversion ratio have in general a higher mean and median of total assets. This makes sense since not all banks report GCO and NPL, especially not smaller banks as measured by total assets.

Table 8

Descriptive statistics for the entire dataset (panel A) and part of the dataset (panel B)

Panel A: Descriptive statistics entire dataset

	Mean	Median	Min	Max	StdDev	N
Conversion ratio	0.537	0.281	0.005	2.500	0.662	35739
NPL ratio	0.028	0.013	0.000	0.228	0.039	44063
GCO ratio	0.007	0.003	0.000	0.065	0.011	40418
Total assets	23568	2429	770	642191	83815	88215
ROA	0.007	0.006	-0.032	0.078	0.012	70023
Capital ratio	0.092	0.078	0.008	0.697	0.087	72675

Panel B: Descriptive statistics for observations with the conversion ratio available

	Mean	Median	Min	Max	StdDev	N
Conversion ratio	0.537	0.281	0.005	2.500	0.662	35739
NPL ratio	0.026	0.012	0.000	0.228	0.038	35428
GCO ratio	0.006	0.003	0.000	0.065	0.010	35739
Total assets	25009	2462	770	642191	89679	35739
ROA	0.008	0.007	-0.032	0.078	0.010	35727
Capital ratio	0.090	0.085	0.008	0.697	0.045	34562

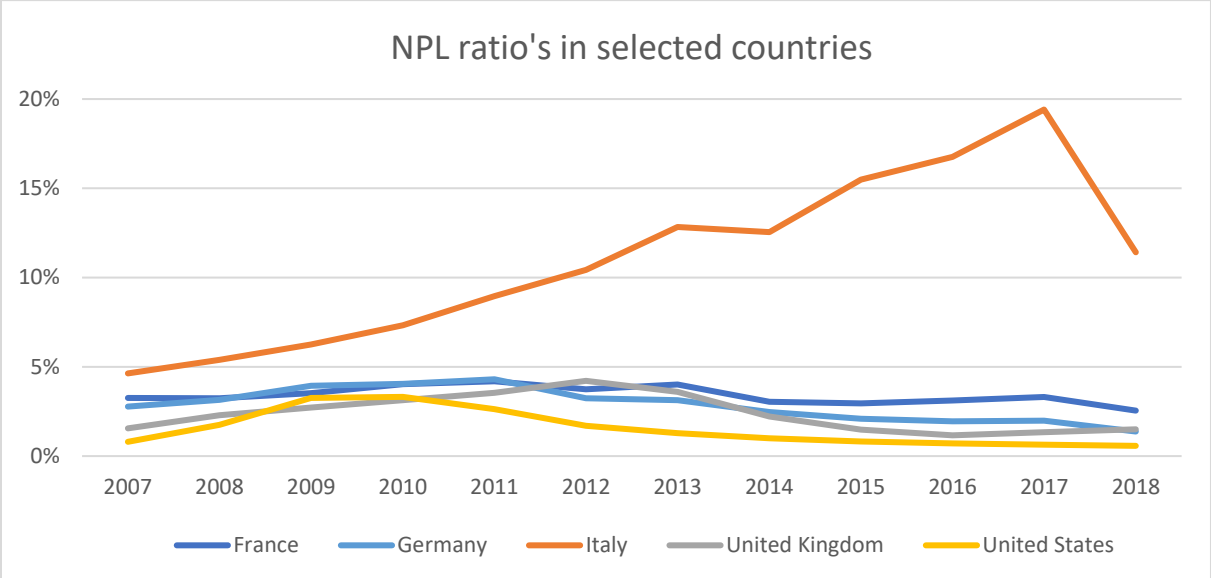
Note: Descriptive statistics for the entire dataset in panel A and for observations with a non-missing *conversion ratio* in panel B. *Conversion ratio* is GCO divided by lagged NPLs, excluding observations if GCO=0, *NPL ratio* is NPL scaled to lagged gross loans, excluding observations if NPL=0, *GCO ratio* is GCO scaled to lagged gross loans, *total assets* is in millions of US dollars, *ROA* is net income scaled to lagged total assets and capital ratio is equity scaled to lagged total assets. *Conversion ratio* is winsorized at the 5th and 95th percentile, all the other variables are winsorized at the 1st and 99th percentile. In the columns for each of these variables is given mean, median, minimum value, maximum value, standard deviation and the number of observations.

3.4. NPL ratios

Figure 1, on the following page, shows the median of the NPL ratios for banks in France, Germany, Italy, the U.K. and the U.S. from 2007-2018. First, banks in Italy have the highest NPL ratios in every single year, from around 5% in 2007 up to almost 20% in 2017 and back to around 11% in 2018. Second, all other four countries have a median NPL ratio below 5% every year. Lastly, the U.S. has the lowest NPL ratio since 2011 and has been under 1% since 2014. All the data concerning NPL ratios from 1990 to 2019 is from table A4 in appendix A. However, only from 2007 to 2018 do all countries have more than 25 observations each year, therefore, figure 1 only shows the median NPL ratios from 2007 to 2018.

Figure 1

Median NPL ratio from 2007 to 2018 for France, Germany, Italy, U.K. and U.S.



3.5. Conversion ratio

Table 9 below shows descriptive statistics for the conversion ratio in France, Germany, Italy, the U.K. and the U.S. Panel A reports these statistics for the full sample, all years. Panel B only includes years between 1990 and 2014 and panel C includes years from 2015 onwards. So, table C shows the conversion ratio after the implementation of the EBA ITS.

Table 9

Conversion ratio descriptive statistics by country in 3 time periods

Panel A: All years

	Mean	Median	StdDev	Min	Max	N
France	0.109	0.057	0.231	0.005	2.500	1306
Germany	0.024	0.007	0.092	0.005	2.500	3292
Italy	0.115	0.043	0.258	0.005	2.500	2505
United Kingdom	0.410	0.228	0.546	0.005	2.500	1192
United States	0.663	0.400	0.689	0.005	2.500	27444
Total	0.537	0.281	0.662	0.005	2.500	35739

Panel B: 1990-2014

	Mean	Median	StdDev	Min	Max	N
France	0.108	0.063	0.175	0.005	2.496	592
Germany	0.028	0.007	0.074	0.005	0.830	824
Italy	0.144	0.056	0.298	0.005	2.500	1781
United Kingdom	0.444	0.246	0.564	0.005	2.500	888
United States	0.741	0.500	0.704	0.005	2.500	20807
Total	0.649	0.389	0.692	0.005	2.500	24892

Panel C: 2015-2019

	Mean	Median	StdDev	Min	Max	N
France	0.110	0.053	0.269	0.005	2.500	714
Germany	0.022	0.007	0.097	0.005	2.500	2468
Italy	0.045	0.023	0.070	0.005	0.829	724
United Kingdom	0.312	0.178	0.476	0.005	2.500	304
United States	0.416	0.216	0.575	0.005	2.500	6637
Total	0.279	0.099	0.498	0.005	2.500	10847

Note: Descriptive statistics concerning the conversion ratio in all 5 selected countries. Panel A contains all years from 1990-2019. Panel B contains years from 1990-2014. Panel C contains years from 2015-2019. The *conversion ratio* is GCOs divided by lagged NPLs, excluding observations if GCO=0, winsorized at p5, p95. Mean is the mean of the *conversion ratio* in each country over the relevant timespan, median is the median observation, StdDev is standard deviation, min is the minimum value, Max is the maximum value and N is the number of observations. Total shows statistics for all countries combined.

Panel A shows that the U.S. has the highest mean conversion ratio of 0.66. Besides, the U.K. has the second highest conversion ratio with 0.41. France and Italy have considerably lower conversion ratios with a mean of around 0.11 and 0.12 respectively. Germany has the lowest conversion ratio with 0.02. This indicates that in the U.S. and U.K. more NPLs convert into charge-offs in the following year/years compared to France, Germany and Italy. Furthermore, the minimum and maximum observations are equal for all countries, this is because I winsorized the conversion ratio at the 5^{th} and 95^{th} percentile.

