Instituto Superior de Ciências do Trabalho e da Empresa

MODELING GOODWILL FOR EUROZONE BANKS

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ABSTRACT

The present research aims to explain the difference between market and book value of banks, through bank-specific accounting measures.

This study applies the theoretical model proposed by Begley, Chamberlain and Li (2006) on a sample composed by banks settled on Eurozone. Focused on banking business dynamics and its unique specificity, this line of work outstands against the prevalence of manufacturing settings on valuation research literature. The model relates banking-specific accounting measures with the difference between market and book value (which corresponds to goodwill), creating an activity-based perspective of banking business with associated financial assets and liabilities.

The model identifies lending and borrowing activities as the key value drivers of goodwill, embodying the banking traditional role of financial intermediation of deposits/loans. Empirical proof states that Eurozone banks unrecorded value lies mostly on lending activity rather than on borrowing activity. Deposit taking does not endorse additional value beyond its book value, although fee income garnered through financial services provided to customers is recognized to incorporate future value, since it is expected that the relationship between the bank and the customer endures. Thus, results suggested that fee income of Eurozone banks is further associated with lending activity than with deposit taking activity.

Nonetheless, as observed in previous research, empirical evidence shows that lending and borrowing activities encompass a limited scope of banking business, since designated operational assets and liabilities did not contemplate every item not marked-to-market on banks balance sheet. This conclusion points towards the inclusion of future modeling expansions.

Keywords: Eurozone, goodwill, banks, valuation, residual income

JEL Descriptors: G21, M41

RESUMO

A presente investigação pretende explicar a diferença entre o valor de mercado e o valor contabilístico de bancos comerciais, através de variáveis contabilísticas específicas.

Este estudo aplica o modelo proposto por Begley, Chamberlain e Li (2006) a uma amostra composta por bancos sedeados na Zona Euro. O modelo relaciona variáveis contabilísticas específicas de bancos com a diferença entre valor de mercado e valor contabilístico (*goodwill*), criando uma perspectiva do negócio da banca assente em actividades associadas a determinados activos e passivos.

O modelo identifica as actividades de concessão de crédito (CC) e de tomada de depósitos (TD) como determinantes na definição do *goodwill*, correspondentes ao papel tradicional da banca de intermediação financeira.

Os resultados empíricos demonstram que o *goodwill* dos bancos da Zona Euro deriva fundamentalmente da CC. Da TD não deriva valor para além do seu valor contabilístico, apesar de os rendimentos de serviços a clientes recebidos na forma de comissões incorporarem valor futuro, já que é esperado que o relacionamento entre os clientes e o banco perdure. Resultados sugerem que os serviços a clientes dos bancos da Zona Euro estão associados à CC em detrimento da TD.

Contudo, tal como observado em estudos anteriores, fica patente a indicação de que as actividades identificadas apresentam um alcance limitado sobre o negócio da banca, pois os activos e passivos operacionais designados não contemplam todos os itens não valorizados ao seu valor de mercado no balanço dos bancos. Esta conclusão aponta para a inclusão de futuras expansões do modelo.

Palavras-chave: Zona Euro, goodwill, bancos, avaliação, resultado líquido residual

Classificação JEL: G21, M41

Executive summary

The present research aims to explain the goodwill for banks, through bank-specific accounting measures. Goodwill refers to the difference between market and book value.

This study applies the theoretical model proposed by Begley, Chamberlain and Li (2006) on a sample composed by banks settled on Eurozone. The model is a derivation of the residual income valuation models introduced by Ohlson (1995) and Feltham and Ohlson (1995), which were based on accounting variables. However, focusing on banking business dynamics and its unique specificity, this line of work outstands against the prevalence of manufacturing settings on valuation research literature. The model relates banking-specific accounting measures with the difference between market and book value (which corresponds to goodwill), creating an activity-based perspective of banking business with associated financial assets and liabilities.

The model identifies lending and borrowing activities as the key value drivers of goodwill, embodying the banking traditional role of financial intermediation of deposits/loans. The methodology includes the definition of operational assets and liabilities, regarding each activity. This definition implies that every other assets and liabilities not classified as operational is considered to be financial and, therefore, marked-to-market – that is, it is assumed that net financial assets are not biased, since its book value equals its market value.

Empirical proof states that Eurozone banks unrecorded value lies mostly on lending activity rather than on borrowing activity. Deposit taking does not endorse additional value beyond its book value, although fee income garnered through financial services provided to customers is recognized to incorporate future value, since it is expected that the relationship between the bank and the customer endures. Thus, results suggested that fee income of Eurozone banks is further connected with lending activity than with deposit taking activity. Indeed, lending activity encapsulates a close relation of banks with customers, since banks commonly offer reduced interest rate on loans to borrowers who acquire other financial products and services, strengthening the referred relation.

Nonetheless, as studied in previous research, empirical evidence shows that lending and borrowing activities encompass a limited scope of banking business, since designated operational assets and liabilities did not contemplate every item not marked-to-market

on banks balance sheet. This conclusion points towards the inclusion of future modeling expansions.

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1 INTRODUCTION

Financial accounting has a very important function in the economy: it allows not only to measure companies' performance over time but also to compare performances amongst different companies on a given period of time. In fact, comparability is one of the main features required to financial accounting. That requirement leads to an extensive set of rules and conventions, most of the times enforced by law, increasing the level of complexity on accounting. This way, financial accounting standards has evolved towards comparability rather than towards representation of value.

However, as financial markets grew and competition escalated, stockholder's demand on companies' growth has intensified. Mergers and acquisitions are common events on today's economy, providing a greater focus on valuation issues rather than on accounting. Even though there is no consensual method of valuation for any type of financial asset, the fact is that conventional wisdom understates financial accounting for these matters (although it is often the main source of information for most valuation methods). Conservatism on financial accounting is held as the major contributor for that notion. Nevertheless, efforts have been made through time to ensure that financial accounting still provides a truthful notion of the value of a firm – namely, fair value accounting. However, while the two foremost accounting standards bodies – FASB (Financial Accounting Standards Board) in the United States (US) and IASB (International Accounting Standards Board) in the European Union (EU) – have made efforts towards fair value accounting, both regulators and companies are unwilling to make such move, alleging (i) difficulties on implementation, and (ii) an unnecessary degree of variability on earnings on and firm's value. Thus, it remains a substantial gap between book value and market value of a given firm, assuming that the most suitable definition of firm value is the one provided by its market capitalization.

There is plenty of academic research on the reasons for that gap; yet, consensus is still far ahead. This gap is commonly associated to speculation and arbitrage practices on capital markets, but evidence is limited. Nevertheless, research literature is prevalent for companies operating on manufacturing settings, as referred ahead on section 2. For financial firms such as banks, however, research is still sparse. The ubiquity of banks on the economy added to their weight and influence on financial markets heighten the need of improved understanding of its value drivers.

The specificity of banking business sets it aside of core valuation literature. The way that market players perceive value created by banking activity is poorly explained by research literature. A worthy exception goes to Begley, Chamberlain and Li (2006) (henceforth designated as BCL), where the authors establish a theoretical framework for the activities that they define as value-creating (derived from banks intermediation role on the economy) and implement an empirical approach strongly connected to its underlying theory, providing a powerful analytical tool for banks value. This is accomplished by using accounting measures as explanatory factors for the gap between market value and book value. That study also has merit to provide empirical proof of the theory (as accounting measures are widely available in contrast to other kind of information, such as cash flows commonly used on project valuations), applied on an US-based banks sample. BCL model also controls for conservatism on banking accounting by inferring the accounting policy for loan loss allowance.

1.1 PURPOSE OF THE STUDY

The aim of the present study is to replicate BCL on a different sample, in order to test the broadness of its underlying theory. Selecting a sample of European Union (EU) - based banks, integrated on Eurozone for 1999-2006 results in the inclusion of banks from 12 countries. This sample substantially differs from BCL sample in regulatory terms and sample homogeneity is not guaranteed at first sight since variety derived from country specific characteristics is introduced.

1.2 CONTRIBUTION TO RESEARCH

This work intends to increment the understanding of banking business in the Eurozone. Instead of roughly explaining statistical variance of market capitalization through random variables, the intention is to identify the major value drivers of that business, stated through accounting measures. The expectation is to cover the main dynamics of banking business, relying on BCL theoretical model.

Applying the model to a different sample will allow to acknowledge its strengths and weaknesses and therefore increasing the scope of its application. Additionally, it contributes to a better comprehension of financial accounting role on banking valuation, as it scrutinizes the way market players perceive banks ability to generate value.

Besides, as banking business is entirely based on financial assets and liabilities, operational assets and liabilities are easily mislabeled as financial (understood as related to activity funding issues). Model structure implies a definition of banks operational assets and liabilities concerning the underlying activity it pursuits. This way, financial assets have a lighter weight on banks' balance and the true source of value is more easily isolated from funding resources essential to undertake the operational activity. Hence, identification of operational and financial assets is a very sensible parameter in BCL model.

2 LITERATURE REVIEW

Nowadays, relevant valuation literature is bounded by the theoretical developments that were achieved during the mid-nineties. In the accounting scene, academic work concerning valuation has been intensively underpinned by residual income valuation theory, overwhelming other possible views of the value of a firm. This theory has gathered sufficient acceptance among researchers to encompass a framework basis from which following accounting valuation studies have evolved.

Hence, the milestone of accounting valuation theories was set in 1995 by J. A. Ohlson. In his research, Ohlson theorizes how a firm's market value relates to earnings, book value of equity and dividends, using the residual income approach. Altough it was not a pioneering study about the relation between accounting information and the market value of a firm (residual income valuation has been studied in academic literature for a long time – see Preinreich 1938), Ohlson's model was innovative as it translated cash flows into accounting measures in a very elegant way. Nonetheless, there are obvious limitations to discounting future accounting figures to endorse significant economic meaning to accounting data (Peasnell 1981).

In his model, Ohlson clarifies two primary assumptions regarding earnings, book value of equity and dividends: (1) a firm's book value is affected only by income (increase) and dividends (decrease), net of capital contributions (clean surplus relation), and (2) dividends reduce book value of equity but not future earnings. These assumptions imply that the present value of expected dividends (which is assumed to equal a firm's market value, accordingly to the neoclassical security valuation theory) is linked to the book value of equity plus the present value of expected abnormal earnings (which makes the latter equivalent to goodwill).

Abnormal earnings (also known as residual income) is an accounting-based measure which is understood as earnings discounted of a charge for the use of capital. By using this concept, the model avoids dividend policy restraining, from which security analysis is not able to emancipate as it depends directly from the estimation of future dividends. Therefore, the model can be resumed to this relation:

$$v_t = bv_t + \alpha_1 X^a_t + \alpha_2 I_t \tag{1}$$

assuming clean surplus relation:

$bv_t = bv_{t-1} + X_t - D_t$

where:

v_t = market value of the firm at date *t*;

bv_t = book value of the firm at date *t*;

$X^a_t = X_t - r * bv_{t-1}$ = abnormal earnings obtained between date *t-1* and *t*;

X_t = total earnings at obtained between date *t-1* and *t;*

r = rate of return applied to capital invested in the previous period;

D_t = dividends paid (outflow) at date *t*.

I_t = other non-accounting information available at date *t*.

As previously mentioned, dividends do affect market value and book value of equity at the exact same scale (= 1) but do not affect earnings (explaining the absence of dividends on (1)). Nevertheless, as Ohlson points out, a firm's ability to generate earnings is a function of its net investment in assets, that is, its book value of equity. So dividends at date *t* affect future earnings as it reduce future book value of the firm. However, building a model that comprises dividend policy irrelevancy and owner's equity accounting resolves an important issue concerning accounting-based equity valuation.

Subsequently, Feltham and Ohlson (1995) have put together a residual income model which relates a firm's market value to disclosed accounting information, decomposing in financial and operational activities. The model's structure is obviously oriented for a manufacturing firm, considering the clear distinction between financial and operational activities and the assumption of clean surplus accounting. The premise of unbiased accounting for financial activities (book equals market value) allows dividend policy not to influence the firm's value, as dividends (or capital contributions) impact directly on financial assets and not on cash flows (resolving dividend policy irrelevancy issue, as before). Therefore, financing events are isolated from economic events (though they relate through cash flows transferred from operational activity to financial assets), as operational activity is implicitly residual in this model.

In 1998, Dechow *et al* have made an empirical application of Ohlson's residual income model (1995). They study the extent to which simple accounting summary measures can explain future abnormal earnings, current prices, and future security returns. Their empirical work is based on an approach that differs from Ohlson's original model. They deliberately remove I from v expression, arguing that it carries no analytical use to the model. Ohlson refutes by pointing out that I along with X^a (residual income or abnormal earnings) is a reflection of firm's market value, contrasting with the overstated assumption that goodwill corresponds to X solely. Additionally, I holds an important role on the conceptualization of Ohlson's model and it was introduced in the model because of its economic meaning and not because of mathematical convenience. It is important to note that I's goal is to summarize value-relevant events that have not yet impact on accounting data. This means that there are information which impacts on firm's market value on date t that is incorporated in financial statements in date $t+1$, creating a lag on the accounting data. Accounting only recognizes I-related information through transactions, where events are reliably quantifiable. Hence, I is useful to predict future abnormal earnings. This makes the removal of I inherently inconvenient from a theoretical perspective.

Nevertheless, Dechow *et al* paper was revised and published in 1999, on account of Ohlson's comments, but consciously relying on his model in a selective way. The authors argue that the study has goals beyond the forecasting of future abnormal earnings, as it examines the use of abnormal earnings to forecast future security returns, which is a motivation beyond the scope of the Ohlson's model as this latter implies no arbitrage.

Afterwards, Begley, Chamberlain, and Li (2006) make their contribution to valuation research by presenting a residual income model suitable for banks. The authors rely on Feltham and Ohlson residual income model (1995, 1996) to capture the drivers that influence the gap between market and book value by defining and modeling the activities that banking business traditionally involves. This means that they explicitly depart from the base model of Feltham and Ohlson, which is specifically crafted for manufacturing companies by taking advantage of its clear distinction between operational and financing activities. That deviation is compelled by the acknowledgement that the value created by banks arises from assets and liabilities which are financial by nature.

The activities defined in BCL represent the traditional banking core business – intermediation –, decomposed in lending and borrowing. A separated model is structured for each activity, in three steps: (1) defining a linear information dynamics describing cash flows generated by the activity; (2) converting those cash flows into accrual accounting items; and (3) deriving the valuation equation in terms of accounting measures. The empirical estimation is then performed on an US banks sample, intrinsically linked to the theoretical models. The empirical examination finds that there is no evidence that goodwill is significantly generated by lending activity. Nevertheless, there is strong evidence that goodwill is generated in borrowing, suggesting that banks have core deposit intangibles not recognized in the balance sheet.

Although BCL empirical estimation does not excel previous studies on residual income valuation, its findings are relevant in theoretical terms, allowing to draw back meaningful conclusions (Lundholm 2006).

