



**HAL**  
open science

# Banks' Leverage: Does US Dollar Diversification Really Matter?

Justine Pedrono, Aurélien Violon

► **To cite this version:**

Justine Pedrono, Aurélien Violon. Banks' Leverage: Does US Dollar Diversification Really Matter?. 2015. halshs-01216658v2

**HAL Id: halshs-01216658**

**<https://shs.hal.science/halshs-01216658v2>**

Preprint submitted on 19 Nov 2015 (v2), last revised 17 Feb 2016 (v3)

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

**Banks' Leverage:  
Does US Dollar Diversification Really Matter?**

Justine Pedrono  
Aurélien Violon

# Banks' leverage: does US dollar diversification really matter?

Justine Pedrono\* and Aurélien Violon†

November 19, 2015

Work in progress<sup>1</sup>

ABSTRACT:

Assets of banks located in France are mainly denominated in euro and in US dollar. Currency diversification, which measures how much of assets are denominated in US dollar, implies a credit risk diversification and a valuation effect on assets. Theoretically, as currency diversification affects directly the total composition of banks collateral, it changes their debt capacity and their resilience to economic shocks under given circumstances. Thereby, currency diversification of asset should be relevant to the analysis of leverage and leverage procyclicality. Using very confidential data on credit institutions located in France between 1999 and 2014, we examine whether US dollar diversification of asset is pertinent for the analysis of banking leverage. We adopt the two types of literature on leverage known as the leverage procyclicality and the capital structure decision. Our results confirm previous analysis on leverage procyclicality and capital structure decision. Regarding currency diversification, our results suggest that the currency dimension is relevant to leverage procyclicality and to the role played by collateral as determinant of leverage. Additionally, our analysis underlines the presence of a pure valuation effect due to US dollar diversification. It confirms the importance of the exchange rate channel when assets are denominated in foreign currency. As leverage is mainly driven by assets, currency mismatch should not affect leverage. Our results supports this last theoretical expectation.

JEL classification: F3, F4, G15

Keywords: procyclical leverage, capital structure, currency diversification, currency mismatch.

---

\* Aix-Marseille University (Aix-Marseille School of Economics), CNRS & EHESS

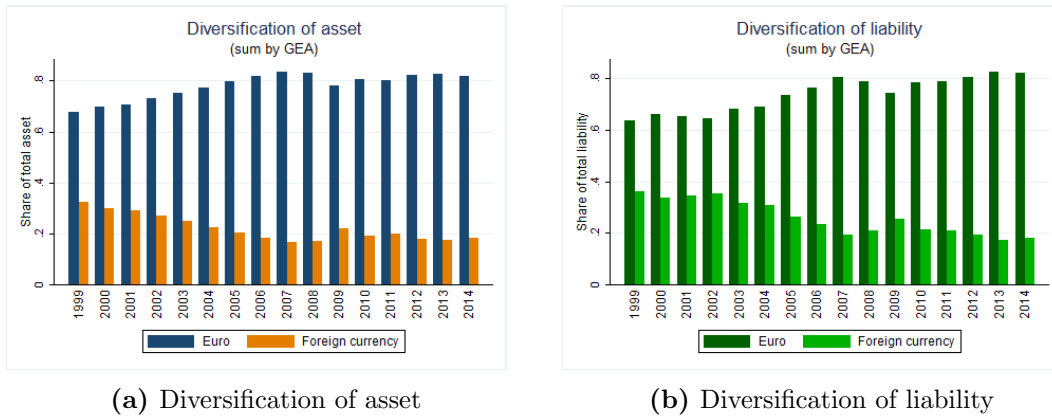
† Banque de France - ACPR

<sup>1</sup>DRAFT PAPER: Please do not cite or circulate without the author's permission

## Introduction

With the subprime crisis, leverage procyclicality and leverage determinants have redrawn researchers' intention. On one hand, numerous papers such as Adrian and Shin [2008, 2010], Adrian et al. [2012], Adrian and Shin [2013], Baglioni et al. [2013a] focus on the relationship between the leverage's dynamic and the economic and financial environment. This approach is linked to the financial accelerator theory developed by Bernanke and Gertler [1989]. Banks, and especially investment banks, use their financial assets as collateral to raise funds. As their financial assets are marked to market, they follow the dynamic of the business cycle. During economic boom, the value of asset increases and the banks' leverage goes up. By increasing their investment, banks feed the positive cycle on assets. This mechanism goes along with an endogenous process as developed in Adrian et al. [2012] and it implies that banks follow a Value at Risk rule. Thus, the pre-2008 period was characterized by a leveraging while the post subprime crisis is characterized by a deleveraging of investment banks. On the other hand, recent papers such as Gropp and Heider [2010], Kalemli-Ozcan et al. [2011] focus on the determinants of leverage. This part of the literature uses the classical capital structure theory which combined several lagged explanatory variables such as banks size, profitability and collateral. The attention is not in the leverage growth rate - as for the leverage procyclicality - but on the leverage taken in level. In so doing, they confirm the importance of collateral as a determinant of the leverage especially for investment banks. The two types of literature are linked to each other through the attention they pay to the collateral.

Additionally, the recent subprime episode has also highlighted the international implication of European global banks on the US financial markets. Following Borio and Disyatat [2011], Baba et al. [2009], McGuire and Von Peter [2012], European banks were largely involved in US money markets by using their local subsidiaries as sources



**Figure 1: Balance sheet diversification**

of funding. Because of their large investments in the United States, European banks also contributed to the subprime bubble. Considering this international development, European banks are supposed to have some degree of currency diversification of both their assets and their liabilities. Figure 1 confirms this currency diversification for credit institutions located in France. It provides the average share of assets (a) and liabilities (b) denominated in foreign currency or in euro. Unsurprisingly, the euro is dominant over the period. Between 1999 and 2007, its share grown mainly due to the introduction and the enlargement of the currency area. However, currency diversification measuring by the share of assets or liabilities in foreign currency includes a significant part of the banks' balance sheet over the period and it regains weight since 2008.

A currency diversification of asset changes the composition of collateral and the bank's responsiveness to the business cycle. As developed in Pedrono [2015], a bank's balance sheet is expressed in domestic value thereby implying a converting process for assets initially denominated in foreign currency. Thus total collateral of the bank, which is part of total assets, is also affected by this conversion. Additionally to the diversification on credit risk, currency diversification introduces an exchange rate channel on the determination of the leverage known as the valuation effect. Depending on the exchange

rate regime and the correlation between assets in the bank's portfolio, currency diversification affects leverage determination. Theoretically, when the exchange rate regime is floating and the financial markets are not completely correlated, currency diversification should reduce leverage procyclicality.

Empirically, currency diversification has not been included neither in the analysis of the leverage procyclicality nor in the study of the leverage determinants. Past analyses such as Burgman [1996], Chen et al. [1997], Griffin and Karolyi [1998], Singh and Nejadmalayeri [2004], Akhtar [2005], include an international diversification dimension but, it focuses on the resident non-resident characteristic. Supposing that having external activities does not necessarily imply different currencies, this analysis does take into account the potential exchange rate channel.

Besides the recent renewed interest of academic literature in banking leverage issues, financial regulators have also been more and more focused on this topic over the past few years. In 2010, the Basel Committee on Banking Supervision (BCBS) introduced a leverage ratio as a key component of the Basel III framework.<sup>2</sup> At the time we are writing this paper, some jurisdictions such as the United States and the United Kingdom have already declared their will to implement a binding minimum leverage ratio requirement in line with the Basel approach. In the European Union, the leverage ratio requirement is still under review by the European Commission. Therefore, knowing that financial regulators are paying closer and closer attention to banking leverage, we believe that shedding light on the relations between currency diversification and leverage characteristics can also be of major interest for banking supervisors.

---

<sup>2</sup>In this paper, we define banking leverage as the ratio of assets divided by equity. In the regulatory perspective, the reverse is more frequently used: the leverage ratio divides a capital measure by an exposure measure. Therefore, setting a minimum requirement to the leverage ratio is strictly equivalent to setting a maximum on banking leverage. <http://www.bis.org/publ/bcbs189.pdf>

The purpose of this paper is to feed the current gap in the literature by developing an empirical analysis on the link between bank leverage and currency diversification. More precisely, we want to investigate the effect of total asset's US dollar diversification on leverage. Our analysis is thus different from the optimal portfolio literature. As leverage should be driven by asset, we focus on this side of the balance sheet. We do not especially focus on currency mismatch.

We use innovative micro and confidential data on credit institutions located in French between 1999 and 2014. Accessing to this kind of data gives us all information on the currency breakdown of each bank's balance sheet. To our knowledge this paper is the first attempt to link empirically currency diversification with leverage dynamics. This is the main contribution of this paper. Our results confirm previous analysis on leverage procyclicality and capital structure decision. Regarding currency diversification, our results suggest that the currency dimension is relevant to leverage procyclicality and to the role played by collateral in the determination of leverage. Additionally, our analysis underlines the presence of a pure valuation effect due to US dollar diversification. It confirms the importance of the exchange rate channel when assets are denominated in foreign currency. As leverage is mainly driven by assets, currency mismatch should not affect leverage. Our results supports this last theoretical expectation.

The remainder of the paper is organized as follows. Section 1 provides some theory development on leverage procyclicality related to Adrian and Shin [2010, 2013], Pedrono [2015]. Section 2 describes the data set and provides details on the sample selection. Section 3 gives some descriptive statistics on variables we are interested in, with a specific focus on currency diversification. As we want to examine whether the currency diversification is relevant for both part of the literature, section 4 provides details on the two models we use. Results are given in section 5.