Comparing panel B and panel C shows that the conversion ratio in Italy, the U.K. and the U.S. is lower recently than it was from 1990-2014. In addition, the conversion ratio in Germany seems to stay around 2% to 3%.

Lastly, observing all 3 panels shows that the mean is always higher than the median, often it is double the median. This show that the distribution of the conversion ratio is skewed to the right and the mean is influenced by outliers. Furthermore, since the conversion ratio is winsorized at the 5^{th} and 95^{th} percentile, the effect of outliers is already weakened.

The conversion ratio has changed a lot over time, table A5 in appendix A shows the mean and median of the conversion ratio from 1990-2019 for all five countries. Table A6 in appendix A shows the number of observations for the conversion ratio from 1990-2019 for each country per year. Table A6 shows that many years have no or few observations, particularly in the first 15 years. Therefore, figure 2 shows the mean of the conversion ratio over time for Italy, the U.K. and the U.S., since 2002 when each country has more than 30 observations each year (except the U.K. in 2005/2006). In addition, figure 3 shows the mean of the conversion ratio over time for all five countries from 2012 to 2018, when all countries have more than 30 observations each year.

First, figure 2 and figure 3 show that the U.S. has the highest conversion ratio from 2002 to 2018, fluctuating around 1.0 from 2002 to 2009 and thereafter declining to around 0.35 from 2012 onwards. The U.K. has the second highest conversion ratio every year from 2002 to 2018, except for 2003. The U.K.'s conversion ratio fluctuates mostly around 0.35. Italy has a lower conversion ratio than

both the U.K. and the U.S. at around 0.05. In addition, figure 3 shows that from 2013 onwards Germany's conversion ratio stays below 0.05 and is therefore the lowest of all five countries. Moreover, France has a conversion ratio of about 0.1 from 2012 to 2018. Overall, these findings are in line with the expectations. The U.K. and U.S. have mostly a higher conversion ratio than Italy, especially from 2006 to 2014. In addition, the U.K. and U.S. have higher conversion ratios after 2014, as expected.

Figure 2

Conversion ratio means in Italy, United Kingdom and United States from 2002 to 2018

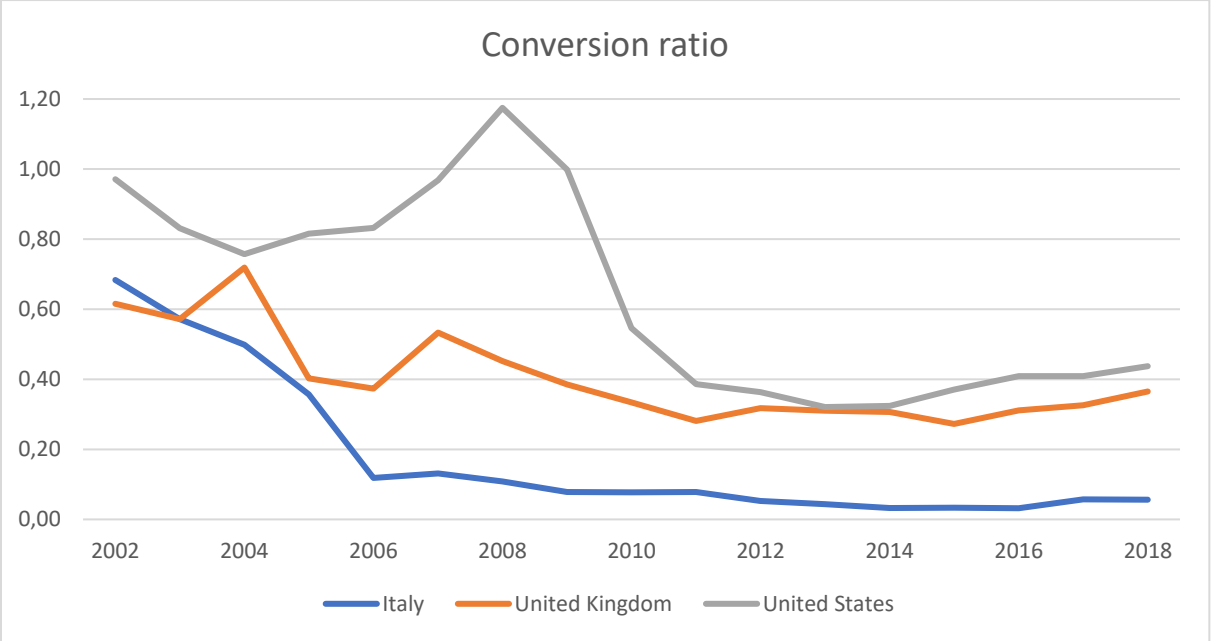
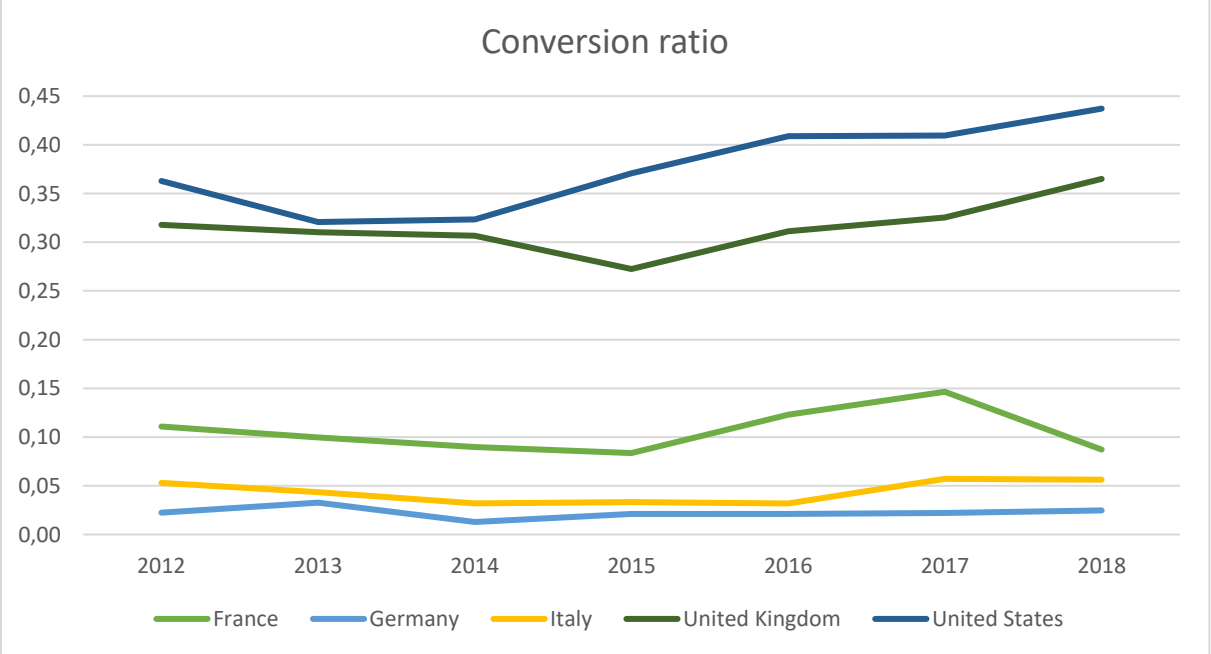


Figure 3

Conversion ratio means in France, Germany, Italy, U.K. and U.S. from 2012 to 2018



3.6. Conclusion empirical analysis

In conclusion, the existing literature and the BRS survey suggest that both the U.K. and the U.S. have downwards biased NPL data in an international comparison. In addition, Italy is suggested to have an upwards bias of the NPL data in an international setting. Lastly, France and Germany are also expected to have a downwards bias when compared to the U.K. and the U.S. since the implementation of the EBA ITS (2014). Therefore, I expected the conversion ratio to be highest for the U.K. and U.S. and lowest for Italy over the entire timespan.

Figure 2, figure 3 and table A5 in appendix A show that the conversion ratio for Italy is mostly lower than for the U.K. before 2014, but not always. Furthermore, the data show that the conversion ratio for Italy is lower than for the U.S. over the entire timespan and lower than for the U.K. after 2014. These findings mostly confirm the expectations based on the existing literature. Finally, France and Germany have a lower conversion ratio than the U.S. and U.K. from 2012 onwards, as seen in figure 3, this is exactly as expected.