3 RESEARCH METHODOLOGY

Ohlson (1995) presented a model on which the market value of firm would be a linear function of book value and net income. In his model, there was no room for accounting bias derived from accrual policies and conservative accounting. To overcome this unrealistic approach for firm valuation, Ohlson and Feltham (1996) assumed that there are specific accounting items that can explain the bias. While these authors focused their analysis on non-accounting information to explain the bias between a firm's book value and its market value (goodwill), BCL used an approach consisting on the identification of value-creating activities, specific to the banking business.

BCL identified two activities: lending and borrowing. This choice has great impact on the study because it endorses bank's traditional intermediation role on the economy as the major value-creating activity. As there are obvious reasons to point intermediation as such, nowadays modern banking comes strongly associated with other relevant value-creating activities (cross-selling, asset management, proprietary trading, among others). On the course of the empirical analysis, these other value-creating activities will be pointed out, but not scrutinized as they go beyond the scope of this study.

3.1 CONCEPTUAL MODEL

3.1.1 Model framework

At the core of BCL model is the equivalence of two theoretical ways of expressing firm value. They state a cash flow valuation relation (henceforth referred to as CVR) and an operating income valuation relation (henceforth referred to as OVR) to express the same reality – firm value.

CVR is based on the previous work of Feltham and Ohlson (1995, 1996) and consists on the discounted stream of expected free cash flows plus financial assets, which are assumed to be marked-to-market. This assumption is justified in Feltham and Ohlson's work because their study's object was a firm established in a manufacturing sector, where financial assets are exclusively linked to fund raising issues and completely dissociated to operational business. Regarding banking industry, the definition of financial assets as intended by Feltham and Ohlson is not clear. Balance sheet of a bank is composed mostly by financial assets/liabilities, due to its business nature. Thus, it is relevant to clarify the distinction between net financial assets that are attached to the operational activities of a bank and the net financial assets that are related to financing the business. Furthermore, CVR implies a no arbitrage, risk neutrality and dividend policy irrelevance scenario.

OVR has the same basis as CVR, and additionally implies clean surplus relation for equity (condition that allows equity only to change through net income and dividends). OVR states that firm value can be expressed as the discounted stream of expected residual operating income plus the book value of equity. The representation of the mentioned expressions of firm value is as follows:

$$v_t = fa_t + \Sigma^{\infty}_{\tau = t+1} E[oc_t] * (1 + l)^{-\tau} \quad \text{(2) or (CVR)}$$

$$v_t = bv_t + \Sigma^{\infty}_{\tau = t+1} E[roi_t] * (1 + l)^{-\tau} \quad \text{(3) or (OVR)}$$

where:

v_t = firm's market value at time t;

fa_t = net financial assets at time t (negative when financial liabilities exceed financial assets), which are marked-to-market;

oa_t = net operational assets at time t (negative when operational liabilities exceed operational assets), which are valued at its book value;

bv_t = firm's book value at time t, which equals the sum of net financial assets and net operational assets $(bv_t = fa_t + oa_t)$;

oc_{t+1} = operating cash flow net of investments at time $t+1$;

roi_{t+1} = residual operating income at time $t+1$, which equals operating income (oi_{t+1}) less a capital charge on net operational assets $(l * oa_t)$ at time t (at beginning of period $t+1$);

l = risk-free rate.

Rearranging both CVR and OVR, the same equivalences return an expression of market value of net operational assets (vo_t) and goodwill (gw_t):

$$vo_t = v_t - fa_t = \Sigma^{\infty}_{\tau = t+1} E[oc_{\tau}] * (1 + l)^{-\tau} \quad (4)$$

$$gw_t = v_t - bv_t = \Sigma^{\infty}_{\tau = t+1} E[roi_{\tau}] * (1 + l)^{-\tau} \quad (5)$$

In order to expose the stated relation between (4) and (5), the following explanation might be helpful. Considering that v_t equals the sum of fa_t and vo_t, and that bv_t equals the sum of fa_t and oa_t, goodwill can be expressed as:

$$gw_t = v_t - bv_t = (fa_t + vo_t) - (fa_t + oa_t) = vo_t - oa_t \quad (6)$$

The coefficient for fa_t is 1, so net financial assets can be removed from the equation to improve focus on goodwill driven by net operational assets. While oa_t is an accounting measure, obtained through financial statements, vo_t relies on (4) equivalence, which is expressed in terms of cash flows. In order to obtain an expression of market value of net operational assets in terms of accounting measures, BCL built a theoretical model of translation of operating cash flows to standard accounting figures. This transformation encompasses accrual accounting policies which Feltham and Ohlson (1995, 1996) generically found as source of bias of book value capturing the market value of a firm.

According to (5), oa_t is determined by the definition of which accounting measures mirrors the net operational assets attached to each activity alone: Loans (net of loan loss allowance) for the lending activity and Deposits for the borrowing activity. All other net assets are considered to be financial. Then, the value created by lending and borrowing activities (vo_t) is defined in terms of the cash flows each generate through the underlying net operational assets.

To underpin clearness on the following model construction, the design of cash flows and subsequent translation to accounting measures will be presented separately for each activity.

3.1.2 Lending activity

3.1.2.1 Cash flow valuation

The lending bank undertakes this activity by raising funds through equity or through debt issuance at risk-free rate to finance loans issuances to customers. The expected cash flows generated through lending activity are defined in BCL by linear information dynamics (LID1), as follows:

$$cr^{l}_{t+1} = r_l \gamma_1 cur_t + \varepsilon^{l}_{r,\,t+1}$$

$$cur_{t+1} = ninv_{t+1} + \gamma_1 cur_t + \varepsilon_{cur,\,t+1}$$

$$ninv_{t+1} = \omega_{ii}\, ninv_t + \varepsilon_{i,\,t+1}$$

$$npl_{t+1} = (1 - \gamma_1)\, cur_t + \gamma_2\, npl_t + \varepsilon_{n,\,t+1} \qquad \text{(LID1)}$$

where:

cur_t = current performing loans at time t (therefore excludes non performing loans);

r_l = average interest rate on current loans;

γ_1 = fraction of current loans which persists as performing loans from past periods;

cr^{l}_{t} = cash received from loans at time *t;*

$ninv_t$ = net new investments on loans at time *t* (loan issuances deducted of principal repayments)*;*

ω_{ii} = growth on lending;

γ_2 = fraction of non performing loans which persists as non performing loans from past periods;

npl_t = non performing loans (loans on default on principal or interest).

LID1 captures the cash flows involved on lending activity and the way those cash flows evolve through time. A shock variable is included on each linear equation of LID1, in order to capture variations not foreseen. Cash received from loans at time *t+1* (cr^{l}_{t+1}) is stated as the interest received from the performing current loans held at time *t* (cur_t). Current loans for the next period (cur_{t+1}) depend on current loans at time *t* that persist to the next period (adjusted by the weight γ_1) and on new investments net of repayments ($ninv_{t+1}$) occurred during that period. Net new investments on loans at time *t+1* ($ninv_{t+1}$) are a function of net new investments on loans at time *t*, multiplied by a parameter (ω_{ii}) which represents growth on this activity. To simplify, it is assumed that loans are renewed on their maturity date, so every change on loans are captured by $ninv_t$. Non performing loans at time *t+1* depend on the amount of current loans at time *t* that are defaulting (captured through 1-γ_1 parameter) plus the amount of non performing loans at time t that persists to the next period (captured through γ_2 parameter).

It is worth to highlight that the notion of persistence of performing loans to the next period (γ_1) has implicit the default rate on loans ($1 - \gamma_1$). Besides, persistence of non performing loans to the next period (γ_2) has implicit the rate at which defaulting loans are written off the books ($1 - \gamma_2$). Thus, there is an underlying assumption that non performing loans never recover from its default status, definitively interrupting its contribution to interest received.

After this definition of lending model's linear information dynamics and focusing on (4), vo_t consists on the discounted stream of expected operational cash flows (oc_t). For a given period t, lending's operating cash flows equals interest received from loans (cr^l_t) deducted of net new investments on loans ($ninv_t$), that is:

$$oc_t = cr^l_t - ninv_t \tag{7}$$

Perpetuating oc_t into the future in order to obtain vo_t (relying on (4) and LID1) results on the following linear combination (algebraic demonstration of this procedure is available on BCL; therefore, it will not be here reproduced), meaning that market value of the lending bank's operational assets is a function of its current loans and net new investments in loans:

$$vo_t = \pi_{cur}\, cur_t + \pi_{ninv}\, ninv_t \tag{8}$$

$$cur_t : \qquad \pi_{cur} \equiv r_l\, \gamma_1\, \Phi_{\gamma 1}$$

$$ninv_t : \qquad \pi_{ninv} \equiv \omega_{ii}\, \Phi_i\, \Phi_{\gamma 1}\, [\gamma_1\, (1 + r_l) - (1 + l)]$$

where: $\Phi_{\gamma 1} \equiv (1 + l - \gamma_1)^{-1}$

$$\Phi_i \equiv (1 + l - \omega_{ii})^{-1}$$

Including cur_t on the value expression above instead of cr^l_t (as in oc_t expression) has implicit the notion that cr^l_t directly depends upon cur_t. This means that cash flows received in the form of interest from loans are closely tied up to its underlying asset, under the relation: $\pi_{cur}\, cur_t = cr^l_t$.

The stated coefficients have specific meanings:

1) Current loans coefficient (π_{cur}) adjusts current loans (cur_t) to the future cash flows it generates in the form of interest received ($r_l\ \gamma_1$). Higher stated interest rate on loans (r_l) and higher persistence rate of performing loans into the future (γ_1) implies greater value created. The discount rate incorporates the effect of persistence of performing loans through γ_1 on the risk-free interest rate (l). This means that if γ_1 equals 1, implying that loans never default, the received cash flows ($r_l\ \gamma_1$) are discounted as perpetuity at the risk-free rate (l). Therefore, π_{cur} should be positive.

2) Net new investments on loans coefficient (π_{ninv}) reflects the spread between the cash flows received from interest earned from loans which are not defaulting ($\gamma_1\ (1 + r_l)$) and the cash flows paid by the bank for funding current loans ($1 + l$). This spread is adjusted to reflect growth on lending (ω_{ii}), which value is required to range in [0 ; ($1 + l$)] – this implies that lending model does not allow for negative growth. The discount rate is influenced by the persistence of performing loans (γ_1) and, on the other hand, by the growth parameter (ω_{ii}). The sign of π_{ninv} directly depends on the spread: if the cost of funding loan issues exceeds interest earned from those loans, π_{ninv} will be negative; and vice versa.

The coefficient π_{ninv} is intended to express $ninv_t$ as a positive or as a negative net present value investment for the lending bank. If the spread embedded in π_{ninv} happens to be null, when funding costs equals performing loans interest earned ($\gamma_1\ (1 + r_l) = (1 + l)$), that means loans are zero net present value investments, having no impact on the market value of operational assets, neither through π_{ninv} nor π_{cur}. To see this, consider:

$$\gamma_1\ (1 + r_l) = (1 + l) \Leftrightarrow \gamma_1 + r_l\ \gamma_1 = (1 + l) \Leftrightarrow r_l\ \gamma_1 = 1 + l - \gamma_1 \qquad (9)$$

$$\pi_{ninv} = \omega_{ii}\ \Phi_i\ \Phi_{\gamma 1}\ [\gamma_1\ (1 + r_l) - (1 + l)] = \omega_{ii}\ \Phi_i\ \Phi_{\gamma 1} * [\ 0\ ] = 0$$

$$\pi_{cur} = r_l\ \gamma_1\ \Phi_{\gamma 1} = (1 + l - \gamma_1) * (1 + l - \gamma_1)^{-1} = 1$$

Hence, in this specific case, loans should have a similar treatment to net financial assets since do not inflict any bias to firm valuation ($vo_t = cur_t = oa_t$).

3.1.2.2 Accounting Valuation

Cash flows of the lending activity, as previously defined, are based on non observable variables like cur_t. A further step is necessary in order to link cash flows to observable variables from accounting. This translation is beneficial to the study because it scans the possibility of accounting policies being a source of bias between book and market value of banks. Otherwise, relying on the equivalence of CVR and OVR, this step would be useless. Furthermore, this translation is also convenient because accounting measures (opposed to cash flows) are commonly available information that allows to empirically testing the underlying theory.

Looking back to (5), it states that the difference between market and book value of a firm (gw_t) is the discounted stream of expected residual operating income (roi_t). As already referred, residual operating income includes operating income deducted of a capital charge on net operational assets outstanding at the previous period:

$$roi_t = oi_t - l * oa_{t-1} \tag{10}$$

For the lending bank, oi_t corresponds to interest revenues at time t (rev_t) less net increases on loan loss provision at time t (bde_t), and oa_t corresponds to net loans at time t (nl_t). It is worth to note that these variables are accounting measures, observable on bank's financial statements or other attached disclosures.

For simplicity matters, the model assumes that banks performs cash accounting for interest received from loans ($rev_t = cr^l_t$). Net loans, in turn, correspond to gross loans (which consists of $gl_t = cur_t + npl_t$) less loan loss allowance ($nl_t = gl_t - all_t$). Loan loss allowance (all_t) consists on an amount of loans set aside for an occurrence of default (regarding principal or interest) that may or may not happen. The definition of the proper amount depends on the bank's accounting policies and risk strategies, although there are legal restraints and control measures imposed by monetary system supervisory entities. Indeed, loan loss allowance is still the major bank's accrual because there is no single rule for establishing the most appropriate amount to be set aside; instead, there are boundaries of what supervisory entities find reasonable to be granted as a safe reserve to future losses derived from defaulting loans. The allowance is increased by the loan loss provision (bde_t), which, in parallel to manufacturing firms, roughly corresponds to a bad debt expense. On banking business, however, it is a very important indicator of asset quality jointly with the relative weight of all_t on gl_t and with the relative amount of non performing loans, among others.

Definition of all_t in the lending model derives from two sources acting as accounting policies. It is assumed that banks undertake this accrual process by setting a general reserve based on the amount of gross loans [$(1 - \delta_{gl})\, gl_t$] and a specific reserve based on the amount of non performing loans [$\delta_{npl}\ npl_t$]. Both δ_{gl} and δ_{npl} parameters value range is [0 ; 1]. Thinking of the weight of $(1 - \delta_{gl})$ on gl_t as the amount of gross loans to be set aside as a general reserve for future loan losses implies that δ_{gl} can be understood as the survivorship rate of gross loans to the next period. On the other hand, δ_{npl} is the portion of non performing loans that are provisioned by the loan loss allowance. Hence, the loan loss allowance can be expressed as the sum of the two referred sources:

$$all_t = (1 - \delta_{gl})\ gl_t + \delta_{npl}\ npl_t \tag{11}$$

Yet, a clear distinction from γ_1 in cash flow valuation and δ_{gl} needs to be drawn: loan loss allowance is meant to ensure that a default risk assessment is being made by banks, which are expecting that a portion of their loan portfolio will not perform. So, the parameter δ_{gl} addresses for the portion of the loan portfolio that is expected not to default. In contrast, $(1\text{-}\gamma_1)$ reflects the portion of the loan portfolio that does default and, consequently, is reclassified as non performing loans. Additionally, considering that non performing loans are those which have missed repayments of principal or interest, it is expected that δ_{npl} value will be very close to its range's upper bound.