# 1 Theory on leverage procyclicality

Following Adrian and Shin [2010, 2013], the leverage procyclicality is derived from the definition of the Value at Risk (VaR) and the fact that banks are dynamic in the management of their balance sheet. Considering a random variable  $A$  for the value of asset at a given horizon, the VaR can be defined as the maximum loss  $V$  of asset value  $A_0$  with given probability. Formally, the banks Value-at-Risk at confidence level  $c$  relative to some base level  $A_0$  is smallest non-negative number  $V$  such that:

$$Prob(A \leq A_0 - V) \leq 1 - c \quad (1)$$

Then, the VaR rule stipulates that banks maintain a sufficient amount of equity  $E$  to cover potential loss  $V$  such that:

$$E = V \quad (2)$$

To be solvent, bank adjusts its exposure when the situation is more risky. Thereby, bank brings its VaR back in line with its equity.

Bank's leverage  $\lambda$  is defined as a ratio of total asset over equity such that:

$$\lambda = \frac{A}{E} = \frac{A}{V} = \frac{1}{v} \quad (3)$$

$$\text{where : } v = \frac{V}{A}$$

Where  $v$  is the unit VaR that we can interpret as a risk premium. As demonstrated in Adrian and Shin [2010, 2013],  $v$  is counter-cyclical. It means that leverage goes positively with total asset.



Introducing currency diversification changes the definition of total asset. Note  $A$  the domestic asset in domestic currency and  $A^*$  the foreign asset in foreign currency. Thereby, total asset expressed in domestic currency is the sum of  $A$  and  $SA^*$  where  $S$  is the exchange rate. The leverage becomes:

$$\lambda = \frac{A + SA^*}{E} = \frac{A + SA^*}{V} = \frac{1}{v} \quad (4)$$

$$\text{where : } v = \frac{V}{A + SA^*}$$

Adding a foreign asset changes the definition of the risk premium which now depends on both assets expressed in domestic currency. It follows that leverage is still positively related to total asset but this relationship depends on the degree of currency diversification. If both assets are positively correlated but not completely, and if the exchange rate regime is fixed, the introduction of a second asset diversifies the credit risk. The leverage procyclicality is thereby reduced.

Consider a floating exchange rate regime with a cyclical domestic currency as euro is supposed to be. Following Pedrono [2015], floating exchange rate implies additional space capacity on the bank's balance sheet through a valuation effect. As balance sheets are expressed in domestic currency, the converting process affects the weight of assets within the bank's portfolio. Under these assumptions, a floating regime implies a growing share of the asset that offers higher returns. Space capacity on the bank's balance sheet is thereby going up. Compared to fixed exchange rate, it increases procyclicality. However, it results from the combination of the two effects a decrease in the leverage procyclicality.

Following this literature, currency diversification is challenging leverage procyclicality through its impact on total asset. Our main focus should be on the interaction term between total asset and currency diversification.

Additionally, the theoretical results suggest that currency mismatch is irrelevant for the leverage procyclicality. As leverage is driven by the composition of assets, currency diversification of liability does not affect the relationship. This empirical analysis is a great opportunity to verify whether currency mismatch is pertinent.

## 2 Data set and sample selection

Our sample consists of french and foreign credit institutions located in France. Data are collected by the french banking supervision authority known as the ACPR. Data are on a yearly basis from 1999 to 2014 included.

A first sample selection is directly applied within the request conditions of the data. Thus, our data concern all institutions that are subject to the monetary statistic.<sup>3</sup> For the other institutions, there is a selection on the total amount in foreign currency of their balance sheet: institutions with less than 800 million euros in foreign currency are excluded to the sample.

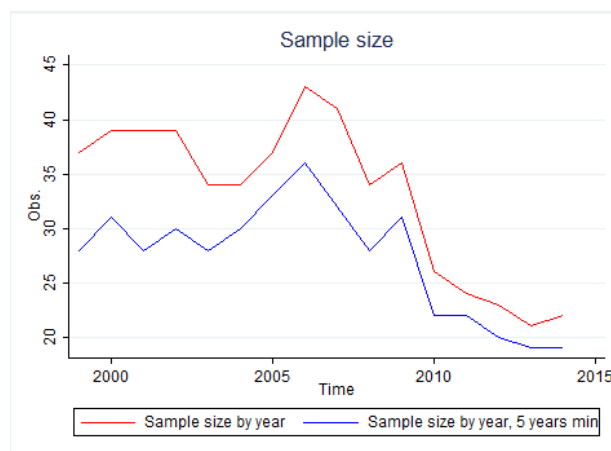
We add two other sample selections to built sub-samples. First, we keep credit institutions which have a minimum of 5 years occurrence over the period. It brings more stability on our sample. Second, we identify investment banks by following the methodology of Baglioni et al. [2013b] except that we focus on the type of liabilities the bank uses. Contrary to the United States, banks in France can make both opera-

---

<sup>3</sup>It includes all institutions that are large enough to be under the scope of the ECB for the monetary policy.

tions under the same entity. There is no distinction between commercial and investment banks. Under these circumstances, they are called universal. However, according to Adrian and Shin [2013] investment banks are supposed to be more procyclical. In this paper, a credit institution is thus identified as an investment bank if its average ratio of deposit to total debt is lower than the median value of the total sample over the period.

Because of bankruptcies, sample selection and merger acquisitions, our panel is unbalanced. Figure 1 illustrates the evolution of our sample. We have a total of 529 observations over the period for the all sample (red line) with a minimum of 21 observations in 2013 and a maximum of 43 observations in 2006. The decline in observations since 2006 can be partly explained by the concentration of the french banking system. Introducing the constraint of a 5 years occurrence (blue line) reduces the sample size for each period.



**Figure 2: Sample size.** The red line consists of credit institutions located in France. Institutions are either subject to monetary statistics or they have at least 800 million euros in foreign currency in their balance sheet. The blue line illustrates the institutions that have at least a five years occurrence over the period.

The final data set brings together two types of data. First, we focus on classical

accounting data such as total asset, collateral, equity, net income and interest product. Those data can be collected at a different level of consolidation depending on the credit institution. For large and international institutions, data are consolidated using the IFRS accounting standards. Smaller parent institutions provide consolidated data and use french accounting standards (FRGAAP). Finally, stand-alone institutions provide unconsolidated data.

As we are interested in the global banks' strategy, we institute a prioritization rule which says that the higher level of consolidation will be always preferred for each period. With years, consolidated data becomes more and more dominant. In 2014, all the data are consolidated. As the three different levels of consolidation may imply different rules and definitions of the balance sheet components, we control for it in our analysis.

The second type of data includes foreign currency exposures. On the asset side, we get the currency breakdown of credits and debt securities, while the liability is composed of total deposits and debt issued. The currency breakdown is given for 5 major currencies known as the euro, the US dollar, the Japanese yen, the Swiss franc and the Pound sterling.<sup>4</sup> As data are expressed in euro, the exchange rate channel is already included in the final degree of currency diversification.

Exposures in currencies are unconsolidated. As our interest is on the global analysis of banking groups, we need to build a proxy of consolidated diversification. The solution we choose consists in adding up currency exposures of all affiliates in the same banking group. Thereby, currency diversification of a banking group is measured through a ratio of total amount denominated in a given currency relative to the total amount in all currencies.

---

<sup>4</sup>The Pound sterling is only available since 2003. Before 2003, it was included in the "other" category.

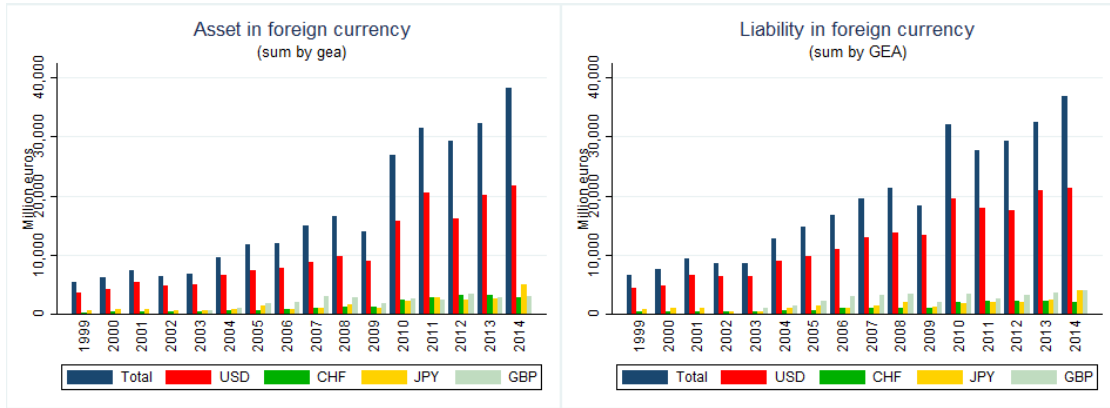
This measure may have two issues. First, there is a risk of a double counting because of intra-group flows. However, as long as diversification is a ratio, the double counting issue appears in both the numerator and the denominator. It mitigates the risk. Second, unconsolidated data do not include exposures of affiliates abroad. Thus, this measure of currency diversification might underestimate the true degree of diversification of a banking group.

An alternative of this measure of currency diversification consists in keeping the exposures of the head of the group only. However, this alternative shows really thin differences with our measure, except for cooperative banking groups. As cooperative banking groups are more decentralized, we believe that our measure better captures the overall currency diversification of these groups.

### **3 Descriptive statistics**

Figure 3 provides the foreign currency breakdown of assets and liabilities over the past fifteen years. For both sides of the balance we observe a growing trend of activities denominated in foreign currencies as developed in Borio and Disyatat [2011], Baba et al. [2009], McGuire and Von Peter [2012]. Despite this global progression, two main shocks are observable. The financial crisis and the US dollar shortage stand out with the slowdown of 2008 and the decline of 2009, while the disturbances due to the euro area debt crisis show up in 2011 and 2012.