Overall, the findings are in line with the expectations based on the existing literature. Countries with an internationally downwards biased NPL ratio such as the U.K. have a higher conversion ratio (more NPLs convert into write-offs). And conversely, Italy, with an internationally upwards biased NPL ratio has a lower conversion ratio (less NPLs convert into write-offs).

4. LLP timeliness models

In this section of the thesis I will use the results from the previous sections to replicate the cross-country LLP timeliness model from Bushman & Williams (2012) with adjusted NPL data. First using the original years and countries used by Bushman & Williams. Second, using data from France, Germany, Italy, U.K. and U.S. for 2012 to 2018. The adjustments depend on the findings from the previous section.

First, section 4.1 details how LLP are accounted for and how the LLP influences earnings and therefore equity. Second, section 4.2 briefly summarizes the existing LLP literature and LLP timeliness literature. Third, section 4.3 describes how biased NPL data could influence LLP timeliness models and describes the expected outcomes of using adjusted NPL data to replicate Bushman & Williams' (2012) LLP timeliness model. Fourth, section 4.4 details the methodology used by Bushman & Williams to estimate smoothing and LLP timeliness using (2). Fifth, section 4.5 details the data that was used to estimate the model in the sample selection. Sixth, section 4.6 describes the results. Lastly, section 4.7 summarizes this section and the findings from this section.

4.1. Loan loss provision accounting

The LLP is a provision set up to cover future credit losses, part of the equity is already set aside to reflect the effect of future uncollectable loans. The LLP is an expense item on the income statement that therefore reduces earnings. The accumulated flow of LLPs is reflected in the stock variable loan loss reserve (LLR), also called allowance for loan and lease losses (ALLL). The LLR is a balance sheet item that is deducted from gross loans to get loans net of allowance, it is a contra asset account. In addition, the LLR decreases if loans are written off, therefore the GCOs and LLPs are the flow variables that influence the stock variable LLR. When a loan is deemed impaired, an expense is debited, and an allowance is credited, equity and assets decrease. When the loan is written off, the allowance is debited, and the gross loan is credited. At this time, nothing happens to equity if the loan was fully provisioned.

4.2. LLP timeliness literature review

LLPs are often a bank's largest accrual, in addition, LLPs are to a large extend discretionary. There is therefore an extensive stream of literature covering LLPs. A large literature investigates income smoothing through the LLP. Since LLPs lower net income, provisions can be increased during times of higher net income to smooth earnings and decreased during times of lower net income to smooth earnings. In the literature this hypothesis is usually tested by checking the coefficient of earnings before LLP (EBLLP) on the dependent variable LLP. Previous empirical research has often found a positive relation between EBLLP and LLP, therefore indicating income smoothing through the LLP (Ma, 1988; Wahlen, 1994; Fonseca & Gonzalez, 2008; Bushman & Williams, 2012). However, some studies do not confirm this and instead report not finding any proof of income smoothing (Ahmed et al., 1999).

A second stream of literature investigates the timeliness of LLPs. For example, Laeven & Majnoni (2003) find a negative relation between LLPs and GDP (gross domestic product) . This would suggest that banks create higher provisions in macro economically less favourable times and lower provisions in economically more favourable times. Therefore, LLPs could increase the procyclicality of the economy. In addition, in response to the great financial crisis the FASB and IASB have issued new accounting standards. These accounting standards (ASC 326/IFRS 9) take a more forward-looking approach regarding LLPs as opposed to the old backward-looking approach. This has only increased the interest in LLP timeliness models. For example, Kim et al. (2019) find that IFRS 9 increases timeliness using an international cross-country sample. Furthermore, Huizinga & Laeven (2019) find that there is a negative association between LLPs and GDP growth and that this association is more pronounced in the Euro area as compared to other economies like the U.S. This suggests a possibly greater procyclicality caused by LLPs in the Euro area.

Thirdly, some researchers have used future period NPLs to measure the timeliness of provisioning. Possibly the first, Nichols et al. (2009) compared private and public banks in the U.S. between 1990 and 2003. They found that the coefficient of future period NPLs on current period LLPs

was positive for both private and public banks, but larger for public banks. Furthermore, Bushman & Williams (2012) used the model shown in (2) to estimate both smoothing and timeliness across 27 countries from 1995 to 2006. They find that the coefficient of both $Ebllp_{itj}$ and ΔNPL_{it+1j} are positive. They also find that there is a lot a variation between countries in LLP timeliness.

$$LLP_{itj} = \gamma_0 + \gamma_1 Ebllp_{itj} + \gamma_2 \Delta NPL_{it+1j} + \gamma_3 \Delta NPL_{itj} + \gamma_4 \Delta NPL_{it-1j} + \gamma_5 \Delta NPL_{it-2j} + \gamma_6 CAP_{it-1j} + \gamma_7 Size_{it-1j} + \gamma_8 \%\Delta GDP_{tj} + \varepsilon_{itj} \quad (2)$$

In their model LLP_{itj} and $Ebllp_{itj}$ are deflated by gross loans and ΔNPL is deflated by total assets. For NPLs they use the year-on-year change. Furthermore, they measure CAP_{it-1j} (capital) by dividing beginning of the period equity by assets, size is natural logarithm of total assets. Lastly, they include the percentage change in GDP per capita as a control variable. All variables are measured for bank i, in year t, in country j. In addition, Akins et al. (2017) measure timely loss recognition by dividing current loan loss reserves by next year's NPLs. They estimate county level LLR timeliness by taking the average of this measure of all banks in a country. They find that their LLR timeliness measure differs substantially across countries, the U.K. and U.S. are among their timeliest countries.

4.3. Link and expectations

So, the previous section shows that the existing LLP (timeliness) literature frequently uses NPL data to estimate regression coefficients. Section 2 and section 3 show that NPL definitions vary from country to country. Therefore, LLP timeliness models using cross-country data seem to be biased. Theoretically it seems that it's not possible to accurately measure and compare country level LLP timeliness. Section 4.6 will replicate the Bushman & Williams (2012) model to see how sensitive the country level LLP timeliness measure is to changes in NPL data; the adjustments are made to correct for the assumed biases.

Let's assume that all banks in all countries use the same methods to establish their LLPs based on the same variables. However, because of the different NPL definitions, NPLs do differ. Banks in countries with a downwardly biased definition (U.K./U.S.) of NPL data will have lower amount of NPLs relative to the LLPs and vice versa for countries with an upwardly biased definition. Therefore, it might seem that countries are timely, merely because the stock of NPLs in the following year is lower compared to current LLPs. This is certainly true for Akins et al.'s (2017) measure for country level timeliness, dividing the current LLR by next period's NPLs. In this case the denominator is directly biased and therefore a downwardly biased country seems timelier. However, I assume that this will also be the case for the measure used by Bushman & Williams (2012).

Besides, for the replication of table 1 and 2a from Bushman & Williams (2012) using the original years and countries it is expected that all means, and coefficients are relatively the same. That is, the data shows evidence for smoothing and a positive coefficient for all 4 NPL variables. However, using adjusted NPL data, I expect that countries with a downwards bias seem less timely after adjusting the data and vice versa. In addition, the exact same analysis is performed on the more recent dataset from 2012 to 2018 including France, Germany, Italy, the U.K. and U.S. In this setting I expect the same results as for the previous, original setting. In other words, smoothing and NPL have positive coefficients and downwardly biased countries seem timelier before adjusting the data.

4.4. Methodology

First, smoothing and LLP timeliness are estimated for each entire sample using the model from Bushman & Williams (2012) as shows in (2). The coefficient of $Ebllp$ on the dependent variable LLP represent income smoothing. The coefficient of ΔNPL_{t+1} on LLP represent timeliness. Second, both smoothing and timeliness are measured at the country level. Third, the country level coefficient of forward-NPL (timeliness) is estimated using adjusted NPL data for selected countries. Since it is hard to pinpoint an exact NPL data adjustment I use a sensitivity table. The table shows how the forward-NPL coefficient responds to a certain percentage points increase(/decrease) in NPL data in each country.