Considering all_t expression above exposed allows to re-express net loans at time t as:

$$nl_t = gl_t - all_t = gl_t - [(1 - \delta_{gl})\ gl_t + \delta_{npl}\ npl_t] = \delta_{gl}\ gl_t - \delta_{npl}\ npl_t \tag{12}$$

which correspond to net operational assets at time t for the lending bank. The structure of loan loss accounting for the lending model is processed as follows:

$$\left.\begin{aligned} all_t &= all_{t-1} + bde_t - write\text{-}offs_t \\ gl_t &= gl_{t-1} + ninv_t - write\text{-}offs_t \\ nl_t &= (gl_{t-1} + ninv_t - write\text{-}offs_t) - (all_{t-1} + bde_t - write\text{-}offs_t) = nl_{t-1} + ninv_t - bde_t \end{aligned}\right] \quad \text{(ALL)}$$

Restating this last expression in order to bde_t ($bde_t = nl_t - nl_{t-1} - ninv_t$) and considering the accrual procedures stated above yields residual operating income at time t as:

$$roi_t = cr^l_t + nl_t - ninv_t - (1 + l) * nl_{t-1} =$$

$$= cr^l_t + \delta_{gl} (gl_t - gl_{t-1}) - \delta_{npl} (npl_t - npl_{t-1}) - ninv_t - l * (\delta_{gl} gl_{t-1} - \delta_{npl} npl_{t-1}) \quad (13)$$

Perpetuating roi_t into the future in order to obtain gw_t (relying on (5)) results on the following linear combination (algebraic demonstration of this procedure is available on BCL), meaning that the difference between market and book value of the lending bank is a function of non performing loans, net new investments in loans and gross loans, adjusted by its respective coefficients:

$$gw_t = \alpha_{npl} npl_t + \alpha_{ninv} ninv_t + \alpha_{gl} gl_t \quad (14)$$

$$npl_t : \quad \alpha_{npl} = \delta_{npl} - \Phi_{\gamma 1} r_l \gamma_1$$

$$gl_t : \quad \alpha_{gl} = \Phi_{\gamma 1} r_l \gamma_1 - \delta_{gl}$$

$$ninv_t : \quad \alpha_{ninv} = \Phi_i \omega_{ii} (\Phi_{\gamma 1} r_l \gamma_1 - 1)$$

where: $\Phi_{\gamma 1} \equiv (1 + l - \gamma_1)^{-1}$

$\Phi_i \equiv (1 + l - \omega_{ii})^{-1}$

Including gl_t and npl_t on the value expression above instead of cr^l_t (as in roi_t expression) has again implicit the notion that cr^l_t directly depends upon cur_t (which, as already referred, it is equivalent to $gl_t - npl_t$. Cash received due to interest from loans will be addressed by the coefficients on both gl_t and npl_t. The first states the interest due and the latter deducts the interest on default.

Concerning the coefficients on the expression, α_{ninv} is similar to π_{ninv}, defined as in (8); α_{gl} and α_{npl} (which have a value range of [-1 ; 1]) are a combination of π_{cur} presented in cash flow valuation, but additionally incorporate accounting policies associated to each underlying operational asset, through δ_{npl} and δ_{gl} :

1) The coefficient α_{npl} is determined in two ways, influencing its sign: (a) the portion of non performing loans set aside as loan loss allowance is interpreted as the amount of cash held as a reserve for loan losses that accounting does not incorporate on its definition of operational assets (due to conservatism), but still generates value that is recognized by the market through the possibility of recovery; (b) the amount of interest

on loans that will not be garnered due to defaulting is taken into account by its net present value;

2) The coefficient α_{gl} complements α_{npl} as it reflects (a) net present value of interest from gross loans (which deducted of interest not received due to defaulting just referred equals cr^{l}_{t}) and (b) the portion of gross loans not set aside as loan loss allowance (which deducted of the portion of non performing loans set aside as loan loss allowance just referred equals cur_t).

Supposing the market value equals book value of net operational assets, the coefficients on (14) are forced to equal zero. Nullity of α_{ninv}, therefore, forces interest rate on performing loans to equal loans funding rate [$\gamma_1\ (1 + r_l) = (1 + l)$], which means that new loans are zero net present value investments. Furthermore, to ensure α_{npl} and α_{gl} equal zero forces the loan loss parameters to equal one ($\delta_{gl} = \delta_{npl} = 1$), as well as the present value of interest on performing loans ($\Phi_{\gamma 1}\ r_l\ \gamma_1 = 1$). This means that loan loss allowance must correspond to the total amount of non performing loans.

The following backwards process reconciles the linking process between cash flow and accounting valuation, from (14) to (6):

$$
\begin{aligned}
gw_t &= \alpha_{npl}\ npl_t + \alpha_{ninv}\ ninv_t + \alpha_{gl}\ gl_t = \\
&= [\Phi_{\gamma 1}\ r_l\ \gamma_1\ (gl_t - npl_t)] + \pi_{ninv}\ ninv_t - (\delta_{gl}\ gl_t - \delta_{npl}\ npl_t) = \\
&= (cr^{l}_{t} + \pi_{ninv}\ ninv_t) - nl_t = \\
&= (\pi_{cur}\ cur_t + \pi_{ninv}\ ninv_t) - nl_t = \\
&= vo_t - nl_t = \\
&= vo_t - oa_t
\end{aligned}
$$

Decomposition of α_{gl} and α_{npl} makes possible the rearrangement of the equation in order to visualize the translations made and the interconnection between both valuation equations of cash flow and accounting.

3.1.3 Borrowing activity

3.1.3.1 Cash flow valuation

The borrowing bank undertakes this activity by taking deposits from customers, paying them interest for those funds and selling them banking services (credit cards, checks, transfers, brokerage, insurance, retirement plans, asset management, among others). The expected cash flows generated through borrowing activity are defined in BCL by linear information dynamics (LID2), as follows:

$cr^{d}_{t+1} = fee_{t+1} – r_d\, dep_t + \varepsilon^{d}_{r,\, t+1}$

$fee_{t+1} = \omega_{ff}\, fee_t + \omega_{fd}\, nd_t + \varepsilon_{f,\, t+1}$

$nd_{t+1} = \omega_{dd}\, nd_t + \varepsilon_{d,\, t+1}$

$dep_{t+1} = dep_t + nd_{t+1}$ (LID2)

where:

fee_t = fee income from banking services at time t;

dep_t = amount of deposits from customers at time t;

r_d = the stated interest rate paid on deposits from customers;

cr^d = cash received from borrowing activity at time t;

nd_t = new deposits at time t;

ω_{ff} = persistence of fee income to the future, independent of level of bank deposits;

ω_{fd} = increase on fee income due to increase in level of bank deposits;

ω_{dd} = growth on borrowing.

LID2 captures the cash flows involved on borrowing activity and the way those cash flows evolve through time. A shock variable is included on each linear equation of LID2, in order to capture variations not foreseen. Cash received at time $t+1$ (cr^{l}_{t+1}) is stated as the difference between fee income (fee_{t+1}) and the interest paid to customers on the borrowed funds at time t ($r_d\, dep_t$). In its turn, fee income for the next period (fee_{t+1}) is function of (a) past fee income (fee_t), adjusted by a parameter standing for its persistence to the future (ω_{ff}), and (b) the portion of new deposits ($\omega_{fd}\, nd_t$) that would result on an increase of fee income. This latter may be levered through ω_{dd}, which states for the growth on new deposits (nd_t). New deposits are assumed to be net of reimbursements.

The existence of fees paid by the customers during a given period assumes that the existence of a relationship that endures through time. Thus, the existence of new deposits on the bank is not a necessary condition for this relationship to persist, justifying the $\omega_{ff}\, fee_t$ influence on fee_{t+1}.

After this definition of borrowing model's linear information dynamics and focusing on (4), vo_t consists on the discounted stream of expected operating cash flows (oc_t). For a given period t, borrowing operating cash flows equals cash received from fees deducted of interest paid for borrowed funds (cr^d_t) plus new deposits (nd_t), that is:

$$oc_t = cr^d_t - nd_t \tag{15}$$

Perpetuating oc_t into the future in order to obtain vo_t (relying on (4) and LID2) results on the following linear combination (algebraic demonstration of this procedure is available on BCL), meaning that market value of the borrowing bank's operational assets is a function of its deposits (at beginning of period), fee income and net new deposits:

$$vo_t = \pi_{fee}\, fee_t + \pi_{dep}\, dep_{t-1} + \pi_{nd}\, nd_t \tag{16}$$

$$fee_t: \qquad \pi_{fee} \equiv \omega_{ff}\, \Phi_f$$

$$dep_{t-1}: \qquad \pi_{dep} \equiv - r_d / l$$

$$nd_t: \qquad \pi_{nd} \equiv \Phi_d\, [(1 + l) * (\omega_{fd}\, \Phi_f - r_d / l) + \omega_{dd}]$$

where: $\Phi_f \equiv (1 + l - \omega_{ff})^{-1}$

$$\Phi_d \equiv (1 + l - \omega_{dd})^{-1}$$

Cash received (cr^d_t) considered on (15) is included on vo_t through the combination of $\pi_{fee}\, fee_t$ and $\pi_{dep}\, dep_{t-1}$, relying on LID2.

Therefore, the stated coefficients have specific meanings:

1) Coefficient on fee_t (π_{fee}) reflects the present value of future fees, assuming that the level of fee income will persist at a rate equal to ω_{ff} ; therefore it is expected to be positive.

2) Coefficient on dep_{t-1} (π_{dep}) takes in consideration the spread of interest on deposits. If the spread is null ($r_d / l = 1$), deposits do not impact differently on vo_t rather than on oa_t. This means that when π_{dep} equals -1, deposits would be a financial liability and can be added back to net financial assets (fa_t), eliminating that variable from an expression of goodwill (as it would not be a source of bias between market and book value of the borrowing bank). If the spread is not null, then deposits are considered to have a relevant role in net operational assets. Either way, the coefficient is expected to be negative.

3) Coefficient on nd_t (π_{nd}) reflects (a) the rate at which new deposits persist into the future (ω_{dd}), (b) the spread on interest on deposits (as in π_{dep}), defining whether new deposits will impact or not on vo_t, and (c) the rate (ω_{fd}) at which new deposits will generate future fee income (which is magnified by ω_{dd}, incorporating the future fee income of future new deposits). The sign on π_{nd} is determined by these three forces: it is positively influenced by (a) and (c) and negatively influenced by (b). The possibility of π_{nd} being positive is justified by new deposit's ability to generate future fee income, increasing net operational assets (as an intangible asset) rather than decreasing as a liability (as it would be expected). This could be true if ω_{fd} is positive; if not, new deposits do not generate future fee income and, additionally considering that the spread of interest on deposits is null, then new deposits will even have a negative impact on vo_t (as a liability). If reimbursements exceed new deposits ($nd < 0$), a negative π_{nd} will have a positive effect on vo_t

3.1.3.2 Accounting Valuation

Borrowing activity cash flows, as lending activity, are based on non observable variables; thus it is necessary to link these cash flows to observable variables from accounting, in order to determine the residual operating income for the borrowing activity, relying on the equivalence of CVR and OVR.

On lending model, accounting policies had a significant role in the process of translation of cash flows into accruals. However, in borrowing model, cash flows and accruals match significantly. The exception lies on the translation of cash received (from LID2) to operating income: revenues equal fee income and (deduction of) interest on lagged deposits, which in turn is assumed to be accounted on a cash basis, similarly to the lending model. Additionally, the book value of net operational assets for the borrowing bank equals deposits as a liability; thus, the capital charge on beginning-of-period net operational assets will have a positive effect.

Hence, residual operating income for the borrowing activity is as follows:

$$roi_t = fee_t - r_d\, dep_{t-1} + l * dep_{t-1} \tag{17}$$

Perpetuating roi_t into the future in order to obtain gw_t (relying on (5)) results on the following linear combination (algebraic demonstration of this procedure is available on BCL), meaning that the difference between market and book value of the borrowing bank is a function of fee income, lagged deposits and new deposits, adjusted by its respective coefficients:

$$gw_t = \alpha_{fee}\, fee_t + \alpha_{dep}\, dep_{t-1} + \alpha_{nd}\, nd_t \tag{18}$$

fee_t : $\alpha_{fee} = \omega_{ff}\, \Phi_f$

dep_{t-1} : $\alpha_{dep} = 1 - r_d / l$

nd_t : $\alpha_{nd} = (1 + l)\, \Phi_d\, (\omega_{fd}\, \Phi_f + 1 - r_d / l)$

where: $\Phi_f \equiv (1 + l - \omega_{ff})^{-1}$

$\Phi_d \equiv (1 + l - \omega_{dd})^{-1}$

The stated coefficients from the goodwill expression are similar to the ones from vo_t expression ($\alpha_{fee} = \pi_{fee}$; $\alpha_{nd} = \pi_{nd} + 1$; $\alpha_{dep} = \pi_{dep} + 1$). That is visible considering that $dep_t = dep_{t-1} + nd_t$ and adding oa_t of the borrowing bank (dep_t) to both sides of vo_t, returning the goodwill expression stated above. The translation of π's to α's calls for two notes:

1) The coefficient on dep_{t-1} (α_{dep}) will be negative only when the borrowing bank pays interest on deposits at a higher rate than the one at which it raises funds ($r_d > l$).

2) The coefficient on nd_t (α_{nd}) will be negative when r_d exceeds the risk-free rate (l) to the extent that it overwhelms new deposits ability to generate future fee income through ω_{fd}.

Supposing that market value equals book value of net operational assets, the coefficients on (18) are forced to equal zero. If the spread of interest on deposits is null ($r_d = l$), then lagged deposits (dep_{t-1}) will not impact on goodwill. This condition is also necessary to, jointly with the absence of future fee income derived from new deposits ($\omega_{fd} = 0$), eliminate non-accounted value for new deposits (nd_t). Analogously, fee income should not persist into the future ($\omega_{ff} = 0$), assuming the relationship arisen from deposits extinguishes.

3.1.4 Combining Lending and Borrowing Activities

So far, the model theorizes lending and borrowing as stand-alone activities. Considering both activities together approximates the theoretical model to real world commercial banking. This combination will henceforth be designated as 'combined model'.

The combined model is strongly based on both lending and borrowing models, which makes its description very straightforward, at this point. Firstly, focusing on cash flow valuation, combination of the 8 equations from LID1 and LID2 directly yields the linear information dynamics for combined model, with an exception for cash received, which exactly corresponds to the aggregation of cr^l_t and cr^d_t, as follows:

$$cr_t = cr^l_t + cr^d_t = r_l \gamma_1 cur_t + fee_{t+1} - r_d dep_t + \varepsilon_{r, t+1} \quad (19)$$

Operating cash flows of the combined model also result from direct aggregation of operating cash flows for lending and borrowing models ($oc_t = cr_t + ninv_t - nd_t$). Relying on CVR and perpetuating these cash flows to the future yields market value of operational assets, as follows:

$$vo_t = \pi_{cur} cur_t + \pi_{ninv} ninv_t + \pi_{fee} fee_t + \pi_{dep} dep_{t-1} + \pi_{nd} nd_t \quad (20)$$

Coefficients on each variable are as defined before for lending and borrowing models.