With no surprise, the US dollar is the first foreign currency for both assets and liabilities. Another currency also emerges from figure 3 especially in the recent years, the Japanese yen. As observed in McGuire and Von Peter [2012], the Japanese yen has



(a) Asset

(b) Liability

**Figure 3: Currency breakdown of foreign currency exposures**

always been part of the foreign assets and liabilities for the past twenty years. However, before the crisis European banks were also highly dependent on US money markets even for non US areas like Asian countries thereby creating an asymmetry in their balance sheet. In the recent years, Japanese yen gains weight which might translate an adjustable strategy from European banks. It becomes the second foreign currency for assets in 2011 2013 and 2014 as illustrated in figure 5)a, and it is the second foreign funding currency in 2014 as illustrated in in figure 5)b. This recent evolution of the Japanese yen is also generalized worldwide. Between 2010 and 2013, Japanese yen has known the most important jump in trading activity according to BIS-Survey [2013]. Since the last survey in 2010, trading in Japanese yen increased by 63% and the turnover in the USD/JPY pair rose by 70% in this period. As a result, the yen expended its worldwide share in FX trading by 4%. The confirming recovery of banking activity in 2014 highlighted in BIS-Quarterly-Review [March 2015] has probably contributed to the 2014 yen boom in France. Among the advanced economies, the revival of cross-border bank lending to Japan stands out with a annual percentage changes larger than 15% for the second half of 2014. Additionally, between the end of 2010 and the end of 2014, the annual percentage changes of cross-border claims in Japanese yen was positive while the US dollar

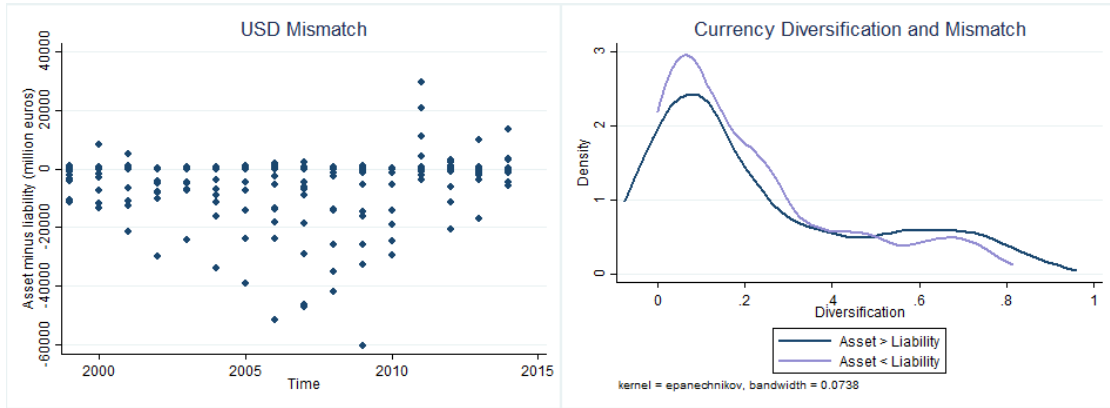
fluctuated between positive and negative percentage rates. Finally, the combination of large cross-border claims to Japan and accommodating monetary policy in Japan may have encourage french banks' funding in Japanese yen in 2014 as observed in figure 3)b.

Figure 3 also highlights a potential currency mismatch between assets and liabilities with a dominance of the latter. These results might seem different to McGuire and Von Peter [2012] - where net foreign positions for French banks is positive - but it is not. We are looking at the positions in foreign currency where euro is excluded while it is included in the McGuire and Von Peter [2012] all currencies net positions. Focusing on US dollar exposures, figure 4)a. confirms the currency mismatch by plotting the difference between assets and liabilities denominated in US dollar. Despite the heterogeneity between credit institutions, the pre-crisis period is characterized by a growing US dollar currency mismatch which confirms the balance sheet asymmetry. In McGuire and Von Peter [2012], we find also negative foreign positions in US dollar in several periods before 2009.<sup>5</sup> In both analysis, the crisis seems to have a readjustment effect where currency mismatches reduces since 2007.

Theoretically, currency mismatch is not supposed to affect leverage procyclicality. However, we include this dimension in our analysis in order to see whether it is relevant or not. We identify with a dummy credit institutions that have a positive mismatch with higher assets in foreign currency and credit institutions with a negative currency mismatch. With such a distinction, we might think that the dummy would capture the degree of currency diversification of asset but it is not. Figure 4)b. plots the currency diversification of asset for the two types of credit institutions. As both distributions include high degree of currency diversification and similar shape, the introduction of the mismatch position might not diminish the effect of diversification in regressions.

---

<sup>5</sup>Especially for 2001-2002Q2, 2003Q2-2003Q3, 2004Q4, 2005Q4, and 2008. However, they focus on net foreign positions while we focus on net positions including domestic and foreign positions.



(a) Currency mismatch

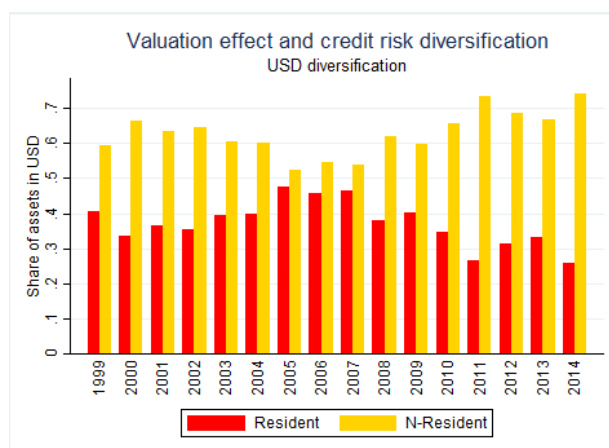
(b) Mismatch and distributions (1999-2014)

**Figure 4: Currency mismatch**

Currency diversification implies two effects on collateral. First it introduces a diversification in credit risk if assets are sufficiently different. Second it induces a valuation effect due to conversion. Figure 5) illustrates the contribution of pure valuation effect in US dollar diversification. Share of assets denominated in US dollar with euro area counterparty should not imply a credit risk diversification. Shares relative to non-residents induce both effects for reporting banks. Following the red bars, the pure valuation effect due to currency diversification had increased between 2000 and 2007. After the crisis, US dollar diversification mainly concerns non-resident counterparty.

The two main variables we are interested in show specific characteristics that might induce empirical issues in the last part of our analysis. For both the currency diversification of asset (figure 6)a.) and the leverage (figure 6)b.), graphs show the presence of heterogeneity. For each variable there is a concentration of institutions below the median while the upper distribution of the two variables is less concentrated. Second, distributions of each variable are quite stable over time. In figure 6)a. red circles consist of credit institutions that had a currency diversification higher than 0.5 in 1999, while

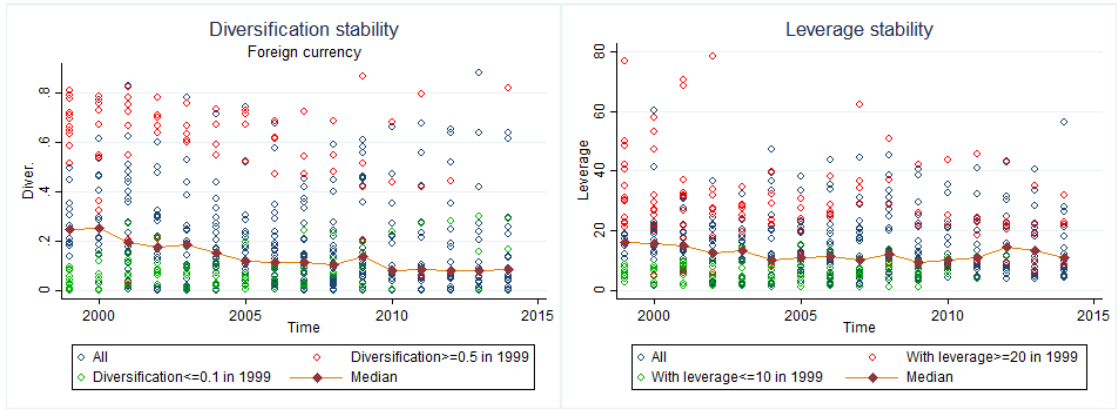




**Figure 5: Currency diversification of asset:** Resident includes all euro area counterparty while "N-Resident" excludes euro area counterparty. Bars are for average shares of assets in USD related to each counterparty. Only banks that have a US dollar diversification are included in this graph.

green circles represent institutions with a currency diversification lower than 0.1 in 1999. Figure 6)a. suggests that there is no reversal of the situation. The highest diversified institutions stay highly diversified over time while the lowest diversified institutions stay in the right side of the distribution except for some institutions in the recent years. This assessment is also true for the leverage in figure 6)b. Credit institutions with leverage higher than 20 in 1999 are in red while institutions with leverage lower than 10 in 1999 are in green. The stability in the leverage distribution has been well documented by Lemmon et al. [2008]. According to this analysis, the stability in distributions might imply some identification issues when we introduce banks Fixed-Effects.