4.5. Sample selection

This section uses the same two datasets as before plus a dataset from the World Bank to merge GDP data. I use a legacy dataset from BankScope to replicate table 1 and 2a. The dataset initially contains 346,580 bank-year observations from 200 countries spanning from 1985 to 2012. For this analysis, only the 27 countries and 12 years that Bushman & Williams (2012) use are kept. Therefore, all other countries are dropped, only years between 1995 and 2006 are kept. Central banks are dropped. Bank-years that don't constitute a full year are dropped (404 observation). Also, some bank-year duplicates are dropped (86). This results in a sample of 157,929 bank-year observations. GDP growth in percentages per capita is added to the dataset using a dataset from the World Bank. Finally, all variables are winsorized at the 1st and 99th percentile.

Second, for the time period 2012-2018 I use a dataset from Orbis Bank Focus. The dataset contains banks from France, Germany, Italy, the U.K. and U.S. between 2012 and 2019 with more than 1 billion US dollars in total assets in the last available year. So, the dataset initially contains 37,710 bank-year observations. First, all observations from 2019 are dropped. Since IFRS 9 was introduced in 2018, the accounting standards concerning provisioning have changed. Therefore, 2018 can only be used for the forward-NPL variable and not for the LLP variable. In addition, central banks and banks-years that don't constitute a full year are dropped. The final sample contains 25,524 bank-year

observations. Lastly, GDP growth in percentages per capita is added to the dataset using a dataset from the World Bank. Finally, all variables are winsorized at the 1st and 99th percentile.

4.6. Results cross-country LLP timeliness

First, the results from the time period 1995 to 2006 for the original Bushman & Williams (2012) replication are shown. Second, the results for the time period 2012 to 2018 using selected countries from the previous section are shown.

Table 10 panel A below shows the descriptive statistics of the first sample. *LLP*, *Ebllp* and *Size* show almost the exact same mean and median as Bushman. *ΔNPL* seems to be slightly smaller in this dataset than in the original dataset. The median for *Capital* is 0.086, which means that banks on average have 8,6% of equity compared to total assets in the beginning of the year. However, in the original Bushman paper this was 14%. Furthermore, the *%ΔGDP* seems to differ slightly. This shouldn't be the case because the GDP data should be the same for both samples.

Panel B shows the results of the OLS regression. The coefficient of *EBLLP* is 0.066, that indicates that banks on average smooth their earnings through LLPs. Close to Bushman & William's 0.0586. In addition, the coefficient of ΔNPL_{t+1} (forward-NPL) is slightly negative and significant at the 10% level only. Originally, they found a coefficient of 0.0393 significant at the 1% level. Furthermore, the coefficient of the NPL variables for the current period and the first lag are very identical. The second lag of NPLs has a coefficient of 0.038, about half of what it originally was. This dataset has 33,241 bank-year observations, originally, they had 55,236. So, the smaller dataset might explain some of the differences. Lastly, this model has an R-squared of 0.096 against 0.3320 originally. This is not in line with the expectation that all means, and coefficients would be approximately the same in this replication.

Table 11 shows the results of the country level estimation of smoothing and forward-NPL. The second column shows that most bank-year observations are from Japan and the U.S. Furthermore, 13 countries have a smoothing coefficient different from 0 at the 10% level. Also, 9 countries have a forward-NPL coefficient different from 0 at the 10% level. Originally this was 22 and 20 respectively. This might be due to the bigger dataset that was originally used. Furthermore, the country level smoothing estimates for Germany, the U.K. and U.S. are similar to their original estimations. However, the country level estimate for forward-NPL in the U.S. changes sign and is statistically significantly different from 0 in both estimates at the 5% level. Again, this could be due to the larger dataset, originally there were 49,414 U.S. bank-year observations and in this dataset, there are only 28,838 bank-year observations. Also, the forward-NPL coefficient for Germany and the U.K. are not statistically significantly different from zero at the 10% level. This is not in line with the expectation that the forward-NPL coefficient would be approximately the same as in the original analysis. However, the results of the smoothing coefficient are in line with the expectations.

Table 10

Replication of Bushman & Williams (2012) using original years and countries

Panel A. Descriptive statistics

	Mean	Median	StdDev
LLP	0.005	0.000	0.012
Ebllp	0.029	0.022	0.043
ΔNPL	0.000	0.000	0.009
Capital	0.118	0.086	0.133
Size	5.895	5.545	2.047
%ΔGDP	2.023	1.981	1.395

Panel B: OLS regression; income smoothing through LLP

	Dependent: LLP
Ebllp	0.066***
	(0.002)
ΔNPL_{t+1}	-0.008*
	(0.005)
ΔNPL_{t}	0.132***
	(0.005)
ΔNPL_{t-1}	0.088***
	(0.005)
ΔNPL_{t-2}	0.038***
	(0.004)
Capital	0.004*
	(0.002)
Size	0.001***
	(0.000)
%ΔGDP	-0.001***
	(0.000)
Observations	33,241
R-squared	0.096

***, **, * represent significance at the 0.01, 0.05 and 0.1 level, respectively

Note: Panel A shows the descriptive statistics for the entire sample spanning from 1995 to 2006 for the 27 countries that Bushman & Williams (2012) included. Panel B shows a fixed effects OLS regressions with *LLP* as the dependent variable and 8 independent variables. Standard errors are reported between brackets. *LLP* is the loan loss provision divided by lagged gross loans. *EBLPP* is earnings before tax and the loan loss provision divided by lagged gross loans. *ΔNPL* is the year on year change in NPLs divided by lagged total assets, this variable is provided for the year t+1 (Forward-NPL), the current year and 2 previous years. *Capital* is equity/total assets at the beginning of the year. *Size* is the natural logarithm of total assets in millions of USD at the beginning of the period. *%ΔGDP* is the percentage change in GDP per capita. All variables are winsorized at the 1st and 99th percentile. Observations is the total number of bank year observatons included, table 11 shows the bank-year observations split up by country.

Table 11

Replication of Bushman and Williams (2012): Country level smoothing and forward-NPL

Country	N	Smoothing	Forward-NPL
Argentina	97	0.078**	- 0.295**
Australia	162	0.140	- 0.906***
Austria	7		
Canada	102	- 0.020	- 0.116
Chile	194	0.098***	0.096
Germany	23	0.054	- 0.013
Hong Kong	15	- 0.112	- 0.946**
India	201	0.218***	- 0.090
Ireland	24	- 0.164	- 0.087
Israel	93	- 0.052	0.049**
Japan	2006	0.128***	- 0.004
Mexico	162	0.071**	0.020
Netherlands	8		
Norway	250	- 0.001	0.029
Pakistan	108	- 0.213***	- 0.21**
Peru	95	0.372***	- 0.045
Philippines	66	0.221**	- 0.207**
Portugal	123	0.09***	- 0.257*
Singapore	49	- 0.671***	- 0.079
South Africa	41	0.080	0.052
Spain	260	0.167***	- 0.002
Switzerland	21	0.069	- 0.069
Thailand	69	0.168**	- 0.171*
Turkey	60	0.099	0.535
U.K.	151	0.010	0.019
U.S.	28838	0.058***	0.011**
Zimbabwe	16		
Total	33241		
Mean		0.037	- 0.112
Median		0.075	- 0.057
StdDev		0.197	0.297

***, **, * represent significance at the 0.01, 0.05 and 0.10 level, respectively

Note: This table shows the coefficients of *Ebllp* (smoothing) and ΔNPL_{t+1} (forward-NPL) on *LLP* at the country level from table 10. In the first column are all the countries included. N shows the number of bank-year observations per country that are used to measure both smoothing and forward-NPL (=timeliness). Smoothing shows the country level coefficient of *Ebllp* on *LLP*. Forward-NPL show the country level coefficient of ΔNPL_{t+1} on *LLP*. A blank cell indicates there were not enough observations for the country to estimate the coefficients. In the first column, total shows the total number of bank-year observations for the entire sample, the same as in the previous table. At the bottom, mean/median/StdDev show the mean, median and standard deviation of the smoothing and timeliness measure for all the countries.