Secondly, focusing on accounting valuation, residual operating income is as follows:

$$roi_t = fee_t - r_d dep_{t-1} + l * dep_{t-1} + r_l \gamma_1 cur_{t-1} + nl_t - ninv_t - (1 + l) * nl_{t-1} \quad (21)$$

Relying on OVR and perpetuating roi_t to the future yields goodwill as a linear combination of nonperforming loans, gross loans, new investments in loans, lagged deposits, new deposits, and fee income:

$$gw_t = \alpha_{gl}\, gl_t + \alpha_{npl}\, npl_t + \alpha_{ninv}\, ninv_t + \alpha_{fee}\, fee_t + \alpha_{dep}\, dep_{t\text{-}1} + \alpha_{nd}\, nd_t \qquad (22)$$

Coefficients on each variable are as defined before for lending and borrowing models.

3.2 STATISTICAL ANALYSIS TECHNIQUES

This section presents a brief description of statistical techniques that are applied in empirical analysis. Appropriate emphasis will be given to the most relevant features of these techniques, according to the analysis performed on section 4.5 and assessing its underlying rationale.

3.2.1 Multiple linear regression

Multiple linear regression is a popular technique that reveals relationships between variables, although it not proves causality. Its main purpose is to evaluate the relationship between a dependent (explained) variable and a group of independent (explanatory) variables, identifying a hierarchy of importance among the latter to that relationship.

Independent variables are assumed to be uncorrelated with each other – otherwise, multicollienarity may occur, which severely distorts coefficients estimates. Multicollinearity is not directly identifiable, but there are a few elements which signal for its presence. Highly correlated independent variables, high variation inflation factors or low tolerance will be analyzed to detect such situation.

A relevant function of multiple regressions is the prediction of dependent variable. Furthermore, it is essentially by the difference between predicted and observed values for dependent variable (also known as residuals) that three main assumptions of this technique are verified: normality, linearity and homocedasticity of residuals. These assumptions are verifiable through residuals scatter plots: (1) normality requires that standardized residuals are symmetrically distributed around each and every predicted value for the dependent variable (with greater concentration on the center of the plot); (2) linearity requires that the overall shape on the scatter plot is rectangular and does not suggest a curve; and (3) homocedasticity requires that the spread of residuals for small predicted values is about the same for large predicted values. If not, heterocedasticity occurs, which does not invalidate the analysis but weakens it. A reduction or even elimination of heterocedasticity may be accomplished if weights are applied to regression variables. That weight has to concur with what is causing the residuals to have different variances for different levels of magnitude of the predicted values. Heterocedasticity may alternatively be detected through White test statistic, which is asymptotically distributed as χ^2 with degrees of freedom equal to the number of independent variables in the regression, not including the constant. This general test does not require any specification of the form of the heterocedasticity and it is more accurate, comparatively with residuals scatter plot analysis, because it provides a significance test.

Nevertheless, heterocedasticity problem may be overlooked if Huber-White standard errors are used in multiple linear regressions. These (also known as) robust standard errors are adjusted for residuals correlations across observations, which occur specially in panel data. Statistical inference becomes then much more reliable than with typical standard errors.

3.2.2 Multivariate outlier detection

Multiple regressions outcome is tremendously sensitive to extreme observations (commonly named as outliers), which reduces the precision of estimated regression coefficients. To prevent such loss on regression prediction capability, a preliminary statistical analysis detects which observations would result to be extreme or significantly out of sample's range. As the model comprises multiple explanatory variables, it is more appropriate to perform a multivariate analysis (such as Mahalanobi's distance) rather than a univariate analysis (like box-plot analysis for each single variable involved). This way, unusual combinations are detected and flagged within the sample rather than observations which feature one or more variables with extreme absolute values.

Mahalanobi's distance measures the distance of an observation from remaining sample centroid (centroid is the intersection of means of all variables involved). Such distance evaluates each observation, using significance tests relying on χ^2 distribution (degrees of freedom equal the number of independent variables on the model). Observations which present a Mahalanobi's distance greater than the critical χ^2 at the desired *p*-value are labeled as outliers.

3.2.3 Principal components analysis

The goal of principal components analysis (henceforth designated as PCA) is to reduce the number of variables into fewer components. PCA consists on extracting maximum variance from a set of variables, which linear combination differentiates observations.

The usefulness of PCA on this study will be justified under the presence of multicollinearity. Such circumstance happens when two or more independent variables are correlated, which means that the variance of each of that correlated independent variables is likely to be the same. Therefore, a pure statistical approach would recommend the deletion of one of the concurrent independent variables or, as an alternative, the substitution of the variables juxtaposition by a principal component, which would statistically preserve and represent the same variance. PCA, as explained ahead on section 4.5.1, may strengthen the link between model specifications and the analyzed data.

This procedure creates a first principal component, which encloses a standardized solution with the most variance extracted. This principal component would be the one substituting conflicting independent variables. If all resulting components are considered, the observed initial variance would be reproduced.

PCA is usually followed by rotation of the extracted solution. As rotation does not contribute to improve the statistical quality of the solution (because rotated solutions are mathematically equivalent to extracted solution), but merely facilitate interpretability, it is not a relevant technique for this study.

4 EMPIRICAL ANALYSIS

4.1 SAMPLE DESCRIPTION

The sample used in this study comprises financial firms in the banking business, settled in EU countries (listed in table 2) on which currency was Euro for the 1999-2006 period. The sample contains data from commercial banks, business credit institutions and mortgage banks (henceforth referred to as banks), excluding firms providing other financial services such as insurance, dealing/brokerage or investment advice.

The option for Eurozone companies grants a sufficiently representative universe of observations that allows for statistical inference. Simultaneously, this restrictive scope serves the purpose of sample consistency improvement as well. Capital markets are undeniably global, but economic and legal realities from home countries are prevalent on the way banks run their business. Therefore, a common background is required to guarantee that banks operate on similar markets so that its business, accounting information and market value are not biased by surrounding environmental issues. This requirement is thoroughly fulfilled by Eurozone, since European Central Bank (henceforth BCE) – empowered by European Union to pursuit its role as a central bank, concerning monetary policy and financial systems regulation and supervision – enforces a consistent and homogeneous financial and economic setting for Eurozone banks to operate, regardless of its ‘nationality’. Indeed, Eurozone offers a unique economic setting, presenting an ideal site for this sort of study.

Accounting data was retrieved from Compustat Global Financial Services (henceforth CGFS) and market data was retrieved from Thomson ONE Banker (henceforth Thomson). The considered companies for the sample were the ones for which data was available on both databases, for the mentioned period. Table 1 discloses the sampling process performed regarding model singularities and fit leverage on empirical analysis.

The sampling process encloses nine steps:

(1) CGFS original sample contained 22 472 firm-year observations from financial companies settled all over the world.

(2) A primary selection of observations representing financial companies settled on Eurozone countries and in countries with Economic and Monetary Union (EMU) formal agreement led to a sample of 4 164 observations.

(3) CGFS offers an extensive set of accounting variables, which surely involves substantial work to maintain. However, a considerable number of firm-year observations were lacking of accounting information on key variables of the model (gross loans, deposits, fee income and common equity). Therefore, those observations (2 711) were eliminated from the sample. An additional and unfruitful validation was made to detect and eliminate observations with negative book value of common equity, considering the underlying assumption of clean surplus relation, stipulated in Ohlson (1995) (which states that, in the long run, book value of equity is an unbiased estimator of firm's market value, which range is [0 ; +∞[ ).

(4) At this point, the sample contained 497 observations which functional currency was not euro. In order to avoid exchange differences issues and to improve analysis coherence, those observations were eliminated from the sample.

(5) Subsequently, 237 observations were eliminated due to model specifications. The model contains variables which represent annual changes for specific accounting items, which means that, for each company, the first year observation was only used to calculate annual changes and then eliminated from the sample. At that point, the sample retrieved from CGFS included 719 firm-year observations.

(6) Afterwards, during the process of consolidating accounting data provided by CGFS and market data provided by Thomson, 361 observations were eliminated from the sample due to the absence of a firm-year observation in either one of the data sources.

(7) Additionally, 27 observations were set aside as they represented financial companies which activities do not comprise the lending/borrowing business. Indeed, these financial companies (insurance, dealing/brokerage or investment advice) may show loans or deposits in balance sheet or present fee income on income statement, but this would be in a residual manner, (justifying why these observations bypassed step (3) representing another kind of activities, differing in its essence from lending and borrowing).

(8) Observations referring to year 1999 formed a very small set of data, standing as insignificant for panel data analysis; thus, 4 observations were eliminated from the sample.

(9) Multivariate outlier detection yielded 25 observations located at a distance greater than 32.9 from the observed centroid (distance criteria determined by χ^2 at $p < 0.001$). These observations were classified as outliers and removed from the sample.

Table 1 – Disclosure of sampling process

Step		Number of firm-year observations
(1)	Compustat Global Financial Services data querying for 1999 - 2006 period *(data figures in original currency and scaled)*	22 472
(2)	Selection of Eurozone-based observations *(including countries with EMU formal agreement)*	- 18 308
(3)	Data validation for key accounting variables *(specifically gross loans, non-performing loans, deposits, fee income and common equity)*	- 2 711
(4)	Deletion of observations with data stated on a different currency than euro *(avoiding exchange rate differences issues)*	- 497
(5)	Deletion of first firm-year observations *(used for flow variables calculation only)*	- 237
(6)	Deletion of observations without market data on Thomson ONE Banker *(reference date postponed for a 3-months period relative to CGFS reference date)*	- 361
(7)	Deletion of observations which main activity is not directly related to intermediation *(insurance, dealing/brokerage and investment advice)*	- 27
(8)	Deletion of observations referring to 1999 *(small set of observations for panel data analysis)*	- 4
(9)	Exclusion of observations classified as outliers (*defined as such by Mahalanobi's distance at* p *< 0,001 as multivariate outlier criteria)*	- 25
	Final sample	= 302

Thus, the final sample is composed by 302 firm-year observations on 73 companies. The final sample characterization and distribution by country is presented in table 2. Except for two companies, which are classified as business credit institutions (corresponding to 7 firm-year observations), all remaining companies are classified as commercial banks.

Table 2 – Characterization and distribution of final sample by country

Country*	Number of companies	Number of observations	Mean values Market capitalization †	Book value of equity †	M/BV ratio ‡	Total assets †	Gross loans †	Deposits †
Austria	6	12	7 770	3 648	2.1	86 814	45 378	34 939
Belgium	2	9	21 195	11 416	1.9	445 857	167 471	122 001
Finland	2	12	498	479	1.0	8 437	3 717	3 362
France	5	23	9 786	6 005	1.6	172 660	50 694	37 903
Germany	8	28	15 388	15 297	1.0	458 875	152 390	141 783
Greece	3	7	8 108	2 102	3.9	39 153	22 877	20 515
Ireland	3	16	11 600	4 446	2.6	92 688	59 631	41 647
Italy	25	101	5 811	3 268	1.8	57 307	32 924	22 050
Netherlands	2	4	16 544	6 159	2.7	292 520	166 720	132 149
Portugal	4	24	3 749	1 676	2.2	37 187	25 203	16 302
Spain	13	66	11 129	5 277	2.1	90 079	51 294	35 794
Total	73	302	8 827	5 125	1.7	124 266	55 053	42 114

* Luxembourg was also included on Euro zone country list; however, observations from that country were not fit to enter final sample.

† Values displayed in EUR billions

‡ Market-to-book ratio

The sample distribution by country and year is presented on table 3. There is an undeniable annual growth factor on the database's number of observations, which creates a reverse form of survivorship bias. For this matter, CGFS records an alert informing which companies no longer operate (no such record on final sample), which companies were subsequently acquired or merged (two companies on final sample, corresponding to four observations occurred before that event) and other sort of alerts. Yet, CGFS do lack on company's information on 2000-01 period, when comparing to remaining years, causing total observations for those years to be less than yearly average. Such constitutes a database fail and do not mirror Eurozone banking industry evolution, which has been on a consolidation phase during the considered period, where a considerable number of mergers and acquisitions between banks has taken place.

Table 3 – Decomposition of final sample by country and by year

Country	Year							Total
	2000	2001	2002	2003	2004	2005	2006	
Austria	1	0	0	1	2	6	2	12
Belgium	0	2	2	2	2	1	0	9
Finland	2	2	2	1	2	2	1	12
France	1	3	3	5	5	3	3	23
Germany	3	4	4	5	6	4	2	28
Greece	0	0	0	1	2	3	1	7
Ireland	1	2	2	3	3	3	2	16
Italy	0	0	13	22	22	23	21	101
Netherlands	1	1	0	1	0	1	0	4
Portugal	2	2	4	4	4	4	4	24
Spain	3	6	11	13	12	12	9	66
Total	14	22	41	58	60	62	45	302

4.2 DATA CONSISTENCY

Composition of this particular sample may hold several problems at first sight, based on the argument that observations are settled on different national grounds, which opens up the possibility of existing some sort of bias within the sample, due to different national-level backgrounds where banks operate. Although there is a consensus about globalization of capital and monetary markets, local organization may stifle sample consistency. This argument is worth a close look at the issue.

Each one of the considered countries has a national central bank which contributes to the smooth conduct of policies related to the prudential supervision of banks and the stability of the financial system, on behalf of the ECB, which centrally coordinates the monetary policy of the Euro Currency Union. Hence, the possibility of the sample being biased for enclosing data from 12 different countries is surely influenced by the fact that (i) prudential supervision is homogeneous throughout the Eurozone, and (ii) there are now less significant differences between countries on banks' risk and accounting policies derived from different levels of strictness on that supervision than on the period before Eurozone. Nevertheless, table 4 contains the breakdown by year of accounting standards adopted by banks on the sample.

Table 4 – Evolution of firm-year observations regarding guiding accounting standards

Standards	Year							Total
	2000	2001	2002	2003	2004	2005	2006	
Domestic standards generally in accordance with IASB guidelines	4	4	4	5	7	59	44	127
Domestic standards guided by EU directives *	10	18	37	53	53	3	1	175
Total	14	22	41	58	60	62	45	302

* Prior to the transposition of IAS/IFRS on EU directives, which were inforced to listed companies since 2005.

Table 4 may suggest that final sample would have variables measured differently as accounting standards clearly vary across the sample, derived from the adoption of IAS/IFRS on EU since January 1st 2005, through its incorporation on EU legislation. To tackle that supposition and discern on its possible consequences, see table 5, which contains a condensed list of the main changes between Domestic standards generally in accordance with IASB guidelines and Domestic standards guided by former EU directives, concerning the set of accounting variables on which the theoretical model is based on.