Finally, table 1 presents summary statistics for all variables included in our analysis where size is the logarithm of total asset,  $\Delta$ Leverage and  $\Delta$ Asset are the annual growth rate of leverage and asset respectively. Profit. is a ratio of net income over total asset and it measures the profitability of credit institutions. Diver is the US dollar currency diversification and US dollar diversification with resident counterparty is defined through Diver\_RES. As our motivations come from the international involvement of European



(a) Currency diversification of asset

(b) Leverage

**Figure 6: Heterogeneity and constant distributions**

banks in the US financial markets, the rest of the paper focuses on US dollar diversification. Finally, the two dummies Invest. and Mis. Pos. are also included to count for the identification of investment banks and mismatch positions respectively.<sup>6</sup> The standard deviation, minimum and maximum confirm the presence of heterogeneity in our sample. For instance, the collateral ratio, defined as a ratio of all debt securities over total asset, highlights the presence of heterogeneity. Some credit institutions do not have any collateral while others mainly have financial assets in their total asset with a maximum of 81%.

<sup>6</sup>The complete definitions of variables are provided in the appendix.

**Table 1: Summary statistics**

These summary statistics are for the complete sample over the period 1999-2014. This table presents variable averages, standard deviation, minimum and maximum. Variable definitions are provided in the appendix.

Variable	Mean	Std. Dev.	Min.	Max.	N
Leverage	16.04	12.67	1.14	78.68	529
Size	8.52	2.81	2.76	14.5	529
$\Delta$ Leverage	-0.02	0.25	-1.43	1.19	444
$\Delta$ Asset	0.03	0.22	-1.6	1.1	444
Profit.	0.01	0.02	-0.05	0.2	529
Coll. Ratio	0.2	0.2	0	0.81	529
Diver	0.17	0.2	0	0.84	529
Diver.RES	0.05	0.09	0	0.67	529
Invest.	0.49	0.5	0	1	529
Mis. Pos.	0.5	0.5	0	1	529

## 4 Models

There are two approaches available for this analysis. First, we focus on the approach proposed by Adrian and Shin [2008]. They focus on the procyclicality of leverage while the second approach looks at the determinants of leverage in level.

### 4.1 Leverage procyclicality and currency diversification:

Adrian and Shin [2008] develop an error correction model which links changes in leverage with changes in asset thereby confirming the procyclicality of the leverage. By showing a strong and positive relationship, they demonstrate that financial intermediaries adjust their balance sheet actively. In their model, the dependent variable is the log difference of leverage  $\Delta$ Leverage and the variable of interest is the log difference of total asset  $\Delta$ Asset. Thanks to this specification they also highlight that the leverage is a mean reverting process with a negative relationship between the dependent variable and the lagged value of leverage in log.

As explained in section 1 currency diversification should challenge leverage procycli-

cality through its impact on total asset. We introduce in this model an interaction variable between changes in asset and US dollar diversification at the previous period thereby capturing the impact of the initial currency diversification. We add *Divers* which measures the degree of US dollar diversification at the previous period. *Divers* is part of the control variables as our interest is really on the interaction term. The complete specification is of the form:

$$\begin{aligned} \Delta Leverage_{i,t} = & \alpha + \beta_1 \ln(Leverage_{i,t-1}) + \beta_2 \Delta Asset_{i,t} \\ & + \beta_3 (\Delta Asset_{i,t} \times Divers_{t-1}) + \delta Controls + \gamma FE_{time} + u_{i,t} \end{aligned} \tag{PRO}$$

Where  $\Delta$  represents the difference between  $t$  and  $t - 1$ . We introduced three control variables in *Controls* in addition to *Diver*. First, we define a ratio of total off-balance to total asset and we keep the log-difference of it. This variable would control for hedging strategy. Second, we use a dummy *Conso* which is equal to 1 if the data are consolidated. Finally, we introduce another dummy *IFRS* which is equal to 1 if credit institutions are under the IFRS accounting standards. These two dummies control for the different sources we have explained in section 2. They are also taken in difference. As we want to see whether the mismatch position is relevant or not for the leverage procyclicality, we introduce in some specifications a dummy *Mis. pos* which is equal to 1 if total asset denominated in foreign currency is higher than total liability denominated in foreign currency. Finally, we control time fixed effect in order to capture crisis and changes in regulation.  $u_{i,t}$  is the term of error.

Despite its interesting approach, this first specification may include some endogeneity. As the dependent variable and the explanatory variable *Asset* are contemporaneous, it is difficult to identify the causality of the relationship. As an alternative, we develop a

second approach relative to the literature on capital structure.

## 4.2 Currency diversification as a determinant of the leverage:

The capital structure approach focuses on the determinants of the leverage in level. In this global approach, all variables are in level and the explanatory variables are lagged as in Gropp and Heider [2010]. Two main theories feed this approach, the trade-off theory from Kraus and Litzenberger [1973] and the pecking order theory from Myers and Majluf [1984]. All together, they identify four main determinants of the leverage.

The trad-off theory suggests that *Size* affects positively the leverage. Larger institutions benefit from an implicit protection against bankruptcy because of their too big to fail position. There is less risk for creditors and the cost of raising debt decreases. Banks have thereby an incentive to increase their leverage.

Regarding profitability captured by the variable *Profit*, the trade-off theory predicts that higher profitability decreases the cost of raising debt because of the good signal sent to creditors. Thus, the relationship should be positive. On the contrary, the pecking-order theory suggests a negative relationship. Institutions with large profits would prefer to use this resource instead of new to debt or additional equity. In fact issuing new debt or increasing equity is quite costly for the bank.

According to the trade-off theory, the collateral measured by the variable *Coll. ratio* gives a guarantee for the creditors of the institution. Considering that more collateral reduces the cost of debt, banks should have higher leverage.

Following the literature on multinational companies and internationalization<sup>7</sup>, we

---

<sup>7</sup>Burgman [1996], Chen et al. [1997], Griffin and Karolyi [1998], Akhtar [2005]

may think that US dollar diversification induces two potential and opposite effects. In one hand, it allows a credit risk diversification of banks' total asset. Assuming that US dollar diversification also concerns bank's collateral, collateral is diversified regarding risks and offers a better guarantee for creditors. US dollar diversification may thereby increase the role played by collateral in the determination of leverage. In the other hand, US dollar diversification induces extra monitoring and risks about exchange rate fluctuations. Considering that exchange rate is floating, US dollar diversification may reduce the role played by collateral as a determinant of leverage. These two effects are captured by the interaction term between the collateral ratio and US dollar diversification with the coefficient  $\beta_5$ . As it includes opposite effects, the expected sign of  $\beta_5$  is undefined. We introduce *Divers* with  $\beta_4$  as a control variable.

The final specification is of the form:

$$\begin{aligned} \text{Leverage}_{i,t} = & \alpha + \beta_1 \text{Size}_{i,t-1} + \beta_2 \text{Profit}_{i,t-1} + \beta_3 \text{Coll. ratio}_{i,t-1} + \beta_4 \text{Divers}_{i,t-1} \\ & + \beta_5 (\text{Coll. ratio}_{i,t-1} \times \text{Divers}_{i,t-1}) + \delta \text{Controls} + \gamma \text{FE}_{time} + u_{i,t} \end{aligned} \quad (\text{CAP})$$

Where the *Controls* variable includes same variables as in the first approach *Off BS*, *Conso*, *IFRS* and *Mis. pos* except that they are in level.

## 5 Empirical findings

Four samples are studied in this paper. In (1) we include all observations without additional restrictions. It corresponds to credit institutions subject to monetary statistics or credit institutions with at least 800 million euros in foreign currency in their balance sheet. Then, we keep in (2) only institutions with a minimum of 5 years occurrence over

the period. As previous empirical research have shown difference in leverage between investment banks and commercial banks, (3) only includes institutions that have been identified as investment banks. In the last sample (2+3), we combine the last two constraints and keep investment banks with at least 5 years occurrence. We performed unit root tests on each variable.

As our sample includes a long period where banks faced regulatory changes and crisis, time fixed-effects may capture that changes over time. Additionally, we also consider a two periods decomposition to verify that estimators are not completely biased by the crisis.

## **5.1 US dollar diversification of asset and leverage procyclicality:**

### **5.1.1 A global vision from 1999 to 2014:**

Table 4 reproduces similar results as in Adrian and Shin [2008]. With a negative and significant coefficient for all specifications, we can confirm the mean reverting process of the leverage. All coefficients relative to the growth rate of asset are positive and significant thereby confirming the leverage procyclicality. The largest leverage procyclicality is observed when we focus on investment banks with repeated occurrences as in column (2+3).

Our main variable of interest known as the interaction variable between the growth rate of asset and the lagged US dollar diversification is positive for all samples and has a significant coefficient for investment banks. These first results goes against the theory prediction at least for the investment banks in (3). Theoretically, the valuation effect is supposed to be dominated by the effect of credit risk diversification. The absence of significance may illustrate this two opposite effects in (1), (2) and (2+3), while valuation effect seems to dominate in (3).

Table 5 goes further on the two different channels of currency diversification. Our previous measure of US dollar diversification does not allow us to distinguish between the credit risk diversification and the valuation effect due to exchange rate fluctuation. Instead of using the total US dollar diversification of asset, we might use the US dollar diversification of asset with domestic counterparty `Divers_RES` to capture the pure valuation effect. As assets are linked to resident, this new measure removed the risk credit diversification. Table 5 reports the results with the variable `Divers_RES`. Our main variable of interest - the interaction term between the growth rate of assets and the US dollar diversification - is positive and significant for all investment banks and investment banks with at least five years occurrence. These results confirm the presence of a valuation effect of US dollar diversification on leverage through the dynamic of total asset. Compared to previous estimators, coefficients are larger when they only induce domestic counterparty. Considering that `Divers` includes both effects of US dollar diversification, our results supports the idea that there are two distinct effects which might be opposed to each other.