Lastly, table 12 shows the sensitivity of the country level forward-NPL coefficient to adjusted NPL data. Since the previous sections show that the U.K. and U.S. have a downwards bias, the NPL data in both countries are adjusted upwards. The table shows how the forward-NPL coefficient reacts to a 25% to 100% increase in NPL values for each bank. The table shows that by increasing the NPL data by 25% the coefficient of forward-NPL decreases. The coefficient proportionally decreases after every increase in NPL data. Therefore, it seems that by increasing the NPL values, to adjust for the downwards bias in NPL data, banks in the U.K. and U.S. seem less timely. This matches the expectation that countries with downwardly biased NPL data will seem less timely after adjusting for the bias.

Table 12

Sensitivity of the country level Forward-NPL coefficient to adjusted NPL data, 1995 to 2006

	0%	25%	50%	75%	100%	P-value
Forward-NPL UK	0.019	0.015	0.013	0.011	0.009	0.840
Forward-NPL US	0.011	0.009	0.008	0.006	0.006	0.036

Note: This table shows the change in the country level coefficient of Forward-NPL after adjusting the NPL values for banks in each country. Data span from 1995 to 2006. Forward-NPL UK and Forward-NPL US are the coefficients of Forward-NPL for the U.K. and U.S. The first row shows the percentage increase in NPL data. 0% corresponds to no increase, the baseline taken from table 11. Subsequently, 25%,50%, 75% and 100% show the change in the forward-NPL country level coefficient if the NPL data is increased by the respective percentage. P-value refers to the p-value of the country level forward-NPL coefficient, it stays the same after adjustments.

Secondly, table 13, 14 and 15 show the same results for France, Germany, Italy, the U.K. and U.S. between 2012 and 2018. Table 13 panel A shows the descriptive statistics. It shows that the mean and median of all variables except *size* and *%ΔGDP* roughly approximates the descriptive statistics from table 10. *Size* has a mean of 14.912 which means that on average the natural logarithm of banks' total assets in million of US dollars at the beginning of the year is 14.912. Therefore, the average bank in this second sample has 1,549 million of US dollars in assets. The sample selection causes this difference, only banks with more than 1 billion US dollars at the last available year are selected. Also, the percentage change in GDP per capita differs slightly from Bushman & Williams' (2012) original value, this is to be expected since this sample consists of different countries and years. On average, the GDP increased by 1.3% per year per capita. Panel B shows the regression results, the coefficient of *Ebllp* is 0.142. That indicates that higher earnings before provisioning are associated with higher provisions. Therefore, this is evidence that banks use provisions to smooth income. However, the coefficient of ΔNPL_{t+1} on *LLP* is not statically significant from zero. Therefore, it seems that the forward-NPL is not associated with higher or lower provisioning in the entire sample. Furthermore, the coefficients of ΔNPL_t, ΔNPL_{t-1} and ΔNPL_{t-2} are all positive and significant, this indicates that current and past NPLs have a positive relation with current LLPs.

Table 13

Replication of Bushman & Williams (2012), 2012-2018, France, Germany, Italy, U.K., U.S.

Panel A. Descriptive statistics

	Mean	Median	StdDev
LLP	0.004	0.002	0.010
Ebllp	0.025	0.018	0.040
ΔNPL	-0.001	-0.001	0.012
Capital	0.110	0.098	0.081
Size	14.912	14.473	1.569
%ΔGDP	1.326	1.502	0.809

Panel B: OLS regression; income smoothing through LLP

	Dependent: LLP
Ebllp	0.142***
	(0.008)
ΔNPL_{t+1}	-0.001
	(0.007)
ΔNPL_{t}	0.081***
	(0.014)
ΔNPL_{t-1}	0.061***
	(0.017)
ΔNPL_{t-2}	0.029**
	(0.012)
Capital	0.033***
	(0.008)
Size	0.004***
	(0.001)
%ΔGDP	-0.001***
	(0.000)
Observations	4,341
R-squared	0.182

***, **, * represent significance at the 0.01, 0.05 and 0.1 level, respectively

Note: Panel A shows the descriptive statistics for the entire sample spanning from 2012 to 2018 for the 27 countries that Bushman & Williams (2012) included. Panel B shows a fixed effects OLS regressions with *LLP* as the dependent variable and 8 independent variables. Standard errors are reported between brackets. *LLP* is the loan loss provision divided by lagged gross loans. *Ebllp* is earnings before tax and the loan loss provision divided by lagged gross loans. *ΔNPL* is the year on year change in NPLs divided by lagged total assets, this variable is provided for the year t+1 (Forward-NPL), the current year and 2 previous years. *Capital* is equity/total assets at the beginning of the year. *Size* is the natural logarithm of total assets in millions of USD at the beginning of the period. *%ΔGDP* is the percentage change in GDP per capita. All variables are winsorized at the 1st and 99th percentile. Observations is the total number of bank year observations included, table 14 shows the bank-year observations split up by country.

Moreover, table 14 shows the country level coefficients of *Ebllp* and ΔNPL_{t+1} which represent smoothing and timeliness. The second column shows the number of observations for each country. Again, most observations are from the U.S. The third column shows the coefficient representing smoothing and shows that for all countries except the U.K. there is a significant positive relation. This indicates that there is an association between earnings before provisioning and provisions, therefore

indicating that banks smooth net income. This is in line with the expectation that the smoothing coefficients would be positive.

The fourth column shows the coefficient representing timeliness. It shows that for Germany, the U.K. and U.S. there is negative relation between next year's NPLs and current years LLPs. This indicates that banks on average in these countries don't anticipate future worsening of loan portfolios by currently increasing provisions. On the other hand, France shows a positive coefficient significant at the 10% level. So, for 4 out of 5 countries the forward-NPL coefficient is negative, contrary to the expectation.

Table 14

Country level income smoothing and LLP timeliness, 2012-2018, France, Germany, Italy, U.K., U.S.

Country	N	Smoothing	Forward-NPL
France	338	0.035*	0.055*
Germany	787	0.328***	- 0.197***
Italy	347	0.182***	- 0.007
U.K.	116	- 0.188**	- 0.104**
U.S.	2753	0.063*	- 0.147***
Total	4341		
Mean		0.0840	- 0.0800
Median		0.0630	- 0.1044
StdDev		0.1910	0.1028

***, **, * represent significance at the 0.01, 0.05 and 0.10 level, respectively

Note: This table shows the coefficients of *Ebllp* (smoothing) and ΔNPL_{t+1} (forward-NPL) on *LLP* at the country level from table 13. In the first column are all the countries included. N shows the number of bank-year observations per country that are used to measure both smoothing and forward-NPL (=timeliness). Smoothing shows the country level coefficient of *Ebllp* on *LLP*. Forward-NPL show the country level coefficient of ΔNPL_{t+1} on *LLP*. In the first column, total shows the total number of bank-year observations for the entire sample, the same as in the previous table. At the bottom, mean/median/StdDev show the mean, median and standard deviation of the smoothing and timeliness measure for all the countries.

Further, table 15 shows the sensitivity of the coefficient of ΔNPL_{t+1}, representing timeliness, to changes in NPL data. The data are adjusted according to the results of the previous sections. Therefore, the presumable downwards bias for the U.K. and U.S. is addressed by adjusting the NPL data for banks in those countries upwards. Vice versa, the presumable upwards bias for France, Germany and Italy is addressed by adjusting the NPL data for banks in those countries downwards. Panel A shows that adjusting the NPL data upwards for the U.K. and U.S. reduces the coefficient, however, it doesn't change the sign of the coefficient. Therefore, it seems that banks are timelier after adjusting the data upwards to correct for a downwards NPL bias. Conversely, adjusting the NPL data for Germany and Italy downwards only magnifies the negative coefficient. Therefore, it seems that banks are less timely after adjusting the data downwards to adjust for an upwards bias. On the other hand, after adjusting the NPL data downwards for France the forward-NPL coefficient does indeed increase as expected. Therefore, it seems that banks are timelier after adjusting the NPL data downwards to correct for an upwards bias. Expect for France, this is not in line with the expectation that after adjusting NPL data upwards

(/downwards) for downwards(/upwards) biased countries, the forward-NPL country level coefficient seems less(/more) timely.