Table 5 – Main changes on accounting standards, affecting relevant accounting variables

Accounting variables	Domestic standards guided by EU directives *	Domestic standards generally in accordance with IASB guidelines
Loans (inc. non-performing)	Acquisition cost	Amortized cost (IAS 39)
Deposits	Acquisition cost	Amortized cost (IAS 39)
Fee income	Recognized as gain/loss at the period it refers to (virtually cash basis)	Deferred recognition as gain/loss if attached to a specific financial instrument (IAS 39 - accrual basis)
Equity	Preferred shares recognized in equity	Preferred shares recognized as a liability (IAS 32 - principle of substance over form)
	Treasury shares recognized as an asset; realized gains and losses recognized in earnings	Treasury shares deducted to equity; fair value changes recognized in earnings

* Prior to the transposition of IAS/IFRS on EU directives, which were inforced to listed companies since 2005.

It is important to state that, before January 1st 2005, Domestic standards guided by former EU directives may have had exceptions to accounting procedures indicated in table 5 due to different local, national level approaches to the EU directives, which were, at the time, considerably unrestrictive. Nevertheless, such looseness on accounting standards is not found to be significant for accounting variables in question on that period, due to common legislative and supervisory entities ever existing throughout Eurozone – from monetary supervision from ECB to stock exchange markets regulation, mainly concerning the mandatory delivery of consistent and reliable information by banks to stakeholders, particularly stockholders.

Amortized cost

After January 1st 2005, the main and significant changes regarding individualized balance sheet items happened to affect a broad extent of financial assets, which are required to be measured at fair value. Yet, along with loans (on asset side), a broad extent of financial liabilities are permitted (but not required) to be measured at fair value. Thus, the large bulk of loans and deposits is accounted at amortized cost by banks (as fair value changes would imply greater volatility and consequent impact on earnings). However, implementation of amortized cost accounting on loans and deposits, mandated by IAS 39, introduces changes on their measurement, as well as on fee income recognition. Received fees and beard direct costs in result of a loan grant or deposit transaction should be included on the initial measurement of the loan/deposit (i.e. its fair value) and then amortized over the life of its underlying loan/deposit. This way, loan/deposit-generated fees are recognized as gain or loss as the loan/deposit approximates its maturity, on an accrual fashion. This procedure contrasts with the former one, where received fees and beard direct costs were recognized directly as gain or loss, in the period it referred to, virtually on a cash basis. Thus, it is the moment of recognition that embodies the difference among accounting procedures. On the other hand, fees not directly related to a loan/deposit are immediately recognized as gain or loss, similarly to the procedure steered by Domestic standards guided by former EU directives.

It is worth to mention that the combined model (as defined in (22)) encompasses information arisen by the interaction between loans (separated in gross loans and non-performing loans), deposits and fee income. The transition to Domestic standards generally in accordance with IASB guidelines and to amortized cost accounting impacts on those accounting variables, indeed. But the bottom line is all value involving loan/deposit transactions and fees generated by those transactions are within combined model, whatever accounting standards are in use:

(1) Fee income corresponds to its homogeneous concept on both standards settings, although the moment of recognition may vary after January 1st 2005;

(2) Loans/deposits correspond to its homogeneous concept before transition to IAS/IFRS (2000-04 period); yet, on the subsequent years, loans/deposits also include fees directly associated to it (amortized until loans/deposits maturity), besides principal amounts.

This fact may reduce consistency in 2005-06 period relatively to the previous period, as fee amounts may be partitioned in three variables (*gl*, *ldep* and *fee*, as in (22)). Nevertheless, fee amounts will always be enclosed on the equation.

Equity

Transition to IAS/IFRS had several implications on equity. Apart collateral effects due to transition-specific adjustments originated by other balance sheet items, equity implications may be resumed to table 5 content – preferred shares and treasury shares.

Impact of change in preferred shares accounting is minimal since it is related to its presentation on balance sheet, rather than its measurement. IAS 32 requires this item to be presented as liability (according to its nature) instead of being presented as an equity component (based on its form of equity instrument).

Change in treasury shares accounting has greater impact, both on presentation and subsequent measurement after initial recognition. After IAS/IFRS transition, treasury shares are no longer presented as trading securities (on asset side); instead, they are deducted to equity. Besides that, and before transition, banks with stock-based remuneration programs only recognized in earnings realized gains and losses. Afterwards, fair value changes associated to stocks granted to employees on those programs are also recognized in earnings, having its counterweight on equity.

Further explanations on the impact of these features are presented ahead, on section 4.4.

Impairment on loans

BCL lending model specification assumes that loan loss allowance is totally dependent of banks management deliberation. As referred on section 3.1.2.2, loan loss allowance is captured by two parameters (δ_{gl} and δ_{npl}), which translate the adopted accounting policy.

Banking supervision has had an important role on prudential requirements over loan losses management. However, transition to IAS/IFRS introduced a specific and complex way of calculating impairment on loans. First, significant loans should be individually assessed for an objective evidence of impairment. Then, (a) significant loans not impaired, plus (b) not significant loans are considered as a portfolio and reassessed for an objective evidence of impairment.

This change on impairment rules has considerable impact and differs significantly from BCL model assumption. This point will be referred on section 4.6.2.

4.3 EMPIRICAL ESTIMATION

This section encloses the statement of empirical estimated expressions of goodwill in terms of lending and borrowing activities, based on the linear combinations of the models described in section 3. These expressions will be empirically tested on the retrieved sample, to allow concluding about the robustness of the referred models on different settings.

The empirical estimation presented on this section will be demonstrated in terms of the combined model. Lending and borrowing models empirical estimation procedures are similar, so they will not be here scrutinized.

The starting point of the estimation of goodwill, derived from the lending and borrowing activities considered together, is the resulting expression of the combined model on (22).

A set of dummy variables will be introduced on empirical estimated equation (one dummy variable for each year), in order to consent financial market volatility to be accounted on the analysis. This way, an artificial intercept will be allowed to vary empirically, according to observation year.

It is relevant to observe that the original model implies that net financial assets are marked-to-market. This means that the coefficient on net financial assets equals 1 and has no effect on goodwill. Rewriting (23) as a function of the market value of the firm (according to (6)) and acknowledging that $bvce_t$ equals the sum of net operational assets and net financial assets at time t helps visualize the previous statement:

$$v_t = (1 + \alpha_{bvce})\ bvce_t + \alpha_{ninv}\ ninv_t + \alpha_{gl}\ gl_t + \alpha_{npl}\ npl_t + \alpha_{nd}\ nd_t + \alpha_{dep}\ dep_{t-1} + \\ + \alpha_{fee}\ fee_t + year\ dummies \tag{23}$$

Assuming that α_{bvce} is null, net financial assets are forced to cause no bias relatively to its market value. However, empirical proof on BCL indicated that net financial assets are biased and, therefore, are not marked-to-market, since α_{bvce} resulted positive and significantly different from zero. As a consequence, empirical estimation is presented in two subdivisions, assuming $\alpha_{bvce} = 0$ or considering $\alpha_{bvce} \neq 0$.

4.3.1 Financial assets marked-to-market

Empirical estimated equation for goodwill on the combined model directly derives from (22), plus an additional set of seven year dummies, as follows:

$$gw_t = \alpha_{ninv}\ ninv_t + \alpha_{gl}\ gl_t + \alpha_{npl}\ npl_t + \alpha_{nd}\ nd_t + \alpha_{dep}\ dep_{t-1} + \alpha_{fee}\ fee_t + \\ + year\ dummies \tag{24}$$

Consistently, estimated equations for lending activity and for borrowing activity correspond to (14) and (18), respectively, plus an additional set of seven year dummies, as follows:

Lending model: $$gw_t = \alpha_{ninv}\ ninv_t + \alpha_{gl}\ gl_t + \alpha_{npl}\ npl_t + year\ dummies \tag{25}$$

Borrowing model: $$gw_t = \alpha_{nd}\ nd_t + \alpha_{dep}\ dep_{t-1} + \alpha_{fee}\ fee_t + year\ dummies \tag{26}$$

4.3.2 Financial assets not marked-to-market

However, according to BCL final conclusions, there is evidence on their study that net financial assets are not booked by its market value, which means that α_{bvce}, as indicated in (23), is not necessarily null.

Relaxing the constraint of net financial assets being accounted at its market value has effect on empirical estimation, as a standard intercept is included on the equation. Subtracting $bvce_t$ to both sides of the equation postulated on (23) provides an alternative goodwill expression. Adding a set of seven dummy variables (representing each year's volatility), results as follows:

$$gw_t = \alpha_{bvce}\, bvce_t + \alpha_{ninv}\, ninv_t + \alpha_{gl}\, gl_t + \alpha_{npl}\, npl_t + \alpha_{nd}\, nd_t + \alpha_{dep}\, dep_{t-1} + \alpha_{fee}\, fee_t + year\ dummies \qquad (27)$$

In this scenario, α_{bvce} should be understood as a market-to-book value multiplier to where the other α's coefficients add their respective independent effect on goodwill. In other words, the α's indicate the incremental coefficient on operational assets and liabilities relative to the base coefficient, α_{bvce}, which multiplies all net assets (including net financial assets).

This is a different point of view from what was defined as goodwill on (24); there, α's indicate whether operational assets and liabilities' associated coefficients significantly differ or not from zero. This distinction is important because it conditions how empirical results should be read.

Coherently, estimated equations are derived from (14), for lending activity, and to (18) for borrowing activity, as follows:

Lending model:
$$gw_t = \alpha_{bvce}\, bvce_t + \alpha_{ninv}\, ninv_t + \alpha_{gl}\, gl_t + \alpha_{npl}\, npl_t + year\ dummies \qquad (28)$$

Borrowing model:
$$gw_t = \alpha_{bvce}\, bvce_t + \alpha_{nd}\, nd_t + \alpha_{dep}\, dep_{t-1} + \alpha_{fee}\, fee_t + year\ dummies \qquad (29)$$

4.4 DATA ADEQUACY

In order to estimate coefficients on empirical equation presented on (24), a measure of all the intervenient variables is required. As often is the case, difficulty arises from the fact that theoretical models are based on concepts not observable on available databases. Thus, it is important to reconcile the desired information with the obtained data. Table 6 summarizes the variables retrieved from CGFS and Thomson ONE Banker, which are expected to embody the theoretical variables presented on section 3.1.

Variable *mv* states firm's market value and it refers only to common shares, for coherence matters. Not every listed company which issued preferred shares have these shares also listed on a stock exchange (or have these shares listed on a different stock exchange than the one where common shares are traded). As *mv* is intended for use on *gw* computation, then accounting variable representing firm's book value should report also only for common shares domain. This justifies *bvce* calculation formula, which deducts preferred shares' book value to firm's equity. Such procedure elicits standard's change (appointed on section 4.2 – see table 5) impact on empirical estimation.

It is important to note that computation of *gl* includes deduction of [Reserves for credit losses] and [Unearned income] to [Loans from customers] because they are included on this CGFS variable but not expected on theoretical model.

Furthermore, due to excessive observations where Non-performing loans was missing, a secondary database was used to minimize observation skiving. Hence, Thomson ONE Banker also provided this item through Worldscope, from which were retrieved data for about one third of final sample (96 observations).

Table 6 – Correspondence of variables used on theoretical model to variables available on CGFS and Thomson*

Variable		Components		Source
Market capitalization	*mv* =	+ MarketCapDaily	[Market Capitalization - Daily] †	Datastream*
Book value of common equity	*bvce* =	+ data215	[Shareholders' Equity - Total]	CGFS
		- data197	[Preferred/Preference Capital-Redeemable]	
		- data198	[Preferred/Preference Capital-Nonredeem.]	
Goodwill	*gw* =	+ *mv*		-
		- *bvce*		
Gross loans	*gl* =	+ data72	[Loans/Claims/Advances - Customers]	CGFS
		+ data70	[Reserves for Credit Losses - (Assets)]	
		+ data71	[Unearned Income]	
New investment in loans	*ninv* =	+ Δ *gl*	‡	-
		+ data427	[Loan Losses Written Off- Charged to Income]	CGFS
		+ data428	[Loan Losses Written Off- Charged to Reserves]	
Non-performing loans	*npl* =	+ data229	[Nonperforming Assets - Nonaccrual Loans]	CGFS
		+ data230	[Nonperforming Assets - Restructured Loans]	CGFS
		+ data231	[Nonperforming Assets - Other R.E.Owned]	CGFS
		+ 02285	[NON-PERFORMING LOANS] §	Worldscope*
Deposits	*dep* =	+ data142	[Deposits - Total - Customer]	CGFS
New deposits	*nd* =	+ Δ *dep*	‡	-
Fee income	*fee* =	+ data335	[Commissions and Fees - Other]	CGFS
		- data376	[Commissions and Fees Paid - Other]	
Total assets	*ta* =	+ data217	[Liabilities & Shareholders' Equity-Total]	CGFS

* Thomson ONE Banker provides data from several databases, such as Datastream and Worldscope.

† Data contained on 'MarketCapDaily' component was cross-checked with the product of 'PriceClose' (last price traded at for specified day) and 'CommonSharesOutstandingDaily' (daily common shares outstanding).
‡ Δ stands for annual change.

§ Data for Non-performing loans variable was retrieved mainly by CGFS and residually by Worldscope* to reduce missing data count.

4.5 EMPIRICAL TESTS

Having in mind the empirical estimated equations postulated on section 4.3, empirical tests will be performed for the three models – lending, borrowing and combined. To simplify and improve readability, variable's time indicators on every empirical estimated equation will be removed henceforth on this section, since all variables are referred to the same time period – except for dep_{t-1}, which will be renamed as *ldep* (lagged deposits). Table 7 presents a summary of descriptive statistics for final sample.

Table 7 – Summary of descriptive statistics for final sample

Variables	Central tendency				Dispersion			Distribution	
	Mean	Q1	Median	Q3	Min.	Max.	Coefficient of variation*	Skewness	Kurtosis
mv	8 827	505	2 722	10 353	26	83 557	1.65	2.64	7.37
bvce	5 125	385	1 304	5 196	43	44 852	1.65	2.45	5.94
gw	3 702	140	888	4 586	- 23 609	49 681	2.11	2.62	10.84
gl	55 053	3 512	15 730	65 904	74	501 322	1.57	2.36	5.99
ninv	4 179	153	926	4 016	- 100 954	288 064	5.81	6.06	69.05
npl	1 441	60	208	1 067	0	18 151	2.01	3.07	10.30
ldep †	42 114	2 409	9 273	47 560	6	380 787	1.69	2.51	6.57
nd	3 610	- 0	383	2 616	- 60 482	150 859	4.55	5.01	39.26
fee	958	55	189	914	- 1	10 073	1.84	2.88	9.20
ta	124 266	5 823	23 970	110 571	445	1126 230	1.77	2.29	4.65

* Ratio of standard deviation to mean.
† See first paragraph of section 4.5.