Banking leverage is supposed to be driven by the dynamic of asset thereby putting liability aside. As demonstrated in theory, a currency mismatch should not affect the leverage procyclicality. We introduce in table 6 the mismatch position in order to check this assumption. Coefficients are not significant for all samples and this additional variable does not increase the adjusted  $R^2$  compared to the previous table. This result is in line with the theoretical conclusion. As leverage is mainly driven by collateral, currency mismatch which induces the liability of banks should not affect leverage procyclicality.



### 5.1.2 A two periods decomposition:

Our analysis is over a long period from 1999 to 2014. It includes two main sub-periods. On the one hand, from 1999 to 2007 the euro has been launched and developed. This first sub-period has been characterized by growing enthusiasm around the unique currency and its potential as a leading international currency. On the other hand, from 2008 to 2014 the euro area financial system has been hit by several shocks such as the propagation of the subprime crisis in 2008, the Greek debt crisis in 2011 and the different threats of euro area exit since then. In this second sub-period, some doubts came out about the robustness of the euro as a potential leading international currency. Thus, the way the US dollar diversification affects leverage may have changed from one sub-period to the other.

Table 7 decomposes the 1999-2014 period into two sub-periods known as 1999-2007 and 2008-2014 for the pre-crisis and the post-crisis period respectively. Despite the lack of significance for the mean reverting process in the post-crisis sub-period, results from Adrian and Shin [2008] are still valid and there is no complete reversal of the situation between the pre-crisis and the post-crisis sub-period.

Conversely, the role played by US dollar diversification of asset seems to be more specific to sub-periods. Regarding our main variable of interest the interaction term, our results suggest that the post-crisis sub-period is much more relevant for the impact of currency diversification. Coefficients are positive and significant for all samples.

This difference between the two sub-periods may come from the dynamic of the exchange rate euro-dollar. The pre-crisis period is characterized by an almost continuous appreciation of the euro while the post-crisis is much more volatile. The fluctuations of the exchange rate in the post-crisis are potentially more related to financial distress in each financial market. For instance, with the banking crisis and the Greek debt crisis

euro area experienced two main financial distresses between June 2011 and July 2012. This specific year was also associated to a euro depreciation. Considering these changes, the valuation effect on assets denominated in US dollar relative domestic counterparty accentuated the decline in total asset relative to euro area. Thereby, US dollar diversification may have magnified the leverage responsiveness to total assets.

## **5.2 US dollar diversification on asset and capital structure:**

### **5.2.1 A global vision from 1999 to 2014:**

Regarding the three main determinants identified by the literature - known as size, profitability and collateral - our results in table 8 confirm both theories depending on the variable. Size is positive and significant for all specifications thereby confirming the trade-off theory. The largest institutions benefit from an implicit protection which reduces their cost of raising debt. Thus, larger institutions tend to have higher leverage. The profitability is negative and significant for almost all samples. These results confirm the pecking order theory where banks prefer to use their profit instead of raising new debt. The collateral ratio is positive and significant for all samples thereby supporting the trade-off theory. Considering that collateral offers a protection for the creditors, banks benefit from lower cost of debt which leads to higher leverage. Moreover, coefficients increase when we focus on all investment banks and investment banks with at least five years occurrence.

Our main variable of interest - the interaction term between the collateral ratio and the US dollar diversification - should tell us whether US dollar diversification reduces the role played by collateral in the determination of leverage. The coefficient of this interaction term is negative for all specifications and significant for the two samples focusing on investment banks. It suggests that benefits from credit risk diversification is

dominated by the disadvantages of exchange rate fluctuations.

Going further, table 9 reports regressions when the US dollar diversification of asset only concerns domestic counterparty. Divers\_RES isolates the pure effect of exchange rate fluctuation and excludes credit risk diversification. With large and mainly significant coefficients on the interaction term, our results suggest that US dollar diversification of asset relative to domestic counterparty reduces the role played by collateral in the determination of leverage. Comparing with previous results, it supports the idea that US dollar diversification includes two opposite effects which are relevant for the determination of leverage.

Finally, we introduce the mismatch position dummy in table 10. It does not change our previous conclusion and the coefficient of the mismatch position are not significant. As in the leverage procyclicality, currency mismatch does not affect leverage. It supports the theory.

### **5.2.2 A two periods decomposition:**

Capital structure decision theory is linked to the creditors' perception of banks stability and performance. The subprime crisis followed by the euro debt crisis may have affected it for different reasons. First, the implicit guarantee of the "Too big to fail" has been questioned with large banks bankruptcy. Second, risk was undervalued before the crisis which plays an important role in the risk premium and the cost of debt. An adjustment has been observed since then which might increase the role of profit as a source of funding. Third, the notion of collateral and the way banks raise funds has changed in the euro area since the beginning of the crisis. On one hand, the safety of government bonds has been questioned with the euro area debt crisis. On the other hand, the ECB has

enlarged the definition of eligible collateral and proposed new facilities which changes the usual sources of funding. Finally, and as in the leverage procyclicality, the pertinence of the euro as leading international currency has been also questioned with the euro area crisis and the fact that the cost of US dollar debt has largely increased especially in 2011.

For all these reasons, table 11 decomposes the complete period of 1999-2014 into two sub-periods from 1999 to 2007 and from 2008 to 2014 for the pre-crisis and the post-crisis period respectively. There is no complete reversal of the situation for the usual variables used in the capital structure decision. However, coefficients of collateral for the (1) and (2) samples has considerably decreased and lost part of its significance in the post-crisis period.

Regarding our main variable of interest, our results suggest that the post-crisis period is more relevant to capture the role played by US dollar diversification. Compared to the global period or the pre-crisis sub-period, coefficients relative to the interaction term are larger. As mentioned in the previous section, the exchange rate euro-dollar was more volatile in the post-crisis period thereby increasing risks relative to exchange rate fluctuations.

### **5.2.3 Introducing banks Fixed-Effects:**

As we might want to identify leverage determinants within banks, we introduce in table 12 banks Fixed-Effects. Profitability and the collateral ratio are not significant anymore which suggests that heterogeneity comes from cross section for those variables. As highlighted by Lemmon et al. [2008], capital structures is mainly determined by stable factors that do not change over time. Our descriptive statistics in previous section illustrate it.

Our main variable of interest - the interaction term between collateral and US dollar

diversification - is not significant anymore while the the diversification taking apart is negative and significant for all samples.

### 5.3 Additional findings

This section adds several results from different specifications we think interesting to study. Instead of looking at the US dollar currency diversification, we focus on the total foreign currency diversification in order to capture the complete currency diversification. Coefficients and significance of variables linked to diversification decrease. As this variable captures different currencies it may induces several exchange rate fluctuations which may play an opposite role. The US dollar diversification is in this sens more precise.

The period we focus on is 1999-2014. As we have lagged explanatory variables, the first observation of leverage is in 2000. Changing the period from 1999-2014 to 1998-2014 implies that some explanatory variables are outside the euro area period thereby introducing potential structural issues. However, enlarging the period to 1998-2014 does not change the coefficients but it affects the significance of a limited number of coefficients.

An alternative to the current accounting definition of leverage is the Basel III definition which replaces equity by TIER1 and adds the off balance sheet to total asset. With this new definition, leverage is less procyclical or even no procyclical. Our results are in line with previous literature.

The dummy *Mis. Pos* is quite limited in its definition because it does not capture the size of the mismatch. An alternative is to define a ratio of the currency mismatch over total asset. However, this new measurement definitely captures the degree of currency diversification of asset.

Our panel data includes between 20 and 42 different banks depending on years. In previous sections, we choose to cluster the standard errors within banks. However, as mentioned by Kézdi [2004] a limited number of clusters (less than 50) may lead to incorrect estimators. Removing the clustering for robust standard errors does improve the significance of coefficients especially for the capital structure decision.

Finally, it might be interesting to underline the fact that off-balance sheet ratio is mostly irrelevant to the leverage analysis even though we introduce currency diversification. Our results suggest that currency diversification has to be included in banking monitoring even if banks have hedging strategies.

## **Conclusion**

Using a very confidential data set on credit institutions located in France between 1999 and 2014 enables us to examine whether currency diversification is relevant for both the leverage procyclicality and the determination of leverage. Theoretically, as currency diversification of assets affects directly the total composition of banks collateral, it changes their debt capacity and the determination on their leverage.

This paper implies two main contributions. First, it feeds a gap in the empirical literature which does not include currency diversification in the determinants of the leverage. Second, these micro data are very innovative. They provide information on the currency breakdown of each credit institution's balance sheet.

We choose to adopt to types of approaches known as the leverage procyclicality and the capital structure decision. Our results confirm previous conclusions from the two types of literature. Regarding currency diversification of asset, it suggests that US dollar

diversification is relevant to the analysis of leverage. For leverage procyclicality and investment banks, the valuation effect induced by US dollar diversification dominates the credit risk diversification thereby increasing the leverage responsiveness to asset. Leverage procyclicality goes up with US dollar diversification. Turning to capital structure decision, US dollar diversification reduces the role played by collateral in the determination of leverage because of the extra risk introduced by exchange rate fluctuations. Our conclusions also underline the presence of a pure valuation effect due to US dollar diversification. Additionally, our results confirms the theoretical prediction where currency mismatch does not affect leverage. Implicitly it supports the idea that leverage is only driven by the asset of banks.

Considering all the sample we look at, the effect of US dollar diversification depends on the type of banks and the sub-period decomposition. In both types of literature, US dollar diversification expresses itself more easily within investment banks. Regarding the crisis decomposition, our results suggest that the post-crisis period is more relevant for capturing the impact of US dollar diversification on leverage through collateral.

Finally, our analysis can be improved in several ways. First, we might focus on the relationship between collateral and US dollar diversification in order to distinguish the two effect of diversification on collateral. Second, further investigations on econometric methods are necessary to threat the potential endogeneity issue highlighted in the leverage procyclicality.