Table 15

Sensitivity of the country Forward-NPL coefficient to adjusted NPL data, 2012-2018

Panel A: Adjusting NPL data upwards

	0%	25%	50%	75%	100%	P-value
Forward-NPL UK	-0.104	-0.084	-0.070	-0.060	-0.052	0.015
Forward-NPL US	-0.147	-0.118	-0.098	-0.084	-0.074	0.000

Panel B: Adjusting NPL data downwards

	0%	-25%	-50%	-75%	P-value
Forward-NPL France	0.055	0.073	0.110	0.219	0.069
Forward-NPL Germany	-0.197	-0.262	-0.393	-0.786	0.000
Forward-NPL Italy	-0.007	-0.009	-0.013	-0.026	0.747

Note: This table shows the change in the country level coefficient of Forward-NPL after adjusting the NPL values for banks in each country. Data span from 2012 to 2018. Panel A shows the coefficient of forward-NPL in the UK and US after adjusting the NPL data upwards from 25% to 100%. Panel B shows the coefficient of forward-NPL in France, Germany and Italy after adjusting the NPL data downwards 25%, 50% and 75%. The first row shows the percentage increase in NPL data. 0% corresponds to no increase(/decrease), the baseline taken from table 11. Subsequently, 25%,50%, 75% and 100% show the change in the forward-NPL country level coefficient if the NPL data is increased(/decreased) by the respective percentage. P-value refers to the p-value of the country level forward-NPL coefficient, it stays the same after adjustments.

The observed relationship between adjusting NPL data and the forward-NPL coefficient in the LLP timeliness model from Bushman & Williams (2012) is shown in (3). Forward-NPL unadjusted is the coefficient of ΔNPL_{t+1} at the country level before adjusting NPL data. *NPL-multiplier* is the factor that is used to increase/decrease the data, a 25% decrease in NPL data corresponds to a 0.75 *NPL-multiplier*. Therefore, the entire term of *1/NPL-multiplier* will become 1.33. In other words, adjusting the NPL data downwards will magnify the forward-NPL coefficient. *Forward-NPL adjusted* is the coefficient of ΔNPL_{t+1} at the country level after adjusting NPL data. Equation (3) shows that if NPL data are doubled (NPL multiplier = 2.0) the forward-NPL after adjusting equals half the unadjusted forward-NPL. Conversely when decreasing the NPL data by 50% (NPL-multiplier=0.5), the adjusted coefficient will be magnified by a factor 2.

$$\textit{Forward-NPL adjusted} = \frac{\mathbf{1}}{\mathbf{NPL-multiplier}} * \textit{forward-NPL unadjusted} \tag{3}$$

In conclusion, adjusting NPL data upwards reduces the coefficient proportionally regardless of the sign. Adjusting data downwards increases the coefficient proportionally regardless of the sign. Beforehand, I expected countries with downwardly biased NPL data to seem more timelier before

adjusting the data upwards. This is only observed when the sign of the forward-NPL coefficient is positive, otherwise the effect of adjusting NPL data is exactly opposite.

4.7. Conclusion cross-country LLP timeliness model

For both time periods the data shows evidence that banks use provisions to smooth earnings, in line with most of the existing literature. The country level coefficients show that for most countries there is a significant positive relation between earnings before provisions and provisions, therefore indicating income smoothing.

The results of the LLP timeliness measure (forward-NPL) are more mixed. For the original Bushman & Williams setting replication I find a slight negative coefficient for forward-NPL for the overall sample (-0.008, p-value<0.10), while they originally found a significant positive coefficient (0.0393, p-value<0.05). This might be because of the smaller dataset used for this analysis. In addition, I find that Germany, the U.K. and U.S. have a significant negative association between next year's NPLs and current year provisions between 2012 and 2018.

Most importantly, I adjust NPL data to address the presumed definitional biases. This shows that, if the data is adjusted upwards, the coefficient is reduced proportionally, regardless of sign. Conversely, if the data is adjusted downwards, the coefficient is magnified proportionally, regardless of sign. Equation (3) illustrates the observed relation. Therefore, adjusting NPL data upwards for downwardly biased countries does not always translate to a lower forward-NPL coefficient and does therefore not indicate that a country's provisioning is less timely.

In conclusion, biased NPL data significantly influences the LLP timeliness model by Bushman & Williams (2012) shown in (2). Therefore, it is not possible to accurately measure and compare country level LLP timeliness using biased NPL data.

5. Conclusion

In this section the conclusions are discussed. First, the motivation for this research is briefly reiterated, and the resulting main research question is reiterated and answered. Second, the main findings are summarized. In addition, the main findings for each section are summarized in more detail. Fourth, the implications following from the main results are discussed. Finally, section 5.1 discusses the limitations of this research. In addition, section 5.1 discusses some suggestions for future research to improve upon this thesis.

The existing literature shows that there are differences in NPL definitions between countries (Barisitz, 2011, 2013b). Furthermore, these differences seem to considerable influence NPL data and complicate cross-country comparisons. However, the extent to which differing NPL definitions bias NPL data has not been empirically measured. Nevertheless, NPL data are an important asset quality indicator for banks and are widely used. Investors use NPL data to compare the asset quality of banks

and academics use NPL data as input to estimate various models, such as LLP timeliness models. Therefore, this thesis aimed to empirically investigate different NPL definitions and practices across countries. The main research question is:

"*Are the NPL definitional biases empirically observable in France, Germany, Italy, the U.K. and U.S. between 1989 and 2019?"*

This thesis measured the NPL definitional bias by dividing GCOs by lagged NPLs. If this ratio is lower for a certain country, it is assumed that less NPLs are converted into write-offs and therefore the NPL data might be biased upwards. The data predominantly show lower conversion ratios for countries with a theoretically assumed upwards bias and vice versa. In conclusion, it seems that NPL definitional biases are empirically observable in France, Germany, Italy, the U.K. and U.S. Subsequently, biased NPL data significantly biases models that use unadjusted NPL data. Therefore, it is virtually impossible to accurately measure country level LLP timeliness. In addition, this would be true for any cross-country estimation based on unadjusted biased NPL data.

More specifically, section 2 summarized the existing literature and theoretically compared NPLs to impaired loans. First, prior literature shows that before 2014 Italy is expected to have an upwards NPL bias and the U.K. and U.S. are expected to have a downwards NPL bias. Furthermore, after 2014 it is expected that the NPL data of Europe are biased downwards compared to the U.K. and U.S. Second, section 2 shows that the theoretical relation between NPLs and impaired loans is complex and it's hard to disentangle the two concepts.

Further, first section 3.1 explored the difference between NPLs and impaired loans in a practical way. The empirical comparison showed that in the U.S. NPLs equal impaired loans, which both consist of loans on nonaccrual status and loans more than 90 days past due. Contrarily, in Europe regulatory data (NPLs) are only publicly available on an aggregated level, therefore the empirical relation between NPLs and impaired loans in the E.U. remains ambiguous.

In addition, section 3.5 showed that the conversion ratio for Italy is around 50% lower than the conversion ratio for the U.K. and U.S. from 2006 to 2019. Also, the conversion ratio for Italy, France and Germany is around 70% lower than the conversion for the U.K. and U.S. from 2012 to 2019. These results are in line with the expectations based on the existing literature. Also, these results seem to confirm that the NPL definitional biases can be observed using the conversion ratio.

Lastly, section 4 showed that cross-country LLP timeliness models rely on NPL data from different countries to estimate country level provision timeliness. First, this thesis replicated the analysis from Bushman & Williams (2012) using their model shown in (3). In addition, the model was estimated using adjusted NPL data based on the previous findings. Table 12 and table 15 show that the country level timeliness measure can change drastically after adjusting NPL data. This shows that country level timeliness measures are biased and inaccurate when using unadjusted biased NPL data.