The analysis of the strength of linear relations between model variables is assessed on table 8. Dispersion and distribution statistics suggest that model variables do not have a normal distribution; nonetheless, Pearson's correlation coefficients are presented, due to its adequacy to continuous variables.

Table 8 – Parametric correlation coefficients between model variables

	Pearson's *r*					
	gl	*ninv*	*npl*	*ldep*	*nd*	*fee*
ninv	0.396					
npl	0.799	0.189				
ldep	0.852	0.118	0.700			
nd	0.477	0.700	0.272	0.304		
fee	0.830	0.141	0.656	0.943	0.364	
gw	0.603	0.490	0.261	0.542	0.496	0.579
R^2 *	0.364	0.240	0.068	0.294	0.246	0.335

* Coefficient of determination resulting from simple linear regression of *gw* against each independent variable (e.g. regression equation: $gw = \alpha + \beta\, gl + \varepsilon$, when independent variable is gross loans), based on correlation coefficient.

The observed sign of all model variables coefficients of correlation is positive. Gross loans (*gl*) is the best individual predictor (r = 0.603) of *gw*, presenting a coefficient of determination of 0.364. Furthermore, except for *npl,* all independent variables present a moderated and positive correlation with *gw* (around 0.5-0.6).

Adding up the obtained information, there are signs that assumption limitations may interfere on linear regression application. It is observable that strong correlation between independent variables (*gl*, *ldep* and *fee* have correlation coefficients above 0.8) may question their independence, causing multicollinearity to emerge. Moreover, dispersion of dependent and independent variables is quite considerable, which may inflict with homogeneity of variance of errors' assumption. Such supposition is compliant with figures from table 7, which suggest that variance of errors could be affected by banks dimension. Attending the disparity between mean and median along with the maximum value of each variable, the belief on the presence of heteroscedasticity is strengthened. White's general test statistic of 249.8 (χ^2 = 69) rejects the null hypothesis of homocedasticity, confirming the existence of such problem on a preliminary regression analysis, performed for combined model with unscaled variables. That argues for a weighted least squares regression, after scaling variables according to bank size.

Such procedure was also followed by BCL due to data fit issues, which allows for a more straightforward comparison of achieved results. BCL used *bvce* as a weight representing bank size. Although it not solved their problem, it improved their White test.

Comparison of *bvce* as weight with alternative weights (*ta* and *mv*) for this study analysis revealed that *bvce* is the best choice for a scaling factor – White's general test statistic: 120.8 ($\chi^2 = 69$). However, it did not eliminate the problem, albeit substantially minimized it. Notation needs to be adapted: prefix '*s_*' is added to all model variables ('*s_*' stands for scaled).

This transformation impacts on both sets of empirical estimated equations stated on sections 4.3.1 and 4.3.2, regarding the acceptance or rejection of the assumption of net financial assets being marked-to-market.

4.5.1 Financial assets marked-to-market

Empirical estimated equations below reflect the change introduced by weighted least squares appliance on equations (24), (25) and (26):

Combined model:

$$s\_gw = \alpha_{ninv}\, s\_ninv + \alpha_{gl}\, s\_gl + \alpha_{npl}\, s\_npl + \alpha_{nd}\, s\_nd + \alpha_{dep}\, s\_ldep + \alpha_{fee}\, s\_fee + \\ + \text{year dummies} \quad (30)$$

Lending model:

$$s\_gw = \alpha_{ninv}\, s\_ninv + \alpha_{gl}\, s\_gl + \alpha_{npl}\, s\_npl + \text{year dummies} \quad (31)$$

Borrowing model:

$$s\_gw = \alpha_{nd}\, s\_nd + \alpha_{dep}\, s\_ldep + \alpha_{fee}\, s\_fee + \text{year dummies} \quad (32)$$

It becomes appropriate to present a new set of descriptive statistics for weighted variables, on table 9.

Table 9 – Summary of descriptive statistics for final sample – variables scaled by *bvce*

Variables	Central tendency				Dispersion			Distribution	
	Mean	Q1	Median	Q3	Min.	Max.	Coefficient of variation*	Skewness	Kurtosis
s_gw	0.97	0.30	0.89	1.47	-1.00	3.87	0.97	0.56	0.35
s_gl	11.30	8.66	10.81	13.70	0.55	30.60	0.37	0.69	2.15
s_ninv	1.17	0.42	1.04	1.93	-6.41	8.19	1.36	-0.22	4.20
s_npl	0.25	0.07	0.15	0.39	0.00	1.54	1.02	1.99	5.57
s_ldep	7.77	5.89	7.44	9.59	0.08	25.48	0.44	0.72	2.76
s_nd	0.60	0.00	0.45	1.09	-5.51	5.25	2.01	0.34	4.69
s_fee	0.17	0.12	0.16	0.21	-0.01	0.50	0.46	0.90	1.94

* Ratio of standard deviation to mean.

Statistic for dispersion' coefficient of variation has drastically improved. Besides, distribution of variables has generally approximated normality. Table 10 contains analysis of linear relations between each model variable, based on Pearson's correlation coefficient.

Table 10 – Parametric correlation coefficients between model variables (scaled by *bvce*)

	Pearson's *r*					
	s_gl	*s_ninv*	*s_npl*	*s_ldep*	*s_nd*	*s_fee*
s_ninv	0.706					
s_npl	0.782	0.587				
s_ldep	0.995	0.681	0.766			
s_nd	0.551	0.778	0.474	0.532		
s_fee	0.968	0.710	0.788	0.973	0.580	
s_gw	0.727	0.654	0.623	0.720	0.559	0.786
R^2 *	0.529	0.428	0.388	0.519	0.312	0.617

* Coefficient of determination resulting from simple linear regression of *s_gw* against each independent variable (e.g. regression equation: $s\_gw = \alpha + \beta\ s\_gl + \varepsilon$, when independent variable is gross loans scaled by *bvce* based on correlation coefficient.

Again, the sign of all model variables correlation coefficients is positive. After applying the scaling factor, the best individual predictor is now *fee*, presenting a coefficient of determination substantially higher than *gl* (unscaled) presented before (0.617 vs 0.364). However, strong correlation coefficients pointed before for *gl*, *ldep* and *fee* are now slightly higher (above 0.9). Such fact alerts for the strong possibility of the presence of multicollinearity on multiple linear regression – this possibility is discussed ahead.

Table 11 shows multiple linear regression results for lending, borrowing and combined models. Adjusted R^2 for each model is presented on last row.

Table 11 – Coefficients of multiples linear regressions, including Huber-White robust *t*-statistics

Variables	Lending model (31)		Borrowing model (32)		Combined model (30)	
	Coef.	*t*-statistic (*p* value)	Coef.	*t*-statistic (*p* value)	Coef.	*t*-statistic (*p* value)
(year dummies) *	0.461	2,46 (0.016)	0.366	2,22 (0.022)	0.100	0.67 (0.314)
s_gl	0.024	1.69 (0.093)	-	-	0.039	2.33 (0.020)
s_ninv	0.221	4.98 (0.000)	-	-	0.192	3.88 (0.000)
s_npl	-0.388	-1.49 (0.136)	-	-	-0.570	-2.13 (0.034)
s_ldep	-	-	0.001	0.06 (0.952)	-0.038	-1.64 (0.102)
s_nd	-	-	0.222	4.25 (0.000)	0.034	0.63 (0.529)
s_fee	-	-	2.200	2.74 (0.007)	3.132	4.15 (0.000)
Adjusted R^2	0.638		0.602		0.664	

* Corresponds to coefficient and statistic average of all dummy variables

Analysis of variance assures that at least one of the coefficients associated to independent variables is significantly different from zero. Huber-White *t*-statistics are presented to control for signs of heteroscedasticity, pointed out by White test previously performed. Multicollinearity diagnostics is presented on table 12.

Table 12 – Multicollinearity diagnostics: Variance Inflation Factor (VIF) and Tolerance

Variables	Lending model (31)		Borrowing model (32)		Combined model (30)	
	VIF	Tolerance	VIF	Tolerance	VIF	Tolerance
s_gl	2	0.291	-	-	20 *	0.049
s_ninv	2	0.446	-	-	3	0.315
s_npl	2	0.403	-	-	3	0.376
s_ldep	-	-	8	0.131	14 *	0.070
s_nd	-	-	1	0.727	2	0.490
s_fee	-	-	7	0.145	7	0.135

* A VIF greater than 10 signals for potencial presence of multicollinearity among independent variables.

Independent variables *s_gl* and *s_ldep* present a high variation inflation factor (VIF), greater than 10, which indicate that multicollinearity is a threat for combined model reliability. This feature is compliant with high correlation coefficient detected earlier on this section between the referred variables (0.995 – see table 10). Such condition is highly undesirable for regression applicability, as coefficients may be distorted and *t*-statistics underestimated.

This strong relation between those variables was expected. This fact is symptomatic of the way banks raise funds for lending operations. Deposits from customers are commonly the cheapest source of funding, which banks redirect to interest generating assets, such as loans. This process represents the traditional intermediation role of banks in the economy, so a link between *s_gl* and *s_ldep* was expected. These two variables also signal for the intensity of the interaction between customers and banks. On this course, table 10 shows that there is also a strong relation between *s_fee* and both *s_gl* and *s_ldep*, suggesting that these two latter generate not only interest flows but also fee income, usually arisen from services that customers ask to banks perform for them. This is true despite fee income is not linked to specific amounts of loans or deposits, unlike interest income. Nevertheless, it seems that a relation between the magnitude of *s_fee* and of the balance variables, *s_gl* and *s_ldep*, persists.

In case of multicollinearity, statistical theory advises to eliminate one of the conflicting variables, since they explain the same portion of dependent variable' variation and, as such, are duplicated on the linear regression equation. As an alternative, statistical theory also suggests that a principal component analysis, aggregating *s_gl* and *s_ldep* in one single factor as independent variable, would solve the multicollinearity issue, preserving both variables explanatory power on *s_gw*. Table 13 contains a comparison of alternatives cited above.

Table 13 – Regression coefficients of alternative solutions for multicollinearity potential presence on combined model (30)

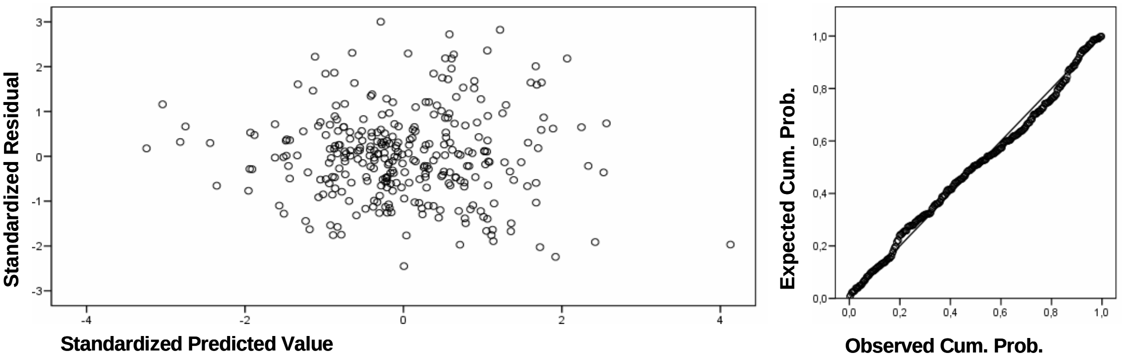
Variables	Supressing *s_ldep*		Supressing *s_gl*		Including factor		Initial combined model	
	Coef.	*t*-statistic (*p* value)	Coef.	*t*-statistic (*p* value)	Coef.	*t*-statistic (*p* value)	Coef.	*t*-statistic (*p* value)
(year dummies) *	0.085	1.37 (0.325)	0.251	1.55 (0.181)	0.254	1.60 (0.216)	0.100	0.67 (0.314)
s_gl	0.018	1.32 (0.188)	-	-	-	-	0.039	2.33 (0.020)
s_ninv	0.207	4.18 (0.000)	0.229	4.86 (0.000)	0.192	4.59 (0.000)	0.192	3.88 (0.000)
s_npl	-0.486	-1.82 (0.069)	-0.381	-1.55 (0.123)	-0.404	-1.57 (0.116)	-0.570	-2.13 (0.034)
s_ldep	-	-	-0.007	-0.39 (0.700)	-	-	-0.038	-1.64 (0.102)
s_nd	0.041	0.78 (0.435)	0.040	0.74 (0.458)	0.042	0.79 (0.432)	0.034	0.63 (0.529)
s_fee	2.636	3.92 (0.000)	2.845	3.90 (0.000)	2.657	3.73 (0.000)	3.132	4.15 (0.000)
Factor †	-	-	-	-	0.164	0.36 (0.717)	-	-
Adjusted R^2	0.661		0.659		0.659		0.664	

* Corresponds to coefficient and *t*-statistic of all dummy variables.
† Factor obtained on principal component analysis from *s_gl* and *s_ldep*, with 98.9% of variance

Suppressing *s_gl* or suppressing *s_ldep* do not comply with theoretical model neither do reveal to be statistically nor significantly advantageous. Initial combined model outperforms alternative solutions regarding *s_gl*, and *s_ldep* reveals to be consistently not significant (eliciting the possibility of multicollinearity being underestimating its *t*-statistic). Thus, none of the variables will be removed from the linear regression equation of the combined model, because such procedure would have greater impact on the interpretation based on the underlying theoretical model than the impact of duplicating the effect of two variables on the statistical analysis of the empirical results. Regression including the principal component reveals the latter not to be significant on explaining *s_gw*. Thus, analysis of results on the following section will anchor on initial combined model, providing the awareness of the verified limitation.

Scatter plots of regression residuals for the combined model provide a straightforward method to assess regression assumptions integrity. Figure 1 present a plot of predicted values of *s_gw* against residuals and a normal p-p plot of standardized residuals:

Figure 1 - Regression residuals plots: financial assets marked-to-market



The plot on the left evidences (1) normality of errors, as residuals range is about [-2.5 ; 3.0] (plot on the right confirms it); (2) linearity, although there is no trace of a curve (the slope tends to be a bit negative but very close to zero); (3) heteroscedasticity, as the spread of residuals is slightly larger when predicted values are higher than when these are lower. Remember that the heteroscedasticity present on this analysis is held as the most correct specification for the data, as weights has been adequately considered. However, the persistence of this situation indicates that an unconsidered and relevant element, that interacts with an independent variable and is not part of regression equation, may exist.