## References

- T. Adrian and H. S. Shin. Liquidity and financial cycles. *BIS WP 256*, 2008.
- T. Adrian and H. S. Shin. Liquidity and leverage. *Journal of financial intermediation.*, 2010.
- T. Adrian and H. S. Shin. Procyclical leverage and value-at-risk. *NBER WP 18943*, 2013.
- T. Adrian, H. S. Shin, and J.-P. Zigrand. Procyclical leverage and endogenous risk. *Princeton University*, 2012.
- S. Akhtar. The determinants of capital structure for australian multinational and domestic corporations. *Australian journal of management*, 30:321–341, 2005.
- N. Baba, R. McCauley, and S. Srichander Ramaswamy. Us dollar money market funds and non-us banks. *BIS Quarterly Review*, 2009.
- A. Baglioni, E. Beccalli, A. Boitani, and A. Monticini. Is the leverage of european banks procyclical? *Empirical Economics*, 45:1251–1266, 2013a.
- A. Baglioni, E. Beccalli, A. Boitani, and A. Monticini. Is the leverage of european banks procyclical? *Empirical Economics*, 43:1251–1266, 2013b.
- B. Bernanke and M. Gertler. Agency costs, net worth, and business fluctuations. *American Economic Review*, 79:14–31, 1989.
- BIS-Quarterly-Review. Highlights of global financing flows. *BIS Quarterly Review*, March 2015.
- BIS-Survey. Foreign exchange turnover in april 2013: preliminary global results. *Triennial Central Bank Survey, BIS*, 2013.



- C. Borio and P. Disyatat. Global imbalances and the financial crisis: Link or no link? *BIS WP 346*, 2011.
- T. Burgman. An empirical examination of multinational corporate capital structure. *Journal of international business studies*, 27:553–570, 1996.
- C. Chen, A. Cheng, J. He, and J. Kim. An investigation of the relationship between international activities and capital structure. *Journal of international business studies*, 28:563–577, 1997.
- J. Griffin and A. Karolyi. Another look at the role of the industrial structure of markets for international diversification strategies. *Journal of financial economics*, 50:351–373, 1998.
- R. Gropp and F. Heider. The determinants of bank capital structure. *Review of finance*, 14:587 – 622, 2010.
- S. Kalemli-Ozcan, B. Sorensen, and S. Yesiltas. Leverage across firms, banks and countries: some evidence from banks. *NBER WP 17354*, 2011.
- G. Kézdi. Robust standard error estimation in fixed-effects panel models. *Hungarian Statistical Review, Special number 9*, 2004.
- A. Kraus and R. Litzenger. A state-preference model of optimal financial leverage. *Journal of Finance*, 28:911–922, 1973.
- M. Lemmon, M. Roberts, and J. Zender. Back to the beginning: persistence and the cross-section of corporate capital-structure. *Journal of Finance*, 63:1575–1608, 2008.
- P. McGuire and G. Von Peter. The us dollar shortage in global banking and the international policy response. *International Finance*, 15:155–178, 2012.

- S. Myers and N. Majluf. Corporate financing and investment decisions when firms have information that investors do not have. *Journal of Financial Economics*, 13:187–221, 1984.
- J. Pedrono. Banking leverage with currency diversification. *AMSE WP*, 2015.
- M. Singh and A. Nejadmalayeri. Internationalization, capital structure, and cost of capital: evidence from french corporations. *Journal of multinational financial management*, 14:153–169, 2004.

## 6 Appendix

### .1 Variable definitions

**Table 2:** Variable definitions

<u>Main variables:</u>	
<i>Leverage</i>	$\frac{Asset}{Equity}$
$\Delta$ <i>Leverage</i>	Growth rate of leverage
$\Delta$ <i>Asset</i>	Growth rate of asset
<i>Size</i>	$\ln(Asset)$
<i>Profit.</i>	$\frac{Net\ income}{Asset}$
<i>Coll. ratio</i>	$\frac{Collateral}{Asset}$
<i>Divers</i>	$\frac{Asset\ denominated\ in\ USD}{Total\ Asset}$
<i>Divers_RES</i>	$\frac{Asset\ denominated\ in\ USD\ with\ resident\ conterparty}{Total\ Asset}$
<i>Invest.</i>	$=1\ if\ \left(\frac{Deposit}{Total\ Debt}\right)_i < \left(\frac{Deposit}{Total\ Debt}\right)_{median(i...N)}$
<i>Mis. Pos</i>	$=1\ if\ Asset\ in\ foreign\ currency > Liability\ in\ foreign\ currency$
<u>Controls:</u>	
<i>FR</i>	=1 if banks are french
<i>Dep. Ratio</i>	=”low” if the bank’s deposit ratio deposit/debt is in the left hand side of the distribution (the first 25%) ; =”medium low” if its ratio is in between the 25% and the 50% ; =”medium high” if its ratio is in between the 50% and the 75% ; and =”high” if its ratio is in the last 25% of the right side of the distribution.
<i>Sub Cat.</i>	Breakdown credit institutions between banks, cooperative banking groups and other
<i>Conso</i>	=1 if data are consolidated
$\Delta$ <i>Conso</i>	Changes in <i>Conso</i>
<i>IFRS</i>	=1 if banks report data using IFRS standards
$\Delta$ <i>IFRS</i>	Changes in <i>IFRS</i>
<i>Off BS</i>	$\frac{Off-balance\ sheet}{Asset}$
$\Delta$ <i>Off BS</i>	growth rate of <i>Off BS</i>

## .2 Correlation

**Table 3:** Variance co-variance matrix (1999-2014)

	<i>Leverage</i>	$\Delta$ <i>Leverage</i>	<i>Size</i>	$\Delta$ <i>Asset</i>	<i>Profit</i>	<i>Coll. ratio</i>	<i>Diver.</i>	<i>Diver_RES</i>	<i>Invest.</i>	<i>Mis. Pos</i>
<i>Leverage</i>	1									
	529									
$\Delta$ <i>Leverage</i>	0.1993*	1								
	0									
	444	444								
<i>Size</i>	0.4931*	0.0337	1							
	0	0.4792								
	529	444	529							
$\Delta$ <i>Asset</i>	0.2127*	0.6229*	0.1776*	1						
	0	0	0.0002							
	444	444	444	444						
<i>Profit</i>	-0.3287*	-0.0832	-0.1815*	0.0235	1					
	0	0.0799	0	0.6213						
	529	444	529	444	529					
<i>Coll. ratio</i>	0.1891*	-0.0225	0.1693*	0.027	0.1261*	1				
	0	0.6359	0.0001	0.5708	0.0037					
	529	444	529	444	529	529				
<i>Divers</i>	-0.0982*	-0.0361	-0.3498*	-0.0681	-0.1066*	-0.2289*	1			
	0.0239	0.4477	0	0.1518	0.0142	0				
	529	444	529	444	529	529	529			
<i>Divers_RES</i>	-0.0951*	0.0643	-0.2868*	0.0095	-0.0019	-0.1683*	0.6160*	1		
	0.0288	0.1764	0	0.841	0.9646	0.0001	0			
	529	444	529	444	529	529	529	529		
<i>Invest.</i>	-0.1247*	0.0301	-0.2790*	0.0258	0.043	-0.2245*	0.2840*	0.2394*	1	
	0.0041	0.5266	0	0.588	0.3234	0	0	0		
	529	444	529	444	529	529	529	529	529	
<i>Mis Pos</i>	-0.1864*	-0.0148	-0.1974*	-0.1131*	0.0811	-0.1130*	0.0728	0.0317	-0.0322	1
	0	0.7552	0	0.0171	0.0623	0.0093	0.0942	0.4673	0.4601	
	529	444	529	444	529	529	529	529	529	529

### .3 Empirical results

#### .3.1 Leverage Procyclicality

**Table 4:** Procyclical leverage and US dollar diversification

Dependant variable :  $\Delta Leverage_t$

Four samples are studied: (1) is the unconstrained sample with all banks ; (2) includes banks with a minimum of 5 years occurrence over the period ; (3) focuses on investment banks ; (2+3) is for investment banks with a minimum of 5 years occurrence. Standard errors are clustered.

LSDV include sub-category of banks and banks' nationality. Time Fixed-Effects included.

	(1)	(2)	(3)	(2+3)
$\ln(Leverage_{t-1})$	-0.04*** (0.01)	-0.05*** (0.01)	-0.05*** (0.02)	-0.06*** (0.02)
$\Delta Asset_t$	0.74*** (0.10)	0.81*** (0.11)	0.72*** (0.13)	0.86*** (0.14)
$(\Delta Asset_t \times Divers_{t-1})$	0.04 (0.28)	0.07 (0.31)	0.56* (0.30)	0.58 (0.42)
$Divers_{t-1}$	-0.10 (0.08)	-0.14 (0.08)	-0.02 (0.12)	-0.10 (0.09)
$\Delta conso$	-0.04 (0.07)	-0.03 (0.08)	-0.16* (0.08)	-0.15 (0.09)
$\Delta Off BS$	-0.00 (0.02)	0.01 (0.01)	-0.02 (0.02)	0.01 (0.02)
$\Delta IFRS$	0.08 (0.06)	0.09 (0.06)	0.12 (0.10)	0.10 (0.11)
<i>Constant</i>	0.12** (0.05)	0.15** (0.06)	0.15** (0.06)	0.20** (0.07)
Adjusted R <sup>2</sup>	0.44	0.50	0.55	0.63
<i>N</i>	412	367	210	191

\*  $p < 0.1$ ; \*\*  $p < 0.05$ ; \*\*\*  $p < 0.01$

**Table 5:** Procyclical leverage, US dollar diversification and pure valuation effectDependant variable :  $\Delta Leverage_t$ 

Four samples are studied: (1) is the unconstrained sample with all banks ; (2) includes banks with a minimum of 5 years occurrence over the period ; (3) focuses on investment banks ; (2+3) is for investment banks with a minimum of 5 years occurrence. Standard errors are clustered.