This thesis empirically observed theoretically assumed biases in NPL data in 5 major economies. The results underscore the conclusions from Barisitz's theoretical comparisons (2011, 2013b). These results have several important implications. First, going forward, the U.K., U.S. and EU still seem to use different NPL definitions. This is important to consider for researchers, policymakers and investors. Second, historical NPL data seem to be biased even more and the cross-country differences seem to be even more pronounced. This implicates that research using historical cross-country NPL data should consider this and possibly adjust the historical data. This is particularly true when using cross-country NPL data including both Italy and the U.K./U.S.

Furthermore, there are several ways for future researchers to mitigate the bias caused by differing NPL definitions. First, researchers can use logarithmic differences of NPL data, following Beck et al. (2013) and Fraccaroli (2019). Second, researchers can make specific adjustments to the data based on previous research, such as Jakubík & Reininger (2013) did by using Barisitz's (2011, 2013b) work.

5.1. Limitations and recommendations

There are several limitations to the findings in this thesis. Most importantly, the conversion ratio is a crude way to measure NPL definitional biases. First, it assumes loans are uniformly charged-off in different countries. If write-off practices differ significantly across countries, the conversion ratio will be biased. For example, if a loan is classified as non-performing and subsequently written off in the same year, the loan will only show up in the numerator (GCOs) and not in the denominator (lagged NPLs) and therefore seriously bias the estimation of the conversion ratio upwards. Conversely, if a loan is classified as non-performing but charging off is delayed several years, the estimation would be biased downwards. Second, the conversion ratio doesn't consider other variables that influence the ratio of GCOs to NPLs such as the macroeconomic environment. For example, if some countries are in an economic depression, the ratio of charge-offs to NPLs might therefore be bigger.

In addition, this thesis used a limited legacy BankScope dataset containing yearly bank financial statement data for the period 1989 to 2011. For example, to replicate the Bushman & Williams (2012) LLP timeliness model this paper used 33,241 observations as opposed to the original 55,236. First, the number of observations is limited. Second, this thesis used yearly data, quarterly data might be more accurate, especially if write-off practices differ as outlined above.

There are several ideas for future research. First, for 1989 to 2011 the conversion ratio could be calculated using a more extensive dataset. Second, this entire research could be replicated using a dataset containing quarterly bank financial statement data, thereby reducing the bias of nonuniform charge-off practices. Third, the assumed ongoing bias between the UK/U.S. and Europe could be further investigated. Theoretically by further determining how the classification of loans differs. Empirically, by using more sophisticated estimation techniques that also incorporate other variables that influence the conversion ratio.

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Appendix A

Table A1

Variables from 4 databases related to NPLs

Variable name	Label	Observations	Source
impnpl	Impaired / Non Performing Loans	59%	Orbis
timpnpl	Total impaired / Non-performing loans	35%	Orbis
timpnpa	Total impaired / Non-performing loans	30%	Orbis
imploans	Impaired loans (as reported)	49%	Orbis
NPL ratio	NPL ratio (as reported) %	3%	Orbis
Nonaccrualloans	Non-accrual loans	23%	Orbis
P90DPD	+ 90 days past due	37%	Orbis
stage1customers	Gross loans & advances to customers - Stage 1	1%	Orbis
stage2customers	Gross loans & advances to customers - Stage 2	1%	Orbis
stage3customers	Gross loans & advances to customers - Stage 3	1%	Orbis
lossloans	Loss loans	2%	Orbis
doubtfulloans	Doubtful loans	8%	Orbis
substandardloans	Substandard loans	5%	Orbis
specialmentionloans	Special mention loans	2%	Orbis
otherclassifiedloans	Other classified loans	11%	Orbis
performingloans	Performing loans	26%	Orbis
pastduenotimp	Past due but not impaired	31%	Orbis
restructuredloans	Rescheduled/restructured loans	29%	Orbis
data2170	Impaired loans (memo)	63%	Legacy
data11110	Memo: Impaired Loans included above	63%	Legacy
data18200	Impaired Loans(NPLs)/ Gross Loans	62%	Legacy
data30250	Nonaccrual Loans	42%	Legacy
data30240	+90 Days past due	41%	Legacy
data30170	Special Mention Loans	1%	Legacy
data30180	Substandard Loans	3%	Legacy
data30190	Doubtful Loans	3%	Legacy
data30200	Loss Loans	2%	Legacy
data30210	Other Classified Loans	0%	Legacy
data30260	Restructured Loans	9%	Legacy
RCFD1403	TOTAL LOANS AND LEASE FINANCE RECEIVABLES: NONACCRUAL	n.a.	WRDS Bank Regulatory
RCFD1407	TOTAL LOANS AND LEASE FINANCING RECEIVABLES: PAST DUE 90 DAYS OR MORE AND STILL ACCRUING	n.a.	WRDS Bank Regulatory
npatq	Nonperforming Assets - Total, quarterly	n.a.	COMPUSTAT Capital IQ

Note: Variable name is the name of the variable when I first acquired the dataset, label is the label provided without altering it, observations is the percentage of observations that include the specific variable divided by the percentage of observations that have a non-missing value for total assets and source is the relevant source of the data. Orbis means Orbis Bank Focus, legacy means legacy BankScope database

Table A2

Number of observations per country for the conversion ratio

Country	Total observations	Observations percentage	Selected observations	Selected percentage
Australia	258	0.65	0	0
Austria	142	0.36	0	0
Belgium	35	0.09	0	0
Bulgaria	74	0.19	0	0
Canada	207	0.52	0	0
Chile	101	0.25	0	0
Croatia	50	0.13	0	0
Cyprus	40	0.10	0	0
Czech Republic	94	0.24	0	0
Denmark	195	0.49	0	0
Estonia	26	0.07	0	0
Finland	59	0.15	0	0
France	1,306	3.28	1,306	3.65
Germany	3,292	8.28	3,292	9.21
Greece	31	0.08	0	0
Hungary	45	0.11	0	0
Iceland	15	0.04	0	0
Ireland	53	0.13	0	0
Israel	75	0.19	0	0
Italy	2,505	6.30	2,505	7.01
Japan	621	1.56	0	0
Latvia	15	0.04	0	0
Lithuania	23	0.06	0	0
Luxembourg	33	0.08	0	0
Malta	35	0.09	0	0
Mexico	168	0.42	0	0
Netherlands	141	0.35	0	0
New Zealand	81	0.20	0	0
Norway	293	0.74	0	0
Poland	105	0.26	0	0
Portugal	32	0.08	0	0
Republic of Korea	222	0.56	0	0
Romania	70	0.18	0	0
Slovakia	42	0.11	0	0
Slovenia	43	0.11	0	0
Spain	176	0.44	0	0
Sweden	240	0.60	0	0
Switzerland	39	0.10	0	0
Turkey	149	0.37	0	0
U.K.	1,192	3.00	1,192	3.34
U.S.	27,444	69.01	27,444	76.79
Total	39,767	100	35,739	100

Note: Total observation is the total number of non-missing observations for the *conversion ratio* per country. Observation percentage is the total observation per country divided by the total number of observations for all countries in percentages. Selected shows the number of observations after keeping only the 5 selected countries. Selected percentage is the selected number of observations divided by the total number of selected observations in percentages.

Table A3

Variable construction main empirical analysis

	Description	Winsorized	Source
Conversion ratio	Gross charge-offs to lagged NPLs excluding values when GCO=0	p5,p95	Both
NPL ratio	Non-performing loans to lagged gross loans excluding values when NPL=0	p1,p99	Both
GCO ratio	Gross charge-offs to lagged gross loans excluding values when GCO=0	p1,p99	Both
Total assets	Total assets in millions of US dollars	p1,p99	Both
ROA	Return on assets; ratio of net income to lagged total assets	p1,p99	Both
Capital ratio	Ratio of equity to lagged total assets	p1,p99	Both
NPL dataset 1	NPLs in the first dataset is an item called data18200 labeled "impaired loans (memo)"		Legacy Bankscope
NPL dataset 2	NPLs in the second dataset is an item called 'impnpl' in Orbis Bank Focus		Orbis Bank Focus

Note: Includes all the variables from section 3.2 to section 3.6, variables are shown in row 1 through 8. Description further details the variable and how it is calculated if applicable. Winsorized describes at what percentiles the variable is winsorized if applicable, a blank space means that the variable is not winsorized. Source contains the dataset that is used to obtain the variable, both means that the legacy download from Bankscope is used for 1990 to 2011 and Orbis Bank Focus is used for 2012 to 2019.