4.5.2 Financial assets not marked-to-market

Empirical estimated equations below reflect the change introduced by weighted least squares appliance on equations (27), (28) and (29), on a scenario where book value of net financial assets is biased:

Combined model:

$$s\_gw = \alpha_{bvce} + \alpha_{ninv}\, s\_ninv + \alpha_{gl}\, s\_gl + \alpha_{npl}\, s\_npl + \alpha_{nd}\, s\_nd + \alpha_{dep}\, s\_ldep + \\ + \alpha_{fee}\, s\_fee + year\ dummies \quad (33)$$

Lending model:

$$s\_gw = \alpha_{bvce} + \alpha_{ninv}\, s\_ninv + \alpha_{gl}\, s\_gl + \alpha_{npl}\, s\_npl + year\ dummies \quad (34)$$

Borrowing model:

$$s\_gw = \alpha_{bvce} + \alpha_{nd}\, s\_nd + \alpha_{dep}\, s\_ldep + \alpha_{fee}\, s\_fee + year\ dummies \qquad (35)$$

The above equations diverge from the ones on the section before because of the introduction of a standard intercept (α_{bvce}). As referred before, such inclusion modifies interpretation of empirical results, as equations (33), (34) and (35) incorporate an implicit market-to-book value ratio, and remaining coefficients on each independent variable represent incremental value added by each variable to that ratio.

Multiple linear regression results for lending, borrowing and combined models are presented on Table 14, where Adjusted R^2 for each model is outlined on last row.

Table 14 – Coefficients of multiple linear regressions, including Huber White robust *t*-statistics

Variables	Lending model (34)		Borrowing model (35)		Combined model (33)	
	Coef.	*t*-statistic (*p* value)	Coef.	*t*-statistic (*p* value)	Coef.	*t*-statistic (*p* value)
(intercept) *	0.495	2,37 (0,035)	0.259	1,26 (0,175)	0.477	2,20 (0,031)
s_gl	0.024	1,69 (0,091)	-	-	0.039	2,36 (0,019)
s_ninv	0.220	4,98 (0,000)	-	-	0.192	3,87 (0,000)
s_npl	-0.391	-1,50 (0,134)	-	-	-0.577	-2,15 (0,032)
s_ldep	-	-	0.017	1,52 (0,128)	-0.038	-1,65 (0,101)
s_nd	-	-	0.164	5,06 (0,000)	0.034	0,63 (0,529)
s_fee	-	-	3.539	6,42 (0,000)	3.153	4,17 (0,000)
Adjusted R^2	0.255		0.251		0.309	

* Corresponds to coefficient and statistic average of all dummy variables

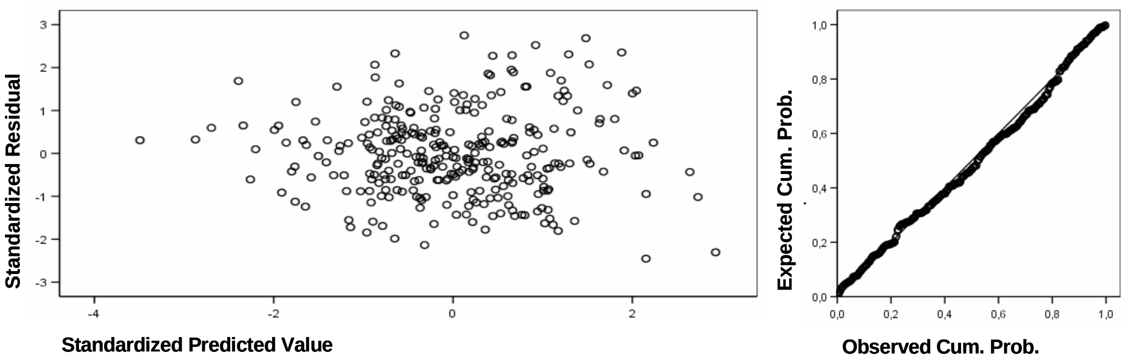
Table 15 contains multicollinearity diagnostics for regressions of table 14, with no indication of any possible problem.

Table 15 – Multicollinearity diagnostics: Variance Inflation Factor (VIF) and Tolerance

Variables	Lending model (34)		Borrowing model (35)		Combined model (33)	
	VIF	Tolerance	VIF	Tolerance	VIF	Tolerance
s_gl	1	0.754	-	-	2	0.405
s_ninv	1	0.688	-	-	2	0.486
s_npl	1	0.794	-	-	1	0.743
s_ldep	-	-	1	0.780	2	0.427
s_nd	-	-	1	0.929	2	0.611
s_fee	-	-	1	0.780	1	0.763

Subsequently, figure 2 presents a plot of predicted values of *s_gw* against residuals and a normal p-p plot of standardized residuals.

Figure 2 - Regression residuals plots: financial assets not marked-to-market



Although presenting higher density around its center, left component of figure 2 strongly resembles to homologous figure 1, so commentaries concerning residual analysis for figure 1 also apply to the one above.

4.6 RESULTS ANALYSIS

This section encloses the linkage between the conceptual model and the empirical tests, presented on sections 3.1 and 4.5, respectively. Coherently, current analysis will also be divided according to the acceptance or rejection of the assumption that net financial assets are marked-to-market. This section also includes suggestions over economic implications of results.

Although this analysis includes comparisons with BCL results, it is pertinent to remember that empirical tests on this study were applied to a Eurozone banks sample on 2000-06 period, differently from what BCL did: their sample represented US commercial banks on 1991-2000 period. Hence, empirical performance of both studies is not directly comparable due to the effect of underlying data fit.

Additionally, BCL variables construction was severely limited by information unavailability, specifically *s_fee* (based on an aggregate of non-interest income to represent fee income) and *s_npl* (considered only non-performing loans on default for more than sixty days).

4.6.1 Financial assets marked-to-market

This section is strictly meant to provide an insight of how the model behaves when this central assumption would be observed, by comparing with BCL results. A thoroughly analysis of coefficients meaning will be disregarded at this point and remitted to the next section (4.6.2), since this assumption has been empirically disproved.

The following table compares results achieved on section 4.5.1 with BCL results, for the three models – lending, borrowing and combined.

Table 16 – Comparison of empirical estimated results with BCL results, assuming net financial assets are marked-to-market

Variables	Lending model		Borrowing model		Combined model	
	(31)	BCL	(32)	BCL	(30)	BCL
(year dummies) *	0.461 †	-12,485 †	0.366 †	-13,523 †	0.100	-12.465 †
s_gl	0.024	0,138 †	-	-	0.039 †	0.048 †
s_ninv	0.221 †	0,011	-	-	0.192 †	0.002
s_npl	-0.388	-1,794 †	-	-	-0.570 †	-2.081 †
s_ldep	-	-	0.001	0.066 †	-0.038	0.049 †
s_nd	-	-	0.222 †	0.128 †	0.034	0.085 †
s_fee	-	-	2.200 †	1.706 †	3.132 †	1.567 †
Adjusted R^2	0.638	0.620	0.602	0.633	0.664	0.652

* Corresponds to coefficient and statistic average of all dummy variables
† Indicates statistically meaningful coefficient estimates (Huber-White robust *t*-statistics greater than ≈ 2), at 0.05 level of significance

BCL concluded there was no indication that lending would be a value-creating activity, since coefficient on *s_ninv* was statistically insignificant – therefore, net new investments on loans were not considered as positive net present value investments. Eurozone banks empirical tests retrieved the exact opposite result, given that coefficient on *s_ninv* was the only significant variable. This suggests that linear information dynamics might be inadequate for modeling Eurozone banks accounting policies regarding loan loss allowance (since *s_gl* and *s_npl* coefficients were verified to be not significant), but recognizes the value arisen from net new investments on loans and its growth ability, not captured by its book value.

Concerning borrowing model, BCL concluded that core deposits intangible were an important unrecorded asset for banks. The present study recognizes that new deposits may be stated as positive net present value investments, due to its influence on fees received from services provided to customers. However, the level of lagged deposits turned out to be statistically insignificant, leading to the notion that book value of deposits matches its market value.

The combination of lending and borrowing leads to a confirmation of value-creating ability of lending activity. Borrowing activity is confirmed to be a fee-generating activity, rejecting deposit taking as a determinant for the creation of unrecorded value for the bank.

4.6.2 Financial assets not marked-to-market

The following analysis encompasses an interpretation of estimated coefficients for the multiple linear regression of the combined model, according to the modified empirical model that rejects the assumption that net financial assets are marked-to-market.

Lending and borrowing models can be directly inferred from the following analysis. To simplify it, the specific results for those two isolated activities will not be presented or discussed here.

Benchmark analysis

Table 17 presents the estimated coefficients obtained on section 4.5.2, against the ones obtained in BCL. For this matter, it is important to be aware that comparable results in BCL for this study correspond to a subset of US large banks sample.

Adjusted R^2 indicated on table last row suggests, at first glance, that this study empirical evidence does not outperform BCL on an overall basis (0.309 achieved on Eurozone banks sample against 0.370 achieved on US large banks sample).

Such means that the model performed best on a US setting for that given period, but at the expense of a reduced set of variables. Curiously, those significant independent variables are *s_fee* and *s_npl*, which were, as referred previously, limited proxies for the desired theoretical variables.

Table 17 – Comparison of empirical estimated results for combined model (Eurozone banks) with BCL results (US large banks), assuming net financial assets are not marked-to-market (including Huber-White robust *t*-statistic)

Variables	Coefficients		H-W *t*-statistics		Sign	
	Eurozone banks	US large banks	Eurozone banks	US large banks	Eurozone banks	US large banks
(intercept) *	0.477	0.697	2.20	5.67	+	+
s_gl	0.039	-0.012	2.36	n.s.	+	-
s_ninv	0.192	0.035	3.87	n.s.	+	+
s_npl	-0.577	-1.525	-2.15	-5.22	-	-
s_ldep	-0.038	0.005	n.s.	n.s.	-	+
s_nd	0.034	0.029	n.s.	n.s.	+	+
s_fee	3.153	1.859	4.17	10.90	+	+
Adjusted R^2	0.309	0.370				

* Corresponds to coefficient and statistic average of all dummy variables
n.s. stands for not significant at 0.05 level, when coefficient estimates' associated Huber-White robust *t*-statistics are lesser than ≈ 2

The number of estimated coefficients with statistical significance resulting from Eurozone banks sample is greater, allowing for a broader extension of coefficients interpretation. Moreover, coefficient on *s_npl* for US large banks sample (-1.525) was inconsistent with combined model specifications, since it exceeded 1. Eurozone banks sample, in turn, gets beyond that caveat and presents a negative value of -0.577 for that coefficient, which complies with model terms. This fact confirms that proxy variable used for non-performing loans on BCL is biased indeed, since model performed coherently on Eurozone banks sample.

Signs are consistent across samples for statistically significant coefficients. Exceptions goes to *s_gl* and *s_ldep*, which revealed to be not significant under US large banks sample (this latter was also not significant under Eurozone banks sample) and presented a strong correlation on Eurozone banks sample.

Intercept interpretation

Coefficient on the intercept states for the variation of market value to book value of a bank (0.477), which corresponds to a market-to-book ratio of 1.477 for all net assets (operational and financial) on banks balance sheet. This value carries the confirmation about the inadequacy of the assumption of net financial assets being marked-to-market, which required that the intercept coefficient would be null, forcing market-to-book value multiplier to equal 1.

The market-to-book ratio of 1.477 for Eurozone banks sample compares with a ratio of 1.697 for US large banks sample. The discrepancy between samples may be explained by a better macroeconomic environment on the US during the 1991-2000 period than on Eurozone during the 2000-06 period.

In fact, a major regulatory change on banking industry towards flexibility and mobility of banks occurred about the same time on US and EU, at the beginning of the 1990s, promoting the liberalization of financial markets and facilitating geographical expansion. This deregulation process allowed banks for lower liquidity risk through diversification of loans portfolio and of deposits base. In result, major mergers and acquisition operations took place, accelerating consolidation of banking industry, which led to significant efficiency gains, substantially increasing competition. In the process, new products and services were introduced to maintain and amplify customers' base, which increased non-interest income weight on banking income.

Such events occurred more markedly on US than on EU. Banking activity is closely connected to the overall performance of the economy, and as US economy had a stronger performance on the mentioned period, it allowed for US banks to present a remarkable growth pace. US banks strategy has been very aggressive and strongly leveraged since, actively focusing on riskier assets with high rates of return (e.g. emerging markets) and less collateral guarantees, which steered toward greater revenue efficiency. In a 2003 Deustche Bank Research publication, twelve US banks were on the world's top-twenty by market capitalization (only two Eurozone banks and four UK banks were on that list).

However, it also may be argued that US banks also beneficiated of internet start-up's euphoria on the US stock market at the middle-end of 1991-2000 period, which may have influenced their market value to fictional levels, away from accounting information. Nonetheless, the discrepancy of market-to-book ratios is naturally accepted, given the facts cited above.

Parameters inference

Lending and borrowing components of the combined model report significant coefficients, allowing to infer about boundaries for parameters imbedded on those coefficients, as they relate to each other. For that purpose, assume (i) l = 4.44%, that is, the risk-free rate corresponds to the compound rate of the annual average of 10-year government bond yields, issued by Eurozone countries over the 1999-2006 period (the weightings are based on each country's nominal stock of government bonds of around 10 years' maturity), and (ii) γ_1 = 97.8%, derived from an average ratio of non-performing loans over total loans of 2.2%, deducted from sample data.

Table 18 contains a relation of combined model's parameters, complying with theoretical model restraints and conjecturing on the following extreme situations:

a) Loan loss allowance is unaffected by the level of gross loans ($\delta_{gl} = 1$);

b) Growth of net new investments in loans is positive ($\omega_{ii} > 0$);

c) Growth of new deposits is positive ($\omega_{dd} > 0$);

d) Growth of new deposits is less then $1 + l$ ($\omega_{dd} < 1 + l$).

Table 18 – Parameters estimation based on regression estimated coefficients (assuming net financial asset are not marked-to-market) and combined model theoretical restraints

Activity	Parameters	Lending activity		Borrowing activity		Admitted interval
		Scenario a)	Scenario b)	Scenario c)	Scenario d)	
	l^*	4.44%		4.44%		-
Lending	γ_1	97.8%		-	-	[0 , 1]
	r_l	7.05%	6.79%	-	-	-
	δ_{gl}	1.000	0.962	-	-	[0 , 1]
	δ_{npl}	0.462	0.424	-	-	[0 , 1]
	ω_{ii}	86.63%	103.70%	-	-	[0 , 1 + l]
Borrowing	$r_d^{\dagger}$	-	-	4.61%		-
	ω_{ff}	-	-	79.0%		[0 , 1 + l]
	$\omega_{fd}^{\dagger}$	-	-	0.068	0.070	[0 , 1 + l]
	$\omega_{dd}^{\dagger}$	-	-	0.000	1.044	[0 , 1 + l]

* Based on external data (source: ECB - Eurostat)

† Based on not significant regression coefficients at 0.05 significance level (α_{ldep} and α_{nd})

Scenario a) is limited by the upper bound of δ_{gl}. Scenario b) sets the minimum value for $\omega_{ii}\ \Phi_i$ on 148.708, since a negative value returned from *($\Phi_{\gamma 1}\ r_l\ \gamma_1$ – 1)* component overwhelms the lowest acceptable value for ω_{ii} (which is zero). Three decimal places are used for this purpose and that $\Phi_{\gamma 1}\ r_l\ \gamma_1$ on scenario b) equals 1.001 to emphasize that *($\Phi_{\gamma 1}\ r_l\ \gamma_1$ – 1)* is greater than zero. Scenario c) and d) are limited by theoretical restraints on ω_{dd} and involves ω_{fd} computation. Interval for loan loss accounting parameters (δ_{gl} and δ_{npl}) is directly backed out from a system of two equations formed by model specification of coefficients α_{gl} and α_{npl}. Values for parameters r_l and ω_{ii} result from that system solution along with a third equation (model specification of coefficient α_{ninv}):

Figure 3 – Scenarios for lending model parameters based on retrieved empirical coefficients

	α_{gl} =	$\Phi_{\gamma 1}\ r_1\ \gamma_1$	− δ_{gl}	α_{npl} =	δ_{npl}	− $\Phi_{\gamma 1}\ r_1\ \gamma_1$
a)	0.039 =	1.039	− 1.000	-0.577 =	0.462	− 1.039
b)	0.039 =	1.001	− 0.962	-0.577 =	0.424	− 1.001

	α_{ninv} =	$\omega_{ii}\ \Phi_i$	* ($\Phi\gamma 1\ \gamma_1\ r_1$ − 1)
a)	0.192 =	4.876	* (1.039 − 1.000)
b)	0.192 =	148.708	* (1.001 − 1.000)

Parameters r_d and ω_{ff} are directly backed out from model specification of α_{dep} and α_{fee} , respectively. Similarly to loan loss accounting parameters, intervals for parameters ω_{fd} and ω_{dd} were backed out from α_{nd}, considering extreme possible values for ω_{dd}.