LSDV include sub-category of banks and banks' nationality. The RES column focuses on US dollar diversification with resident counterparty only. Time Fixed-Effects included.

	RES (1)	RES (2)	RES (3)	RES (2+3)
$\ln(Leverage_{t-1})$	-0.03*** (0.01)	-0.04*** (0.01)	-0.05*** (0.02)	-0.05** (0.02)
$\Delta Asset_t$	0.74*** (0.09)	0.80*** (0.10)	0.67*** (0.12)	0.81*** (0.11)
$(\Delta Asset_t \times Divers\_RES_{t-1})$	-0.01 (1.10)	-0.02 (1.17)	2.86*** (0.82)	2.85*** (0.78)
$Divers\_RES_{t-1}$	-0.25 (0.28)	-0.27 (0.31)	0.09 (0.27)	-0.08 (0.25)
$\Delta conso$	-0.03 (0.07)	-0.01 (0.08)	-0.16** (0.08)	-0.16* (0.09)
$\Delta Off\ BS$	-0.00 (0.02)	0.00 (0.01)	-0.03 (0.02)	0.01 (0.02)
$\Delta IFRS$	0.06 (0.06)	0.07 (0.06)	0.14 (0.10)	0.12 (0.11)
$Constant$	0.07** (0.04)	0.07* (0.04)	0.14** (0.06)	0.17** (0.07)
Adjusted R <sup>2</sup>	0.44	0.49	0.57	0.64
N	412	367	210	191

\*  $p < 0.1$ ; \*\*  $p < 0.05$ ; \*\*\*  $p < 0.01$

**Table 6:** Procyclical leverage, US dollar diversification and currency mismatch positionDependant variable :  $\Delta Leverage_t$ 

Four samples are studied: (1) is the unconstrained sample with all banks ; (2) includes banks with a minimum of 5 years occurrence over the period ; (3) focuses on investment banks ; (2+3) is for investment banks with a minimum of 5 years occurrence. Standard errors are clustered.

LSDV include sub-category of banks and banks' nationality. Time Fixed-Effects included.

	(1)	(2)	(3)	(2+3)
$\ln(Leverage_{t-1})$	-0.04*** (0.01)	-0.05*** (0.01)	-0.06*** (0.02)	-0.06*** (0.02)
$\Delta Asset_t$	0.73*** (0.10)	0.80*** (0.11)	0.70*** (0.13)	0.85*** (0.13)
$(\Delta Asset_t \times Divers_{t-1})$	0.06 (0.28)	0.08 (0.31)	0.59* (0.30)	0.61 (0.41)
$Divers_{t-1}$	-0.10 (0.08)	-0.14 (0.08)	-0.02 (0.11)	-0.10 (0.09)
$Mis. Post_{t-1}$	-0.03 (0.02)	-0.01 (0.02)	-0.03 (0.02)	-0.02 (0.02)
$\Delta conso$	-0.05 (0.08)	-0.03 (0.08)	-0.15 (0.09)	-0.15 (0.10)
$\Delta Off BS$	-0.00 (0.02)	0.01 (0.01)	-0.02 (0.02)	0.01 (0.02)
$\Delta IFRS$	0.08 (0.06)	0.09 (0.06)	0.12 (0.10)	0.10 (0.11)
_cons	0.14** (0.06)	0.14** (0.06)	0.17** (0.07)	0.21*** (0.07)
Adjusted R <sup>2</sup>	0.44	0.50	0.55	0.63
N	412	367	210	191

\*  $p < 0.1$ ; \*\*  $p < 0.05$ ; \*\*\*  $p < 0.01$



**Table 7:** Procyclical leverage, US dollar diversification and crisis decomposition

Dependant variable :  $\Delta Leverage_t$

Four samples are studied: (1) is the unconstrained sample with all banks ; (2) includes banks with a minimum of 5 years occurrence over the period ; (3) focuses on investment banks ; (2+3) is for investment banks with a minimum of 5 years occurrence. Standard errors are clustered. LSDV include sub-category of banks and banks' nationality. The All column is equivalent to the specification of table 4 which takes the complete period as a all. The Crisis column decomposes each coefficient relative to two sub-periods: the pre-crisis period from 1999 to 2007 and the post-crisis period from 2008 to 2014. Not all control variables shown. Time Fixed-Effects included.

	All (1)	Crisis (1)	All (2)	Crisis (2)	All (3)	Crisis (3)	All (2+3)	Crisis (2+3)
$\ln(Leverage_{t-1})$	-0.04*** (0.01)		-0.05*** (0.01)		-0.05*** (0.02)		-0.06*** (0.02)	
<i>Pre – crisis</i>		-0.05*** (0.01)		-0.06*** (0.01)		-0.06** (0.02)		-0.07** (0.03)
<i>Post – crisis</i>		-0.01 (0.02)		-0.02 (0.02)		-0.04** (0.02)		-0.05** (0.02)
$\Delta Asset_t$	0.74*** (0.10)		0.81*** (0.11)		0.72*** (0.13)		0.86*** (0.14)	
<i>Pre – crisis</i>		0.71*** (0.12)		0.80*** (0.14)		0.70*** (0.14)		0.83*** (0.15)
<i>Post – crisis</i>		0.85*** (0.08)		0.82*** (0.09)		0.86*** (0.12)		0.90*** (0.12)
$(\Delta Asset_t \times Divers_{t-1})$	0.04 (0.28)		0.07 (0.31)		0.56* (0.30)		0.58 (0.42)	
<i>Pre – crisis</i>		-0.04 (0.33)		-0.14 (0.40)		0.69* (0.36)		0.92 (0.61)
<i>Post – crisis</i>		0.52*** (0.19)		0.62*** (0.20)		0.48** (0.20)		0.37* (0.21)
$Divers_{t-1}$	-0.10 (0.08)		-0.14 (0.08)		-0.02 (0.12)		-0.10 (0.09)	
<i>Pre – crisis</i>		-0.11 (0.09)		-0.14 (0.10)		0.12 (0.13)		0.00 (0.12)
<i>Post – crisis</i>		-0.09 (0.07)		-0.13* (0.07)		-0.16 (0.14)		-0.17 (0.14)
<i>Post – crisis dummy</i>		-0.07 (0.07)		-0.03 (0.08)		0.00 (0.12)		-0.01 (0.12)
<i>Constant</i>	0.12** (0.05)	0.11* (0.06)	0.15** (0.06)	0.12* (0.06)	0.15** (0.06)	0.11 (0.10)	0.20** (0.07)	0.17 (0.10)
Adjusted R <sup>2</sup>	0.44	0.45	0.50	0.50	0.55	0.55	0.63	0.62
N	412	412	367	367	210	210	191	191

\*  $p < 0.1$ ; \*\*  $p < 0.05$ ; \*\*\*  $p < 0.01$

### .3.2 Leverage Determinant:

**Table 8:** Leverage determinant and US dollar diversification

Dependant variable :

$Leverage_t$

Four samples are studied: (1) is the unconstrained sample with all banks ; (2) includes banks with a minimum of 5 years occurrence over the period ; (3) focuses on investment banks ; (2+3) is for investment banks with a minimum of 5 years occurrence. Standard errors are clustered. LSDV include sub-category of banks, Dep. Ratio and banks' nationality. Time Fixed-Effects included.

	(1)	(2)	(3)	(2+3)
$Size_{t-1}$	3.15*** (0.40)	3.31*** (0.42)	3.66*** (0.79)	3.47*** (0.84)
$Profit_{t-1}$	-86.72** (35.35)	-72.93* (39.86)	-89.84 (68.90)	-185.86* (95.24)
$Coll. ratio_{t-1}$	15.07* (8.37)	16.96* (8.59)	27.06*** (8.84)	29.02*** (8.77)
$Divers_{t-1}$	1.02 (3.70)	1.18 (4.03)	-4.88 (8.01)	-3.83 (9.28)
$(Coll.xDivers)_{t-1}$	-45.59 (42.64)	-52.93 (44.96)	-77.82* (39.10)	-90.23** (35.86)
$Conso_{t-1}$	-0.93 (2.70)	-1.69 (2.85)	-2.01 (6.13)	-2.01 (6.44)
$Off BS_{t-1}$	0.30 (1.62)	0.86 (1.67)	2.33 (1.49)	2.56* (1.47)
$IFRS_{t-1}$	1.82 (2.69)	1.44 (2.90)	-0.73 (3.37)	0.76 (3.54)
$Constant$	-11.37*** (3.96)	-11.74** (4.76)	-16.69*** (3.69)	-16.61*** (3.29)
Adjusted R <sup>2</sup>	0.50	0.55	0.62	0.65
N	412	367	210	191

\*  $p < 0.1$ ; \*\*  $p < 0.05$ ; \*\*\*  $p < 0.01$

**Table 9:** Leverage determinant, US dollar diversification and pure valuation effect

Dependant variable :

*Leverage<sub>t</sub>*

Four samples are studied: (1) is the unconstrained sample with all banks ; (2) includes banks with a minimum of 5 years occurrence over the period ; (3) focuses on investment banks ; (2+3) is for investment banks with a minimum of 5 years occurrence. Standard errors are clustered. LSDV include sub-category of banks, Dep. Ratio and banks' nationality. US dollar diversification focuses on US dollar diversification with resident counterparty only. Time Fixed-Effects included.