Table A4

NPL ratio medians over time in France, Germany, Italy, U.K. and U.S.

Year	Median	N	Median	N	Median	N	Median	N	Median	N
1990	0.076	2	.	0	.	0	0.059	4	0.021	4
1991	0.080	5	.	0	.	0	0.081	5	0.021	10
1992	0.063	7	.	0	.	0	0.114	7	0.016	13
1993	0.047	8	.	0	.	0	0.074	9	0.010	16
1994	0.075	4	.	0	.	0	0.071	12	0.009	223
1995	0.102	4	0.018	1	.	0	0.045	25	0.008	383
1996	0.081	4	0.013	1	.	0	0.030	36	0.007	401
1997	0.052	4	0.010	1	.	0	0.022	53	0.007	456
1998	0.057	4	0.020	5	.	0	0.023	55	0.006	434
1999	0.337	5	0.044	5	.	0	0.020	54	0.006	454
2000	0.039	31	0.028	5	0.017	175	0.015	51	0.006	949
2001	0.050	49	0.033	4	0.016	188	0.020	51	0.007	995
2002	0.053	49	0.041	5	0.015	184	0.024	59	0.007	1077
2003	0.059	71	0.052	8	0.017	189	0.028	63	0.006	1173
2004	0.049	84	0.040	13	0.014	197	0.023	59	0.005	1183
2005	0.041	90	0.038	15	0.013	101	0.017	33	0.004	1221
2006	0.035	112	0.029	19	0.043	242	0.014	64	0.004	1291
2007	0.033	187	0.028	26	0.046	265	0.015	92	0.008	1436
2008	0.032	234	0.031	27	0.054	301	0.023	106	0.018	1535
2009	0.035	251	0.039	27	0.063	329	0.027	100	0.033	1571
2010	0.040	256	0.040	30	0.073	306	0.031	102	0.033	1683
2011	0.042	371	0.043	179	0.090	418	0.035	169	0.026	2545
2012	0.037	143	0.032	111	0.104	152	0.042	57	0.017	1475
2013	0.040	163	0.031	266	0.128	162	0.036	63	0.013	1593
2014	0.030	200	0.025	725	0.126	188	0.022	107	0.010	1597
2015	0.029	205	0.021	699	0.155	197	0.015	120	0.008	1496
2016	0.031	203	0.020	682	0.168	204	0.012	125	0.007	1490
2017	0.033	197	0.020	692	0.194	206	0.013	118	0.006	1493
2018	0.025	196	0.014	701	0.114	208	0.015	114	0.006	1306
2019	0.034	5	0.018	3	0.052	3	0.019	23	0.006	1015

Note: This table shows the medians of the *NPL ratio* for banks in selected countries. *NPL ratio* is the NPLs divided by the lagged gross loans winsorized at the 1st and 99th percentile, excluding observations if NPL=0. Median is the median *NPL ratio* for all the banks in each country in a certain year. N is the number of observations used to determine the median.

Table A5

Means and medians of the conversion ratio over time

	France		Germany		Italy		United Kingdom		United States	
Year	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median
1990	.	.	.	.	.	.	0.756	0.756	1.397	1.334
1991	.	.	.	.	.	.	0.250	0.266	1.169	0.819
1992	.	.	.	.	.	.	0.195	0.240	1.038	0.907
1993	.	.	.	.	.	.	0.137	0.142	0.571	0.386
1994	.	.	.	.	.	.	0.159	0.165	0.604	0.400
1995	.	.	.	.	.	.	0.168	0.189	0.868	0.571
1996	.	.	.	.	.	.	0.460	0.214	0.926	0.658
1997	.	.	.	.	.	.	0.687	0.362	1.026	0.740
1998	.	.	.	.	.	.	0.633	0.312	1.040	0.868
1999	.	.	.	.	.	.	0.539	0.288	0.999	0.808
2000	.	.	.	.	0.342	0.342	0.593	0.290	1.024	0.833
2001	.	.	.	.	0.367	0.367	0.518	0.380	1.105	0.931
2002	.	.	.	.	0.683	0.375	0.616	0.446	0.971	0.750
2003	.	.	.	.	0.571	0.399	0.572	0.413	0.831	0.619
2004	.	.	.	.	0.498	0.315	0.719	0.373	0.757	0.500
2005	.	.	0.013	0.013	0.357	0.233	0.402	0.297	0.816	0.556
2006	0.015	0.015	0.247	0.203	0.118	0.071	0.373	0.302	0.832	0.600
2007	0.017	0.019	0.150	0.132	0.131	0.086	0.533	0.388	0.968	0.736
2008	0.206	0.032	0.188	0.136	0.109	0.079	0.452	0.280	1.175	1.000
2009	0.140	0.100	0.165	0.084	0.078	0.059	0.385	0.257	0.998	0.813
2010	0.112	0.068	0.128	0.102	0.078	0.042	0.334	0.191	0.546	0.417
2011	0.110	0.071	0.166	0.123	0.078	0.043	0.281	0.202	0.386	0.275
2012	0.111	0.069	0.022	0.013	0.053	0.031	0.318	0.153	0.363	0.228
2013	0.100	0.063	0.033	0.007	0.044	0.020	0.310	0.152	0.321	0.190
2014	0.090	0.052	0.013	0.005	0.032	0.013	0.307	0.179	0.324	0.182
2015	0.084	0.052	0.021	0.006	0.033	0.013	0.273	0.187	0.371	0.181
2016	0.123	0.059	0.021	0.007	0.032	0.016	0.311	0.154	0.409	0.220
2017	0.147	0.069	0.022	0.008	0.057	0.033	0.325	0.170	0.409	0.225
2018	0.087	0.022	0.025	0.007	0.056	0.033	0.365	0.220	0.437	0.228
2019	0.041	0.014	0.094	0.094	0.029	0.031	0.225	0.121	0.48	0.24

Note: *Conversion ratio* is GCOs divided by lagged NPLs, winsorized at p5, p95 and excluding observations if GCO=0. Means and medians of the *conversion ratio* over time in France, Germany, Italy, United Kingdom and the United states. Years from 1990 to 2019 are provided in row 1 through 19, countries are divided over the columns 2 through 11. Dots mean there were no observations in a given year. Years with less than 30 observations for each country are in grey.

Table A6

Number of observations for the conversion ratio per year in each selected country

Year	France	Germany	Italy	U.K.	U.S.	Total/year
1990	0	0	0	2	4	6
1991	0	0	0	4	4	8
1992	0	0	0	5	5	10
1993	0	0	0	8	16	24
1994	0	0	0	9	197	206
1995	0	0	0	13	356	369
1996	0	0	0	25	389	414
1997	0	0	0	36	422	458
1998	0	0	0	42	389	431
1999	0	0	0	41	412	453
2000	0	0	2	40	813	855
2001	0	0	1	38	865	904
2002	0	0	34	41	962	1,037
2003	0	0	51	39	1,040	1,130
2004	0	0	122	40	1,026	1,188
2005	0	1	59	12	1,032	1,104
2006	2	3	91	26	1,035	1,157
2007	3	7	186	45	1,184	1,425
2008	29	11	189	53	1,393	1,675
2009	33	13	198	64	1,489	1,797
2010	38	17	179	63	1,622	1,919
2011	56	16	216	69	1,569	1,926
2012	116	38	135	49	1,446	1,784
2013	141	99	152	52	1,569	2,013
2014	174	619	166	72	1,568	2,599
2015	177	639	170	74	1,474	2,534
2016	177	605	178	82	1,454	2,496
2017	181	597	185	78	1,450	2,491
2018	173	626	188	58	1,276	2,321
2019	6	1	3	12	983	1,005
Total/country	1,306	3,292	2505	1192	27,444	35,739

Note: This table shows the non-missing observations for the *conversion ratio* per year by country. In the rows are the years from 1990 to 2019 and in the columns are the countries. The last column is the sum of all countries and therefore shows the non-missing number of observations per year. The last row shows the sum of observations per country.