Parameters interpretation

Concerning loan loss allowance accounting policy, its determinants result from levels on gross loans and non-performing loans – see equation (11). The proportion of non-performing loans that contributes to loan loss allowance figure (δ_{npl}) lies in the interval of [0.424 , 0.462], which oddly means that less than half of non-performing loans amount is being set aside as a provision. On the other hand, the alternative determinant of loan loss allowance *(1 - δ_{gl})* is very close to zero (interval of [0 , 0.038]).

Nevertheless, table 9 discloses the disproportion along gross loans mean and non-performing loans mean – 11.30 and 0.25, respectively (scaled by *bvce*). Translating the interval of δ_{gl} and δ_{npl} to average values scaled by *bvce*, the major contributor to loan loss allowance is gross loans for about 74% of the range of the interval:

Figure 4 - Scenarios for loan loss allowance accounting policy parameters

$$all_t = (1-\delta_{gl}) * gl_t + \delta_{npl} * npl_t$$

a)

$$0.116 = \underbrace{0.000 * 11.30}_{=} + \underbrace{0.462 * 0.25}_{=}$$

$$0.116 = 0.000 + 0.116$$

b)

$$0.535 = \underbrace{0.038 * 11.30}_{=} + \underbrace{0.424 * 0.25}_{=}$$

$$0.535 = 0.429 + 0.106$$

Loan loss allowance (all_t) is positioned over the interval [0.116 ; 0.535], scaled by *bvce*. Adding up this information, loans portfolio quality of Eurozone banks may be assessed by an average ratio of non-performing loans over total loans of 2.2%, corresponding to an average ratio of coverage by provisions from 46% on scenario a) to 214% on scenario b).

The interval of [0.424 , 0.462] for non-performing loans contribution for loan loss allowance (δ_{npl}) is considered to be unexpectedly low. Since these sort of loans are overdue, it was expected an evidence that near all non-performing loans would be provisioned, as default risk is dreadfully high for these items. But if a scenario where δ_{npl} equals 1 is considered, along with retrieved values for coefficients α_{gl} and α_{npl}, the restraint for δ_{gl} is unobserved because this parameter would exceed 1. Thus, scenario a) encompasses the maximum allowed value for δ_{npl}, although it seems insufficient and rather discretionary for a loan loss accounting policy, contrasting with recent risk assessment methodologies mentioned in section 4.2.

Moreover, the present value of interest generated by current performing loans ($\Phi_{\gamma 1}\ r_l\ \gamma_1$) has substantial importance on defining goodwill, since its final effect on goodwill is positively influenced by the level of gross loans, and negatively influenced by the level of non-performing loans. On scenarios a) and b), the implied interest rate on loans denotes a marginal rate of [2.4% , 2.6%] over the risk-free rate (l) and a marginal rate of [2.2% , 2.4%] over the interest rate paid on deposits (r_d).

New investments on loans (*s_ninv*) are considered to endorse positive net present value to the bank, judging by α_{ninv}. Its market value is, on average, 0.669 times greater than its book value (0.477 + 0.192). The inferred interval of values where the growth parameter (ω_{ii}) may be positioned, derived from scenarios a) and b), is [87% , 104%]. Over this implied growth rate interval lays the interpretation that positive net present value of new investments on loans is rather motivated by its growth ability than by the interest margin it generates.

Concerning the borrowing component of combined model, there is only one significant coefficient (α_{fee}). Coefficients on *s_ldep* and *s_nd* were verified not to add any statistically significant contribution for *s_gw* explanation.

Coefficient α_{fee} represents the effect of net present value associated to the persistence of fee income to the next period and it retuned a high and positive coefficient (3.153). Yet, it was expected a simultaneous association of such contribution to statistical significance of the level and renewal of deposits (*s_ldep* and *s_nd*, respectively), on behalf of the relationship between customer savings and the bank. Unlike BCL, which suggested that core deposits intangible were an important unrecorded asset for US large banks, the empirical evidence on Eurozone banks indicates that deposits level is not perceived as a value driver that creates goodwill distinctively from the remaining net financial assets. In fact, the not significant coefficient on *s_ldep* revealed to be negative, signaling for its influence on the equation as a liability. This suggests, according to theoretical model, that banks are supporting a negative spread on customer deposits, where the interest rate paid to customers (4.61%) is higher than the risk-free rate at which banks reinvest those funds (4.44%). Coefficient on *s_nd* is also not significant, indicating that new deposits do not represent additional interest margins, and do not generate additional interaction with customers, drying this potential source of fee income. Conformingly, only 7% of new deposits is inferred to have effect on fee income (ω_{fd}), regarding scenarios c) and d).

Hence, considering the lack of empirical evidence over the association of deposit-taking with fee income, the notion that lending activity is the vehicle sustaining the relationship between customers and Eurozone banks gathers additional strength. Fees received from services provided to customers may arise from lending activity, namely under customer loyalty programs that benefit borrowers who have, for instance, signed other financial products at the expense of a reduction on loans interest rate.

Further analysing α_{fee}, the value retrieved from empirical tests for Eurozone sample clearly surpasses the coefficient presented on US large banks sample (3.153 vs 1.859). Bearing in mind that Eurozone banks were considered to lag on efficiency comparing to US banks, the higher coefficient for Eurozone sample confirms that market investors are expecting a greater growth rate of fee income than on US large banks sample. Since α_{nd} is not recognized as a significant contributor for explaining goodwill, the absolute amount of fee income is held as an indicator of future fee income, pointing to the notion that there is a substantial growth margin for Eurozone banks, comparing to US large banks sample.

Besides that, coefficient of US large banks sample was associated to a proxy variable for fee income, due to data unavailability. That proxy variable corresponded to non-interest income on BCL, which is an aggregate with multiple sources besides fee income. Thus, a bias on linkage between theoretical model and empirical results may be present on US large banks sample.

5 DISCUSSION AND RECOMMENDATIONS

Previous sections presented a work developed on a premise that theoretical models must be empirically proven and, conversely, that empirical analysis must be strongly linked to theory, so results may be provided of full meaning.

5.1 MAIN CONCLUSIONS

The main conclusion of this study grants a direct response to its purpose: the model is now successfully tested on two different samples, which were retrieved from two different financial settings, and although specific details did not converge, the model behavior was consistent, presenting a comfortable level of reliability.

Notwithstanding, a central assumption of the model proved not to be possible to hold, since empirical results were evident to show that net financial assets are not marked-to-market. Nowadays banks offer multiple products and services to its customers, resulting on increased diversity of their balance sheet. The combination of lending and borrowing activities is thus verified to encompass a limited scope of banking business. Goodwill is inherently affected, according to model definition, which means that banks market value comprises other sources of value that are not parameterized on the model. This model caveat was early detected and empirical results were analyzed under that notion.

Eurozone banks showed that the source of goodwill lies mostly on lending activity. Net new investments on loans are perceived as positive net present value investments, while borrowing activity, as defined in combined model, does not endorse significant explanatory power as a whole, contrary to what was found on US large banks sample by BCL. Specifically, deposit taking does not endorse additional value beyond its book value; nevertheless, fee income garnered through financial services provided to customers is recognized to incorporate future value since it is expected that the relationship between the bank and the customer endures. Results suggested that fee income is further connected with lending activity than with deposit taking activity.

Furthermore, empirical evidence has raised some issues over loan loss accounting as defined in the model. The level of non-performing loans set aside as loan loss allowance, resulting from model covenants, is considered to be rather insufficient, given that loan losses is a profoundly regulated matter on Eurozone and that defaulting is the innermost concern regarding banking business risk.

Simultaneously, this work enables an increased understanding over accounting role on banks valuation. It is clear that there is a substantial gap between the information that bank accounting is able to provide and the fair value of a bank, as perceived by the market. Yet, along with standards evolution towards enclosing that gap, this line of work makes possible to successfully identify and blueprint value drivers within banking business. Throughout this study, lending and borrowing have been labeled as the key value-creating activities for a bank, granting focus on the intermediation role of banking in the economy. Model expansions to other concurrent banking activities surely will capture the source of value on a greater extent, as suggested ahead on section 5.3.

5.2 LIMITATIONS OF THE STUDY

Net financial assets were verified to be not marked-to-market, which consists on the major model limitation. This limitation is directly caused by the early designation of the value-creating activities of a bank – lending and borrowing. This step implied the definition of net operational assets for each activity, assuming by default that the excluded net assets were all financial and, therefore, marked-to-market. Following what was mentioned before on the main conclusions, the broadness of that definition was undersized, considering the full scope of today's banking business. Banks balance sheet encloses net assets which should be considered as operational (as suggested on the next section), observing its particular cash flow dynamics and translation of cash flows into accounting accruals.

Moreover, empirical tests were performed smoothly providing uncompromised results. However, given the number of firm-year observations within the Eurozone on the initial set retrieved from CGFS database (prior to sampling process), the expectation would be that final sample would match up to BCL sample (about 1.8 thousand firm-year observations). However, database led to a 302 firm-year observations' sample, substantially less than BCL, but adequate for statistical inference.

The missing data for Non-performing loans variable was the foremost cause for sample size reduction. It imposed a consolidation of CGFS and Worldscope (Thomson Financial) databases on this specific accounting measure, indicating that this kind of information is generally not available for publication, despite of its importance as an indicator for loan portfolio quality. Additionally, as noticed on section 4.6.2, deduction of non-performing loans contribution to loan loss allowance questioned the fit of model specifications and empirical evidence.

Furthermore, the sample encompasses a transition period across Eurozone regarding IAS/IFRS adoption on January 1st, 2005. While the impact of this transition was scrutinized on section 4.2, an unforeseen issue might exist, albeit there is a belief that its effect should be minimal.

5.3 DIRECTIONS FOR FUTURE RESEARCH

This section introduces two concrete directions for expansion of BCL combined model. An extension of borrowing model is suggested and a completely new activity, regarding investment in securities, is proposed. This latter is independent from other activities, facilitating integration on an expanded combined model.

Borrowing model extension

Borrowing model design is partly settled on a generic premise that fee income is influenced by the intensity of interaction between banks and its customers, measured by (1) the level of lagged deposits, (2) new deposits volume and (3) a survivorship term. Additionally, the ability of paying less interest by those deposits than the risk-free interest rate also creates value for the bank.

However, fee income encompasses a broad variety of sources. On a retail perspective, initial model configuration is mainly correct, as individuals tend to exercise a greater volume of transactions with the bank that holds their savings/investments. Yet, on a commercial perspective, that configuration is incomplete. Companies nowadays are severely pressured by growth compromises, which lead to major fund requirements in order to pursuit investment plans for positive net present value projects. These fund requirements are supposed to be fulfilled in several ways. Democratization of capital markets has motivated companies to directly raise funds through debt issuing or securitization, reducing dependency from traditional banking borrowing.

Following that evolution, banks nowadays are increasingly focusing its business on financial services and advisory, causing fee income weight on earnings to progressively balance with interest income weight. Central point of the argument is that this sort of involvement with customers (mainly corporate) is not totally captured by those accounting measures mentioned before (*s_ldep* and *s_nd* were verified to be irrelevant on explaining goodwill for Eurozone banks sample). Specifically, operations to fulfill fund requirements such as the ones referred above are usually backed up by guarantees or loan commitments, which are not considered on financial statements; rather, they are classified as off-balance sheet items, translating contingent assets/liabilities. Banks provide financial and transactional support to those operations through transaction-facilitating, market-making or underwriting, and charge fees according to transaction's complexity, volume and risk. As with deposit-related items, off-balance sheet items are not directly related to the amount of fee income. Instead, their level and growth ability are indirectly influencing fee income, embodying the interaction between customers (again, mainly corporate) and banks that trigger fees.

Hence, the inclusion on borrowing model of a variable that captured the growth ability of relevant off-balance sheet items should be considered on future expansions.

Proprietary trading activity

As banks are facing increasing competitiveness due to capital markets globalization and openness to a larger number of clients, interest income is no longer the bulk of banks' earnings, as customers (mainly corporate) are getting easier access to funds. In result, fee income has already been mentioned as an important alternative for income. However, notwithstanding interest and fee income, a third main source of income is relevant for banking earnings structure – investments in securities.

Banking activities, as postulated so far, have disregarded the role of security portfolios on banks operational activity. This key item has three significant contributions: (1) provides great flexibility on asset liquidity management, leveraging the asset-liability synchronization and facilitating short-term as well as long-term financial planning; (2) enhances asset profitability, by garnering both interest (mostly through debt securities) and dividends (mostly through equity securities), adjusted by portfolio risk management; and (3) permits recognition of gains/losses resulting from market variations when timing is suitable, that is, it allows postponement of transactions to future favorable market windows.

Security portfolios are usually segregated in two: a trading portfolio and an investment portfolio. Trading portfolio incorporates securities which (1) are intended to be held for a short-term period, focusing on taking advantage of market variations, or (2) are in custody in result of an underwriting operation for a corporate customer (typically an equity or debt issue) or for individual customers (normally an investment under the premise of high liquidity for the customer). Accounting standards generally recognize fair value variations of trading portfolio directly on earnings, what compels banks to be quite selective on this portfolio composition.

In its turn, investment portfolio incorporates securities which are intended to be held for a long-term period. Usually, these investments are considered to be strategic and present a lower risk level than trading securities. Accounting standards generally recognize realized fair value variations on earnings and unrealized fair value variations on equity as a revaluation reserve.

A set of variables representing security stocks and new investments on securities, capturing the cash flows dynamics involved would provide an interesting insight for value creating ability of this activity.

Finally, this activity proposed designation – proprietary trading – is meant to distinguish from other financial services which banks provide to customers – namely asset management.

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