	(1)	(2)	(3)	(2+3)
<i>Size<sub>t-1</sub></i>	2.22*** (0.39)	2.18*** (0.41)	3.38*** (0.74)	3.16*** (0.76)
<i>Profit<sub>t-1</sub></i>	-124.48** (47.08)	-123.26** (54.27)	-74.84 (62.29)	-143.29 (88.60)
<i>Coll. ratio<sub>t-1</sub></i>	16.35* (8.77)	17.55* * (9.21)	25.11** (9.86)	26.61** (10.29)
<i>Divers.RES<sub>t-1</sub></i>	6.89 (5.58)	6.41 (5.81)	7.37 (28.20)	21.16 (29.64)
<i>(Coll.xDivers.RES)<sub>t-1</sub></i>	-123.33* (73.45)	-123.33 (76.70)	-251.83** (123.24)	-302.56** (136.96)
<i>Conso<sub>t-1</sub></i>	-0.62 (2.69)	-0.02 (2.85)	0.84 (5.84)	1.24 (5.96)
<i>Off BS<sub>t-1</sub></i>	-1.05 (1.63)	-0.66 (1.76)	2.64 (1.84)	2.81 (1.95)
<i>IFRS<sub>t-1</sub></i>	-0.68 (2.99)	-0.88 (3.16)	0.82 (3.47)	2.59 (3.57)
<i>Constant</i>	-8.09** (3.45)	-7.96* (4.36)	-17.95*** (4.35)	-18.22*** (4.37)
Adjusted R <sup>2</sup>	0.39	0.41	0.60	0.61
<i>N</i>	412	367	210	191

\*  $p < 0.1$ ; \*\*  $p < 0.05$ ; \*\*\*  $p < 0.01$

**Table 10:** Leverage determinant, US dollar diversification and mismatch position

Dependant variable :

*Leverage<sub>t</sub>*

Four samples are studied: (1) is the unconstrained sample with all banks ; (2) includes banks with a minimum of 5 years occurrence over the period ; (3) focuses on investment banks ; (2+3) is for investment banks with a minimum of 5 years occurrence. Standard errors are clustered. LSDV include sub-category of banks, Dep. Ratio and banks' nationality. Time Fixed-Effects included.

	(1)	(2)	(3)	(2+3)
<i>Size<sub>t-1</sub></i>	3.14*** (0.38)	3.38*** (0.38)	3.53*** (0.73)	3.38*** (0.78)
<i>Profit<sub>t-1</sub></i>	-86.55** (35.64)	-72.19* (38.65)	-90.89 (70.60)	-188.18* (98.56)
<i>Coll. ratio<sub>t-1</sub></i>	14.97* (8.17)	17.49** (8.26)	26.35*** (8.62)	28.58*** (8.49)
<i>Divers<sub>t-1</sub></i>	1.00 (3.68)	1.50 (3.95)	-4.82 (7.99)	-3.92 (9.37)
<i>(Coll.xDivers)<sub>t-1</sub></i>	-45.27 (41.72)	-54.73 (43.39)	-75.31** (37.05)	-88.60** (33.46)
<i>Mis Post<sub>t-1</sub></i>	-0.24 (1.33)	0.91 (1.40)	-1.26 (1.42)	-0.74 (1.46)
<i>Conso<sub>t-1</sub></i>	-0.95 (2.75)	-1.60 (2.90)	-1.85 (6.13)	-1.91 (6.40)
<i>Off BS<sub>t-1</sub></i>	0.30 (1.62)	0.83 (1.71)	2.25 (1.47)	2.50* (1.44)
<i>IFRS<sub>t-1</sub></i>	1.84 (2.69)	1.34 (2.85)	-0.50 (3.30)	0.89 (3.51)
<i>Constant</i>	-11.15*** (4.01)	-12.74*** (4.69)	-17.03*** (3.35)	-13.74*** (3.88)
Adjusted R <sup>2</sup>	0.50	0.55	0.62	0.64
N	412	367	210	191

\*  $p < 0.1$ ; \*\*  $p < 0.05$ ; \*\*\*  $p < 0.01$

**Table 11:** Leverage determinant, US dollar diversification and crisis decompositionDependant variable :  $Leverage_t$ 

Four samples are studied: (1) is the unconstrained sample with all banks ; (2) includes banks with a minimum of 5 years occurrence over the period ; (3) focuses on investment banks ; (2+3) is for investment banks with a minimum of 5 years occurrence. Standard errors are clustered. LSDV include sub-category of banks, Dep. Ratio and banks' nationality. The All column is equivalent to the specification of the previous table which takes the complete period as a all. The Crisis column decomposes each coefficient relative to two sub-periods: the pre-crisis period from 1999 to 2007 and the post-crisis period from 2008 to 2014. Not all control variables shown. Time Fixed-Effects included.

	All (1)	Crisis (1)	All (2)	Crisis (2)	All (3)	Crisis (3)	All (2+3)	Crisis (2+3)
$Size_{t-1}$	3.15*** (0.40)		3.31*** (0.42)		3.66*** (0.79)		3.47*** (0.84)	
<i>Pre – crisis</i>		3.15*** (0.39)		3.43*** (0.43)		3.43*** (0.84)		3.21*** (0.95)
<i>Post – crisis</i>		2.96*** (0.67)		3.09*** (0.70)		4.11*** (0.79)		4.04*** (0.76)
$Profit_{t-1}$	-86.72** (35.35)		-72.93* (39.86)		-89.84 (68.90)		-185.86* (95.24)	
<i>Pre – crisis</i>		-82.28** (35.24)		-67.33* (36.67)		-74.83 (72.74)		-208.55 (123.63)
<i>Post – crisis</i>		-100.19* (50.39)		-90.46 (60.62)		-265.33 (190.16)		-236.47 (193.93)
$Coll. ratio_{t-1}$	15.07* (8.37)		16.96* (8.59)		27.06*** (8.84)		29.02*** (8.77)	
<i>Pre – crisis</i>		21.30** (9.27)		24.28** (9.57)		30.39*** (9.89)		34.19*** (9.64)
<i>Post – crisis</i>		1.60 (9.86)		1.59 (10.79)		23.63*** (8.10)		22.99*** (8.08)
$Divers_{t-1}$	1.02 (3.70)		1.18 (4.03)		-4.88 (8.01)		-3.83 (9.28)	
<i>Pre – crisis</i>		1.12 (3.85)		3.73 (3.97)		-5.93 (11.00)		-0.28 (15.92)
<i>Post – crisis</i>		0.34 (8.40)		-7.39 (8.21)		1.67 (11.23)		2.54 (11.77)
$(Coll.xDivers)_{t-1}$	-45.59 (42.64)		-52.93 (44.96)		-77.82* (39.10)		-90.23** (35.86)	
<i>Pre – crisis</i>		-58.78 (41.30)		-69.09 (43.14)		-70.60 (42.21)		-93.45** (41.18)
<i>Post – crisis</i>		-21.77 (77.37)		-13.84 (82.05)		-183.74** (67.99)		-178.80** (69.46)
<i>Post – crisis dummy</i>		0.19 (6.47)		4.30 (7.63)		-3.89 (9.19)		-7.59 (10.40)
<i>Constant</i>	-11.37*** (3.96)	-7.58** (3.76)	-11.74** (4.76)	-10.61** (3.98)	-16.69*** (3.69)	-15.26** (6.30)	-16.61*** (3.29)	-11.20* (5.99)
Adjusted R <sup>2</sup>	0.50	0.51	0.55	0.56	0.62	0.63	0.65	0.66
N	412	412	367	367	210	210	191	191

\*  $p < 0.1$ ; \*\*  $p < 0.05$ ; \*\*\*  $p < 0.01$

**Table 12:** Leverage determinant and US dollar diversification: introducing banks' Fixed Effect

Dependant variable :

*Leverage<sub>t</sub>*

Four samples are studied: (1) is the unconstrained sample with all banks ; (2) includes banks with a minimum of 5 years occurrence over the period ; (3) focuses on investment banks ; (2+3) is for investment banks with a minimum of 5 years occurrence. Standard errors are clustered. Time Fixed-Effects included.

	(1)	(2)	(3)	(2+3)
<i>Size<sub>t-1</sub></i>	8.08*** (2.29)	8.40*** (2.38)	9.21*** (2.46)	9.79*** (2.51)
<i>Profit<sub>t-1</sub></i>	-28.16 (17.13)	-23.89 (20.25)	49.37 (101.07)	81.84 (98.55)
<i>Coll. ratio<sub>t-1</sub></i>	7.08 (5.11)	8.12 (5.69)	18.10 (12.13)	20.15 (12.90)
<i>Divers<sub>t-1</sub></i>	-10.92* (5.74)	-10.76* (6.00)	-15.86** (7.10)	-14.12* (7.12)
<i>(Coll.xDivers)<sub>t-1</sub></i>	-14.45 (25.11)	-17.30 (26.65)	-50.24 (36.65)	-59.73 (38.49)
<i>Conso<sub>t-1</sub></i>	-8.07** (3.43)	-8.11** (3.41)	-5.19** (2.07)	-5.05** (2.05)
<i>Off BS<sub>t-1</sub></i>	-0.93 (2.16)	-0.69 (2.23)	-1.00 (2.31)	-0.61 (2.34)
<i>IFRS<sub>t-1</sub></i>	0.57 (2.38)	0.16 (2.46)	1.95 (2.35)	0.66 (2.26)
<i>Constant</i>	-48.03** (19.10)	-51.69** (20.62)	-69.71*** (25.30)	-76.08*** (25.68)
Within R <sup>2</sup>	0.27	0.28	0.32	0.33
N	412	367	209	196

\*  $p < 0.1$ ; \*\*  $p < 0.05$ ; \*\*\*  $p < 0.01$